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- NF-POGO Alumni Network for the Ocean -

NF-POGO Alumni E-Newsletter – Volume 23, May 2023

Monitoring our ocean

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NF-POGO Alumni E-Newsletter – Volume 23, May 2023

In this issue:

Cover photo
Sampling at NANO-DOAP TEPAST station.
Credits: Lantun P Dewanti

From the Editorial Board

The ocean is our mighty ally in mitigating climate change. It has taken up 90% of the heat trapped in the atmosphere which makes it bear the brunt of the climate crisis. It is time to put the ocean at the centre of the global agenda. Because we live on one planet, it is time to take action!

Continuous time-series measurements have become prerequisites for monitoring and forecasting the changes that happen in the ocean. During the COP27 climate conference that was held in Sharm El-Sheikh in Egypt last year, the Global Ocean Observing System (GOOS), led by UNESCO's Intergovernmental Oceanographic Commission, proposed monitoring programmes such as the Ocean Observing Co-Design Programme, which aims to highlight the importance of ocean carbon observation.

In this new issue of the NANO Newsletter, we are delighted to feature some of the most recent research findings linked to the NANO Global Project "A Global Study of Deoxygenation, Ocean Acidification, and Productivity at Selected Sites" (NANO-DOAP). NANO-DOAP aims to advance knowledge and observation of the coastal ocean by collecting data from a series of existing, or establishing new, monitoring stations, all led by NANO members. Stations featured in this issue are located in 3 continents.

In addition, we hear from recent additions to the NANO family, Zuleica Almeida Duarte and Carola Ferronato, about their experiences on the NF-POGO Shipboard Training Programme along the archipelago of Cape Verde and the Northern coast of Spain, respectively.

Next, we have a report on the impact of COVID-19 lockdown on water quality along the Atlantic Moroccan coast. Dr. Hind Azidane and colleagues presented results from satellite data time series analysis of the total suspended matter for different locations before, during and after the lockdown period. Finally, Hadeer Abdo tells about her research which focuses mainly on impact of anthropogenic pressures on the soft corals along the Egyptian coast of the Red Sea.

In our final section, we announce the upcoming scientific events in marine science, which can provide you with more opportunities!

Yours sincerely,

Marwa Baloza

Editor-in-chief

NANO was founded by:
Shubha Sathyendranath and Trevor Platt - Former Executive Directors of POGO
Sophie Seeyave - Chief Executive Officer of POGO
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NF-POGO Visiting Fellowship for Shipboard Training

NRP D Carlos I

Mission Open Sea (2021)

NF-POGO Shipboard Training Fellowship on board the NRP D Carlos I
(30 October 2021 - 3 April 2022)

Zuleica Almeida Duarte

Alumnus profile: https://nf-pogo-alumni.org/profile/**Zuleica%20Almeida%20Duarte/**

My name is Zuleica Almeida Duarte. I'm from São Nicolau, Cabo Verde. I'm a student in the biological sciences course at the Technical University of the Atlantic.

Between October 30th to November 15th, 2021, I received training onboard the Portuguese Navy ship, D. Carlos I, around the archipelago of Cabo Verde. During the expedition, I had the opportunity to learn how to collect samples for the determination of pH, disolved oxygen (DO), metals, nutrients and photosynthetic pigments using the Rosette system and CTD probes. On board, I filtered samples for photosynthetic pigment, pH determination and DO determination.

After the expedition I had the opportunity to travel to Portugal to analyze the samples at the Instituto Hidrográfico (IH), in Lisbon. At the IH laboratories, I learned how to determine photosynthetic pigments in the Thermo evolution spectrometer, metals and semi-metal Arsenic by atomic absorption spectrometry, and nutrients by molecular absorption spectrometry. In addition, I also participated in two expeditions on the Tagus River.

The training experience was very rewarding and wonderful, as I had the opportunity to meet new people and get to know a little bit of their cultures. Being my first trip out of Cabo Verde, it was significant in many other aspects, besides contributing directly to the end of my degree. It also helped me make up my mind on pursuing a master's degree in marine biology.

Currently I am doing an internship at the Communications department of Biosphere, an NGO based in Mindelo, Cabo Verde. Previously, I have worked with them on several campaigns for the conservation and protection of sea turtles in the Santa Luzia Natural Reserve and on the shark capture and tagging project.

Words fall short to express my gratitude to thank Nippon Foundation, POGO and the IH for the opportunity, especially Dr. Carla Palma, my host supervisor. I hope both organisations continue with this noble goal of helping underprivileged countries.

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NF-POGO Visiting Fellowship for Shipboard Training

BO Lura

RADIALES Cruise (2022)

2022 NF-POGO Shipboard Training Fellowship for training on-board RADIALES cruise on board R/V Lura (15 February - 15 May 2022)

Carola Ferronato

Alumnus profile: https://nf-pogo-alumni.org/profile/**carolaferronato/**

I am an oceanographer and I am currently enrolled in a PhD position in biology, to study phytoplankton ecology in shelf seas. I had the opportunity to participate in a NF-POGO-IEO Shipboard Training Programme, which included several daily multidisciplinary cruises along the Northern coast of Spain and laboratory work at the IEO A Coruña. This 3-month training focused on sampling and processing plankton communities, their abundance and biomass, and related physico-chemical parameters. I learned new techniques to identify microbial/ phytoplankton/zooplankton such as: flow cytometry, flowcam, zooscan and DNA sequencing. Additionally, I learnt about the equipment and methodology used to measure chlorophyll-a concentration, dissolved oxygen and inorganic nutrients, among other variables. Furthermore, I had the chance to collaborate in an icthyoplankton research cruise to assess the biomass of some important commercial fish species of the NE Atlantic. Overall, I gained more experience in field sampling as well as in the planning, preparation and execution of oceanographic expeditions. This training programme is an excellent platform for capacity building and for discussing interdisciplinary research topics with other colleagues and experts.

I would like to thank all who could make this possible: my host supervisors Dr. Marta M Varela Rozados and María Angeles Louro Pico, great professionals and excellent people. Also to the POGO staff for their tremendous support during the whole journey. And lastly to my parent supervisor **Dr. Valeria Guinder** for encouring me to continue developing my scientific skills.

NANO Global Project (NANO-DOAP) Ensenada (Mexico) station

Dinoflagellates blooms may affect the Mexican NANO-DOAP station: studying their bio-optical characteristics

Adriana González-Silvera* and Mariana Larios-Muñiz

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The NANO Global Project (NANO-DOAP) "A global study of Deoxygenation, Ocean Acidification and Productivity at selected sites" has the objective of monitoring the levels of ocean acidification and deoxygenation worldwide based on data collected from a series of coastal stations. One of these stations is in Todos Santos Bay, Ensenada (Baja California, Mexico) where the Phytoplankton Ecology Team (POPEYE) has been overseeing this and other projects since 2016.

Todos Santos Bay is located on the northwest coast of Baja California, Mexico, between 31°40'–31°56' N and 116°36'–116°50' W (Figure 1). It is a semi-enclosed coastal water body where harmful algal blooms (HABs) are regularly recorded and associated with wastewater discharges (domestic and industrial) and agricultural runoff causing strong economic consequences particularly affecting the development of bivalve mollusc and tuna cultures. One of the most recurrent species that affect the bay is the dinoflagellate *Lingulodinium polyedra* which has been associated with the production of paralyzing toxins such as saxitoxins and yessotoxins; such blooms can last from weeks to months in the bay.

On both 8th June 2019 and 23rd March 2022, when we were returning from the NANO-DOAP station, we had the opportunity to collect samples from three different sites when a strong bloom of *L. polyedra* was developing (see Figure 1). Chlorophyll-a concentration (Chl-a) ranged from 10 to 36.2 mg/m³ and phytoplankton abundance from 121,120 to 717,800 Cel/L (Table 1) changing the water colour to red (Figure 2). A satellite image from OLCI-FR sensor (Sentinel 3; 300 m resolution) from 23rd March allowed the visualization of the extent of this bloom which covered almost the entire bay. On this day, we took samples at station S3 when Chl-a was at 8.2 mg/m³. Water samples from the three stations were taken to analyze the light absorption properties of particulate and dissolved material. On 23rd March we also deployed the RAMSES hyperspectral radiometer, an instrument that measures marine reflectance ($Rrs_{(\lambda)}$). In doing so we had the objective of determining some optical characteristic specific to this dinoflagellate bloom that can help us to modify or propose new algorithms for the remote detection of this type of bloom, as long as more data are acquired.

Some peculiarities were observed. First, the strong change in $Rrs_{(\lambda)}$ when comparing the NANO-DOAP station and station S3, which was characterized by a change in the blue:green ratio (indicated by the arrows in Figure 3), a characteristic feature related to the increase in Chl-a. However, there was also a strong decrease of $Rrs_{(\lambda)}$ in the UV part of the spectrum.

The spectral shape of the light absorption coefficient by phytoplankton ($aph_{(\lambda)}$) and detritus and coloured dissolved organic matter ($adg_{(\lambda)}$), between 250 and 700 nm, were examined (Figure 4) and compared to the average spectrum of the NANO-DOAP station, where no bloom has been detected, and Chl-a is in general below 2 mg/m³. The $aph_{(\lambda)}$ spectra from the stations affected by *L. polyedra* were characterized by a peak around 380 nm that is not observed in the NANO-DOAP station. Also, the $adg_{(\lambda)}$ spectra showed some peaks between 310 and 380 nm, most pronounced at 310 nm at station S2 which was that with the highest Chl-a (36.2 mg/m³). The presence of these peaks in the UV part of the spectrum (between 310 and 360 nm) has been associated with light absorption by mycosporine-like amino acids (MAAs) that some surface bloom-forming dinoflagellates can produce as a photoprotective compound against the UV radiation. It can be found

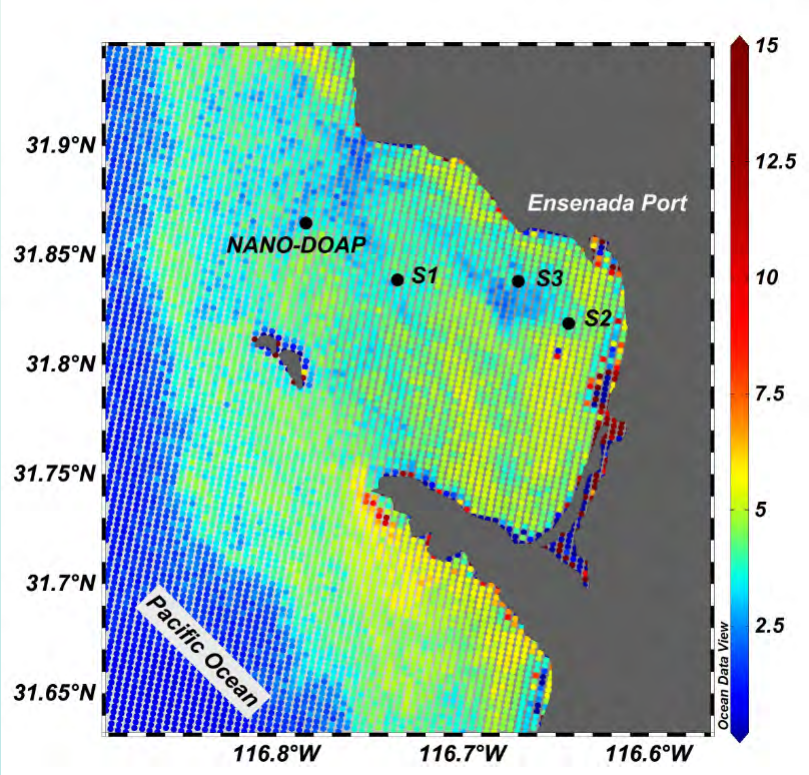

Figure 1 - Satellite image of chlorophyll a concentration (mg/m³) at 300 m of spatial resolution, from sensor OLCI FR (Sentinel 3). Map depicts the geographical location of the NANO-DOAP sampling station and of the three opportunity stations (S1, S2 and S3).

in the cytoplasm of a cell, which explains the peaks observed in $aph(\lambda)$, and also can be released in water, explaining the peaks observed in $adg(\lambda)$.

These results are still under analysis and we are looking for more data that can help us to confirm the patterns observed. First, as a tool to implement some type of warning system for *L. polyedra* bloom development using satellite images or buoy platforms and also to understand the role of MAA synthesis for this species success and/or for the entire bay ecosystem (including the NANO-DOAP station).

Acknowledgments

We thank Maria Ester Guzman Hernandez for the microscopic counts of these samples and all the students and professors at the NANO-DOAP station in Ensenada who have been participating in field campaigns and laboratory analyses. Also, we thank CONACyT for the grant received by the students M.E. Guzman and M. Larios Muñiz and project CF-1327711.

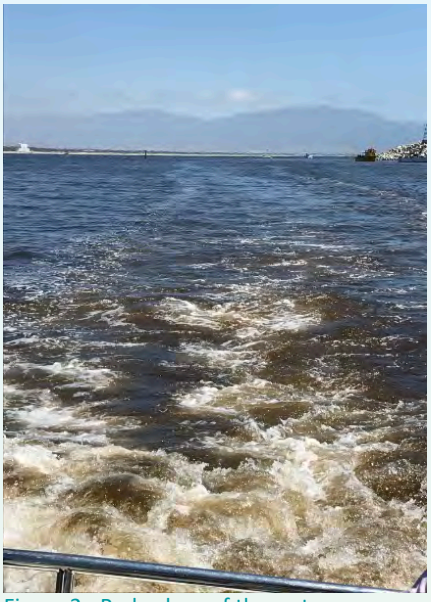

Figure 2 - Red colour of the water seen from the boat stern on June 8th 2019.

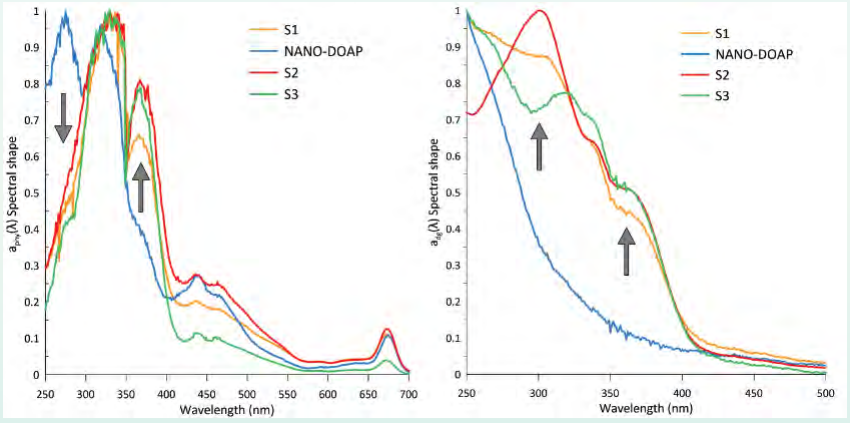

Figure 3 - Spectral shape of the light absorption coefficient by phytoplankton ($aph(\lambda)$, left) and by detritus and coloured dissolved organic matter ($adg(\lambda)$, right) for the three stations affected by *L. polyedra* bloom and for the NANO-DOAP station. Arrows were used to emphasize those regions of the electromagnetic spectra where more pronounced changes were observed.

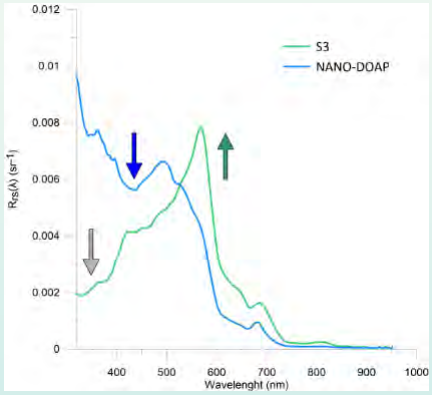

Figure 4 - Remote sensing reflectance ($Rrs(\lambda)$) measured at stations S3 and at the NANO-DOAP station.

Table 1 - Data from the stations affected by the *Lingulodinium polyedra* bloom.

Date	Site	Chl-a (mg/m^3)	Abundance (cel/L)	% Dominance
June 8th 2019	S1	10	121,120	85% *Lingulodinium polyedra*
June 8th 2019	S2	36.2	717,800	87% *Lingulodinium polyedra*
March 23th 2022	S3	8.2	260,080	65% *Lingulodinium polyedra*

NANO RESEARCH PROJECT

NANO Global Project (NANO-DOAP) Salambô and Kuriat Island (Tunisia) stations

Coastal hydrographic monitoring: nearly four years of NANO-DOAP in Tunisia

Houssem Smeti

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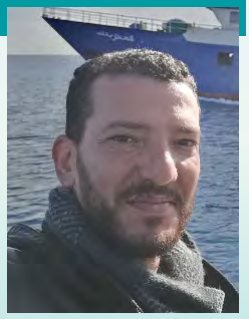

The participation of NANO members from Tunisia in the NANO project started in 2012 with the **NANO North-West Africa project: Observation and modeling of coastal hydrodynamics and erosion**. Then, in 2017, I joined the NANO-DOAP project which led to the establishment of three time-series stations off the coast of Monastir city and near Kuriat islands (central eastern Tunisia). These islands (Figure 1) are located 18 km off the coast of the city of Monastir and consist of two small islands: the Small Kuriat and the Great Kuriat, 0.7 km² and 2.7 km² in area, respectively. Large areas of sea grass (*Posidonia oceanica*) meadows cover the

bottom of the sea around the Islands. The Kuriat islands are a principal nesting beach for the loggerhead sea turtle (*Caretta caretta*) and many bird species. These islands are an ideal location for long-term monitoring of essential oceanographic variables, as they are relatively far from the main sources of anthropogenic activities located along the coastline. They constitute a hot spot for tourism and artisanal fishing, and are part of the Mediterranean consortium of marine and coastal protected areas as an important conservation site for several marine species.

Given their relatively easily-accessible offshore location, the Kuriat Islands are ideal for long-term monitoring of selected essential oceanographic variables. As part of the NANO-DOAP project, a bi-monthly sampling has been maintained at two stations: (S1) near the coast of the city of Monastir and (S2) near Kuriat islands since March 2019 (sampling at a third station, S3, occurred until December 2020). Ongoing fieldwork is carried bimonthly at S1 and S2. A coastal fishing boat is hired to help with the fieldwork. Using a handheld YSI/Xylem environmental multi-sensor, temperature (Temp), salinity (Sal) and dissolved oxygen (DO) are measured in surface water. The conductivity and DO probes are calibrated every two months. Here we present for the first time the preliminary results from time-series data collected at the nearshore station S1, from March 2019 to August 2022 (Figure 2). The data show the predominance of the seasonal cycle, typical of the south Mediterranean semi-arid climate. Higher sea surface Temp and Sal were recorded during the summer dry period (June-Sep) while cooler and fresher water occured during the winter season. The concentration of DO was inversely correlated to Temp and Sal.

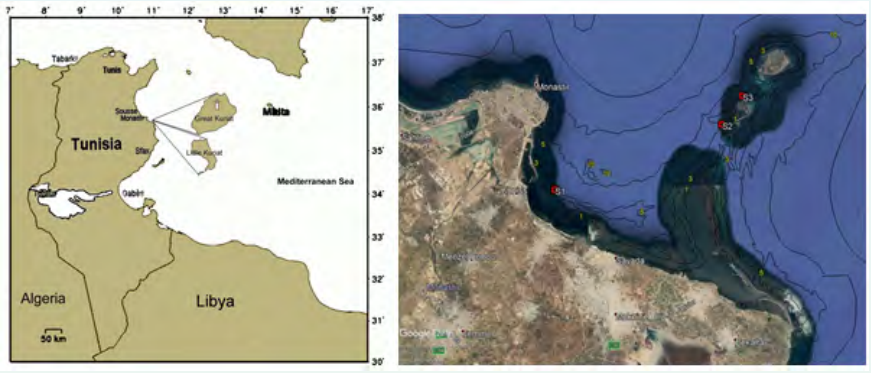

Figure 1 - NANO-DOAP Tunisian stations in Kuriat Island

NANO-DOAP activities in the Kuriat islands study site also included public outreach. An outreach event was organized with a group of teenagers brought by a French youth association who were completing an internship with the NGO “Notre Grand Bleu”. Participants were introduced to the importance of coastal water quality monitoring and the instruments that can be used for such work. My collaboration with the NGO dates back to 2017, during the inception of the NANO-DOAP project.

Currently, the station representative and two members of the NGO are involved in the fieldwork. There is also a plan for future collaboration with a local university (Higher Institute of Biotechnology) that can help maintain the study site and possibly involve bachelor students in environmental sciences and master students in monitoring and management of coastal environment.

Future plans for coastal observations at the Tunisian site “Kuriat Islands” include sampling of other EOVs (i.e. sea level height, chlorophyll-a; pH and nutrients) and public outreach events, especially for the youth.

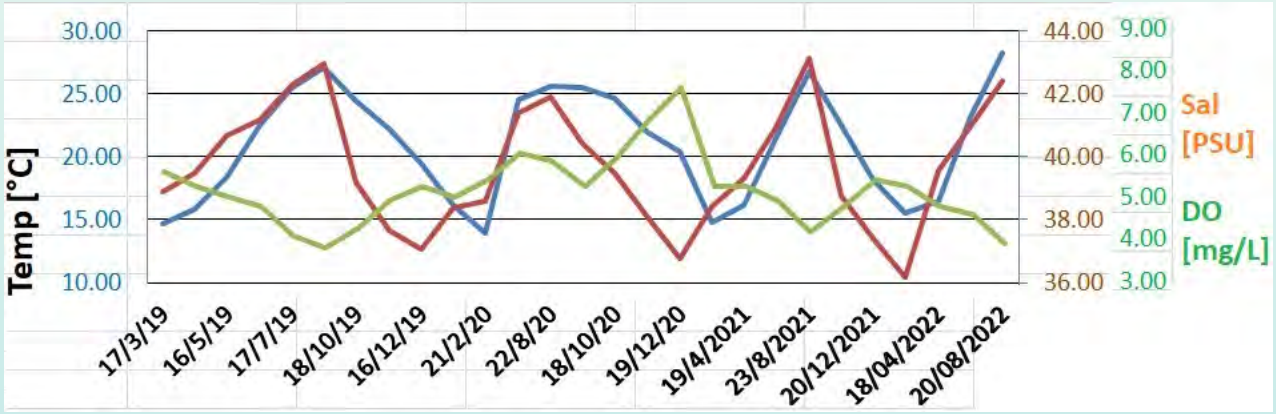

Figure 2 -Time-series of Temperature, Salinity and Dissolved Oxygen collected at NANO-DOAP station S1 from March 2019 to August 2022.

Fieldwork and Outreach at the Tunisian NANO-DOAP station. Photos credit: H. Smeti.

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NANO Global Project (NANO-DOAP) The Pangandaraan TEPAST (Indonesia) station
Initiative for long-term measurements in Eastern Indian Ocean

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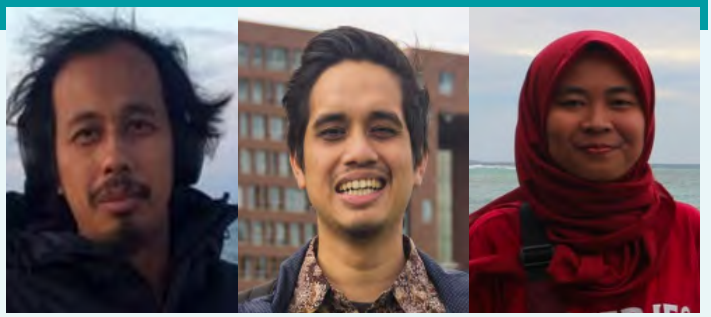

Indian Ocean Characteristics

Recently, ocean monitoring has become a priority in global studies. In the era of global warming and climate change, *in situ* data with continuous observation are essential to predict shifts in ocean conditions. With **NANO-DOAP**, we initiate monitoring one of the complex systems in the Eastern Indian Ocean. The Eastern Indian Ocean (EIO) is one of the most important oceans in the world, with high diversity in ecosystems and fish species. It is located between Australia and Indonesia and has connections with the Antarctic and the Southern Ocean. This area has recently been related to several phenomena, such as global warming, El Niño Southern Oscillation (ENSO), and Indian Ocean Dipole (IOD).

In this project, we carried out continuous monitoring at Pangandaraan Bay, located on a peninsula on the south coast of West Java (-7.716°S, 108.508°W). This area is known for its upwelling that usually occur from June to October. Due to the high productivity, this location has become an important fisheries location. In general, the dynamics of this area have a very complex circulation. Pangandaraan Bay is also well known for its rip currents. Besides that, on a seasonal scale, Pangandaraan areas are influenced by the Australian and Asian Monsoons. The study area is also prone to natural disasters, particularly earthquakes and tsunami waves.

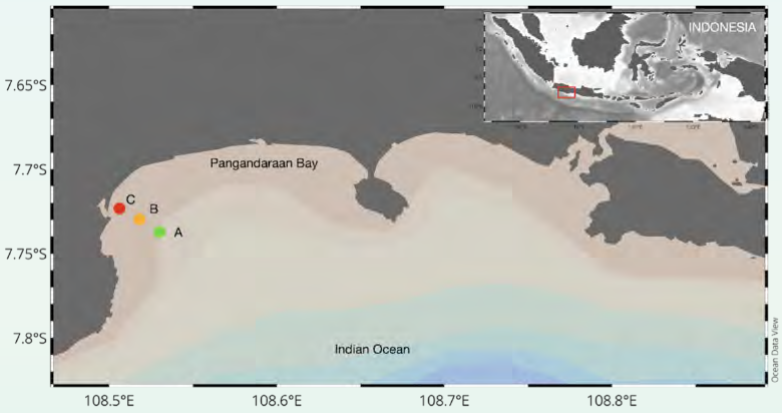

Figure 1 - NANO DOAP sampling locations in EIO (south Java sea)

Data Summary

The TEPAST station has been part of NANO-DOAP project since September 2021, monitoring ocean dynamics and supporting global observations by sampling at a fixed station between the 16th and the 20th day of every month. Usually, sampling is done in the morning due to wind and tide conditions. First, water samples are collected in three depths (surface, 10, and 20 metres). The parameters measured in the field include temperature, salinity, pH, dissolved oxygen, and chlorophyll-a. Samples are taken using the Nansen bottle, and a multiparameter instrument measures all parameters except chlorophyll-a concentration. A 1.5 litre sample of water from the Nansen bottle is then analysed in the laboratory based on the chl-a protocol. In addition, the water transparency at the station is also measured with a Secchi disc.

Generally, the average for all parameters is not quite different between the surface and seabed. The average temperature is around 29.70 °C, with a minimum value of 26.70 °C (July) and a maximum of 32.71 °C (June). Salinity has an average of around 28.68 PSU with a minimum value of 24.70 PSU (April) and a maximum of 32.37 PSU (October). Dissolved oxygen has an average of around 6.07 mg/l with a minimum value of 4.17 mg/l (July) and a maximum of 7.33 mg/l (September). pH averages around 7.33, with a minimum value of 5.97 (September) and a maximum of 8.47 (July). Chlorophyll-a has an average of 0.040 mg/l with a minimum value of 0.029 mg/l (September) and a maximum of 0.061 mg/l (February). Finally, ocean transparency based on the Secchi disc, shows an average value of 6.74 m with a minimum value of 4.00 m and a maximum of 7.13 m.

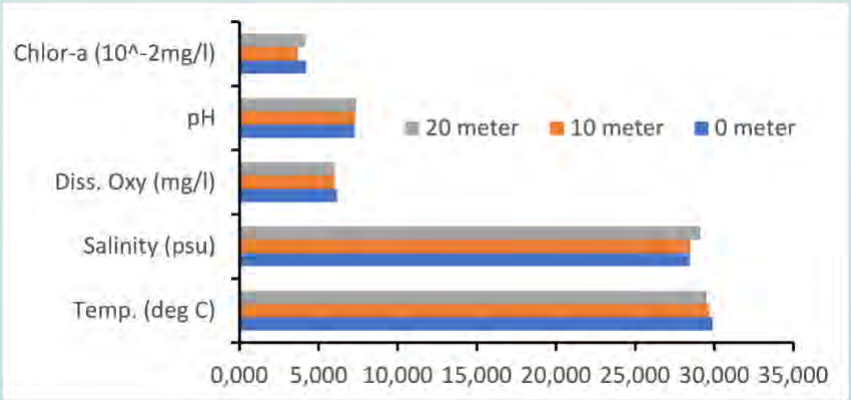

Figure 2 - Monthly average data for one-year monitoring at three depths.

Experience

This project led us to have many experiences. One challenge of sampling in the Indian Ocean is weather and waves. It was difficult to get data from June to August due to extreme waves (nearly 3 metres). Usually, calm water occurs in the morning between 5 AM and 8 AM followed by rough conditions the rest of the day. Thanks to this project, we gained experience in sampling under different conditions; as Franklin D. Roosevelt said, "the smooth sea never made a skilled sailor". One field observer and laboratory analyst were involved in this project (Anggi Nugraha and Riana C. Dewi). Their experience enhanced and became a foundation for teaching and laboratory activities for students. This year, several students from the fisheries department were also involved in collecting samples. The linkage between field observation and teaching is excellent.

In the future, we will add several parameters, including nutrient composition and plankton identifications. Those parameters are quite important since this area is known as an upwelling region and habitat for tuna. It is expected that this new station will become a pioneer in Indonesia and contribute to stakeholders and government decision-making for managing the ocean in terms of ocean health and sustainability.

Figure 3 - NANO-DOAP TEPAST Activities in field and laboratory.

Career insights survey

Dear NANO member,

At the 24th POGO annual meeting, a crucial topic emerged among NANO members and was brought to POGO: the growing number of scientists leaving academia. We have discussed potential reasons behind this trend and aim to address the issue in greater depth to raise awareness among our members. To achieve this, we have created a survey and kindly invite you to collaborate with us. The survey is entirely anonymous and aims not only to provide us with valuable insights into the careers of our NANO members but also to help us create a commission to discuss coping mechanisms, solutions, and additional support for those in need.

The survey results will be published in our next newsletter. This will help us reach members as well as other researchers and institutions, and bring greater attention to the issues ECOPs are facing.

We are who we are because of you, and your opinion is of the utmost importance to us. We want to listen.

Please answer the survey at *https://forms.gle/9W2JMAp6iZnT7txJA* by 15 June 2023.

This initiative is led by Alum Fernanda DI Alzira.

COVID-19's impact on the water quality along Moroccan coast

H. Azidane[1]*, Noir Purba Primadona[2+], M. Boko[3], M. E. Bouhaddioui[4] and B. Magrane[5]

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+Alum profile: https://nf-pogo-alumni.org/profile/Noaa1782/

Introduction

In March 2020, the coronavirus disease 2019 (COVID-19) was in the spotlight of news media worldwide, mainly because of its impacts on the economy, anthropogenic as well as industrial activities. The Government of Morocco implemented stringent lockdowns starting 23rd March, 2020 and then relaxing it in different phases from 1st June 2020. Thus, as in many other coastal cities across the world, environmental change in the area threatened its water quality during this period (Dantas et al., 2020; Yunus et al., 2020; Garg et al., 2020). In this study, we examined this event from an environmental perspective by analyzing the impact of the pandemic over the Atlantic coast and of operations like dredging on the concentration of Total Suspended Matter (TSM). The mapping of TSM using satellite data is particularly important in a wide range of aquatic sciences and management applications. Shallow water of the Moroccan coast is influenced by TSM, especially over areas that have a strong tidal influence where the resuspension of sediments may reach further offshore. There is also a strong influence of TSM due to High Sebou River run off (Azidane et al., 2021). This pandemic has provided a good opportunity to assess the impact of anthropogenic activities on the Moroccan coast. In this regard, we hypothesize that the COVID-19-induced lockdown will have improved the water quality of the region.

Material and methods

Study area

The Moroccan coast of the Atlantic Ocean is an important region in the local ecological system. This region experiences strong currents and various tidal elevations. The area harbors several major and minor ports and is subject to intensive industrial activities and urban growth (DPDPM, 2008). Thus, as many other coastal regions, environmental change, inland processes including sediment, nutrient fluxes (riverine flux), and anthropogenic activities in the area threaten its water quality (Bennasser et al., 1998; Bouasria et al., 2007; Alaoui et al., 2008; DPDPM, 2011b). An increasing level of sand mining, for example, has stirred up heavy metals in the sediment load from the Sebou river in Kenitra city (DPDPM, 2007; METL, 2014; Jaaidi and Cirac, 1987). The study area is situated in the North Atlantic Ocean, on the north-western coast of Africa, between Spain and Western Sahara (Figure 1). Along the coastline, different geomorphologies have been recognized and described depending on topography, elevation, shape, and composition characteristics (e.g., rock types and unconsolidated materials), and the different water bodies such as rivers, estuaries, lagoons, and deltas drain into the coast. The longshore drifts associated with the waves are the principal agents responsible for the sedimentary transport and the sand distribution along the coat. Many researchers concluded that this area along the coast has a potential coastal erosion (Moussaid et al., 2015; Azidane et al., 2017). A variety of the present erosion could be associated with coastal response to river sediment sources, river sediment transport, and sea level rise and dune destruction. Indeed, the higher dredging intensity that occurs along the Moroccan coast and illegal sand extraction can minimize sediment volumes. These marine activities are mostly distributed in the northern and western parts of the study area (Figure 1).

Figure 1 - Study area maps with the location of 111 PINS.

Datasets and image processing

Satellite-derived TSM data, considered a good indicator of water quality (e. G., Azidane et al., 2021) was processed and mapped over the study area for periods pre-, post- and during lockdown. Composites for April 2018 and April 2019 represent two different pre-lockdown periods, when tourism, industrial and aquaculture activities where "business as usual". April 2020 and April 2021 represent the periods during lockdown and post-lockdown, respectively. During these months, such activities were completely ceased. A total of 240 Landsat images of the Moroccan coast were obtained

from GlobColour Merged for the period from April 2018 to April 2021, with daily temporal resolution and 4km spatial resolution (Table 1). The TSM values corresponding to our points of interest were geo-corrected, and land and cloud areas were masked out in order to obtain very precise TSM measurements. Upon extracting a dataset to a local system, the data were displayed to access image quality and then processed using the ESA Sentinel Application Platform (SNAP). Figure 2 shows the following steps using the latest platform.

Table 1 - Landsat images of the Moroccan coast used in this study.

Period of acquisition	Product ID	Remarks
01/04/2018 - 30/04/2018	L3m_20180401__695624552_4_AV-OLA_TSM_DAY_00---- L3m_20180430__695624552_4_AV-OLA_TSM_DAY_00	Pre-Lockdown
01/04/2019 - 30/04/2019	L3m_20190401__892672513_4_AV-OLA_TSM_DAY_00---- L3m_20190430__892672513_4_AV-OLB_TSM_DAY_00	Pre-Lockdown
01/04/2020 - 30/04/2020	L3m_20200401__298557981_4_AV-OLA_TSM_DAY_00---- L3m_20200430__298557981_4_AV-OLB_TSM_DAY_00	During Lockdown
01/04/2021 - 30/04/2021	L3m_20210401__660445597_4_AV-OLA_TSM_DAY_00---- L3m_20210430__660445597_4_AV-OLB_TSM_DAY_00	Post-Lockdown

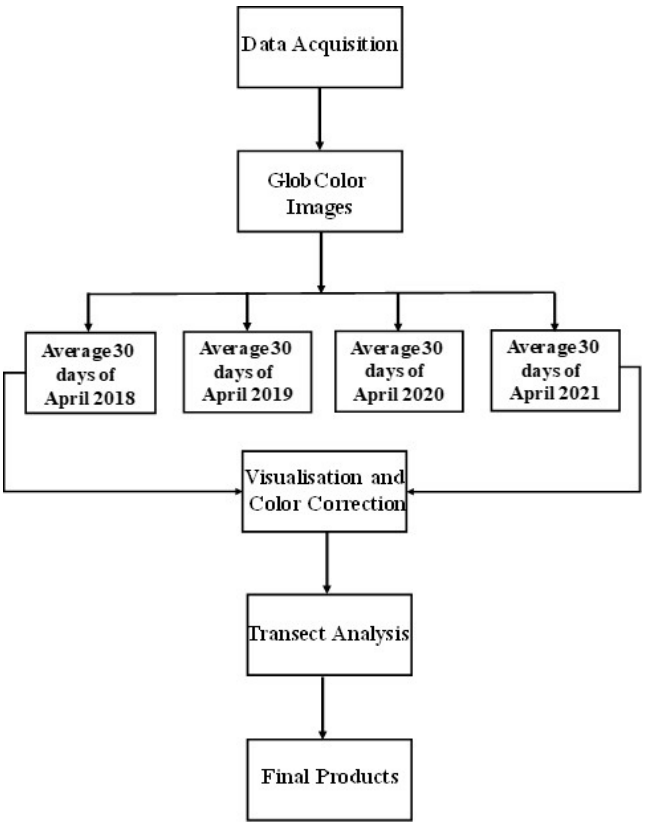

Figure 2 - Workflow of extracting Total Suspended Matter using Sentinel Application Platform (SNAP) software.

Results and Discussion

Daily variability of satellite TSM concentration

A remarkably high TSM was observed on Google Earth Engine over the shallow region during the pandemic (Figure 3). TSM data from 1st to 30th April has been studied for a period of 4 years (2018-2021; Figure 4).

Figure 4 shows an important variation of TSM values from north to south. In April 2018, the highest values were registered in the north (Tanger region), in the north and the south of the Oum-Er-Rbia river mouth and Tensift river mouth. Similar changes were found in April 2019, but in less turbid waters. This may have been due to higher amount of sand dredging concentrated in these áreas, consistent with the results of Azidane et al. (2017).

However, the pattern of turbidity has changed over April 2020 and 2021. It was inferred that the water quality has improved over the coast. It showed a positive drop in the level of water quality. This indicates that there was less sand dredging or other coastal activities.

Morocco is known for its intense industrial activities. Being on the bank of the river, the effluent from these industries reach the rivers (e.g. Sebou river, Oum-Er-Rbia river and Tensift river) and pollute their waters, especially during the pre-lockdown period.

On the other hand, along the Moroccan coast, it was noticed that the turbidity was higher during the pre-lockdown period (April 2018 and April 2019). But it reduced during the lockdown and post-lockdown periods (April 2020 and April 2021).

For quantitative verification, information from 111 pixels was used to examine the TSM mean in each pixel box. Their location areas are displayed in Figure 1. Further, comparing the average TSM during the lockdown period (April 2020) with those of the pre-lockdown period, an important decrease was observed (-40.6% on average) (See Table 2). Overall, the analysis showed that the TSM value is consistently low in the shallow water during the lockdown time interval. Therefore, it seems that the lockdown did have a positive impact on shallow water quality.

Descriptive statistics and time series analysis are used to detect the trend of the water quality during the pre-lockdown, the lockdown, and the post lockdown along the Moroccan coast. Figure 5 shows the trend of TSM concentration of coast water in April 2018, 2019, 2020 and 2021.

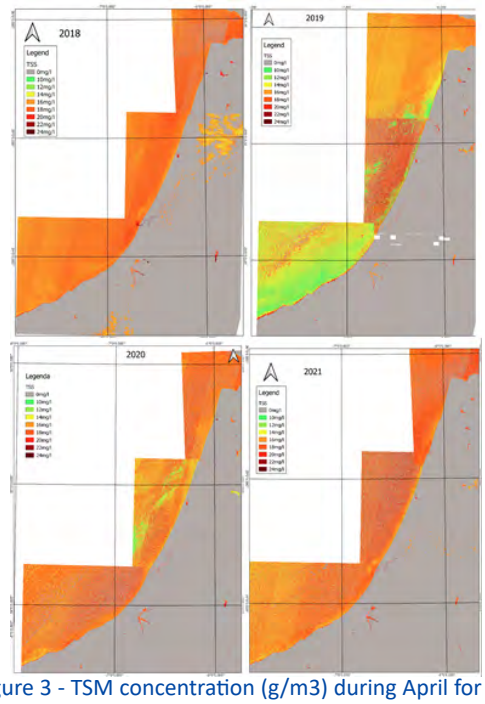

Figure 3 - TSM concentration (g/m3) during April for the years 2018 to 2021 as seen on Google Earth Engine.

Table 2 - Mean Total Suspended Matter concentrations along the Moroccan coast in 2020.

TSM average (g/m³)		% Decrease
Pre-lockdown	During lockdown	(pre-lockdown vs. during lockdown)
11.883	7.059	40.595

The TSM had spatial variability between 2018 and 2021 (Figure 5). The results of statistical analysis showed that, in general, water turbidity was lower in April 2020 followed by 2021, during and post-lockdown periods, respectively. Nonetheless, the northern sector, close to the mouth of Sebou river (between PINS 95 and 97), recorded high TSM concentration on the same periods, likely due to local population activities. Collecting and checking *in situ* data should be good steps to identify the possible causes of this differentiation.

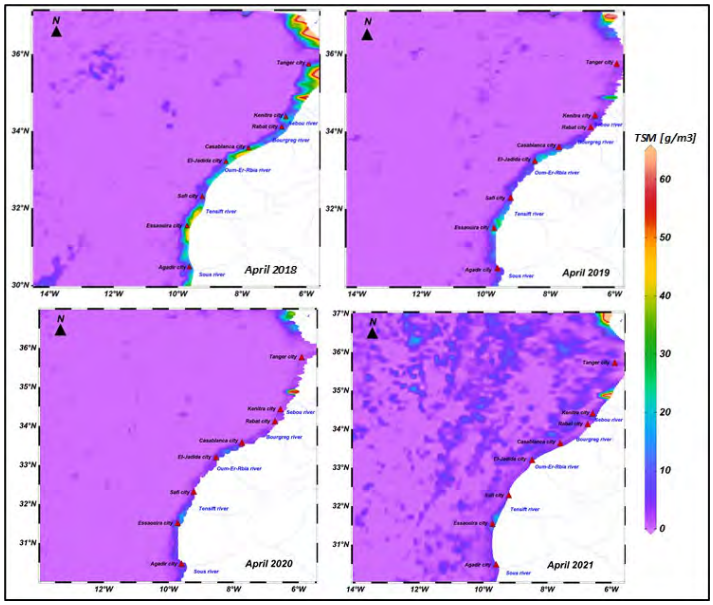

Figure4 - Total Suspended Matter from 2018 to 2021 during April (values in g/m³; violet is low and red is the highest concentration).

It is now clear that satellite images recorded in April (2018-2021) were good tools for analysing the TSM concentration (e.g. Wang et al., 2020; Dantas et al., 2020). Within a few months of the lockdown, the water quality had improved in the area. So for the eco-restoration of different components of the environment along the coast, the wastewater and the industrial waste or other input elements should be managed properly, to reduce further infection and environmental pollution, which tends to be a matter of concern globally.

Conclusions

Through our study, we demonstrate how satellite data and time series analysis of TSM products contributed to our understanding of lockdown impact on shallow coastal areas. The spatial distribution and temporal variability of TSM concentration in the North Atlantic Ocean of Moroccan coastal waters were investigated for the months April 2018, 2019, 2020 and 2021. Results clearly established that higher TSM concentrations were observed in April 2018 and 2019, and lower TSM concentrations characterized in April 2020 and 2021.

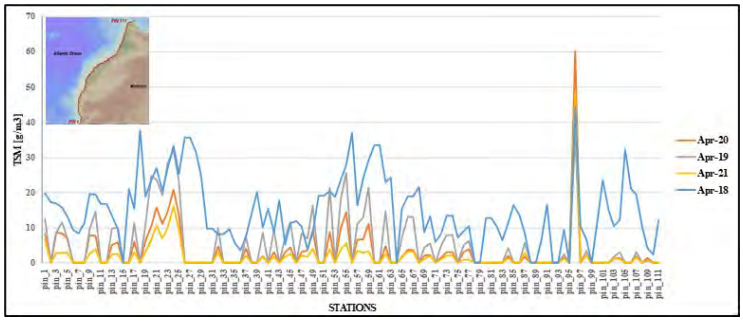

Figure 5 - Time series analysis of suspended particulate matter concentrations in Morocco during April (2018-2021).

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Coral reef defies global climate change

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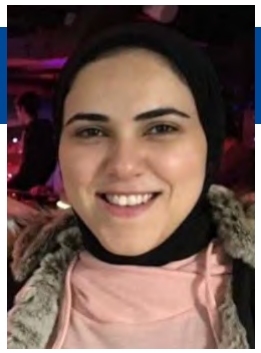

I am an Egyptian marine biologist living in Port Said, Egypt. Growing up in a coastal city located on the Mediterranean Sea magnified my passion to discover more about seas and oceans around the globe. Furthermore, the presence of the endemic habitats in the Egyptian Red Sea (Baby ocean) made me curious, to delve deeper in its features as well.

This interest developed into my current career path. Under climate change threaths, the Red Sea is considered by many to be the last refuge for the world's corals, important organisms for primary production in the ocean. Nonetheless, studies conducted on the Red Sea coral reefs are very limited. These organisms encouraged me to study more about them in the Red Sea and other ocean basins to understand their differences. Therefore, I decided to study oceanography and got my BSc. from the Marine Science Department, Faculty of Science, Port Said University, Egypt. I am also a scuba diver, having obtained my PADI diving certification, which allows me to stay linked to the ocean and its mysteries.

Over the course of time, I felt like I belonged to the Red Sea, so I decided to do my Master's degree, which was not easy, but I took it upon myself to learn more about the Red Sea's secrets and conserve that precious nature. My master's thesis concerned the natural and human threats which disrupt soft coral distribution along the Egyptian coast of the Red Sea. Furthermore, it represented the first research on the genetic identification of zooxanthella hosted by soft coral genera in the Egyptian Red Sea. My research also investigated the thermal tolerance of soft corals towards climate change by identifying the core taxa and the functional diversity of their associated micro-biomes (specifically, zooxanthellae) which certainly ameliorate the coral resilience.

After completing my Master's degree, I was fortunate to receive training at the NF-POGO Centre of Excellence in Observational Oceanography at the AWI, in Germany. During my time in Helgoland, I had the chance of acquiring practical skills in field and laboratories, as well as of working with experts in a great scientific environment, which increased my knowledge immensely. At the CofE, I was able to further expand and develop my interest in this field, by researching cold water corals for my graduation project. Currently, I am working on my PhD thesis entitled "Coral Resilience based on High-Resolution Characterization of Microbiomes in the Red Sea Corals, Egypt". I am making good progress in my study which is segmented to a survey, and collecting samples for genetic identification. My PhD study is sponsored by HEPCA, an NGO that works primarily with marine and land conservation in the Red Sea Governorate in Egypt. I will never stop observing the Red Sea's mysteries about the thermal tolerance towards the current greatest challenge of climate change.

Finally, I enthusiastically participated at the United Nations Climate Change Conference (COP27) in Sharm El-Sheikh, Egypt in November 2022, as one of the NANO alumni in the POGO delegation. I believe this conference raised the general public awareness about our environments and ocean.

Scientific events announcements

Towards the new Arctic Ocean – Past, Present, Future
Tromsø, Norway
7-9 November 2023

We welcome contributions from the international research community and discussions across Earth system science to shed light on and reveal both regional characteristics, connections and pan-Arctic responses. Join with contributions and discussions on how the Arctic Ocean is changing and what it will look like in the near future.

Deadline for abstracts
15 May 2023

https://www.nansenlegacy-symposium.com/

West Africa Marine Science Symposium (WAMSS)
Accra, Ghana
18-20 August 2023

WAMSS will bring together marine and coastal experts, storytellers, youth, government bodies, Non-governmental organisations, funders, and National Geographic Society Explorers from and working in West Africa in order to: Foster critical knowledge exchange and cross-pollinate perspectives on the challenges and opportunities in the region, sharing successes and lessons learned with practitioners across sectors as well as the broader public. WAMSS plan to highlight career paths and funding opportunities, offer grant writing workshops, and forge critical connections. Identify successful marine research and conservation models and catalyze collaborative projects by connecting funders with potential grant applicants.

Deadline for abstracts
31 May 2023

https://wamssmeeting.com/index.html

9th World Fisheries Congress
Seattle, USA
3-9 March 2024

Every four years delegates from around the world meet to exchange ideas and perspectives about new research, emerging issues, scientific breakthroughs, and governance related to fisheries science, industry, conservation, and management. Join us in 2024 as we explore the congress theme of Fish and Fisheries at the Food-Water-Energy Nexus. We are preparing a program composed of an opening plenary, general sessions, education workshops, and planned symposia related to sustainability, fish and aquatic ecosystems, fisheries and society, and innovations in fisheries..

Deadline for abstracts
30 June 2023

https://wfc2024.fisheries.org/

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