



Cameroon Wildlife
Conservation Society



WORKSHOP REPORT

3rd EDITION

WEST AND CENTRAL AFRICA COASTAL AREAS –
MAPPING VULNERABILITY, ADAPTABILITY AND RESILIENCE IN A
CHANGING CLIMATE (WACA-VAR)



December 6th to 8th, 2023

Kribi, Cameroon

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Table of Content

CONTEXT AND OBJECTIVES OF THE WACA-VAR 2023 WORKSHOP	4
WORKSHOP PROGRAM	6
DAY ONE: WEDNESDAY 06 th DECEMBER 2023 (WACA-VAR and related projets in the Gulf of Guinea)	8
12h00 - 13h00 : Lunch break.....	8
13h00 - 13h10 : Opening remark and family photo - Dr Rafael ALMAR.....	8
13h10 - 13h30 : WACA ResIP program - Ousmane Ilboudo (UEMOA), Ahmed Senhoury (PRCM), Sarah Jung (World Bank) - On line	8
13h30 - 13h50 : ENGUL Research program 2023-2024 - Marie-Noelle Woillez (AFD) - On line	9
13h50 - 14h10 : WACA-VAR program - Donatus Angnuureng (UCC).....	9
14h10 - 16h10 : Short course : MEPELS (<i>Modèle d'évolution des plages et environnement littoraux sableux</i>) - Thierry Garlan (SHOM).....	9
16h10 - 16h30 : Coffee – break	10
16h30 – 18h30 : Short course : S2Shores (Bathymetry estimation using Sentinel 2 satellite image) - Erwin Bergsma (CNES).....	10
DAY TWO: THURSDAY 07 th DECEMBER 2023 (WACA-VAR Activities).....	11
07h00 - 07h45 : Breakfast	11
7h50 - 8h10 : Coastal vulnerability in Senegal - Abdoulaye NDOUR (UCAD).....	11
8h10 - 8h30 : Coastal vulnerability in Côte d'Ivoire - Alassane OUATTARA (UNA)	11
8h30 - 8h50 : Coastal vulnerability in Benin - Frédéric BONOU (UNSTIM).....	11
8h50 - 09h10 : Training programs, University of Cape Coast (Ghana) - Donatus ANGNUURENG (ACECOR - UCC).....	12
09h10 - 09h30 : Coastal vulnerability in Gabon - Sylvie Brizard ZONGO (USTM)	12
09h30 - 09h45 : Coffee break.....	12
09h45 - 10h15 : Questions & Answers session	12
10h15 - 11h15 : Open discussion on WACA-VAR perspectives – Rafael ALMAR (IRD)	12
i. Special issue continuation and expansion.....	13
ii. Data sharing	13
iii. Forecasting of coastal changes	14
iv. Technical training and mobility.....	14
v. Web Site (announcements, field photos, latest publications, etc.).....	14
vi. List of expertise / mailing list.....	14
vii. Next edition of WACA-VAR workshop	15
viii. Bring private sector and companies to WACA-VAR (seeking private funding)	15
ix. What can we do to attract attention in Africa by media, governments, etc. ?.....	15

x. Suggestions.....	16
11h15 - 12h30 : Short course : Methods for Calculating Coastal Risk Vulnerability Indices (Flooding) – Raphaël ONGUENE	16
12h30 - 13h15 : Lunch break.....	17
13h15 - 13h30 : Cameroon Wildlife Conservation Society – Eugène DUYUKE	17
13h30 - 13h45 : The Cameroon Fisheries Society (CFS) – Thomas EWOUKEM EFOLE	18
13h45 - 14h00 : Association of Professionals in Coastal and Aquatic Management (APCAM) – Ernest OHANDJA	19
14h00 - 14h15 : Association Camerounaise pour la Recherche et l’innovation en Technologies de l’Energie et de l’Environnement (ACRITEE) – Mathieu PESDJOCK.....	20
14h15 - 14h30 : The Institute of Fisheries and Aquatic Sciences – Gabel ESSOME, Narcisse EBANGO.....	20
14h30 - 14h45 : National Advanced School Of Maritime And Ocean Science And Technology (NASMOST) – Grégoire ONDOA ABESSOLO	20
14h45 - 15h00 : Coffee break.....	21
15h00 - 16h00 : Short course : Measure and calculate the carbonate system (ocean acidification) – Ulrich BILOUNGA.....	21
16h00 - 17h00 : Geospatial analysis and environmental indicators : presentation of the package mapme.biodiversity – Lenaïg Moign (IRD).....	21
17h00 - 17h10 : Presentation of attendance certificates	22
DAY THREE: FRIDAY 08 th DECEMBER 2023	23
08h00 - 08h30 : Breakfast	23
08h30 - 10h30 : Field trip.....	23
10h30 : End of WACA-VAR Workshop activities and departure to Douala.....	23
MAIN OUTCOMES OF THE 2023 WACA-VAR KRIBI WORKSHOP	24
LIST OF PARTICIPANTS	25
LIST OF MODERATORS AND RAPPORTEURS	28

CONTEXT AND OBJECTIVES OF THE WACA-VAR 2023 WORKSHOP

The coasts of West and Central Africa (WCA) are low-lying areas endowed with flourishing, functional ecosystems offering multiple services. But population growth and economic activities, in the form of often unplanned urbanization (construction in high-risk areas, beach sand extraction, etc.) and over-exploitation of natural resources (fishing, mangrove exploitation, etc.), combined with climate change, are putting pressure on these coastal ecosystems. As a result, WCA's coastal zones are subject to an intensification of phenomena such as coastal erosion, flooding and pollution, leading to loss of human life, damage to property and infrastructure, and damage to critical ecosystems and their resources. A number of major regional studies point to an increase in these risks, amplified by strong growth in urban populations and the development of economic activities in a changing climate. Consequently, the ability to anticipate, plan and strategically manage the development of WCA's coastal zones is crucial to preventing potential risks.

The West African Coastal Areas (WACA) program was launched in response to the urgent need to protect the coastal zones of West and Central Africa from climate change and human activities. This program supports the establishment of the West African Regional Coastal Observatory (WARCO) and the West African Coastal Master Plan (SDLAO – "*Schéma Directeur du Littoral d'Afrique de l'Ouest*"). WARCO was set up in 2018 with a mandate to (i) support, improve and promote scientific and technical knowledge; (ii) provide tools for understanding and managing coastal zones; and (iii) establish a sustainable and integrated coastal policy. The SDLAO is responsible for identifying coastal zone issues and national coastal risks in a broad context, emphasizing inter-state solidarity and reciprocity in coastal management. It is also responsible for identifying priority coastal issues and analyzing the performance of existing government instruments for managing the various problems. These programs require reliable, up-to-date information to be shared and made available to the various decision-making levels in order to improve the strategic quality of decisions linked to the development, occupation and conservation of WCA's coastal zones.

Following on from WACA, the "West African Coastal Areas- mapping Vulnerability, Adaptability and Resilience in a changing climate" (WACA-VAR) program has been set up to conduct an integrated study and develop innovative management strategies for a sustainable coast in the face of climate change, human activities and economic growth. In addition, an International Research Network (IRN), supported by the Institut de Recherche pour le Développement (IRD), was set up in December 2022 to achieve the objectives of the WACA-VAR program. This network brings together six universities in six West and Central African countries, under the supervision of the French Institute of Research for Development

(IRD): University of Douala (Cameroon), University Cheikh Anta Diop (Senegal), University Nangui Abrogoua (Côte d'Ivoire), University of Cape Coast (Ghana), Institut de Recherches Halieutiques et Océanologiques du Bénin (Benin), Federal University of Technology, Akure (Nigeria). This network aims to (i) improve knowledge of the current and future vulnerabilities of the coasts of West and Central Africa, (ii) provide new data, information and tools that will be useful to investors, local and regional stakeholders (including coastal communities), and (iii) develop the capacities of local and regional stakeholders (including postgraduate students (i.e. MSc, PhD and Postdoc) through the training of current managers, future experts on the coasts of Central and West Africa and young researchers. In addition, this research network coordinates the collection of data on the hydrodynamic and morphological characteristics of the coastline of Central and West Africa through field measurement campaigns, and the implementation and development of coastal video camera observation systems. The first video camera observation system was installed in Grand Popo (Benin) in February 2013, and since then seven (07) other systems have been installed along the West and Central African coasts.

The WACA-VAR 2023 workshop, to be held from December 06 to 08, 2023 in Kribi (Cameroon), follows on from the two previous editions held in 2019 and 2021, in Senegal and Ghana respectively. In addition, this workshop is being held simultaneously with the 1st edition of the International Conference on Coastal Vulnerabilities, Monitoring and Developments (VUSAC 2023), taking place from December 04 to 05 in Douala (Cameroon). During this workshop, the recommendations of the previous edition will be evaluated: special review on the state of knowledge on coastal vulnerabilities in Central and West Africa, data collection on selected hot spots, mobility of researchers, teachers and students, funding, training and outreach. New recommendations will have to be formulated for further activities. Particular attention will be paid to the problems faced by coastal local authorities. Companies, associations, NGOs and others working in the coastal field will be able to report on their needs in terms of studies/research and trainees, and make proposals for coastal management solutions. Finally, the activities of the International Research Network will have to be set up, with the identification of possible funding to carry out these activities.

WORKSHOP PROGRAM



From December 06 to 08, 2023 at Kribi, Cameroon					
WACA-VAR Workshop detailed program					
<i>Date</i>	<i>Period</i>	<i>Moderator(s)</i>	<i>Rapporteur(s)</i>	<i>Activities</i>	<i>Speaker(s)</i>
Wednesday 06/12/23	06 h 00 - 11 h 00	//	//	Journey Douala - Kribi	//
	11 h 00 - 11 h 30			Installation of participants	
	11 h 30 - 13 h 00			Lunch break	
	13 h 00 - 13 h 10	Pr EFOLE E. Thomas	Dr EBANGO NGANDO Narcisse	Opening remark	Rafael ALMAR (IRD)
	13 h 10 - 13 h 30			WACA program (World Bank)	Ousmane Ilboudo (UEMOA) Ahmed Senhoury (PRCM) Sarah Jung (World Bank)
	13 h 30 - 13 h 50			ENGULF program (online)	Marie-Noelle WOILLEZ (AFD)
	13 h 50 - 14 h 10			WACA-VAR program	Donatus Angnuureng (UCC)
	14 h 10 - 15 h 30			Short course 1: MEPELS	Thierry GARLAN (SHOM)
	15 h 30 - 15 h 45			Coffee-break	
	15 h 45 - 17 h 30			Short course 2: S2Shores (Bathymetry estimation using Sentinel 2 satellite imagery)	Erwin BERGSMA (CNES)
08 h 00 - 08 h 20	Pr Alain Didier MISSOUP			Dr ESSOME KOUM Guillaume	Coastal vulnerability in Sénégal
08 h 20 - 08 h 40			Coastal vulnerability in Côte d'Ivoire	Allassane OUATTARA (UNA)	
08 h 40 - 09 h 00		Mlle Fakira KITIO	Coastal vulnerability in Benin Current status, observation systems	Frédéric BONOU (UNSTIM) Zacharie SOHOU (IRHOB)	
09 h 00 - 09 h 20		M. Pascal E. MEYENE	University of Cape Coast/ACECoR, Ghana Activities, expectations and perspectives	Donatus ANGNUURENG (UCC)	

3rd Edition WACA-VAR Workshop
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December 06 – 08, 2023, Kribi, Cameroon

	09 h 20 - 09 h 40			Coastal vulnerability in Gabon	Sylvie Brizard ZONGO (ENEF)
	09 h 40 - 10 h 00			Centre de Suivi Ecologique (CSE) Activities, expectations and perspectives	Babacar NDAO (CSE)
	10 h 00 - 10 h 15		Dr ESSOME KOUM Guillaume	Coffee-break	
	10 h 15 - 11 h 15		Mlle Fakira KITIO	Open discussion on WACA-VAR perspectives	Rafael ALMAR (IRD)
	11 h 15 - 12 h 15		M. Pascal E. MEYENE	Short course 3: Methodology for calculating vulnerability indices to coastal hazards (submersion and erosion)	Raphaël ONGUENE (UDla)
	12 h 15 - 13 h 15			Lunch break	
	13 h 15 - 13 h 30			The Institute of Fisheries and Aquatic Sciences	F. TCHOUMBOUNANG (UDla)
	13 h 30 - 13 h 45			National Advanced School Of Maritime And Ocean Science And Technology (NASMOST)	Grégoire ABESSOLO (UDla)
	13 h 45 - 14 h 00			Cameroon Fisheries Society	Thamas EFOLE (UDs)
	14 h 00 - 14 h 15			Association of Professionals in Coastal and Aquatic Management	Crépin A. MAMA (UDla)
	14 h 15 - 14 h 30			Cameroon Wildlife Conservation Society	Eugène DUYUKE (CWCS)
	14 h 30 - 14 h 45	Pr NDJAKOMO ESSIANE Salomé	Dr KOTTE- MAPOKO Ernest	Association Camerounaise pour la Recherche et l'Innovation en Technologies de l'Energie et de l'Environnement	Mathieu PESDJOCK (ACRITEE)
	14 h 45 - 15 h 00		Mlle Diane B. BOYOGUINO	Coffee-break	
	15 h 00 - 16 h 00			Short course 4: Measure and calculate the carbonate system (ocean acidification)	U. BILOUNGA (SSERECOMA)
	16 h 15 - 17 h 15			Short course 5: Geospatial analysis and environmental indicators : presentation of the package mapme.biodiversity	Lenaïg MOIGN (IRD)
Friday 08/12/23	08 h 00 – 08 h 30			Breakfast	
	08 h 30 - 10 h 30	//	//	Field trip (Lobe falls, the wolf's rock)	//
	10 h 30 - 13 h 30			Back to Douala	

DAY ONE: WEDNESDAY 06th DECEMBER 2023 (WACA-VAR and related projects in the Gulf of Guinea)

On Wednesday, December 06, 2023, participants departed Douala at 8:30am, arriving at the *Centre Pastoral Saint Joseph* at Kribi at around 11:30am. After installation by the local organizing committee (represented by Grégoire O. ABESSOLO), the activities of Workshop 2023 began at 12:00 in the conference room of the Centre Pastoral Saint Joseph de Kribi (Cameroon).

The day's activities were moderated by EFOLE Thomas (UDs, CFS) and DADA Olusegun (FUTA).

12h00 - 13h00 : Lunch break

13h00 - 13h10 : Opening remark and family photo - Dr Rafael ALMAR

Rafael ALMAR officially opened the Workshop. A family photo followed.



Fig. 1: Family photo WACA-VAR 2023 workshop. Photo taken by the organizing committee.

13h10 - 13h30 : WACA ResIP program - Ousmane Ilboudo (UEMOA), Ahmed Senhoury (PRCM), Sarah Jung (World Bank) - On line

The presenters began by outlining the basics (knowledge, finance, dialogue) of the WACA platform, which is in line with the Development Goal: Strengthen the resilience of communities and target areas in West Africa.

Drawing attention to the level of involvement of the various countries involved, the program's regional component aims to:

- improve resilience to climate change in the Project's coastal zones;

- intensify the response to the challenges of coastal resilience development.

The outlook for 2024 and 2025 is focused on :

- the ResIP2 call for research proposals;
- the organization of research symposia on coastal vulnerability and resilience in 2025 and 2027

The WACA program also involves the popularization of new analysis and research tools (Marine Spatial Planning, Coastal Law and Policy, Community Blue Economy), as well as the dissemination of the various reports produced.

It should be noted, however, that the internet connection was not very good and very unstable.

13h30 - 13h50 : ENGUL Research program 2023-2024 - Marie-Noelle Woillez (AFD) - On line

The overall aim of this program is to assess relative sea-level rise and land subsidence of coastal megacities and river deltas along the Gulf of Guinea. After presenting the general context of the coasts of the Gulf of Guinea, the speaker highlights the need for good-quality ocean elevation data, as well as the issue of land subsidence and relative sea-level rise.

Several results (publications) were presented:

- a scoping study of coastal vulnerability to relative sea-level rise in the Gulf of Guinea ;
- a scoping review of the vulnerability of Nigeria's coastland to sea level rise and the contribution of land subsidence ;
- a scoping review of the vulnerability of Ghana's coast to sea level rise.

13h50 - 14h10 : WACA-VAR program - Donatus Angnuureng (UCC)

This presentation provided an overview of WACA-VAR's objectives and mission, which include building researchers' skills, collecting data and supporting development.

A brief presentation was also made of the main resolutions of the WACA-VAR 2021 workshop in Cape Coast (Ghana).

14h10 - 16h10 : Short course : MEPELS (*Modèle d'évolution des plages et environnement littoraux sableux*) - Thierry Garlan (SHOM)

Sandy beaches are complex environments with multiple forcing elements whose importance varies from one beach to another. And modeling is the only tool to look at the physics and to predict the future evolution of the beach. MEPELS was developed in this context, focusing on the forecast of the characteristics of morphodynamic of sandy beaches without geographical limitation.

Three time scales are taken into account in MEPELS: short term (effect of a ten-year storm), medium term (how will be this beach in 3 months or 2 years?) and long term (how will the coastline change with the sea level rise?).

Some practical modeling cases were presented.



Fig. 2: Participants at the WACA-VAR 2023 workshop in Kribi (Cameroon). Photo taken by the organizing committee.

16h10 - 16h30 : Coffee – breack

**16h30 – 18h30 : Short course : S2Shores (Bathymetry estimation using Sentinel 2 satellite image)
- Erwin Bergsma (CNES)**

This training focused on the use of satellite data for coastal zone applications: bathymetry, shoreline detection, coastal topography. The following applications were covered, based on Sentinel-2 and Pleiades data:

- Satellite shoreline detection;
- Coastal bathymetry estimation (S2Shores products).

An introduction and application to development concepts on Jupiter notebooks was also provided.

It was on this last training that the activities of the day of December 06 ended at 18h 45min.

DAY TWO: THURSDAY 07th DECEMBER 2023 (WACA-VAR Activities)

Thursday, December 7, 2023 was marked by a series of exciting and educational presentations, offering in-depth insights into coastal vulnerability in Central and West Africa. The various speakers highlighted the complex and interconnected challenges linked to socio-economic, environmental and climatic factors facing the region's coastal regions.

The day's activities were moderated by ALMAR Rafael (IRD), MISSOUP Alain Didier (UDIa, SCH) and NDJAKOMO ESSIANE Salomé (UEb, ACRITEE).

07h00 - 07h45 : Breakfast

7h50 - 8h10 : Coastal vulnerability in Senegal - Abdoulaye NDOUR (UCAD)

Abdoulaye NDOUR, from UCAD, captivated the audience with an in-depth look at the issues facing Senegal's coasts, highlighting the social-economic and environmental impacts. Case studies, including the Languede Barbarie, Doune Baba Dieye Island, Joan's Spit and Sangomar Spit, provided tangible illustrations of the issues at stake.

8h10 - 8h30 : Coastal vulnerability in Côte d'Ivoire - Alassane OUATTARA (UNA)

In his presentation, Alassane OUATTARA highlighted the case of Grand-Bassam, east of the city of Abidjan, which is experiencing remarkable erosion. He underlined the consequences of the closure of the Vindi canal in April 2023, generating flooding, increased erosion, pollution and the introduction of invasive species. He also mentioned the cumulative coastal vulnerability (environmental and socio-economic vulnerability), the exceptional swell of August 11, 2023 and the damage recorded, regretting that the meteorological services had not been able to predict the induced rise in sea level. Ongoing projects (WACA RestIP, agreements with civil society, the JEAI-IRD project, the AMR 2023-2026 project, etc.), were unveiled, demonstrating a concrete commitment to Côte d'Ivoire's coastal challenges.

8h30 - 8h50 : Coastal vulnerability in Benin - Frédéric BONOU (UNSTIM)

Frédéric BONOU examined in detail coastal vulnerability in Benin, and the status of the video observation system. He informed the audience about the use of video imagery in coastline detection. The results clearly show that part of Benin's coastline is experiencing severe coastal erosion. A pertinent question was raised concerning the specific actions undertaken to combat erosion in Benin. However, these are still limited to data collection and training.

8h50 - 09h10 : Training programs, University of Cape Coast (Ghana) - Donatus ANGNUURENG (ACECOR - UCC)

Dr Donatus ANGNUURENG presented the training and research achievements of the Centre for Coastal Management (CCM) at Ghana's University of Cape Coast (UCC), ranked first in Ghana and West Africa, and 24th in the world. The 104 publications in less than 5 years, the 18 projects implemented since 2022, and the detailed academic programs (Fisheries sciences, Oceanography and limnology, Blue economy, Marine meteorology) illustrated the significant impact of the CCM. Students from the sub-region were warmly invited to apply for scholarships / Master's and PhD programs, underlining the collaborative aspect of coastal research.

09h10 - 09h30 : Coastal vulnerability in Gabon - Sylvie Brizard ZONGO (USTM)

Sylvie Brizard ZONGO provided a crucial contribution with her presentation on "the impact of erosion on sea turtle nesting at Pangora" in Gabon. She contextualized her study by highlighting the sensitivity of Gabon's coasts to erosion, identifying beaches suitable for turtle nesting and proposing protective measures.

09h30 - 09h45 : Coffee break

The breakfast break provided an ideal opportunity for informal exchanges and networking between participants, ensuring the continuation of exciting discussions on coastal issues.

09h45 - 10h15 : Questions & Answers session

During this session, participants were able to exchange views with the morning's exhibitors, under the supervision of the session moderator (MISSOUP Didier Alain), on questions they had not been able to answer earlier. In fact, the session was very enriching in terms of collective understanding of the challenges and solutions associated with coastal vulnerability in Central and West Africa. The presentations really laid the foundations for a stimulating dialogue on further research and action in this crucial area.

10h15 - 11h15 : Open discussion on WACA-VAR perspectives – Rafael ALMAR (IRD)

This discussion session, moderated by Rafael ALMAR, was a key moment of the day, enabling participants to review the recommendations developed at the previous edition of the workshop held in Ghana in November 2021. This included an assessment of the rate of achievement of the targeted objectives, and the formulation of new recommendations for the next two years (2024 and 2025). These discussions laid the foundations for enhanced collaboration and the planning of future initiatives in the field of coastal vulnerability in West and Central Africa.



Fig. 3: Open discussion on WACA-VAR perspectives. Photos taken by the organizing committee.

i. Special issue continuation and expansion

Several works and research results linked to the WACA-VAR project have been published in 2022 in a special issue of "Journal of Coastal Conservation", in line with the recommendations of the 2021 edition of the WACA-VAR Workshop.

A special issue for 2024 is currently being prepared in the Journal "Estuaries and Coasts". Submission of articles is open since November 01, 2023 to January 31, 2024. Participants warmly welcomed this news, but asked for the submission deadline to be extended to March 31, 2024. The submission process takes place in two stages:

- Submission of articles to the organizing committee (mail to gregoireabessolo@ish.cm);
- Articles approved by the organizing committee can then be submitted through the editorial management system of the journal.

ii. Data sharing

Data sharing between experts in the WACA-Var scientific community must be effective. Participants recommended setting up a database covering the various research works and publications on coastal vulnerability in Central and West Africa. Abdoulaye NDOUR mentioned the existence of the "Seagrass Spatial Lab" web portal for the dissemination of information in this field. In addition, data collected by the various video systems installed in Central and West Africa (Senegal, Côte d'Ivoire, Benin, Ghana,

Cameroon, etc.) can be shared. However, Raphaël ONGUENE raised concerns about national legislative restrictions on data sharing. Data users will have to comply with these restrictions.

iii. Forecasting of coastal changes

Rafael ALMAR calls on the entire scientific community to work together to develop models for forecasting coastal change and risk in the Gulf of Guinea area. Several studies are underway to determine vulnerability indices, and modeling efforts are currently underway. The WACA-VAR project needs to step up its approach to these decision-support issues.

iv. Technical training and mobility

Rafael ALMAR reminds participants that the WACA-VAR/IRN project is funded to the tune of 15,000 euros per year. This year, 2023, the funds have been used for the transport and accommodation of ten participants in the WACA-VAR workshop. Next year, these funds could therefore be allocated to student training, summer schools, researcher mobility, field measurements and other educational initiatives.

Anselme Crépin MAMA announces a summer school to be held in Cameroon in August 2024, organized by APCAM (Association of Professionals in Coastal and Aquatic Management). The Summer School will focus on the carbonate system, ocean acidification and coastal remote sensing techniques. Other training courses may also be added. He therefore hopes that the WACA-VAR project will support him in organizing this event. Rafael ALMAR pointed out that funds are very limited. Potential activities to be supported will be identified and decisions taken according to priorities.

v. Web Site (announcements, field photos, latest publications, etc.)

The participants discussed the need to create and set up a website to publicize the activities of the WACA-VAR project. This website will be a showcase for information on the progress, actions and initiatives of the WACA-VAR project. The database to be set up could be linked to this website.

The website should be up and running by 2024.

vi. List of expertise / mailing list

A mailing group (<https://groups.google.com/g/wa-coastal-specialists/>) has been set up. Researchers/experts who are not concerned, are encouraged to register to facilitate the sharing of information, offers and other initiatives. This approach contributes to efforts to communicate, popularize and energize the work of coastal experts.

vii. Next edition of WACA-VAR workshop

Initially planned to be held in Côte d'Ivoire, the WACA-VAR 2023 Workshop was finally held in Kribi (Cameroon) following a request by Grégoire O. ABESSOLO (University of Douala, Cameroon). Indeed, the University of Douala and its partners were keen to organize simultaneously the 1st edition of the International Conference on Coastal Vulnerabilities, Monitoring and Developments (VUSAC 2023, from December 04 to 05, 2023) and this WACA-VAR 2023 Workshop (from December 06 to 08, 2023), in order to mobilize the maximum number of stakeholders for this unique meeting and exchange space. Grégoire O. ABESSOLO underlines the success of these events thanks to the active participation of partners such as IRD, CHS, CWCS, APCAM, ACRITEE, etc.

Although Benin had applied (through Frédéric BONOU), Côte d'Ivoire was unanimously chosen to host the fourth edition of the WACA-VAR workshop in 2025. The next edition of the WACA-VAR workshop will therefore be held in Côte d'Ivoire in 2025.

Rafael Almar went on to stress the need for synergy of action between all players in the field. As the World Bank would like to organize a Symposium on the WACA project in 2025, Rafael ALMAR expressed the wish that the WACA-VAR 2025 Workshop and the said Symposium be organized simultaneously, following the format proposed this year by Cameroon.

viii. Bring private sector and companies to WACA-VAR (seeking private funding)

Anselme Crépin MAMA emphasized the importance of private sector participation and the challenges of coordination between civil society, governments and academia. For example, Anselme C. MAMA spoke of the specific activities of the NGO APCAM, including the organization of the summer school in August 2024 and funding requests to IRD, AFD and the World Bank. Participants also mentioned other examples of Private Sector action in Coastal Vulnerability Management, and the implementation of tourism and economic approaches to market activities.

Participants agreed, however, that efforts need to be made to include Private Sector players in WACA-VAR activities in a more practical way.

Participants shared ideas on the challenges and opportunities of drawing African media attention to coastal vulnerability issues.

ix. What can we do to attract attention in Africa by media, governments, etc. ?

The participants strongly recommended actions to popularize WACA-VAR activities among the media and local governments.

x. Suggestions

The following suggestions have been made:

- Develop multidisciplinary offers in the search for funding ;
- Increase the participation of Central African countries in the WACA project. With this in mind, Marius MASSALA MBINDZOUKOU underlined Gabon's involvement in regional initiatives such as the Master program "*Gestion Intégrée des Environnements Littoraux et Marins (GIELM)*" managed simultaneously by four academic institutions, two in Cameroon (University of Douala and University of Yaoundé 1) and two in Gabon (University Omar-Bongo and Ecole Nationale des Eaux et Forêts du Gabon). He also described ENEF's activities and called for synergy of action with WACA-VAR ;
- Find solutions for sharing data between universities and departments free of charge ;
- Encourage Masters/thesis students to be proactive in seeking funding and applying for training opportunities;
- Need for action by WACA-VAR experts in ecotourism and awareness-raising.

11h15 - 12h30 : Short course : Methods for Calculating Coastal Risk Vulnerability Indices (Flooding) – Raphaël ONGUENE

The training session led by Raphaël ONGUENE covered methods for calculating vulnerability indices associated with coastal hazards, focusing specifically on submersion and flooding scenarios. The presentation was structured around a work plan in three distinct modules.

Module 1: Definition of Coastal Risk Concepts

Raphaël ONGUENE opened the workshop by clarifying the fundamental concepts associated with coastal risks. This phase enabled participants to consolidate their understanding of the key terms and issues associated with submersion and flooding phenomena.

Module 2: Presentation of Vulnerability Index Calculation Approaches

In this module, the various approaches used to calculate vulnerability indices were presented in detail. Both quantitative and qualitative methods were analyzed, providing an overview of the tools and models available for assessing coastal zone vulnerability. Case studies were included to illustrate the practical application of these methodologies.

Module 3: Some results on the Cameroon coast

Specific results relating to the Cameroon coast, highlighting potentially vulnerable areas and observed trends, were presented. This practical section offered a concrete perspective on the application of methods for calculating vulnerability indices in a specific context.

In addition, Raphaël ONGUENE presented several relevant initiatives and projects related to coastal risk management:

- Hydrometeorological and Oceanographic Observatory of the City of Douala: an infrastructure dedicated for collecting data crucial to understand hydrometeorological and oceanographic conditions, thus facilitating better forecasting of coastal risks.
- Douala Sustainable City Project: an initiative focused on the sustainable urban development of the city of Douala, aimed at integrating resilience to coastal hazards into urban planning.
- Projet Root: a project involved in the research and development of innovative solutions to strengthen the resilience of coastal communities to natural hazards.
- Master GIELM (*Gestion Intégrée des Environnements Littoraux et Marins*): a specialized academic program aimed at training experts capable of meeting the challenges of integrated coastal environment management.

12h30 - 13h15 : Lunch break

13h15 - 13h30 : Cameroon Wildlife Conservation Society – Eugène DUYUKE

CWCS is a leading national conservation and research NGO with over 20 years of field experience implementing conservation projects covering 5 major landscapes spanning coastal Atlantic forests, mangrove and wetlands. CWCS activities with government has culminated to the creation of the first marine and terrestrial national park in 2018 and recently Manengouba Mountains as the first Herpeto-Ornithological Sanctuary in Central Africa. CWCS currently hosts the Cameroon Mangrove Network's secretariat largely contributing in influencing government policies especially on mangrove and coastal area management issues and ocean protection supported by Oceans 5. CWCS has established with other NGOs, a regional and Central/West African national NGOs network on mangroves and wetlands management in collaboration with Wetlands International and Mangrove Action Projects – USA.

In addition, on November 22, the Academic Board of Commonwealth University in Kigali awarded the honorary degree of Doctor of Wildlife and Conservation Management (Honoris Causa) to Gordon Ajonina, Coordinator of the Cameroon Wildlife Conservation Society (CWCS). In receiving this distinction, Dr. Ajonina becomes the first Cameroonian and Congo Basin conservation biologist to achieve such a prestigious award from the eminent British university.



Fig. 3: Presentation of CWCS (Cameroon Wildlife Conservation Society). Photo taken by the organizing committee.

13h30 - 13h45 : The Cameroon Fisheries Society (CFS) – Thomas EWOUKEM EFOLE

The CFS is a non-governmental, non-political and non-profit-making association, created on 6 June 2022 and approved on 18 August 2022 following the receipt of declaration N°: 16/RDA/C17/SAP, prefecture of Yabassi, is a federating platform for the various players in the sector with a view to anticipating the future and inventing new solutions. Its aim is to "bring together national and international professionals and researchers whose work relates directly or indirectly to different aspects of fisheries, namely the study of aquatic systems, their mechanisms and their implications for the well-being of Man and the Environment".

Its missions include:

- Promote communication between stakeholders at national and international level ;
- Organise training, research and field practice ;
- Promoting the use of research results and field experience ;
- Support governments and private sector players in the development and promotion of fisheries ;
- Facilitating the granting of funding, subsidies, donations and legacies to other organisations and individuals involved in the field ;
- Ensure advocacy, lobbying and routing to the public and private institutions involved ;
- Undertake other activities necessary to achieve the above missions.

Its governing body is : - the General Assembly, - the Executive Board, - the Committee, - the Scientific Committee of the Journal of the Société Camerounaise d'Halieutique, - the regional branches.

13h45 - 14h00 : Association of Professionals in Coastal and Aquatic Management (APCAM) – Ernest OHANDJA

APCAM was created in 2019 with registration number N° 462/2019/RDA/C19/SAAJP according to the provisions of Law N° 90/053 of December 19, 1990 relating to the organization of associations in Cameroon.

The APCAM association's missions till date is focus on participatory and sustainable management of coastal and aquatic ecosystems in the Gulf of Guinea, with a vision of conservation and valorization of natural resources. These missions pass through a certain number of articulations, namely:

- Contribute to the management and protection of coastal and marine biodiversity;
- Support populations in the accomplishment and achievement of the Sustainable Development Goals (SDGs);
- Contribute to the development of coastal environments in a strategy based on the participatory approach
- Carry out applied research activities for the development of the coastal zone with a view to the promotion, conservation and sustainable management of aquatic ecosystems;
- Develop and implement educational programs for clean and environmentally friendly behavior;
- Raise public awareness of risk situations in coastal and marine ecosystems through conferences and seminars;
- Promote the exchange of professional experience between its members and supporters;
- Create synergy with other civil society organizations pursuing the same objectives

APCAM's activities to date extend to raising awareness of coastal populations on natural risks and hazards as part of a collaboration with UNESCO (2020) for the establishment of an Early Warning System (SAP); since 2021, on supporting and raising awareness among fishermen in the coastal strip of Kribi on the economic merits of associative life. In partnership with NGOs and other local associations, APCAM has been invest since September 2023 in a Cameroonian Government project relating to awareness-raising, identification and physio-socio-economic mapping of potential sites designated for secondary conservation in the peripheral zones of the Marine Protected Areas (MPAs), in order to strengthen capacities to improve the effective management of the new network of MPAs and promote community monitoring by fighting against illegal industrial fishing and unreported and illegal fishing in the territorial waters of Cameroon.

14h00 - 14h15 : Association Camerounaise pour la Recherche et l'innovation en Technologies de l'Energie et de l'Environnement (ACRITEE) – Mathieu PESDJOCK

ACRITEE aims to facilitate the effective distribution of emerging technologies and the advancement of sustainable energy by serving as a forum that invites and unites all stakeholders in promoting, researching, and developing energy and environmental technologies through a collaborative framework of consultation and action. ACRITEE has been committed to advancing sustainable energy for the past three years. Their research has been published in peer-reviewed, indexed journals of international acclaim.

In addition, ACRITEE has collaborated in the preparation of four PhD candidates and has five upcoming, while also providing training for students in the design of energy transformation systems and the acquisition of new technologies and electronic instrumentation. ACRITEE is committed to communicating the challenges of technology to the media, education world, elected representatives and the general public in a clear and objective manner.

14h15 - 14h30 : The Institute of Fisheries and Aquatic Sciences – Gabel ESSOME, Narcisse EBANGO

Created in 2009, the Institute of Fisheries and Aquatic Sciences is a sub-regional school of the University of Douala, training high-level executives in the fields of aquaculture, aquatic ecosystem management, oceanography, fisheries management and the processing and quality control of fish products.

14h30 - 14h45 : National Advanced School Of Maritime And Ocean Science And Technology (NASMOST) – Grégoire ONDOA ABESSOLO

Created on January 6, 2022, the Ecole Nationale Supérieure des Sciences et Techniques Maritimes et Océaniques (NASMOST) at the University of Ebolowa is the first school of this kind in Cameroon and in Central Africa. Located in the town of Kribi, it offers training in all maritime trades, and aims to :

- meet the training needs of maritime professions in the Gulf of Guinea ;
- meet the needs of port management in Central Africa;
- facilitate decision-making by local authorities on coastal development issues;
- provide competent and sufficient human resources capable of promoting the development of the maritime and port sector.

In the short term, The NASMOST is set to become a leading academic institution in the sub-region, at the heart of global issues relating to the blue economy. Training focuses on :fishing and mariculture;

- marine equipment architecture and construction;

- marine mechanical engineering ;
- marine energy engineering ;
- Coastal engineering ;
- oceanography - hydrography - meteorology engineering ;
- maritime navigation and information systems ;
- safety and security for port facilities and oil platforms;
- port and maritime management.

14h45 - 15h00 : Coffee break

**15h00 - 16h00 : Short course : Measure and calculate the carbonate system (ocean acidification)
– Ulrich BILOUNGA**

During this presentation, PhD student BILOUNGA Ulrich from SSERECOMA - IRAD, edified participants on the marine carbonate system and its consequences on ocean acidification. In particular, the influence of CO₂ dissolved in ocean waters on water PH (pH decrease). One of the direct consequences of this PH decrease is a reduction in species biodiversity, such as coral reefs, mussel beds and microalgae habitats.

16h00 - 17h00 : Geospatial analysis and environmental indicators : presentation of the package mapme.biodiversity – Lenaïg Moign (IRD)

During this presentation, LENAIG MOIGN from IRD spoke about biodiversity indicators and the use of satellite data in biodiversity studies. Le package Rstudio "Mapme.biodiversity" a été présenté. The package enables the analysis of biodiversity portfolios on a global scale using thousands or millions of Areas of Interest (AOIs) :

- Threat Assessment : It is designed to assess threats to biodiversity using relevant indicators based on freely accessible geodata sources, such as Global Forest Watch.
- Cloud Data Usage: The package supports efficient computation and heavy parallel processing in cloud infrastructures like AWS or Microsoft Azure.
- World Database of Protected Areas (WDPA) Analysis : It provides the ability to analyze the WDPA for several relevant indicators.
- Support for Data Science : Its development is focused on supporting scientific analysis and data science for individuals and organizations engaged in preserving global biodiversity.

The package was used to perform applications for impact assessment :

- Example 1 : assessing the impact of protected areas on deforestation in Madagascar ;

- Example 2 : mangroves of protected areas in Senegal.

17h00 - 17h10 : Presentation of attendance certificates



Fig. 4 : Family photo with certificates of attendance. Photo taken by the organizing committee.

DAY THREE: FRIDAY 08th DECEMBER 2023

08h00 - 08h30 : Breakfast

08h30 - 10h30 : Field trip

A moment of relaxation at Lobé Falls, about thirty kilometers from the town of Kribi.



Fig. 5 : Family photo opposite the Lobe Falls. Photo taken by the organizing committee.

10h30 : End of WACA-VAR Workshop activities and departure to Douala

MAIN OUTCOMES OF THE 2023 WACA-VAR KRIBI WORKSHOP

1. More than ninety researchers, teachers, students and professionals were trained in applications (S2Shores, Rstudio Mapme.biodiversity package) using satellite data, calculation of coastal vulnerability indices, ocean acidification and MEPELS regional modeling.
2. The fourth edition of the WACA-VAR Workshop will be held in Côte d'Ivoire in 2025.
3. As the World Bank and its partners (UEMOA, CSE, etc.) wish to organize a Symposium in 2025, it is particularly recommended that the Symposium in question and the fourth edition of the WACA-VAR Workshop be held simultaneously in Côte d'Ivoire, following the format proposed this year by Cameroon: simultaneous organization of the VUSAC 2023 Conference on Coastal Vulnerabilities, Monitoring and Developments (December 04 to 05, 2023 in Douala) and the third edition of the WACA-VAR Workshop (December 06 to 08, 2023 in Kribi).
4. The deadline for submission of papers to the special edition in the Journal "Estuaries and Coasts" should be extended to March 31, 2024. All participants and researchers from the Gulf of Guinea region are invited to submit their work.
5. The participants recommended :
 - setting up a database covering the various research works and publications on coastal vulnerability in Central and West Africa ;
 - find solutions for sharing data between universities and departments free of charge ;
 - pooling efforts to develop models for forecasting coastal change and risk in the Gulf of Guinea area ;
 - development of multidisciplinary research offerings in the search for funding.
6. Proposals in terms of researcher mobility, student training or training organization are expected for the use of WACA-VAR funding for the year 2024 (15,000 euros).
7. A website to popularize the activities of the WACA-VAR project should be set up in 2024.
8. A list of experts has been opened and all experts are encouraged to sign up to facilitate the sharing of information, offers, and other initiatives.
9. Research questions have been defined (notably on coastal zone modeling and forecasting).

LIST OF PARTICIPANTS

N°	Noms et prénoms	Université	Pays	Participation
1	ABESSOLO ONDOA Grégoire	University of Douala / University of Ebolowa	Cameroon	On-site
2	ALMAR Rafael	IRD	France	On-site
3	AMBENO Fidelis Narika	University of Buea	Cameroon	On-site
4	ANGNUURENG Donatus Bapentire	University of Cape Coast	Ghana	On-site
5	APPOH KOUASSI Menzan Williams	Projet Convention de la Société Civile Ivoirienne	Côte d'Ivoire	On-line
6	ATEBA François René	University of Ebolowa	Cameroon	On-site
7	AYISSI Isidore	University of Douala	Cameroon	On-site
8	BERGSMA Erwin	CNES	France	On-site
9	BESACK Félix	University of Douala	Cameroon	On-site
10	BILOUNGA Ulrich	University of Douala	Cameroon	On-site
11	BONOU Frédéric	Université Nationale des Sciences Technologies, Ingénierie et Mathématiques (UNSTIM)	Bénin	On-site
12	BOYOGUINO BIDIAS Diane	University of Douala	Cameroon	On-site
13	CHOUONG TCHATCHOUANG Durane	SSERECOMA IRAD-KRIBI	Cameroon	On-site
14	DADA Olusegun	Federal University of Technology, Akure	Nigeria	On-site
15	DEUTCHOUA DJITIEU épouse NANA KOUASSI Arlette Danelle	University of Douala	Cameroon	On-site
16	DIMA Willy Noel	Université d'Abomey-Calavi, Cotonou	Bénin	On line
17	DJOPNANG DJIMBIE Justin	University of Douala	Cameroon	On-site
18	DUYUKE Eugène	Cameroon Wildlife Conservation Society (CWCS)	Cameroon	On-site
19	EBODE Valentin Brice	University of Douala	Cameroon	On-site
20	EBOLO NKONGO Victor	University of Douala	Cameroon	On-site
21	EBONJI SETH Rodrigue	University of Douala	Cameroon	On-site
22	EDZENTE ATANGANA Guillaume Stéphane	University of Ebolowa	Cameroon	On-site
23	EFOLE EWOUKEM Thomas	University of Dschang	Cameroon	On-site
24	ELOUGOU NDINGA Nathalie	University of Douala	Cameroon	On-site
25	ENGUENE AMANA Paulin Bertrand	University of Douala	Cameroon	On-site
26	ESSOME BANG Gabel	University of Douala	Cameroon	On-site
27	ESSOME KOUM Guillaume	University of Douala	Cameroon	On-site
28	FONKWA Georges	University of Douala	Cameroon	On-site
29	FOSSI TANKOUA Olivia	University of Douala	Cameroon	On-site
30	GARLAN Thierry	SHOM	France	On-site
31	GHEPDEU YOUNOUNI Gisèle Flodore	University of Douala	Cameroon	On-site
32	GORDON Ajonina	University of Douala	Cameroon	On-site
33	GWENDOLINE Grégoire	CNAM Intechmer	France	On line
34	ILBOUDO Ousmane	UEMOA	Sénégal	On-line
35	JUNG Sarah	World Bank		On-line
36	KAMGA TETSOPGUIM Lyne Joelle	University of Douala	Cameroon	On-site

37	KITIO MESSAGO Fakira	University of Douala	Cameroon	On-site
38	KOCHONI Babatondé Innocent	University of Cape Coast	Ghana	On line
39	KOMENA K. Boniface	Université Alassane Ouattara	Côte d'Ivoire	On-site
40	KOTTE-MAPOKO Ernest Flavien	University of Douala	Cameroon	On-site
41	KPOUMIE NSANGOU Amidou	University of Douala	Cameroon	On-site
42	KUATE OUAFO George-Luther	University of Buea	Cameroon	On-site
43	MAKONGO NJAKA NLOKA	University of Douala	Cameroon	On-site
44	MAMA Anselme Crépin	University of Douala	Cameroon	On-site
45	MASSALA MBINDZOUKOU Marius	Université Omar Bongo, Libreville	Gabon	On-site
46	MATOUKE MATOUKE Moïse	University of Buea	Cameroon	On-site
47	MBARGA NGBWA Engelbert	University of Ebolowa	Cameroon	On-site
48	MESSINA MEVOULA Ornella	University of Douala	Cameroon	On-site
49	MEYENE ESSAGA Alain Pascal	University of Douala / Ministry of Transport	Cameroon	On-site
50	MFOULA NKOLO Frédéric	University of Douala	Cameroon	On-site
51	MFOUMEYENG ENOTO Gaelle	University of Douala	Cameroon	On-site
52	MIMBEU Yves	University of Douala	Cameroon	On-site
53	MISSOUP Alain Didier	University of Douala	Cameroon	On-site
54	MOIGN Lenaïg	Institut de Recherche pour le Développement	France	On-site
55	MUBE KUIETCHE Hervé	University of Dschang	Cameroon	On-site
56	MUTLEN Melvin	University of Douala	Cameroon	On-site
57	MVOGO NDONGO Pierre Armand	University of Douala	Cameroon	On-site
58	NANA TOWA Algrient	Université de Dschang	Cameroon	On-site
59	NDAO Babacar	Centre du Suivi Ecologique (CSE)	Sénégal	On-site
60	NDJAKOMO ESSIANE Salomé	University of Ebolowa	Cameroon	On-site
61	NDJUISSI TAMKO Arlette Noël	University of Douala	Cameroon	On-site
62	NDOMBI NZABA epse MAGANGA Estelle	CENAREST	Gabon	On-site
63	NDONGO Barthélémy	University of Dschang	Cameroon	On-site
64	NDOUR Abdoulaye	Université Cheikh Anta Diop de Dakar (UCAD)	Sénégal	On-site
65	NGA OMBEDE Sabine	University of Douala	Cameroon	On-site
66	NGO MBACK Madeleine Nina Love	University of Douala	Cameroon	On-site
67	NGO SECK Séréna Madona Marie	University of Douala	Cameroon	On-site
68	NGOUANA TADJONG Rubens	University of Douala	Cameroon	On-site
69	NGOUTANE MFOPPA Alvine	University of Douala	Cameroon	On-site
70	NGUESSU Charles		Cameroon	On-site
71	NIANG Awa	Université Cheikh Anta Diop de Dakar (UCAD)	Sénégal	On-line
72	NJIFENJOU Abdou	University of Ebolowa	Cameroon	On-site
73	NJOMOUÉ PANDONG Achille	University of Ebolowa	Cameroon	On-site
74	NJUTAPVOUI FOKOUOP Nourdi	Ministry of Scientific Research	Cameroon	On-site
75	NYA TCHOUNKEU Leslie	University of Douala	Cameroon	On-site
76	NYAMBENG MA'A Paulette	University of Ebolowa	Cameroon	On-site
77	NZOUDMI Epiphanie	University of Douala	Cameroon	On-site
78	OHANDJA Ernest	University of Douala	Cameroon	On-site

3rd Edition WACA-VAR Workshop
WEST AND CENTRAL AFRICA COASTAL AREAS – MAPPING VULNERABILITY, ADAPTABILITY AND RESILIENCE IN A CHANGING CLIMATE
December 06 – 08, 2023, Kribi, Cameroon

79	ONGUENE Raphaël	University of Douala	Cameroon	On-site
80	OUATTARA Allassane	Université Nangui Abrogoua	Côte d'Ivoire	On-site
81	PERABI PAKO José Clotaire	University of Douala	Cameroon	On-site
82	PESDJOCK Mathieu	University of Ebolowa	Cameroon	On-site
83	PEYIENO Martial Judicaël	University of Douala	Cameroon	On-site
84	SAKHO Issa	Université Amadou Mahtar Mbow de Dakar à Diamniadio (UAMMD)	Sénégal	On line
85	SALAKO Kolawolé Valère	University of Cape Coast	Ghana	On line
86	SENHOURY Ahmed	PRCM		On-line
87	SIEGNEU HUTBOU MENKAM Rose	University of Douala	Cameroon	On-site
88	SOHOU Zacharie	Institut de Recherche Halieutique et Océanologique du Benin (IRHOB)	Bénin	On-site
89	SONGMO Berlin Leclair		Cameroon	On-site
90	TCHOCKANG Pauline Théophile	University of Yaoundé 1	Cameroon	On-site
91	TCHOGOM MANGA Josué	University of Douala	Cameroon	On-site
92	TCHOUMBOUGNANG François	Universté de Douala	Cameroon	On-site
93	TEKOU NGUNTE Hervé	University of Douala	Cameroon	On-site
94	TEMWA GORSIRI AWO Donals	University of Douala	Cameroon	On-site
95	TOMEDI EYANGO Minette épouse TABI ABODO	University of Douala	Cameroon	On-site
96	TSOUPOU KUETE Suzy G.	SSERECOMA IRAD-KRIBI	Cameroon	On-site
97	WOILLEZ Marie-Noëlle	AFD		On-line
98	YEMELI Gergino Chounna	University of Padova	Italia	On-site
99	ZANGO Paul	University of Douala	Cameroon	On-site
100	ZONGO Sylvie B.	Université des Sciences et Techniques de Masuku	Gabon	On-site

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