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



ACECoR, IRD-CoSav LeO

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West Africa Coastal Areas
Management Program



THE WORLD BANK
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**WEST AFRICA COASTAL AREAS VULNERABILITY,
ADAPTABILITY AND RESILIENCE IN A CHANGING CLIMATE
(WACA-VAR)**

WORKSHOP REPORT

December 2021



DAY ONE: MONDAY, 22ND NOVEMBER 2021

AFTERNOON SESSION

INTRODUCTION

The workshop commenced at 14:00 H with a welcome address by the Vice-Chancellor of the University of Cape Coast (UCC), Ghana, ably represented by Prof. Kwabena Sarfo, the Dean of the School of Biological Science. He started his address by giving background information on how UCC was selected to host the African Centre of Excellence in Coastal Resilience (ACECoR) program and the need for collaboration with regional institutions, particularly for the training of African coastal experts.

In his opening remarks, Prof. Denis Aheto, the Director of the African Centre of Excellence in Coastal Resilience (ACECoR), University of Cape Coast (UCC) shed more light on the Centre, its proposal, and strategic plan designed in 2012, and resources invested into postgrad students. He emphasised the mandate of the Centre for Coastal Management (CCM-ACECoR) is to organise professional courses, extensions, research activities that feed into policy. He said the plan is ongoing to have international accreditation for three (3) courses - Fisheries, ICZM, and Oceanography to attract international students.

Next, the purpose of the workshop was presented by Dr Pierre Morand (IRD, CoSav LeO). He stated that the main goal of the workshop was to build a regional multidisciplinary research project for the region. He said coastal areas from Mauritania to Cameroon would be the focus while studies would be conducted at the hotspots from the various countries.

EVENING SESSION

PRESENTATION 1

The Workshop discussion began with a presentation by Prof. Appeanning Addo - Director, Institute for Environment and Sanitation Studies, University of Ghana.

He presented on the Sargassum SARTRAC project he is implementing which he said was developed based on the 2018 IRD report that indicated the need to look at sargassum.

He stated that Sargassum has been appearing at the Ghanaian coast since 2011, and it is becoming a problem in West Africa. It has a huge potential to affect our coast as far as coastal management is concerned and has become a new normal that needs to be addressed. He stated that solutions and alternative ways of managing sargassum in addition to traditional coastal management practices should be explored. The research should be based on how to turn the

sargassum nuisance to our advantage. It should also be to identify the opportunities for transformational adaptation that can be generated through the management and re-use of the invasive sargassum seaweed increasingly found across the Caribbean, Central Africa, and West Africa.

Discussion focussed on whether the SARTRAC project takes into account the toxicology aspect of sargassum. Prof. Addo said that the Gulf of Guinea network for sargassum is open for all interested parties to participate and join the ongoing discussion on sargassum. There was the question as to how sargassum could be made beneficial to the poor and vulnerable in society. He said that sargassum could be used as the fish feed as obtained from findings of the research carried out by the Benin students.

PRESENTATION 2

Presentation on the West Africa Regional Coastal Observatory (WARCO) by Ms Marieme Soda Diallo

Ms Marieme Soda Diallo presented the West Africa Regional Coastal Observatory under construction. She said the production of up-to-date quality information on the evolution of coastal risks is a necessity, both to improve the relevance of coastal management and management decisions, and to help raise the awareness of policy-makers responsible for the management of the territories. The process of setting up a regional mechanism for observing the West African coastline was initiated following the declaration of the ministers in charge of the environment in Dakar in 2011, which validated the Master Plan of the Coastal West Africa (SDLAO).

The West African Economic and Monetary Union (WAEMU) assisted the process of setting up the West African Coastal Observation Mission (WACOM), between 2012 and 2017, to develop a system comprising (i) 11 national branches structured around the members of the Steering Committee and the Scientific Committee of the Regional WAEMU Regional Erosion Control Program (PRLEC) and (ii) regional coordination led by the Center for Ecological Monitoring of Dakar (CSE) and supported by IUCN.

The observation mechanism that has been put in place has ensured the endorsement of the SDLAO monitoring framework including (i) a subdivision of the coastline into geomorphologically homogeneous areas and issues, (ii) the organization of the monitoring of coastal risks and the evolution of the issues at the level of these sectors based on a battery of

indicators, followed by the WACOM observer network and (iii) the compilation and dissemination of information on coastal risks in West Africa.

The WACOM produced the 2016 SDLAO update, which highlights the evolving issues, pressures and responses to address coastal risks since the 2011 SDLAO. The 2016 report was validated in 2018 with a recommendation from the ministers in charge of the environment to transition the WACOM to a Regional Coastal Observatory (WARCO). In 2020, a feasibility study for the WARCO was completed, and the SDLAO was updated.

PRESENTATION 3

Presentation on the regional research program: West African Coastal Areas Mapping vulnerability (WACA-VAR) by Dr Olusegun Dada

Dr Olusegun Dada started by giving background information on how the West African Coastal Areas Management (WACA) program was established by the World Bank Group and its partners to meet the urgent need of West African coastal countries on erosion, flooding and pollution. He stated that IRD and its African partners have established the WACA-VAR project to carry out interdisciplinary surveys.

He said WACA-VAR will strengthen the WARCO by feeding it with data, information models and other tools. WACA-VAR will promote regional multidisciplinary research among various research terms, strengthen WARCO by building on existing initiatives, develop human capacity and provide scientific knowledge on coastal issues and data/tools. WACA-VAR is organised into 3 work packages: Geophysical studies, biogeochemical and biodiversity studies, socio-economic, perception and governance (W1); Tools for managing coastal areas management (W2); and Facilitation of capacity building of local players (W3).

During the discussions, the Dean, SBS -UCC stated that WACA-VAR would be very important in integrating students, but it would have to develop a sustainable curriculum to consciously integrate students from the undergraduate level into the regional discourse, if necessary. For example, bilingual language uptake is a major challenge in the capacity building objective of the project. The project is currently focused on building the capacity of young professionals to develop urban capacity for coastal management.

In his opinion, Prof. Aheto stated that undergraduate education is a basis for growing the postgraduate programs but it is limited in research. He, therefore, made a stronger case to increase funding for a postgraduate programme that can feed into the process of new technologies, new ideas. He said the postgraduate trajectory of the project should be

maintained. He suggested that the commercialization of research and knowledge should be developed as part of the project. The project should focus on the infusion of graduates, and giving graduates some entrepreneurial skills. He stated that capacity-building should also encompass the training of professionals to apply the knowledge in problem-solving. It is important to identify small companies and start-ups and include them in the capacity building trajectory in response to the demand for training professionals. Create services to create small companies and start-ups. He said this should be included in the objectives of the project.

DAY TWO: TUESDAY, 23RD NOVEMBER 2021

Solutions

Overview

The session focused on defining coastal hotspots and the extent of research that must be conducted to have a comprehensive understanding of phenomena along the West African coast. With the intensification of coastal environmental challenges along the West African coast, an interdisciplinary research approach that allows for effective long-term monitoring and tracking of both in-land and coastal processes is essential in understanding the relationship between in-land and coastal processes and an overall understanding of coastal processes occurring at the local, national, and regional levels. Such an objective requires adopting tools and methodological approaches in quantifying, observing, analyzing, and predicting coastal phenomena coupled with a strong multi-sectorial and policy coordination. Presenters elaborated on the West African coast's challenges, selected hotspots, and tools and methodologies deployed for research.

MORNING SESSION

PRESENTATION 1

Presentations on the design of Regional Research Project by Dr Pierre Morand

Dr Pierre Morand presented the project concept where he noted that the WACA-VAR project began by defining coastal hotspots and the research scale for specific coastal processes. He pointed out that the definition plays a critical role in selecting sites for research under the project. Dominant drivers of coastal processes at sites chosen needed to be identified over space and time. These provide trends and correlations across the various levels citing coastal structures and coastal processes as examples of issues prevalent across local, national, and regional scales. Such cross-cutting problems require an integrated study to have a holistic view of the problem and develop integrated solutions applicable across the board.

PRESENTATION 2

Examples of Hotspots from some west African countries:

(a) Benin coast by Dr Frederic Bonou

Dr Bonou noted that Benin has an estimated coastline of about 125 km characterized by a high phenomenon of coastal vulnerability caused by both natural and anthropological factors. According to him, sea-level rise, storm swell, and wind are the main causes of coastal erosion.

The country's harbour was said to be responsible for accretion on one side and erosion on the other side. Besides the aforementioned factors, the drift current from Ghana through Togo to Benin also accounts for sediment transport along the coast of Benin. Data on shoreline variability, bathymetry, wind direction, seasonal variability of energy flux were collected from camera systems, remotely sensed data and literature. Over the study period, it has been identified that the coastal zone can generate about eighteen (18) kW of energy.

(b) Cote D'Ivoire coast by Prof. Allassane Ouattara

Prof. Ouattara identified coastal erosion, flooding, overfishing, pollution, and the prevalence of harmful sea algae (Sargassum) as the coastal environmental challenges of the Ivorian coast. Plastic pollution from inland water and nutrient overload from agricultural fields and urban areas account for the pollution of the marine and coastal environment. The challenges were noted to be local but with extended impacts along the West African Coast. In addressing the issues, the leadership of the country has taken steps to:

- Sign a memorandum of understanding (MOU) to protect mangroves of national parks
- Provide financial support to local people to restore mangroves
- Identify five (5) marine protected areas for conservation
- Create one (1) marine protected area (about 2600 km² in area) on the southwest coast due to the migration of shark and tunas
- Collect data on erosion and fishing.
- Engage Non-Governmental Organizations to clean the coast regularly (to address coastal pollution).
- Identify the sizes of fish necessary for the maintenance of sustainable yields.

The key discovery of the methodology that has been applied and could be applied elsewhere has been the establishment of marine protected areas; however, there is no agency responsible for the coastal management. A weak enforcement law remains a bane to successful coastal management. The management of the coast is also supported by the ministries though there is a lack of sectoral coordination. The Ministry of Environment has proposed a new agency to oversee marine protected area management. The effectiveness of the agency is yet to be assessed.

(c) Southern Senegal coast by Prof. Alioune Kane

The construction of large dams along the West African coast has negatively impacted sediment flow, coastal stability and posed threats to lagoon-based cities. Senegal's coastal zone is characterized by about 718 km of littoral environment, diversified ecosystems, and a regular upwelling contributing to the primary productivity of the marine environment. Erosion remains a significant problem along the coast. However, the impacts of climate change have driven people from other sectors of the economy to engage in fishing, thus overexploiting the resource and degrading the ecosystem – the open nature of access being a primary facilitator. Coastal zone resilience adopts two strategies: hard engineering (sea bar, groyne, dike) and soft solution (beach nourishment, typhavelles techniques, mangrove reforestation). Although these strategies tend to address coastal erosion, the high cost of their implementations remains a big challenge in Africa. Nature-based solutions provide sustainable long-term protection via their impact on sediment, flooding, erosion, and maintenance of tidal creeks.

(d) Northern Senegal coast by Dr Issa Sakho

Issa presented on the SCO project. He identified coastal flooding and erosion as the main problems associated with the coast of Senegal. An attempt at solving the issue requires enhancing knowledge on multiple hazards along the coast, identifying current and future hotspots, and developing and adopting tools and indicators for vulnerability assessment along the coast. The study in Senegal found an accretion of the coastal sand bar. 72 storms had occurred from 1979 – 2000, and the City of Guet Ndar had a very high vulnerability index making it a hot spot for erosion and flooding. There is the need to understand the vulnerability index change over time, and whether there is a link between the index and the breach going further south from the city. Where the breach may occur next is even a matter of concern. In Senegal, there is more than one hotspot, but Babarie is the biggest hotspot in the northern part of Senegal.

(e) Guinean coast by Mr Sekou Tidiane Bangoura

The challenge of the Guinean coast includes the clearing of mangroves for housing development, firewood and income, land-use changes because of migration, pollution from ship loading, illegal fishing activities in rivers, and sand mining in rivers. These challenges often result in flooding for which the country has deployed make-shift dikes as a measure to contain higher volumes of water for other purposes.

(f) **Ghana coast by Dr Philip-Neri Jayson-Quashigah**

Ghana's coast is grouped into three (3) zones: the east, central and west coasts. The Eastern coast is characterized by a sandy shoreline with a crumbling Volta delta. Embayed rock headlands and sandbars define the Central coast with a medium to the high-energy surf zone.

The Western coast is defined by a barrier flat backed by coastal lagoons. The coastal environmental challenges found along the Ghanaian coast include saltwater intrusion, erosion, tidal flooding, and sargassum deposition. Factors that account for these phenomena are the low-lying nature of the coast, wave action, hard shoreline stabilization measures, and rising sea levels. The eastern coast has the highest coastal vulnerability index in terms of social and physical vulnerability due to the high incidence of coastal erosion.

Tidal waves have in recent times wiped out the Fuveme community found along the Volta estuary in the Keta Municipality. Video monitoring and drone survey, subsidence assessment, and development of a model for future prediction have been deployed in research to understand the coastal processes along the Ghanaian coast. Early warning systems and effective long-term monitoring are required to provide the needed data for informed decision-making and policy.

It was noted that there may be a presence of canyons offshore, so the estuary is deep. Sediment transport from the river has reduced in the past years. Furthermore, people are unwilling to move from the flood-prone area due to the cultural connections to the area. So, one would wonder if it is not better for people to relocate than stay in their current place.

PRESENTATION 3

Presentation on proposed WACA-VAR Hotspots by Dr Olusegun Dada

The WACA-VAR project has identified several hotspots along the West African coast to be included in the project's activities. The various spots were selected based on prior information on what has been done by IUCN/CSE/WARCO and based on the criteria in defining hotspots as found in the Handbook by SDLAO/SDLAO/UEMOA/IUCN – 2010 edition.

The proposed project hotspots are located in Senegal, Guinea, Ivory Coast, Ghana, Togo, and Benin. These spots have been categorized as very high priority hotspots-characterized by rapid erosion, dynamic mangrove system, sea-level related risks, active erosion, flooding, accretion, unstable fluvio-marine dynamics, morpho- dynamical erosion, with recommendation for regular monitoring.

Two (2) regional/global hotspots: (i) Senegal to Guinea and (ii) Ivory Coast to Nigeria was proposed and this was unanimously agreed by the participants of the workshop, to be studied using satellite data. However, research at the local scale using camera data for monitoring could be deployed to validate these global/ regional-scale studies. Several perspectives emerged from the discussion on the proposed sites. Participants suggested that the criteria for the selection of site must be based on recent scientific findings and stakeholder interests in sites and consideration for developments over time.

AFTERNOON SESSION

PRESENTATION 4

Presentation on the WACA Program by Sarah Jung (World Bank Environmental Specialist)

The WACA Program supports countries' efforts to improve the management of their shared coastal resources and reduce the natural and man-made risks affecting coastal communities. It covers 17 countries from Mauritania to Gabon.

The WACA Program aims to boost the transfer of knowledge, foster political dialogue among countries, and mobilize public and private finance to tackle coastal erosion, flooding, pollution and climate change adaptation. It consists of country projects, regional integration and a WACA Platform as a mechanism to scale-up knowledge, dialogue, and finance. Sarah Jung mentioned that the WACA Program welcomes the WACA VAR initiative as the need to develop research on coastal resilience in the Region was highlighted during the Scientific Committee validating the 2020 SDLAO update and WARCO feasibility study, in June 2020.

There are existing mechanisms to support observation mechanisms and contributing research institutions, at the national and regional level, under the WACA ResIP (West Africa coastal areas resilience investment project under implementation in 6 countries (Mr, SN, CI, BN, TG, STP). And at the regional level (regional integration) the WACA ResIP2 project under preparation should include a component on research and innovation.

PRESENTATION 5

Presentation of a Compendium on Coastal management practices in West Africa by Dr Pierre Morand

The "Compendium report" deals with "existing and potential solutions to control coastal erosion, prevent flooding and mitigate damage to society". This work was funded by the NDF

and WACA-WB projects. It began two years ago and ended in early 2021. It was carried out by several people from IRD and Cape Coast University, and reviewed and improved, with many inputs, by the WACA team and peer-review ITAC committee comprising senior researchers from the West African region.

The objective of the “Compendium report” is to provide a critical review of the various options of coastal risk management, based on the scientific literature on coastal erosion and flood risk in West Africa. The report examines the options according to the specific conditions existing in the region. It started by outlining the main hazards and vulnerability factors that affect West African coastal ecosystems. According to the report, the societal impacts of this physical coastal vulnerability are amplified by the increasing size of the population living in the coastal zone.

The report stated that most of the observed actions to control coastal erosion and prevent flooding consist of hard-engineering solutions, either groins or breakwaters to protect beaches, or dikes to protect harbours or hard revetments or walls to fix the coastline. However, these hard solutions have drawbacks because they are expensive, they are not long-lasting, and they cause adverse side effects, especially down-drift, by disturbing the sedimentary circulation, as has been observed in Ghana.

New solutions to protect coasts and reduce the intensity of erosion and flooding are solutions based on softer engineering techniques, such as dune fixation, mangrove reforestation or beach nourishment, the latter one is just beginning to be used in West Africa. These solutions also involve management solutions that implement regulations, habitat relocation, monitoring and early warning systems. The compendium report attempts to map 29 identified experiences of solutions in WA, two-thirds of which are hard-engineering solutions.

However, the intention is not to banish these hard solutions and replace them completely, but to combine the different types of solutions as best as possible, taking into account the local socio-economic context and also integrating a large-scale sediment balance management. At last, the report highlights the importance of coastal integrated management, at least at two scales, those of the impacts and fragilities (one the one hand), and the mid-scale mechanisms involved, on the other hand, to improve the defence and management of the West African coasts.

PRESENTATION 6

Presentation on Tools and Methodological Approaches on Hotspots by Dr Rafael Almar

Dr Rafael Almar noted that data on the physical coastal parameters of the West African coast is limited with a high demand for such data for decision making – hence the need for an interdisciplinary approach for an integrated solution. Several tools and methodologies are needed to observe, quantify, and predict current and future coastal processes at varying scales. The approaches deployed so far in bridging the data gap include:

- In-situ measurements which are done at the local scale – e.g. through the COASTVAR project
- Technical and scientific training to build human capacity (postdoc, masters)
- Coastal camera observation network developed across five (5) West African countries providing real-time data for monitoring
- Sea level rise monitoring by camera
- Development and testing of models for tracking current trends and future prediction of coastal processes

PRESENTATION 7

Presentation on observing the coastal zone from space by Dr Erwin Bergsma

He presented on:

1. The CNES and its Earth Observation Lab (EOLAB or Lab'OT)
2. Traditional methods in synergy with satellite data
3. Observation of the coastal zone using satellite data
4. Existing programmes (e.g. the Space Climate Observatory)

DAY THREE: WEDNESDAY, 24TH NOVEMBER 2021

What to do?

TOOLS AND METHODOLOGICAL APPROACHES ON HOTSPOTS (2nd session).

MORNING SESSION

PRESENTATION 1

Presentation on Socio-economic and perception surveys: Feedback on the social survey on social vulnerability in Senegal and Ghana by Drs Pierre Morand and Olusegun Dada

- a. Presentation on Socio-economic and perception surveys and Senegal case study by Dr Pierre Morand

Dr Morand stated that the types of data needed for socio-economic surveys in the coastal areas are general quantitative data and specific data to assess the links and interactions between society and the environment in coastal areas. He said sources of such data could be: General censuses, agricultural census, data from the administration.

On sampling survey, he said the new way of collecting data is by perception survey since the census is not designed to address very specific issues and doesn't address key questions. The perception survey is designed for specific data collection. According to him, the main objectives are to: tackle the human dimension of vulnerability; find out their human statements, assess their sentiments regarding possible solutions and seek some original information on environmental changes. To achieve these, the survey questionnaire was developed in four (4) parts, which are:

1. A survey context (the date and GPS)
2. General characteristics of the respondent like the occupation and educational level
3. The presence of environmental phenomena (Coastal erosion, marine submersion etc. A respondent is asked to choose the two coastal phenomena that he/she thinks has the greatest impact on the respondent (ranking).
4. Details on the perception of the phenomenon are gathered from four (4) structural questions:
 - a. Simple observation
 - b. Impacted victim (impact on domestic, professional activities etc); the respondents will use a scale to determine the rate of impact of the phenomenon.
 - c. Manager (Adaptation of practice, control actions undertaken)

- d. Agent of degradation (overconsumption of natural resources, existence of polluting practices)

The developed questionnaire has already been tested for its readability and feasibility, sensitivity, and stability of the answers obtained on a variable concerning an objective fact in Senegal, Ghana, and (in progress in) Nigeria. The IRD team and UCAD team are handling that of Senegal. In Ghana, the UCC-ACECoR team and IRD representative had tested the approach. In Nigeria, Dr Dada with the support of his students is administering the questionnaire. Predominantly and preliminarily, the most-mentioned phenomena were erosion by the sea, flooding by sea and salinization.

In Senegal, coastal erosion is often mentioned, and flooding is a complaint. Severe salinization and plastic pollution come third and fourth. Multivariate analysis was used to show the relationships between the variables. A hierarchical ascending classification was carried out to show four classes (C1, C2, C3, C4) of respondents according to their answers concerning the perceived phenomena. The findings from the Senegal test are a strong spatial correlation between respondents when they share the same environmental conditions. There is also some correlation of perceptions with other variables such as years of settlement and some socio-economic variables.

Dr Morand concluded that perception surveys are interesting and useful but must be analyzed with caution. The level of education must be considered in the region. In responding to some questions, he said situations for about 10 years is considered but not 30 years. In addition, the variability of issues from the human dimension was considered. The number of people that have undergone damage, which is a physical indicator, was assessed. using tablets, smartphones and kobo collect software to collect the data in Senegal and Ghana. The questions span the capacity to move if the respondents are from the place in which the research is being done or if they would like to move or continue to stay there.

b. Presentation on the Anlo Beach community perception of coastal hazards by Dr Olusegun Dada

Dr Olusegun Dada started by giving background information about the Anlo Beach study site in Ghana. He said the residents of Anlo Beach migrated from the Volta region. The population is about 4,500. The north of the site is a mangrove, and the south is bounded by the Atlantic Ocean. They are predominantly fishermen. With 156 respondents, the major hazards in the community were similar to those in Senegal. i.e., erosion, flooding, and salinization. Fifty-eight

(58.8) per cent of the respondents depended on mangroves for utilisation. The majority said they do not use river sand but beach sand for building.

Perception about salinization

Ninety-four (94) per cent of the respondents have salinization impacted on their livelihood, while it affected the majority professional career, and general living conditions. The majority opined that natural causes of salinization are mainly high tide and flooding. The majority agreed that no measures had been taken to curb salinization. The suggested solutions were relocation, use of different means for drinking water apart from well, while the majority had no idea of the solutions to be taken.

Perception about coastal erosion and flooding

From the responses, June, July, and August are the time the respondents experience a lot of erosion. The majority responded they have relocated to their current places and still considering future relocation. The majority opined that erosion is natural, while others said it is human and a few said both. The majority said it is wave action that caused erosion, few said it is sand winning, and the sea defence. The majority said they have not done anything to mitigate the issue but suggested sea defence could be done. The majority said there has been no government intervention. Eighty-one (81) per cent opined that flooding is natural, while few say it is human-induced. The majority say they are scared of their safety. There is no early warning system according to the majority. As to whether the best solution will be relocation or sea defence, they noted that the government has already told them to relocate but no provision has been made for where to relocate to. Most of them are ready to do so but they need assistance.

PRESENTATION 2

Presentation on approaches to access the efficiency of governance by Dr Pierre Morand

Dr Pierre Morand stated that gap-bridging between science and policymaking should involve the local people and have a great deal of participation.

PRESENTATION 3

Presentation on biogeochemical tools and methodology by Dr Philippe Cecchi and Prof. Alassane Ouattara

Dr Philippe Cecchi talked about water-quality monitoring. He stated that water quality data loggers can be used to track parameters at high frequency in the field, such as temperature, pH, conductivity/salinity, dissolved oxygen, water level and chlorophyll fluorescence. This type of technology is needed for water surveys in coastal areas to have comparable, reliable, and accurate data.

The key point of Prof. Alassane Ouattara presentation was on the use of the environmental DNA approach (eDNA) in biological monitoring. He described how to use this technology in the field and its analysis in the laboratory. He said this approach has the advantages of sensitivity and time/labour-saving. The eDNA technology could be applied in investigations of target species (such as invasive species, endangered species, and other rare species) and biodiversity. In addition, environmental pollution impact assessments based on the eDNA technology could be used. Also, Prof. Alassane Ouattara discussed a new strategy to reconstruct past changes in aquatic biodiversity by using Sedimentary ancient DNA (sedaDNA) in paleoecology and paleoceanography. According to him, the DNA kit could cost 250 euros for a kit. This method is useful for the terrestrial ecosystem as well as the aquatic environment.

AFTERNOON SESSION

DISCUSSION

Knowledge Building and Human Capacity Building

The session focused on knowledge building and human capacity, data sharing and harmonization of data collection. There should be a data policy to guide the usage of data for publication. In the course of the meeting, an excel sheet containing various research projects and the lead author and co-authors was prepared.

PRESENTATION 4

Data sharing: Presentation on FishCom Ghana by Joshua Adotey

FishCom Ghana is a platform created on the Fishcom database for research works done in Ghana, but not only done by Ghanaian researchers. It's open to other nationals working in Ghana. You log on to the platform, register and you can submit data or check for information.

FishCom Ghana is an evolving process, so some information is restricted to certain people. Currently, there is no need for an MOU to access the information. If you want raw data, you can write to us, and we can help. There is a data policy and a disclaimer on the platform that specify all information required. It was suggested that owners of the data should be referenced and properly acknowledged.

AFTERNOON SESSION

DISCUSSION

Strategy for human capacity development: exchange of master, PhD, postdoc

Prof. Denis Aheto stated that to know areas to train students and young professionals, there is a need to identify institutions that are capable of handling such training. He suggested that there is a need to ensure easy movement of students within the West African region. If some researchers could teach masters students in Ghana and vice versa. Hence, the exchange of lecturers within the region is necessary to develop solutions.

It was also noted that there is a need to map out programs within the region. It was realised that mapping has been done on the experts of the region in the past, but it has not been updated. It was suggested that a Google Doc should be created to get all interested researchers onboard and to map out the various expertise of researchers in West Africa to allow students to travel within the region.

Members also discussed the possibility of establishing an Erasmus Mundus type of master degree programme for West Africa on coastal issues for our students to learn and train. The creation of a new international program for masters' students in the WACA-VAR program would therefore be appropriate.

It was also suggested that significant resources should be put together to train professionals within West Africa. One way would be to bring researchers from around West Africa together to be trained and or train regional professionals through short courses. It was noted that, with some seed funding, WACA-VAR can help organize short courses online next year for students who need some soft skills. To keep the team connected with the global experts, there is a need to create a list of West African coastal experts and researchers that can be shared with the rest of the world.

EVENING SESSION

FIELD VISIT TO ELMINA AND ANLO BEACH



During a field visit to Anlo Beach, Western Region, Ghana on Wednesday, 24th November 2021. Anlo Beach is one of the hotspots where coastal degradation is taking place.

DAY FOUR: THURSDAY, 25TH NOVEMBER 2021

Concrete lines and challenges

MORNING SESSION

Management of the West Africa coastal vulnerability

PRESENTATION 1

Presentation of the activities of Agence de developpement municipal (ADM) in the fight against coastal erosion in Saint-Louis by Mr Aldioume Cisse

The presentation was centred on the SERPP and PPCS projects of about 35 million USD and 16 million euros, respectively, earmarked to benefit 315 persons. The target of the projects was to propose a management plan for Saint Louis through 4 scenarios: No intervention; relocate the Senegal river mouth; change the watercourse of the river; provide a space for the river. Actions to be undertaken include protecting the city of Saint-Louis, protecting the natural environment: relocating the bird's island, protecting the artisanal fishing activities of Saint Louis through dredging, renourishment and protecting the Gandoala village.

On how the relocation of the population was addressed, Mr Cisse said, indeed, it was difficult to persuade people to relocate but the government managed to convince them by providing amenities like schools and markets for them in the new location.

The project is implemented following the guidelines of the WB not to directly give the money to the population. The project is considering relocating the population on the north of the littoral side.

PRESENTATION 2

Presentation on IRHOB, Benin activities by Dr Zacharie SOHOU

Dr Zacharie Souhou stated that the IRHOB is involved in many activities, including the data collection by ALOC-GG, PROPAO and JEAI in Nigeria, Benin, Togo and Ghana. But there is no data from Togo and Ghana. Buoy data and camera data are also being collected by the Institute. Other activities include forecasts by the TOMAWAC. They communicate with the National Agency of Civil Protection to help relay information on erosion to the public for the necessary actions.

On the littoral, oceanic and climatic analysis at the north of the Gulf of Guinea (ONSET project), he explained that the research project, sponsored by the IRD, is being carried out in

Ghana, Benin, Cote d'Ivoire, Nigeria. The project aimed to build capacities by training graduate students. He gave results of the physio-chemical marine and coastal water from data acquired from Buoy (Alize), including data on air temperature and others. He mentioned that a village predominantly inhabited by fishermen eroded within two years according to their findings. At the Togo border, for instance, the erosion rate was 15 m/yr from 2012 to 2015 and 3 m/yr from 2016 to 2019. However, since then the coastline is being protected.

PRESENTATION 3

Presentation on funding strategies by Dr Rafael Almar

Dr Rafael Almar stated that it is difficult to raise funds, but many sources of funds exist. He noted that the sum of Fifty thousand Euro (€50,000) was already won for workshops and meetings such as the current workshop. Dr Erwin Bergsma informed the group that if there is a laid down platform, the Space Climate Observatory (SCO) could help fund up to 50 % of the project total cost. Other sources of funds expected were listed as the French IRD, World Bank Group, and AFD. When the proposal is completed, funding will be sourced from these organisations.

PRESENTATION 4

Presentation on the hotspots selection coordinated by Drs Pierre Morand and Donatus Angnuureng

The Workshop was able to identify thirteen (13) hotspots along the West African coast. As shown in the Table below, some actions and activities were proposed as ways to efficiently assess and monitor these various hotspots.

Large scale "hotspot" name	Action types	Local hotspot name	Scale	Action 1.1	Action n° 1.2	Action 2	Action 3	Team/ persons responsible	Hotspot responsible
Gulf of Guinea		Kribi	physical	Topo. bathy. Surveys	Hydrody. Surveys	camera monitoring	satellite monitor.	Gregoire Abessolo)	Univ. Douala (Gregoire Abessolo)
			bio-geo-chemic	O ₂ , NaCl, θ, Fluo, pH permanent monitoring	Environm ent DNA assessmen t	seasonal field visits (MO)	person supervised by Al. Ouattara		
			social-governance	percept. surv.	gather secondary data (census) + stakes carto	mapping actors	person supervised by the expert team on the topic		

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West Africa front	Satellite modelling coastal drifts, modelling sediment flows and balance	Mud coast	physical	topo-bathy.	camera monitor.	satellite. monitor.			Olusegun Dada			
			bio-geo-chemic	O ₂ , NaCl, θ, Fluo, pH, permanent monitoring	environme nt. DNA assessmen t	seasonal field visits (MO)						
			social-gov.	Perception survey	gather secondary data (census..) + stakes SIG	mapping actors						
		Lagoon-Barrier coast	physical	“	“	“	“	“		Olusegun Dada		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		Grand Popo coast and lagoon	physical	“	“	“	“	“		Frederic Bonou		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		Nokoue lagoon	physical	“	“	“	“	“		Zacharie Sohoun		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		Elmina	physical	“	“	“	“	“		Donatus Angnuureng		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		Anlo-Shama	physical	“	“	“	“	“		Philip Jayson		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		Grand Lahou lagoon - Bandama mouth	physical	“	“	“	“	“		Allassane O.		
			bio-geo-chemic	“	“	“	“	“				
			social-gov.	“	“	“	“	“				
		West Africa front		Guinea (precise zone: Kaback....)	physical	“	“	“	“		S.T. Bangoura	
					bio-geo-chemic	“	“	“	“	“		
					social-gov.	“	“	“	“	“		
				Casamance (precise zone: Diogue-Karabane)	physical	“	“	“	“	“		Bamol Sow
					bio-geo-chemic	“	“	“	“	“		
					social-gov.	“	“	“	“	“		
Sine - Saloum (precise zone: Joal-Dionewar)	physical			“	“	“	“	“		Issa Sakho		
	bio-geo-chemic			“	“	“	“	“				
	social-gov.			“	“	“	“	“				
		physical	“	“	“	“						

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	Saint-Louis - Langue de Barbarie	bio-geo-chemic	“	“	“	“		Abdoulaye Ndour
		social-gov.	“	“	“	“		
	Banc d'Arguin	physical	“	“	“	“		Djibril LY
		bio-geo-chemic	“	“	“	“		
		social-gov.	“	“	“	“		

The estimated cost of equipment and travels to implement the above hotspot studies per country are provided below.

Action	Activity	Required equipment for each country	Cost per country USD
1.1	Topo-bathymetry surveys	DGPS, Echosounder, surveys	40,000
	Ecology	Loggers eDNA kits Seasonal sampling	52,000
	Social Surveys	Tablets, Handheld GPS	10,000
1.2	Hydrodynamic surveys	ADCP Pressure sensor Tide gauge	50,000
2.0	Camera monitoring	Two cameras	5,000
3.0	Others: Two large-scale hotspot meetings	Five (5) master training	75,000
		2 PhD training	40,000
	Overall workshops, webinars, and training	Travels, workshops, stationeries, administration	40,000
Total		312,000	

AFTERNOON SESSION

Deliberation on Special Issue articles on West African coast

The participants discussed and selected the following topics to be submitted to the Special Issue of the Journal of Coastal Conservation that was launched in November 2021. The potential authors were also identified as shown in the Table below.

Title	Lead Author*	co-authors*							1st draft	Final draft
West African video coastal network	GAO	DAB	RA	FB	EB	SZ		28/2/22	30/4/22	
West African estuaries and lagoons	Awa	BC	IS	OAD	AN	DAB		28/2/22	30/4/22	
West Africa River and deltas	IS	OAD	PJ	Awa	SB	EB		28/2/22	30/4/22	
West Africa mangroves	AO	PC	SB	IS	ZS	DAB		28/2/22	30/4/22	
West Africa sandspits and barriers	AN	RA	EB	OAD	GA	FB	PJ	A	28/2/22	30/4/22

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Review on West African vulnerability perceptions	OAD	DAB	PM	RA	GAO	AK	BC	28/2/22	30/4/22
Coastal Adaptation to livelihood opportunities and challenges in a changing environment	BC	OAD	SK	SD	DAB			28/2/22	30/4/22
Vulnerability of fisher communities in West Africa coast	KB	ZS	PM	AK	DAB	SB		28/2/22	30/4/22
Assessment of the level of coastal management in West Africa	DAB	AN	SA	AK	EkB			28/2/22	30/4/22

***Note: AK – Alioune Kane; Awa– Awa Niang; AN-Abdoulaye Ndour; EB – Erwin Bersgma; BC-Benjamin Campion; FB-Frederic Bonou; IS – Issa Sakho; AO-Allassane Ouattara; GAO – Gregoire A. Ondoa; OAD – Olusegun A. Dada; SA-Senyo Adzah; SK – Stephen Kankam; SD – Selorm Dzantor; PM – Pierre Morand; RA – Rafael Almar; PJ-Philip-Neri Jayson-Quashigah; DAB – Donatus B. Angnuureng; SB – Sekou Bangoora; ZS – Zacharie Sohou; EkB – Emmanuel K Brempong; KB – Komena Boniface

Main outcomes of the 2021 WACA-VAR Cape Coast Workshop

- Data sharing strategy established
- Hotspots identified (Large scale and small scale)
- Common tools and methodologies to be implemented at hotspots
- Teams and persons to be responsible for hotspots
- Regional knowledge gaps to be addressed at hotspots
- Scheduling of review articles in the special issue of Journal of Coastal Conservation on the state of the art knowledge of the West African coast
- Aligning the WACA-VAR project with regards to existing projects (e.g., WARCO)
- Reflection on the financial needs to achieve these goals
- Student exchange and new research dynamics in the region from St. Louis 2019 to Cape Coast 2021.

The way forward after the WACA-VAR Cape Coast 2021 Workshop

The participants at the workshop unanimously agreed to undertake the following:

- Produce articles for the SI on the state-of-the-art knowledge on West African coast vulnerabilities for ecosystems and populations
- Draft project and submit to funding projects (IRD, SCO, AFD and World Bank)
- Each thematic expert team is to produce guidelines of methodologies to implement on the hotspot
- Training for some of the actions to implement
- Launching the actions of data collection and coastal monitoring at hotspots
- Build a West Africa coastal list of persons/experts
- Ensure mobility for scientists, teachers, students, etc.
- Organise webinars/meetings on themes (Video, satellites, coastal dynamics, etc.) and maybe for the two large scale hotspots
- Attract international attention and gain visibility for the coastal research community in West Africa (e.g., CIRN workshop, special issue, etc.).
- Potential WACA-VAR workshop for 2023 in Cote D'Ivoire.

The workshop ended on the 25th of November 2021, at 15:10 GMT with farewell messages from Drs Pierre Morand and Donatus Angnuureng.

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Annexe: List of participants

S/N	Names	Country	Institution	Attendance
1	ABROAKWAH Sika	Ghana	ACECoR-UCC, Cape Coast	in-person
2	ABESSOLO Gregoire	Cameroun	University of Douala	Online
3	ADADE Richard	Ghana	ACECoR-UCC, Cape Coast	in-person
4	ADDO Kwasi Appeaning	Ghana	University of Ghana, Accra	in-person
5	ADOTEY Joshua	Ghana	ACECoR-UCC, Cape Coast	in-person
6	AFOLABI Lateef	Nigeria	ACECoR-UCC, Cape Coast	in-person
7	AGBETOSSOU Foga	Togo	ACECoR-UCC, Cape Coast	in-person
8	AHETO Denis	Ghana	ACECoR-UCC, Cape Coast	in-person
9	AKINYEMI Temiloluwa	Nigeria	ACECoR-UCC, Cape Coast	in-person
10	AKUOKO-GYMAH Ivy	Ghana	ACECoR-UCC, Cape Coast	in-person
11	ALMAR Rafael	France	IRD	in-person
12	AMANKONA Godfred	Ghana	ACECoR-UCC, Cape Coast	in-person
13	ANGNUURENG Donatus	Ghana	ACECoR-UCC, Cape Coast	in-person
14	ANWAR Sajid	Ghana	WACA WB-team	Online
15	ASARE Obeng Adu	Ghana	ACECoR-UCC, Cape Coast	in-person
16	ATTIPOE Esinam	Ghana	ACECoR-UCC, Cape Coast	in-person
17	BANGOURA Sekou Tidiane	Guinea	CERESCOR	in-person
18	BERGSMA Erwin	France	CNES	in-person
19	BLAY Lois M.	Ghana	ACECoR-UCC, Cape Coast	in-person
20	BLUTTY Dorcas M.	Ghana	ACECoR-UCC, Cape Coast	in-person
21	BONOU Frédéric	Benin	UNSTIM/ CIPMA/ IRHOB	in-person
22	BREMONG Emmanuel	Ghana	ACECoR-UCC, Cape Coast	in-person
23	CAMPION Benjamin	Ghana	KNUST	in-person
24	CECCHI Philippe	France	IRD	in-person
25	CISSE Aldiouma	Senegal	ADM	in-person
26	DADA Olusegun	Nigeria	IRD/ FUTA	in-person
27	DAHUNSI Adeola	Nigeria	ACECoR-UCC, Cape Coast	in-person
28	DEIKUMAH Saviour Komla	Ghana	ACECoR-UCC, Cape Coast	in-person
29	DIALLO Marieme Soda	Senegal	CSE	Online
30	DZANTOR Selorm	Ghana	ACECoR-UCC, Cape Coast	in-person
31	FOLORUNSHO Regina	Nigeria	NIOMR, Nigeria	Online
32	GBEKOR-KOVE Peace	Ghana	Environmental Protection Agency EPA	in-person
33	HAUHOUOT Célestin	Cote d'Ivoire	Université F. Houphouët Boigny, Abidjan	Online
34	JAYSON-QUASHIGAH Philip-Neri	Ghana	University of Ghana, Accra	in-person
35	JONAH Alberta	Ghana	ACECoR-UCC, Cape Coast	in-person
36	JUNG Sarah	USA	WACA WB-team	Online
37	KANE Alioune	Senegal	UCAD	in-person
38	KANKAM Stephen	Ghana	HENMPOANO	in-person
39	KINNEY Ken	Ghana	The Development Institute	in-person
40	KOMENA Boniface	Côte d'Ivoire	CIRES/UAO	in-person
41	KWAME Obeng	Ghana	ACECoR-UCC, Cape Coast	in-person
42	MATTAH Precious	Ghana	ACECoR-UCC, Cape Coast	in-person

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43	MINDERHOUD Philip	Italy	UNIPD	Online
44	MORAND Pierre	France	IRD	in-person
45	NDOUR Abdoulaye	Senegal	UCAD	in-person
46	NIANG-FALL Awa	Senegal	UCAD	in-person
47	OUATTARA Allassane	Cote d'Ivoire	Université Nangui Abrogoua	in-person
48	PRAH Ekow	Ghana	ACECoR-UCC, Cape Coast	in-person
49	PRICE Thomas	Senegal	UICN, WACA-RESIP	Online
50	SAKHO Issa	Senegal	University of Thiès	in-person
51	SANE Tidane	Senegal	University of Ziguinchor	Online
52	SARFO Kwabena	Ghana	Dean & Rep. Of UCC Vice-Chancellor	in-person
53	SOHOU Zacharie	Benin	IRHOB/ CNDO/ CBRSI	in-person
54	SOW Bamol Ali	Senegal	University of Ziguinchor	Online
55	TEATINI Pietro	Italy	UNIPD	Online
56	WOILLEZ Marie Noelle	France	AFD	Online

List of sessions moderators and rapporteurs

S/N	Name	Affiliation
Moderators		
1	AKUOKO-GYMAH Ivy	ACECoR-UCC, Cape Coast
2	ADOTEY Joshua	ACECoR-UCC, Cape Coast
3	BLAY Lois M.	ACECoR-UCC, Cape Coast
Rapporteurs		
1	AGBETOSSOU Foga	ACECoR-UCC, Cape Coast
2	AMANKONA Godfred	ACECoR-UCC, Cape Coast
3	ATTIPOE Esinam	ACECoR-UCC, Cape Coast
4	BLUTTY Dorcas M.	ACECoR-UCC, Cape Coast
5	BREMONG Emmanuel	ACECoR-UCC, Cape Coast
6	JONAH Alberta	ACECoR-UCC, Cape Coast
7	KWAME Obeng	ACECoR-UCC, Cape Coast