

UNIVERSITY OF DAR ES SALAAM
INSTITUTE OF RESOURCES ASSESSMENT



**BUILDING CAPACITY TO CROSSLINK COASTAL POLLUTION
WITH CLIMATE CHANGE_BC5**

GHANA FIELD WORK NARRATIVE REPORT DECEMBER 2022



1.0 INTRODUCTION

BC5 project is a strategic north-south-south collaboration between the Norwegian University of Science and Technology (NTNU), the University of Ghana (UG) & affiliated collaboration by University of Dar Es Salaam, Tanzania. BC5 addresses the thematic area “Climate Change and Natural Resources” under NORHED II. BC5 aims at building knowledge on sustainable management of marine and coastal ecosystems and resources, strengthening & improving existing regional coastal research. Under this project research activities are parallel and intertwined with capacity enhancement in education through the establishment of field & experimental training & curriculum development on the combined impact of coastal contamination & climate change on coastal ecosystems in Ghana and Tanzania. BC5’s activities are based on the objectives set by Sustainable Development Goals (SDGs) 14, Life under water, and other cross cutting relevant SDGs. Both Ghana & Tanzania lack crucial data and knowledge on the status of their marine environment. BC5 thematic focus is on the impacts of contaminants (i.e. plastics, e-waste, mining, (pesticides) and nutrients) from agricultural runoff, non-climatic stressors in combination with climatic stressors, on the marine and coastal environment. Apart from research, curriculum development and other scientific activities that will be shared among the core researchers, the project anticipated to train about 6 PhD’s and 12 MSc. candidates for the UDSM among other participating institutions. So far, 3 MSc. and 4 PhD candidates have been enrolled at the UDSM and are fully engaged in the project activities.

Among the enrolled PhD and MSc. students at UDSM, 4 PhD students namely: Daniel Mugassa Stephen, Judith E. Mlay, Veronica Siwalima and Eliengerasia Godliving attended the field work in Ghana. Dr. Joseph Perfect partly attended the fieldwork between 27th November and 3rd December 2022. Dr. Catherine Masao (The UDSM-PI) travelled to Ghana on the 16th November to attend the fierst part of the fields but had immigration issues due to COVID-19 vaccines therefore she had to return to Tanzania the following day i.e. 17th November 2022.

This report provides a narrative of a field activity that was conducted in Ghana between 18th and 30th November 2022. The areas that were visited for the purpose are the Greater Accra region, Western region and Volta region. Prior to the field visits, there was a stakeholders’ session that was conducted at the University of Ghana as explained on Section 1. In section two, we provide some day to day narratives of some of the activities that were undertaken in the field here regarded as technical part of the field visit. The sampling sites for the BC5 Project include Offshore, Estuaries, Rivers (downstream, midstream and upstream), Community wells, Lagoons and Mangroves within the concentration regions in Ghana. Site visits were conducted in these three (3) regions from 18th November to 30th November 2022.

2.0 STAKEHOLDERS WORKSHOP

The aim of this one-day workshop was to emphasize collaborations among researchers in the universities to give more weight to their findings. Researchers have been working on their own, but the time has come to bring all of them together to bring socio-economic impact to the people. It was observed that working separately is making life more difficult for the academia.

The BC5 project is a strategic north-south-south collaboration between the Norwegian University of Science and Technology (NTNU), the University of Ghana (UG), and affiliated collaboration with the University of Dar es Salaam, Tanzania. BC5 as part of its project objectives seeks to promote networks, citizen science, Ocean Literacy and Stewardship through collaborations on multi-stakeholder platforms to promote land-based actions on the marine environment for sustainable resource utilization. It also seeks to address the thematic area “Climate Change and Natural Resources” under NORHED II, as well as building knowledge on sustainable management of marine coastal ecosystems and resources, strengthening and improving existing regional coastal research.

University of Ghana through the Institute of Environment and Sanitation Studies (IESS) would lead the research project, which activities would be parallel and intertwined with capacity enhancement in education through the establishment of field and experimental training and curriculum development on the combined impact of coastal contamination and climate change ecosystems in Ghana and Tanzania. In Ghana the research will be conducted in Ga Mashie in the Greater Accra, Ankobrah river to ascertain how both legal and illegal mining is contaminating the river, and Songor and Keta Ramsar sites, which will look at erosion and mangrove. The project focused on defining and implementing successful programmes to enhance local capacity in education, research, and management of coastal resources.

BC5’s project implementation has fundamental research-based education activities, bringing current problems of great societal importance as part of the research and education curriculum, challenging students to gain knowledge and developing approaches that will result in real impact activities. Former Director of IESS Prof Gordon said:” The combined impacts of pollution and climatic stressors on the environment and biodiversity might be completely different regionally and little knowledge about this prevents effective legislation and policy-making for resilience and sustainability. “BC5 addresses the gap between research needs and practice, education and the management of coastal resources by defining a novel education, research and management model for the area, finding ways of protecting the coastal resources under the impact of human-made contaminants and climatic stressors.”



Group photo of stakeholders who attended the workshop at the GU

3.0 TECHNICAL PART – FIELD WORKS

DAY 2: 18TH NOVEMBER 2022

This was the first day in the field we visit Atlantic Ocean offshore in part of Accra Ghana at Slums area which is located at southern and is the point of entry for the Korle lagoon into the sea. It is located within latitudes $05^{\circ} 31'N$ and $05^{\circ} 31'N$, and longitudes $00^{\circ} 12'W$ and $00^{\circ} 13'W$. Three (Accra_S1, Accra_S2, and Accra_S3) sampling locations were chosen for the offshore sites, where sediment, micro plastic, total trace element, dissolved trace element and eDNA samples were taken. Accra_S1 ($05^{\circ}31'15.22'' N$, $000^{\circ}13'29.03'' W$) in this site watercolor appeared blue-greenish due to high human activities around the area. Accra_S2 ($05^{\circ}31'49.22'' N$, and longitude $000^{\circ}12'49.22'' W$) the similar samples were taken and also the water observed to be bluish-green. In this day there was high tide at the time of sampling and there was no fauna found around the sampling which result to high pollutants.



Figure 1: Field visit site 1 and 3

DAY 3: 19TH NOVEMBER 2022

On this day, we complete the sample at S3 and add a new site at the estuary and lagoon at Korle. The Korle Lagoon is located in Accra's western region, at $5^{\circ}32'29.45''$ North and $0^{\circ}13'18.54''$ West. Within the S4, S5, and S6 areas of the Korle Lagoon, three sampling stations were picked. Accra S3 ($05^{\circ}31'41.11'' N$, $000^{\circ}12'19.64.08'' W$) is the location of a river route that was created when salt seawater and freshwater from the Korle lagoon mixed. Due to the presence of silt from the river interacting with the ocean and the severe pollution from trash, the water became dark brownish. Upstream of the lagoon, at N $05^{\circ}32'02.13'' W$ $000^{\circ}13'09.41''$, and Accra S5 Lagoon N N $05^{\circ}31'52.49''$, there is a commercial area

with relatively little vegetation on both sides. On this vegetation, cattle and horses were seen grazing, and on the other side of the lagoon, there are facilities for waste management, a mall, and other things.



Figure: Sample site S3, S4 and S5

DAY 4: 20TH NOVEMBER 2022

Accra S6_ (N 05°31'53.53" W 000°13'15.39") D, Accra S7_ (N 05°31'53.53" W 000°13'15.39" Midstream Pantang), and S8 (N 05°45'00" W 000°13'45" Upstream Brekusu) were the last sampling locations used in Accra Town. The estuary, which includes a built-in channel connecting the sea to the lagoon and rock boulders on the sandy beach, is where samples from site S6 were obtained. Estuary water was dark and smelled awful, and there was significant land and marine pollution as a result of uncontrolled human activity. Construction activities were seen at sample site Accra S7_, which left the area mostly muddy as a consequence of the work that had been done. Compared to downstream, the water was crystal clear and moving quickly. One of the sources of the Odaw is the sampling site Accra S8, which is situated in the eastern town of Brekusu. There was no dirt or odor in the water, which was crystal clear. In comparison to other sampled sites, there was less human activity here.

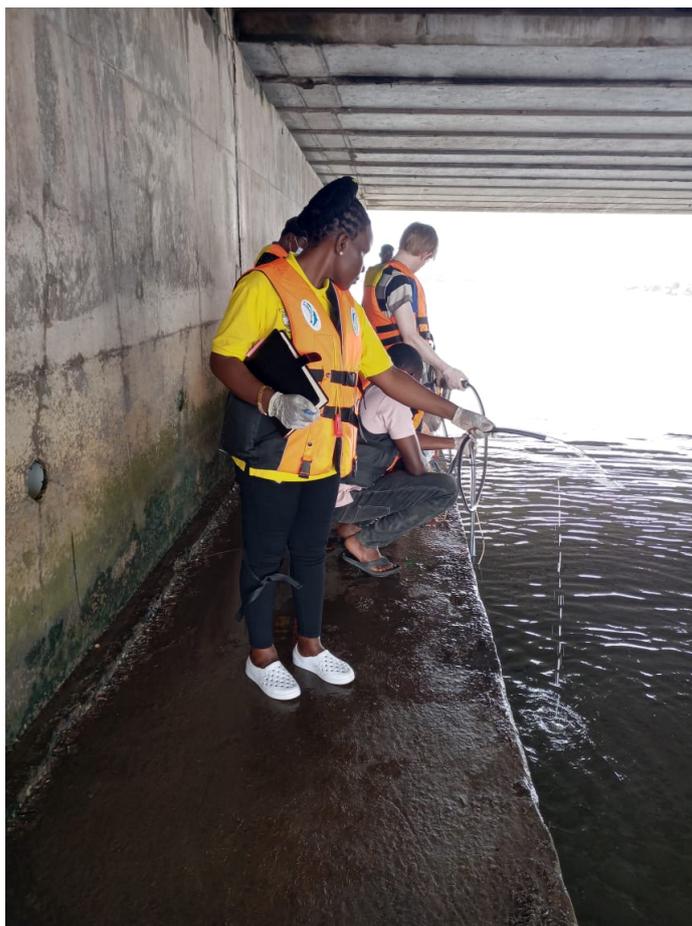


Figure 3: Sampling under the bridge

DAY 5: 20TH NOVEMBER 2022

This day we traveled from the Accra region to the western region, passing through coastal and then western regions. While traveling, we saw several rivers, but the water appeared to be dark in color because of mining activities in the western region. The trip's objective was to see the Ankobra River. It took about 9 hours to travel.

Western region, Ghana.

The Western region is located in the western side of Greater Accra region. The region was visited on 21st November 2022 (Day 5 of the research field work). This field work was conducted for three days (22nd to 24th of November 2022) in Ankobra river together with wells and creek accessed by the community around. Sample collection in sediment and water was to be analysed for microplastics, eDNA, heavy metals (TTE, MeHg and Hg) and some of water quality parameters analysed onsite were pH, salinity, conductivity, temperature, Dissolved Oxygen and Total Dissolved Solids.

The Ankobra river water was looking muddy. Human activities such as illegal small-scale gold mining (galamsey) in the forest reserve was observed to cause this pollution. This pollution has created an environment that no fish could survive and mangroves in the river banks to be degraded, mainly due to pollution of chemicals from these illegal small-scale mining.

All samples that were collected in Ankobra and Nkroful areas were stored in a cool box with ice cubes. Samples were to be transported to the laboratory (in the University of Ghana) for pretreatment before being transported for further analysis in the NTNU laboratories in Norway.

DAY 6: 22ND NOVEMBER 2022

Sampling was done in Ankobra river and its estuary that connects to the Atlantic Ocean. Travelling to the deep ocean was done for quality comparison of sediment and water samples in the estuary and tributaries. The sampling points were three and Table 1 presents sampling location and names.

Table 1: Sampling points in Ankobra; estuary and ocean.

Station Name	Station Location
SAN 1	Latitude 04°53'08.03" North Longitude 002°53'08.03" West
SAN 2	Latitude 04°52'42.29" North Longitude 002°15'41.44" West
SAN 3	Latitude 04°53'55.13" North Longitude 002°17'19.63" West

Parameters that were considered in sediment and water are microplastics, heavy metals (TTE, MeHg and Hg) and water quality parameters (pH, salinity, conductivity, temperature, Dissolved Oxygen, Total Dissolved Solids).

DAY 7: 23RD NOVEMBER 2022

Sampling was done in Ankobra river, about 7 kilometers from the estuary towards upstream and tributaries. There were five sampling points within the river. The two sampling points were done in tributaries of the river and three sampling points in the main river. The collected samples were for the analysis of microplastics, eDNA, heavy metals (TTE, MeHg and Hg) while physical water parameters were taken onsite. Table 2 presents five sampling points names and their location.

Table 2: Sampling points in Ankobra river and tributaries

Station Name	Station Location
SAN R.1	Latitude 04054'19.80" Longitude 002016'05.57"
SAN R.2	Latitude 04056'00.25" Longitude 002015'05.14"

SAN R.3	Latitude 04056'37.06" Longitude 002013'30.07"
SAN R.4 (Tributary)	Latitude 04056'36.64" Longitude 002013'15.45"
SAN R.5 (Tributary)	Latitude 04056'17.88" Longitude 002013'16.97"

DAY 8: 24TH NOVEMBER 2022

Sampling was done at creek and wells in the community around Ankobra and Nkroful areas. Sample collection of water in community wells around Ankobra river was taken and; sediment and water samples were collected at the creek. Parameters that were observed are eDNA heavy metals (TTE, MeHg and Hg) and physical parameters of water that was done onsite.

Table 3: Sampling points in Ankobra and Nkroful Communities.

Station Name	Station Location
Well 1: Ankobra Community	Latitude 04054'04.38" Longitude 002016'14.43"
Well 2: Nkroful Community	Latitude 040'57.52.54" Longitude 002019'19.27"
Creek/ Stream - Water	Latitude 04057'15.96" Longitude 002019'56.95"

Well in Ankobra community was said to have high saline property due to ocean water intrusion. In Nkroful area, the well water was acidic. The acidity is proposed to be caused by leaching of acidic chemicals from a nearby gold mining.

DAY 9: 29TH NOVEMBER 2022

Sampling of water at Pra river was done along its bank and at a well located nearby in the of community. The sampling location in the river is Latitude 05° 07'24.75" and Longitude 001° 37'00.12" and in the well is Latitude N 05 °07'14.44" and Longitude W 001° 36'55.63". This activity was done during the travelling from Ankobra to Accra.

Sampling at Volta Region

From 27th 30th November, that was day 11 to 14 of a field trip, data collection activities was undertaken in Volta region. Samples were taken from the Volta river, offshore sites, estuary and lagoon.

DAY 11 FIELD ACTIVITIES.

Offshore sampling involved site VS1 with coordinates Latitude N 05°45'09.10'' and longitude 000°38'59.30'' and site VS2 with coordinates Latitude N 05°45'59.20 and longitude 000°40'55.40''. Measured depth at VS1 was around 58.7 feet while at VS2 was around 57.3 feet. The difference in color between the seawater and freshwater was observed where seawater had deeper blue color compared to freshwater, and the time of sampling the wind was flowing toward the sea due to high tide. The sample collected were sediments, microplastic, Hg, MeHg, total trace element, dissolved trace element, eDNA, Zooplankton and phytoplankton. All precautions were taken to avoid contamination. All samples were kept in cold box before transferred to the laboratory in Accra.

Sampling at Volta estuary was named as VSR1, its coordinates was N 05°46'29.00'' and E 000°39'56.30''. At the estuary different coloured water was observed due to the mixing of seawater and freshwater, this process created a very big wave and great force. Plastics and other materials were observed to be suspended at the estuary. We collected the sample from 4 pm to 5 pm, low tide was observed where fresh water was moving into the sea. The sample collected were sediments, microplastic, Hg, MeHg, total trace element, dissolved trace element, eDNA, Zooplankton and phytoplankton.

DAY 12 FIELD ACTIVITIES

Sampling was at the side of the Volta river, site VSR2 with coordinates N 05°54'00.80'' and E 000°38'51.40'' and site VSR3 with coordinates N 05°59'23.94'' and E 000°35'36.98''. samples of sediments, microplastic, Hg, MeHg, total trace element, dissolved trace element, eDNA, Zooplankton and phytoplankton were collected the average temperature of both sites was around 29 °C.

DAY 13 FIELD ACTIVITIES

Sampling involved three sites L1, L2 and L3. Starting with site L1 which was upstream, its distance from shoreline was 2.69 km with coordinate N 05°48'26.82'' and E 000°43'25.42''. sample was taken close to the mangrove plants a lot of dead mangroves was observed and the water was black in colour. The average water depth was 5 feet, except of sediments other samples such as microplastic, Hg, MeHg, total trace element, dissolved trace element, eDNA, Zooplankton and phytoplankton were collected at 50cm depth. At 5 cm depth the DO was 1.30mg/L, salinity was 11.92 PSU, pH was 7 and temperature was 30.54 °C. Human activities observed was fishing and harvesting dead mangroves.

Site L2 which was midstream, its distance from shoreline was 800 m with coordinate N 05°47'58.32'' and E 000°42'41.59''. Black water and strong pungent smell was observed. The average water depth

was 16.5 feet but water samples was taken at 50 cm depth. Water quality parameter was performed and D0 was 0.5mg/L, salinity was 20.14 PGS, temperature was 30.89°C and pH was 6.9.

Site L3 was downstream with coordinate N 05°46'38.27'' and E 000°41'36.57''. The average water depth was 4.3 feet, water was relatively shallow and very clear, and surrounded by aquatic plants also a modified canal with high water velocity for transportation. Water quality parameter was performed and D0 was 2.37mg/L, salinity was 2.49 PGS, temperature was 30.7°C and pH was 7.65. Observed human activities was fishing.

DAY 14 FIELD ACTIVITIES.

Sapling was at Keta lagoon complex on an abandoned resort built on water. The Coordinate was N 05°55'52.83'' and E 000°59'21.63''. The average water depth was 6.2 feet, a robot was used to collect microplastic samples. Water quality parameter was performed and D0 was 1.18mg/L, salinity was 16.67 PGS, temperature was 30.68 °C and pH was 7.89.

4.0 MEETING WITH UG CO-SUPERVISORS

After all fields concluded, the Ghana PI (Prof. Chris Gordon) organized meetings for the UDSM students to meet up with their potential supervisors. These meetings were very productive where students received feedbacks from the Ghana supervisors for a first time.

5.0 CONCLUSION AND RECOMMENDATIONS

Largely, the fieldwork was a success and very instrumental to the UDSM PhD students. A good number of sampling techniques were learned. We provide some key observations hereunder for future considerations.

KEY OBSERVATIONS

1. The field work was good and fit to continue capacitating our knowledge in research concerning coastal ecosystems and its pollution.
2. It was good lesson to collect different samples in marine environment. E.g. Micro plastic and trace elements.
3. To work with people of different backgrounds and culture was other lesson.
4. The field practical was so productive to expose us with new technology and data collection methods.
5. The field practical helps us to understand the core areas and focus of the project.
6. Timetable of the day was unknown before actual fieldwork.
7. There was lack of prior debriefings for familiarization and understanding of the anticipated project activities, locations, techniques to be used and expected outputs. This can be improved by having such briefings before initiation of fields every time such excursion is conducted.
8. It is advised that, prior to such fields, there are good understanding of the expected activities, identified sites and planning of all logistics to ensure harmonized working environment and realization of the anticipated outputs.