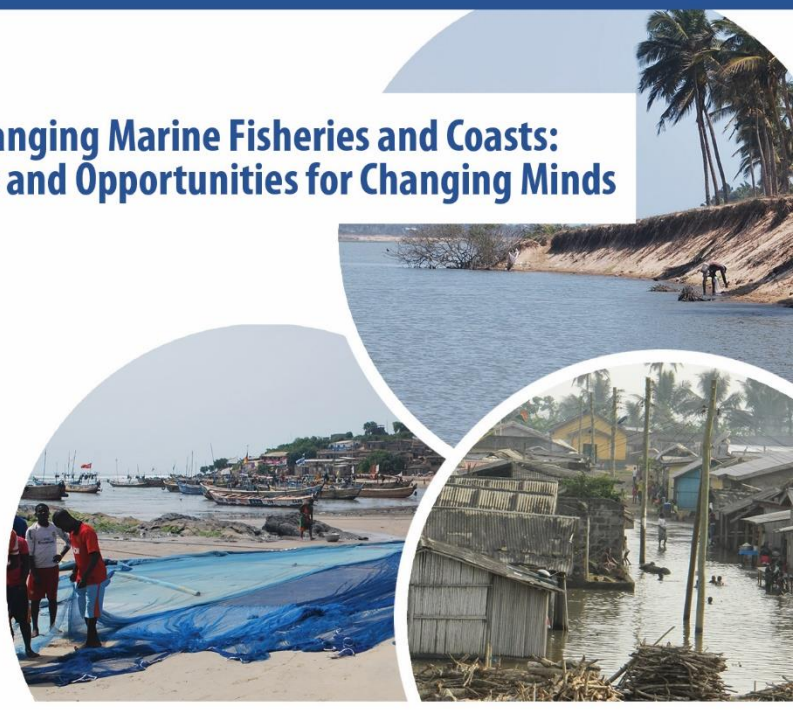
CONFERENCE ON FISHERIES AND COASTAL ENVIRONMENT

ACCRA 2017

25-27 SEPTEMBER 2017

BOOK OF ABSTRACTS

The Changing Marine Fisheries and Coasts: Challenges and Opportunities for Changing Minds



USAID FROM THE AMERICAN PEOPLE

MOFAD MINISTRY OF FISHERIES AND AQUACULTURE DEVELOPMENT

UNIVERSITY OF CAPE COAST DEPARTMENT OF FISHERIES AND AQUATIC SCIENCES

CENTRE FOR COASTAL MANAGEMENT UNIVERSITY OF CAPE COAST, GHANA

THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

CRC COASTAL RESOURCES CENTER

REVISED EDITION

DISCLAIMER

THIS BOOK IS MADE POSSIBLE BY THE GENEROUS SUPPORT OF THE AMERICAN PEOPLE THROUGH THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID). THE CONTENTS ARE THE RESPONSIBILITY OF THE UNIVERSITY OF CAPE COAST AND DO NOT NECESSARILY REFLECT THE VIEWS OF USAID OR THE UNITED STATES GOVERNMENT.

Conference on Fisheries and Coastal Environment

The Changing Marine Fisheries and Coasts: Challenges and Opportunities for Changing Minds

ACCRA 2017

The University of Cape Coast,
University of Rhode Island and the
Ministry of Fisheries and Aquaculture Development

The Centre for Coastal Management (CCM) and the Department of Fisheries and Aquatic Sciences of the University of Cape Coast (UCC) in collaboration with the University of Rhode Island (USA) and the Ministry of Fisheries and Aquaculture Development are organising this maiden conference. This initiative is designed to strengthen policy linkages and enable researchers, journalists, and think tanks connect their voices to the sustainable fisheries and coastal development agenda of Ghana. The conference will provide an opportunity for a more holistic discussion on a resource that is shared by millions of people, yet, under threat and mismanaged. This conference will feature panel discussions, keynote presentations and session papers. There will also be an opportunity for industry and market players to showcase their latest technologies.

This conference is funded by the United States Agency for International Development (USAID) through the University of Cape Coast (USAID/UCC Fisheries and Coastal Management Capacity Building Support Project) and University of Rhode Island (USAID/GHANA Sustainable Fisheries Management Project).

Table of Contents

Centre for Coastal Management, University of Cape Coast

Since its inception in 2013, the Centre for Coastal Management has played a pioneering role and fostered demand-driven research, professional education and community services with an ultimate goal of collectively identifying and implementing strategies for building more resilient coastal communities.

To achieve this requires the skills of many disciplines. The Centre through its programmes, works with a broad range of experts not limited to fisheries scientists, climatologists, oceanographers, coastal ecologists, chemists, geographers, geologists, health professionals and economists. In addition, we engage practitioners committed to the policy and institutional aspects of human development and coastal environmental sustainability such as the national and local government authorities including coastal resource managers, planners, engineers, and disaster management officials at regional and district levels.

Our technical advisory services and decision support tools make the Centre an important reference point that provides opportunities for students, university faculty and research scientists to engage in interdisciplinary research or dialogue to promote understanding of the complex coastal environmental and social challenges. I am pleased that the Centre is committed to providing awareness on these issues and contributing to solutions around its core functions to effect changes that moves us towards healthier coastal ecosystems and human communities.

As I look at the growth over the past few years, I am extremely proud of what we have achieved, and even more excited about our outlook for an equally promising future. CCM is a success story that would not be possible without the contribution of our local and international partners who have shared in our vision and have contributed to our incredible journey thus far. We look forward to continuing to serve and engage with all other stakeholders in the future. We appreciate the ongoing support received from those who are interested in CCM's activities and we look forward to working with all prospective partners. We pledge to continue in our efforts to exceed expectations.

Prof. Denis Worlanyo Aheto
Director, Centre for Coastal Management
University of Cape Coast, Ghana

Department of Fisheries and Aquatic Sciences, University of Cape Coast

The Department of Fisheries and Aquatic Sciences is one of six departments in the School of Biological Sciences. The location of the University, which borders the Gulf of Guinea with the highest marine fish production in Ghana, offers the Department the opportunity to expose students to a vast array of opportunities in fisheries, coastal marine and brackish water studies. The Department offers a four-year Undergraduate programme leading to the award of Bachelor of Science (BSc) degree in Fisheries and Aquatic Sciences. Our Postgraduate programmes lead to the award of Master of Philosophy MPhil and Doctoral (PhD) degrees focusing on the four key areas of specialization: Aquaculture, Fisheries Science, Limnology and Oceanography as well as Integrated Coastal Zone Management. In addition, the Department offers annual professional short course on Climate-Change Adaptation.

Our curriculum and capacity-building strategy are driven by three major development goals. These revolve around maintaining a high ecological health integrity of aquatic ecosystems and resources therein; improving the livelihoods of people dependent on these aquatic systems and to sustainably increase fish production to meet our country's food and nutrition security objectives.

Dr. Noble Kwame Asare
Head, Department of Fisheries and Aquatic Sciences
University of Cape Coast, Ghana

Coastal Resources Center, University of Rhode Island

In Rhode Island and around the globe, the Coastal Resources Center (CRC) at the Graduate School of Oceanography, University of Rhode Island catalyzes the aspirations of coastal communities to help them become more effective stewards of their marine resources—food, people, and place. To implement best practices, craft sound policy, and promote equitable governance, an interdisciplinary CRC team partners with stakeholders to apply science and promote innovation. We empower these communities by facilitating collaboration, advancing knowledge, building capacity, and providing management tools.

CRC's work is focused on:

- safe, local, abundant, and sustainable seafood
- thriving coastal communities, and
- vibrant, well-managed oceans, coasts, and watersheds.

Foreword

This Conference on Fisheries and Coastal Environment reaffirms the commitment of the University of Cape Coast to the sustainability of the fisheries and coastal resources of Ghana which makes very significant contributions to food security, employment and poverty alleviation. This comes at a critical time; a time when all key stakeholders: government, fisheries practitioners, scientists and the private sector are deeply concerned about the decline in fisheries output and the worsening coastal environment. Recent estimates show that annual yields of small pelagics are down from approximately 130,000 metric tonnes (MT) ten years ago to about 30,000 MT. The cause of this decline, among others, is over fishing, weak enforcement of regulations, the lack of stakeholder engagement, a counterproductive fuel subsidy, and widespread illegal, unreported and unregulated fishing practices. I am pleased that this conference provides the needed platform for all the stakeholders to effectively engage on a common stage to promote collective decision-making processes and to improve voluntary compliance with fisheries regulations. I am aware that the conference seeks to promote collective problem solving and to strengthen the legislation on the role of traditional authority in decision-making. The conference is an innovation that will contribute to improve upon management measures needed to rebuild fisheries and bring the needed reforms we all seek to achieve.

Second, the conference will address the need for sustainable management of Ghana's other coastal resources such as mangroves, beach sand, salt, lagoons and estuaries among others and the rational management of our oil and gas resources, which have been politically and economically difficult to address. This is in the interest of the long-term health and sustainability of not only the fisheries sector, but the people of Ghana. I am optimistic that this conference will help to mobilize all stakeholders to address this important goal, and give momentum and political will to sustainably manage the fisheries and coastal resources with effects lasting well beyond this conference. In order to improve the health of the fisheries and coastal resources, a number of short and long-term measures need to be put in place. I would like to take this opportunity to urge all the participants, students, scientists, government and civil society groups to work together towards this goal.

Finally, I would like to sincerely thank the United States Agency for International Development (USAID), the Ministry of Fisheries and Aquaculture Development (MoFAD), the Fisheries Commission of Ghana, and the University of Rhode Island, sister universities and research institutions for partnering our University in this important national event. Together we can rebuild the fish stocks and sustainably manage our coastal resources to bring the needed change that we all desire. I wish to also commend the Centre for Coastal Management and the Department of Fisheries and Aquatic Sciences for living up to their mandates, and to all other international and local organizations and

civil society actively engaged in this important effort, I wish you fruitful deliberations.

Prof. Joseph Ghartey Ampiah
Vice-Chancellor
University of Cape Coast
Ghana

Conference Programme - Summary

DAY 1: MONDAY, SEPTEMBER 25, 2017

TIME	ACTIVITY
08:00	Registration
08:30	Opening and Welcome Remarks by Minister for Fisheries and Aquaculture Development; Hon. Elizabeth Naa Afoley Quaye (MP)
08:40	Agenda Overview and Program Objective by the Director, Centre for Coastal Management, Prof. Denis W. Aheto
MORNING SESSION	
08:45	PLENARY SESSION 1 **Chair:** Mr. Kwasi Twum Addo (Ministry of Energy & Petroleum) **Keynote paper/presentation** by Barbara M.E. Andoh (Imani Ghana) **Topic:** Ghana's Oil & Gas Industry: Opportunities and challenges for fisheries and the coastal environment Plenary Panel: Imani Ghana, Tullow Ghana, Fisheries Commission/MoFAD, Institute for Oil and Gas Studies (UCC), Sustainable Fisheries Management Project, Ghana National Canoe Fishermen Council, Friends of the Nation **Moderator:** Prof. Joseph Aggrey-Fynn, University of Cape Coast **Rapporteur:** USAID Monitoring, Evaluation and Technical Support Services (METSS)
09:45	Coffee/tea Break & Poster Exhibition
10:00	SCIENTIFIC PARALLEL SESSION 1 (10+5 mins each) • *Thematic Area 1* ***(AKITA)****: Fisheries Economics and Value Chains. Chair:* Dr. Akwasi Ampofo-Yeboah, DFARM, UDS • *Thematic Area 2* ***(SENDIA)****: Marine and Coastal Environment.* Chair: Dr. Benjamin Kofi Nyarko • *Thematic Area 3* ***(LOWER)****: Child Labour and Trafficking, Illegal, Unreported and Unregulated Fishing Practices.* Chair: Prof. Joseph Aggrey-Fynn, DFAS, UCC • *Thematic Area 4* ***(UPPER)****: Mariculture, Green Businesses, Livelihoods and Poverty Reduction in Coastal Areas. Chair:* Dr. Daniel Adjei-Boateng, DFWM, KNUST
11:30	PLENARY SESSION

	Chair: Prof. Rose Emma Mamaa Entsua-Mensah, FGA – Deputy Director General, CSIR **Keynote paper/presentation** by Dr. Isaac Frempong Mensa-Bonsu, National Development Planning Commission **Topic: Developing Policy for Stakeholders in Coastal Communities** Plenary Panel: NDPC, Coastal Sustainable Landscapes, Centre for Coastal Management, Hen Mpoano, Dr. Nana Ato Arthur, Head of Local Government Service, Mrs. Doris Yawa Garba, Ministry of Gender, Children and Social Protection **Moderator:** Lawyer Ato Arthur (Director, MoFAD) **Rapporteur:** USAID Monitoring, Evaluation and Technical Support Services (METSS)
12:30	SCIENTIFIC PARALLEL SESSION 2 (10+5 mins each) • *Thematic Area 1* ***(AKITA)****: Fisheries Economics and Value Chains.* Chair: Dr. Cynthia A. Adinortey, Department of Molecular Biology and Biotechnology, UCC • *Thematic Area 2* ***(SENDIA)****: Marine and Coastal Environment.* Chair: Prof. Patrick Ofori Danson (Department of Fisheries and Marine Sciences, University of Ghana) • *Thematic Area 3* ***(LOWER)****: Child Labour and Trafficking, Illegal, Unreported and Unregulated Fishing Practices.* Chair: Dr. Emmanuel Acheampong, DFAS, UCC • *Thematic Area 4* ***(UPPER)****: Mariculture, Green Businesses, Livelihoods and Poverty Reduction in Coastal Areas.* Chair: Prof. Edward Obodai, DFAS, UCC
13:35	Lunch Break & Exhibition
AFTERNOON SESSION	
14:35	**Chair:** Mr. Justice O. Odoi (Senior Environmental Advisor, USAID) **Keynote paper/presentation** by Carl Fiati (Head of Natural Resources, Environmental Protection Agency) Topic: Innovations for Coastal Policy Development Plenary Panel: (Coastal Sustainable Landscapes, Centre for Coastal Management, NDPC, Ministry of Energy and Power), Mr. Fredua Agyeman, Ministry of Environment Science, Technology and Innovation **Moderator:** Ms. Malonin Asibi, Ministry of Gender, Children and

	Social Protection **Rapporteur:** USAID Monitoring, Evaluation and Technical Support Services (METSS)
15:50	**Keynote and Panel on Legal and Policy Reforms in the Fisheries Sector** **Chair:** Maurice Knight, Chief of Party, USAID Sustainable Fisheries Management Project **Keynote Presenter:** Mr. Tuinese Edward Amusu - Legal and Policy Changes to Enable Co-Management in Ghana. Moderator: Noble Wadza Panellists: Tuinese Edward Amusu, Kofi Agbogah **Rapporteur:** USAID Monitoring, Evaluation and Technical Support Services (METSS)
16:50	Closing

DAY 2: TUESDAY, SEPTEMBER 26, 2017

TIME	ACTIVITY
08:00	Registration
08:30	Opening and recap of previous day's activities and overview of day's agenda (Dr. Benjamin B. Campion, KNUST)
	MORNING SESSION
08:45	WORKING GROUP SESSION
09:45	**Break-out Working Group 1** **Chair:** Prof. John Blay, University of Cape Coast **Topic: Sustaining Fisheries & Coastal Research and Extension** • Finance**:** mobilizing investment for Fisheries & Coastal Research and Extension • Public private partnerships: enhancing partnerships for Fisheries & Coastal Research and Extension • Approaches for stakeholder and Media engagement: Engaging stakeholders in Fisheries & Coastal Research and Extension • Innovations and technology: developing innovations for Fisheries & Coastal Research and Extension

	Rapporteur: USAID Monitoring, Evaluation and Technical Support Services (METSS)
	Break-out Working Group 2 **Topic: Opportunities and Actions in the Post-Harvest Sector** **Chair/Moderator:** Mr. Samuel Manu/Dr. Margaret Atikpo **Panellists:** • Emelia Abaka-Edu – NAPTA • Benedicta Avega - Healthy Fish Labeling with Ghana Standards Authority • Emmanuel Kwarteng – Ahotor Stoves **Rapporteur:** Hopeson Eli Etsra
	Break-out Working Groups 3 **Chair/Moderator:** Doris Yeboah **Topic: Community-Based Fisheries Management** **Panellists:** • Development Action Association – Densu Oyster Fishery Co-Management - Abraham Asare • Theophilus Boachie-Yiadom - Friends of the Nation – Co-Management in the Pra Estuary • Stephen Kankam - Hen Mpoano – Co-Management in the Ankobra Estuary • Kofi Agbogah - National Perspective on Co-Management Policy **Rapporteur:** Panellist
	Break-out Working Groups 4 **Chair/Moderator:** Ministry of Gender, Children and Social Protection **Topic: Child Labour and Trafficking in Ghana** **Panellists:** • Dickson Adeborna, USAID Sustainable Fisheries Management Project • Joha Braimah, Free The Slaves

	• Cromwell Awadey, International Needs Ghana • Hannah Antwi, Central and Western Region Fishmongers Association (CEWEFIA) **Rapporteur:** Panellist
	Break-out Working Groups 5 **Chair/Moderator:** Mr. Paul Bannerman, Fisheries Commission, Fisheries Survey and Science Division **Topic: Stock Assessment Monitoring** **Panellists** • Emmanuel Dovlo • Paul Bannerman **Rapporteur:** Mary Asare/Samuel Fant Kombian
10: 45	Coffee/tea Break & Poster Exhibition
11:00	Report out from groups: All Group Chair Persons
12:00	Draft of communique: Session Chair Persons, Moderators and Rapporteurs
13:00	Lunch
AFTERNOON SESSION	
14:35	SCIENTIFIC PARALLEL SESSION 3 (10+5 mins each) • *Thematic Area 1* ***(AKITA)****: Fisheries Economics and Value Chains.* Chair: Dr. Nelson W. Agbo (Head, Dept. of Fisheries and Watershed Management, KNUST) • *Thematic Area 2* ***(SENDIA)****: Marine and Coastal Environment.* Chair Prof. John Blay, DFAS, UCC • *Thematic Area 3* ***(LOWER)****: Child Labour and Trafficking, Illegal, Unreported and Unregulated Fishing Practices.* Chair: Dr. George A. Darpaah (CCM, UCC) • *Thematic Area 4* ***(UPPER)****: Mariculture, Green Businesses, Livelihoods and Poverty Reduction in Coastal Areas.* Chair: Prof. Francis Nunoo, Department of Fisheries and Marine Sciences, UG
15:50	

	Launch of Fisheries and Aquaculture Society **Chair:** Prof. Kobina Yankson (Department of Fisheries and Aquatic Sciences, UCC) **Launch by** Prof. Livingstone K. Sam-Amoah (Provost, College of Agriculture and Natural Sciences, UCC)
16:50	Closing

DAY 3: WEDNESDAY, SEPTEMBER 27, 2017

TIME	ACTIVITY	RESPONSIBILITY
08:00	Registration & Arrival of Dignitaries Musical Interlude	
	SESSION 1: CLOSING CEREMONY	
09:30	Welcome Address by Vice-Chancellor, University of Cape Coast	Prof. Joseph Ghartey Ampiah
09:35	Voices of fishermen and fishmongers from the regions	Representatives from Western, Central, Greater Accra and Volta Regions
10:20	Presentation of communique by Director, Centre for Coastal Management (CCM), University of Cape Coast	Prof. Denis W. Aheto
10:30	Address by Hon. Minister of Fisheries and Aquaculture Development	Hon. Elizabeth Naa Afoley Quaye
10:40	Remarks by USAID/Ghana Mission Director	Sharon L. Cromer
10:55	Musical Interlude	Cultural troupe
11:00	Keynote Address by The President of the Republic of Ghana	H.E. Nana Addo Dankwa Akufo-Addo
11:30	Photographs, Exchange of pleasantries, Interaction with journalists	
12:00 – 1:00	Lunch and Departure	

Artisanal fishing vessels at the Elmina landing quay in the Central Region of Ghana. *Source: DFAS, UCC*

THEMATIC AREA A

FISHERIES AND COASTAL GOVERNANCE AND POLICY

Poster

Towards a Sustained Research, Policy and Governance Dialogues on Marine Fisheries and Coastal Management in Ghana

Campion, B. B.[1] and Darpaah, G. A.[2]

[1]*Department of Fisheries and Watershed Management, Kwame Nkrumah University of Science and Technology, Ghana*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: bbcampion.frnr@knust.edu.gh

Ghana has an unsanitary coastal environmental and a fisheries sector plagued with massive overcapacity resulting in excess competition over the limited fish resources and its consequent declining productivity, economic inefficiency, low incomes, poverty and largely impoverished coastal society. Research, policy and governance dialogues on marine fisheries and coastal management are being undertaken to contribute to a turn-around of this dire situation. We draw on the earlier scientific findings and research results of the Years 1 and 2 of the USAID/UCC Fisheries and Environment Capacity Building Support Project. The research phase focused largely on in-depth surveys and reviews of various social issues in the coastal fishing communities of Ghana. The scope is limited to traditional governance or customary social arrangements, local governance and decentralization and collaborative/community rights-based management and their legal dimensions, environment, sanitation, children, gender and tourism issues. The implementation of the outcomes of research works undertaken in Years 1 and 2 focuses on a set of principles and actions to guide activities at the landing beaches, influence policy and policy makers and the various levels in the coastal districts and the regions. The Centre for Coastal Management and its activities are being promoted to sustain the effort. Relevant presentations and submissions on the research results have been made to the National Development and Planning Commission (NDPC) for inclusion in the next Medium-Term Development Plan, 2018-2021, to strengthen existing fisheries and environmental regulations and sustainably regulate their practices nationally. Furthermore, the media has been fully engaged in the dissemination of research results through stakeholder validation sessions, conference and a field-based training session organized for 18 journalists from 14 media houses and organizations. The overall aim of these activities is to bring to the general public, the illegal, unreported and unregulated fishing practices and unsanitary conditions of our coastal environment to help mobilise support to achieve functionality in the existing marine fisheries laws and observance of healthy environmental practices among the coastal communities of Ghana.

Politics of Knowledge Diffusion from China into the Fish Trawling Industry in Ghana

Ansah, W. J.
Department of Sociology and Anthropology, University of Cape Coast, Ghana

jewans2000@yahoo.com

The notion of knowledge diffusion has appeared in much literature within philosophical and theoretical contexts. Knowledge-intensive activities have become fundamental for efficiency and economic performance. This study explored the politics of knowledge diffusion from China into the fish trawling industry of Ghana. The study asked whether or not the knowledge diffusion from China has taken place in the Ghanaian trawling industry. If so, what process did the knowledge taken place and their implications thereof? If not, which conditions have prevented the knowledge diffusion from occurring? What political processes have been deployed to ensure knowledge diffusion from China to Ghana's fish trawling industry? Using interviews to solicit information from key stakeholders in the fishing industry, the study showed clearly that knowledge diffusion from China to Ghana's fish trawling industry has been minimal without clear cut political processes to allow knowledge diffusion from China. The study concludes that the success of host regions in capturing the advantages of knowledge diffusion, expressed through innovation, crucially relies on fundamental and structural characteristics.

Oral

Towards a Community-Based Management Plan for Ankobra River Estuarine Fishery

Asare, C.* and Kankam, S.

Hen Mpoano, 38 J. Cross Cole Street, Windy Ridge Extension, East Tanokrom, Takoradi, Western Region. P. O. Box AX 296 Takoradi, Western Region, Ghana

*****Corresponding author: casare@henmpoano.org

Co-management or collaborative management is a promising means of improving resource conditions, particularly, where centralized fisheries management is a challenge. In collaborative management, authority and responsibility for managing fisheries resources are shared between government and resource users. A pilot community-based fisheries management planning process for the Ankobra River estuary was initiated under the auspices of the USAID-funded Sustainable Fisheries Management Project (SFMP). During this process, rapid rural appraisals were conducted; estuarine fish species were inventoried and prioritized by resource users on the basis of food security importance and commercial value. Subsequently, a management committee, which was constituted, led the identification of fishing grounds and development of management measures such as closed seasons and closed areas for the priority species. The information gathered was used to prepare a community-based fisheries management plan for the Ankobra River estuary. The process used in this pilot project is proving to be a successful and useful approach for managing the fisheries of small systems such as estuaries and lagoons.

A Tragedy of the "Commons", A Reality in Ghana's Marine Fisheries

Lazar, N.[1*] and Blay, J.[2]

[1]* *Coastal Resources, University of Rhode Island, USA*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: nlazar@crc.uri.eduh

Historically, Ghanaians invented and developed, at the local community level, a traditional management system of fisheries, which constituted one of the foundations of their survival and their wealth: the "commons." In some cases, it was necessary to manage the relative scarcity of these resources and to prevent any conflicts that might arise. This management by the "commons" was often based on making fish available for the community while preserving fish for future generations. The emergence of modern fisheries management systems demonstrated clearly that these "commons" have proved to be ineffective in the management and preservation of fisheries as they failed to evolve at the same rate as the rapid population growth. In addition, the reality of interdependencies and globalization made the "commons" no longer sufficient to address problems of overfishing and overcapacity. The Ghana marine fisheries sector currently scores very low globally relative to the status of fish stocks and the fisheries economic returns. This is caused by ineffective fisheries development and management systems, which remain unable to reconcile the values of the traditional practices and modern systems. An example of this is the challenge of implementing the national fisheries management plan (2015-2019). Although the plan provides for access controls over the artisanal fishery, it nevertheless remains under the "commons" system, enjoying open access and uncontrolled harvest rules. The fishing sector is complex and conservation measures are urgently needed but they cannot be based solely on a conventional, scientific or conservational logic (modern style regulation). Its feasibility must be based on and take account of the diversity of practices, socio-cultural factors, ecological diversity and environmental conditions. In short, this reconciliation between traditional and modern practices may be achieved only by building and managing the interface between nature and society based on locally designed and managed infrastructure to increase wealth of these shrinking marine resources.

Poster

Towards Sustainable Exploitation of Penaeid Shrimps in the Ghanaian Gulf: A Review of the Status of the Fishery

Okpei, P.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

mgodsway@gmail.com

Penaeid shrimps are highly priced seafood and support commercially valuable fisheries in many parts of the world, especially, in tropical coastal and warm-temperature waters. The crustacean, known by Ghanaians of the Akan dialect as *"sesew"* and "*son"* by the Ga's, are widely distributed along the coast of Ghana. Species that currently dominate landings include *Penaeus notialis, Penaeus kerathurus, Parapeneopsis atlantica* and *Parapenaeus longistrostris*. They are noted to be household shell-food fish that frequent diets of many Ghanaians along the coast when in season. A cursory review of related literature on the fishery in Ghana, however, reveals a paucity of relevant information for the sustainable management of this important food source. The population structure and dynamics of stocks in the country, reproductive biology, migration and recruitment patterns, exploitation rates of adults by trawl and artisanal fisheries are not well understood and quantified. A stock assessment of the species in the Ghanaian Gulf waters near fishing communities with abundant landings, especially, Tema, Elmina and Sekondi-Takoradi is therefore necessary to inform the sustainable use and management of the resource. The effect of local climate variability, as an environmental stressor on stock size and survival, is a relevant data gap that needs to be addressed. By using fish stock assessment models and software such as FiSAT developed by the Food and Agriculture Organisation (FAO), information for management of the Penaeid shrimps could be ascertained and utilized by government ministries for the formulation of regulations and plans to guide their exploitation.

Oral

Habitat Distribution and Seasonal Abundance of *Sepia hierredda* in Ghana

Sakyi-Djan, P.[1*], Aggrey-Fynn, J.[1] and Lazar, N.[2]

[1]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*
[2]*Coastal Resources Center, University of Rhode Island, USA*

*Corresponding author: psd72500@gmail.com

Habitat distribution and seasonal abundance of fish species are vital study areas for fisheries science mainly because they are important aspects of fisheries management. Cephalopods are a major exploited resource in Ghana's fisheries, representing about 15-20% of the total industrial landings of which cuttlefish (*Sepia* spp.) represents about 80%. In West Africa, Ghana is the number one exporter of cuttlefish to Asian and European markets. This study therefore assessed the distribution of *Sepia hierredda* and *Sepiella ornata*, seasonal abundance of *Sepia hierredda* and the migratory behaviour of the cuttlefish along the entire Ghanaian coast in the Gulf of Guinea. The study covered a period of 10 months, from January 2016 to October 2016. A total of 1,299 individuals of *S. hierredda* consisting of 180 males and 118 females were obtained during the study. *S. hierredda* was observed to have wider distribution along the entire coast of Ghana; whereas, *S. ornata* occupies mostly the central to western coast. Two peak seasons of cuttlefish were identified, January to March being the major and August to December the minor (FSSD catch data). Fisheries management plan must include and ensure that possible spawning areas identified are protected and mesh size and appropriate gear must be checked.

Poster

Industry-Science Collaboration: A Pilot with Collaborative Research for Improved Cuttlefish Management in Ghana

Okyere, I. [1]*, Amarfio, R. N. A.[2], Kankam, S.[3], Aheto, D. W.[1], Sakyi-Djan, P.[1], Takyi, R.[1], and Castro, K. M.[4]

[1]Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana
[2]Ghana Industrial Trawlers' Association, Tema, Ghana
[3]Hen Mpoano, East Tanokrom, Takoradi, Ghana
[4]Department of Fisheries, Animal and Veterinary Sciences, University of Rhode Island, USA

*Corresponding author: iokyere@ucc.edu.gh

New management approaches are being explored to address fisheries issues in Ghana. A collaborative research project was conducted as a proof of concept involving the Ghana Industrial Trawlers Association (GITA) and the Department of Fisheries and Aquatic Sciences (DFAS-UCC). Objectives of the research were to collect important data on the highly valued cuttlefish fisheries resource for management purposes. The research was financially supported by GITA, USAID/UCC Fisheries & Coastal Management Project, and University of Rhode Island through the USAID Sustainable Fisheries Management Project (SFMP), with outreach support from Hen Mpoano, a local NGO. The study specifically focused on understanding cuttlefish movement, and identifying the breeding grounds and breeding periods using a tag recapture and egg collectors. The feasibility of hatching the eggs in the laboratory was also experimented. A total of 95 cuttlefish were tagged between February and September 2017 in the Central Region with the assistance of inshore fishermen. Twelve egg collectors were monitored weekly for spawning, and underwater cameras were used to observe behavior. From this study, the breeding grounds have been mapped and occur between the 20m and 30m depth contours and, the eggs successfully hatched in the laboratory. There was considerable outreach with the fishermen and they have shown interests and willingness in taking ownership of the project and the results. Although only 2 out of the 95 cuttlefish tagged recaptured, the significant discussion and engagement between all the sectors was very positive. We conclude that participation of fishers in research and management would be enhanced through extensive engagement, and collaboration between science and industry would be a useful approach to addressing the declining stocks.

THEMATIC AREA B

FISHERIES ECONOMICS AND VALUE CHAINS

Dried fish ready for market.
Credit: Fredrick Jonah

Oral

Microbial Safety and Polycyclic Aromatic Hydrocarbon (PAHs) Analysis of Fish from Selected Areas of Central and Western Regions of Ghana

Aheto, D. W.[1], Adinortey, C. A. [2*], Essumang3, D. K. [3] and Adjei, J. K. [4]

[1]*Centre for Coastal Management, University of Cape Coast, Ghana*
[2]*Department of Molecular Biology and Biotechnology, University of Cape Coast, Ghana*
[3]*Department of Chemistry, University of Cape Coast, Ghana*

*Corresponding author: cadinortey@ucc.edu.gh

A microbial analysis on smoked, salted, and fresh fish and a chemical analysis of smoked fish from selected Ghanaian markets were undertaken to assess their contamination levels. Findings from the study suggest that bacteria, moulds, and yeasts isolated from smoked fish were either heat-resistant or resulted from contamination through handling after the smoking process. Salted fish on the contrary was relatively dry with a limited water activity. Hence, microorganisms isolated from salted fish were either halophiles or were introduced during the handling processes. Coliforms were detected in all fish samples collected. *Enterococcus* sp., *Bacillus cereus, Staphylococcus aureus* and *Clostridium perfringens* were detected but their levels were below tolerable limits. *Listeria monocytogenes, Salmonella* spp. and *Vibrio* sp. were not detected in any of the fish sampled. Except naphthalene, which was not detected, the concentrations of all other 15 PAHs in all smoked fish sampled in this study exceeded the maximum acceptable limit set by the European Commission. For instance, the sum total of the concentrations of PAHs in smoked sardines recorded in this work was higher than reported in literature. The results suggest that certain types of smoked fish on the market are unwholesome for human consumption. The elevated levels could be attributed factors including type of fish, firewood, stove used in smoking, the quality of the water body and many more. Hence, the relatively high load of microorganisms in fish, including bacteria, moulds and yeasts and the high PAHs levels recorded in smoked, salted and fresh fish, point to a serious public health threat and highlight the urgent need to intensify education on hygienic and best processing practices of fish in Ghana.

Effect of Different Fuelwoods on the Colour of Smoked Chub Mackerel (*Scomber japonicus*) – A Case Study in Chorkor, Accra, Ghana

Akuamoah-Boateng, A., Adjei-Boateng, D*and Edziyie, R. E.

Department of Fisheries and Watershed Management, Kwame Nkrumah University of Science & Technology, Ghana

*Corresponding author: daboateng.frnr@knust.edu.gh

The effectiveness of different fuelwood in producing the colour of smoked chub mackerel (*Scomber japonicus*) preferred by consumers was evaluated at Chokor, a fishing community in Accra, Ghana. Two different approaches were used: (1) experimental and (2) survey of mackerel processors. In the experimental set-up, fresh chub mackerel was smoked for 2-5 hours with five different types of fuelwood to ascertain their effect on the colour of the smoked fish, while estimating the cost effectiveness of the fuelwoods used. Additionally, data was collected on the smoking of chub mackerel at selected fish processing units to assess the performance of types of fuelwood used. Four fuelwood types were identified namely mangrove (*Rhizophora* sp), Essa (*Celtis zenkeri*), Emire (*Terminalia ivorensis*) Ceiba (*Ceiba pentandra*) and Wawa (*Triplochiton sceleroxylon).* The results showed that mangrove, Essa and Emire are the most preferred fuelwood due to their ability to impart the preferred golden to dark brown colours to the smoked fish. Wawa is least preferred because it imparts a light brown colour to the smoked fish. Mangrove was found to be the most cost-efficient fuelwood with an efficiency of 3.5%.

Oral

Occurrence and Feeding Ecology of the Bagrid Catfish *Chrysichthys nigrodigitatus* in the Pra River Estuary, Ghana

Okyere, I. and Boahemaa-Kobil, E. E.*

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: boahemaakobileunice@gmail.com

One economically important group of fish that utilize estuarine ecosystems are species of the genus *Chrysichthys* in the family Claroteidae. As a contributory research to an ongoing management planning process for fisheries of the River Pra Estuary in Ghana, this study assessed how salinity, dissolved oxygen, and turbidity influenced occurrence of the bagrid catfish, *Chrysichthys nigrodigitatus*, population in the estuary, the food habits of the species, and how food preferences vary amongst the sizes. Fish were sampled from January to April 2017 using a cast net and physicochemical parameters were measured in situ using multiparametric water quality checker. Lengths and weights of fish were determined and stomach contents examined with the aid of dissecting microscope. Salinity showed a general downward trend with the highest of 30 ppt in January and lowest of 1 ppt in April, while turbidity increased progressively from 8 NTU in January to 207 NTU in April. The number of fish caught seemed to decrease as turbidity increased. A total of 282 specimens measuring 8.0 cm to 42.5 cm (TL) were sampled of which fish smaller than 17cm were dominant. The catfish fed on detritus, insects, polychaetes, oligochaetes, bivalves, amphipods, shrimps, crabs and fish, with detrital matter being the most consumed food item. The abundance of a potential food item is a key factor that determines what a fish feeds on. Of a serious concern is the fact that most of these preys inhabit the bottom of water bodies and continuous use of dragnets in the estuary could deplete the populations of these preys and deprive the catfish of their food source. Recommendations are made for management considerations that address illegal mining activities, which silt the estuary, fishing practices that capture juveniles, and fishing practices that could deplete the prey of the catfish.

Impact of Fish Cage Culture on Food Habit of *Chrysichthys* Species in the Volta Lake (Stratum II)

Ameworwor, M. Y.[1]*, Asmah, R.[2], Ofori-Danson, P. K.[3] and Clottey, M. N. K.[1]

[1]*Department of Fisheries &Aquatic Sciences, University of Cape Coast, Ghana,*
[2]*Water Research Institute, Council for Scientific and Industrial Research, P.O. Box M 32, Accra, Ghana*
[3]*Department of Marine & Fisheries Sciences, University of Ghana, P. O. Box LG 99, Legon, Ghana*

*Corresponding author: mameworwor@gmail.com

Stomach content of *Chrysichthys* species were analyzed using the frequency of occurrence method over an eight (8) month period from August 2013 to March 2014 to assess how fish farming in cages on the Volta Lake at Kpeve-Tornu (Stratum II) impacts on the food sources of *Chrysichthys* species, which is one of the dominant species, found in the lake. Fish samples were collected from an area of the lake where there was active cage culture and an area of the lake where there was no fish farming going on as the control site. Seventy-nine stomachs of fishes of standard length range of 12.3 – 36.0 cm were analyzed. The dominant food items identified were *chironomid* larvae and detritus; occurring in 27.3% and 36.4% of stomachs with food items at the cage site and 63.9% and 52.8% at the control site respectively. Plant parts also occurred in 36.4% of the stomachs with food items at the cage site. *Lampsilis* species, a freshwater mussel occurred only in stomachs from the control site in 41.7% of the stomachs with food items. As promising as fish cage culture is to the aquaculture sector in Ghana in supplementing production from capture fisheries, it must be done on a controlled scale if local stocks in the Volta lake are to be protected.

Oral

Chemical Composition and Sensory Analysis of Processed and Fresh Skipjack Tuna (*Katsuwonus pelamis*) in Tema, Greater Accra Region

Kettey-Tagoe, B.,* Alhassan, E. H. and Ampofo-Yeboah, A.

Department of Fisheries & Aquatic Resources Management, University for Development Studies, P. O. Box TL 1882, Tamale, Ghana

*Corresponding author: benjaminketteytagoe5@gmail.com

Skipjack tuna (*Katsuwonus pelamis*) is a highly rated fish species in Ghana and the world at large. Here, the chemical composition and sensory analysis of processed skipjack tuna (*Katsuwonus pelamis*) in Tema in the Greater Accra region, Ghana were studied. Standard methods (AOAC, 1995) were used including oven-drying for moisture, incineration method for ash and micro-Kjeldahl method for crude protein. Sensory evaluation was conducted with 20 trained Panellists using a simplified form for attributes such as colour, odour, flavour, texture and overall acceptance. There were highly significant differences for moisture and crude protein (P = 0.002) and (P = 0.001) respectively, with sample A (very dry smoked skipjack tuna), sample B (dry smoked skipjack tuna), sample C (moist smoked skipjack tuna) and sample D (fresh skipjack tuna) (as control) representing 49.79 Â± 1.732%, 60.22 Â± 1.803%, 59.32 Â± 0.011% and 68.65 Â± 0.161% respectively for moisture and 90.83 Â± 1.095%, 73.32 Â± 1.095%, 88.15 Â± 1.191% and 91.72 Â± 0.191% but no significant difference in ash content (P = 0.733) with sample A, B, C and D representing 0.535 Â± 0.427%, 0.632 Â± 0.151%, 0.930 Â± 0.000% and 0.563 Â± 0.299% respectively. Sensory evaluation was ranked in order of which attribute was preferred by a large number of people and resulted in the fish sample type among sample A, B and C in colour, odour, flavour, texture, and overall acceptability with sample A having the highest rating in all the sensory parameters.

Microbial Quality on Sea Bream (Sparidae: *Pagrus* Spp.) From Two Local Markets in the Kumasi Metropolis, Ghana

Ampofo-Yeboah, A.*, Yakubu, A., Akongyuure, D. N., Atindana, S. A. and Alhassan, E. H.

Department of Fisheries and Aquatic Resources Management, University for Development Studies, Nyankpala Campus, Box TL1882, Tamale, Ghana

*Corresponding author: ampoyeb@yahoo.com; aampofo@uds.edu.gh

This study examined the bacterial load on the fish parts of Sea Bream popularly known in Kumasi as "red fish or wewe". Thirty fresh samples of fish were collected from 5 sites namely Borlaho, Bode, Edwan Aborosan, in the Kumasi Central Market, Asafo 1 and Asafo 2, located in Asafo market in the Kumasi metropolis, between February 2017 and April 2017. Samples were collected thrice and the gills, skin and flesh were checked for microbial presence. Total coliform, faecal coliform, *Escherichia coli* and *Salmonella* spp were the bacteria enumerated. *Salmonella* spp. were found to be absent on all the samples. *Escherichia coli* count was present in all on all samples collected. Total and faecal coliform had higher counts in all the sites 7.9 x 10^6 cfu/100 ml and 4.9 x10^5 cfu/100 ml respectively, which is attributed to poor sanitary conditions around the market and among the fish handlers. The skin had the highest count of bacteria followed by the gills and the flesh. Generally, the counts at all the sites were above the standards making it unsafe for consumption in the fresh state. Sanitary conditions at where the fish were sold were woefully inadequate. Fish sellers should be educated on proper handling techniques to ensure the sale of high quality fish within the markets, as well as sanitation at the selling points.

Oral

Value Chain Analysis of Croakers (*Pseudotolithus* species) in Ghanaian Fishery

Ntim, L.* Blay, J. and Aheto, D. W.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: lesley.ntim@ucc.edu.gh

The croakers, commonly called cassava fish, constitute an abundant and commercially important fish in Ghana and West Africa. The species are commercially important throughout the Atlantic coast of West Africa. They are economically important fisheries and serve as an important source of protein especially in the Central and Western Regions of Ghana. The work aims at assessing the entire value and supply chain of the croakers, taking into consideration relationships at all stages of production, processing, trading to consumption of fish product as well as the roles of service providers such as input dealers and credit givers. A value chain analysis of the species will be undertaken to describe the full range of activities that occur within the fisheries subsector and how the actors work together to bring the fish from harvest to its end user and beyond. This includes activities such as gathering of inputs, production, marketing, distribution, and support to the final consumer. The study will help to scan and describe the strengths and weaknesses of the subsector in qualitative terms. The croaker fishery value chain will reveal where low-cost advantages or disadvantages exist from fish products to customer service activities. The value chain analysis of the species will therefore help to identify gaps needed to be plugged to add value to enhance the supply chain linkage. The economic value at each stage of the chain would be identified and a comparative analysis made between the cost and profit margins. It is expected that, relevant information on the catch contribution, the various forms of processing and the economic value of the species along the supply chain would have been established, a market map developed, and information on the roles played by the various institutions in the cassava fish trade in the Central and Western Regions of Ghana would have been generated.

Determinants of Decline in Sardinella Fishing Industry in Ghana: Bioeconomic Analysis Approach

Danquah, A. J.[1*] and Aheto, D. W.[2]

[1]*Department of Geography and Regional Planning, University of Cape Coast, Ghana*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: abrefad@gmail.com, jones.danquah@ucc.edu.gh

Sardinellas (*Sardinella maderensis* & *Sardinella aurita*) fishery is a major economic activity in the country. However, over the years there have been consistent decline in landings of sardinellas in the country. The study seeks to empirically determine factors that have contributed to low landings of sardinellas in the country. This study employed times series data and a simple vector autoregressive error correction model and granger causality test to evaluate the causal direction of climatic and biological variables on landings. The results indicated that erratic rainfall pattern, rising ocean temperature and overcapacity in the industry, particularly, in artisanal fishing sector have unidirectional causality on the declined landings of sardinellas. Improvements in, and the enforcement of existing laws and policies targeting both industrial and artisanal Sardinella fishery will rejuvenate the industry.

Oral

Sociolinguistic Study of Tilapia Names among the Ewe of Ghana

Aziaku, V. E.[1*] and Akyea, M. F. G. [2]

Department of Ghanaian Languages and Linguistics, University of Cape Coast, Ghana

*Corresponding author: awoonorerskine@gmail.com

"What's the use of their having names,' the Gnat said, 'if they won't answer to them?' 'No use to them,' said Alice; 'but it's useful to the people who name them, I suppose. If not, why do things have names at all?" Lewis Caroll, Through the Looking Glass. The motivation behind this present study is the quote above that suggests that most organisms, including animals, are named but they do not respond to their names as humans do. Modern methods of rearing tilapia in recent years and the importation of same have contributed to the increase in the consumption of tilapia in Ghana as a whole and in particular among the Ewe. However, it seems that consumers of tilapia are only conversant with the generic name of the fish and are less interested in particularising the different species with their names. This paper seeks to investigate the essence of animal names with particular reference to tilapia to the Ewe of Ghana. The research questions that are germane to the study are the following: Is the composition of the names of tilapia derived from their physical characteristics? What is the linguistic structure of the names? What knowledge does the Ewe have about the names of tilapia and how does their knowledge influence the production, preservation, marketing and consumption of the fish? The paper adopts qualitative design in data collection and analysis. The paper establishes that the idiosyncrasies and general physical features of the fish have relevance in their names. Analysis also reveals that the names are both free and bound morphemes and that, the geographic location, vocation, gender and age dynamics affect knowledge of the names of tilapia. This, in some way, influences the production, preservation, marketing and consumption of the fish. The paper concludes that even though some organisms may not respond to their names, the various names of tilapia are significant to the Ewe.

Economics of Dynamic Investments in Marine Inshore Pelagic Fisheries: The Case of Ghana

Agbesi, N. E.

P.O. Box CO. 4214, C1, Tema, Ghana

Corresponding author: enagbesi@yahoo.co.uk

The economics of investments in the inshore fisheries, with particular reference to the purse seine fisheries of Ghana is essential to provide a framework for fisheries policy formulation and better management of the sector. The time lag between decisions to invest in fishing assets and the profit generated was diagnostically assessed. Economic information of the fisheries was gathered from a survey conducted for the inshore purse seine fisheries of Ghana as main instrument for generating socio-economic data. The survey was designed to provide sufficient information for the development of a bio-economic model as well as to provide an overview of the current socio-economic status of the fishery. The fishing effort of the fishing fleet, assumed to be related to the harvesting capacity of the boat, known as the vessel capacity unit (VCU) – (m^2/kW)), based on the size of the vessel and engine horsepower type, was determined. The vessel capacity units in the purse seine fishery ranged from 26-292 (m^2/kW) with an overall average VCU of 136 (m^2/kW). The estimated revenue of ¢202 million (1997) dropped to ¢178 million (1998). The economic profit was estimated to be ¢112.9 million in 1997 and this dropped to ¢100 million in 1998. In all analyses, there was declining trends in financial and economic profit over the study period. Hence, the unemployment in non-fishing sectors, the 'surplus' labour and lack of non-fishing employment in the fishing communities contributed to asymmetry in the entry and exit in fishing activities and, thus, the Ghanaian inshore purse seine pelagic fishery was economically overexploited.

Oral

Ergonomic and Physical Occupational Injury Hazards among Frozen Marine Fish Workers in Ghana: A Case of Asafo Market in Kumasi, Ghana

Yankson, I. K.[1*], Aheto, D. W.[2] and Nyarko, A. B.[3]

[1]*Council for Scientific and Industrial Research - Building and Road Research Institute (CSIR-BRRI), Ghana*
[2]*Centre for Coastal Management, University of Cape Coast, Ghana*
[3]*Kumasi Metropolitan Directorate, Ghana Health Service*

*Corresponding author: kofi.yankson@gmail.com

Frozen food processing workers face hazards due to physical factors, chemicals, biological agents, ergonomic stressors, allergens, complex network of safety risks and different psychosocial factors. This observational cross-sectional study assessed ergonomic and physical occupational hazards predisposing workers of marine frozen fish products to injuries using a checklist. Workers of frozen fish operators were observed while working during the forenoon, between 7.00am and 10.00am. Two out of four large-scale operators and one medium-scale operator of frozen fish products were observed. Ergonomic hazards identified were repetitive movements of the upper limbs, manual handling of heavy loads, wrong working body posture, wrong posture of wrists and prolonged standing. These hazards often lead to work-related musculoskeletal disorders (WMSDs) which are common health problems and major cause of disability in the workplace. Lower back pain, shoulder and neck pains are consequences of WMSDs. The Physical hazard observed was cold and humid environment. Consequences of this exposure include repeated back pain, muscular pain, discomfort, shivering, itching after cold exposure, entire body cold, aggravated asthma, respiratory wheezing, cough, excessive sputum, runny nose, darkening of fingers, reddening of fingers, finger pain, toe pain, urticarial, face pain, chest pain, blurry vision, headache, paleness of fingers, chest pain, arrhythmia and hypothermia. Some cold room workers were observed smoking cigarettes, consuming alcohol and stimulants. Personal protective equipment (PPEs) like jackets, safety boots, gloves and goggles used by some cold room workers were substandard and inappropriate. In conclusion, ergonomic and physical hazards were identified in the study area are proven threats to workers' health. Health and safety training for employers and employees, with focus on working conditions, workers' health, anti-smoking, alcohol consumption campaigns and standard PPE use are recommended. Employers should take steps to monitor their employees' health, particularly, back and muscle pain, respiratory symptoms, episodic finger symptoms and cardiovascular symptoms.

Poster

Towards Ensuring Greater Sustainability and Social Equity in Ghana's Fisheries Sector

Rougier, A.[1], Kuusaana, P.[1], Mundy, V.[1] and Agbogah, K.[2]

[1]*Environmental Justice Foundation, Ghana Office, P.O. Box DL148, Cape Coast, Ghana*
[2]*Hen Mpoano, 38 J. Cross Cole Street, Takoradi, Ghana*

*Corresponding author: antoine.rougier@ejfoundation.org

Ghana's fisheries sector is key to its national economy, accounting for 4.5% of GDP and main livelihoods for about 2.4 million people. Overexploitation and poor management of the sector has led to high levels of illegal, unreported and unregulated (IUU) fishing. In support of reforms in the fisheries sector, the European Union is funding a project aiming at ensuring greater environmental sustainability and social equity in Ghana's fishery. This project coordinated by Environmental Justice Foundation and implemented in partnership with Hen Mpoano, started in 2017, for duration on 36 months, and targets the coastal communities of the Central Region as well as the communities involved in the clam fisheries in the Volta estuary. Using a participatory approach with communities, the project is guided by the United Nation Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security. The project is organised around three main objectives: i. to ensure more sustainable fishing practices through IUU fishing better prevented, monitored and reported, ii. to allow small-scale fishers, to be better empowered to articulate their interests in fisheries tenure rights reforms, and to secure and effectively implement fisheries co-management, iii. to identify and open options of alternative livelihood to small-scale fishing communities. To achieve these objectives, the Environmental Justice Foundation and Hen Mpoano are implementing a range of activities, from sensitization and direct engagement with communities on IUU fishing and fisheries management activities, to the formulation of targeted research works to inform policy reforms or to the production of video and radio contents to raise awareness on the coastal population and the public in Ghana on the threats the fishery sector faces.

Oral

An Assessment of Histamine Concentration in Tuna Fishes in the Ghanaian Market: A Case Study of Frozen and Smoked Tuna in Tema and Accra, Ghana

Osei, H. A., Campion, B. B.*, and Obirikorang, K. A.

Department of Fisheries and Watershed Management, Kwame Nkrumah University of Science and Technology

*Corresponding author: bbcampion@gmail.com

Tuna contains high level of free histidine in its muscles as compared to other species and therefore a higher risk that toxic levels of histamine can be formed, especially, under ambient temperature and mishandling during processing. This study therefore sought to contribute to knowledge on food quality on the Ghanaian markets by assessing histamine concentrations in frozen and smoked tuna at some selected markets in Accra, Ghana. Histamine concentration was determined in thirty samples each for frozen and smoked tuna. All fish samples contained histamine. The histamine concentration was between 11.54 and 67.42 ppm for the frozen samples whilst that in smoked samples was between 12.39 and 158.54 ppm. Twelve and fourteen smoked tuna samples from Makola and Kaneshie markets exceeded the EU permissible limit of 100ppm. A Mann-Whitney Rank Sum Test established a statistically significant difference in histamine concentrations of frozen and smoked tuna samples. On the other hand, there were no differences in histamine concentrations in smoked tunas from the different markets studied. Also, no relationship was found between the source of the product and histamine concentration. Freezing of tuna is therefore a better storage option than smoking. Delay in the start of smoking or slow smoking process may have increased histamine levels. The study recommends that tuna fish smokers consider smoking methods that are faster to reduce the histamine formation and accumulation during the thawing and smoking.

Seaweeds float ashore a sandy beach in Ghana. *Source: DFAS, UCC*

THEMATIC AREA C

MARINE AND COASTAL ENVIRONMENT

Oral

Implications of the Deteriorating Quality of River Pra Estuarine Waters for Ghana's Dwindling Marine Fish Stocks

Okyere, I.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

iokyere@ucc.edu.gh

Ghana is facing an incessant decline in its marine fish stocks over the last two decades. Efforts to manage the dwindling fishery have focused mainly on curbing overcapacity, overexploitation and inappropriate fishing methods with little attention to the blatant degradation of the country's coastal lagoons and estuaries that serve as breeding and nursery habitats for successful recruitment into the marine fishery. To emphasize the need for consideration of these coastal ecosystems in fisheries management plans, this study assessed the quality of the waters of an estuary highly silted from illegal surface and alluvial mining activities, River Pra Estuary; the second largest estuary in Ghana. Temperature, turbidity, salinity, conductivity, dissolved oxygen, pH, nitrate and phosphate concentrations were monitored for 23 months (February 2012 - December 2013), covering wet and dry seasons. Results showed that turbidity, dissolved oxygen, nitrates and phosphates were the main parameters threatening the quality of the Pra Estuary. High turbidities around 1000 ppm known to have detrimental effects on estuarine organisms were persistently recorded at the riverine reaches of the estuary while dissolved oxygen concentrations were below 5 mg/l; the threshold for survival of aquatic life in running waters. Although nitrates and phosphates were far beyond the optimum levels of 1.0 mg/l and 0.1 mg/l respectively required for primary productivity in estuaries, the high turbidity hampers light penetration, which consequently limits primary productivity in the estuary. Implications of how the degraded estuarine environment could be obstructing successful recruitment into the dwindling marine fishery has been discussed, and the appropriate recommendations made for management considerations.

Role of Sediment Transport in Organic Matter Dynamics of the Kakum River Estuarine System, Ghana

Asante, F.* and Asare, N. K.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: frederickasante34@gmail.com

Nutrients are a major prerequisite for primary productivity in the aquatic environment and are derived primarily from the decomposition of organic matter. Sediment transport as a factor in the conveyance, distribution and diagenesis of particulate matter in coastal aquatic ecosystems are well established and documented. This study investigates aspects of sediment transport in relation to the dynamics of allochthonous and autochthonous particulate organic matter (POM) within the Kakum River Estuary and its adjoining mangrove system in the Central Region of Ghana. Vertically fluxing sediments were sampled using simple sediment traps, whilst substrate sediments were obtained using a bottom grab and a sediment corer for POM and granulometric analyses as well as estimating the rates of sediment transport. From the results, there were observable spatial and temporal variations in sedimentation rates and percentage organic matter composition in both trapped and substrate sediments. The rate of sedimentation was highest close to the mouth of the estuary with a mean value of 573.6 ± 84.9 g m^{-2} d^{-1} and a corresponding lowest organic matter constituent. The organic matter load in the substrate sediment was generally lower than that of the trapped sediment whilst reducing from the upstream region toward the mouth of the estuarine system. The findings of the study suggest that remineralization of partially consolidated POM in the substrate by microbial assemblages could be attributed to the disparity between trapped and substrate sediment concentrations.

Oral

Coastline Dynamics: Implication for Environmental Sustenance and Biodiversity Conservation in the Songor Ramsar Site and UNESCO Biosphere Reserve, Ada, Ghana

Agyeman, D. Y.

Songor Ramsar site and Biosphere Reserve, P.O Box 73, Ada-Foah, Ghana

yaw652006@yahoo.com

Songor Ramsar site and UNESCO Biosphere Reserve has over 40 km sandy shoreline that is very significant as a nesting habitat for three of the globally endangered sea turtles. The site is however, buffeted by storm surges and has undergone noticeable ecosystem changes. The habitat change is a major challenge for turtle nesting processes, community sanitation and other environmental activities. To evaluate the ecosystem changes and the impact on nesting turtles, two methods were used: (1) monthly beach erosion, accretion and other environmental data were obtained along demarcated shoreline, and (b) monitoring trends and distribution of turtle species and nesting activities within the site. Analyses of the effectiveness of conservation measures were undertaken. Results indicate that storms surges have resulted in profound beach erosion. Beach dynamics were sporadic and mostly aggravated by storms. Beach recession has altered the natural turtle nesting sites. Erosion rates between of 6.8 and 7.2 meters was recorded between April and July, whiles between August and November the highest average accretion between 2.3 and 3.5 meters was recorded. Areas of high beach erosion were associated with the formation of high cliffs. Cliff heights been 0.30 and 210 cm was recorded. Turtle species and nesting activities varied within and between demarcated zones. Over seventy percentage (70%) of nesting activities occurred between 3 and 15 meters above highest tidal mark with shoreline cliff normally lower than 25 and 45 cm. Over 80% of nesting activities were concentrated along darkened, relatively clean shorelines with natural fine textured sand deposits. Waves and predators destroyed 15% of turtle nests sighted. The current trend calls for renewed and intense conservation efforts, which must be balanced by an integrated ecosystem management regime.

Environmental and Socio-economic Threats of Salt Production on Fisheries: A Case Study at the Songhor Lagoon, Dangme East District

Nego, D. P.*, Alhassan, E. H. and Akongyuure, D. N.

Department of Fisheries and Aquatic Resources Management, University for Development Studies, P. O. Box TL 1882, Tamale, Ghana

*Corresponding author e-mail: priscynego@gmail.com

The study was carried out to identify the environmental and socio-economic threats of salt production on fisheries. This was done to provide suggestions for improving salt mining methods to minimize these threats and maintain a sustainable, sound ecosystem at the Songhor lagoon in the Dangme East District of Ghana. Key informants and personal observations were employed in gathering first-hand information and the administering of questionnaires to both fishermen and salt miners. Four salt mining sites along the eastern side of the lagoon were selected in the study area and the predominant extraction process, which was solar evaporation, identified. The current state of fisheries and salt production was assessed and compared with previous situations to determine whether there were threats to fish. Water quality parameters from the lagoon were also measured. A market analysis was done to check income levels from both salt producers and fishers to compare their profitability and determine whether each activity justified the environmental cost. From the study, it was deduced that some activities associated with salt production such as the siphoning of water and the use of chemicals posed threats to fish species and other aquatic organisms and the lagoon in general, as a Ramsar site and biosphere reserve. The Songhor Lagoon hosts valuable mangrove species, migratory birds and fish species. Some of the environmental threats to fish identified were increased salinity levels and increased siltation, which led to fish mortality and reduced growth. It also impaired fish passage, which distorted the normal functioning of the lagoon ecosystem. Some of the socio-economic threats identified were the reduced length of the fishing season, which reduced fish catch and adversely affected their income levels, thereby affecting their livelihoods. The government through mandated bodies should therefore develop frameworks aimed at improving salt mining activities through legislation, issuance of licenses and sensitization programmes to minimize these threats on fish and the lagoon in general.

Poster

Recent Brackish Water Ostracoda and Foraminifera of Ghana: First Results from Densu Estuary

Frenzel, P.[1*], Johannes Biehler, J.[1], Mauro Alivernini, M.[1] and Akita, L.G.[2]

[1]*Institute of Geosciences, University of Jena, Germany*
[2]*Institute of Marine and Fisheries Sciences, University of Ghana*

*Corresponding author: peter.frenzel@uni-jena.de

The Ostracoda and Foraminifera are two classical microfossil groups used in geosciences for palaeoenvironmental reconstructions and water quality monitoring. A new survey seeks to document the diversity, map the recent distribution and to collect ecological data of Ostracoda and Foraminifera in Ghanaian coastal waters. Data from Densu Estuary is so far available. The outer estuarine part of the Densu shows, for both, groups a higher diversity than areas with lower salinity. Polyhaline sites yield many marine ostracods such as *Cytherella* spp., *Mutilus* sp., Bairdiacea, *Paracytheridea luandensis* (Hartmann, 1974) and marine brackish taxa such as *Loxoconcha* spp. The mesohaline sites are almost exclusively populated by high numbers of the euryhaline ostracod *Cyprideis nigeriensis* (Omatsola, 1970). Most abundant foraminifers are miliolids, including *Quinqueloculina* spp. and *Triloculina* spp., or *Cribroelphidium gunteri* (Cole, 1931) and *Ammonia tepida* (Cushman, 1926). However, other *Ammonia* species and the genera *Textularia* and *Neorotalia* were also found. So far, *Ammotium salsum* (Cushman & Brönnimann, 1948) is the only foraminifer species, which was found in mesohaline waters. The brackish foraminifer fauna is composed of cosmopolitan species commonly found in either South or North African coasts. However, the Ostracoda differ remarkably in the species inventory although it is similar to North African faunas. We present a first faunistic overview on meiobenthos (Ostracoda and Foraminifera) from Densu estuary, one of the largest brackish waters ecosystems of Ghana. A future faunistic and ecological synopsis of Ostracoda and Foraminifera of Ghanaian brackish waters, West Africa, is intended to contribute to the national and international biodiversity database.

Hydrodynamic Influence on the Utilization of a Tropical Estuarine System by Fish Fauna

Sam, N. C*. and Asare, N. K.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana.

*Corresponding author: samnanachristiana@gmail.com

Coastal water bodies are known to provide many ecological roles including the provision of feeding and nursery grounds for many fish species of both ecological and economic values and facilitate the recruitment of marine fish stocks. The occurrence of such fish fauna mostly of marine origin in estuaries and their fringing mangrove systems is subject to prevailing hydrodynamic and physicochemical conditions. This study investigated the occurrence and distribution of fish fauna in relation to spatial and temporal dynamics of hydrographic conditions in the Kakum River Estuary, Ghana. Sampling was conducted between February and March of 2017 during alternating low and high tides. A total of 709 fish specimens belonging to 22 species and 15 families were encountered during the study period. The most abundant species encountered was the banded lampeye, *Aplocheilichthys spilauchen*, a benthopelagic brackishwater species with a percentage composition of 64.5%. *Mugil bananensis, Liza dumerilii and Liza gradisquamis* were the least, accounting for 0.1% each. Seventeen of the species sampled representing 77% were of marine in origin. All measured hydrographic factors (except tidal water levels and turbidity) exhibited temporal variations but no significant spatial variations over the study period. Size class analysis and gonadal development assessment of the commonest fish species suggested that the populations of fish fauna found utilizing the estuarine system were predominantly juveniles. There was no statistically significant relationship between the various hydrographic factors and the density of the dominant species, *Aplocheilichthys spilauchen.* Temperature was however found to significantly influence the size class distribution of the fish. From the study, the importance of estuarine systems, especially, the Kakum River Estuary as nursery and feeding grounds for fishes of ecological and commercial importance was established.

Oral

The Impact of Temperature, Salinity and Genetic Factors on Marine Pelagic Fish Production: The Case of Ghana

Agbesi, N. E.[1] and Asare, A.T.[2*]

[1]*P.O. Box CO.4214, C1, Tema, Ghana.*
[2]*Department of Molecular Biology and Biotechnology, University of Cape Coast, Ghana.*

*Corresponding author: aasare@ucc.edu.gh

Genotypes relate to the environment that impact on marine fish and its abundance or distribution. An organism could only adapt to environmental conditions within the range established by its genetic makeup at inception. It is only through a restructuring of the genotypes by mutation, recombination, and selection that adaptation to a different range of environmental variability could be achieved. The objective of the study was to assess the impact of variations in temperature, salinity and genetic factors on marine pelagic fish production. The data used for the analysis were obtained from the Marine Fisheries Research Division (MFRD), Tema. Mean monthly and annual data on sea surface salinity, temperature and pelagic fish landings from the marine waters of Ghana covering the periods 1972 to 1997 were used. Monthly data were transformed into quarterly and seasonal data (July, August and September). Deviations in mean monthly and annual sea surface temperature, salinity and pelagic landings in Ghana were observed. Sea surface temperatures were lower than the overall mean in the seasonal data, when fish was actually abundant. Salinity and fish landings were higher than the overall mean. The remaining months showed the inverse relationship, suggesting a genetic link to the phenomenon since relatively high salinity might favour the development of otolith. On the whole, pelagic fish behaviour in spawning and feeding in July, August and September may favour critical temperature (26 ^{o}C) and salinity (35.4 pp) requirement associated with interactive genotypes.

Biokinetics and Tissue Distribution of Cadmium in the Bivalve *Anadara senilis* via Sweater Exposure

Kuranchie-Mensah, H.[1,2*], Osae, D. S.[1,2], Teyssié, J.-L.[3], Oberhaënsli, F.[3], Metian, M.[3], Warnau, M.[3] and Serfor-Armah, Y.[1]

[1]*School of Nuclear and Allied Sciences, College of Basic and Applied Sciences, University of Ghana*
[2]*Ghana Atomic Energy Commission, P. O. Box LG 80, Legon-Accra, Ghana*
[3]*IAEA, Environment Laboratories, 4a Quai Antoine Ier, MC-98000, Principality of Monaco, Monaco*

*Corresponding author: hettymens2004@yahoo.com

The bloody cockle (*Anadara senilis*) provides substantial source of protein to coastal populace where they dominant within the shoreline of West Africa. Besides being a major food source in Ghana, these coastal organisms are continually being exposed to anthropogenic contaminants that threaten both environmental health and seafood safety. In order to understand the bioaccumulation potential of this species to environmental toxicants, cockles sampled from the Narkwa lagoon in the Central Region of Ghana were exposed to environmentally realistic concentrations of radio cadmium for 28 days under laboratory conditions. Despite a low uptake rate constant of 1.42 per day, the retention of cadmium in the cockle was very strong with a biological half-life of 1190 days. The soft tissue and soluble fraction was the main binding pools with regards to tissue specificity and subcellular distribution in the cockle. The high cadmium retention indicates that the cockle could preserve the metal for a long time and can therefore be used as a suitable candidate for ecotoxicological studies in Ghana.

Oral

Potentially Toxic and Harmful Phytoplankton Species along the Coast of Ghana

Denutsui, D.[1, 2*], Marina, C.[3], Adotey, K. D.[1, 2] and Serfor-Armah, Y. [1, 2]

[1]*School of Nuclear and Allied Sciences, University of Ghana, Atomic, Ghana*
[2]*National Nuclear Research Institute, Ghana Atomic Energy Commission, Kwabenya, Ghana*
[3]*Intitute of National Oceanography and Experimental Geophysics, Trieste, Italy*

*Corresponding author: dzifaden@yahoo.com

Algal toxins may accumulate in fish and shellfish and consequently cause poisoning in consumers of seafood. These toxins and the algae producing them are regularly monitored in many countries in Europe, the Americas, and in Japan. However, very little is known with regards the occurrence of such algae and their toxins in most African countries. The first reported incidence of harmful algal blooms (HABs) occurred in 1993 and the risk of future toxic blooms prompted the study of harmful and potentially toxic blooms, since Ghanaians generally depend on coastal fisheries. This study assesses the distribution of harmful phytoplankton along the coast of Ghana. The monitoring study so far has identified eleven harmful species which are mostly *thecate* dinoflagellates with five of these species (*Lingulodinium polyedra*, *Gonyaulax spinifera, Dinophysis caudata*, *Dinophysis fortii, Alexandrium* spp*)* being toxin producers with the potential to cause diarrhetic shellfish poisoning, paralytic shellfish poisoning, azaspiracid poisoning and yessotoxin-like poisoning symptoms. Species showed a great variation both in size and in form. Densities of species also varied with seasons (rainy and dry). Critical densities of *Lingulodinium polyedra* were recorded in December 2016 and January 2017. Observations have also revealed possible presence of *Alexandrium* spp., one of the most toxic genera among the HABs species. This indicates that our shores are possibly prone to harmful algal blooms.

Effects of Industrial Waste Effluents on the Quality of Sakumo II Lagoon in Accra, Ghana

Agbemehia, K.* and Fei-Baffoe, B.

Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

*Corresponding author: prayingken@yahoo.com

The aim of this study was to establish the current pollution status of the Sakumo II Lagoon, as well as investigate the impact of effluent discharge from industrial activities on the quality of water in the lagoon. Social survey was also conducted to assess people's awareness and knowledge on the lagoon and importance of the wetland. Water samples were collected from three sections (viz upstream, midstream and downstream based on direction of water flow of the Sakumo ll Lagoon for both wet and dry seasons. Effluents from three industries (Coca Cola Bottling Company-producers of soft drinks, Kasapreko- producers of alcoholic beverages and Printex Company Limited-producers of wax prints) was monitored for temperature, pH, dissolved oxygen (DO), biological oxygen demand (BOD), total suspended solids (TSS), total dissolved solids (TDS), turbidity, electrical conductivity, NO_3-N, PO_4-P, NO-N and NH_4-N. Results obtained were compared with the Environmental Protection Agency (EPA)-Ghana Sector Specific Effluent Guidelines for Discharges, 2002 and mean values from similar studies on the Lagoon. A one-way ANOVA indicated that the pH and turbidity of the lagoon water were the parameters significantly affected ($p=0.005$ and $p=0.0013$) by pollution in both wet and dry seasons. However, TSS (112.1 mg/l), TDS (371.2 mg/l) and conductivity (741.1 µS/cm) were not affected by the effluent discharge as mean values were statistically similar ($p>0.05$). The results of the study showed that the concentrations of nitrate, ammonia, conductivity, TSS and TDS were generally higher in the lagoon and effluent samples analyzed an indication that the water quality of the lagoon has been badly affected by anthropogenic activities.

Oral

Fishermen's Perceptions and Adaptations to Climate Change: A Case of Saltpond, Ghana

Akaba, S.* and Mbroh, I.

Department of Agricultural Economics and Extension, University of Cape Coast, Ghana

*Corresponding author: sakaba@ucc.edu.gh

Climate change has become a global environmental threat to all sectors of most economies. Ghana is one of the worst affected countries due to its high exposure to extreme climate events and low adaptive capacity, especially along the coasts. Adaptation to climate change at the community level is of crucial importance in enabling fishermen to respond to direct and indirect effects of changes in climate. It is in line of this that the study assessed the awareness, perceptions, impacts and responses to climate change and the relationship between respondents' socioeconomic background and perceived impact of climate change among the fishermen in Saltpond. A sample size of 108 was taken from Nankesedo and Ankaful landing beaches. Using structured interview schedule to obtain data, both descriptive and inferential statistics were used. The findings reveal that majority of the respondents were in their youthful age with low level of education and large household sizes, who are either married or in consensual relationships. About 4 out of every 5 fishermen got to know about climate change through personal experience though less than half could explain it. Most fishermen indicated that several aspects of their fishing enterprises have been affected by climate change and they are using myriads of strategies to cope with it. Some of these strategies are inimical to coastal biodiversity and environment sustainability. There were statistically significant relationships between climate change impacts and age, education, years of fishing and mode of fishing. These findings suggest the need for greater investment by the sector ministry and departments in fisheries education on acceptable and innovative responses to increase resilience to shocks and challenges.

Poster

Assessment of the Ecological Health of the Kakum and Pra Estuaries' Mangrove Forests in Ghana

Dali, G. L. A. [1, 2*], Aheto, D. W[2]. and Blay, J.[2]

[1]*Department of Environmental Science, University of Cape Coast, Ghana*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: gadali@ucc.edu.gh

Effective conservation and management of mangrove habitats requires detailed baseline assessment of their biodiversity, functions or services they provide, environment within which they occur, their interactions and prevailing threats. This study assesses the health of the Kakum River and Pra River estuaries' mangrove forests of Ghana to generate comprehensive data needed for the sustainable management of these mangrove ecosystems. Land use and mangrove cover will be determined using satellite images and field measurements via Unmanned Aerial Vehicles (UAVs) and Global Positioning System (GPS). Data on rainfall and temperature for the past three decades (1997-2017) will be obtained from the Meteorological Agency, for time-series analysis. Four sampling stations (each of area 2,500 m²) were selected within each of the two mangrove forests, constituting a total sampling area of 1 ha (10,000 m²) within each study area. Composition, frequency, density and relative abundance of woody plant species will be determined while animal species will be observed and recorded within each plot. Tree diameter and height will be measured for the estimation of the mangrove biomass, using allometric equations, while species diversity of each mangrove forest will also be calculated. Samples of sediments will be taken with an Ekman grab and analysed for pH, salinity, nutrients - carbon (C), nitrogen (N), phosphorus (P) and potassium (K); heavy metals mercury (Hg), arsenic (As), cadmium (Cd), lead (Pb) and zinc (Zn); and presence of macro invertebrates. Litter production will be measured with sixty 50 cm x 50 cm litter traps made of nylon mesh and wood, at both study sites. Physico-chemical parameters of estuarine water will also be assessed along the banks using water quality checker. Social Survey will be done with the help of questionnaire and interview schedule. At the end of this research, a strong scientific database required for the effective and sustainable management of the mangrove ecosystems will be provided.

Oral

Application of Unmanned Aerial Vehicle (UAV) in Monitoring the Keta Sea Defence Structures in Ghana

Jayson-Quashigah, P. N.[1*], Appeaning Addo, K.[1], Wiafe, G.[1, 4], Rovere, A.[2, 3], Casella, E.[2] and Mann, T.[2]

[1]*Department of Marine and Fisheries Sciences, University of Ghana.*
[2]*Leibniz Center for Marine Tropical Research (ZMT), Bremen, Germany.*
[3]*Center for Marine Environmental Sciences (MARUM), University of Bremen, Germany.*
[4]*ECOWAS Coastal and Marine Resource Management Centre, University of Ghana.*

*Corresponding author: pjayson-quashigah@st.ug.edu.gh

Coastal erosion dominates the shoreline of Ghana with the eastern coast reporting some of the highest rates of erosion. Increased coastal erosion in Keta along the eastern coast resulted in the Keta Sea Defence Project (KSDP), which used both hard (groynes and revetment) and soft (nourishment) engineering measures. Although the groynes appear to have trapped sediments that are building the beach and the revetment is preventing the shoreline from moving further inland, there is no effective monitoring system to quantify their impact. Conventional monitoring approaches such as manned aerial photography, satellite imagery and field based methods continue to present significant challenges. However, Unmanned Aerial Vehicles (UAVs) present a better alternative in terms of cost, revisit time and spatial resolution. This study is used UAV to monitor sediment dynamics around the groynes in Keta and quantify the changes overtime. Preliminary results from May 2015 to date reveal significant lateral and topographic changes of over 3m in sections of the beach system. Although the observed changes could be cyclical, they have the potential to influence the beach system in the long term.

Poster

Distribution and Eco-Toxicological Effects of PAHs in Selected Coastal Lagoons in Ghana

Duker, R. Q.*, Asare, N. K. and Obodai, E. A.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding email address: lylex.rq@gmail.com

The coastline of Ghana, which forms part of the Gulf of Guinea, is characterised by about 90 lagoons. Due to development of communities around most of these coastal waters and the associated poor waste management in these areas, these waters have become a reservoir for most domestic and municipal waste, industrial effluents and oils leading to polycyclic aromatic hydrocarbons (PAHs) contamination of the coastal environment. Many PAHs are of concern, as they are carcinogenic. Due to their high hydrophobicity, PAHs when introduced into aquatic environments tend to adsorb unto sediments or organisms such as fish. *Sarotherodon melanotheron*, one of the main sources of protein diet for the communities surrounding these lagoons, will be the species of interest. This project seeks to assess the levels of PAHs in coastal lagoons, using fish biota and determine the efficacy of activated charcoal (AC) in sediment remediation under laboratory conditions. Soxhlet extraction and gas chromatograph will be used to extract and analyse PAHs. Acute and chronic toxicity test will also be used to estimate the efficacy and toxicity level of PAH polluted sediment treated with or without AC. Although AC has advantageous effects, researchers have shown that AC in itself can have negative effects on aquatic organisms. Therefore, this work will also assess how much of AC input is ecologically nontoxic. Also, the carcinogenic human health risk in consuming *S. melanotheron* will be assessed.

Oral

Assessing Shoreline Change in the Volta Estuary Using Remote Sensing Approach

Brempong, E .K.*, Jayson-Quashigah, P. N. and Appeaning Addo, K.

Department of Marine and Fisheries Sciences, University of Ghana

*Corresponding author: brempong5@gmail.com

Estuarine shorelines are highly dynamic and facilitate coastal erosion and flooding in vulnerable areas. The situation is expected to get worse with increasing sea level rise as a result of climate change and anthropogenic activities such as construction of dams upstream. This study assessed shoreline change along the Volta estuary in Ghana using satellite imageries, orthophotos and topographic maps spanning a period of 120 years (1895, 1990, 2000, 2005 and 2015). Using the linear regression method in the Digital Shoreline Analysis System (DSAS), the shoreline migration trends and rates of change were estimated for the eastern and western sides of the Volta estuary both on the river banks and on the coastline. The results show that the eastern and western banks of the river are eroding at an average rate of about 1.94 m/yr and 0.58 m/yr respectively. The coastline is eroding faster at an average rate of about 2.19 m/yr and 0.62 m/yr respectively. The study has revealed that erosion is higher at the eastern side of the Volta estuary compared to the western side. This can be partly explained by the reduction in sediment supply to the eastern coast due to the damming of the Volta River and more recently, sea defence efforts on the western side, which further reduce sediment supply to the east. The trend is likely to continue under rising sea levels. Sustainable management strategies such as soft engineering should therefore be adopted to reduce their impacts.

Using Participatory GIS Approaches for Resource Conservation and Management: Case of the Greater Amanzule Wetland

Mensah, J. C.*, Nortey, D. D. N. and Kankam, S.

Hen Mpoano, (Our Coast), Takoradi, Ghana

*Corresponding author: jmensah@henmpoano.org

Participatory GIS has been identified as one of the effective ways of mapping wetland resources and their related threats, especially, in developing countries like Ghana where high resolution multispectral imagery for local scale mapping and planning is limited. Under the auspices of the USAID-funded Coastal Sustainable Landscapes Project (CSLP), this study explored the use of participatory GIS as a tool for community participation in the conservation, planning and management of mangrove ecosystems associated with the Greater Amanzule Wetland landscape. Participatory mapping was conducted with Community Conservation Committees (CCC) in 14 communities; maps were validated through ground truthing involving wetland resources users who had been trained in the use of GPS. Orthophotos used during the participatory mapping were processed through visual interpretation. Out of a total of 688.75 hectares of mangroves mapped, it was revealed that 160 hectares have been degraded through natural processes and human activities. Mapping products generated for each of the communities aided in communication and identification of specific management actions such as mangrove restoration and ecosystem-based enterprises development. Self-selected members of the communities, including mangrove harvesters, voluntarily established mangrove nurseries and initiated field restoration activities resulting in 21.30 hectares of degraded mangrove areas restored. The participatory approach used in this study is proving to be a successful and cost- effective approach to wetland conservation and management planning in the absence of local scale high resolution imagery.

Oral

Reinforcing What We Know About Beach Evolution: Lessons from Ten Years of Beach Monitoring in Ghana

Jonah, F. E.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

fredrick.jonah@ucc.edu.gh

Coastal erosion continues to be one of the most important issues affecting the heritage, infrastructure, and livelihoods of coastal communities in Ghana. Several recent studies have indicated that human activities, especially those that affect the sediment budgets of the coast, exacerbate the natural evolution of the coast, causing pronounced erosion along most stretches of Ghana's coast. This study, which forms part of a larger study of coastal erosion and related issues within the Central Region of Ghana, uses ordinary photographs taken annually to detail the evolution of four adjoining beaches in Cape Coast from January 2008 to July 2017. The analysis of these photographs provide important insights into how poor coastal planning may eventually affect coastal communities, requiring some form of management intervention. The study also provides additional insights into the medium-term impacts of beach sand mining on former mining sites and adjoining areas where such activities may never have been carried out.

Poster

Coastal Zone Management in Ghana. Assessing the Aesthetic Potential of the Cape Coast Metropolis

Kwao, A.

alexkn2003@yahoo.com

In appreciating the distinguishing features and beauty of the ocean, the phenomenal thinking is how the natural endowments and coastal zone management could create wealth and also serve as sites for attraction. This knowledge in this context is ascribed as aesthetic potential. Conceptualizing this as significant environmental concerns for the country, the metropolis and communities along the coast, this paper sets tone to address: coastal zone management in Ghana, thus, assessing the aesthetic potential of the Cape Coast Metropolis. Precisely, the paper examines the cultural idiosyncrasies and the practices of coastal management in the context of natural and artificial creations that provide diversity and the integration of stakeholders' activities. The paper adopts phenomenology as paradigm to examine the various dimensions and engagements using the qualitative methodology. The purposive technique was used to select the following participants for the study: 5 Environmental Protection Agency officials, 5 members of the Cape Coast Metro Assembly, 5 traditional authorities, 5 chief fishermen, 10 workers of the hospitality industry and 5 coastal management experts. Interview was the main instrument. Verification and validation strategies were used as a form of triangulation. Data was analysed using the discursive method based on themes and data sets. The realization of the study is that, little attention is given to the natural beauty of the coast. Similarly, the cultural activities failed to create adequate spaces and favourable environment for wealth creation. It is recommended that, policy makers and opinion leaders redefine the cultural contexts and innovational practices to boost coastal zone management in the Cape Coast Metropolis.

Poster

Sediment-Water Nutrient Dynamics and Biogeochemical Models in Selected Coastal Ecosystems in Ghana.

Jonah, F. E.*, Asare, N. K. and Acheampong, E.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: fredrick.jonah@ucc.edu.gh

Tracking the dynamics of nutrients in coastal wetlands is an important tool in determining the health of coastal ecosystems. However, such studies are either largely non-existent in Ghana or fail to provide the level of detail required to help managers in land-use and coastal management decision-making. The overall goal of this study is to assess the spatio-temporal distribution of benthic nutrients and fluxes at the sediment-water interface (SWI) and to study the accumulation and transformation processes of nutrients at the SWI, and determine the impact of fluvial and overland inputs on nutrients in estuaries and lagoons. The study focuses on the dynamics N-, P- and Si-based nutrients within the Sumina lagoon (in the Central Region) and Ankobra River Estuary (in the Western Region). Using an in situ experimental setup that simulates both day and night conditions, water samples are collected on hourly basis over an eight hours for laboratory nutrient analysis. In addition, stable isotope techniques will be used to provide additional detail about the sources of nutrients to the study ecosystem. This information is especially required as Ghana attempts to improve the management of coastal ecosystems and rebuild its marine fisheries.

Poster

Impact of Climate Change on Local Livelihoods: A Case Study of Ankobra Estuarine Communities

Amoakoh, A. O.[1*], Kankam, S.[1] and Acheampong, E.[2]

[1] *Hɛn Mpoano (Our Coast), Takoradi,*
[2]*Faculty of Silviculture and Forest Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

*Corresponding author: lexizamoako@yahoo.com/aamoakoh@henmpoano.org

Coastal ecosystems, particularly, estuaries and intertidal environments are important sources of food and livelihood security for the growing coastal population. However, estuarine- dependent livelihoods are increasingly threatened by climate change and unsustainable human exploitation of estuarine resources. This study assessed the impact of climate change and variability on livelihoods, including vulnerability and existing adaptive capacities to climate change and variability in five communities on the Ankobra Estuary. The communities are Sanwoma, Adelekezo, Eshiam, Eziome and Kukuaveli. Different methods namely documentary search, structured questionnaire interviews, field observations and focus group discussions were used to collect the data. Findings from the study shows that Ankobra estuarine communities are experiencing the impact of climate change and variability through factors such as variability in rainfall patterns and amount, increased incidences of flooding, saltwater intrusion into estuaries and freshwater aquifers. The extent of vulnerability to the impact of climate change and variability and adaptive capacity vary from one community to another and depends on livelihood assets. Communities have multiple adaptation strategies including building of temporal housing structures, growing of drought tolerant crops, timing of fishing activities, cultivation of wetlands among others. These adaptation strategies could lead to long-term sustainability if enhanced and promoted.

Poster

Review of Existing Marine Protected Areas (MPA) Around the Globe towards the Establishment of Ghana's MPAs.

Jonah, A.*, Aheto, D. W. and Okyere, I.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: jonahalberta@gmail.com

Establishment of Marine Protected Areas (MPAs) in critical areas of Ghana's coastal and marine zones is one of the tools for sustainably managing the declining fisheries resources. The Government of Ghana, supported by various stakeholders, has adopted a 5-year national marine fisheries management plan, in which the establishment of MPAs in Ghana is enshrined. This is supported by other activities including the development of a roadmap to guide MPA establishment in Ghana, Regional and institutional stakeholder consultation for sensitization, MPA objectives setting and MPA site identification. The role of academia in this process cannot be overlooked. Progressive research is required to understand the dynamics of the MPA concept. MPAs have been established in various parts of the world with relatively few success stories. It is in the interest of policy makers and implementers of the MPA strategy to note the conditions for success or failure of MPAs in coastal communities. A review and discussion on cases of MPAs across the world, with the conditions for success achieved and failures encountered, as well as a critique on the efforts made within the country towards MPA establishment, is the focus of this presentation. To achieve this, desktop, secondary data collection method will be employed to review literature on cases obtained from books, web search engines, reports and news. Recommendations for Ghana's MPAs establishment and management will be outlined. This will largely support the comprehensive discussions and considerations in the establishment and management of MPAs in Ghana for the sustainability of the fisheries sector.

FishCoMGhana: An online database on coastal environments and aquatic living resources of Ghana

Acheampong, E.

Department of Fisheries and Aquatic Sciences, University of Cape Coast.

emmanuel.acheampong@ucc.edu.gh

Ultimately, sustainable fisheries development depends on timely access to accurate data on the status of exploited organisms, their environments and the trends that underpin their utilisation. Hence, academic institutions and agencies engaged in research are important nodes of fisheries development. They generate data to feed the development of new policies and understanding to improve the work of fisheries managers, fishing businesses and citizens whose livelihoods depends on fisheries and other aquatic living resources. Yet in many instances, these data is scattered in the repositories of different national institutions (e.g., universities and scientific survey divisions of government ministries) and international agencies such the Food and Agriculture Organisation of the United Nations, or hidden behind the paywall of international journals. FishCoMGhana (**Fish**eries and **Co**astal **M**anagement of **Ghana**) is an online data archiving and management infrastructure that addresses this problem. It provides a common point of reference for historical data, new field observations and experimental results (both published and unpublished) on inland, marine and coastal resources of Ghana. In the past, having access to such a range of information required different libraries of reference works because no single resource contained all these data. Therefore, the use of FishCoMGhana would enhance Ghana's capacity to effectively integrate long-term observations on her aquatic habitats and resources for sustainable development. FishCoMGhana accepts data from all stakeholders, subjects the data to quality assurance controls consistent with international standards, acknowledges the intellectual property of authors, and provides the data free of charge to all stakeholders at www.fishcomghana.com. It is recommended as a reliable source of information on Ghana's fisheries resources and their supporting ecosystems.

Poster

Assessment of the Ecological Conditions of the Ankrobra Estuary and its Implications for Livelihoods

Effah, E.* and Aheto, D. W.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana
*Corresponding author: elizabeth.effah@ucc.edu.gh

Coastal estuaries are among some of the most productive ecosystems in the world and occupy 13 percent of coastal areas worldwide. They serve as important nursery, feeding and breeding areas for both native and migratory species. These ecosystems have limited renewable resources that are essential for socio-economic development and environmental sustainability. However, they are highly stressed by anthropogenic activities including fisheries, which have led to their deterioration and posed a lot of threat to livelihoods. The sustainable use of these resources requires a combination of surface water assessment programmes, decision making and management tools that are supported by ongoing monitoring and the availability of high quality data. Most developing countries are facing challenges in establishing effective water quality assessment programmes. To address these challenge, deployment of real time data, low-cost, rapid and reliable field sampling tools and technologies, data sharing and management institutions need to be established. The Ankobra estuary in the Western Region of Ghana has diverse and abundant flora and fish fauna. The abundant food resources and protection provided by estuarine shoals make this region an ideal nursery ground for several commercially important fish species and a source of livelihood for the inhabitants of the communities around it. However, illegal mining and other anthropogenic activities going on around the area pose a lot of threat to the ecosystem and the people in general. Through this research, the ecosystem health of the Ankobra estuary will be determined by assessing the level of pollution in the water and fish diversity. The study will also determine the users of the resources in the estuary and recommend appropriate management measures for their sustainable use.

Water and Sediment Quality of Densu Estuary Using Multiple Ecological Indicators

Akita, L.G.[1*], Mahu, E.[1], Akrong, M.O.[2], Alivernini, M.[3],Frenzel, P.J.[3], Banu, R.A.[2], Klubi, E.[1] and Laudien, J.[4]

[1] Department of Fisheries and Marine Science, University of Ghana
[2]Council for Scientific and Industrial Research, Water Research Institute, Ghana
[3]Institute for Geosciences,University of Jena, Burgweg 11, 07749 Jena, Germany
[4]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research. Am AltenHafen 26, 27568 Bremerhaven, Germany

*Corresponding author: lailah.akita@gmail.com

The knowledge of ecological integrity of estuaries along the coast of Ghana is still scarce. This study was carried out to ascertain the influence of environmental parameters on the water and sediment quality of the Densu estuary using standard methods. Water and sediment samples collected from ten stations in April 2017, were analysed for Zn, Pb, Cd, Hg, percentage organic carbon (OC), total nitrogen (TN) and total phosphorus (TP), nutrients, chlorophyll a, microbial and among many. The results shows temperature range from 30.74 to 34.1^{o}C; electrical conductivity, 35.8 to 52.6 mS/cm, salinity, 22.8 to 34.7 ppt; DO, 6.44 to 18.8 mg/l; total suspended solids, 21.9 to 21.6 g/l; alkalinity, 3.2 to 3.9; sulphate, 15 to 37 mg/l; nitrate: 1.7 to 7.5 mg/l; phosphate, 0.05 to 1.10 mg/l, chlorophyll a, 0.96 to 4.38 µg/l. The water quality index (WQI) for Densu estuary range from 359.5 to 484.4, suggesting unsuitable for drinking. The range of sediment quality parameters were: % C, 0.76 to 2.05, % TN, 0.06 to 0.015; % C:N, 12.31 to 34.81; % TP, 0.44 to 1.38. The range of metals concentrations in the sediment (dry weight) were: Zn, 7.3 to 158.3 mg/kg; Pb, 1.9 to 84.7 mg/kg; Hg, 0.01 to 0.05 mg/kg and Cd was below detection limit. The estuary showed no contamination with respect to Hg ($CF \leq 1$), moderate to considerable contamination with respect to Pb ($2 \leq CF \leq 5$) and moderate contamination with respect to Zn ($1 \leq CF \leq 2$). The potential ecological risk index of each metal was less than 40, indicating low potential ecological risk. The presence of total coliform bacteria (*E. coli* and *Enterococcus* sp.) in water and sediment suggest faecal contamination, which can cause health risks to the ecosystems and human water users. This study provides an integrated assessment of environmental quality of Densu estuary, useful for its management.

Oral

Spatial and temporal distribution of macrophytes in the Tano River and Abbey Lagoon

Afagachie, J. A.[1*], Campion, B. B. [1], Obirikorang, K. A.[1], Gaisie-Essilfie, F. A.[2] and Mensah, Y. M.[3]

[1]*Department of Fisheries and Watershed Management, KNUST, Ghana*
[2]*Energy Centre, KNUST, Ghana*
[3]*Department of Chemical Engineering, KNUST, Ghana*

*Corresponding author: joseafa2000@yahoo.com

This research seeks to contribute to knowledge on the potential use of water hyacinth (*Eichhornia crassipes*) as a second generation of biofuels in Ghana by assessing the spatial and temporal distribution of the water hyacinth and the physicochemical parameters affecting its growth and distribution. The study was conducted on the Abbey Lagoon and the Tano River of the Jomoro District in Western Region of Ghana. A longitudinal survey was conducted monthly from September, 2016 to August, 2017 to assess the spatial and temporal distribution of the macrophyte. Waypoints were marked along the edges of the vegetation in the Tano River and the Abbey Lagoon at a stretch of about 20.181 and 23.428 kilometers respectively using a GPS. Dissolved oxygen, salinity, pH, temperature, total dissolved solids and conductivity were measured in situ using the Hanna multiparameter probe. The results showed that the macrophyte cover varied spatially and temporally, especially, in the Tano River but it is not a yearly phenomenon. The levels of pH and dissolved oxygen in the River and Lagoon, were not significantly different from each other (0.1335, 0.4528) at P=0.05. However, Salinity, temperature, total dissolved solids and conductivity varied significantly between the River and the Lagoon ($P< 0.0001$) at P=0.05. Using September as a baseline for the estimation of vegetation cover, there was an estimated growth of 3.10, 3.55 and 6.57m for the months of October, November and January respectively but December, April and August showed decreasing macrophyte cover of 0.67, 2.17 and 2.05m respectively. However, February and June did not show observable change in macrophytes cover. The there is sufficient water hyacinth biomass to be used for biofuels. However, the varying natural environmental conditions lead to variations in biomass which will threaten the sustainability of an established factory. It is therefore recommended that the water hyacinth be cultivated where the environment conditions can be controlled.

Poster

Assessment and Characterization of the Lobster (Palinuridea) Fishery in Ghana

Fynn-Korsah, S.*, Aggrey-Fynn, J. and Okyere, I

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: sfynn-korsah@ucc.edu.gh

The royal spiny lobster is a tropical species found in the eastern Atlantic from approximately 28° N and 15° S between Morocco and Angola (including the Cape Verde Islands), as well as in the western Mediterranean. Despite the importance of this species in the lobster fishery in West Africa, little or no data exist on the species in some countries where it is exploited for economic purposes. In Ghana where the species are fished on commercial bases, only catch data exist with no biological assessment of the stocks. This study therefore, seeks to assess the stocks of the spiny lobster in Ghana and characterize the lobster fishery for the purpose of effective management. The growth and mortality parameters and some biological reference points (MSY, fMSY, FMSY, Fmax) will be estimated. In addition, the reproductive biology of the species as well as the socio-economic importance of the fishery will be ascertained.

Poster

Death of Whales on the Shores of Ghana: A Pathophysiological Evaluation

Asante, D[1*], Sam C. N.[2] and Arizi, E. K. [2]

[1]*Department of Forensic Sciences, University of Cape Coast, Ghana*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: duasante@ucc.edu.gh

Whales' reactions to offshore anthropogenic activities have been extensively studied worldwide from the ecological point of view and short-term behavioural responses to underwater noise caused by ships, naval activities and seismic explorations. This may result in ecological change, behavioural modification, physiological imbalance that cumulatively, may cause stranding and eventually death of certain species. This study therefore assessed the ecology and pathophysiological conditions of dead whales on the coasts of Ghana. Data of sixteen 16 whale stranding from 2007-2013 were analysed. Necropsy and histopathological analysis were carried out for 5 of them. Sites of stranding were also documented. From observed results, the western coast of Ghana significantly had higher (70%) whale stranding as compared to other areas (Central (10%) and Greater Accra (5%). Some carcass (14) were considered code 5 (advanced decomposition) and therefore too autolyzed for necropsy while others (2) were less decomposed. Common pathological lesions such as congestion, intracranial haemorrhage, cranial and caudal bone fractures and emphysematous lung lobules were documented. Histologically, no oil, inflammation and neoplastic lesions detected in the organs. Gas bubbles were microscopically detected within many vessels or tissues, but it was not possible to determine if these were due to putrefaction or some other process. It was concluded that the initial aetiological agent, which initiates cascade of events, is the seismic sound, and that, bioacoustics activities in deep waters or offshore must be critically monitored and managed within tolerable limits to prevent stranding of these endangered magnificent creatures.

Mapping Potential Fishing Zones in Support of Inshore Fisheries Management in Ghana

Debrah, E. A.[1]*, Wiafe, G.[2], Agyekum, K. A.[2] and Denis Aheto[1, 3]

[1]*Department of Fisheries and Aquatic Sciences, University of Cape Coast Cape Coast, Ghana*
[2]*ECOWAS Coastal and Marine Resource Management Centre, University of Ghana Legon, Ghana*
[3]*Centre for Coastal Management, CCM, University of Cape Coast Cape Coast, Ghana*

*Corresponding author email: akushika@ymail.com

Catches obtained from a semi-industrial fishing vessel were investigated to ascertain fishing activities of these vessels at sea in an effort to define mechanisms for Monitoring Control and Surveillance of the inshore fleet. The vessels were fitted with Class-B transponders and monitored over a period of six months, from August, 2015 to January, 2016. The satellite automatic identification system (Sat-AIS), data of the vessels during their fishing expeditions provided important information on location of the catches. During the study, 4,278 specimens comprising 10 species, and 7 families were captured. The most abundant were shrimps (Penaiedae) and the least abundant was *Rhinobatos rhinobatos* (Rhinobatidae). The monthly mean weights of the species varied from 10kg to 80kg. The highest catch per unit effort (CPUE) and chlorophyll-a (CHL-a) concentration was recorded in October 2015 and the highest monthly species composition was recorded in November 2015. The species encountered showed highly significant relationship between their total length and body weight and were also generally in good conditions as they made adequate use of food resources available. Additionally, satellite data on sea surface temperature (SST), sea surface height (SSH), sea surface salinity (SSS) and chlorophyll-a concentration were analyzed to determine potential fishing zones off the coast of Ghana. It was observed that high catches corresponded with areas of SST, 18.5 – 29.5 ^{o}C; CHL-a, 0.3 – 1.2 mgm$^{3;}$ SSH, 1.88 - 2.15 m; and SSS, 32.5 - 35 psu The study showed that the trawling vessel showed a progressive behavior of steaming/speeding throughout the study period. The trawling vessel also fished within a depth of 30-100m of the Inshore Exclusive Zone of the central portions off the coastal waters of Ghana which it is required by law. However, an expedition was undertaken with a trawling gear which contravenes the Fisheries Act, 2002.The study provides for the first time in Ghana, information on the typical fishing activities of the semi-industrial fishing fleet, areas where surveillance should be increased and thus, a mechanism for carrying out monitoring, control and Surveillance as a tool for fisheries management.

Oral

Risk Profiling of the Volta Delta, Ghana

Nyarko, B. K.[1*], Appeaning Addo, K.[2], Amisigo, B.[3], Jayson-Quashigah, P.[2], Martey, F.[4], Franceshini, G.[5] and Hill, C.[6]

[1]*Dept. of Geog. University of Cape Coast , Cape Coast, Ghana*
[2]*Dept. of Marine and Fisheries Sciences, University of Ghana, Ghana*
[3]*Water Research Institute, CSIR, Accra*
[4]*Ghana Meteorological Agency, Accra, Ghana*
[5]*FAO, Rome. Italy*
[6]*University of Southampton, Sothampton, UK*

*Corresponding author email: bnyarko@ucc.edu.gh

The Volta Delta has attracted attention at national and international level due to its level of vulnerability to climate change and occurrence of disasters. Focusing and identifying the risk areas is important for policy and a humanitarian point of view, but not sufficient for reducing their tragic consequences to people, economies and the environment. Therefore developing a risk profile of the Volta Delta is an essential task for effective and long-term disaster-risk reduction. The theory underpinning this study is the concept of Modern Portfolio Theory which attempts to maximize expected portfolio returns for a given amount of portfolio risk (or equivalently to minimize risk for a given level of expected return) by carefully choosing the proportions of various asset classes in the portfolio. The Cox proportional hazards regression model was used as the model for the risk profile. The optimal level of environmental risk for activities in the Volta Delta was found considering the risk required, risk capacity and risk tolerance. Using the multihazard and other ancillary data, a risk profile was developed for the Volta Delta. The result indicates that risks are distributed across the Delta. However, areas that have government interventions, such as sea defence system and irrigation facilities have less threat. In addition, wealthy areas do effectively reduce the threat of any form of disaster.

Assessment of Settling Fluxes and Ecotoxicological Risks of Fine Sedimentary Metals in Tema Harbour (Ghana)

Benjamin O. Botwe [1,2*], Elvis Nyarko [2], Piet N.L. Lens [1]

[1] *UNESCO-IHE, PO Box 3015, 2601 DA Delft, the Netherlands*
[2] *Department of Marine and Fisheries Sciences, University of Ghana, PO Box LG 99, Legon, Accra, Ghana*

*Corresponding author email: bbotwe@ug.edu.gh; boseibotwe@yahoo.co.uk

The Volta Delta has attracted attention at national and international level due to its level of vulnerability to climate change and occurrence of disasters. Focusing and identifying the risk areas is important for policy and a humanitarian point of view, but not sufficient for reducing their tragic consequences to people, economies and the environment. Therefore developing a risk profile of the Volta Delta is an essential task for effective and long-term disaster-risk reduction. The theory underpinning this study is the concept of Modern Portfolio Theory which attempts to maximize expected portfolio returns for a given amount of portfolio risk (or equivalently to minimize risk for a given level of expected return) by carefully choosing the proportions of various asset classes in the portfolio. The Cox proportional hazards regression model was used as the model for the risk profile. The optimal level of environmental risk for activities in the Volta Delta was found considering the risk required, risk capacity and risk tolerance. Using the multihazard and other ancillary data, a risk profile was developed for the Volta Delta. The result indicates that risks are distributed across the Delta. However, areas that have government interventions, such as sea defence system and irrigation facilities have less threat. In addition, wealthy areas do effectively reduce the threat of any form of disaster.

Researcher investigates mesh size of illegal monofilament net by improvising with a pen cover. *Credit: Ernest Obeng Chuku*

THEMATIC AREA D
CHILD LABOUR AND TRAFFICKING, ILLEGAL, UNREPORTED AND UNREGULATED FISHING PRACTICES

Oral

Artisanal Marine Fishing in Ghana: Cosmovisions, Competition and Illegalities

Akonor, T. E.* and Abane, H.

Department of Sociology and Anthropology, University of Cape Coast, Ghana

*Corresponding author: eakonor@ucc.edu.gh

Artisanal marine fishermen along the west and central coast of Ghana have customary ways of regulating their industry to ensure its sustainability. These are enshrined in the worldviews of fishing communities that dictate a spiritual affinity with spirit beings and are expressed in religious practices. In recent times however, local fishermen are faced with a myriad of problems that make their livelihoods vulnerable. These include competition from foreign trawlers and other local fishermen, unregulated fishing and use of illegal fishing practices. The study has used interviews and focus group discussions to generate data for a content analysis. One hundred and two respondents were purposively sampled from selected fishing communities along the central and west coast of the country in addition to six fisheries officers and two representatives of industrial fisheries of the two study regions. Two focus group discussions were also organized in each of the two regions with chief fishermen and their councils. This research article argues that competition from, particularly, foreign fishermen that leads to depleting fish stocks has accounted for a departure from the use of community customary worldviews and traditional regulations to manage marine fish stocks. It is recommended that the marine waters of the country must be monitored, state laws that govern international fishing must be implemented and the use of oath swearing as a traditional method of enforcing discipline among fishermen at sea should be encouraged in all fishing communities along the coast of Ghana.

Oral

An Assessment of Unreported Fish Catches in the Marine Fisheries Sector of Ghana

Nunoo, F. K. E.*, Lutterodt, K. B. and Yeboah, C. O.

Department of Marine and Fisheries Sciences, University of Ghana, P. O. Box LG 99, Legon, Ghana

*Corresponding author: fkenunoo@ug.edu.gh

One of the main aims of fisheries management is to estimate total fish extracted from a waterbody to support fisheries decision making. Achieving this objective is however impeded by inaccurate reporting of the actual total fish withdrawals from marine fisheries. To help bridge this gap, this study describes the categories and types of unreported marine fish catch; and estimates their quantities. A case study approach using a questionnaire and Fisheries Observers helped to determine the categories and quantities of unreported catches. Data was collected from three marine artisanal fish landing sites namely Jamestown, Prampram and Ningo in the Greater Accra Region; and from four (4) industrial vessels that fished in Ghanaian coastal waters. Results categorised unreported catches into two main types viz, take-home catches and fish consumed during fishing trips by artisanal fishers. There were four categories in the industrial fisheries that are take-home catches, discards, fish consumed during fishing trips and fish trans-shipped at sea by industrial fishers. A significant amount of 99,879 metric tonnes of fish goes unreported annually from the three artisanal landing beaches and the four industrial vessels. This figure is however, likely to increase significantly, conceding the over 300 artisanal landing villages and high number of fishermen within the coastal regions of the country. High numbers of small sized (< 15 cm in TL) Carangidae (*Decapterus punctatus, Decapterus rhonchus*), Scombridae (*Scomber japonicas, Scomberomorus tritor*) are transshipped. Discards of cephalopods such as juvenile squids, cuttlefish and *Priacanthus arenatus* at sea are unreported. This has profound adverse implications for fisheries management, sustainability of fisheries and food security in the country; and a concerted effort should be made by all relevant stakeholders to curtail it.

Oral

A New Tool to Improve Fisheries Monitoring, Surveillance and Control Capabilities in Ghana

Agyei, D.[1*], Aheto, D. W.[1], Wiafe, G.[2] and Adu-Agyekum, K.[2]

[1] *Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*
[2] *ECOWAS Coastal and Marine Resource Management Centre, University of Ghana*

*Corresponding author: danielagyei16@yahoo.com

This study employed Satellite Automatic Identification System (Sat-AIS) to monitor the activities of artisanal tuna canoes in Ghana. Class-B transponders were mounted on two wooden canoes operating from Sekondi fishing harbour, and their activities monitored over a period of six months, from August, 2015, to January 2016. The vessels were mainly involved in the harvesting of tuna in the coastal waters of Ghana. The results indicated that skipjack (*Katsuwonus pelamis*), bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*) and frigate tuna (*Auxis thazard*) were the dominant species in the catch during the study period. Based on the analysis of speed profiles from the vessel trajectories obtained from AIS data, speeds between 2 to 4.3 knots was classified as fishing speeds for canoe fisheries. Findings from this study suggest that, the use of Sat-AIS, augmented by a Class-B transponder could be a useful tool in in monitoring of canoe fleet in Ghana. Based on the findings of this study, it was recommended that the government should make it mandatory for all small scale fishing fleets to have the Sat-AIS devices to enhance surveillance, monitoring and control of small-scale fisheries in Ghana.

Re-trafficking in the Coastal Fishing Communities and the Volta Lake of Ghana: Children Agency and Intra-Household Bargaining Position

Golo, H. K.[1*] and Eshun, I. [2]

[1]*Centre for Conflict, Human Rights and Peace Studies (CHRAPS). University of Education, Winneba, Ghana.*
[2]*Department of Social Studies Education. University of Education, Winneba, Ghana.*

*Corresponding author: isaaceshun@uew.edu.gh

It is estimated that human trafficking is a $150 billion industry and every country, including Ghana must do everything possible to stop this human trade. Re-trafficking of rescued and re-integrated children has become a long-drawn-out phenomenon along the rural coastal fishing communities and the Volta Lake. This study sought to explore the extent to which the interplay of the re-traffic children's agency and the existing intra-household bargaining positions within households influence re-trafficking. *A* multiple case study design was adopted by focusing on four fishing communities in the Volta Region. Bakpakorfe and Okpalama are fishing communities along the Volta Lake, whilst Amutinu and Tetekorfe are rural coastal fishing communities. In-depth interviews and focus group discussions were employed to elicit information from 16 re-trafficked children and 12 of their parents/guardians as well as 8 "slave masters" and 4 "slave mistresses" for the study. Mainly, qualitative way of using direct quotations and interpretative techniques were adopted in analysing the data. The data on the socio-demographic background of the respondents were analysed using simple percentages. *It* was established in this study that, both parents and children play a major role in the re-trafficking phenomenon. That is, while the re-trafficking in the study communities thrives primarily on parents' decisions and negotiations, the children, at times, manoeuvre their way back to where they were rescued. Poverty is seen to be the pushing factor for the re-trafficking. It is, therefore, recommended that, frantic efforts should be made by the government and other stakeholders working in the field of child protection and welfare to establish very viable poverty reduction activities within artisanal fishing communities in Ghana. Also, the Ministry of Gender, Children and Social Protection and the Social Welfare Department should develop mechanisms that can encourage children to participate in decisions and involve them in policies that affect their development and security.

Oral

Perceptions and Experiences of Child Trafficking in Selected Communities along the Volta Lake

Peterson, M. A.

Department of Population and Health, University of Cape Coast, Ghana

aboagyewaapeterson@gmail.com

Child trafficking is particularly pervasive within the West African region, partly due to the porous nature of borders and some cultural practices such as fostering; as most parents are of the view that their children are being trained. Child trafficking along the Volta Lake has been linked to the construction of the Akosombo dam, which caused the loss of livelihoods and poverty. The study explored the knowledge, perceptions and experiences of the Dzemeni, Fanti-Korpe, Torkor-Aglama, Kpando-Torkor, Tongor-Jakiti and Attrokropo that are fishing communities along the Volta Lake on the differences between fostering and child trafficking and also explored the gender dynamics. A mixed methods approach using survey, in-depth interviews and focus group discussions was employed. Secondary data from the Anti-human Trafficking Unit of the Ghana Police Service, Ho Volta-Region was also used. Majority of the participants regarded child trafficking as a crime. However, they did not consider fostered children who were forced into child labour and exploited as a crime. Women have been portrayed as victims in most human trafficking literature, interestingly, this study revealed that majority of those who sold their children were women while the men were the recruiters. Also, most of the victims were male. According to the Anti-human Trafficking Unit, trafficking of female children (especially for sexual exploitation) has now reduced partly due to campaigns against this act. It is therefore imperative for campaigns to be increased on trafficking of males.

A Child's Vulnerability – Reducing Child Labor and Trafficking in the Fisheries Sector in Ghana

Ottah Atikpo, M.[1*], Avega, B.[2] and Antwi, H.[3]

[1]*USAID/Sustainable Fisheries Management Project, Accra, Ghana*
[2]*SNV Netherlands Development Organisation, Accra, Ghana*
[3]*Central and Western Region Fisheries Improvement Association, Elmina, Central Region, Ghana*

*Corresponding author: magatik@yahoo.co.uk/margaret.sfmp@crcuri.org

It is estimated that there are over 2.7 million child laborers in Ghana and that the largest employers of child labor in Ghana are in the artisanal fisheries, cocoa and mining sectors. Child Labor and Trafficking (CLaT) victims in the fisheries sector are exposed to various degrees of life-threatening dangers. The U.S. Government's 2016 Trafficking in Persons Report classified Ghana as a Tier 2 Watch List country for the second year in a row, meaning that Ghana government does not fully meet the minimum standards for the elimination of child labor and trafficking in persons. The root cause has been poverty and large family sizes; thus parents are in desperation sell their children as laborers. Whereas within the fisheries sector the source area is the coastal communities, the riverine basin communities serve as the demand areas. Consequently, children are transported/trafficked from the coastal communities to the inland communities for laborious activities, sometimes leading to death. In view of this, the USAID/Sustainable Fisheries Management Project implemented a number of strategies aimed at reducing CLaT in the fisheries sector through behavioral change communications and livelihood interventions that target adult caretakers (parents and guardians) who serve as the key perpetrators due to poverty or lack of knowledge on the effects of CLaT challenges on children. Some of the strategies include building the capacity of and supporting Community Child Protection Committees (CCPCs) and anti-CLaT advocates on Child Labor and Trafficking; use of the systematic referral mechanisms and protocols developed under the Child Protection Compacts; and development of Community Action Plans. The objectives are to facilitate capacity building of volunteers for community child protection committees towards continuous peer-to-peer influence against CLaT; create extensive awareness in the fishing communities on the negative effects of child labour; and facilitate continuous education on family planning and provision of workable livelihood interventions.

THEMATIC AREA E

MARICULTURE, GREEN BUSINESSES, LIVELIHOODS AND POVERTY REDUCTION IN COASTAL AREAS

Community members build racks with suspended coconut cultches at Narkwa in the Central Region of Ghana. *Credit: Ernest Obeng Chuku*

Public-Private Partnership for Aquaculture Development in Ghana: The University of Cape Coast – Ainoo Ansah Farms Experience

Ainoo-Ansah, J.[1]* and Aheto, D. W.[2,3]

[1]*Ainoo-Ansah Farms, P. O. Box OS 2655, Accra, Ghana*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*
[3]*Centre for Coastal Management, University of Cape Coast, Ghana*

*Correspondence: pinnacle.bus.link@gmail.com

There are many investments in research and many social interventions in aquaculture by various universities and development organizations geared towards economic development in West Africa. However, the translation of research into innovation and impact has been inadequate. Meanwhile, other economies have developed models where research is driven by demand. In pursuit of appropriate pathways of impacting on the Ghanaian fish farmer, Ainoo-Ansah Farms and the Department of Fisheries and Aquatic Sciences signed a Memorandum of Understanding to undertake joint scientific and hands-on activities relative to tilapia farming, project implementation, research, training since 2013. This paper focuses on the training component of a development project that involved curriculum development, preparation, and publication of a training manual and off-campus training on the partner's farm. The collaboration has produced results and experiences worth sharing with regards to overall impact, governance, learning, resource management, communication, motivation, and implementation styles among others. There have been other spin-offs from the collaboration. The farm has developed collaborations with two other public Universities in Ghana and another in South Africa. The presentation is descriptive based on observation and direct experiences of the actors. A number of questions arise which should be of research interest towards the development of models for the integration of university activities and programs with private sector development. The role of governments and the international community in these developments is emphasized.

Oral

Assessment of Vulnerability and Coping Livelihood Strategies of Fishermen in Selected Coastal Communities in the Central Region of Ghana

Awiah Dzantor, S.[1] and Aheto, D. W.[2*]

[2]Department of Geography, University of Cape Coast, Ghana
[2]Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: seldzantor@gmail.com

The study assessed the vulnerability and livelihood coping strategies of fishermen in selected coastal communities (Winneba, Apam, Biriwa, Moree and Elmina), in the Central Region of Ghana. Cross-sectional data covering demographic, incomes, their perceptions on current state of fish stocks, climate and non-climate threats to fishing activities, as well as their exposure, sensitivity and adaptive capacities were collected from a purposively selected sample of 422 fishermen using a multi-stage sampling technique. Data was collected using questionnaires and interview schedules. The questionnaire data were analysed using SPSS Version 21, Microsoft Excel (Version 2016). Gephi Software Version 9.0 was used for social network analysis (SNA) within the population. The results showed that most of the fishermen depended heavily on fishing as a major source of livelihood. Nonetheless, their income levels were trifling due to declining fisheries. Ninety-six percent (96%) of the respondents reported reduction in the fish stocks over the past 10 years. The vulnerability of the communities proved to be significantly high. The livelihood coping strategies were largely informal, comprising farming and trading among others, adopted by a limited number of fishermen in the study areas. A little over half of the fishers representing 66.3% of total respondents were willing to leave the fishing sector for different livelihoods, given other prospects. It is concluded that improving livelihoods will require strengthening supplementary livelihood occupations. Educating fishers on the dangers of using illicit fishing methods is recommended for growth of the sector and enhancement of income levels of the fishermen.

Livelihood Strategies and Outcomes of Fisher Folks in Selected Rural Coastal Communities of Ghana

Golo, H. K.[1*] and Eshun, I. [2]

[1]*Centre for Conflict, Human Rights and Peace Studies (CHRAPS). University of Education, Winneba, Ghana.*
[2]*Department of Social Studies Education. University of Education, Winneba, Ghana.*

*Corresponding author: harrigol@yahoo.com

People choose livelihood strategies that provide them with livelihood outcomes. For those living in poverty, livelihood strategies are usually varied and often complex. This study explores the livelihood strategies and outcomes of fisher folks in rural coastal communities. This paper focuses on two sub-themes: livelihood strategies and livelihood outcomes of fisher folks in four selected rural coastal communities in the Volta and Central Regions of Ghana. This study adopted a mixed method research approach with a multiple case study design. The population included fisher folks - fishermen, fish mongers, fish processors, boat owners, net owners, outboard motor owners, middle men and women in the fishing industry. Twenty fisher folks were interviewed from each of the four communities. In addition, one focus group discussion was held in each of the four communities. Interpretative technique was employed in analysing the qualitative data, whilst a simple percentage was employed for the quantitative data collected. The research established three predominant livelihood strategies pursued in the study settings. These are livelihood diversification, intensification and migration. The livelihood outcomes they aimed to achieve were to: improve health and wellbeing; increase food security; have access to resources; increase income; and decrease vulnerability. The study categorised fisher folks who strive to achieve their livelihood outcomes into three, namely, 'positive', 'mid', and 'negative'. The study recommended the need for investment in livelihood activities within rural fishing communities as a way of broadening fisher folks' entitlements and capabilities.

Oral

Farming of African Catfish, *Clarias gariepinus*: Alternative Sustainable Livelihood for Coastal Communities in Western Region, Ghana

Agbeko, E.* Asmah, R., Anani, A. F., Mensah, T. D .E. and Atsakpo, P.

CSIR-Water Research Institute (Aquaculture Research and Development Centre, Akosombo), P.O. Box AH. 38, Achimota, Accra, Ghana

*Corresponding author: etornyo@yahoo.co.uk/etornyo@csir-water.com

Alternative sustainable livelihoods are essential for development of coastal communities as well as for conservation of marine and coastal ecosystem biodiversity. Farming of African catfish in earthen ponds as an alternative source of livelihood was evaluated for growth performance in three selected coastal communities, namely Half-Assini, New Ankasa and Kamgbunli in the Western Region of Ghana from August to December, 2016. *Clarias gariepinu*s fingerlings of initial mean weight 23.1 ± 0.7 g were randomly stocked at 5 fish m^{-2} in three earthen ponds with dimensions 119, 160 and 225 m^2 of mean depth 1.0 ± 0.25 m. The cultured fish were fed with pelleted commercial catfish feed at 5.5 - 2.0 % of mean body weight, ration three times daily. Water quality was monitored monthly using standard methods for sampling and analyzing waste water. Water temperature (30.00 ± 1.08 mg l^{-1}), dissolved oxygen (5.35 ± 2.85 mg l^{-1}), total hardness (52 ± 32.18), conductivity (466.50 ± 230.29 µS cm^{-1}) and pH (7.2 - 6.80), were within permissible levels. Slight nutrient enrichment was observed as ammonia-N, nitrate-N and nitrite-N were >1.20 mg l^{-1}, except for phosphate-P which was < 0.5 mg l^{-1}. After 120 culture days, final mean weights of cultured catfish were 1003.7 ± 116.4, 1101.8 ± 327.2 and 843.8 ± 47.8 g for Half-Assini, New Ankasa and Kamgbunli, respectively. The condition factor of harvested fish ranged from 0.78 to 0.88. Combined survival rate was 82.77% with a feed conversion ratio of 1.33. Based on analyses from the 5 key indicators (poverty reduction, well-being and capabilities, livelihood adaptation, Vulnerability and resilience, and natural resource base sustainability) for assessing sustainable livelihood; catfish farming would be 70% sustainable livelihood for the selected coastal communities. Catfish farming could be a viable option for livelihood support for coastal communities, if given capacity building and fish feed support to minimize vulnerability and enhance resilience of the venture.

An Alternative Livelihood for Rural Coastal Communities in Ghana: A Focus on the Culture of Mangrove Oyster

Asare, B. [1*], Obodai, E. A.[2] and Acheampong, E.[2]

[1]*Catfish Ghana Limited, Akosombo*
[2]*Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana*

*Corresponding author: kasare26.ba@gmail.com

The mangrove oyster, *Crassostrea tulipa*, is an important source of animal protein for many coastal communities. Nonetheless, the species has received little attention despite the dwindling fish stock in Ghanaian waters in recent times. There have been several preliminary studies conducted to identify viable aquaculture techniques that will increase the yield (growth rate and size) of the oysters as a means of supplementary livelihood for coastal communities in Ghana and elsewhere. As part of the extended efforts, this paper sought to address the socioeconomic dynamics of the oyster fishery in Ghana using a small fishing community, Nakwa as a test case. We assessed the relative sizes sold on the market and the optimum duration of culture of the species. An interview guide and oysters purchased from the local market were used to gather information on the socioeconomic dynamics while coconut cultches on racks were used to culture oyster spats collected from the Nakwa Lagoon, in the Central Region of Ghana. The results indicated that 60 % of the respondents harvest the oyster for sale, consumption or both. The oysters are available all year round although the sizes and quantity harvested were found to be reducing in recent times. The study showed that the various sizes of oysters found on the market could be obtained within seven months of culture with better meat condition. Nonetheless, a period of five months is adequate to meet the local market size of 5.95 ± 1.37 cm. The cultured oysters had high growth rate (0.82 cm/month), thus, grew from 1.65 ± 0.042 to 7.07 ± 0.12 cm within 7 months. Based on the high demand and interest of respondents to culture the species, there is a high potential for oyster culture at Nakwa with useful lessons for similar coastal communities in Ghana.

Oral

Village Savings and Loan Associations (VSLAs) as Strategy for Empowering Communities for Sustainable Management of Coastal Ecosystems

Aduomih, A. A. O.* and Kankam, S.

Hen Mpoano, 38 J. Cross Cole Street, Windy Ridge Extension, East Tanokrom, Takoradi, Western Region. P. O. Box AX 296 Takoradi, Western Region, Ghana

*****Corresponding author: aowusu@henmpoano.org

Coastal communities in the Western region of Ghana have few livelihood diversification opportunities. This problem is magnified by the inability of majority of coastal dwellers at the bottom of the financial pyramid to access conventional sources of loans to start or expand small-scale enterprises. This has reinforced a perpetual cycle of over-dependence on natural resources for survival. Village Savings and Loan Associations (VSLA) has been applied in the rural settings to organize and empower community members to build cohesion for managing their natural resources and generate self-funding for livelihood initiatives. Under the auspices of the USAID-funded Coastal Sustainable Landscapes Project (CSLP) and Sustainable Fisheries Management Project (SFMP), three (3) VSLAs were established in the riparian communities of the Ankobra River and their performance assessed against their contributions to household livelihood improvement and sustainable management of coastal resources. The assessment was carried out using regular monitoring visits with field schedules, interview checklist, and focus group discussions over a 2-year period. Findings reveal that VSLAs, have created institutions that organize members into groups and facilitate ready access to loans from their savings; improved household business outcomes and empowered women to advocate sustainable management of coastal resources in the Ankobra river catchment.

Effects of Declining Fish Landings on the Livelihood of Coastal Communities in Central Region of Ghana

Danquah, A. J.[1*] and Roberts, O. C.[2]

[1]*Department of Geography and Regional Planning, College of Humanities and Legal Studies, University of Cape Coast, Ghana*
[2]*Guidance and Counselling Unit, University of Energy and Natural Resources, Post Office Box 212, Sunyani-B/A, Ghana.*

*Corresponding author: abrefad@gmail.com/jones.danquah@ucc.edu.gh

Ghana's fishing industries is dominated by the artisanal fishermen and it is main contributor of household income of communities along its 500 km stretch of coastline. The economic spill-over of the artisanal fishing industry is huge spanning from the coast to the hinterlands. The fishing industry contributes significant proportion to gross domestic product of the country. However, over the years the industry is on the verge of collapsing due decrease in fish landings. This study assesses the economic effects of reduced fish catch on households and their level of understanding of underlined causes, as well as available alternative livelihood coping strategies at their disposal. To achieve this, 200 fishing households were randomly selected from three communities; namely Moree, Anomabo and Elimina. Structured questionnaires were administered to elicit the expected information from the households within the case study communities. The key instrument design to assess the understanding and perception of causes of decline in fishing landing is based on a five points Likert scale structure. The results of the study indicated that, unorthodox fishing methods and industrial fishing were key factors cited by the communities to cause decline in fish catch. The reduction in fishing landings has prompted most households in the communities to adopt alternative livelihoods in the forms of petty trading, masonry, hairdressing and driving ranked highest. Migration is identified as another coping strategy from decline in fish landings. In conclusion, there is gradual and consistent decline in income of fishing folks over the years affecting their general wellbeing.

Oral

Bee Keeping for Sustainable Livelihoods among Coastal Fishing Communities in Ghana

Kwapong, P.

Department of Conservation Biology and Entomology, University of Cape Coast, Ghana.

pkwapong@ucc.edu.gh

The need for sustainable livelihoods for coastal communities in Ghana is critical. Population growth rate continues to increase, whiles marine resource stocks continued to dwindle. Even where suitable fisheries management systems are in place, there are simply too many people fishing for fish. Alternative livelihoods are essential for both the development of coastal communities and conservation of the marine and coastal biodiversity and ecosystems. This paper presents basic information about managing wild bees and on the use of their products. It identifies and describes major bee species and their importance for nature conservation and for sustainable livelihoods of the coastal people. Bee products are considered at both the subsistence and commercial levels, and attention is given to the potential for further development of managing wild bees in local communities. The role of bees for pollination of crops and forestry and farming are presented. Wild bee keeping techniques, honey production and marketing and the international trade in bee products are described. The potential benefits associated with bee keeping are explored and the useful role that bee keeping can play in creating sustainable livelihoods for two coastal fishing communities (Anlo Beach and Half Assini) are described. Bee keeping is a useful means of strengthening livelihoods because it produces a range of outcomes: pollination services, honey, bees wax, pollen, propolis, royal jelly and value added products (candles, skin ointment, beer), apitherapy, cultural values (candles, beers) used in rituals.

Determining Incentives for Community Participation in Local Governance of Oil and Gas Resources in South Western Ghana

Dolphine, W. D.[1*] and Lawrence Damnyag, L.[2]

[1]*Department of Silviculture and Forest Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*
[2]*CSIR-Forestry Research Institute of Ghana, Kumasi, Ghana*

*Corresponding author: wildeldol@gmail.com

This study investigated incentives for local communities' participation in the governance of oil and gas resources. It also determined the relationship between existing incentives and interest to participate. Systematic random sampling was used to select 200 household respondents from Atuabo and Discove communities. Data collected was analyzed quantitatively employing correlation technique, factor analysis and one-way analysis of variance (ANOVA). Over 90% of the respondents indicated material incentives as the main form of available incentives in the study communities. There was a weak negative and significant correlation between available incentives and level of participation in decision making, $r= -0.026$, $N=68$ and $p<0.0005$. Livelihood, social and economic indicators recorded the highest loadings of 0.855, 1.163 and 0.909 respectively from the principal component analysis. These indicators have been identified as incentives for participation in local governance of oil and gas resources. Both males and females within the working age group were indifferent towards social, livelihood and economic incentives. The study communities were also indifferent towards livelihood and economic incentives but differed in the case of social incentive with Discove community recording the higher preference. Monetary support in the form of loans and supplementary livelihood training to farmers and fishermen were to be added as incentives. For active participation of local communities, this study recommends, decentralization in the governance of oil and gas resources. Community leaders are also to put in measures to increase the involvement of women to ensure a broader participation.

Oral

Culture of Nile Tilapia, *Oreochromis niloticus* for Food Security: Education for Coastal Fisher Folks and Investors

Kusorgbor, K. J.*, Agbeko, E., Anani, A. F., Mensah, T. D. E., Agyakwah, K. S. and Teye, J.

CSIR-Water Research Institute (Aquaculture Research and Development Centre), P.O. Box AH. 38, Achimota, Accra, Ghana

*Corresponding author: kusorgborj@yahoo.com

Marine fishery resources are dwindling; therefore capture fisheries must be augmented with fish farming for sustainable livelihood and food security. This poster presents a stepwise process to advocate for alternative livelihood adaptation through farming of the "Akosombo strain" of the Nile tilapia from fry to table size stages in ponds and cage culturing systems. Pictorial annotation method was used. Every 2 weeks, broodstock are carefully fetched out of hapa-in-earthen ponds and the mouth washed of all fry and eggs into clean water. The eggs are separated from the fry and incubated in a recirculatory hatchery system for hatching whilst the fry are stocked in 5x2 m^2 hapas for monosex male fingerling production. The fry are fed to satiation with 17-α methyl testosterone hormonal powdered feed for 28 days. The mono sex male fry are transferred into nursery ponds to be fed with non-hormonal starter powdered feed for a period of 6-8 weeks to produce mono sex fingerlings. The fingerlings are stocked into grow-out ponds or fish cages and fed with pelleted or extruded fish feed to produce marketable-sized tilapia within a period of 4-6 months. To obtain good market value, the fish are sorted into size categories based on weight before sales. Hence, a viable investment into the farming of improved "Akosombo strain" of Nile Tilapia using cage culture could translate into 18.5% return on capital employed and 92.3% return on equity.

Poster

Minimizing Losses in Cultch Construction Materials towards a Profitable Oyster (*Crassostrea tulipa)* Farming Business in Coastal Ghana

Chuku, E. O.* and Osei, I. K.

Department of Fisheries and Aquatic Sciences, University of Cape Coast, Ghana

*Corresponding author: eobengchuku@ucc.edu.gh

Rearing of the West African Mangrove Oyster (*Crassostrea tulipa*) in Ghana promises to be a sure way to the sustainable use of the shell food fish and a supplementary livelihood option for coastal dwellers. Although the venture has not gained much attention as opposed to the business of rearing other fish species for example the Nile tilapia (*Oreochromis niloticus*), some preliminary investigations into the use of some locally available materials that are used as substrate and holding facilities for the rearing of the species has been undertaken. This study was conducted to ascertain the initial length of rope needed to hold coconut cultches with desired equidistance between shells and number of coconut shells. A model that factored rope and cultch thickness was used to establish the relationship between initial and final rope lengths. Units of five cultches each, with shell thickness (0.30 ± 0.0037 S.E.) were constructed using a ¼-inch nylon rope. It was established that for a standard five-cultch unit (with inter-cultch distance of 15 cm) meant for a 1×1 m^2 frame length/height of racks to be used for the culture of oysters, a total length 2 m of ¼-inch nylon rope is required. This produces a minimum of 50 cm rope length at each end for fastening to rack frames. Oyster farmers can therefore rely on this information to easily, construct cultches for rearing the species in coastal ecosystems in Ghana without wasting ropes as construction materials, from either underestimation or overestimation; to maximise profitability. It is however recommended that further studies be conducted to derive a universal model to predict rope length required for any thickness of rope and cultch material, distances between cultches and for other rack dimensions.

Oral

Potential For The Culture of Red-Chinned Tilapia, *Tilapia guineensis* (Bleeker, 1862): A Comparative Growth Study with Nile Tilapia in Freshwater Ponds

Asase, A.

University of Energy and Natural Resources P. O. Box 214, Sunyani, Ghana

amos.asase@uenr.edu.gh

A 10-week trial was conducted to study the culture potential of *Tilapia guineensis* by comparing its growth to that of Nile tilapia, *Oreochromis niloticus*, cultured in a hapa-in-earthen pond system. Mixed sex juveniles of both species of average weight (29.90 ± 0.05 g) were stocked at a rate of 10fish/m². Each treatment was replicated thrice. Fish were fed a 38% crude protein commercial fish diet. Results from the study indicated that, *T. guineensis* showed the higher final body weight (63.08 ± 4.46g) in the experiment than *O. niloticus* (62.86 ± 2.67g). However, there were no significant differences ($p>0.05$) in final mean weights, mean daily weight gain and specific growth rates between the two treatments during the culture regime. Although gross yield and survival (1149.69 ± 60.87g, 87.50 ± 2.89%) were high respectively in *O. niloticus* than *T. guineensis* (1044.02± 98.90, 82.50 ± 1.77%) under the same culture system, they did not differ significantly from each other ($p>0.05$). In general, although *T. guineensis* shows no distinct variation in sizes among its sexes other than *O. niloticus*, it showed superior growth with an appreciable feed conversion rate.

Gut Metabolism: The Constraints and Opportunities for Sustainable Production of Industrial Aquafeeds

The Microbiology Group
Department of Biochemistry, University of Cape Coast, Ghana

Corresponding author: ssarfo@ucc.edu.gh/magbale@ucc.edu.gh

Aquaculture is one of the fastest growing food production areas worldwide. With half of total fish and shellfish consumed globally coming from this sector, aquaculture has now assumed importance in terms of global food system, environment, and human health. Increase intensification in this sector has rather put severe constraints on the available feed stocks required to support industrial aquafeeds. The traditional method of feeding fish in farms that use fish meals prepared using wild fish can no longer sustain the industry, due to its potential to dwindle the existing stocks of wild fishes. There have also been reports of risks of contaminants in fishmeal and fish oil use in aquafeeds. The use of crop-based feed ingredients holds promise in many developing nations trying to boost their economies through aquaculture of a sustainable fish feed production that can support the sector. Presently, high quality local aquafeeds are limited hence, sustainable fish farming is highly dependent on importation of expensive commercial feed to ensure balanced diet and high performance. Fishmeal can be replaced with crop-based fish recipes whilst fish oil can also be replaced with vegetable oil such as canola oil. The metabolism of the gut of the organism play important role in its nourishment on any recipe. In addition to amylolytic, lipolytic, and proteolytic digestive enzymes secreted by this organ in response to food, the gut also harbours large groups of commensal bacteria that can secret cellulolytic enzymes to complement the fish digestive function. Food also controls the relative abundances of the gut microbiota. It is therefore proposed that the analysis of fish gut enzymes, microbiota and their metabolites in gut offers novel opportunities to screen crop-based and insect-based recipes to develop local high quality aquafeeds. Clearly, successful development of aquafeeds depends on a better understanding of the role of gut microbiota in feed utilization.

Poster

Effects of Dietary Protein Levels on Growth, Feed Utilization and Body Composition of Juvenile African Bonytongue, *Heterotis niloticus*

Agbo, W. N.[1*], Amisah, S.[1], Akpaglo, P. K.[1] and Frimpong, E. A.[2]

[1]*Department of Fisheries and Watershed Management, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*
[2]*Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, USA*

*Corresponding author: nelagbo@gmail.com

This study evaluated the effect of four isoenergetic diets with varying crude protein (CP) levels of 26.2%, 32.1%, 34.6% and 42.8% on growth, feed utilization and whole body proximate composition of African Bony-tongue, *Heterotis niloticus* juveniles. *H. niloticus* juveniles (initial weight 32.65±0.03g) were stocked in rearing hapas (2x1 m^2) at 5 fish per hapa. Each diet was assigned to triplicate groups of fish in a completely randomized design and the experiment lasted for ten weeks. An increasing growth trend and better feed utilization was observed as dietary protein levels increased from 26.2% to 42.8% dietary protein. Fish fed 42.8% protein diet had the best growth performance and nutrient utilization, with a mean weight gain of 202.30±19.6%, feed conversion ratio of 1.20±0.15 and protein efficiency ratio of 1.66±0.2, however this was not significantly different from values of fish fed 32.1% and 34.6% dietary protein. Significantly, lower values were recorded for fish fed 26.2% dietary protein. Whole body nutrient composition was not affected by the diets. The results of this study suggest that *H. niloticus* juveniles would grow best when fed diets containing at least 32.1% protein.

Poster

Development of PCR-Based Methods for Diagnosis of Fungal Infections in Cultured Fish (*Oreochromis niloticus*) in Ghana

Sakyi, R. L. [1,2*], Yankson, K.[1], Aheto, D. W.[1] and Osei-Atweneboana, M. Y.[2]

[1]*Department of Fisheries and Aquatic Sciences, University of Cape Coast. Ghana*
[2]*CSIR- Water Research Institute, Accra, Ghana*

*Corresponding author: rho_lims@yahoo.com

The rapid detection of pathogens in both clinical and sub-clinical infected fish is essential for effective health management in aquaculture. Molecular techniques are potentially faster and more sensitive than culture, serology, and histology methods that are mostly used to identify fish pathogens. The ability to quickly determine the presence or absence of a pathogenic organism in fish has significant economic benefits. Among the causative agents of infectious diseases in aquaculture, the pathogens of fungal origin are poorly characterized, making the development of molecular diagnoses very relevant. For this study, 50 diseased samples of *Oreochromis niloticus* showing common disease symptoms of red patches on skin and cloudy eyes were sampled from some aquaculture farms in Ghana for detection of fungal infections. From each fish sample, DNA was extracted from disease portions, liver, kidney, gut and skin wash together with gills. A polymerase chain reaction (PCR) technique based on the small subunit ribosomal RNA (18S rRNA) gene was designed to amplify specific fragment of DNA, and were subsequently identified by size using gel electrophoresis. About 80% of samples screened against the internal transcribed spacer (ITS) primer set showed amplification of the expected fragment size. Fungal specific DNA was detected mostly in skin washes and the red patches on skin. Sequencing analysis will further be undertaken to help detect species specific pathogens. From the study, it was observed that similar to bacterial infections, fungal infections contribute significantly to disease conditions in aquaculture farms in Ghana. This report introduces the first DNA-based detection method for fungal infection to be used alone as a diagnostic tool without prior culture analysis, in fish diseases in Ghana. Consequently, this PCR-based method will greatly accelerate research on disease pathogens in fish and has great potential for field application for its highest advantage of speed and sensitivity.

Oral

Livelihood regeneration in the Keta Lagoon Complex of Southern Volta Basin of Ghana: A Proposition

Mattah, P. A. D.

Directorate of Academic Planning and Quality Assurance, University of Cape Coast

Email: pmattah@ucc.edu.gh

Lagoon ecosystems are productive systems which provide economic, ecological, social and aesthetic services to coastal societies. In spite of being highly productive, they are most vulnerable to physical, ecological and anthropogenic disturbances. In the South-eastern part of Ghana and immediately east of the Volta estuary lies the Keta Lagoon Complex, which is the largest of its kind and a Wetland of International Importance in the country. The Keta Lagoon Complex presented a unique agro-ecological and socio-cultural environment which hitherto was very productive. The complex is a nursery ground for numerous species of fishes which supported artisanal fisheries as well as migratory birds. The adjoining sand spit has been used for ages in cultivating different types of vegetables. Mangrove vegetation of the wetland have provided hard wood for building as well as fuelwood to surrounding communities. However, the construction of Akosombo dam on the Volta river, rapid population growth, continuous fishery activity, intensive use of agro-chemicals for vegetable farming and erratic rainfall due to climate variability have adversely affected the productivity of the lagoon complex. Clear evidence have been adduced to nutrient overload (hypereutrophic) and low fish diversity as well as siltation of the lagoon. Other pertinent problems confronting the people include deterioration of soils, erosion of the coastline, pollution of the freshwater aquifer, salt water intrusion of the ground water and out migration of the youth to urban areas. These problems have increased poverty among the inhabitants and require urgent and proactive action to restore the ecosystem. A basin-wide approach, occupational diversification, understanding of micro-level (household) perception of the situation, multi-district (including five districts in the area) and multi-stakeholder involvements are hereby proposed for a comprehensive restoration of the lagoon complex. The outcome will be a restored lagoon ecosystem, revived fishery and farming activities and consequently a revived local economy.

Acknowledgements

We acknowledge the contributions of the following people who played very significant roles in the organization of this conference:

Hon. Elizabeth Naa Afoley Quaye (MP)
Prof. Joseph Ghartey Ampiah
Justice Odoi
Prof. Denis Worlanyo Aheto
Dr. Noble Asare
Esinam Attipoe
Vera Cudjoe
Dr. Benjamin Campion
Dr. George Darpaah
Maurice Knight
Ernest Obeng Chuku
Joshua Adotey
Richard Takyi
Saaka Adams
Evans Boah-Mensah
Yvonne Sefenu Ocloo
Adwoa Sey
Collins Osae
Wendy Martey

This conference is funded by the United States Agency for International Development (USAID) through the University of Cape Coast (USAID/UCC Fisheries and Coastal Management Capacity Building Support Project) and University of Rhode Island (USAID/GHANA Sustainable Fisheries Management Project)