



BELLS UNIVERSITY OF TECHNOLOGY
OTA, OGUN STATE, NIGERIA

TOPIC:
**AT THE CROSSROADS OF HUNGER AND
SUSTAINABILITY: ENVIRONMENTAL AND
MANAGEMENT PARADIGMS IN
AQUACULTURE AND ARTISANAL FISHERIES**

An Inaugural Lecture

By

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At the Crossroads of Hunger and Sustainability: Environmental and Management Paradigms in Aquaculture and Artisanal Fisheries

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CITATION OF PROFESSOR AUGUSTINE OMOIKE

Born during the Biafran war, Professor Augustine Omoike hails from Opoji, Edo State. He had his first degree at Edo State University (now Ambrose Alli University) Ekpoma, Edo State. His academic formation took place at the University of Ibadan, where he earned both his Master's and Doctoral degrees in Aquaculture and Fisheries Management. His doctoral research on the sustainable management of reservoir fisheries laid the scientific foundation for a career devoted to inland fisheries ecology, stock assessment, and aquaculture sustainability.

Professor Omoike's scholarship directly engages the global dilemma reflected in today's lecture topic—the tension between hunger and sustainability. His research spans fish nutrition, alternative feed development, aquaculture systems management, biodiversity assessment, and artisanal fisheries dynamics. By investigating low-cost feed resources such as agro-industrial by-products, plant protein sources, and locally available materials, he has contributed to reducing dependence on expensive conventional feed ingredients. His involvement with an advanced training in GIS for fisheries research in Japan and higher education development in China further broadened his technical and global outlook, reinforcing a research orientation that combines environmental science with production systems management.

His publication record reflects sustained scientific productivity in aquaculture nutrition, fish growth performance, aquatic ecology, and fisheries management. Across numerous peer-reviewed journal articles and conference contributions, Professor Omoike has consistently translated experimental findings into management implications, linking laboratory nutrition trials with field-level production realities and policy-relevant fisheries insights. His body of work collectively advances the environmental and management paradigms required for sustainable aquatic food systems.

As a teacher and mentor, Professor Omoike has shaped the training of students in biological sciences, aquaculture, ecology, and animal production, supervising researches that range from fish health and microbiology to hatchery management and aquatic resource assessment, across Institutions. His research tentacles spread across continents as he was one of the 40 scholars across the globe invited to enjoy travel awards to

present a paper on fisheries regulation at world Fisheries Congress in Japan in 2008; and also, the 10th International Symposium on Tilapia in Aquaculture in Israel in 2013. He was also one of the few Nigerian nominees who enjoyed full sponsorship by the Chinese Govt. to attend a seminar on “Training College Teachers of African English-speaking Countries” at the Northeast Normal University, China, in 2009.

Within Bells University of Technology, his leadership contributions are equally significant. From his appointment in 2005, he rose steadily through the academic ranks to become a Professor in 2021. He has served in key administrative capacities and committees including:

- Dean, College of Food, Agricultural Science and Technology (COLFAST), August 13, 2024 till date.
- Director, Quality Assurance, Bells University of Technology, 2022 till 2024.
- Acting Dean College of Natural and Applied Sciences November 2020 till 2022.
- Deputy Dean, College of Natural and Applied Sciences (COLNAS), Bells University of Technology, Ota August 2016 till November 2020.
- Ag Director, Industrial Training Coordinating Unit [Student Industrial Work Experience Scheme (SIWES)] 2010 till 2018.
- Programme Unit Coordinator, Aquaculture and Fisheries, Bells University of Technology, Ota (2005 till 2010).
- Programme Unit Coordinator, Marine Biology Unit, Bells University of Technology, Ota (2005 till 2010).
- Warden, Male Hall of Residence (2008 till 2012).
- Chairman, Accreditation Committee, Nigeria Private University Games Association (NPUGA) 2010 till 2015.
- Co-Editor, Bells University Journal of Applied Sciences and Environment (BUJASE).
- University Research Grant Committee 2009 till 2012
- Member University Staff Disciplinary Committee 2008 till 2012, 2023 till date;
- University Ceremonial's Committee 2009 till 2025
- Monitoring Committee on Attendance at Lecture 2010 till 2013;
- Publication Committee 2009 till 2013

- Business Committee of Senate 2008 till 2013;
- Strategic Planning/Development Committee 2015;
- Chairman, Admission and Scholarship Committee (ASC), Bells Postgraduate Studies 2023 till 2025;
- Member, Examination Misconduct Committee, 2020 till date 2024;
- Chairman, Appointment and Promotion committee for Technologist 2020 till 2022; among several others.

Professionally, Professor Omoike is affiliated with the Fisheries Society of Nigeria (FISON) and the Association of Nigerian Fisheries Scientists (ANIFS), and is active in national and international scientific forums. His career bridges science, policy relevance, and community-oriented application. His research confronts hunger not only by increasing fish production, but by promoting environmentally responsible practices.

He is a person rooted in deep Catholic faith and integrity, whose values reflect in his professional and personal life. He is a devout and principled scholar known for discipline, commitment, strong moral and spiritual conviction and a deep sense of humour.

He is a Catechist, a Legionary, and a charismatic member. He was the first President, Archdiocese of Ibadan Catholic Men Organization. He is currently the Provincial President, Catholic Men Organization (Ibadan, Ilorin, Osogbo, Ondo, Ekiti and Oyo Arch/Dioceses) and former Provost II, National Catholic Men Organization of Nigeria.

At his leisure time, he enjoys sporting activities especially goal keeping, boxing, scouting, watching wrestling and listening to news.

He is happily married to Mrs Adenike Damilola Omoike (Nee Ogunsola) a Principal Librarian at Kenneth Dike Library, University of Ibadan. The marriage is blessed with children.

Ladies and gentlemen, it is with great academic pride that we present Professor Augustine Omoike, Professor of Aquaculture and Fisheries Management, to deliver, today, the ninth Inaugural Lecture of Bells University of Technology, Ota.

Protocol and Salutation

Distinguished Vice-Chancellor,
Members of the University Management,
Deans, Directors and Heads of Departments,
Distinguished Professors and Esteemed Colleagues,
Honourable Members of the Senate,
Invited Guests,
Dear Students,
Ladies and Gentlemen,

I am deeply honoured and profoundly grateful for the privilege to stand with profuse joy before this distinguished audience today to deliver this **historic ninth inaugural lecture of the University and the first to emanate from the Department of Agriculture and Agricultural Technology**. I do so with humility, a sense of responsibility, and sincere appreciation for the confidence reposed in me by this great University. My gratitude goes especially to the University Management for granting me this platform, and to my mentors, colleagues, students, friends, and family members whose support, encouragement, and collegiality have sustained and shaped my academic journey over the years.

The title of this lecture, **“At the Crossroads of Hunger and Sustainability: Environmental and Management Paradigms in Aquaculture and Artisanal Fisheries”** reflects not only an area of scholarly engagement, but also a lifelong concern with the intersection of nature, livelihoods, and human wellbeing.

Opening Transition

Inaugural lectures occupy a unique and reflective space in the academic tradition. They offer scholars an opportunity not merely to present research findings, but to take stock of the intellectual pathways that have guided their work, the questions that have animated their curiosity, and the societal challenges to which their scholarship responds. They are moments of synthesis, where personal history, disciplinary evolution, and public responsibility converge.

Today, I respectfully invite you to journey with me across the waters that sustain life, nourish communities, and anchor livelihoods. These waters, our rivers, lakes, wetlands, coastal zones, and managed aquatic systems, are not merely ecological spaces, but living social, economic, and cultural landscapes. Within them, the enduring questions of sustainability, equity, governance, and human survival are encountered and negotiated each day.

Distinguished Vice-Chancellor, members of Senate, colleagues, ladies and gentlemen,

My life journey began under circumstances of profound uncertainty and upheaval. I was born during a period of war, a time when fear, instability, and survival shaped decisions and actions in ways that are difficult to comprehend outside such contexts. In the confusion that surrounded my birth, my father, compelled by the harsh realities of conflict and military obligation, directed that I be discarded. This decision reflected the extremity of the moment rather than personal disregard. It was my mother who, guided by instinct, courage, and compassion, later retrieved me. That singular act marked the beginning of a life shaped by resilience and grace. At the same time, my father had disappeared into military service, leaving my earliest years framed by separation, uncertainty, and survival. When my father later became fully integrated into military life, my upbringing was firmly grounded in an environment characterized by discipline, order, duty, and structure. Growing up within a military household instilled early lessons of obedience, responsibility, resilience, and respect for authority. These values became deeply embedded in my character and later found expression in my academic orientation, professional conduct, and approach to leadership. As part of this formative upbringing, I became actively involved in the Boy Scouts movement. Scouting further reinforced discipline, teamwork, leadership, and service to society. One experience from this period remains particularly vivid in my memory. In 1977, as a pupil at Maalam Maiduri Primary School, I was among the Cub Scouts lined along the roadside during the official visit of the then Head of State, General Olusegun Obasanjo, to the commissioning of the General Post Office at Maalam Maiduri town, in what is now Jigawa State but was then part of Kano State. At the time, it appeared simply as a moment of national ceremony. In retrospect, it became an early encounter with the symbolism of leadership, governance, and service to the nation. That period in Nigeria's history was also marked by General Obasanjo's strong interest in agriculture as a foundation for national development, most notably through the Operation Feed the Nation programme, this was also publicised by the well-known juju music maestro, Chief Ebenezer Obey, in his musical track released during this period. Although I was young, the national emphasis on food production, self-reliance, and collective responsibility left an impression on my developing consciousness. The message was clear: a nation that cannot feed itself remains vulnerable, regardless of its resources or ambitions. In later years, as my academic interests took shape, this early exposure to agriculture as a national priority resurfaced with clarity and purpose. Years later, when General Obasanjo returned to national leadership in a civilian capacity and renewed emphasis on agriculture and food security, that childhood moment assumed even deeper meaning. It

reinforced an enduring lesson that leadership carries responsibility not only for power and policy, but for the sustenance and wellbeing of the people. In a way that only time and reflection can reveal, those early encounters with national leadership and agricultural reform planted seeds that would later find expression in my scholarly commitment to sustainable food security. Owing to my father's military postings, our family life involved frequent relocation across the country. I later left Maalam Maiduri to join my father in Ibadan, and subsequently he was moved to the Nigerian Army School of Military Engineering (NASME), Makurdi following further transfers. These movements afforded me the rare privilege of traversing diverse regions of Nigeria at an early age, exposing me to varied cultures, social systems, and lived realities. This early national mobility broadened my world view, nurtured my adaptability, and instilled a deep sense of national consciousness in me. Collectively, these my life experiences, birth amid wartime uncertainty, rescue through maternal courage, upbringing within military discipline, structured youth engagement through scouting, early exposure to national leadership, awareness on agricultural reform initiatives, and extensive movement across the nation, laid a firm foundation for resilience, discipline, adaptability, and service. These attributes have remained integral to my character and have continued to inform my academic pursuits and enduring commitment to addressing national challenges through scholarship.

My formal education continued at **St. John's Catholic Primary School, Eleta, Ibadan**, where I received foundational instruction that emphasized discipline, moral responsibility, and academic diligence. This early grounding provided the structure upon which my subsequent educational pursuits were built. I proceeded to **Ibadan City Academy** for my secondary education, where my intellectual interests were further shaped and refined. It was during this period that my inclination toward the biological sciences and their relevance to human welfare began to crystallize, laying the groundwork for my future academic direction. In pursuit of a deeper understanding of food production systems, I undertook my first degree at **Edo State University, Ekpoma—now Ambrose Alli University**—where I obtained a **Bachelor of Agriculture (B. Agric.) in Animal Science (Animal Option)**. My undergraduate training exposed me to the scientific principles underlying animal production and health, with particular emphasis on the effect of diseases as a major constraint to food availability and productivity. This experience strengthened my resolve to engage in scholarly work that addresses factors limiting food security. Omoike (2006), found that the most prevalent diseases affecting small ruminants in Edo State areas include **pneumoenteritis, pneumonia, diarrhoea, helminthiasis, and mange. Notably,**

mange emerged as a significant threat among goats, whereas helminthiasis posed a greater challenge for sheep and it was established that the incidence of major diseases peaks during the **wet season** (Omoike et al., 2014). Building upon this foundation, I advanced to postgraduate studies at the **University of Ibadan, Ibadan**, where I pursued both my **Master's and Doctorate degrees in Aquaculture and Fisheries Management**. This transition represented a deliberate broadening of my scholarly focus from terrestrial livestock systems to aquatic food systems, in recognition of the critical role of fisheries and aquaculture in meeting the protein needs of a growing population. My postgraduate training at the University of Ibadan provided advanced competence in aquatic resource management, environmental sustainability, and food security-oriented research. Omoike & Falaye (2007) investigated the inland water fisheries management model in Nigeria, looking into the edict enforcement to curb unethical usage of inland fisheries, where we recommended **Routine, multidisciplinary resource assessment and monitoring** of inland waters (**SDG 13, SDG 14**), **strengthened enforcement mechanisms** with adequate surveillance infrastructure (**SDG 16 – Peace, Justice and Strong Institutions**), **stakeholder participation and institutional collaboration**, including tertiary institutions located near water bodies (**SDG 17 – Partnerships for the Goals**) and **Public sensitization on non-consumptive uses** of aquatic resources, including recreation and ecotourism (**SDG 11, SDG 13**). Collectively, this educational trajectory—spanning primary, secondary, undergraduate, and postgraduate study—reflects a coherent and intentional academic progression anchored in the pursuit of sustainable food security. Each stage of my education contributed incrementally to my understanding of biological systems, environmental interactions, and management paradigms that now underpin my scholarly contributions in aquaculture and artisanal fisheries. My academic career has been guided by a deliberate and enduring commitment to sustainable food security. From the outset, my scholarly choices were informed by the understanding that food security lies at the heart of human development, national stability, and social wellbeing. As God would have it, the very national leadership whose early agricultural vision left an impression on my childhood also provided, many years later, the university platform on which I stand today as a Professor. I view this convergence not merely as coincidence, but as a reminder that personal journeys, national history, and scholarly purpose are often more deeply connected than we initially realise. These personal, national, and professional experiences converge on the central question that anchors this inaugural lecture:

How can we increase fish production and improve livelihoods without

exhausting the very waters that sustain us?

This question speaks to science, ethics, governance, and responsibility. It reflects the enduring lesson that sustainable development requires foresight, stewardship, and deliberate management. It is within this context that this lecture examines sustainable food security through environmental and management paradigms from the perspectives of aquaculture and artisanal fisheries.

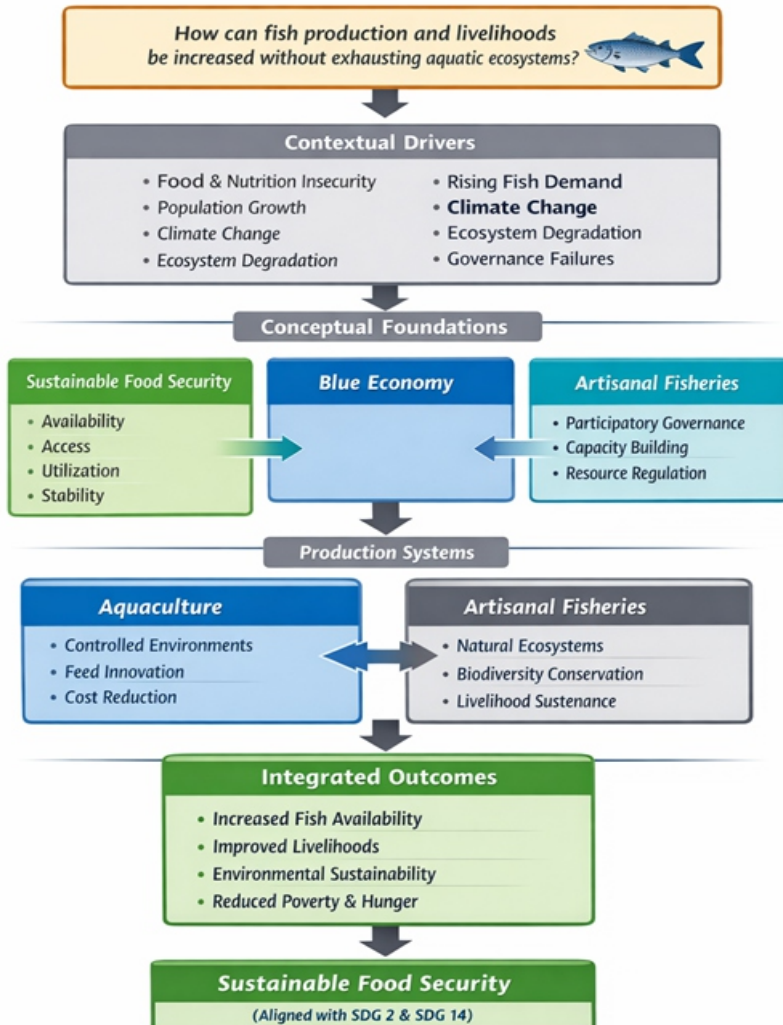


Figure 1: Environmental and Management Paradigm for Sustainable Food Security.

Vice-Chancellor, distinguished ladies and gentlemen, the chart displayed before you is not merely illustrative. It is the conceptual frame upon which this entire lecture is structured. Every argument, example, and analysis that follows is organized around the logic embedded in this framework.

At the top is the guiding question: *How can fish production and livelihoods be increased without exhausting aquatic ecosystems?* This question serves as the intellectual anchor of the lecture and defines the balance between productivity and sustainability that underpins all subsequent analysis. Beneath this are the contextual drivers: food and nutrition insecurity, population growth, rising fish demand, climate change, ecosystem degradation, and governance failures. These drivers define the real-world pressures shaping aquatic food systems and explain why new environmental and management approaches are required. The lecture then draws on three conceptual foundations: sustainable food security, the blue economy, and artisanal fisheries governance. Together, they provide the lens through which evidence and policy are interpreted. From these foundations emerge the production systems of aquaculture and artisanal fisheries, treated here as complementary rather than competing systems. Their interaction leads to integrated outcomes of increased fish availability, improved livelihoods, environmental sustainability, and reduced poverty and hunger. These outcomes culminate in sustainable food security aligned with Sustainable Development Goals 2 and 14. As the lecture progresses, each of these layers will be examined in turn, following the logic of this framework.

Food Security in Africa and Nigeria: Rethinking Abundance, Scarcity, and Sustainability

Vice-Chancellor, distinguished colleagues, ladies and gentlemen,

Food security remains one of the most profound and enduring challenges confronting humanity in the twenty first century. It is a challenge that goes far beyond the question of food availability to encompass access, utilization, stability, and sustainability. In Africa, this challenge assumes a particularly paradoxical character. The continent is richly endowed with extensive land resources, vast inland and marine waters, and abundant biodiversity, yet it continues to record some of the highest levels of hunger and malnutrition globally. As the world approaches the 2030 target of the Sustainable Development Goals, Africa remains significantly off track in achieving Goal 2, which seeks to end hunger and ensure food and nutrition security for all (FAO, 2019). This is corroborated by Adeosun et al. (2015) which posited that despite

the significant contribution of Ogun River on the livelihood of the respondents, it had no significant impact ($P>0.05$) on the security of food for people in this village. The research was carried out to determine the Socio-Economic Impact of Ogun River on Food Security at Opeji Village, Nigeria. More than 100 million Africans currently experience extreme food insecurity, despite decades of development interventions and policy reforms (Africa Center for Strategic Studies, 2021). This persistent condition demands a critical reassessment of how food security has been conceptualized, pursued, and governed across the continent. It suggests that Africa's food crisis is not fundamentally the result of natural resource scarcity, but rather the outcome of governance deficits, institutional weaknesses, environmental degradation, and unsustainable food systems that fail to translate resource abundance into human wellbeing. Within this broader context, fisheries and aquaculture offer a particularly revealing lens through which we can examine the contradictions of abundance and deprivation. Fish occupies a unique and often underestimated position in Africa's food and nutrition landscape. For more than 30 percent of the continent's population, fish constitutes the main or sole source of animal protein, supplying essential amino acids and micronutrients that are vital for physical growth, cognitive development, and disease resistance (Tran et al., 2019; Obiero et al., 2019). In many coastal, riparian, and inland communities, fish is not merely a dietary preference but a nutritional necessity that underpins household food security. Beyond its dietary significance, the fisheries sector plays a critical socioeconomic role across Africa. It supports millions of livelihoods across capture, farming, processing, transportation, and marketing activities, while contributing meaningfully to national and regional economies (Kawarazuka & Béné, 2011; Béné et al., 2016; Chan et al., 2019). Fisheries therefore occupy a strategic position at the intersection of food security, employment creation, poverty reduction, and social stability. Yet, despite these multiple contributions, the sector has remained peripheral within mainstream food security discourse and policy, which have historically privileged terrestrial agriculture and staple crops. The limited contribution of fisheries to food security outcomes in Africa is closely linked to the deepening crisis in capture fisheries. Historically, capture fisheries formed the backbone of fish supply across the continent, particularly for low-income households. Today, however, these systems are under severe strain. Over exploitation of fish stocks, habitat destruction, illegal fishing practices, weak regulatory enforcement, and the accelerating impacts of climate change have collectively undermined the

productivity and resilience of wild fisheries (Hara, 2011; Cohen et al., 2016; Ntshane & Gambiza, 2016). As a result, capture fisheries are increasingly unable to meet the demands of a rapidly growing and urbanizing population with changing dietary preferences (Gordon et al., 2013; Obiero et al., 2019). Nigeria provides a particularly instructive and intensified example of these dynamics. As Africa's most populous nation, Nigeria also has the highest demand for fish on the continent. Fish accounts for a substantial share of animal protein consumption across income groups, yet domestic production remains persistently inadequate. The resulting supply deficit, estimated at over two million metric tonnes annually, has entrenched heavy dependence on fish imports and exposed the national food system to external shocks, currency volatility, and global supply disruptions (Cai et al., 2017; FAO, 2018). This situation persists despite Nigeria's extensive inland waters, long coastline, and decades of fisheries development efforts. The Nigerian experience underscores the limitations of conventional food security strategies that emphasize production volume without sufficient attention to sustainability, equity, and system integration. In response to the declining performance of capture fisheries, aquaculture has emerged as the fastest growing food production sector in Africa. Between 1995 and 2018, aquaculture output on the continent increased more than twenty-fold, driven largely by freshwater finfish production in a small number of countries, including Egypt, Nigeria, Uganda, and Ghana (Adeleke et al., 2021; Halwart, 2020). This rapid growth has repositioned aquaculture as a central pillar of future fish supply.

In Nigeria, aquaculture development has been particularly dynamic. Catfish farming, concentrated in peri urban and urban fringe areas, has expanded rapidly, generating employment, stimulating private investment, and contributing significantly to domestic fish supply (Adewumi & Olaleye, 2011; BusinessDay, 2017). This growth demonstrates the sector's capacity to respond to market demand and reduce dependence on imports. However, it also exposes deep structural constraints that limit its broader contribution to food and nutrition security.

High feed costs, unreliable access to quality fingerlings, weak extension services, limited access to affordable finance, and governance challenges continue to constrain aquaculture productivity, particularly among small scale producers who supply a significant share of domestic markets (Adeoye et al., 2012; Chan et al., 2019). Consequently, increased production has not automatically translated into affordable fish for low-income households or into

meaningful reductions in malnutrition. This disconnect highlights a critical lesson: production growth, when pursued in isolation, does not guarantee food security. At the core of this challenge lies a conceptual and institutional fragmentation. Fisheries and aquaculture have often been treated as sector specific or environmental concerns rather than integral components of national food systems. Fisheries management has traditionally emphasized conservation, stock sustainability, and economic efficiency, while food security policies have focused primarily on staple crops such as cereals and roots, marginalizing fish as a strategic food resource (HLPE, 2014; Bennett et al., 2021). This separation has limited policy coherence and weakened the contribution of aquatic food systems to broader development goals. What is required, therefore, is a fundamental paradigm shift. Food security must be reconceptualized as a sustainability driven food systems challenge rather than a narrow production problem. Such a perspective recognizes that food security emerges from the interaction of ecological resilience, institutional capacity, technological innovation, inclusive value chains, and social equity. Within this framework, sustainable aquaculture and well governed artisanal fisheries assume a central role, not only as sources of food, but as instruments for social inclusion, environmental stewardship, and economic resilience. When supported by effective governance, science informed management, reliable feed and seed systems, strengthened research and extension services, and improved market access, aquaculture can increase fish availability while reducing pressure on declining wild stocks (Troell et al., 2014). At the same time, strengthening artisanal fisheries governance can enhance sustainability, protect livelihoods, and ensure equitable access to aquatic resources. Together, these systems can form the backbone of resilient aquatic food systems capable of withstanding environmental, economic, and social shocks. Distinguished colleagues, the evidence from Africa and Nigeria leads to a clear conclusion. The challenge before us is not simply to produce more food, but to produce it sustainably, distribute it equitably, and govern it responsibly. Fish and aquaculture must no longer be viewed as peripheral sectors, but as central pillars of inclusive and resilient food systems. Aligning production growth with sustainability principles is not optional; it is imperative for Africa, and Nigeria in particular, to secure the nutritional wellbeing of present and future generations (FAO, 2019; Chan et al., 2019)

Conceptual and Paradigmatic Foundations of Sustainable Food Security

In an inaugural lecture, it is important not only to present findings, but also to

make explicit the ideas and convictions that have guided a lifetime of scholarship. This section therefore sets out the conceptual and paradigmatic foundations upon which this lecture rests. It explains how aquaculture and artisanal fisheries are approached, not as isolated sectors, but as interconnected pathways to sustainable food security. At the heart of this lecture lies a simple but demanding question that has shaped my academic journey: **How can fish production and livelihoods be increased without exhausting the very waters that sustain us?** This question is both scientific and ethical. It asks not only how much food we can produce, but how responsibly we can manage the natural systems upon which that production depends.

Conceptual Foundations of the Lecture

At the core of this lecture are three closely connected ideas that shape its intellectual direction and give coherence to the arguments I will develop. These ideas are the Blue Economy, artisanal fisheries, and sustainable food security. They are not abstract theories discussed for their own sake. Rather, they are practical lenses through which we can understand how aquatic resources can be managed to nourish people, sustain livelihoods, and protect the environment over time. Let me begin with the Blue Economy, which provides the broad development framework for this lecture. The Blue Economy refers to the sustainable use of aquatic resources including oceans, seas, rivers, lakes, wetlands, and coastal environments for economic growth, improved livelihoods, and job creation, while maintaining the health and resilience of aquatic ecosystems (UNEP, 2015; World Bank & United Nations, 2017). It represents a deliberate shift away from extractive, short term exploitation toward a long-term development vision in which water-based resources are treated as strategic national assets. In simple terms, the Blue Economy asks a fundamental question: how do we benefit from our waters without destroying them? This question is particularly important for Nigeria. We are a country richly endowed with inland waters, a long Atlantic coastline, and diverse aquatic ecosystems, yet, despite this abundance, we remain heavily dependent on fish imports and struggle with persistent food insecurity (FAO et al., 2024; WorldFish, 2025). The emergence of Nigeria's Blue Economy framework, supported by the creation of a dedicated ministry, reflects a growing recognition that aquatic resources have been underutilized, poorly managed, and insufficiently integrated into national development planning (National Hydrographic Agency, 2024; Anammah & Ezenyimulu, 2024). However, the Blue Economy is not a guarantee of success. It is a framework, not a miracle. Its success depends on how well we balance

utilisation with conservation, growth with restraint, and economic ambition with ecological responsibility (World Bank, 2025).

Within this broader Blue Economy lies a sector that is often overlooked but absolutely central to food security and livelihoods across Africa and Nigeria: artisanal fisheries. Artisanal fisheries are small scale, community-based fishing systems that rely on simple gear, family labour, and close interaction with local ecosystems (FAO, 2004, 2015). They may appear modest when compared with industrial fishing or large-scale aquaculture, but collectively they provide affordable protein for millions of households and employment for a vast number of people along our rivers, lakes, and coastal communities (FAO, Duke University, & WorldFish, 2023a, 2023b).

For many Nigerians, fish from artisanal fisheries is not a luxury item. It is the most accessible and reliable source of animal protein (Hendriks, 2022). Beyond food, artisanal fisheries sustain cultural traditions, social networks, and local economies that have evolved over generations. Artisanal fishers are not merely harvesters of fish; they are custodians of indigenous ecological knowledge. Through lived experience, they understand seasonal changes, breeding cycles, migratory patterns, and ecosystem signals in ways that formal science often struggles to replicate (March & Failler, 2023).

Yet, despite their importance, artisanal fisheries are among the most vulnerable components of our aquatic systems. They face declining fish stocks, environmental degradation, pollution, climate variability, weak governance, and increasing competition from industrial and illegal fishing operations (FAO, Duke University & WorldFish, 2023b; March & Failler, 2023). What is important to emphasise here is that this vulnerability is not a result of ignorance or irresponsibility on the part of artisanal fishers. Rather, it reflects systemic failures in management, regulation, and policy (FAO, 2015). When fishers are excluded from decision making and left without institutional support, overexploitation often becomes a survival strategy rather than a deliberate choice.

This leads us naturally to the third concept that anchors this lecture: sustainable food security. Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food for an active and healthy life (FAO, 1996; World Bank, 2024). It rests on four pillars: availability, access, utilisation, and stability. Sustainability adds a critical dimension by asking whether today's food systems can continue to deliver these outcomes tomorrow without undermining future generations (Makombe, 2023).

In Africa, and particularly in Nigeria, food insecurity is often discussed as a problem of insufficient production. But the evidence tells a different story. Food insecurity in the region is driven largely by governance failures, institutional weaknesses, environmental degradation, and fragmented food systems rather than absolute scarcity (FAO et al., 2024; Food Security Portal, 2024). Fish plays a vital nutritional role, yet its contribution to food security remains constrained by declining capture fisheries and uneven aquaculture development (WorldFish, 2025).

The central argument I advance in this lecture is that food security cannot be achieved through production expansion alone. Increasing output without protecting ecosystems, strengthening institutions, and supporting livelihoods simply shifts crisis into the future (Makombe, 2023; Hendriks, 2022). Sustainable food security requires integrated food systems in which aquaculture growth complements artisanal fisheries, governance systems protect both people and ecosystems, and environmental integrity is treated as a foundation rather than an afterthought (FAO et al., 2024).

When these three concepts are viewed together, their relationship becomes clear. The Blue Economy provides the development vision and policy space (World Bank & United Nations, 2017). Artisanal fisheries represent the human, cultural, and livelihood dimension of aquatic systems (FAO, 2015; George et al., 2021). Sustainable food security defines the societal outcome toward which all environmental and management efforts must be directed (FAO, 1996; World Bank, 2024). Together, they form the conceptual foundation of this lecture and justify the environmental and management paradigm that will guide the discussions that follow.

As we proceed, these concepts will help us understand why managing our waters wisely is not simply an environmental concern, but a moral, economic, and developmental imperative. For how we manage our aquatic resources today will determine not only how well we feed ourselves now, but how secure the future will be for generations yet unborn.

The Environmental Paradigm: Stewardship as the Foundation

A central message of this lecture is that no food system can survive in a degraded environment. Aquatic ecosystems such as rivers, lakes, wetlands, floodplains, and coastal waters form the ecological foundation upon which both fisheries and aquaculture depend. When these systems are polluted, fragmented, or excessively exploited, fish stocks decline, productivity collapses, and livelihoods are undermined. This relationship has been consistently demonstrated across

inland and marine systems, particularly in the Global South, where dependence on aquatic resources is highest (FAO, 2022; World Bank, 2023).

Environmental degradation is therefore not an abstract ecological concern. It translates directly into hunger, poverty, conflict, and social instability. Declining water quality reduces fish survival and growth, habitat loss eliminates breeding and nursery grounds, and sedimentation alters trophic dynamics, often favouring a few resilient species at the expense of biodiversity (Welcomme et al., 2010; Cowx and Portocarrero Aya, 2011). In artisanal fishing communities, these ecological changes manifest as declining catches, increased fishing effort, and deepening vulnerability.

Recognising this reality, this lecture advances an environmental paradigm centred on stewardship rather than exploitation. Stewardship acknowledges that aquatic ecosystems have limits and that long term productivity depends on maintaining ecological integrity. The paradigm therefore prioritises ecosystem-based management, effluent control, water recycling, and nutrient reuse within aquaculture systems, all of which reduce pollution loads and improve resource efficiency (Boyd et al., 2020). It also emphasises the protection of critical habitats such as spawning and nursery grounds, seasonal closures in artisanal fisheries to align harvesting with reproductive cycles, and the integration of traditional ecological knowledge with scientific assessment (Berkes, 2018; FAO, 2021).

The guiding principle is clear and uncompromising. Sustainability begins with stewardship. Without healthy waters, aquaculture intensification becomes environmentally self-defeating, and fisheries management reforms lose their ecological foundation. Environmental integrity is not an optional addition to food security. It is its precondition.

The Management Paradigm: The Human Dimension of Sustainability

Environmental integrity alone, however, is not sufficient. Even the most productive ecosystems can fail under poor governance, weak institutions, and inequitable access. Management therefore represents the human dimension of sustainability and shapes how resources are accessed, allocated, used, and conserved over time.

In the context of artisanal fisheries, this lecture identifies three interrelated pillars of effective management. The first is participatory governance, which actively involves fishers and local communities in decision making processes. Decades of evidence show that when resource users participate in rule setting and monitoring, compliance improves, conflict declines, and stewardship

behavior increases (Ostrom, 1990; Jentoft and Chuenpagdee, 2015).

The second pillar is capacity development. Sustainable management requires skills in data collection, interpretation, adaptive decision making, and institutional coordination. Where fishers and local institutions lack access to training, information, and organisational support, management frameworks often fail regardless of ecological potential (FAO, 2016; World Bank, 2020).

The third pillar is resource conservation, achieved through regulated harvesting, habitat protection, gear control, and enforcement mechanisms that are perceived as legitimate and fair. Conservation measures are most effective when they are socially embedded rather than externally imposed, balancing ecological objectives with livelihood realities (Béné et al., 2016).

Together, these approaches transform fishers from perceived exploiters into co-managers and custodians of aquatic ecosystems. Where such arrangements exist, evidence consistently points to improved equity, enhanced resilience, and more stable fish stocks over time (Gutierrez et al., 2011).

Aquaculture as a Strategic Pathway to Food Security

Within this environmental and management context, aquaculture occupies a central place in this lecture as the fastest growing response to declining wild fish stocks. Globally and across Africa, aquaculture now accounts for the majority of growth in fish supply, bridging the widening gap between demand and capture fisheries production (FAO, 2022).

Aquaculture offers controlled environments in which productivity can be increased while reducing pressure on natural ecosystems. It creates employment, stimulates rural economies, and provides a reliable source of affordable animal protein. However, its promise is constrained by persistent challenges, particularly the high cost of fish feed, which can account for up to seventy percent of production costs in small and medium scale systems. Dependence on imported feed ingredients exposes farmers to price volatility, while limited access to credit, technology, and extension services restricts participation by small scale producers (Tacon and Metian, 2015; WorldFish, 2021).

Drawing from my research, this lecture demonstrates how locally sourced feed alternatives, improved biological and hatchery management, and environmentally responsible production systems can reduce costs, enhance sustainability, and lessen dependence on capture fisheries. By recycling agricultural by products, improving feed efficiency, and integrating aquaculture

with farming systems, production can expand without expanding environmental footprints.

In this sense, aquaculture is repositioned not merely as a production system, but as a strategic pathway to sustainable food security, complementing rather than replacing artisanal fisheries.

Integrating Environment, Management and Production

The paradigms discussed converge within the conceptual framework presented earlier in this lecture. Environmental integrity provides the foundation, management provides direction, and production systems deliver outcomes that advance food security, livelihoods, and resilience.

Aquaculture and artisanal fisheries are therefore not competing systems. They are complementary pathways within a shared socio ecological system. Aquaculture increases supply through controlled production, while artisanal fisheries sustain biodiversity, culture, and livelihoods through natural ecosystems. Both depend on healthy waters and effective governance.

The central lesson is this: food security is not achieved by choosing between production and conservation, but by integrating them through stewardship and sound management. It is only by aligning environmental integrity with human institutions and production systems that we can increase fish production and improve livelihoods, without exhausting the very waters that sustain us.

My Research Contributions and Innovations

Distinguished Vice-Chancellor, members of Senate, colleagues, ladies and gentlemen,

My research contributions are anchored in a sustained engagement with a central and pressing question: **how can aquatic resources be harnessed to enhance food security and livelihoods without compromising ecological integrity.** This question arises directly from the realities confronting developing economies, particularly in Sub-Saharan Africa, where rapid population growth, accelerating urbanisation, and changing dietary patterns have intensified demand for affordable animal protein. At the same time, the natural systems that support fish production are under growing stress from overexploitation, habitat degradation, pollution, and weak governance structures (FAO, 2024; World Bank, 2023).

Fish occupies a unique and strategic position within this challenge. Although it is nutritionally rich, culturally acceptable, and often more affordable than other

animal protein sources yet both capture fisheries and aquaculture systems face serious constraints. Inland capture fisheries show evidence of stagnation and decline due to overfishing and ecosystem degradation, while aquaculture expansion is constrained by high feed costs, inconsistent seed quality, poor early life survival, and inefficient production systems (Omoike, 2018; Falaye et al., 2019). My research has therefore been guided by the conviction that food security and environmental sustainability must be pursued together through improved management and system design, rather than treated as competing objectives.

Over time, this engagement has crystallized into a coherent and cumulative body of scholarship spanning aquaculture nutrition, reproductive and hatchery management, integrated production systems, and inland fisheries ecology. Although these research strands operate at different biological and spatial scales, they are united by a common analytical premise: durable productivity gains are achieved through biological efficiency and management innovation rather than intensified extraction of natural resources (Omoike and Falaye, 2020; Omoike et al., 2021). Collectively, these studies articulate an environmental and management paradigm for sustainable aquatic food systems.

Aquaculture Nutrition: Methods, Results, and Implications

A substantial proportion of my research has focused on aquaculture nutrition because feed represents the most critical interface between production efficiency, profitability, and environmental sustainability. In Nigeria and much of Sub-Saharan Africa, feed accounts for 50 to 70 percent of total aquaculture production costs, making it the single most important determinant of enterprise viability (Falaye et al., 2016; Omoike et al., 2018). Dependence on imported fishmeal and maize further exposes producers to price volatility, foreign exchange constraints, and direct competition with human food systems.

Methodologically, my feeding trials were designed as controlled laboratory and semi-intensive experiments, primarily involving African catfish *Clarias gariepinus* and Nile tilapia *Oreochromis niloticus*. Diets were formulated to be isonitrogenous, typically within the range of 35 to 40 percent crude protein, to ensure that observed differences in growth performance could be attributed to ingredient substitution rather than protein level. Proximate composition of feeds and fish carcasses was determined using AOAC standard procedures, while water quality parameters such as temperature, dissolved oxygen, and pH were monitored throughout the trials to minimize confounding effects.

Growth performance was assessed using standard aquaculture indices including weight gain, specific growth rate, feed conversion ratio, protein efficiency ratio, and survival rate. Statistical analyses were conducted using one way analysis of variance, with post hoc mean separation tests applied at p less than 0.05 to ensure robustness of inference (Falaye et al., 2016; Omoike and Ajose, 2018).

Across multiple experiments, conventional feed ingredients were systematically replaced with locally available alternatives including poultry offal meal, cowpea hull meal, tropical almond kernel meal, maize bran, noodle waste, brewer's dried grain, and toadmeal (Omoike et al., 2018; Falaye et al., 2019; Omoike and Falaye, 2020). A synthesis of these feeding trials is presented in Table 1, which summarises inclusion levels, growth performance relative to control diets, feed conversion efficiency, and estimated cost reductions.

Table 1: Alternative Feed Ingredients Evaluated Across Studies

Alternative Ingredient	Fish Species	Inclusion Level (%)	Growth Performance vs Control	FCR Range	Cost Reduction (%)	Key Finding
Poultry offal meal	<i>Clarias gariepinus</i>	0–90	Comparable up to 30%	1.4–1.6	~25	Safe partial fishmeal replacement
Cowpea hull meal	<i>C. gariepinus</i>	0–100	Improved at ≥50%	~1.5	~30	High inclusion feasible
Tropical almond kernel	<i>C. gariepinus</i>	0–75	Optimal at 75%	~1.3	~35	Roasting improves digestibility
Maize bran	<i>O. niloticus</i>	0–100	Equal or better	~1.4	~20	Energy source substitution
Noodle waste	<i>O. niloticus</i>	0–100	Optimal at 25%	~1.5	~30	Waste valorisation
Brewer’s dried grain	<i>C. gariepinus</i>	0–40	Comparable	~1.6	~25	Agro-industrial by-product
Toadmeal	<i>C. gariepinus</i>	0–100	Best at 100%	~1.3	~40	Full replacement viable

Empirically, these studies demonstrated that growth performance and survival were maintained across a wide range of substitution levels when ingredients were appropriately processed. Feed conversion ratios for alternative diets were consistently comparable to those of conventional maize or fishmeal-based diets, typically ranging between 1.3 and 1.6, with no statistically significant differences in many treatments. These efficiencies are illustrated in Figure 2, which compares feed conversion ratios across alternative and conventional diets.

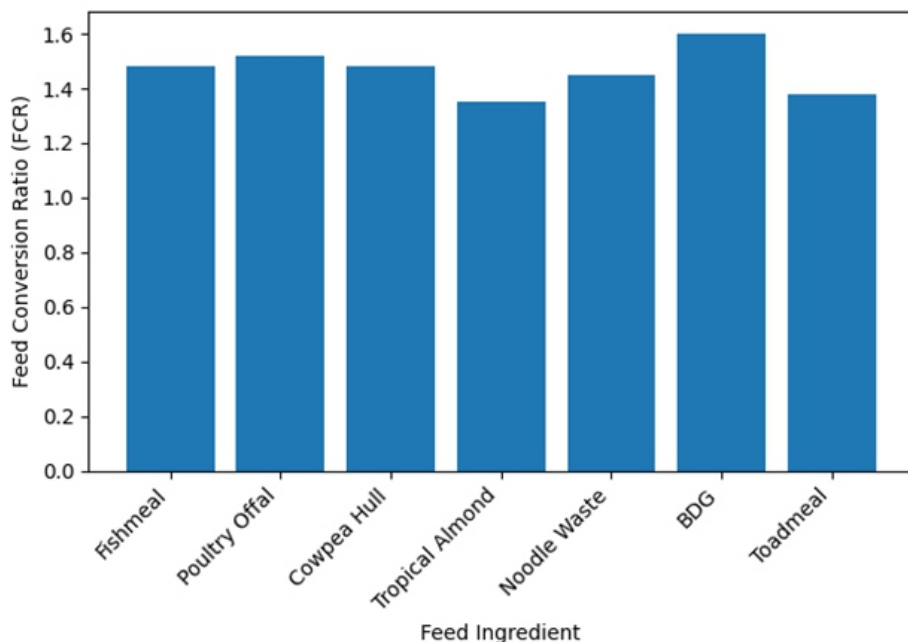


Figure 2: Feed Conversion Ratio Across Alternative Diets

Source: Compiled from feeding trials reported in Falaye & Omoike (2011); Omoike & Falaye (2012); Elezuo et al. (2018); Omoike et al. (2018, 2019, 2020)

Beyond biological performance, the economic implications of these findings are particularly significant. Several trials recorded 20 to 40 percent reductions in cost per kilogram of weight gain, especially in diets incorporating agro industrial by products such as brewer's dried grain and noodle waste (Omoike et al., 2018; Omoike and Falaye, 2020). These results demonstrate that alternative feeds not only sustain growth performance, but also enhance affordability and accessibility of aquaculture for small and medium scale producers.

Digestibility studies provided critical mechanistic insight into these outcomes. Using apparent digestibility coefficient analysis, often with inert markers, these studies demonstrated that processing methods such as boiling, roasting, soaking, and toasting significantly improved protein and energy digestibility, with differences statistically significant at $p < 0.05$ (Falaye et al., 2016; Omoike et al., 2019). Roasted tropical almond kernel meal and boiled legume-based ingredients consistently recorded higher digestibility values than raw forms, translating directly into improved feed utilisation and growth.

The broader contribution of this body of work lies in reframing aquaculture feed innovation as an environmental and governance strategy. By reducing dependence on fishmeal, these studies provide a pathway for lowering pressure on wild fish stocks, reducing competition between aquaculture and capture fisheries, and promoting circular use of agricultural and agro industrial residues. Feed sustainability, in this context, emerges not from technological sophistication, but from context appropriate optimisation of local resources.

Reproductive and Stock Management: Linking Physiology to Productivity

A second major strand of my research addresses reproductive and stock management, particularly in Nile tilapia culture systems where uncontrolled reproduction undermines growth efficiency, feed utilisation, and economic returns (Omoike et al., 2021). Early maturation and prolific spawning in mixed sex populations lead to overcrowding, stunted growth, and wide size variability, all of which reduce market value and increase production costs.

Methodologically, these studies employed controlled hatchery and grow out experiments, involving defined broodstock sex ratios, androgen treated feeds, and hapa based culture systems. Broodstock were stocked at ratios including one male to two females and one male to three females, and seed production was quantified through systematic counts of eggs, sac fry, and swim up fry. Sex determination in juveniles was conducted through gonadal examination, while growth, survival, feed conversion, and condition factor were monitored over culture periods ranging from 56 to 98 days (Omoike and Ajose, 2018; Omoike et al., 2021).

Results showed that female biased broodstock sex ratios, particularly one male to three females, produced significantly higher fry output than balanced or male dominated ratios, with differences statistically significant at p less than 0.05 (Omoike and Ajose, 2018). This finding demonstrates that hatchery productivity can be improved through management optimisation rather than expansion of broodstock numbers or infrastructure.

In sex reversal trials, androgen treated populations consistently achieved male proportions exceeding 90 percent, and mono-sex populations recorded significantly higher weight gain and specific growth rate than mixed sex controls. These differences are illustrated in Figure 3, which shows divergent growth trajectories between mono-sex and mixed-sex tilapia populations. Survival rates exceeded 90 to 95 percent, indicating that productivity gains were not achieved at the expense of fish health or welfare.

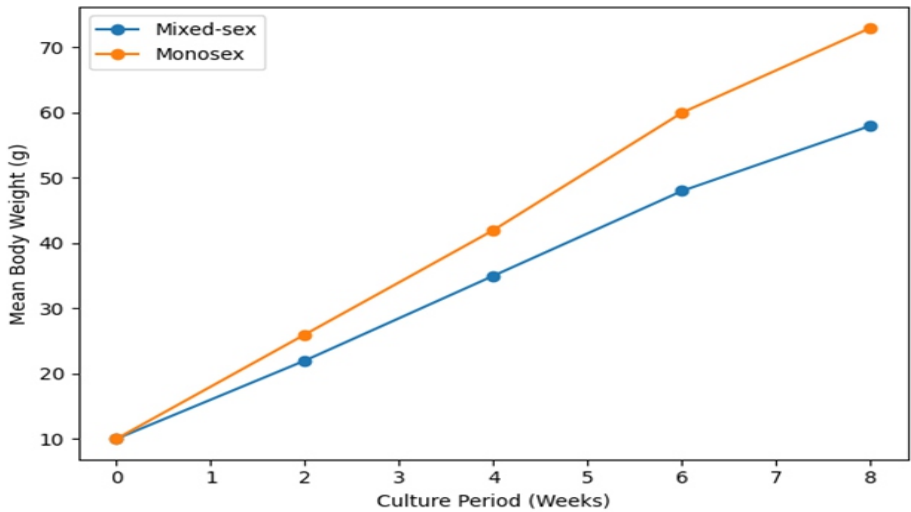


Figure 3: Growth Performance of Monosex vs Mixed-Sex Tilapia
Source: Adapted from Omoike et al. (2021) and Falaye & Omoike (2012).

A related study examined the gonadosomatic index, providing physiological insight into these growth patterns. Regression analysis revealed a statistically significant negative relationship between gonadosomatic index and somatic growth, with correlation coefficients confirming an inverse association at $p < 0.05$ (Omoike et al., 2019). This relationship is illustrated in Figure 4 and demonstrates that reproductive investment diverts metabolic energy away from growth.

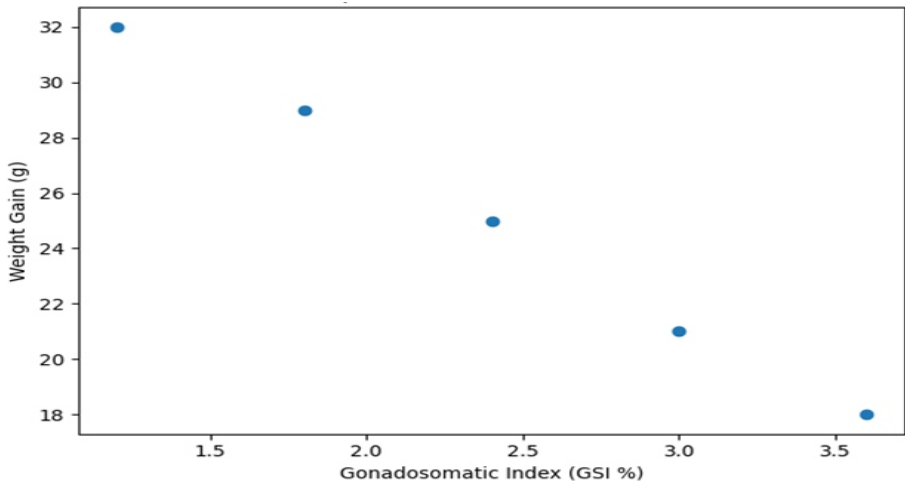


Figure 4: Relationship Between GSI and Somatic Growth
Source: Compiled from correlation analyses reported in Omoike et al. (2019).

These findings establish reproductive control not merely as a technical intervention, but as an efficiency enhancing and environmentally relevant management strategy. By reducing uncontrolled reproduction, reproductive management lowers feed wastage, organic loading, and metabolic inefficiencies within culture systems, thereby improving both economic performance and environmental outcomes.

Hatchery Biosecurity and Early Life Survival

My research has also addressed hatchery biosecurity and early life survival, an area often overlooked in discussions of aquaculture sustainability. Although high mortality during the hatchling stage is frequently treated as biologically inevitable yet empirical evidence from my studies suggests that it is largely management induced rather than biologically determined (Omoike et al., 2019).

In comparative experiments, hatchlings were cultured under siphoned and unsiphoned water management regimes, with all other conditions held constant. Microbial loads were assessed using total viable counts, total coliform counts, and biochemical identification of bacterial and fungal isolates, and statistical comparisons were conducted using analysis of variance.

Results showed a progressive and statistically significant increase in bacterial loads in unsiphoned systems, while siphoned systems maintained consistently lower microbial counts throughout the culture period at $p < 0.05$. Dominant bacterial genera included *Pseudomonas*, *Staphylococcus*, *Escherichia coli*, and *Streptococcus*. These contrasting trends are illustrated in Figure 5, which clearly demonstrates the suppressive effect of routine siphoning on microbial proliferation.

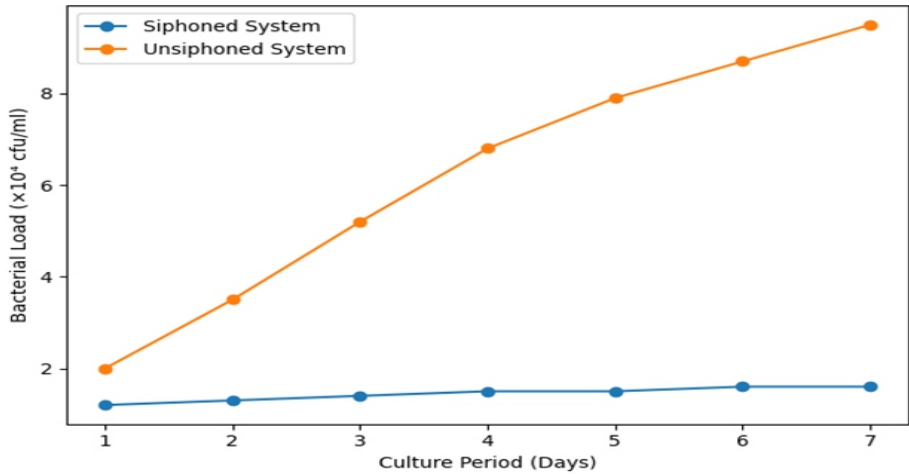


Figure 5: Bacterial Load in Hatchling Culture Systems
Source: Adapted from Omoike & Ajose (2019).

The implication of this finding is substantial. It shows that improvements in hatchery output can be achieved through simple, low-cost management interventions, without increasing broodstock numbers, water use, or capital investment. Hatchery sustainability, in this context, is primarily a function of management discipline rather than technological complexity.

Integrated Aquaculture Agriculture Systems: System Level Evidence

Beyond individual production units, my research extended to integrated aquaculture agriculture systems, particularly fish pig rice combinations, reflecting an interest in resource use efficiency at the system level (Falaye et al., 2019).

Methodologically, comparative experiments evaluated integrated fish pig rice systems against conventional monoculture systems using indicators such as fish growth, rice yield, water use efficiency, and physico chemical water parameters. Statistical analysis employed t tests and analysis of variance to assess differences between systems.

Integrated systems consistently recorded significantly higher fish weight gain and rice yield compared with conventional systems. Most notably, water use efficiency increased by ten to seventeen times, reflecting the effectiveness of nutrient recycling and water reuse within integrated systems. These advantages are summarised in Table 2, which compares performance indicators between integrated and conventional production models.

Table 2: Performance Comparison – Integrated vs Conventional Systems

Indicator	Integrated System	Conventional System	% Difference
Fish weight gain (g)	Higher	Lower	+25–30%
Rice yield (t/ha)	Higher	Lower	+40–50%
Water use efficiency	Very high	Low	×10–17
Input cost	Lower	Higher	–20–30%

Importantly, physico chemical parameters such as dissolved oxygen and pH remained within acceptable ranges, confirming that productivity gains were achieved through system redesign rather than environmental degradation. These findings demonstrate that sustainability is achieved not by limiting production, but by aligning biological processes and resource flows within integrated systems.

Inland Fisheries Ecology and the Limits of Extraction

Finally, my work on inland fisheries ecology provides the ecological context within which aquaculture development must be situated. Using stomach content analysis, diversity indices, and length weight relationships, my studies documented species composition, trophic structure, and adaptive feeding strategies in inland waters (Omoike, 2018).

Long term monitoring of Asejire Reservoir revealed declining species diversity, increasing dominance of resilient omnivorous species, and evidence of growth overfishing, reflected in truncated size distributions (Omoike et al., 2023). Complementary socio-economic studies demonstrated that proximity to aquatic resources does not automatically translate into improved food security without effective governance and livelihood integration (Adeosun et al., 2015). Together, these findings underscore the ecological limits of extraction-based food security strategies and highlight the necessity of ecosystem-based fisheries management.

Collectively, this body of work demonstrates that sustainable food security in aquatic systems is not the outcome of a single technology, species, or production model. Rather, it emerges from a continuous process of aligning biological efficiency with environmental responsibility. Across aquaculture nutrition, reproductive and hatchery management, integrated production systems, and inland fisheries ecology, the consistent insight is that productivity gains are most durable when achieved through improved management rather than intensified extraction.

The cumulative evidence from my work, and from the broader literature to which it speaks, strongly suggests that aquaculture and artisanal fisheries should not be framed as competing or mutually exclusive pathways to food security. Such a framing is analytically limiting and policy counterproductive. Rather, these systems represent distinct but complementary modes of aquatic food production, each operating under different ecological logics, temporal dynamics, and management requirements, yet contributing jointly to food security when properly aligned within a broader environmental and governance framework.

Aquaculture is fundamentally a controlled production system. Its strength lies in its capacity to expand supply predictably and efficiently through deliberate management interventions. By optimising feed formulation, regulating reproduction, improving early life survival, and integrating production systems,

aquaculture enables high output per unit of land and water. When properly managed, it reduces uncertainty, stabilises supply, and alleviates pressure on wild fish stocks. In this sense, aquaculture is not merely an alternative to capture fisheries. It functions as a buffering mechanism that absorbs growing demand for fish protein in contexts where natural systems can no longer sustain increased extraction.

Artisanal fisheries, by contrast, are embedded within natural and semi natural ecosystems. Their value extends beyond harvest volumes to include biodiversity conservation, cultural identity, social cohesion, and rural livelihoods. These fisheries function as socio ecological systems in which ecological processes, traditional knowledge, and community practices interact continuously. However, their long-term viability is contingent upon respect for ecological limits and the presence of effective governance arrangements. Where exploitation exceeds regenerative capacity, or where institutions fail to regulate access and effort, artisanal fisheries rapidly transition from engines of food security to sites of ecological decline and livelihood vulnerability.

What emerges clearly from this synthesis is that neither aquaculture nor artisanal fisheries can, in isolation, deliver sustainable food security. Aquaculture systems that ignore environmental integrity through excessive stocking densities, poor waste management, or continued reliance on wild fish inputs risk transferring ecological pressure from open waters to managed systems, thereby reproducing sustainability challenges in a different form. Conversely, artisanal fisheries that operate without effective management, ecological safeguards, or livelihood diversification risk eroding the very resource base upon which they depend, leading to declining catches, reduced incomes, and heightened food insecurity over time.

Sustainable outcomes therefore depend not on privileging one system over the other, but on recognising and managing their interdependence. Aquaculture and artisanal fisheries occupy different points along the continuum of control and natural variability. When strategically aligned, aquaculture can reduce fishing pressure on vulnerable stocks, while well managed artisanal fisheries can maintain ecosystem functions, genetic diversity, and cultural continuity. The role of governance is central in mediating this relationship through policy coherence, spatial planning, regulatory enforcement, and institutional coordination that recognises the differentiated roles of each system.

It is precisely at this intersection, where controlled production meets natural

ecosystems, that the central argument of this lecture is anchored. Sustainable food security does not emerge from technological advancement alone, nor from conservation in isolation, but from the co-evolution of environmental health and management innovation. Aquaculture contributes by expanding supply through efficiency, predictability, and system integration. Artisanal fisheries contribute by sustaining ecological balance, cultural heritage, and employment within natural systems. Governance provides the enabling framework that aligns incentives, enforces limits, and ensures that productivity gains in one domain do not generate ecological costs in another.

This integrated perspective moves beyond sectoral thinking and offers a more credible pathway for addressing contemporary food security challenges. It recognises that the future of fish production lies not in choosing between aquaculture and artisanal fisheries, but in designing management systems that allow both to function within their ecological capacities while reinforcing one another's strengths. Only through such an approach can fish production be increased in a manner that safeguards the waters, ecosystems, and communities upon which it ultimately depends.

From System Integration to Policy and Development Implications

Distinguished Vice Chancellor, members of Senate, colleagues, ladies and gentlemen,

The policy recommendations presented in Table 3 represent a logical extension of the integrated perspective advanced in this lecture. The table synthesises key policy domains emerging from the research by identifying the principal challenges, corresponding policy responses, and anticipated development outcomes. In doing so, it explicitly links empirical evidence from aquaculture nutrition, hatchery management, integrated production systems, and inland fisheries ecology to relevant Sustainable Development Goals. The table illustrates how evidence-based research can inform regulatory reform, guide investment priorities, promote inclusive participation, and strengthen environmental stewardship within fisheries and aquaculture governance frameworks.

Having established that aquaculture and artisanal fisheries function as complementary systems whose long-term sustainability depends on environmental integrity and effective management, the critical next step is to translate this conceptual understanding into deliberate and coordinated policy action.

Table 3: Policy Implications of Research Findings for Sustainable Fisheries and Aquaculture Development

Policy Domain	Key Issue Identified by Research	Policy Recommendation	Expected Development Outcome	Key Supporting Studies	Relevant SDGs
Regulatory Frameworks	Weak enforcement enables overfishing, poor hatchery practices, and environmentally harmful aquaculture expansion	Strengthen fisheries and aquaculture regulations with clear environmental standards, monitoring, and enforcement mechanisms	Reduced resource depletion, improved compliance, and long -term ecosystem sustainability	Omoike (2018); Omoike et al. (2023)	SDG 14 (Life Below Water); SDG 16 (Institutions)
Aquaculture Feed and Input Policy	Dependence on fishmeal and maize increases costs and pressure on wild stocks	Promote alternative feed ingredients through standards, incentives, and research support	Lower feed costs, reduced pressure on capture fisheries, strengthened local value chains	Falaye et al. (2011); Falaye et al. (2016); Omoike & Falaye (2020)	SDG 2 (Zero Hunger); SDG 12 (Responsible Consumption & Production); SDG 14
Extension Services and Capacity Building	Limited technical knowledge constrains adoption of improved feeding and hatchery practices	Invest in extension services, training programmes, and demonstration farms	Improved productivity, reduced mortality, and faster innovation uptake	Omoike et al. (2019); Omoike & Ajose (2019)	SDG 4 (Quality Education); SDG 2; SDG 8 (Decent Work & Growth)
Access to Finance and Credit	Small-scale producers lack capital to adopt improved technologies and integrated systems	Develop targeted credit schemes, low-interest loans, and insurance products	Increased investment, enterprise growth, and producer resilience	Adeosun et al. (2015); Omoike et al. (2019)	SDG 1 (No Poverty); SDG 8; SDG 10 (Reduced Inequalities)
Youth Inclusion	Ageing workforce and weak generational replacement	Introduce youth - focused training, incubation programmes, and start-up support	Job creation, innovation uptake, and long-term	Adeosun et al. (2015)	SDG 8; SDG 4; SDG 9 (Innovation)

Women Inclusion	Women's contributions in processing and marketing are under-supported	Implement gender-responsive policies that improve women's access to training, finance, and decision-making	Improved equity, household incomes, and food security	Adeosun et al. (2015)	SDG 5 (Gender Equality); SDG 2; SDG 8
Integrated Production Systems	Fragmented farming systems result in inefficient resource use and waste	Encourage integrated aquaculture–agriculture systems through incentives and land-use planning	Higher productivity, improved water-use efficiency, climate resilience	Falaye et al. (2019); Omoike et al. (2019)	SDG 2; SDG 6 (Clean Water); SDG 12; SDG 13 (Climate Action)
Artisanal Fisheries Management	Declining biodiversity and growth overfishing undermine livelihoods	Implement ecosystem-based fisheries management, including gear regulation and seasonal controls	Biodiversity conservation and stable artisanal livelihoods	Omoike (2004); Omoike (2018); Omoike et al. (2023)	SDG 14; SDG 1; SDG 2
Environmental Stewardship and Incentives	Unsustainable practices persist where environmental responsibility is unrewarded	Introduce incentives for best management practices and penalties for destructive activities	Behavioural change toward sustainability	Omoike et al. (2019); Falaye et al. (2019)	SDG 12; SDG 14; SDG 15 (Life on Land)
National Development Alignment	Sectoral policies operate in isolation from national and global goals	Align fisheries and aquaculture policies with national development plans and the SDGs	Policy coherence and measurable development impact	Adeosun et al. (2015); Omoike et al. (2023)	SDG 2; SDG 8; SDG 14; SDG 17 (Partnerships)

First, there is a clear need for stronger and more coherent regulatory frameworks. Governments must move beyond fragmented oversight and strengthen fisheries and aquaculture regulations that clearly define environmental standards, regulate fishing effort, and improve monitoring and enforcement. Such frameworks are essential not to restrict productivity, but to ensure that increased production does not erode the ecological foundations on which both aquaculture and artisanal fisheries depend.

Flowing from this is the recommendation to reform aquaculture feed and input policies. Public policy should actively support the use of locally available alternative feed ingredients through appropriate standards, incentives, and sustained research investment. Reducing dependence on fishmeal and maize will simultaneously lower production costs, reduce pressure on capture fisheries, and deepen local value chains, thereby aligning food security objectives with environmental stewardship.

Equally important is sustained investment in extension services and capacity building. Many of the management innovations discussed in this lecture, ranging from improved feeding and reproductive control to hatchery biosecurity and integrated production systems, require effective knowledge transfer to become impactful at scale. Strengthening extension systems, training programmes, and demonstration facilities is therefore indispensable for translating research outcomes into widespread practice.

These recommendations must be reinforced by improved access to finance and credit. Small scale fish farmers and artisanal fishers require affordable financial instruments, such as targeted credit schemes, concessional loans, and insurance products, to adopt improved technologies and management practices. Without such support, innovation remains confined to a limited segment of producers, and productivity gains cannot be sustained.

The policy pathway also demands deliberate social inclusion, particularly of youth and women. An ageing workforce and persistent gender barriers weaken the long-term viability of fisheries and aquaculture. Expanding access to training, entrepreneurship opportunities, and finance for youth and women is therefore both a social obligation and a strategic investment in innovation, employment, and sector renewal.

In addition, policy must actively promote integrated production systems. Supporting integrated aquaculture and agriculture models through land use planning, technical guidelines, and targeted incentives will improve water use efficiency, enhance waste recycling, and strengthen climate resilience. Such systems demonstrate how productivity gains can be achieved through system design rather than resource expansion.

Attention must also be directed towards artisanal fisheries management. Ecosystem based approaches, such as regulated gear use, seasonal controls, and continuous biodiversity monitoring, are essential to sustaining fish stocks and protecting livelihoods. These measures recognise that artisanal fisheries remain

a critical pillar of food security and cultural heritage, but only when ecological limits are respected.

Finally, all these recommendations converge on the need for policies that reward environmental stewardship and ensure national development alignment. Sustainable practices must be incentivised, while destructive activities are discouraged, if environmental responsibility is to become the rational choice. Aligning fisheries and aquaculture policies with national development strategies and the Sustainable Development Goals ensures coherence between local production systems and broader development aspirations.

In sum, the policy and development implications of this lecture reinforce a central conclusion: sustainable food security is not simply a technical achievement, but a governance outcome. It emerges when environmental health, management innovation, social inclusion, and policy coherence are deliberately integrated into a single development vision.

10. Conclusion and Call to Action

Distinguished Vice Chancellor, members of Senate, colleagues, ladies and gentlemen,

As this lecture draws to a close, it is important to return to the central insight that has guided the analysis, evidence, and reflections presented today. Food security is not measured by quantity alone. It is not defined solely by how much food is produced, harvested, or supplied to markets. Rather, true food security is measured by quality, equity, and resilience. It is measured by the nutritional value of food, by who has access to it, and by whether the systems that produce it can endure environmental, economic, and social pressures over time.

The evidence examined in this lecture demonstrates clearly that increasing fish production without regard to environmental integrity, management discipline, and governance coherence offers only short-term gains. Such an approach may raise output temporarily, but it ultimately undermines the ecological foundations upon which food systems depend. In contrast, productivity gains achieved through improved management, biological efficiency, and system integration are more durable, more inclusive, and more environmentally responsible.

This leads to a second and more demanding conclusion. Sustainability is not an accident of nature, nor an automatic outcome of technological progress. Sustainability is a choice. It is a choice shaped by science, guided by ethics, and enforced through governance. It reflects deliberate decisions about how

resources are accessed, how benefits are distributed, and how limits are respected. Where science informs management, where ethics guide decision making, and where institutions function effectively, sustainability becomes achievable. Where these elements are absent, degradation and insecurity follow, regardless of resource abundance.

Throughout this lecture, aquaculture and artisanal fisheries have been presented not as competing pathways, but as complementary systems whose contributions to food security depend on how wisely they are managed. Aquaculture demonstrates the power of controlled production to expand supply, reduce uncertainty, and relieve pressure on wild stocks, but only when it is environmentally responsible and socially inclusive. Artisanal fisheries remind us that food systems are also cultural systems, embedded in ecosystems, livelihoods, and traditions that cannot be replaced by technology alone. Both systems require healthy waters, informed management, and coherent policy frameworks to fulfil their potential.

The future of food security, therefore, does not depend simply on how much fish we harvest, but on how wisely we manage the waters from which that fish is derived. Rivers, lakes, wetlands, reservoirs, and coastal ecosystems are not infinite. They are living systems with thresholds and limits. When these limits are exceeded, recovery is slow and often incomplete. Managing waters wisely means recognising ecological boundaries, investing in stewardship, strengthening institutions, and aligning production goals with long term sustainability.

This understanding carries with it a clear call to action.

For scientists and researchers, the responsibility is to continue generating knowledge that is not only rigorous, but relevant. Research must move beyond description to solution-oriented inquiry, addressing the practical challenges of feed sustainability, reproductive control, hatchery survival, system integration, and ecosystem-based management. Equally important is the responsibility to communicate findings clearly to policymakers, practitioners, and communities, ensuring that science informs decision making at all levels.

For policymakers and institutions, the call is to translate evidence into action. Regulatory frameworks must be strengthened and enforced, not to constrain development, but to safeguard its foundations. Investment priorities must support research, extension, and capacity development. Policies must reward environmental stewardship, promote inclusion of youth and women, and align fisheries and aquaculture development with national and global sustainability

goals.

For producers, fishers, and practitioners, the call is to embrace management innovation as a pathway to resilience. Sustainable practices are not a burden, but an investment in long term productivity, stability, and livelihoods. Stewardship of aquatic resources is not a sacrifice of opportunity, but a means of securing it for future generations.

And for society as a whole, the call is to recognize that food security is inseparable from environmental responsibility. What we consume, how it is produced, and how resources are governed reflect collective values and priorities. A society that exhausts its waters in pursuit of short-term gain ultimately compromises its own future.

Distinguished colleagues, the message that emerges from this body of work is both simple and profound. If we must feed the growing world of tomorrow, we must begin by healing and managing the waters of today. In doing so, we affirm that sustainable food security is not merely a technical challenge, but a moral and developmental imperative. It is a commitment to future generations that the pursuit of nourishment will not come at the cost of the ecosystems that sustain life itself.

Appreciation and Acknowledgements

Distinguished Vice-Chancellor, members of senate, colleagues, ladies and gentlemen,

As I conclude this inaugural lecture, it is important to acknowledge that the journey reflected in this body of work has not been a solitary one. Research, teaching, and service within the university thrive through collaboration, mentorship, and institutional support, and I have been privileged to benefit from all three.

I give all glory, honour, and adoration to God Almighty, the giver of life, wisdom, and purpose, whose unfailing grace has guided me through every season of my life and academic journey. Through uncertainties and milestones, His direction has remained constant, and it is by His providence that I stand on this podium today. This inaugural lecture therefore represents not merely a personal academic milestone, but the fruit of a long journey shaped by divine enablement, perseverance, and the kindness and support of many individuals and institutions.

I acknowledge with deep appreciation **Chief Olusegun Obasanjo, GCFR, PhD**, whose visionary leadership opened new frontiers for higher education in Nigeria

through the approval of private universities, and particularly **Bells University of Technology, Ota**, which provided a nurturing platform that contributed immensely to my academic growth and professional development.

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Prof. Augustine Omoike

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INAUGURAL LECTURE SERIES.

(June 25, 2015 - March 25, 2026)

1. The 1st Inaugural Lecture titled: "Food Product Development, Quality Assurance and Nutrition: Whither the Humane Senses?" by Professor Olugbenga A. Ben Ogunmoyela of the Department of Food Sciences and Technology. June 25, 2015.
2. The 2nd Inaugural Lecture titled: "Crisis in Forest Conservation in Nigeria: Threats to Livelihoods and Human Survival" by Professor Gbadebo Jonathan Osemeobo of the Department of Biological Sciences. January 13, 2016.
3. The 3rd Inaugural Lecture titled: "Minerals, Metals & Materials: The Hidden Wealth of A Nation" by Professor Gabriel Oladipo Oluwadare of the Department of Biomedical Engineering. May 18, 2016.
4. The 4th Inaugural Lecture titled: "Fungal Impact on Man: From Waste to Health" by Professor Olubukola Kuforiji of the Department of Biological Sciences. March 8, 2017.
5. The 5th Inaugural Lecture titled: "Chemistry is Reaction: Reaction is Chemistry" by Professor Violette Nkechi Atasié of the Department of Chemical and Food Sciences. March 7, 2018.
6. The 6th Inaugural Lecture titled: "Man and Materials: The indivisible Entities" by Professor Ojo Sunday Fayomi of the Department of Mechanical Engineering. March 14, 2025.
7. The 7th Inaugural Lecture titled: "My Nigeria Food Story: Scarcity in the Midst of Plenty" by Professor Ngozi Ugo Arisa, Department of Food Science and Technology. September 24, 2025.
8. The Eighth (8th) Inaugural Lecture titled: "Radiation and Human Well-being: A Doubled-Edged Sword in our World – Balancing the Benefits and Risks" by Augustine Kolapo Ademola Professor of Radiation and Health Physics, Deputy Dean, COLNAS. Wednesday, 8th October, 2025
9. The Ninth (9th) Inaugural Lecture titled: "At the Crossroads of Hunger and Sustainability: Environmental and Management Paradigms in Aquaculture and Artisanal Fisheries" by Augustine Omoike, MfS, MANIFS, Professor of Aquaculture and Fisheries Management, Dean, College of Food, Agricultural Science & Technology. Wednesday, 25th March, 2026

