Norad

WorldFish CGIAR

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Annual Workshop Report

28 – 30 November 2022, WorldFish Penang, Malaysia

In partnership with

icipe CORAF SLU Swedish University of Agricultural Sciences ALLER AQUA ZAMBIA Natural Resources Development College

Annual Workshop Report

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Table of contents

Introduction

Workshop objectives

The purpose of the 2022 Annual workshop of the project "Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)" was to bring together project partners to meet in person, discuss the overall project goal and the specific project activities in each country, and conduct the 2023 annual planning for the FASA project.

Date and Venue

The workshop took place from the 28th to 29th November 2022 at WorldFish HQ, Penang, Malaysia, followed by a site visit to Fisheries Research Institute Malaysia, Pulau Sayak and Jitra Aquaculture Extension Centre in Kedah on the 30th November 2022. The first two days of the workshop was conducted both in-person and virtually (hybrid) to accommodate the participants who could not attend in person.

Workshop Participants

Thirty participants attended the first day, and 25 participants attended the second day of the workshop at the WorldFish Headquarter Penang. The participants were representatives from:

1. West and Central Africa Council for Agricultural Research and Development (CORAF)
2. International Centre of Insect Physiology and Ecology (ICIPE)
3. Swedish University of Agricultural Sciences (SLU)
4. Aller Aqua Zambia Limited
5. Includovate (Consultant for Gender and Social Inclusion)
6. NAGI Enterprise (Consultant for Climate Change and Environmental Assessment)
7. WorldFish Zambia Team Members
8. WorldFish HQ Malaysia Team Members

Workshop Activities

The detailed agenda of the workshop and detailed list of participants are in the Appendices A and B, respectively.

Plate1. Group photo taken on the 28th November 2022, during the first day of the FASA project Annual workshop with participants at WorldFish HQ, Penang, Malaysia.

Day 1: Presentations from FASA project partners

Opening

The workshop began with an opening speech of Dr. Mohammed Essam Yassin, the Interim Director General of WorldFish, who welcomed the participants and mentioned how important this project is for WorldFish and its partners, for the aquaculture sector in Africa and for people relying on fish to make a living. Then the participant listened to the recorded speech of Dr. John Benzie, the Acting Director of Aquatic Foods Biosciences, who introduced Aquatic Foods Biosciences Department of WorldFish, highlighting the relevance of fish feeds and nutrition research in contributing to reduce the yield gaps observed in the aquaculture sector in Africa. Thereafter, Dr. Rodrigue Yossa, the Project Leader, spoke on behalf of NORAD and delivered the Norad's welcome speech. Dr. Rodrigue Yossa also presented the objective of the workshop and the detailed agenda of the 3-day workshop. The first day of the workshop mainly focused on the introduction of the project partners and their understanding of their respective contributions to the FASA project, while the third day of the workshop was dedicated to site visits in Malaysia.

Presentations

The presentations were made by representatives of the partner institutions, and mainly included the following elements:

1. Introduction on partner organization and team,
2. Experience in fish feeds and Nutrition,
3. Understanding of the workplan to implement the FASA project in the project countries

Moreover, WorldFish project management and support teams presented on their role and involvement in the FASA project. Copies of the Power Point presentations of the Day 1 are in the **Appendices C** and **D**. The following are the main messages derived from each presentation delivered on the Day 1.

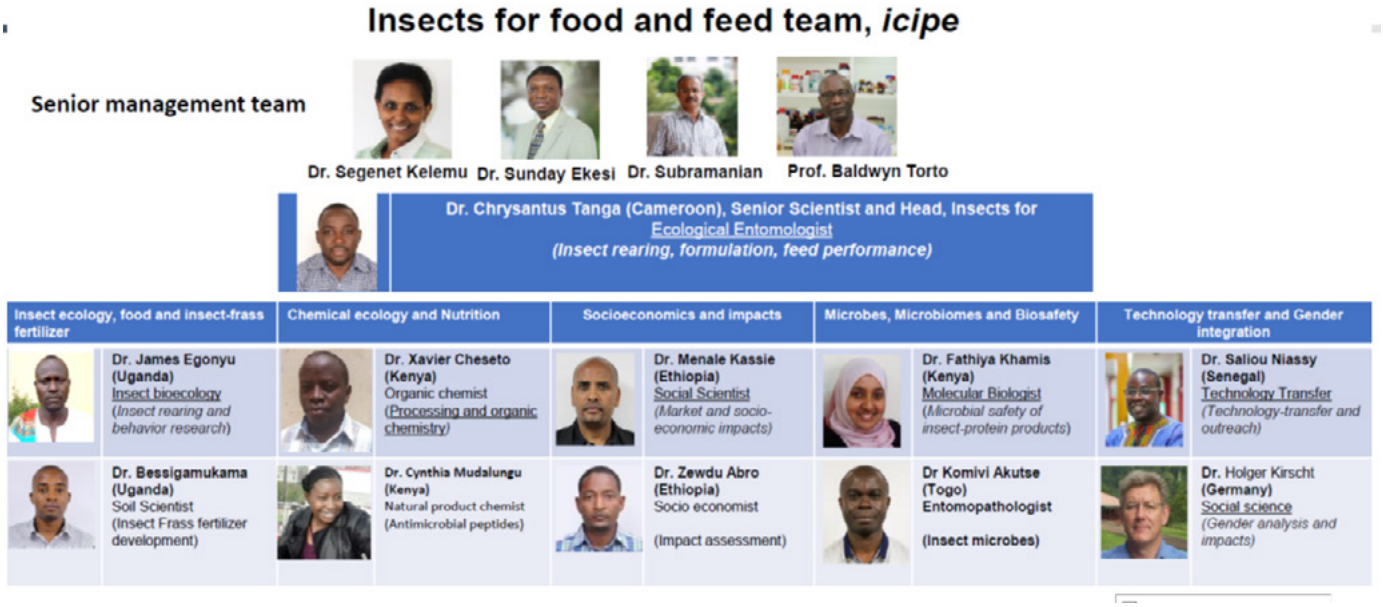
ICIPE

Dr. Chrysantus Mbi Tanga,

Introduction on organization and team:

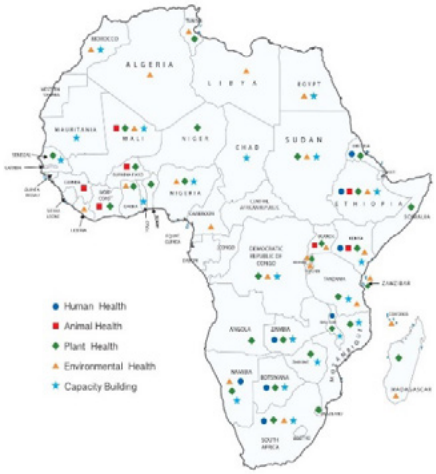
- ICIPE is a Centre of Excellence in Africa- for research and capacity building in insect science and its application.
- An intergovernmental organization- Charter signed by 13 countries worldwide.
- This centre has over than 571 staff from 40 nationalities including several contracted workers.
- Recruit about 150-180 graduate students annually.
- ICIPE work within the framework of One Health and a general framework for the research work within the three thematic areas/program:
    - Human Health
    - Agriculture (Plant & Animal Health)
    - Environment Health

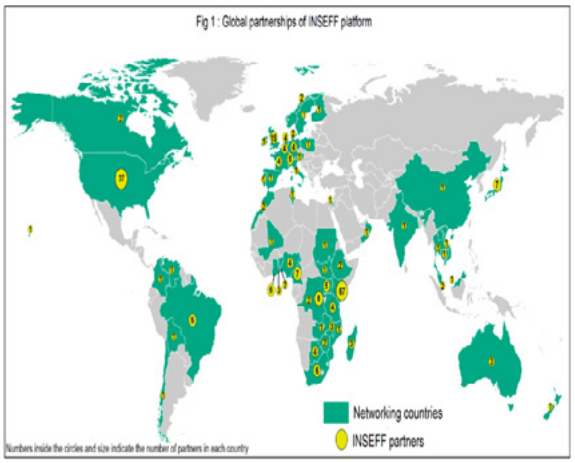
In addition, within this program there is PASET-RSIF a capacity building, supported by African countries.



Research work location

- Has more than 200 partners in 61 countries across 5 continents
- Most of the activities, particularly those under the Insect for food and feed programme, have been mentioned in 494 publications.





Experience in Fish Feeds and Nutrition

- ICIPE has diverse experience in fish feed and nutrition; 2000 edible insects have been identified globally, including 552 edible insects found in Africa. The ICIPE conducted the research listed below on fish feed.
  - Black soldier fly production: A sustainable model of circular economy
  - Insect oils as ingredient in aquafeed and others
  - Policy Engagement, Standard Development & Certifications
  - Scaling insect farms in East Africa
  - Nutritional quality of extruded fish feeds made from insect meal
  - Microbial quality of extruded fish feeds
  - Scaling insect protein for fish production
  - Better carcass quality

CORAF

Dr. James Apochi

Introduction on organization and team:

CORAF (West and Central Africa Council for Agricultural Research and Development):

- National Center of Specialization (NCoS) on Aquaculture supervised by ARCN – Point of entry to Nigeria
- Nigerian Institute for Oceanography and Marine Research (NIOMR), Lagos
- National Institute for Freshwater Fisheries Research (NIFFR), New Bussa
- Nigerian Stored Products Research Institute (NSPRI), Ilorin

Experience in Fish Feeds and Nutrition:

- Cassava flour to replace maize in fish feed – about 40% of cassava flour included
- Study of nutritional and anti-nutritional composition of cassava leaf and production of Cassava leaf protein concentrate
- Production of indigenous less expensive fishmeal from dep sea fish (Lantern fish)
- Probiotic production from the isolation of LAB from the gut of indigenous fish species
- Clupeid fishmeal Production and Utilization
- Use Of baobab leaf meal as a source of Vitamin C in fish feed
- Development of feeds for all stages of catfish and tilapia
- Assessment of the use of maggot meal as a replacement of fishmeal in the diet of catfish

Geographies & Available Facilities:

- Facilities at the NCoS (NFFRI and NIOMR) which needs to be up graded
- The demonstration research will be carried in Fish Farmer's farm with enough ponds (12 pond for each species) to be rented for use.
- Laboratory equipment for chemical analysis not available in NCoS will be sourced from outside

Partnership:

- Grand cereals Limited. Producer of Vital fish feed
- TRITON group of company
- OBA FARMS Limited producer of Crown fish feed
- NIOMR fish feed miller (Government feed miller
- Olam International, Blue crown
- Lawrence Feed mill Ventures
- Abdulsalam Fish Farm

WorldFish Zambia

Dr. Arthertone Jere & Mr. Gregory Kasanga

Overview of the status of feed research in Zambia.

Currently, Fish feeds takes about 60% of the production cost for both smallholder & commercial aquaculture farmers in Zambia. The biggest constraints are limited access to high quality fish feed. In Northern & Luapula provinces, only 16% of fish farmers use high-quality fish feed which limiting farm productivity. Sustainable efforts to resolve feed Challenges is to search for viable alternatives to local fish feed continue to be focus on Zambia.

Experience in Fish Feeds and Nutrition

- Studies conducted on fish feed.
  - A review of aquafeed business models and the feed value chain in Zambia and Malawi.
  - WorldFish pilots last-mile feed business models to boost aquaculture in Zambia

- Project goals:
  - 5 Novel ingredients to be used as key ingredients
  - Novel feed ingredients database development
  - Adoption of local feed diets by 5000 smallholders' farmers in Zambia

Partnership:
- Local Learning Institutions: CBU; UNZA; KMU & MU
- Local Millers: Butemwe milling
- Research Journals: JABS & IAPRI
- Associations: ADAZ & ZNFU
- Research Institutions: NADEC & CFRI
- Statistics: CSO & ZARI
- Farmers & Farmer Cooperative: Buyantashi Co.; Kanzala C & Msekese

WorldFish Malaysia

Dr. Rodrigue Yossa

Introduction

Some activities will be also conducted in Penang includes research work and all aspect of project management. In Malaysia, aquaculture work will include Aquaculture research, aquaculture extension, impact assessment and consultants. Non-aquaculture includes project management, Monitoring and Evaluation (MEL) & Data management, communication, procurement, Finance, Accounting.

- Aquaculture research activities – and WF HQ Penang Team consisted of:
  - Nurulhuda Ahmad Fatan
  - Aaqillah Amr
  - Muhammad Rahimi
  - Ning Shahirah

- Facilities that are available at the WorldFish Penang to conduct the fish feed experiment:
  - Feed making facilities – to produce sinking feed
  - Basic Fish culture facility (aquariums, tanks)
  - Digestibility experiment facility Recirculating Aquaculture System (RAS)
  - Big tanks
  - Lab for proximate analysis

Experience in fish feeds and Nutrition

Journal papers, technical reports, and a feed formulator app have all been developed:
- Apparent digestibility coefficients of local palm kernel cakes, rice bran, maize bran, and sago flour in the GIFT strain of Nile tilapia (***Oreochromis niloticus***)
- Apparent digestibility coefficients of banana peel, cassava peel, cocoa husk, copra waste and sugarcane bagasse in the GIFT strain of Nile tilapia (***Oreochromis niloticus***)
- Assessment of existing and potential feed resources for improving aquaculture production in selected Asian and African countries.
- Free feed formulator application

Partnership:
- Universiti Sains Malaysia (USM)
- Universiti Malaysia Terengganu (UMT)

Question (Q) and Answer (A)

Q: Is there a knowledge exchange where the African partners may receive training on the feed production process and support the entire feed line, including the ability to create their own feed and then market it to the private sector as a business opportunity?
As specified in the project description, the feed will be formulated by experts from outside the African countries.

A: There are many components in the project. First component is the scoping study to select some ingredients based on environmental and gender consideration. The project's PhD students will work on improving national ingredients. The improved ingredients will be returned to the countries, and the feed will be tested on farms in the respective countries.
This means that local students will undertake the work at SLU, thus there will be a component of local capacity building, and they will be able to learn the technologies and bring the innovation back to their home countries.

Additional comments

Q: It is essential to share knowledge in order to educate fish farmers and feed millers. Another key concern is the lack of a sustainability channel through which local governments can engage with feed millers and farmers under their authority to sustain feed production in order to support farmers when the project ends.
A: The issue is not entirely addressed because it will create more local jobs, transfer local technologies, and expand the project output beyond the scope of this project's end. Actually, it is not the role of a feed miller to produce feed ingredients, but feed millers just obtain ingredients from the market and produce feed with them. Thus, the technologies transfer should be positioned in the value chain before it reaches the feed mill. Therefore, if any ingredients are proven useful, a viability study can be conducted to facilitate technology transfer.

Q: Is there any provision in the project that would allow exchange visit? Can experts from the local feed miller from countries be given training in the institution in Europe or any engagement between private sectors?
A: No provision in the project to travel to Sweden for the visit.

Q: How is ICIPE managing the insect and hoe do they deal with some environment concerns?
A: It follows the circular economy model. Pollution is reduced when waste is collected from the environment, and the residues that are left from the growing of flies can become a by-product waste that is more stable as a good source of fertiliser due to the high level of chitin. Furthermore, using insects to compose waste at low temperatures produces very low levels of emission.

Q: The quantity produced in ICEPE is always minimal. How is such a high production of insect meal possible?
A: This is understandable because it is a new technology, but it is continually growing fast. It is possible to expand if there is waste to feed the insect.

Includovate

Dr. Sujata Ganguly

Introduction of organization and team

- Includovate is innovate about inclusion. Not only work on gender but also focus more on social inclusion, so all voices are heard, and no one left behind. Gender is not primarily men and women against each other but need to work together to see the impact and make it sustainable.
- Includovate works on various project with different organizations. Includovate is a social enterprise and believe in capacity building, have regular learning session among researcher as not different people have different understating and perspective in social gender and inclusion.
- Consideration in gender study:
  - Social norms and attitudes need to be differentiated in any gender study and understands
  - Disaggregate analysis i.e., male, or female percentage is not gender. Need to understand behind the stories of male or female participation in any task or work.
  - Decision power between male or female is really participation or not.
  - Needed assessment - bring together everyone respective of any identity and hear their problem, everyone has their own requirement.
  - Social ecological model – different level where individual, household, community, and society

- Have work with WorldFish on extensive literature review on social and gender risk associated with fish feed ingredient.
- Have found number of challenges.
- How can fish feed be produced in affordability and without women and youth is missing out or marginalised
- Project fact from literature review / problem:
  - Identity issue-e.g., farmers and women farmers. Identity can bring confidence
  - GESI blind evidence – reporting mainly in total without segregation of male or women
  - Need to address the root cause- ultimate goal is sustainable impact so need to ensure women are involved and address all the social norms

- Project goals:
  - Identify needs, risks, and opportunities associated with the use of novel ingredients that are gendered and socially differentiated
  - Identify opportunities to advance GSI goals of Norad, WorldFish, and other key stakeholders within the novel feeds landscape.
  - Ensure that women, youth, and OMG are prioritised throughout implementation

- Project component
  - Literature review
  - Building existing information and knowledge without replicating
  - Develop RQs with people from countries
  - Design the study.

- GSI analysis framework
  - Law, policies, institutional practise
  - Cultural, norms, belief
  - Gender roles, responsibilities, and time use
  - Access to and control over resources
  - Power and decision making

- Project component
  - In depth interview
  - Key informant interview
  - Focus group discussion
  - Survey
  - All these will be finalised and discussed with the project leader and team.
- Tentative list of partnerships:
  - Small and medium-scale feed millers and smallholder farmers
  - NARS
  - Scaling partners

NRDC

Dr Rodrigue Yossa, on behalf of Dr. Alice Tembo

Introduction

- NRDC was established in 1964 through a declaration by the First Republican President Dr Kenneth David Kaunda
- The first cohort of students was admitted in 1965 in two three year diploma programmes in Agriculture and a certificate in Home Economics
- Over the last five decades, the programmes have evolved to include ten diploma programmes in agriculture and related disciplines including Fisheries Science.
- Aquaculture Skills Training Centre and E learning platform established and through collaboration and support from WorldFish
- The Fish Laboratory was upgraded through the design and building of a flow through
- Aquaculture system with support from WorldFish.
- Two major research projects were conducted in collaboration with WorldFish and other institutions.
  - Replacing fishmeal with a single cell protein feedstuff in Nile tilapia *Oreochromis niloticus* diets.
  - Performance of *Oreochromis niloticus* and *Oreochromis andersonii* in controlled laboratory conditions in Zambia.
- NRDC ready to host the feed experiments during the project life cycle.

Project goals

- Capacity building of NRDC's Staff in research activities particularly the NRDC's contact person and other staff of Fisheries Science department.
- Exposure of students to research findings through seminars and scientific talks.
- Utilization of novel feed at the Aquaculture Skills Centre to boost fish production and
- adoption by aquaprenuers countrywide.
- Lessons learned from other participating countries on feed experiments and impacts in chosen communities.

Project component

- NRDC shall host the feed experiments in the Fish Lab.
- NRDC shall provide a contact person who will support the researchers in conducting and implementing the feed trials.
- NRDC shall provide a Technician who will support the researchers upgrade the Fish Lab to a Recirculating Aquaculture System.
- NRDC shall participate in the Annual Project Meetings
- NRDC shall receive rentals from WorldFish to facilitate security of the Fish Lab.

Partnership

- WorldFish
- Possibility of building more Partnerships

SLU, Sweden

Prof. Sri. Kartik Baruah

Introduction on organization and team:

- SLU vision is to play key role in development for sustainable life based on science and education. Sustainable is the most important element in every project
- A world class international university although it is just a 40-year old university and has taken a world top 300-400.
- Collaboration is very important and work with private, public and farmers in Sweden and outside Sweden. To achieve a goal with working together
- Try to address issue that are very fundamental to human being.
- Works a lot on sustainable food supply.
- Welfare is also important point concerning the animal ethics in the research.
- Managed pollution in aquatic system for clean water and oceans
- Sustainable cities and rural areas
- Reason to work on fundamental issues is to make the world a better place
- Research and education at SLU
  - Education to produce sustainable experts of the future.
  - Research in natural science, social science, and the humanities. – Transdisciplinary approach, curiosity and problem solving.
  - Unique infrastructure – modern research vessel, research station, experimental parks, database, biobank and world class laboratories.
- Location – SLU is located at three principal locations (Umea, Uppsala and Alnarp)
- SLU is under Ministry of Enterprise and Innovation, that why is SLU is technology driven university

Aquaculture scientific team:

- Research interest- the whole idea is sustainable aquaculture
  - Novel feed – waste to novel feed
  - Artemia research – for larvae fish
  - Nutraceuticals – feed additive come from waste
  - Health management – together with microbial management
  - Epigenetics

- Research areas
  - Wet lab for digestibility and growth experiment- RAS system, multispecies and can adjust the temperature
  - Artemia lab – part and member of international artemia consortium and recognised by FAO
  - Nutraceuticals in health and microbial management

- Experience in training Ph.D. students and research in fish feeds and nutrition:
- Development of a holistic anti-infective strategy for controlling Acute Hepatopancreatic necrosis disease in farmed white-legged shrimp *Paneaus vannamei*. Funding: World Bank
- Bio-conversion of non-food bio-resources to novel feeds for salmonids - a Nordic approach. Funding: NordForsk Grant
- Novel Microbial Ingredients in diets for Atlantic salmon (*Salmo salar*) - Impact on growth performance, health, and robustness. Funding: NordForsk Grant
- New feed resources - molecular insights of bioactive components effect on absorption, gene expression, microbiota, and metabolism in fish. Funding: Netaji Subhas - ICAR International Fellowship, India.
- Sustainable fish farming in Rwanda. Funding: SIDA, Sweden

- Completed studies
  - Interaction effects of plant-derived compounds on the performance of Artemia challenged with pathogenic biotic stressor". Funding - ICAR PhD grant - India
  - Effect of the symbiotic compounds, produced under laboratory conditions, on the growth, reproduction performance and expression of immune-related genes in Zebrafish.
  - Nutritive value and use of locally available low-cost feed ingredients for Tilapia farming in Tanzania. Funding: SIDA, Sweden
  - Brewer's yeast as a protein source in the diet of tilapia (*Oreochromis niloticus*) and freshwater prawns (*Macrobrachium rosenbergii*) reared in a clear water or biofloc environment. Funding: SIDA, Sweden

- Role of SLU in FASA project
  - Capacity Building
  - Supervision of two PhD thesis students: Nigeria & Zambia
  - Contribute to other relevant activities of the project

- PhD Student Activities timelines
  - 2 PhD hiring and registration from Zambia and Nigeria – Y2(Q2)
  - Conduct experiments to prioritise 15 ingredients: biochemical analysis of ingredients –Y2(Q1)-Y3
  - Develop and use processing techniques to improve quality of 15 ingredients-Y2(Q3)-Y3(Q1)
  - Quality checks the improved ingredients, and formulate and produce fish feed, and lab trial Y 2 (Q3) – Y (Q4)
  - Conduct validation study on farm Y 3(Q3) – Y (Q4)
  - PhD defences Y 4(Q2) – Y 5 (Q2

Question and Answer

Q: Concerning the development of a student project, it is important to collaborate with the local Zambian team in the development of the project so that it may reflect what is happening in the country. How would technology be transferred to the country?
A: It is important to obtain input from partners to produce a good PhD proposal, so all PhD selection and research proposals will be developed in collaboration with the countries.

Q: What is the definition of quality feed ingredients?
A: Quality feed is a nutritionally balanced feed that can meet the fish's nutrient requirements. In addition, a quality feed generates low impact on the environment or water quality.

Additional comment:
We must be aware of the actual impact of the objective that we are trying to achieve. For example, if the goal is to incorporate as many locally sourced feed ingredients as possible, this can be achieved, but we may not achieve our goal if the cost of fish farming becomes uneconomical

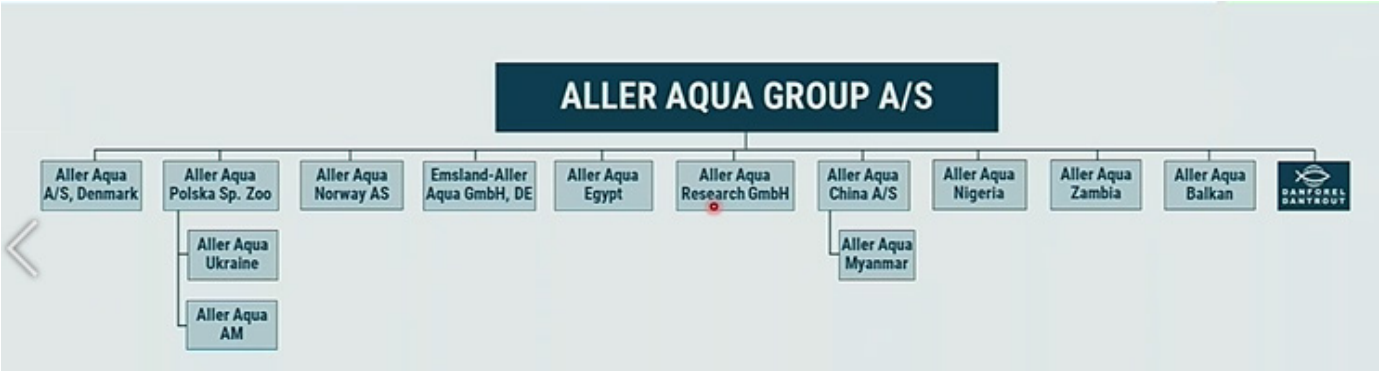
Aller Aqua

Dr. Alexander Michael Greiling

Introduction on organization and team

- Aller Aqua has more than 58 years of experience in developing and producing the most effective and high-quality fish feed
- Active in 70+ countries and the 3rd largest fish feed producer in the EU
- Employees from over 30 different nationalities
- Currently have 7 factories in Denmark, Germany, Poland, Egypt, China, Zambia, and Serbia
- Produce feed for a large variety of species
- Well known as very careful selection of high-quality raw materials and feed also known to high quality
- Also, do continuous testing of feed at our Research Centre at selected test stations.

Organogram:



- Aller aqua research is a separate entity within the business and not fall under a specific factory in specific countries
- Aller aqua Zambia – built in 2017 and situated in Lake Kariba. The most modern in Africa and production capacity is 50,000 T/year
- Aller Aqua research – established in 2017 in Germany. Trial stations consisted of RAS.
- Aller Aqua research Zambia- Situated in lake Kariba. Main function: Testing new ingredients and formulations, benchmarking, and technical sales support. Has 8 caged (5x5x4 m)

Experience working with WorldFish

- Collaborated in project of replacing fishmeal with single cell proteins, MRD-Pro and DY-Pro, in tilapia *Oreochromis niloticus* diet.
- Role of Aller Aqua:
  - Supply of information on relevant raw materials
  - Supply of fishmeal
  - Assisting in trial setup and induction of local research staff (in Zambia)
  - Provided input to scientific research paper

Workplan to implement the FASA project

- Assist literature research
- Help in RM evaluation
- Provide frequent feasibility updates for various RMs- Includes feasibility assessments
- Assist in reporting
- Assist in designing research protocols and evaluation of trials if needed
- Assist in feed formulation –
- Support on site trainings - has MOU with WorldFish Zambia
- Any other support required by WF if needed

Insight to industry needs regarding raw materials

Two different kinds of challenges:

- Direct – directly to relate any raw material
  - Consistency in composition – to be able to produce consistence feed
  - Availability of volume – production capacity is directly link to the input. Need 400-500 ton / month to satisfy inclusion rate
  - Number of raw materials is limited – has limited of silo

- Indirect – are usually around the raw material
  - Supplier due diligence – not just a feed miller but has standard to meet and cannot accept anything and cannot get information from the supplier
  - Reliability and associated expenses (Transport, supplier) – getting late raw material mean factory could be idle for the days and cost need to be covered
  - Lab testing facilities is limited – Supplier could provide the information before send the material to the factory.

NAGI Enterprise

Dr. Mzime Regina Murisa

Introduction on organization and team

- NAGI is a consultant firm that based in Lusaka Zambia
- Have team member come from different part of Africa with various experience such as impact assessment, climate change etc
- Have experience dealing with multi and transdisciplinary projects
- The FASA project focuses on:
  - Sustainable aquatic food system – focus on climate and environmental impact assessment
  - Alternative, sustainable fish feed versus commercial feed
  - Integrate CC and environmental consideration in fish feed life cycle
    - Weakness in available data –to fil the gaps
    - Improve understanding in term of carbon foot print along the life cycles - where and why?
    - Identify potential opportunities include mitigation pathway within the novel feed ingredients
    - Promote sustainable aquaculture development
- Project key fact
  - Identify the gaps and have data evidence, policy

Experience in Climate Change and fish feeds

- Integrated Aquaculture Project
- Aquaculture Project – known as the Highly Indebted Poor Countries' (HIPC) integrated fish-farming Programme in Mulanje, Thyolo & Phalombe districts of southern Malawi
- Aquaculture Value Chain Project (AVCP)

Partnership:

- Swedish University of Agricultural Sciences (SLU),
- International Centre of Insect Physiology and Ecology (ICIPE),
- Aller Aqua Africa,
- West and Central African Council for Agricultural Research (CORAF)
- Local research scientists in each project country (WorldFish, ICIPE, and CORAF)
- Research scientists of the partners (NARS, ICIPE, CORAF) will contribute to the design of research protocols and implement the research

Question and Answer

Q: Is it possible to NAGI to provide the partners with a template that can be used for data collection for climate change work?
A: Yes, one important thing we want to do is collaborate with consultants and partners to develop strategies for various components and data collection. However, it is important to agree on who is responsible for that and then organize a training session to gather the staff, students on the ground together. We have a template, but we need to make it participatory, inclusive and with a focus on baseline analysis to identify gaps in different components.

Q: Does NAGI have representative in each country? In addition, NAGI staff travel to the project sites.
A: Yes, we will visit the different nations and rely extensively on local experience because each country differs.

Q: In terms of climate change, do you have expertise or potential for measuring gas emissions in the demonstration pond when fish is fed insect-based feed?
A: Yes, it is certainly possible. We mostly follow guideline, but it was designed to be used in developed countries, whereas testing in developing countries was done as part of the Southeast Asia. The guide has to be geographically fitted.

Q: At the Aller aqua experiment site. The cage is 5x5x4 metres. Why are we using this measurement? Because the depth of freshwater fish cages is not as deep as four due to oxygen availability. The average freshwater cage depth is 1.5m.
A: The cages are designed to mimic the cages in Lake Kariba.

Monitoring and Evaluation and Learning

Maggie Culhaj, Timothy Manyise, Saadiah Ghazali

Overview on the MEL activities of the project

- MEL Plan
- Impact assessment plan
- Data Management
- Learning and adaptive management
- MEL system

Introduction on the MEL plan.

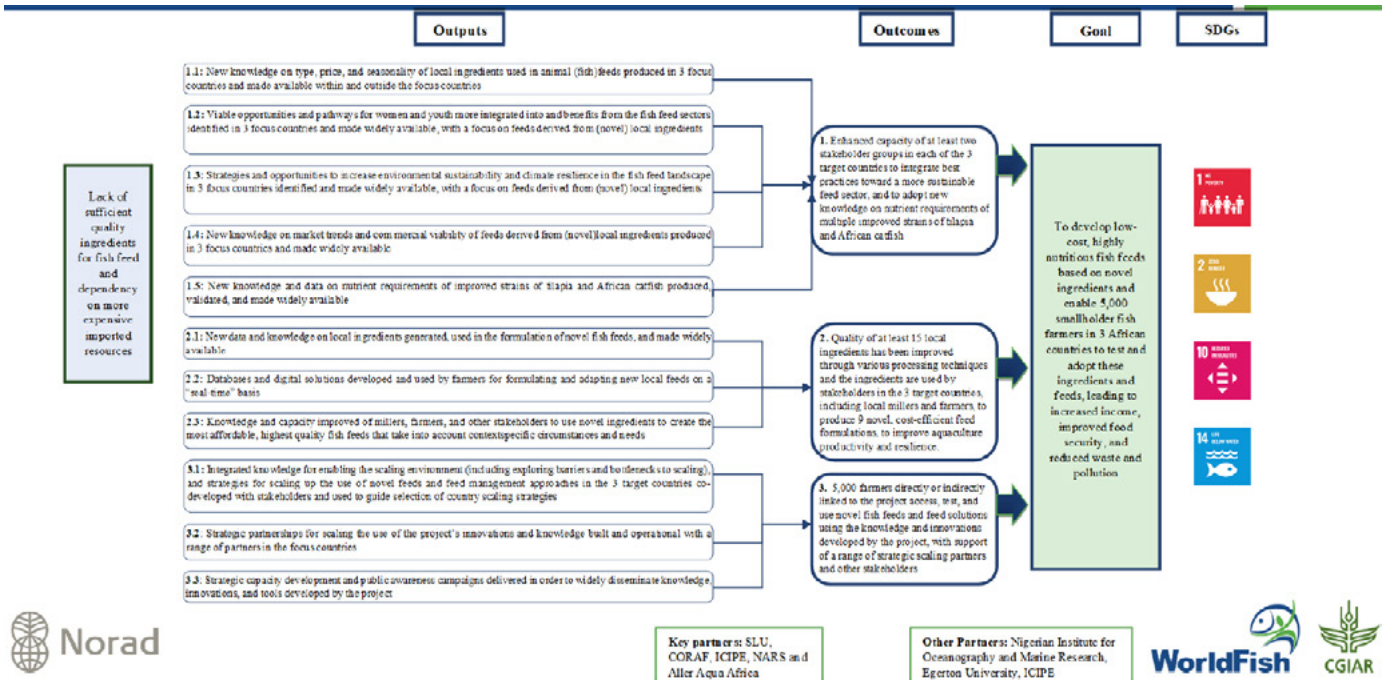
- We need MEL to ensure effective implementation and performance measurement by developing a robust and cohesive monitoring approach to ensure the impact program is on a path to success.
- To have a framework / tool that guide the MEL throughout the project
- Documentation on how and what information will be collected and analysis to support better decision making
- To ensure better transparency and accountability
- To generate learning through evidence

MEL component

- Theory of change
- Indicator matrix
- MEL activities overview
- Roles and responsibilities
- Impact assessment – measure toward the time until the project to see if we achieve the intended objectives
- Data management

- Learning and adaptive management
- Impact assessment – measure toward the time until the project to see if we achieve the intended objectives
- Data management
- Learning and adaptive management

FASA theory of change



MEL Indicator

- To set target and goal, and track the result
- 37indicators
  - Output indicator (32)
  - Outcome indicator (5)
- To ensure the quality of collection and reporting of results

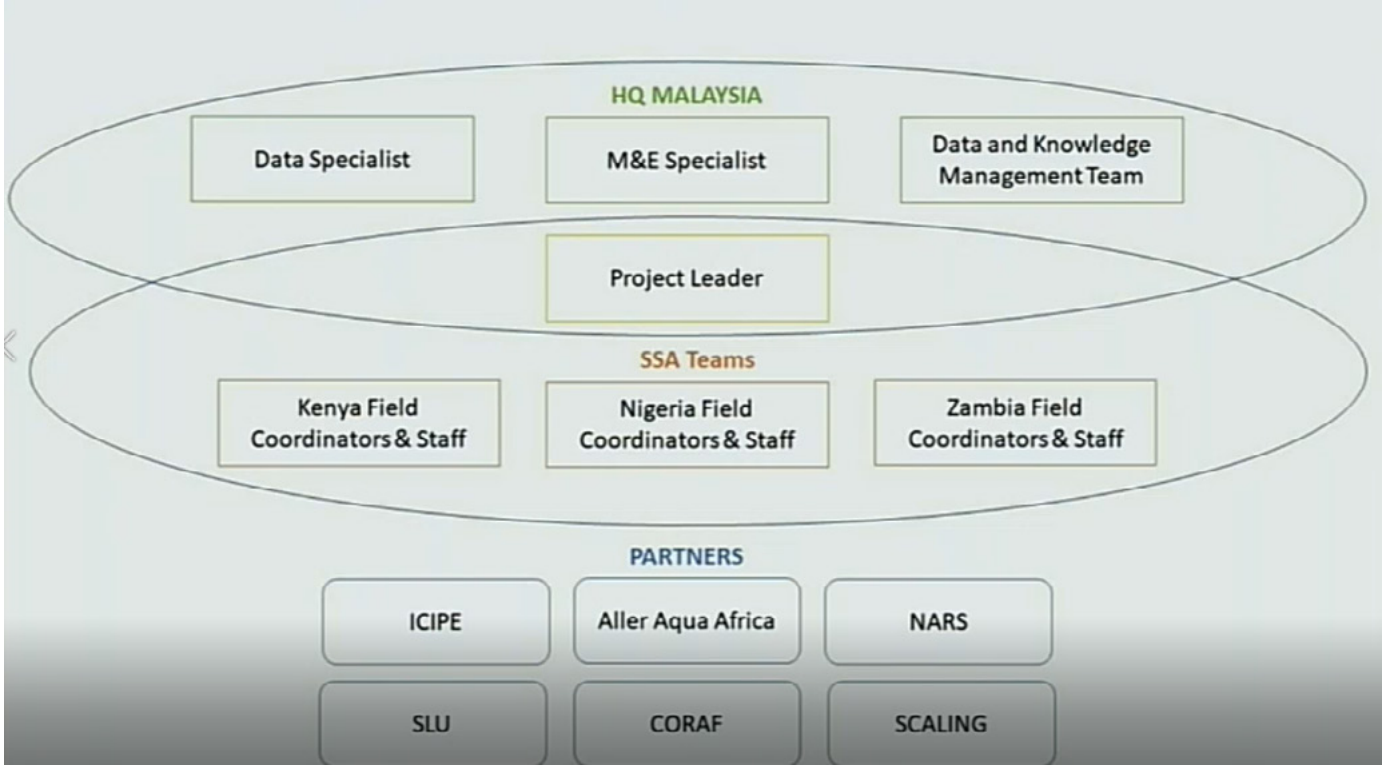
MEL activities

Have a team to track at three main level:

- Activities and output monitoring
  - Track progress against the workplan
  - Will use MEL web-based platform for planning, reporting, and learning
- Outcome monitoring
  - Outcome will be tracked periodically using performance indicator as per the indicator matrix
  - The result will undergo data quality check
  - Template will be provided
  - Will coordinate with country level team
- Evaluation and impact assessment
  - To assess the effectiveness of the intervention and its effect in achieving goals
  - Will be conducted periodically

Roles and responsibilities

- MEL team will coordinate with country focal points and project manager to collect/ validate data
- Quarterly performance report will be produced and shared with the project stakeholders



Impact assessment plan

- Baseline evaluation
  - Baseline characterization among farmers and feed millers during first 4 month
- Midterm evaluation
- End term evaluation
- Annual assessment
  - Assessment a contextualized system base theory of change
  - Assessing the quality and influence of capacity building
  - Assessing the socioeconomic impact
  - Assessing the effect of establishing innovation scaling partnership structure

Data Management

- Data management plan
  - Written document which is part of MEL that outlines all necessary information from how to collect, manage, analyse, storage and preserve your research data
  - Outline strategy through each research data life cycle
- Data quality Assessment
  - Process of cleaning data with the aim to identify any inconsistency or anomalies in the data
  - Three main stages of data quality assessment

Data collection	Digitization and data entry	Data Analysing
Calibration of instruments to check the precision, bias and/or scale of measurement	Setting up validation rules or input masks in data entry software	Double-checking coding of observations or responses and out-of-range values
Taking multiple measurements, observations or samples	Using controlled vocabularies, code lists and choice lists to minimize manual data entry	Checking data completeness
Using standardized methods and protocols for capturing observations, alongside recording forms with clear instructions	Detailed labeling of variable and record names to avoid confusion	Adding variable and value labels where appropriate
Checking the truth of the record with an expert	Designing a purpose-built database structure to organize data and data files	Verifying random samples of the digital data against the original data
Computer-assisted interview software to: standardize interviews, verify response consistency, route and customize questions so that only appropriate questions are asked	Accompanying notes and documentation about the data	Statistical analyses such as frequencies, means, ranges or clustering to detect errors and anomalous values

Data storage

- Recommended folder structure, wil be shared with project team

Folder name	Description
0. Disclaimer	WorldFish data disclaimer on usage of the data (This will be automatically be uploaded by admin)
1. Method documentation	Documentation relating to the methods that will be/were used in data collection
2. Questionnaires	Tools that were developed for data collection in the project
3. Data collection tools	This can either be the forms that were developed for data entry of the field data e.g. CSPro data entry templates or xls files (field data collections using phones or tablets) if the project used ODK or any other mobile data collection method
4. Handbooks, Guides and Manuals	Handbooks, Guides and Manuals associated with data collection
5. Unpublished reports	Any unpublished reports relating to the project
6. Raw and verified data	The following should be uploaded here: • csv, stata, spss, R files for the raw data collected. • Cleaned and verified data should also be put here. • Calculated indicators can be also be put in this folder (the indicators should be accompanied by their variable descriptions)
7. Codebook	Descriptions of variables for the data collected.
8. Scripts	Scripts for calculating indicators should be put here with accompanying indicator report

Disemination of data

- Knowledge and information generated in this project will be archived in WorldFish open repositories (Dspace and Dataverse)
- Links:
  - https://dataverse.harvard.edu/dataverse/worldfish
  - https://digitalarchive.worldfishcenter.org/
- Will go through a quality check at various level
- Open access repository and can be shared.

Learning and Dapative management

- The learning agenda for FAA is embedded in the activities carried out for the project implementation
- Collected data will serve to inform management for better decisions and adapting
- Learning opportunities are framed and linked to adaptive management
- Different ways learning tools
  - Review/ assessment/ scoping studies
  - TOC review and adaptation
  - Staff meeting and project review workshop
  - Annual project meeting and outcome monitoring studies
  - Strategic collaborations –stakeholders and partners

Online MEL platform overview

- https://mel.cgiar.org/
- Platform that has been designed for project management implementation from the research to knowledge sharing
- Has been used by some of CGIAR centres

Communications

Mr. Sean Lee

FASA communication plan

- Objectives:
  - Demonstrate to stakeholders and other audiences where how what and why FASA has made difference
  - To ensure investors and partners view FASA as credible, relevant and result oriented
  - Enable staff and partners to learn, communicate and share project knowledge
  - Build a knowledge hub to disseminate project activities / learnings

- To achieve the objectives
  - Maintain FASA reputation and credibility (i.e., branding)
  - Understand the communication needs of target audience
  - Continuous learn from communication effort
  - Maintain strong relationship between project staff and partners

- Key principles
  - Right message – develop credible content
  - Right form- relevant approach
  - Right person
  - Right channel
  - Right context
  - Right support

- Target audience
  - Bilateral donors
  - Partners
  - Policy markers
  - Media
  - Beneficiaries
  - Project staff
  - Country directors
  - WorldFish leadership

- Communication tools and dissemination

- Actions in 2022
  - Set up project website
  - Press release of project launch
  - PPT template
  - Roll up banners
  - Blog on the project launch – CGIAR website
  - Promotion in social media
  - Campaign newsletter to promote the project

- Action 2023
  - Update website
  - Continue to publish blog

Technical Reporting

Dr. Rodrigue Yossa

FASA project Technical report

- Technical reporting team need to send to Dr. Rodrigue and copy to Ms.Yogeswary
  - Dr. Rodrigue Yossa (R.Yossa@cgiar.org)
  - Yogeswary Chellappan (y.chellapan@cgiar.org)
- Quality check for the report from partners
- Technical report submission
  - Technical report for donor is different from partners to WF

Technical report schedule for Donor

Project Implementation Period: 1 July 2022 – 30 June 2027

- 1 July – 31 December 2022 (Submission Deadline - 15 April 2023)
- 1 January – 31 December 2023 (Submission Deadline – 15 April 2024)
- 1 January – 31 December 2024 (Submission Deadline – 15 April 2025)
- 1 January – 31 December 2025 (Submission Deadline – 15 April 2026)
- 1 January – 31 December 2026 (Submission Deadline – 15 April 2027)
- 1 July 2022 – 30 June 2027 (Submission Deadline – 31 October 2027)

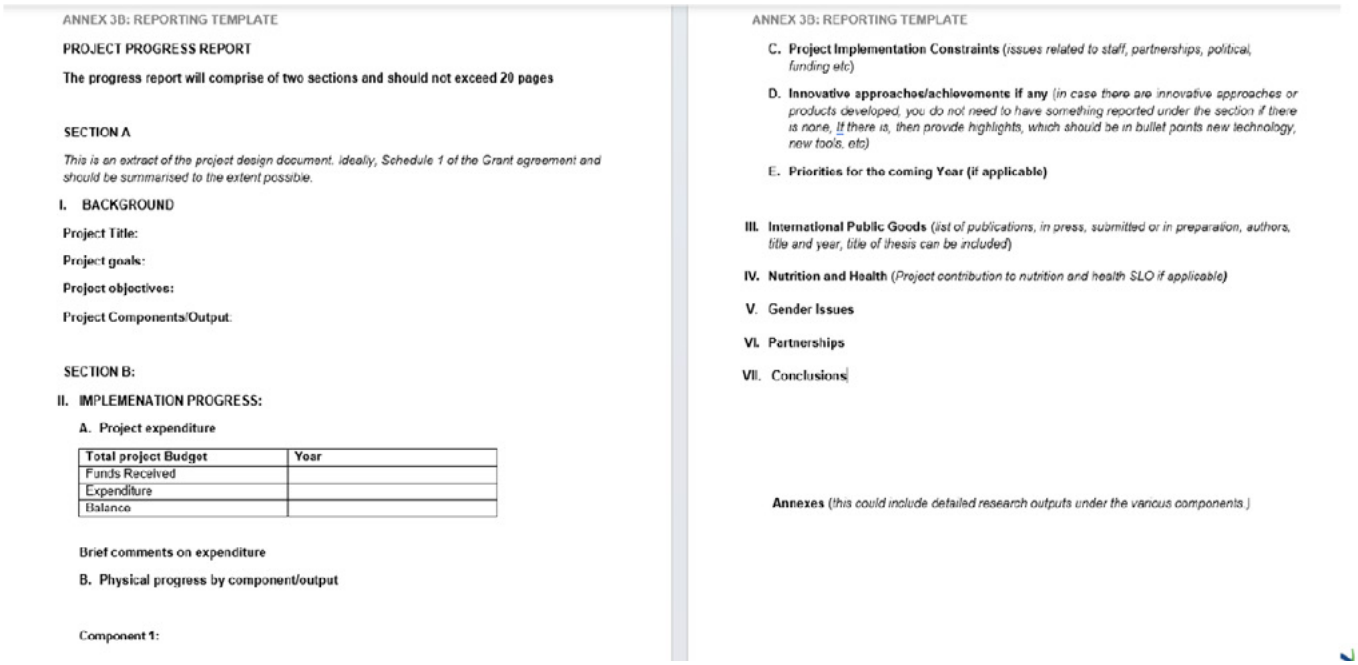
Technical report of partners and consultants

- Annual technical report will be submitted to donor.
- Midyear technical report will only for internal use and not submit to the donor, just to update if there is amendment in the activities

Project Implementation Period: 1 July 2022 – 30 June 2027

No	Reporting Period	Type of Report	Due Date
1.	October 2022 – December 2022	• FASA_Annual Technical Report 2022Q4	30 January 2023
2.	January 2023 – June 2023	• FASA_Mid-Year Technical Report 2023Q1-Q2	30 July 2023
3.	January 2023 – December 2023	• FASA_Annual Technical Report 2023Q1-Q4	30 January 2024
4.	January 2024 – June 2024	• FASA_Mid-Year Technical Report 2024Q1-Q2	30 July 2024
5.	January 2024 – December 2024	• FASA_Annual Technical Report 2024Q1-Q4	30 January 2025
6.	January 2025 – June 2025	• FASA_Mid-Year Technical Report 2025Q1-Q2	30 July 2025
7.	January 2025 - December 2025	• FASA_Annual Technical Report 2025Q1-Q4	30 January 2026
8.	January 2026 – June 2026	• FASA_Mid-Year Technical Report 2026Q1-Q2	30 July 2026
9.	January 2026 – December 2026	• FASA_Annual Technical Report 2026Q1-Q4	30 January 2027
10.	January 2027 – April 2027	• FASA_Mid-Year Technical Report 2027Q1-Q2	30 May 2027
11.	October 2022 – April 2027	• FASA_Final Technical Report 2022-2027	30 May 2027

Report template



ANNEX 3B: REPORTING TEMPLATE

PROJECT PROGRESS REPORT

The progress report will comprise of two sections and should not exceed 20 pages

SECTION A

This is an extract of the project design document. ideally, Schedule 1 of the Grant agreement and should be summarised to the extent possible.

I. BACKGROUND

Project Title:

Project goals:

Project objectives:

Project Components/Output:

SECTION B:

II. IMPLEMENATION PROGRESS:

A. Project expenditure

Total project Budget	Year
Funds Received	
Expenditure	
Balance	

Brief comments on expenditure

B. Physical progress by component/output

Component 1:

ANNEX 3B: REPORTING TEMPLATE

C. **Project Implementation Constraints** (*issues related to staff, partnerships, political, funding etc*)

D. **Innovative approachos/achievements if any** (*in case there are innovative approaches or products developed, you do not need to have something reported under the section if there is none, If there is, then provide highlights, which should be in bullet points new technology, new tools, etc*)

E. **Priorities for the coming Year (if applicable)**

III. **International Public Goods** (*list of publications, in press, submitted or in preparation, authors, title and year, title of thesis can be included*)

IV. **Nutrition and Health** (*Project contribution to nutrition and health SLO if applicable*)

V. Gender Issues

VI. Partnerships

VII. Conclusions

Annexes (*this could include detailed research outputs under the various components.*)

Report detail

2 PROGRESS REPORT

2.1 Any progress reports to be submitted in accordance with the Specific Conditions shall describe the results achieved by the Project during the reporting period. The report shall be set up in a way that allows direct comparison with the latest approved Application, work plan and budget, and shall be signed by an authorised representative of the Grant Recipient.

2.2 The progress reports shall, as a minimum, include:

a) an account of the results achieved so far by the Project, using the format, indicators and targets of the approved results framework. The overview must:
   - show delivered main outputs compared to planned Outputs;
   - show the Project's progress towards achieving the Outcome;
   - if possible, describe the likelihood of the Impact being achieved.

b) an account and assessment of deviations from the latest approved Application and/or work plan;

c) a brief update on the risk management of the Project, including:
   - any new risk factors;
   - how materialized risks have been handled in the reporting period;
   - the effectiveness of mitigating measures;
   - how risks will be handled going forward.

   The update shall include both risks affecting Project achievements and the risks for negative consequences from the Project on its surroundings. Potential negative effects on the cross-cutting issues as referred to in the Specific Conditions article 3 shall always be accounted for.

d) a brief account of work undertaken to prevent instances of corruption and sexual exploitation, sexual abuse and sexual harassment (SEAH) from occurring in the future and, if received any allegations during the reporting period, how these were handled and any actions taken.

Finance – Financial reporting

Mr. Tan Chao Yan

Financial reporting schedule to NORAD

- Annual basis reporting

Project Implementation Period: 1 July 2022 – 30 June 2027

- 1 July – 31 December 2022 (Submission Deadline - 15 April 2023)
- 1 January – 31 December 2023 (Submission Deadline – 15 April 2024)
- 1 January – 31 December 2024 (Submission Deadline – 15 April 2025)
- 1 January – 31 December 2025 (Submission Deadline – 15 April 2026)
- 1 January – 31 December 2026 (Submission Deadline – 15 April 2027)
- 1 July 2022 – 30 June 2027 (Submission Deadline – 31 October 2027)

Audit reporting schedule

- External audit on annual basis

- 1 July – 31 December 2022 (Submission Deadline - 1 June 2023)
- 1 January – 31 December 2023 (Submission Deadline – 1 June 2024)
- 1 January – 31 December 2024 (Submission Deadline – 1 June 2025)
- 1 January – 31 December 2025 (Submission Deadline – 1 June 2026)
- 1 January – 31 December 2026 (Submission Deadline – 1 June 2027)
- 1 July 2022 – 30 June 2027 (Submission Deadline – 31 October 2027)

Partner reporting schedule

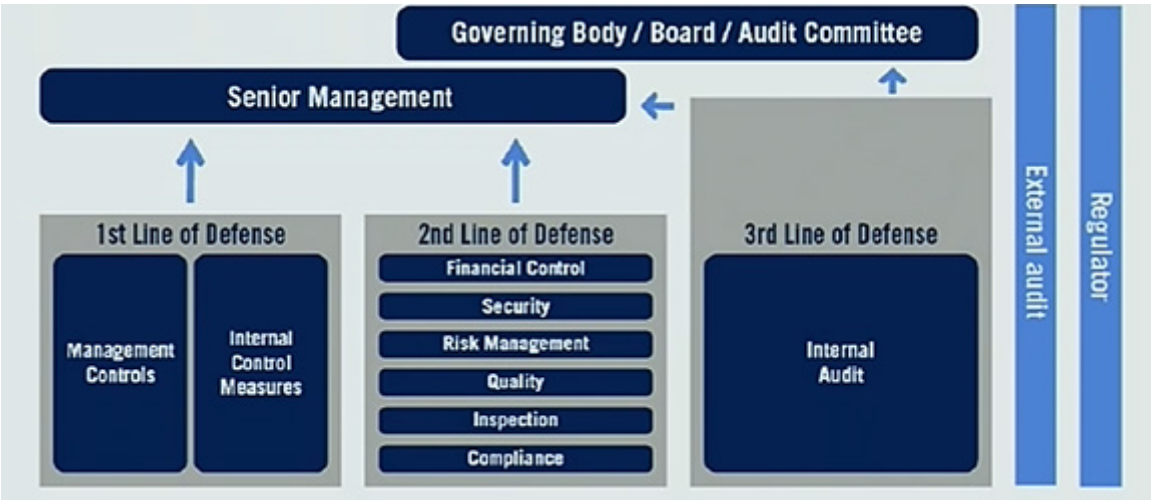
No	Reporting Period	Type of Report	Due Date
1.	October 2022 – December 2022	• FASA_Annual Financial Report 2022Q4	30 December 2022
2.	January 2023 – June 2023	• FASA_Mid-Year Financial Report 2023Q1-Q2	30 July 2023
3.	January 2023 – December 2023	• FASA_Annual Financial Report 2023Q1-Q4	30 December 2023
4.	January 2024 – June 2024	• FASA_Mid-Year Financial Report 2024Q1-Q2	30 July 2024
5.	January 2024 – December 2024	• FASA_Annual Financial Report 2024Q1-Q4	30 December 2024
6.	January 2025 – June 2025	• FASA_Mid-Year Financial Report 2025Q1-Q2	30 July 2025
7.	January 2025 – December 2025	• FASA_Annual Financial Report 2025Q1-Q4	30 December 2025
8.	January 2026 – June 2026	• FASA_Mid-Year Financial Report 2026Q1-Q2	30 July 2026
9.	January 2026 – December 2026	• FASA_Annual Financial Report 2026Q1-Q4	30 December 2026
10.	January 2027 – April 2027	• FASA_Mid-Year Financial Report 2027Q1-Q2	30 May 2027
11.	October 2022 – April 2027	• FASA_Final Financial Report 2022-2027	30 May 2027

Risks and Compliances

Ms. Azira Azmi

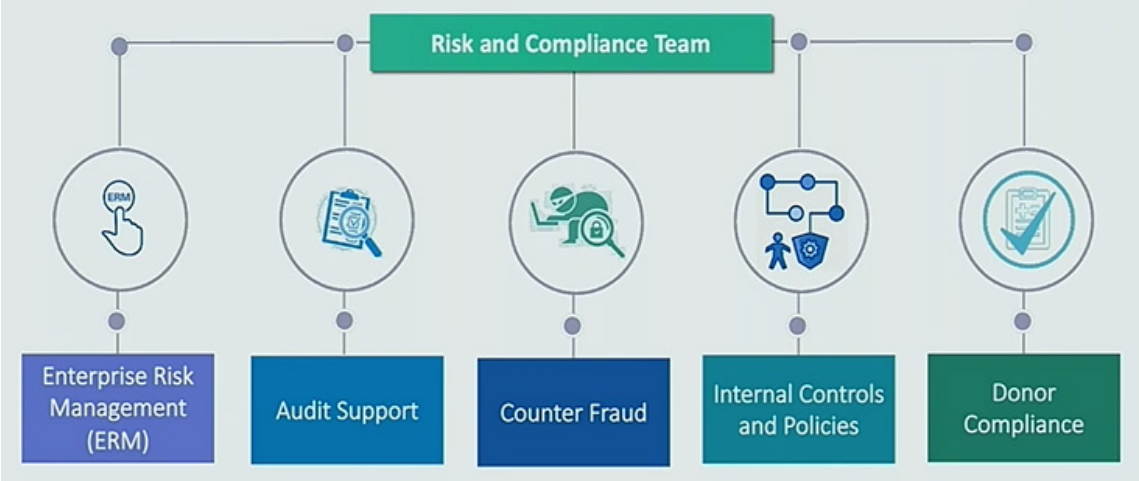
Governance & Risk Management

- To ensure effective control, WF applied the industry best practise 3 lines of defence model
- Framework instituted by Institute of Internal Auditor



What we do to provide support in risk and compliance for the project:

- Provide support in 5 different area:



Procurements

Mr. Hector Morais

- Procurement compliance involve formulating, following, and enforcing process for spend management
- To ensure suppliers, buyers and employees stick to policy and procedure to protect WF from fraud, corruption and rogue spending

Procurement compliance methods

- Implementation of standardized policy and procedure
  - Various threshold - price vs quotation number : > 1000 : 3 quotations
  - Numbers of suppliers: >5000 : 5 suppliers
  - Conflict of interest
  - Procurement committee
  - One drive file management system
  - Filing system that is used by all countries, from the start top the end procurement process

- Online platform to deposit documentation.
- Supplier CSI watchdog checks for
- Database to register supplier

Project Management (Contract and Grant)

Ms. Tan Su Ching

- PMU is WorldFish's central hub for all project management functionality; it sets project management standards, procedures and practices and ensures they are being followed
- PMU facilitates the development and sharing of project management resources, methodologies, tools, and techniques across the organization.

Project Management Unit (Grants and Contracts Team)

- Contracts review and clearance
- Contracts discussion and negotiation with donors and partners
- Contracts maintenance and administration (Fully countersigned copy)
- Follow up any discussion/ Modification/ Addendum if required
- Contract compliance, templates, tools
- Legal matters (Intellectual Property/ Policies/ Guidelines/ Termination/ Dispute Resolution)
- Providing ad hoc whenever necessary in relating to contract updates

Day 2: Planning sessions for years 2023

During the second day of the workshop, the Project Leader gave a comprehensive overview of the current implementation status of the project. Then, each project partner presented its tentative detailed annual workplan for 2023, which was discussed with the workshop participants. At the end of the second day, the Project Leader shared the updated Project Implementation Plan, which considered the delay observed by the project during the project mobilization phase (first semester). Project outputs and deliverables were thoroughly discussed, and the responsibility of each partner re-iterated. The Project Leader also put an emphasis on the necessity for a collaboration between the project partners, in the project countries, during the implementation of the project. It was also discussed what the timeframe, budget and particular outputs/ deliverables are for each team. Copies of presentations delivered during the Day 2 are in Appendix E.

The following are the main messages derived from each presentation delivered on the Day 2.

Presentation by Dr Chrysantus Mbi Tango (ICIPE)

Project work location

- Usenge Fish Cages Lake Victoria, Siaya County
- 100, 300m^2 Ponds in Samia, Busia County near Lake Victoria
- Kenya Marine and Fisheries Research Institute (KMFRI), Sagana, Nyeri County
- Kamuthanga Aqua Fish Farm in Machakos County

Project activities and timelines

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project agreements with WF																				
Start-up meetings																				
Recruit new staff																				
Recruit 10 MSc																				
Start-up workshop																				
1.1.1.1: Conduct literature review of relevant research documents and protocols																				
1.1.1.2: Design scoping studies for each country																				
1.1.1.3: Data collection (including sample ingredients) and analysis																				

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.1.1.4: Report preparation and publication																				
1.5.1.1: Design research protocols																				
1.5.1.3: Secure animal ethics approval																				
1.5.1.4: Conduct 12 tilapia experiments and 8 catfish experiments in project countries																				
1.5.1.5: Analyse data and samples																				
1.5.1.6: Research report preparation and publication and addition of results to WF's Better Management Practices guidelines (BMPs)																				
1.5.1.7: Develop new WF database of essential nutrient requirements in improved strains of tilapia and African catfish																				
2.1.2.1: Organise and facilitate 1 online stakeholder workshop per country																				

Project activities and timelines

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.1.2.2: Reports preparation and dissemination																				
2.1.3.1: Synthesize all findings on ingredients generated so far to enable prioritisation																				
2.1.3.2: Discuss all results with internal and external partners (including 1 online workshop per project country) and select 15 ingredients																				
2.1.3.3: Develop and use processing techniques to improve the quality of the 15 local ingredients as needed (e.g., fermentation, soaking, drying, detoxification, etc.)																				
2.1.3.4: Quality check the improved ingredients																				
2.1.3.5: Formulate fish feeds using software																				
2.1.3.6: Produce 9 experimental fish feeds																				
2.1.4.1: Design and validate research protocols																				
2.1.4.2: Conduct validation experiments on-farm																				

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.1.4.3: Analyse the data and produce reports																				
2.1.4.4: Hold workshops to share and discuss results																				
2.2.1.1: Develop database with a feed formulation-application/tool(FeedCalculator)																				
2.2.1.2: Develop a mobile version of the database and integrate into existing mobile apps widely used by farmers (including social media apps such as WhatsApp)																				
2.2.1.3: Hold an online workshop in each project country to obtain feedback from key project partners on initial design																				
2.2.1.4: Finalise both tools based on feedback from key project partners																				
2.3.1.1: Conduct 3 in-person workshops (1 for each project country) and 1 online workshop																				
2.3.1.2: Develop overall printed booklets/manuals																				
2.3.1.3: Develop and insert a unique set of 9 fish feeds per country in the booklet based on the novel ingredients (a total of 27 unique feeds)																				

Project activities and timelines

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.3.2.1: Organise and facilitate 4 training workshops per country (2 online and 2 in-person)																				
2.3.2.2: Reports preparation and dissemination																				
3.1.1.1: Organise and facilitate 2 stakeholder workshops per country (total of 6)																				
3.1.1.2: Report preparation and dissemination																				
3.2.1: Develop innovation platforms for bringing key scaling stakeholders together																				
3.2.2: Identify and set up demonstration sites and model farms																				
3.2.3: Host farmer field days on demo sites and model farms																				
3.2.4: Build partnerships with cooperatives to test and use novel feeds																				
3.2.4: Support establishment of new feed services and businesses by young people, farmers, etc																				

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3.2.5: Support small-scale millers to develop new product based on project's innovations																				
3.2.6: Build partnerships with NGOs, private sector, and extension service providers to incorporate project's knowledge and innovations to aquaculture farmers																				
3.3.2.1: Develop and publish factsheets (online and printed), BMPs, and project report																				
3.3.2.5: Design and conduct context-specific outreach to target end-users (farmers and millers) to support scale-up																				
3.3.2.6: Develop scaling potential outside of project by identifying additional scaling opportunities																				

Presentation by Dr. James Apochi (CORAF)

Project team

- Dr. James Apochi
- Dr Ibiyo L.M.O
- Dr. Iretioluwa Caroline Ayoolalusi

Project activities

- Scoping studies on the type, price and seasonality of local ingredients used in fish feeds in Nigeria.
- Re-evaluation of Nutrients requirements of improved strains of tilapia and African catfish using locally available ingredients in Nigeria
- Re-evaluation of nutrients requirements in improved strains of tilapia and African catfish using locally available ingredients in Nigeria.
- Four experiments each on tilapia and African catfish will be carried out
- Update result in the database
- Workshop organization
- PhD student component and research activities

Project work location

- Scoping study will be carried out through assessment survey of selected states per every Geopolitical zone with a total of twenty-two (22) states and FCT chosen to obtain knowledge.
  - North Central: Benue, Nasarawa, Niger, and Plateau States, as well as the Federal Capital Territory.
  - North East: Adamawa, Borno, Taraba, and Yobe States.
  - North West: Kaduna, Kano, Sokoto, and Zamfara States.
  - South East: Abia, Ebonyi, and Imo South
  - South: Akwa Ibom, Delta, and Rivers States
  - South West: Ekiti, Lagos, Ondo and Oyo States.
- Every available ingredient will be collected in the selected local and urban markets with the assistance of field personnel.

Project timeline

- Three months for sampling and data collection and two months for analysis and write up. (Y2)
- Four experiments each on Tilapia and African catfish (Y2-Y4)
- PhD student research on growth performance studies (Y3:Q4-Y4)

Partnerships

- Farmers and Ingredients marketers
- Fish feed Millers and fish farmers.

Presentation by Dr. Arthertone Jere & Mr. Gregory Kasanga (WorldFish Zambia)

Work plan to implement the FASA project in Zambia

- Implementation plan
  - Conduct projects start up workshop
  - Tentative date: Dec 2022 or Jan 2023
  - Online workshop

- Implement outcome 1
  - Literature review – work with WorldFish and Zambia university's publication
  - Design scoping studies
  - Data collection
  - Report and publication
  - Implementation plan – Output 5
  - Design research protocol (Y1: Q3)
  - RAS system setup at NRDC (Y1: Q1-Q3
  - Secure animal ethics (Y1: Q 3)
  - Conduct experiment (12 experiment) (Y1 –Y3)
  - Data and samples analysis (Y2-Y4)
  - Publication (Y4-Y5)

Template for scoping study data collection:

Activity: Scoping assessment
Sub activity 1.1.1.2 : Design scoping studies

Ingredient	Price (Relative cost)	Region / Province (Source)	Seasonality	Abundance	Availability	Remarks
Groundnut cake		Northern				
Maize bran						
Insert meal						
Algae						
Bllodmeal						

*More ingredients can be added to this list

Ingredient	Target: Data Analysis (For best feed formulation)	Price (Relative cost)	Region/Province (Source)	Seasonality	Abundance	Availability	Rank
Maize Bran	✓						
	✓						
	✓						
	✓						
	✓						
	✓						
	✓						
	✓						

Map where the activities and scoping of ingredient will be conducted.

Overall activities – structured only for 2023

- Project start up engagement (Dec 2022)
- Recruitment of MSc and PhD (Jan 2023 – March 2023)
- Scoping assessment of scoping ingredient (Jan 2023 - Sep 2023)
- Investigate nutrient requirements in improved strains of tilapia (Dec 2022 – Dec 2023)
- Renovate NRDC lab (Dec 2022 – July 2023)
- Partner engagement – (Dec 2022, April 2023, Aug 2023, Dec 2023)
- Laboratory experiment (Jun 2023-Dec 2023)
- Field trial experiment (Jun2023 – Dec 2023)

Question (Q) and Answer (A)

Comment: In addition to the raw material ranking, it was suggested that the inclusion amount that may be used in the fish feed be considered.

Comment: It is important for the government to collect as much quantity data on ingredients together with fertiliser and manure on the agro-ecological system, use of water and energy sources and/or process, particularly for LCA and environmental impact.

Comment: Suggested to have a structured and template for the questionnaires of the scoping studies.

Comment: It was suggested that a standard form is provided, but only one partner will ask the questions, particularly about gender or climate change subject. Because, people from many disciplines have different understanding.

Comment: It is possible to incorporate a standard scoping questionnaire with a country-specific questionnaire. Could also offer online training for conducting the survey. Communication and coordination are also required among the partners in each country.

Comment: In conducting the scoping studies, we should focus on the outcome and output. Additional unrelated questions would interfere the objectives

Comment: Animal and human ethics must be applied, and a research protocol is essential for the application. WorldFish will share examples of research protocols with partners, and once established the Project Leader must approve the research protocols developed by each partner.

Presentation by Dr. Aaqillah Amr and Dr. Rodrigue Yossa (WorldFish Penang)

Detailed planning of Work in Malaysia

- Introduction
  - Conducted lab analysis and digestibility experiment of samples from scoping studies
  - Feed ingredient database development

- Team Members at WorldFish Penang
  - Dr. Aaqillah Amr
  - Nurulhuda
  - Muhammad Rahimi
  - Ning Shahira
  - Dr. Rodrigue Yossa

- Workstation
  - Aquaculture lab- WorldFish Penang

- Work plan timeline
  - Conduct digestibility experiment to identify the potential local ingredients (Y2-Y3)
  - Experiment 1 and 2 (July 22-Jun 23)
  - Experiment 3, 4 and 5 (July 23 – Jun 24)
  - Experiment 6 (July 24 – Dec 24)

- Lab analysis (Y2-Y3)
  - Proximate analysis
  - Anti-Nutritional Factors
  - Apparent digestibility coefficient
  - Database development (Y2-Y3)

- Result discussion with partners and 1 online workshop (Y2:Q4)
  - In order to select relevant ingredient to be used in the PhD study
  - To consider gender and climate change element when selecting the ingredients

- Project management (Y1-Y5)
  - WF support team contribution
  - Monthly meeting (online) with the stakeholders

Question (Q) and Answer (A)

Comment and suggestion: The digestibility study is for Tilapia (in Penang). Suggested to keep as many tissues and samples as possible, so if we want to be innovative and if something new emerges in the future, it can be reinvestigated.

Comment: Assuming 30 ingredients will be received from countries, Malaysia will receive 10 ingredients each country. There are 18 tanks units with swirl separators for faecal collection at the facility at WorldFish Malaysia. As a result, only have six treatments with three duplicates can be used in each digestibility experiment at once, consisting of diets made of five test ingredients and one reference diet at a time. The approaches are to collect all the ingredients at the same time and freeze them until the experiment is ready to be conducted.

Q: Will the digestibility testing be conducted using both raw and processed materials?
A: Yes, at WorldFish, raw materials will be used for the experiment, but PhD students will produce processed materials and conduct digestibility with them at SLU.

Q: So does SLU will receive the same batches as WorldFish, then process and test the digestibility using the same batch raw materials?
A: Yes, the same batches of ingredients but not the same number of ingredients. Malaysia will receive 10 ingredients per countries while SLU will receive five ingredients per country.

Q: Will SLU consider the material flow when fortifying the raw materials? As an example, when you do grain debranning, you will not just get fortified debranning, but you will also get bran that can be sold for additional income, which is not good for fish, but good for terrestrial animals. It is important also, to record the volume of the product that is produced after processing even if it is for different use.
A: Rodrigue will raise this issue with WorldFish's procurement team, as they are in a position to deal with the processes and ensuring that the necessary documents are provided. It would be helpful to know the quantity to be sent in advance

Comment: Make note of the process of importing raw materials to Penang and Sweden, which included customs clearance, import and export permits. The process is not simple, and the respective countries must plan ahead of time if they want to export the material.

Q: Does this mean that when the time comes to manufacture the feed on the ground, someone will already know how to treat a considerable amount of raw material to fortify in the way specified by the project? Will technology be transferred, or will SLU provide enough volume for the local team to produce the feed formulation?
A: SLU will consult with all partners on this matter.

Q: Is the digestibility experiment will be conducted in vivo or in vitro?
A: According to the project description, in vivo testing will be performed in the experiment

Presentation by Dr. Kartik Baruah (SLU Sweden)

General layout of the PhD thesis

- Focus on Tilapia and Catfish
- Novel feed ingredients
- Digestibility study at WF
- Ingredient conditioning and diet formulating
- Growth trial
- Validation study

Important for the student to understand the science

Activities in SLU is mainly on the PhD recruitment and PhD research activities

- Recruitment of PhD student - Advertisement jointly by WFC & SLU
- Registration at SLU
- Doctoral courses – 30 credit courses at SLU (statistics, ethics)
- Lab works at SLU
- Validation study at their home country
- Writing and PhD thesis defences

Some technical things and problem will be faced in the countries need to be discussed further

Question (Q) and Answer (A)

Q: Suggested to look at the influence of feed on the somatic index and hepatosomatic index. Then question on what parameters will be collected in the nutrigenomics study?
A: Will collect sample for transcriptomic analysis, measuring a broad spectrum to see what is happening at the gene level with an emphasis on immunological, metabolic cascade.

Q: Concerning the genetically improved strain against the wild variety of fish. If WorldFish will adopt Tilapia GIFT for digestibility assessment, should SLU use the same fish? Perhaps the outcome will differ if other fish are used.
A: Due to the difficulty in delivering the GIFT to SLU, it is difficult to use the same fish for experiment. Therefore, it is fine to use different improved strain.

Day 3: Site Visit to Fisheries Research Institute Malaysia, Kedah, and Visit to Jitra Aquaculture Extension Centre, Pulau Sayak.

Participants of the 2022 FASA Annual Workshop visited the Department of Fisheries' Research Institute at Pulau Sayak and the Aquaculture Expansion Center at Jitra, in the morning and afternoon respectively, on the 30th November 2022. The goal of the visits was to learn how the Malaysian Government is supporting the aquaculture sector in the country and to get familiar with the infrastructure and management plans that are applied in these institutions.

Plate 2. Welcoming and briefing session by Mr. Mohammed Suhaimee Abd. Manaf, Director Department of Fisheries Research Institute at Pulau Sayak.

Plate 3. Participants visited the feed making facility at the Fisheries' Research Institute at Pulau Sayak

Plate 4. Participants visited the seaweed research facility at the Fisheries' Research Institute at Pulau Sayak.

Plate 5. Welcoming and briefing session by Mr Akmal research officer at the Aquaculture Expansion Center at Jitra.

Plate 6. Participants visited the fish pond facility at the Aquaculture Expansion Center at Jitra.

Outcome of the workshop

The main outcome of the workshop was the revision of the Implementation Plan of the FASA project (Appendix F). This revised Implementation Plan will be submitted to the donor for approval. Going forward, it is this revised plan that will be used to implement the project on the ground.

Next Steps and Conclusion

- Each partner to submit its 2023 Annual Workplan to the Project Leader for approval
- Each partner to implement the 2023 project activities in Kenya, Nigeria, Zambia, Sweden and Malaysia, as per the revised Implementation Plan and the approved annual workplan
- The next annual project workshop will take place in Nigeria in November 2023

List of plates

Appendix A: Workshop Agenda

Agenda

Event : Annual Project Workshop 2022
Date : 28 – 30th November 2022 (Monday – Wednesday)
Location : WorldFish HQ, Penang, Malaysia
Project : Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)
Project Leader & Moderator : Rodrigue Yossa

Day 1

Monday / 28th November 2022 / WF Auditorium/ Presentations from FASA partners		
08.30 – 08.45 am	ETA at WorldFish Lobby. Meet & Greet (coffee/tea served at the foyer)	
Opening (Auditorium)		
09.00 – 09.05 am	Welcome Speech	Essam Mohammed
09.05 – 09.10 am	Introduction to Aquatic Foods Bioscience	John Benzie
09.10 – 09.15 am	Welcome of Norad or Ambassador of Norway	Norad/Norwegian embassy?
09.15 – 09.25 am	Introduction and scope of the meeting	Rodrigue Yossa
Session 1:		
09.25 – 09.40 am	Introduction on organization and team, experience in fish feeds and Nutrition, workplan to implement the FASA project in Kenya (geographies, local partners, available facilities, etc.)	ICIPE (Chrysantus Mbi Tanga)
09.40 – 09.55 am	Introduction on organization and team, experience in fish feeds and Nutrition, workplan to implement the FASA project in Nigeria (geographies, local partners, available facilities, etc.)	CORAF (James Apochi)
09.55 – 10.10 am	Introduction on organization and team, experience in fish feeds and Nutrition, workplan to implement the FASA project in Zambia (geographies, local partners, available facilities, etc.)	WorldFish Zambia (Arthertone Jere)
10.10 – 10.25 am	Introduction on organization and team, experience in fish feeds and Nutrition, workplan to implement the FASA project in Malaysia (geographies, local partners, available facilities, etc.)	Project Leader (Rodrigue Yossa)
10.25 – 10.45 am	Discussion/ Q & A	
10.45 – 11.00 am	Coffee Break at the foyer	
Session 2:		
11.00 – 11.15 am	Introduction on organization and team, experience in market assessments and scaling, workplan to implement the FASA project	ILRI (Edwin Kimani Kang'ethe)
11.15 – 11.30 am	Introduction on organization and team, experience in vocational training and collaboration with WorldFish, workplan to implement the FASA project	NRDC (Alice Tembo)
11.30 – 11.45 am	Introduction on organization and team, experience in training Ph.D. students and research in fish feeds and nutrition, workplan to implement the FASA project	SLU (Sri Kartik Baruah)
11.45 – 12.05 pm	Discussion/ Q & A	
12.00 – 13.00 pm	Lunch at WF Cafeteria	
Session 3:		
13.00 – 13.15 pm	Introduction on organization and team, experience working with WorldFish, workplan to implement the FASA project	Aller Aqua (Alexander Michael Greiling)
13.15 – 13.30 pm	Introduction on organization and team, experience in gender and fish feeds, workplan to implement the FASA project	Gender
13.30 – 13.45 pm	Introduction on organization and team, experience in CC and fish feeds, workplan to implement the FASA project	Climate Change
13.45 – 14.00 pm	Discussion/ Q & A	
14.00 – 14.15 pm	MEL plan and MEL online system	Megi Cullhaj
14.15 – 14.30 pm	Data management plan	Megi Cullhaj

14.30 – 14.45 pm	Impact Assessment Plan	Timothy Manyise
14.45 – 15.15 pm	Coffee Break at the foyer	
15.15 – 15.30 pm	Comms plan	Sean Lee / Anar Khalil
15.30 – 15.35 pm	Technical reporting	Rodrigue Yossa
15.35 – 15.40 pm	Financial reporting	Tan Chao Yan
15.40 – 15.45 pm	Finance and Compliance	Glenda Munyukwi
15.45 – 15.50 pm	Procurement compliance	Hector Morais
15.50 – 16.00 pm	Grants and Contract compliance	Tan Su Ching
16.00 – 16.15 pm	Discussion/ Q & A	
End of open session for all staff		
19.00 – 21.30 pm	Dinner at XX (TBA)	

Day 2

The project leader will give a comprehensive overview of the current implementation plan during these meetings, which will be followed by a discussion of more in-depth planning for the years 2023 and 2024 with provided current budgets, taking into consideration the collaboration between partners and WorldFish.

In this discussion, it will be made clear what the timeframe and particular outputs/deliverables are for each team.

Tuesday / 29th November 2022 / Block J/ Planning sessions for years 2023 & 2024		
08.30 – 08.45 am	ETA at Block J. Meet & Greet (coffee/tea served at the foyer)	
09.00 – 09.05 am	Introduction and scope of the meeting	Project Leader (Rodrigue Yossa)
Session 1:		
09.05 – 10.05 am	Detailed planning of work in Kenya	ICIPE (Chrysantus Mbi Tanga)
10.05 – 11.05 am	Detailed planning of work in Nigeria	CORAF (James Apochi)
11.05 – 11.30 am	Coffee Break at the foyer	
11.30 – 12.30 pm	Detailed planning of work in Zambia	WF Zambia (Arthertone Jere)
12.00 – 13.30 pm	Lunch at WF Cafeteria	
Session 2:		
13.30 – 14.15 pm	Detailed planning of work in Malaysia	Project Leader (Rodrigue Yossa)
14.00 – 14.30 pm	Detailed planning of work in Sweden	SLU (Sri Kartik Baruah)
14.30 – 15.00 pm	Discussion/ Q & A	
15.00 – 15.15 pm	Coffee Break	
Session 3:		
15.15 – 16.00 pm	Updated implementation plan of the FASA project	Project Leader (Rodrigue Yossa)
16.00 – 16.30 pm	Discussion/ Q & A	
End of open session for all staff		

Day 3: Site Visit to Jitra Aquaculture Extension Center, Kedah, and Green Island Feed Mills at Simpang Ampat.

Wednesday / 30th November 2022 /Evergreen Laurel Hotel/ Site Visit	
08.15 – 08.30 am	Pick-up at Evergreen Laurel Hotel Lobby
08.30 – 10.30 am	Evergreen Laurel Hotel to Jitra Aquaculture Extension Center, Kedah
10.30 – 12.00 am	Site Visit
12.00 – 13.00 pm	Lunch
13.00 – 15.00 pm	Jitra Aquaculture Extension Center, Kedah to Green Island Feed Mills at Simpang Ampat
15.00 – 16.00 pm	Site Visit
16.00 – 17.00 pm	Green Island Feed Mills at Simpang Ampat to Evergreen Laurel Hotel
End-	

Day 4: Optional: Individual meetings with key staff at WorldFish Penang

Appendix B: Participant list

Attendance List

Event : Annual Project Workshop 2022
Date : 28 – 30th November 2022 (Monday – Wednesday)
Location : WorldFish HQ, Penang, Malaysia
Project : Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)
Project Leader & Moderator : Rodrigue Yossa

Date : 28th November 2022, Monday

Venue : Auditorium, WorldFish HQ, Penang, Malaysia

No	Organisation	Name of Participant	Attendance
FASA Partner (s)			
1	CORAF	James Ocheme Apochi	Yes
2	CORAF	Lenient Mercy Onivie Ibiyo	Yes
3	CORAF	Caroline Iretioluwa Ayo-Olalusi	Yes
4	NRDC	Alice Tembo	No
5	SLU	Sri Kartik Baruah	Yes
6	ICIPE	Chrysantus Mbi Tanga	Yes
7	Aller Aqua	Alexander Michael Greiling	Yes
8	Includovate	Sujata Ganguly	Yes
9	Nagi Enterprise	Mzime Regina Murisa	Virtual
10	Nagi Enterprise	Angela Samundengo	Virtual
11	Nagi Enterprise	Fanuel Kapute	Virtual
WorldFish			
1	Interim Director General and Acting Senior Director of Aquatic Foods Systems	Essam Mohammed	Yes
2	Senior Scientist (Project Leader)	Rodrigue Yossa	Yes
3	Scientist Zambia	Arthertone Jere	Yes
4	Research Assistant	Gregory Mulenga Kasanga	Yes
5	Scientist Malaysia	Aaqillah Amr Binti Mohd Amran	Yes
6	Research Assistant-Laboratory	Ning Shahira Binti Sharbini	Yes
7	Research Assistant-Fish feeds	Muhammad Rahimi Ramli	Yes
8	Research Analyst	Nurulhuda Ahmad Fatan,	Yes
9	Research Assistant	Khairul Rizal Abu Bakar	No
10	Monitoring Evaluation and Learning Manager	Megi Cullhaj	Yes

11	Science Communications Specialist	Sean Lee	Yes
12	Head of Human Resources (IWMI)	Anne Heese	Yes
13	Human Resources Specialist	Abdul Aziz, Azimah	Yes
14	Portfolio Manager (PMU)	Emily Khor	Yes
15	Senior Program Associate (PMU)	Yogeswary Chellappan	Yes
16	Senior Program Associate (PMU)	Pak Song Kee	No
17	Office Administrator	Pauline Michael	Yes
18	Grants and Contracts Manager	Tan Su Ching	Yes
19	Grants and Contracts Specialist	Hanley Ong	Yes
20	Risk and Compliance Analyst	Azira Azmi	Yes
21	Global Procurement Lead	Hector Morais	Virtual
22	Manager, Research Finance	Tan Ban Swee	Yes
23	Project Accountant	Tan Chao Yan	Yes
24	Assistant Accountant	Ooi Jia Qi	Yes
25	Country Director, Zambia & Southern Africa	Victor Siamudaala	No
26	Consultant	Sunil Siriwardena	No
27	Consultant	Rohana Subasinghe	No
28	Manager, Operations and Program Delivery	Victoria Nkole	No
29	Accounts Manager	Isaac Toyin Emmanuel,	No
30	Senior Accountant	Chindika Sakala	No
31	HR Specialist	Lee Huey Ching	Yes
32	HR Manager, Reward and HR Systems	Sim Hui Yee	Yes
33	Compliance and Admin Manager	Fok Siew Choy	Yes
34	Research Assistant	Solehah Hashim	Yes
35	Research Assistant	Nuratikah Azmi	Yes
36	Research Assistant	Difa Dhaniah Zharfan Engcong	Yes
37	Research Assistant	Nurimanina Najwa Shahrin	Yes
38	Research Assistant	Wong Jian Shen	Yes

Attendance List

Event : Annual Project Workshop 2022
Date : 28 – 30th November 2022 (Monday – Wednesday)
Location : WorldFish HQ, Penang, Malaysia
Project : Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)
Project Leader & Moderator : Rodrigue Yossa

Date: 29th November 2022, Tuesday

Venue: Black J, WorldFish HQ, Penang, Malaysia

No	Organisation	Name of Participant	Attendance
1	CORAF	James Ocheme Apochi	Yes
2	CORAF	Lenient Mercy Onivie Ibiyo	Yes
3	CORAF	Caroline Iretioluwa Ayo-Olalusi	Yes
4	NRDC	Alice Tembo	No
5	SLU	Sri Kartik Baruah	Yes
6	ICIPE	Chrysantus Mbi Tanga	Yes
7	Aller Aqua	Alexander Michael Greiling	Yes
8	Includovate	Sujata Ganguly	Yes
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10	Nagi Enterprise	Angela Samundengo	Virtual
11	Nagi Enterprise	Fanuel Kapute	Virtual
WorldFish			
1	Senior Scientist (Project Leader)	Rodrigue Yossa	Yes
2	Scientist Zambia	Arthertone Jere	Yes
3	Research Assistant	Gregory Mulenga Kasanga	Yes
4	Post-Doctoral Fellow	Aaqillah Amr Binti Mohd Amran	Yes
5	Research Assistant-Laboratory	Ning Shahira Binti Sharbini	Yes
6	Research Assistant-Fish feeds	Muhammad Rahimi Ramli	Yes
7	Research Analyst	Nurulhuda Ahmad Fatan	Yes
8	Research Assistant	Khairul Rizal Abu Bakar	Yes
9	Research Program Manager	Megi Cullhaj	Yes
10	Portfolio Manager (PMU)	Emily Khor	Yes
11	Senior Program Associate (PMU)	Yogeswary Chellappan	Yes
12	Office Administrator	Pauline Michael	Yes

13	Research Finance Manager	Tan Ban Swee	No
14	Project Accountant	Tan Chao Yan	Yes
15	Assistant Accountant	Ooi Jia Qi	Yes
16	Country Director, Zambia & Southern Africa	Victor Siamudaala	No
17	Consultant	Sunil Siriwardena	No
18	Consultant	Rohana Subasinghe	No
19	Manager, Operations and Program Delivery	Nkole, Victoria	No
20	Accounts Manager	Emmanuel, Isaac Toyin	No
21	Senior Accountant	Sakala, Chindika	No

Appendix C: Presentation Day 1

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

CHRYSANTUS MBI TANGA ICIPE

TEAM

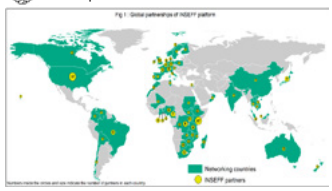
Organization

Organization with a *unique* history: >50 years

- A *Center of Excellence* in Africa- for research and capacity building in insect science and its application
- An *intergovernmental organization*- Charter signed by 13 countries worldwide
- >571 staff (>30 nationalities) including several contracted workers
- 150-180 graduate students annually

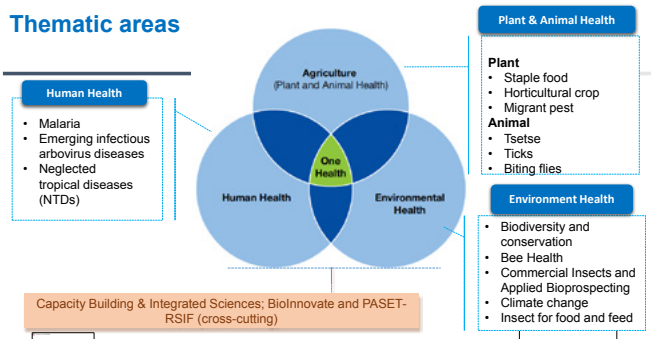
Where we work

> 200 partners in 61 countries across 5 continents



INSEFF has been mentioned in 494 articles produced in 15 major languages across 40 countries in 4 continents. The estimated reach is over 3 billion people.

Thematic areas



Introduction

Rethinking Beyond Current Food Systems

- ❑ Due successive shocks: war in Ukraine & COVID-19 pandemic, records in 2022 show minimum of 123 million people are acutely food insecure.
- ❑ Situation projected to get worsen in the next 2 decades unless drastic measures are taken to reverse food insecurity.

How we work

Project Key Facts

Opportunities: Feeds & Employment

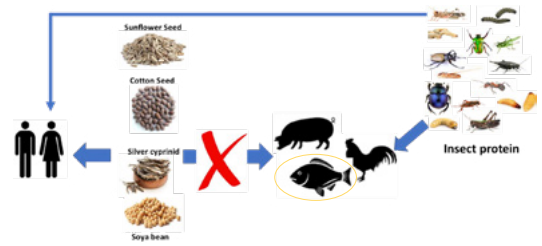
Fishmeal price

In Kenya, potential market demand of protein is 115,000 MT/yr valued at US$103.5-115 million/year (**25,328 NEW JOBS**), if each farmer produces **2 MT** of dry insects/month.

Accompanying this increase is the demand for feed to produce meat (**1.1 billion tons of feed in 2018**)

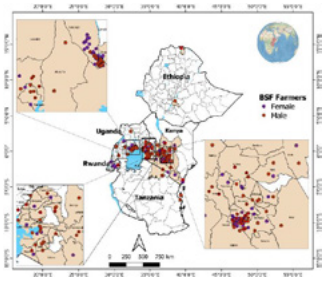
EXPERIENCE IN FISH FEEDS AND NUTRITION

Sustainable Protein Economy Debate



- In Kenya, 5-50% adoption of IBF would **fish, soyabean, and maize** to feed **4.8 million** people/year

Scaling insect farms in East Africa

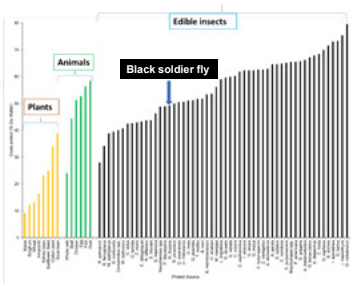


Large Scale: ~ 1,320 – 3,600 MT/year

EXPERIENCE IN FISH FEEDS AND NUTRITION

Insect protein

- Globally, 2000 edible insect species
- Africa has 552 edible species
- Excellent source of
  - ✓Crude protein: 28-80%
  - ✓Fat content: 15-40%
  - ✓Iron: 4-64 mg/100 g
  - ✓Zinc: 8-88 mg/100g



EXPERIENCE IN FISH FEEDS AND NUTRITION

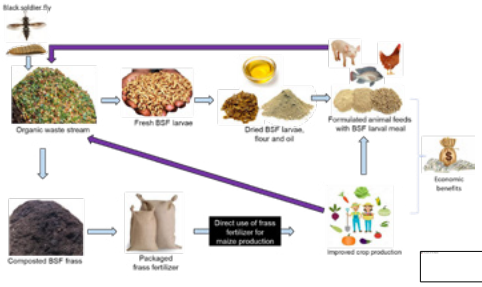
Nutritional quality of extruded fish feeds

Table 1. Inclusion levels of ingredients (%) and proximate composition (%) of the extruded pellets.

Ingredients/extruded pellets	BSFLM0_CE	BSFLM0_HE	BSFLM75_CE	BSFLM75_HE
BSFLM	0.00	0.00	21.75	21.75
Fish meal	29.00	29.00	7.25	7.25
Maize germ	19.00	19.00	19.00	19.00
Sunflower cake	19.00	19.00	19.00	19.00
Wheat Pollard	29.00	29.00	29.00	29.00
Cassava floor	4.00	4.00	4.00	4.00
Proximate Composition (dry weight basis)				
Crude protein	29.42 ± 0.99^{b}	31.48 ± 0.93^{a}	27.36 ± 0.12^{c}	27.03 ± 0.14^{d}
Crude fat	6.88 ± 0.38^{c}	4.93 ± 0.91^{d}	16.41 ± 0.37^{a}	15.6 ± 0.42^{b}
Crude fiber	9.97 ± 0.38^{bc}	9.28 ± 0.50^{c}	12.16 ± 0.18^{a}	10.18 ± 0.42^{b}
Ash	9.59 ± 0.42^{a}	9.05 ± 0.37^{ab}	8.66 ± 0.48^{b}	7.64 ± 0.26^{c}
Carbohydrate	44.14 ± 0.54^{b}	45.26 ± 0.12^{a}	35.40 ± 0.64^{d}	39.55 ± 0.45^{c}

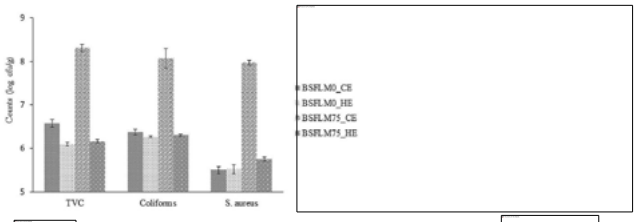
EXPERIENCE IN FISH FEEDS AND NUTRITION

Black soldier fly production: A sustainable model of circular economy



EXPERIENCE IN FISH FEEDS AND NUTRITION

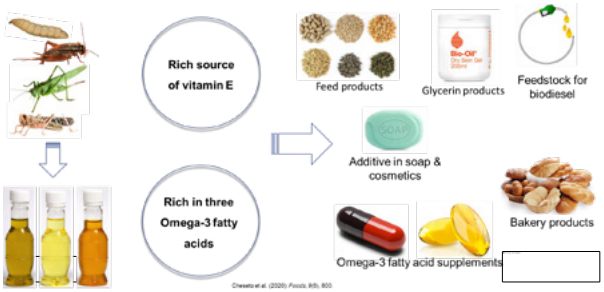
Microbial quality of extruded fish feeds



Were et al. (2020) J. Appl. Aquac

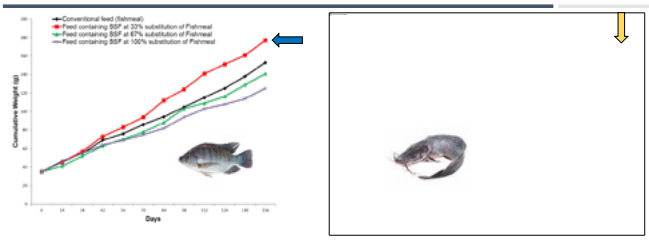
EXPERIENCE IN FISH FEEDS AND NUTRITION

Insect oils as ingredient in aquafeed and others



EXPERIENCE IN FISH FEEDS AND NUTRITION

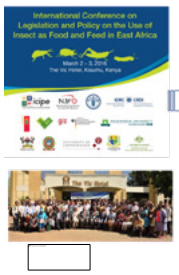
Scaling insect protein for fish production



Over 15% increase growth rate and 20% increase in weight gain

EXPERIENCE IN FISH FEEDS AND NUTRITION

Policy Engagement, Standard Development & Certifications



KEBS Kenya Bureau of Standards

RSB Rwanda Standards Board

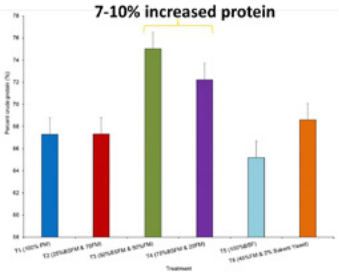
UNBS Uganda National Bureau of Standards

tbs

- 1 International conference.
- >52 face to face meetings.
- 12 Policy dialogues.
- 21 Workshops.
- 17 Technical committee meetings.
- 15 Insect-based products. certified.
- 4 new standards developed.

EXPERIENCE IN FISH FEEDS AND NUTRITION

Better carcass quality



Primary project goals

Develop low-cost, highly nutritious fish feeds based on novel ingredients and enable 5,000 smallholder fish farmers in 3 African countries to test and adopt these ingredients and feeds (30% women and 40% youth), leading to increased income, improved food security, and reduced waste and pollution.

TARGET SITES (LOCATIONS & FACILITIES)

Kamuthanga Aqua Fish Farm in Machakos County

Africa's first certified fish farm with EcoMark Africa label from ARSO using Recirculating Aquaculture System (RAS)

Plug-in type of RAS technology

Expected outcomes

Outcome 1: Enhanced capacity of at least two stakeholder groups in each of the 3 target countries to integrate best practices toward a more sustainable feed sector, and to adopt new knowledge on nutrient requirements of multiple improved strains of tilapia and African catfish

Outcome 2: Quality of at least 15 local ingredients has been improved through various processing techniques and the ingredients are used by stakeholders in the 3 target countries, including local millers and farmers, to produce 9 novel, cost-efficient feed formulations, to improve aquaculture productivity and resilience.

Outcome 3: 5,000 farmers directly or indirectly linked to the project access, test, and use novel fish feeds and feed solutions using the knowledge and innovations developed by the project, with support of a range of strategic scaling partners and other stakeholders.

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 1: Participation in annual project meetings and planning a Start-up workshop	Detail activities: Participate in annual project meetings and conduct a project start-up workshop at ICIPE (Kenya) in the year of 2022
Output 2: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in 3 focus countries and made available within and outside the focus countries	Detail activities: Conduct 1 scoping assessment, which includes (i) Conducting a literature review of relevant research documents and protocol; (ii) Design scoping studies for Kenya; (iii) Data collection (including sample ingredients) and analysis; and (iv) Report preparation and publication.

TARGET SITES (LOCATIONS & FACILITIES)

USENGE FISH CAGES LAKE VICTORIA, SIAYA COUNTY

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 3: New knowledge and data on nutrient requirements of improved strains of tilapia and African catfish produced, validated, and made widely available	Detail activities: Investigate nutrient requirements in improved strains of tilapia and African catfish which includes (i) Design research protocols; (ii) Secure animal ethics approval; (iii) Conduct 12 tilapia experiments and 8 catfish experiments in project countries; (iv) Analyse data and samples; and (v) Research report preparation and publication and addition of results to WF's Better Management Practices guidelines (BMPs).

TARGET SITES (LOCATIONS & FACILITIES)

100, 300M² PONDS IN SAMIA, BUSIA COUNTY NEAR LAKE VICTORIA

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 4: New data and knowledge on local ingredients generated, used in the formulation of novel fish feeds, and made widely available	Detail activities: Stakeholder consultations (1 online workshop per country) to discuss results of activity 2.1.1 and potential benefits, risks, challenges, and hazards to the use of local ingredients which includes (i) Organise and facilitate 1 online stakeholder workshop per country; and (ii) Reports preparation and dissemination. Detail activities: Validate 9 formulated fish feeds through 6 on-farm pilots (2 per country which include (i) Design and validate research protocols; (ii) Conduct validation experiments on-farm; (iii) Analyse the data and produce reports; and (iv) Hold workshops to share and discuss results (1 workshop per country).

TARGET SITES (LOCATIONS & FACILITIES)

Kenya Marine and Fisheries Research Institute (KMFRI), Sagana, Nyeri County

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 5: Knowledge and capacity improved of millers, farmers, and other stakeholders to use novel ingredients to create the most affordable, highest quality fish feeds that take into account context-specific circumstances and needs	Detail activities: Hold consultation workshops to develop the printed booklets/manuals for ingredients and fish feeds, which includes (i) Organise and facilitate 2 workshops per country (1 online and 1 in-person); and (ii) Reports preparation and dissemination. Detail activities: Hold workshops to train feed millers and fish farmers on ingredients, feeds, practices, databases, booklets/manuals which includes (i) Organise and facilitate 4 training workshops per country (2 online and 2 in-person); and (ii) Reports preparation and dissemination.

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 6: Integrated knowledge for enabling the scaling environment (including exploring barriers and bottlenecks to scaling), and strategies for scaling up the use of novel feeds and feed management approaches in the 3 target countries co-developed with stakeholders and used to guide selection of country scaling strategies.	Detail activities: Stakeholder consultations to co-develop scaling strategies which includes (i) Organise and facilitate 2 stakeholder workshops per country (total of 6); and (ii) Report preparation and dissemination

Partnerships

1. Kenya Marine and Fisheries Research Institute (KMFRI)
2. Kamuthanga Fish Farm, Machakos, Kenya
3. Victory Farms Ltd, Kenya (Private sector)
4. National Universities (e.g., University of Eldoret etc)
5. JABALI FISH FARM (JABALI FISHERIES TRADERS)
6. Beach Management Units (BMU), County Government
7. Kenya Bureau of Standards (KEBS)

Workplan/project components

Expected outputs and required activities to be performed by icipe

Outputs	Activities
Output 7: Support is offered to other project stakeholders working in Kenya	Detail activities: Support to the gender, climate change, scaling, MEL, Communication, Project Leadership and other stakeholders involved in project that are not based in Kenya are supported by ICIPE during the implementation of their activities in Kenya, including guidance in the project areas in Kenya, invitation letters for visa application, hotel reservations, venue booking for workshops, etc.

Thank You

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By Dr. James Apochi (CORAF)

Norad

WorldFish CGIAR

Introduction on organization and team

- CORAF (West and Central Africa Council for Agricultural Research and Development) is in charge of the FASA Project
- National Center of Specialization (NCoS) on Aquaculture supervised by ARCN
  - Nigerian Institute for Oceanography and Marine Research (NIOMR), Lagos
  - National Institute for Freshwater Fisheries Research (NIFFR), New Bussa
  - Nigerian Stored Products Research Institute (NSPRI), Ilorin
- Recruitment of Research Team from NCoS by CORAF
  - Research Leader (Aquaculture Specialist, PhD) will coordinate all the activities of the project
  - Research Scientist (Aquaculture Nutritionist, PhD) full-time and will lead the Activities 1.1, 2.1, 2.2, 3.2, 3.5 and 4.4
  - Research Technician (MSc) full-time
  - Lab Attendant

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Experience in fish feeds and Nutrition

- **CASSAVA FLOUR**

Cassava was used to replace maize in fish feed due to high cost of maize and maize being the major diet for human. About 40% cassava flour was included in Extruded floating fish feed

- **CASSAVA LEAF PROTEIN CONCENTRATE**

Production of Cassava leaf protein concentrate from the leaves. Studied have been carried out on its nutritional and anti-nutritional composition and have incorporated it into a practical extruded diet for fish.

- **LANTERN FISHMEAL PRODUCTION**

Capturing, processing and utilization of a deep-sea fish species (Lantern fish) for the production of an indigenous less expensive fishmeal is on-going

- **PROBIOTIC PRODUCTION**

The novel production of isolating probiotics (Lactic acid bacteria LAB) from the gut of our indigenous fish species and their subsequent culture and used as an addictive or supplement in fish feed to boost fish's health and increase production.

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WorldFish CGIAR

Experience in fish feeds and Nutrition Contd.

- **CLUPEID FISHMEAL PRODUCTION AND UTILIZATION**

Clupeid fish has been studied with its chemical composition determined and used to produce local fishmeal (WAAPP Fishmeal) which is replacing foreign fishmeal in fish feeds in Nigeria.

- **USE OF BAOBAB LEAF MEAL AS SOURCE OF VITAMIN C**

Baobab leaves studied and used to produce leaf meal as source of vitamin C in fish feeds.

- **DEVELOPMENT OF FEEDS FOR ALL STAGES OF CATFISH AND TILAPIA**

Development of different feeds for fry, fingerlings, juveniles and broodstock of freshwater fish has been carried out.

- **UTILIZATION OF INSECT PROTEIN**

Performance of maggot meal as a substitute for imported fishmeal in the culture of *Clarias gariepinus* Juveniles was investigated. Based on the results, the use of maggot to substitute the costly fish meal to about 75% inclusion level is recommended to fish farmers and feed industry though work is on-going.

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Workplan

Geographies

Scoping study will be carried out through assessment survey of selected states per every Geopolitical zone with a total of twenty two (22) states and FCT chosen to obtain knowledge and current nutrient composition of available feed ingredients in Nigeria to increase data in use for fish feeds project. Every available ingredient will be collected in the selected local and urban markets with the assistance of field personnel in each of the state and locality who could be a staff of the Ministry of Agriculture.

Norad

WorldFish CGIAR

Workplan Contd.

Three Months for Sampling and data collection and Two Months for Analysis and write up. The selected states are highlighted below:

North Central: Consisting of Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau States, as well as the Federal Capital Territory.

North East: Consisting of Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe States.

North West: Consisting of Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara States.

South East: Consisting of Abia, Anambra, Ebonyi, Enugu, and Imo States.

South South: Consisting of Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States.

South West: Consisting of Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo States.

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Partnership

Local partners

1. Grand cereals Limited. Producer of Vital fish feed: Mrs Adedeji, Mobile- +2348036071406
2. TRITON group of company: Mr Ope, +2348134564837
3. OBA FARMS Limited producer of Crown fish feed: Dr. Godwin, +2347031074749
4. NIOMR fish feed miller (Government feed miller): Mr Bernard Edah +2348037729387
5: Olam International, Blue crown: Mr Busayo,+2347062951587
6. Lawrence Feed mill Ventures
7. Abdulsalam Fish Farm

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Facilities

Available Facilities

- Facilities at the NCoS (NFFRI and NIOMR) which needs to be up graded
- The demonstration research will be carried in Fish Farmer's farm with enough ponds (12 ponds for each species) to be rented for use.
- Laboratory equipment for chemical analysis not available in NCoS will be sourced from outside

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icipe CORAF SLU ALLEA AQUA ZAMBIA

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Arthertone Jere & Gregory M. Kasanga
Yossa Rodrigue - Project Leader

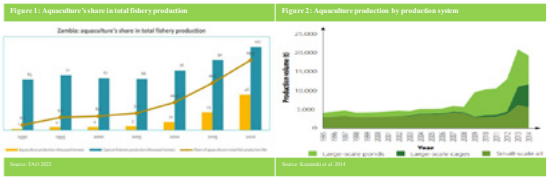
Norad

WorldFish CGIAR

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Introduction

- Aquaculture is the fastest growing food production industry/sector in Zambia, increasing from 12.9 to 36.1 tones, 2012–2018, respectively(Mwewa et al., 2021)
- High increase in demand & reduction in availability of quality fish feeds has lead to slow growth of smallholder aquaculture producers in Zambia (FAO, 2020).

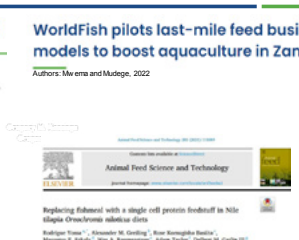


Current Status in Zambia

- Currently, Fish feeds takes about 60% of the production cost for both smallholder & commercial aquaculture farmers in Zambia (GOM,2020; FAO, 2020)
- Smallholder fish farmers in Zambia face a myriad of challenges, but one of their biggest constraints is limited access to high-quality fish feed (Mwema & Mudege, 2022)
- Study conducted in Northern & Luapula provinces of Zambia revealed that only 18% of fish farmers use high-quality fish feed... **limiting farm productivity**
- Smallholders fish farmers are integral to the country's aquaculture sector & are largely responsible for feeding & nourishing its rural populations.
- As such, supporting local production through use of local ingredient if amended can help to uplift the current situation, more studies on the use of different feed ingredient needs to be done (Hua, 2019).

Picture Credits: Jere, 2019, Towela 2021, Mwema et al., 2021

Current Status in Zambia (Studies conducted on Feeds)



Sustainable Efforts to Resolve Feed Challenges

- Search for viable alternatives to local fish feed continue to be focus in Zambia (SADC, 2019; GOM,2020; FAO, 2020),

Forward plan

Phase	SCOOPING	RESEARCH	TESTING	CAPACITY
Process	Feed Ingredient & nutrient requirements of strains of Tilapia	Develop 5 novel local ingredients for cost-effective feed.	Testing and use of novel fish feeds	Enhance capacity of 2 stakeholders
Touchpoints	5 novel ingredients to be developed	Southern, Northern, Muchinga, Lusaka, Eastern & North Western Provinces of Zambia	5,000 farmers	(1) Local Miller (1) Fish Farmer Cooperative
Satisfactory Levels	★★★★★	★★★★★	★★★★★	★★★★★

Project goals

Partnerships

Thank You

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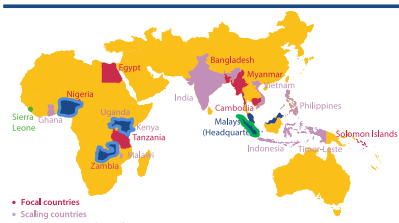
FASA Project Annual Workshop: Introduction and scope of the meeting

By Rodrigue Yossa, Project Leader

Content

1. **Project Objective, Partners and Geographies**
2. **Annual Workshop Goal & Frequency**
3. **2022 Annual Workshops**

Project Objective, Partners and Geographies



GOAL: July 2022 - June 2017

To develop low-cost, highly nutritious fish feeds based on novel ingredients and enable 5,000 smallholder fish farmers in 3 African countries to test and adopt these ingredients and feeds, leading to increased income, improved food security, and reduced waste and pollution.

Consultants

Local feed millers & farmers groups

Annual Workshop Goal & Frequency

Objectives of annual workshop:

1) Meet in person: synergy and complementarity
2) Discuss project progress in each country
3) Conduct the annual planning for next year
4) Site visit

Annual project workshop cost breakdown - Malaysia (HQ) – x 2 (Y1 & Y5)
Annual project workshop cost breakdown - Nigeria (Y2)
Annual project workshop cost breakdown - Zambia (Y3)
Annual project workshop cost breakdown - Kenya (Y4)

2022 Annual Workshops

Day 1, Monday 28th November 2022 : 3 sessions in Auditorium / WF Auditorium/ Presentations from FASA partners

Day 2, Tuesday 29th November 2022: 3 sessions in Block J / Planning sessions for years 2022-2023 (Nov. 2022- Dec. 2023)

Day 3, Wednesday 30th November 2022: 2 Site Visits

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By Alice Tembo NRDC

Norad

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Introduction on organization and team, experience in vocational training and collaboration with WorldFish, workplan to implement the FASA project

1. Introduction
2. Project key facts
3. Project goals
4. Project components
5. Partnerships

Flow-through aquaculture system in the NRDC Fish Lab

Introduction

- The Natural Resources Development College (NRDC), one of Zambia's top Agricultural college, was established in 1964 through a declaration by the First Republican President Dr. Kenneth David Kaunda.
- The first cohort of students was admitted in 1965 in two three-year diploma programmes in Agriculture and a certificate in Home Economics.
- Over the last five decades, the programmes offered have evolved to include ten diploma programmes in agriculture and related disciplines. Fisheries Science is one such discipline.
- Diploma Qualification is the flagship qualification offered by the college. Graduates attain level 6 diploma qualifications under the Zambia Qualification Framework (ZQF).
- In line with the college vision, practical learning is core and highly esteemed.
- The Fisheries Science curriculum was upgraded, an Aquaculture Skills Training Centre and E-learning platform established and commencement of students internships from first year of study have been implemented through collaboration and support from WorldFish.
- NRDC has produced over 12,000 quality graduates well versed in hands-on skills since inception who have contributed greatly to national development in various portfolios.

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Project key facts

- The Fish Laboratory was upgraded through the design and building of a flow-through aquaculture system with support from WorldFish.
- Two major research projects were conducted in the Wet Lab in collaboration with WorldFish and other institutions. "Replacing fishmeal with a single cell protein feedstuff in Nile tilapia *Oreochromis niloticus* diets" and "Performance of *Oreochromis niloticus* and *Oreochromis andersonii* in controlled laboratory conditions in Zambia."
- NRDC students and staff utilize the upgraded Fish Lab in Basic Research.
- Further upgrade of the Fish Lab will be done to facilitate hosting of the novel feed experiments
- NRDC ready to host the feed experiments during the project life cycle
- NRDC will provide security to the Fish Lab

Norad WorldFish CGIAR

Project goals

- NRDC Staff capacity building in research activities particularly the NRDC contact person and other staff of Fisheries Science department.
- Exposure of students to research findings through seminars and Scientific talks.
- Utilization of novel feed at the Aquaculture Skills Centre to boost fish production and adoption by aquaprenuers countrywide.
- Vital lessons will be learned from other participating countries on feed experiments and impacts in chosen communities.

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Project components

- NRDC shall host the feed experiments in the Fish Lab.
- NRDC shall provide a contact person who will support the researchers in conducting and implementing the feed trials.
- NRDC shall provide a Technician who will support the researchers upgrade the Fish Lab to a Recirculating Aquaculture System.
- NRDC shall participate in the Annual Project Meetings
- NRDC shall receive rentals from WorldFish to facilitate security of the Fish Lab.

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Partnerships

- WorldFish
- Possibility of building more Partnerships

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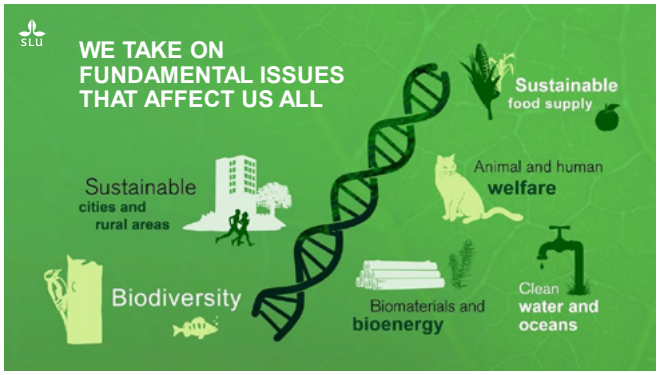
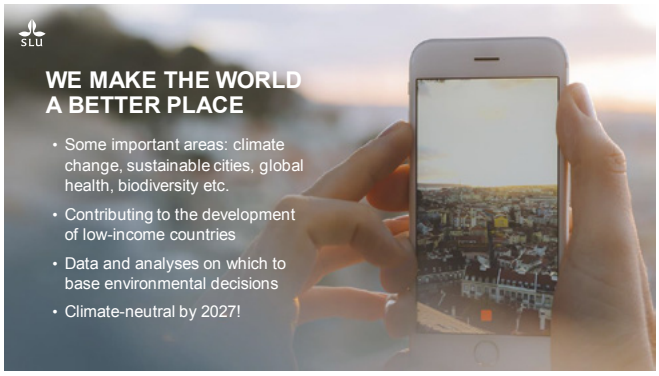
Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Dr. Kartik Baruah, Associate Professor & Research Group Leader
Swedish University of Agriculture Sciences, Uppsala

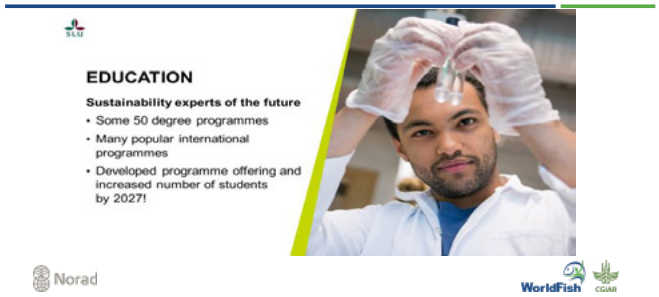
Norad

WorldFish CGIAR

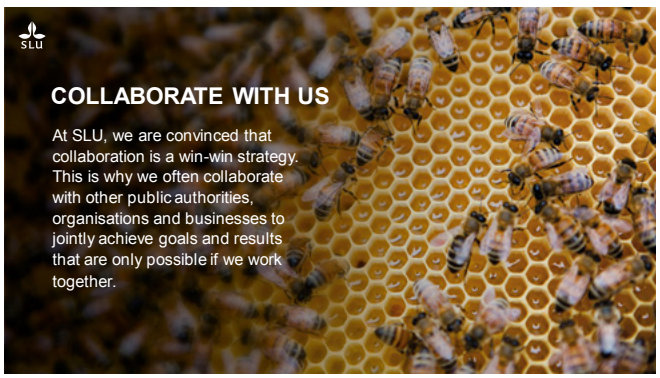




Research & Education at SLU



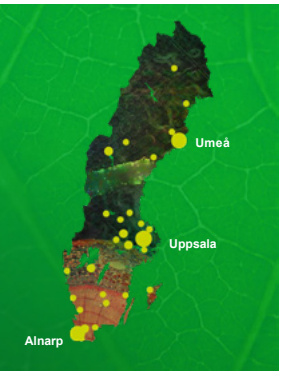
Research & Education at SLU



Research & Education at SLU

SLU IN SWEDEN

SLU is located at three principal locations in Sweden. We also conduct research, education, environmental assessment and collaborative activities at many research stations, experimental parks and campuses throughout Sweden.



SLU IN FIGURES

4 400 FULL-TIME STUDENTS

530 DOCTORAL STUDENTS

50 DEGREE PROGRAMMES

4 000 MILLION IN TURNOVER 2021 (Sek)

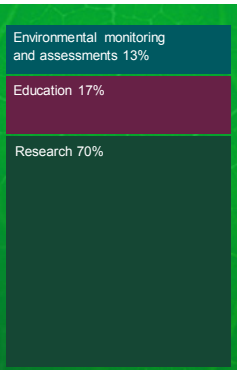
3 200 FULL-TIME EMPLOYEES

225 PROFESSORS

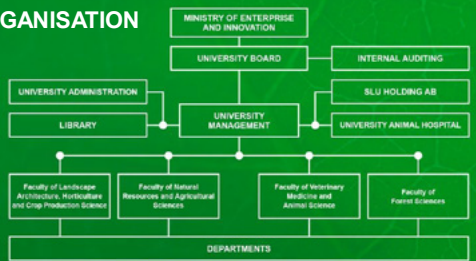
EXPENDITURE 2021

Breakdown of expanditure:

1. 70% Research and doctoral education
2. 17% Undergraduate and Master's courses and programmes
3. 13% Environmental monitoring and assessment

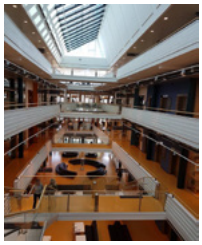


ORGANISATION



Swedish University of Agricultural Sciences

Faculty of Veterinary Medicine and Animal Sciences



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Partnerships

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Aquaculture Scientific Team

Scientific staff at professor level


Prof. Torbjörn Lundh


Prof. Anders Kiessling


Assoc. Prof. Kartik Baruah

Scientific staff at researcher level


Dr. Parisa Norouzitallab


Dr. Aleksandar Vidakovic


Dr. Hanna Carlberg

Technical Staff

Norad

WorldFish CGIAR

FASA Team at SLU


Assoc. Prof. Kartik Baruah


Prof. Torbjörn Lundh


Dr. Parisa Norouzitallab

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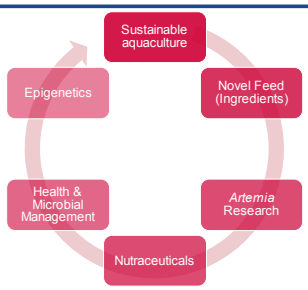
Research Areas of Interest



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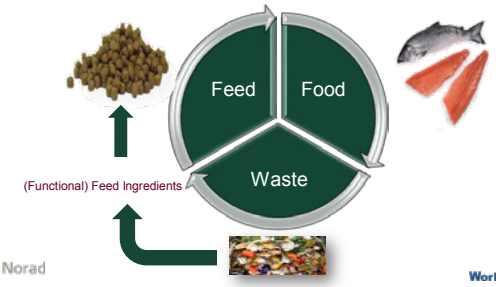
Research Interest: Waste to Novel Feed



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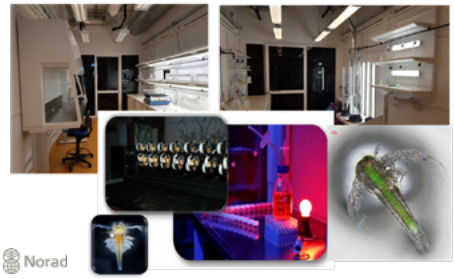
Research Areas: Wet lab for Digestibility & Growth trials

Research Areas: Nutraceuticals in Health & Microbial Management

Research Areas: *Artemia* Lab at SLU



https://www.slu.se/en/departments/animal-nutrition-management/research/our-laboratories-at-hu/artemia-lab/

PhD Students: Ongoing

Sri Lanka

Development of a holistic anti-infective strategy for controlling Acute Hepatopancreatic necrosis disease in farmed white-legged shrimp *Paneaus vannamei*".

Funding: World Bank

Assoc. Prof. Kartik Baruah

Dr. Parisa Norouzitallab

Prof. Yeong Yik Sung

Research Areas: *Artemia* as feed and model organism

In collaboration with NACA-Thailand and member countries in Europe and the Global South, *SLU-Artemia* to play a lead role in cross-disciplinary research for sustainable *Artemia* production

PhD Students: Ongoing

India

Bio-conversion of non-food bio-resources to novel feeds for salmonids - a Nordic approach.

Funding: NordForsk Grant

Assoc. Prof. Kartik Baruah

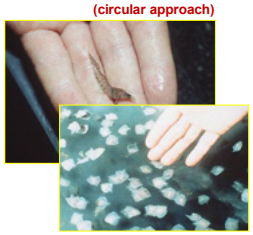
Prof. Torbjörn Lundh

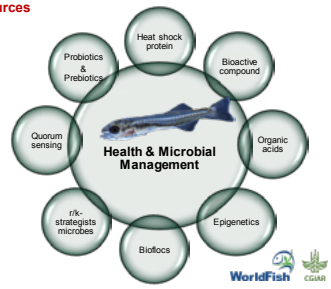
Dr. Aleksandar Vidakovic

Prof. Margareth Øverlundh

Research Areas: Nutraceuticals in Health & Microbial Management

From sustainable and less competitive sources (circular approach)





PhD Students: Ongoing

Dominic

Ghana

Novel Microbial Ingredients in diets for Atlantic salmon (Salmo salar) - Impact on growth performance, health and robustness

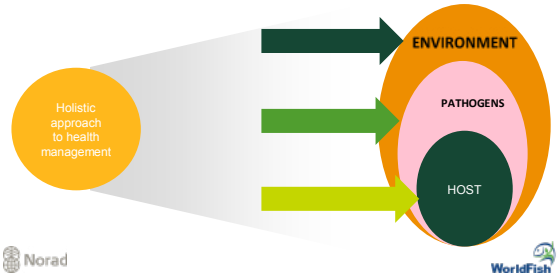
Funding: NordForsk Grant

Assoc. Prof. Kartik Baruah

Prof. Torbjörn Lundh

Prof. Margareth Øverlundh

Research Areas: Nutraceuticals in Health & Microbial Management



PhD Students: Ongoing

India

New feed resources - molecular insights of bioactive components effect on absorption, gene expression, microbiota and metabolism in fish.

Funding: Netaji Subhas - ICAR International Fellowship, India.

Prof. Torbjörn Lundh

Dr. Aleksandar Vidakovic

Assoc. Prof. Johan Dicksved

PhD Students: Ongoing

Rwanda

Sustainable fish farming in Rwanda.

Funding: SIDA, Sweden.

Prof. Torbjörn Lundh

Dr. Aleksandar Vidakovic

PhD Students: completed

India

Interaction effects of plant-derived compounds on the performance of *Artemia* challenged with pathogenic biotic stressor".
FUNDING - ICAR PhD grant - India

Priya

Studying the effects of feeding ginger supplements on the growth, immune responses and transcriptome-related changes in rainbow trout".

Funding: Science and Engineering Research Board (SERB) Overseas visiting Doctoral Fellowship.

Assoc. Prof. Kartik Baruah

PhD Students: Completed

Iran

Effect of the synbiotic compounds, produced under laboratory conditions, on the growth, reproduction performance and expression of immune-related genes in Zebrafish.

Assoc. Prof. Kartik Baruah

PhD Students: completed

Tanzania

Nutritive value and use of locally available low-cost feed ingredients for Tilapia farming in Tanzania".

Funding: SIDA, Sweden.

Vietnam

Brewer's yeast as a protein source in the diet of tilapia (*Oreochromis niloticus*) and freshwater prawns (*Macrobrachium rosenbergii*) reared in a clear water or biofloc environment

Funding: SIDA, Sweden.

Prof. Anders Kiessling

Prof. Torbjörn Lundh

Role of SLU in the FASA Project

- Capacity Building
- Supervision of two PhD thesis students: Nigera & Zambia
- Contribute to other relevant activities of the project

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icipe CORAF SLU ZAMBIA

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Introduction to Aller Aqua Research & Aller Aqua Zambia
28.11.2022 - Dr. Alexander M. Greiling

Norad

WorldFish CGIAR

3. Aller Aqua Research

- Aller Aqua Research is established in 2013
- Laboratory trials are mostly conducted at Aller Aqua Research in Büsum, Germany
- The trial station consists of several recirculating aquaculture systems, adaptable to different environmental conditions
- Partnership with universities and access to modern laboratories for a variety of analytical methods complete the set-up of Aller Aqua Research
- In close partnership with fish farmers the laboratory trials are scaled up and re-evaluated under field conditions

Norad WorldFish CGIAR

Introduction to Aller Aqua Research & Aller Aqua Zambia

1. Overview
2. Organogram
3. Aller Aqua Zambia and Aller Aqua Research
4. Prior collaborations with WorldFish
5. Role in FASA project
6. Insights to industry challenges regarding raw materials

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3. Aller Aqua Research - Trial Station Zambia

- Situated on Lake Kariba (Zambia)
- 4 Employees
- 8 cages (5x5x4m)
- 1 work platform
- Main functions:
  - Testing of new ingredients
  - Testing of new formulations
  - Benchmarking
  - Technical Sales Support

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1. Overview of Aller Aqua

- More than 58 years of experience in developing and producing the most effective and high-quality fish feed
- Active in 70+ countries and the 3rd largest fish feed producer in the EU
- Employees from 30+ different nationalities
- Factories in 7 countries: Denmark, Germany, Poland, Egypt, China, Zambia, and Serbia
- A large variety of feeds for 30+ species
- Careful selection of high-quality raw materials
- Continuous testing of feed at our Research Center, at selected test stations, and at participating fish farms

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4. Prior collaborations with WorldFish

Project title:
- Replacing fishmeal with single cell proteins, MRD-Pro and DY-Pro, in tilapia *Oreochromis niloticus* diet

Role of Aller Aqua:
- Supply of information on relevant raw materials
- Supply of fishmeal
- Assisting in trial setup and induction of local research staff (in Zambia)
- Provided input to scientific research paper

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2. Organogram

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5. Role in FASA project

- Assist literature research
- Help in RM evaluation
- Provide frequent feasibility updates for various RMs
  - Includes feasibility assessments
- Assist in reporting
- Assist in designing research protocols and evaluation of trials
- Assist in feed formulation
- Support on site trainings

- Workplan:
  - In line with WF workplan; on call if input is needed

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3. Aller Aqua Zambia Ltd.

- Factory built in 2017
- Situated near Lake Kariba
- Joint venture with Oakfield Holding
- The factory is still the most modern of its kind in Africa
- Production capacity 50.000 T/year

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6. Insights to industry needs regarding raw materials

Direct RM related challenges:
- Consistency in composition
- Availability of volume
- Number of RMs limited

Indirect challenges:
- Supplier Due-Diligence
- Reliability + associated expenses (direct/indirect)
  - Transport
  - Supplier
- Laboratory testing facilities limited

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Gender and Social Inclusion (GSI) in (FASA)

Dr. Sujata Ganguly, Includovate

Norad

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WE ARE A CERTIFIED SOCIAL ENTERPRISE

that donates the majority of our profits to furthering our mission.

OUR MISSION

is to incubate transformative and inclusive solutions for measuring, studying and changing discriminatory norms that lead to poverty, inequality and injustice.

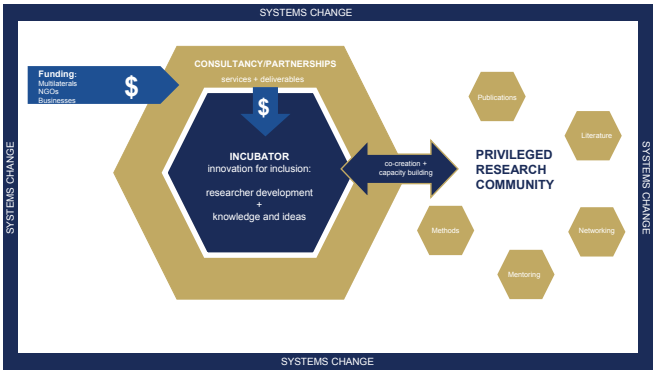
OUR VISION

is for inclusive markets, businesses, states and institutions that provide all people with the power, aspiration and ability to innovate for their development and advancement.

Feminist Leadership and Sistership Licence

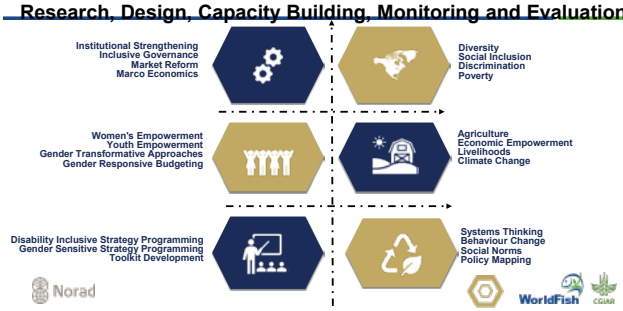
Headquarter: Australia
Pilot: Ethiopia
Expansion: Papua New Guinea
Scale up potential: Kenya, Tanzania, Rwanda, Uganda, India, and anywhere in the Global South

Social License Model



INCLUDOVATE'S AREAS OF SPECIALISATION

Research, Design, Capacity Building, Monitoring and Evaluation



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Includovate's projects

55 projects in three years - with more than 50 per cent being in Africa	**Gender Inclusion - using participatory methods is core strength (over 25 per cent)**	**Partner organisations/ Researchers in different countries**
At least 8 multi-country projects spread across more than three countries	**World Fish - worked on two earlier research focusing on women empowerment as well as on fish feeds**	**At least 3 projects, focusing exclusively on GESI, training, tool kit development**

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Previous work on fish feeds

Affordable local ingredients for fish feeds in low-income contexts: A social and gender risk and opportunity analysis

Available at:

https://digitalarchive.worldfishcenter.org/handle/20.500.12348/5102

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Introduction

Increased global fish demand is increasing intensification.

Fish feed is the main cost and accounts for 40-70 percent of total production costs in intensive farming systems (Enyidi et al. 2017; Singh et al. 2018).

Successful intensification requires a nutritionally balanced diet for fish and low cost production (Bharathi et al. 2019).

How to reduce costs? Shift to using local ingredients in fish feeds & develop related businesses.

But all innovations and investments come with risks *and* opportunities.

Risk of uneven reach/ benefits for women and youth (and other marginalised groups).

How can fish feeds be produced with affordability and without women, youth and OMG missing out?

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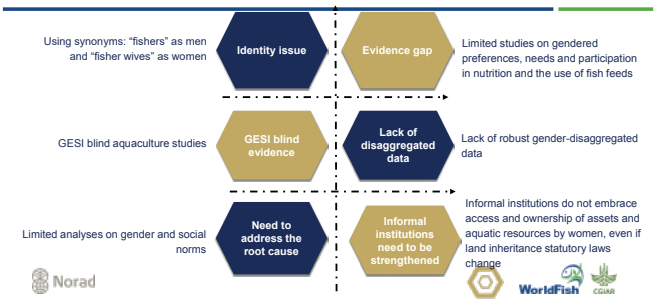
Project facts from literature review



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Project goals

1.

Identify needs, risks, and opportunities associated with the use of novel ingredients that are gendered and socially differentiated.

2.

Identify opportunities to advance GSI goals of Norad, WorldFish, and other key stakeholders within the novel feeds landscape.

3.

Ensure that women, youth, and OMG are prioritised throughout implementation

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Project components - completed in 6 months

- Start with a literature review to identify country specific gaps
- Build upon existing knowledge, e.g. WEFI
- Co-create/develop RQs with people from the country of study - meet with partners (local cooperatives and groups of women, youth, fish farmers, and feed millers)
- Design it to be repeated

Outputs:

- Country level gender and social inclusion assessment in the Nigeria, Zambia and Kenya using a context-sensitive approach and compiling sex-disaggregated data.
- Gender and Inclusive Development Action Plan (GIDAP)
- Outcome report
- Publications

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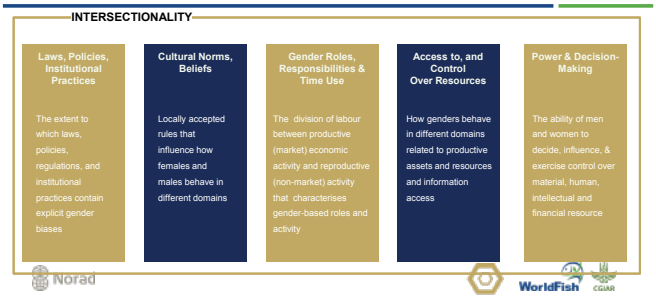
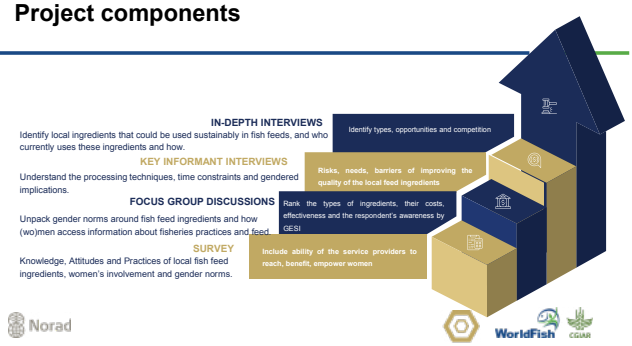
GSI analysis framework



Project components



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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Dolore magna aliqua

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Integration of Climate Change and Environmental Considerations in Fish Feeds and Nutrition Research

1. Introduction
2. Project key facts
3. Project goals
4. Project components
5. Partnerships
6. Work Plan

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NAGI CONSULTANCY

Presented by NAGI Enterprise

1. Introduction

- The FASA project focuses on
  - Sustainable aquatic food systems
  - Alternative, sustainable fish feeds versus commercial feeds and
  - Integrating climate change & environmental considerations in fish feed life cycles:
    - Highlight weaknesses in the currently available data
    - Improve and broaden understanding of aquaculture fish feed's carbon footprint along value chains - where and how greenhouse gas (GHG) emissions arise
    - Identify potential opportunities including mitigation pathways within the novel fish feeds landscape
    - Promote aquaculture development that is sustainable and optimize resource use and management opportunities

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2. Project key facts

- There are gaps in fish feed nutrition research & climate change mitigation
- Most emission intensities have concentrated on seafood value chains
- Additionally, research has concentrated on outsourced commercial feed e.g., sea-based fishmeal vs locally sourced materials
- Impact Assessments are limited to:
  - Few freshwater species
  - Geographic location
  - A few processes like fish production vs. value chain
- Filling gaps requires primary data from feed companies and farmers on a case-by-case level

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Project key facts…

- Decision-making and policy must be backed by data and scientific evidence
- Current and projected development of aquaculture following existing governmental policies may not directly reduce GHG emissions and hence, not support climate change mitigation objectives
- Comprehensive approaches have the potential to integrate cc as well as environmental and socio-economic considerations in impact assessments as well as foot-printing
- Previously, only *EIAs* were considered for assessing potential environmental impacts

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Landscape Analysis Approach

3. Project goals

- To develop low-cost, highly nutritious fish feeds based on novel ingredients and enable 5,000 smallholder fish farmers in 3 African countries to test and adopt these ingredients and feeds, leading to increased income, improved food security, and reduced waste and pollution.
- WorldFish estimates that 30% of total fish farmers will be women and 40% will be youth.

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4. Project Components

1) Climate and Environment Report
2) Life Cycle Assessment
3) Outcome Reports
   1) Draft outcome report
   2) Final outcome report
   3) Environment Risk Assessment
   4) Environmental Assessments plans
   5) Policy briefs

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Environmental assessment using SEA

(a). **Screening** - investigate whether the policy, plan or programme falls under the SEA legal framework and undertake preliminary investigations regarding SEA requirements for it

(b). **Scoping** - define boundaries of investigation, including assessment of environmental and social issues and the opportunities, alternatives, and assumptions required

(c). **Documentation** of the state of the environment and social context - to establish a baseline on which to base judgments continuously throughout the SEA process

(d). **Determination** of the likely environmental, health, and social impacts - to guide direction of the SEA

(e). **Informing and consulting** relevant institutions on environmental, health, and social, policies, plans, or programs issues including potentially have transboundary effects

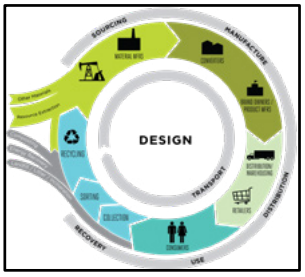
(f). **Influencing** "Decision-making" - for the policy, plan or program based on the assessment

(g). **M&E**- for effects and effectiveness of policies, plans, and programs after their implementation

10

Output 2: Life Cycle Assessment (ISO 14040 & 14044: 2006) Report

To assess and quantify the benefits (or disbenefits) of new fish feeds and novel ingredients in enhancing sustainable management of natural resources and their contribution to reducing greenhouse gas emissions



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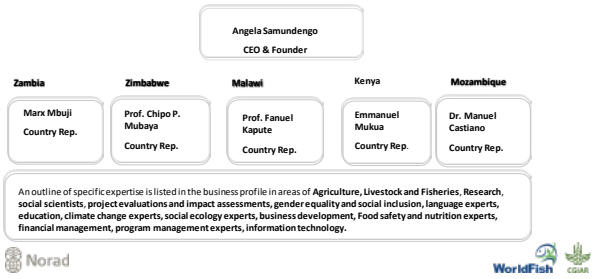
NAGI Enterprise Organizational Structure



5. Partnerships

- Swedish University of Agricultural Sciences (SLU),
- International Centre of Insect Physiology and Ecology (ICIPE),
- Aller Aqua Africa,
- West and Central African Council for Agricultural Research (CORAF)
- Local research scientists in each project country (WorldFish, ICIPE, and CORAF)
- Research scientists of the partners (NARS, ICIPE, CORAF) will contribute to the design of research protocols and implement the research.

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6. Workplan

Deliverables and Milestones		2022		2023					
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	FASA annual project workshop	28-29							
2	Signing of Contract	30-5							
3	**Climate change and environment analysis report**								
a	Annotated Outline		5-15						
b	Development and agreement on research data collections tools		5-15						
c	First Draft (for input by project team members)		15-31						
d	Second Draft (for input by project team members and donor)				1-15				
e	Final report to be completed after incorporating a-c above)				15-20				
f	Review comments and incorporate in the report and submit				21-28				
g	Development of research proposal and protocols		5-14						
4	**Life Cycle Assessment (LCA)**								
a	Annotated Outline					1-10			
b	First Draft (for input by project team members)						11-1		
c	Together with WorldFish, review and agree on research data collection tools				31-28				
d	Second Draft (for input by project team members and donor)						2-9		
e	Final report after incorporating all input						10-20		
5	**Outcome report and publication**								
a	Draft outcome report (1 for each country)						20-30		
b	Final outcome report (One for each country)							1-15	
c	Draft Journal Article 1							1-30	
d	Draft Jounal Article 2								20-15
e	Draft Journal article 3								1-30

Appendix D: Presentation day 1

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Monitoring, Evaluation and Learning

Megi Cullhaj, Timothy Manyise, Saadiah Ghazali

28 November 2022

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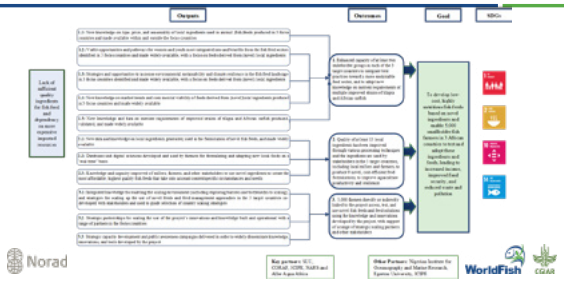
FASA Theory of Change



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Project MEL Activities

1. MEL Plan
2. Impact Assessment Plan
3. Data Management
4. Learning and Adaptive Management
5. MEL System

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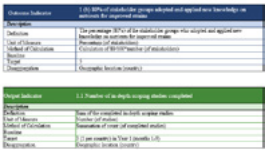
Indicators

There are overall 37 indicators.

- 5 – Outcome Level
- 32 – Output Level



Each indicator has a sheet that defines it, to ensure the quality of collection and reporting of results. They will be collected on a *routine* (frequently collected, measured, and assessed throughout the project) and *periodic* (measured annually or at the end of the project) basis.

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Monitoring, Evaluation and Learning (MEL)

Megi Cullhaj

MEL Activities Overview

- Activity and output monitoring

The project team will routinely collect data as part of project activities to monitor the progress of activities and results, ensuring that the activities planned in the annual work plans are implemented as planned and that the target outputs are achieved. To do so, the project will use the MEL Web-based platform that WorldFish has adopted for planning, reporting and learning.

- Outcome monitoring

The outcome will be tracked periodically by using mainly performance indicators as per the indicators Matrix, which contains in detail a list of indicators per objective, baseline values, data sources, collection methods, and reporting frequency, etc. The results will undergo data quality check.

- Evaluation and Impact Assessment

To assess the effectiveness of the intervention and its effects in achieving the ultimate goals. Impact studies will be conducted periodically by a team of specialists.

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Introduction

Why a MEL Plan?

- To ensure effective implementation and performance measurement by developing a robust and cohesive monitoring approach to ensure the impact program is on a path to success.
- To have a framework/tool that guides the monitoring, evaluation, and learning throughout the life of the project.
- To document how and what information will be gathered, analyzed, and used to inform adaptive project management and review progress (support better decision-making).
- To ensure better transparency and accountability.
- To generate learning through evidence.

The MEL Plan will be reviewed annually, and updated if necessary, and a revised version will be submitted along with the proposed Annual Work Plan.

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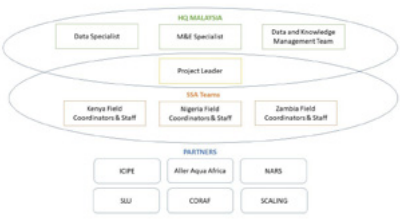
Roles and Responsibilities



- The MEL team will coordinate on an ongoing basis with country focal points and the project manager to collect and/or validate the data.
- A brief quarterly performance report will be produced but the MEL team and shared with the project stakeholders to generate learning and adaptive management.
- A meeting with the project team (including partners) is recommended.

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MEL Plan components

1. Theory of Change and Results or Logical framework
2. Indicators matrix
3. MEL activities overview
4. Roles and Responsibilities
5. Impact Assessment
6. Data Management
7. Learning and Adaptive Management

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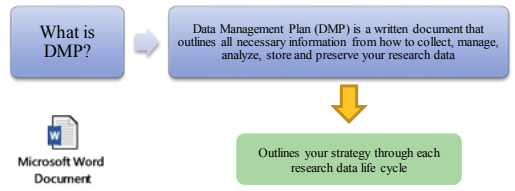
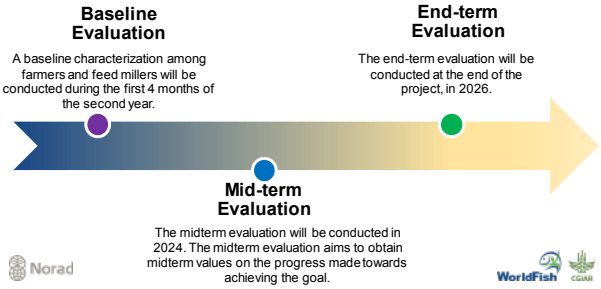
Impact Assessment

Timothy Manyise

Data Management Plan (DMP)



Impact Assessment Plan



Data Quality Assessment

Process of cleaning data with the aim to identify any inconsistencies or anomalies in the data

Data collection	Digitization and data entry	Data Analysing
Calibration of instruments to check the precision, bias and/or scale of measurement	Setting up validation rules or input masks in data entry software	Double-checking coding of observations or responses and out-of-range values
Taking multiple measurements, observations or samples	Using controlled vocabularies, code lists and choice lists to minimize manual data entry	Checking data completeness
Using standardized methods and protocols for capturing observations, alongside recording forms with clear instructions	Detailed labeling of variable and record names to avoid confusion	Adding variable and value labels where appropriate
Checking the truth of the record with an expert	Designing a purpose-built database structure to organize data and data files	Verifying random samples of the digital data against the original data
Computer-assisted interview software to: standardize interviews, verify response consistency, route and customize questions so that only appropriate questions are asked	Accompanying notes and documentation about the data	Statistical analyses such as frequencies, means, ranges or clustering to detect errors and anomalous values

Impact Assessment Plan

Data Storage

Recommended folder structure

Folder name	Description
0. Disclaimer	WorldFish data disclaimer on usage of the data (This will be automatically be uploaded by admin)
1. Method documentation	Documentation relating to the methods that will be/were used in data collection
2. Questionnaires	Tools that were developed for data collection in the project
3. Data collection tools	This can either be the forms that were developed for data entry of the field data e.g. CSPro data entry templates or xls files (field data collections using phones or tablets) if the project used ODK or any other mobile data collection method
4. Handbooks, Guides and Manuals	Handbooks, Guides and Manuals associated with data collection
5. Unpublished reports	Any unpublished reports relating to the project
6. Raw and verified data	The following should be uploaded here: • csv, stata, spss, R files for the raw data collected. • Cleaned and verified data should also be put here. • Calculated indicators can be also be put in this folder (the indicators should be accompanied by their variable descriptions)
7. Codebook	Descriptions of variables for the data collected.
8. Scripts	Scripts for calculating indicators should be put here with accompanying indicator report

Data Management

Saadiah Ghazali

Dissemination of Data

Knowledge and information generated by this project will be archived in WorldFish's Open repositories (DSpace and Dataverse)

Research Data Management

1. Data Management Plan (DMP)
2. Data Quality Assessment
3. Data Storage
4. Dissemination of Data

Learning and Adaptive Management

The Learning agenda for FASA is embedded in the activities carried out for the project implementation. The routine collected data and evidence will serve to inform management in taking better decisions and adapting as and when required. Learning opportunities at different levels of project implementation are framed and linked to adaptive management.

The project team will document, share, and make use of lessons learned for continuous project improvement. Lessons Learning and Adaptive Management based activities:

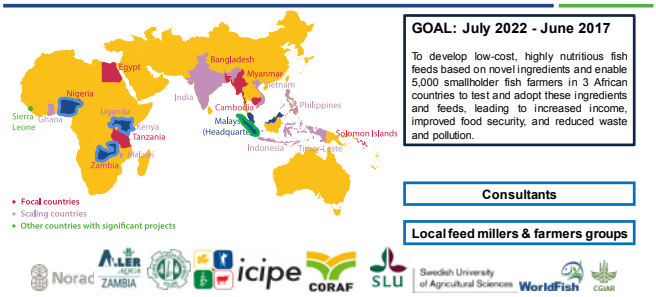
- Review/Assessment/Scoping Studies
- ToC Review and Adaptation
- Staff Meeting and Project Review Workshop Pause-and-Reflect sessions
- Annual Project Meeting and Outcome Monitoring Studies
- Strategic Collaborations – stakeholders and partners workshops

Online: MEL Platform overview

Content

1. **Project Objective, Partners and Geographies**
2. **Annual Workshop Goal & Frequency**
3. **2022 Annual Workshops**

Project Objective, Partners and Geographies



GOAL: July 2022 - June 2017

To develop low-cost, highly nutritious fish feeds based on novel ingredients and enable 5,000 smallholder fish farmers in 3 African countries to test and adopt these ingredients and feeds, leading to increased income, improved food security, and reduced waste and pollution.

Consultants

Local feed millers & farmers groups

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Annual Workshop Goal & Frequency

Objectives of annual workshop:

1) Meet in person: synergy and complementarity
2) Discuss project progress in each country
3) Conduct the annual planning for next year
4) Site visit

Annual project workshop cost breakdown - Malaysia (HQ) – x 2 (Y1 & Y5)
Annual project workshop cost breakdown - Nigeria (Y2)
Annual project workshop cost breakdown - Zambia (Y3)
Annual project workshop cost breakdown - Kenya (Y4)

2022 Annual Workshops

Day 1, Monday 28th November 2022 : 3 sessions in Auditorium / WF Auditorium/ Presentations from FASA partners

Day 2, Tuesday 29th November 2022: 3 sessions in Block J / Planning sessions for years 2022-2023 (Nov. 2022- Dec. 2023)

Day 3, Wednesday 30th November 2022: 2 Site Visits

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By: Tan Su Ching
Grants and Contracts Manager

Norad

WorldFish CGIAR

Introduction : General

WorldFish Legal Name :

International Center For Living Aquatic Resources Management (ICLARM) also known as WorldFish

Brand Name : WorldFish

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Project Management Unit

❑Project Management Unit (PMU) is WorldFish's central hub for all project management functionality, it sets project management standards, procedures and practices and ensures they are being followed. PMU leads on project management quality and delivery excellence across WorldFish research and development portfolio. *We coordinate with all HQ corporate functions to get necessary support to projects.*

❑PMU works with project team to ensure projects are delivered with the highest research quality, best management practices and international standards including CGIAR performance standards in line with contractual requirements; on budget, on time and to the intended impact.

❑PMU facilitates the development and sharing of project management resources, methodologies, tools and techniques across the organization

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Project Management Unit(Grants and Contracts Team)

- ❑ Contracts review and clearance
- ❑ Contracts discussion and negotiation with donors and partners
- ❑ Contracts maintenance and administration (Fully countersigned copy)
- ❑ Follow up any discussion/ Modification/ Addendum if required
- ❑ Contract compliance, templates, tools
- ❑ Legal matters (Intellectual Property/ Policies/ Guidelines/ Termination/ Dispute Resolution)
- ❑ Providing ad hoc whenever necessary in relating to contract updates

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WorldFish Perspective and Challenges

?????

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Partner Sub-grant Agreement

- ❑ Partner sub-grant agreement
- ❑ Compliance with all the donor flow down provision as Annexed
- ❑ Reporting requirement (Technical and Financial)
- ❑ WorldFish General Terms and Conditions

Contract Matters:
s.tan@cgiar.org SU CHING

gcu@cgiar.org

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By Azira Azmi
Risk and Compliance Analyst

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Finance & Compliance

1. Governance & Risk Management
2. Risk & Compliance Team – what we do?
3. Risk & Compliance Team – what have been achieved?

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Governance & Risk Management
3 Lines of Defense

- WorldFish's risk governance distinguishes between 3 fundamental roles in which all functions manage risks collectively.
- The Risk & Compliance Team is the second line of defense

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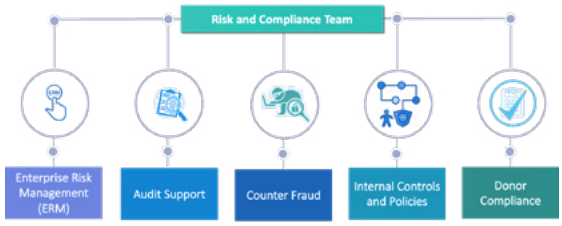
Risk & Compliance Team
What we do?



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Risk & Compliance Team
What have been achieved?

- ✓ Risk assessments that identify weaknesses in internal control (project & country office)
- ✓ Risk management and fraud prevention training to Implementing Partners
- ✓ Fraud investigations
- ✓ Writing policies
- ✓ Quality Data Review
- ✓ Project risk assessments

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By Hector Morais
WF Global Procurement Lead

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

By: Tan Su Ching
Grants and Contracts Manager

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Procurement Compliance

WF procurement compliance involves formulating, following and enforcing processes for our spend management.

It ensures that suppliers, buyers, and employees stick to the policy & procedures, protecting WF from fraud, corruption, and rogue spending.

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Introduction : General

WorldFish Legal Name :

International Center For Living Aquatic Resources Management (ICLARM) also known as WorldFish

Brand Name : WorldFish

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Procurement Compliance Methods

1. Implementation of Standardized Policy & Procedure meeting international standards (5 policy & 11 templates)
   a) various thresholds
   b) minimum number of suppliers invited
   c) conflict of interest
   d) procurement Committee
2. One Drive-File Management System

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Project Management Unit

❑Project Management Unit (PMU) is WorldFish's central hub for all project management functionality, it sets project management standards, procedures and practices and ensures they are being followed. PMU leads on project management quality and delivery excellence across WorldFish research and development portfolio. *We coordinate with all HQ corporate functions to get necessary support to projects.*

❑PMU works with project team to ensure projects are delivered with the highest research quality, best management practices and international standards including CGIAR performance standards in line with contractual requirements; on budget, on time and to the intended impact.

❑PMU facilitates the development and sharing of project management resources, methodologies, tools and techniques across the organization

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Project goals

3. Supplier CSI Watchdog checks for registration & Performance Evaluation
4. Centralized Risk and Audit Assessment for PO above $1000
5. Incorporating technology for procurement activities i.e. RFQ/RFP in OCS

Procurement Compliance involves various stakeholders in WF to play its part

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Project Management Unit(Grants and Contracts Team)

- ❑ Contracts review and clearance
- ❑ Contracts discussion and negotiation with donors and partners
- ❑ Contracts maintenance and administration (Fully countersigned copy)
- ❑ Follow up any discussion/ Modification/ Addendum if required
- ❑ Contract compliance, templates, tools
- ❑ Legal matters (Intellectual Property/ Policies/ Guidelines/ Termination/ Dispute Resolution)
- ❑ Providing ad hoc whenever necessary in relating to contract updates

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WorldFish Perspective and Challenges

?????

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Partner Sub-grant Agreement

- Partner sub-grant agreement
- Compliance with all the donor flow down provision as Annexed
- Reporting requirement (Technical and Financial)
- WorldFish General Terms and Conditions

Contract Matters:
s.tan@cgiar.org SU CHING

gcu@cgiar.org

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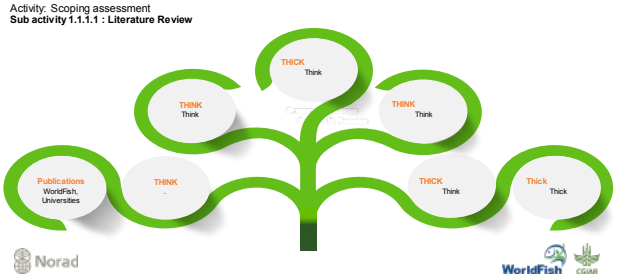
Appendix E: Presentation Day 2

IMPLEMENTATION PLAN – OUTPUT 1

Output 1.1: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in Zambia and made available within and outside the focus countries

Activity: Scoping assessment
Sub activity 1.1.1.1 : Literature Review



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IMPLENTATION PLAN

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IMPLEMENTATION PLAN – OUTPUT 1

Output 1.1: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in Zambia and made available within and outside the focus countries

Activity: Scoping assessment
Sub activity 1.1.1.2 : Design scoping studies

Ingredient	Price (Relative cost)	Region / Province (Source)	Seasonality	Abundance	Availability	Remarks
Groundnut cake		Northern				
Maize bran						
Insert meal						
Algae						
Bllodmeal						

*More ingredients can be added to this list

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IMPLEMENTATION PLAN

	GOAL: Conduct project start-up workshop			
	AIM	**Invitation letter**	**Secure Venue and Prepare Draft Agenda**	**WF Support (media, logistics, cratering)**
Responsible Department/ Employee	Arthertone Jere & Gregory Kasanga, AAZ, WF-Zambia	Arthertone Jere & Gregory Kasanga WF -Zambia	Arthertone Jere & Gregory Kasanga WF -Zambia	Arthertone Jere & Gregory Kasanga WF -Zambia
Resources Needed	Consult (Rodrigue & WF-Zambia)	Consult WF - Zambia	Consult WF - Zambia	Consult WF - Zambia
Progress	30% (View Progress chart).	0% (View Progress chart).	0% (View Progress chart).	0% (View Progress chart).
Completion Date	16th December 2022 15th January, 2022	7th December 2022	8th December 2022	13th December 2022
Improvement	Online.	Insert your desired text here.	Insert your desired text here.	Insert your desired text here.

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IMPLEMENTATION PLAN – OUTPUT 1

Output 1.1: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in Zambia and made available within and outside the focus countries

Activity: Scoping assessment
Sub activity: 1.1.1.3 Data collection and Analysis

Ingredient	Is it LCA Analysis (For best feed formulation)	Price (Relative cost)	Region/Province (Source)	Seasonality	Abundance	Availability	Rank
Maize Bran	✓		"				
	✓			"			
	✓						
	✓	""		"			
	✓						
	✓		"				
	✓			""			
	✓						

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IMPLEMENTATION PLAN – OUTCOME 1
Enhanced capacity of at least two stakeholder groups in each of the 3 target countries to integrate best practices toward a more sustainable feed sector, and to adopt new knowledge on nutrient requirements of multiple improved strains of tilapia and African catfish

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IMPLEMENTATION PLAN – OUTPUT 1.1 CONCLUSION

Output 1.1: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in Zambia and made available within and outside the focus countries

Activity: Scoping assessment
Sub activity: 1.1.1.4 Publications

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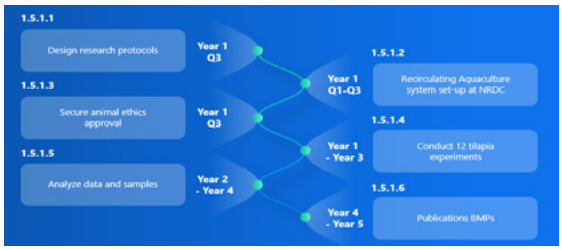
IMPLEMENTATION PLAN – OUTPUT 5

Output 1.5: New knowledge and data on nutrient requirements of improved strains of tilapia produced, validated and made widely available.
Output 1.5.1 Investigate nutrient requirements in improved strains of tilapia



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IMPLEMENTATION PLAN – OVERALL TIMELINE & WORK LOCATION

Activity	Sub Activity	Organiser	Location	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nutrient requirement of Tilapia strain																
	Planning Meeting	WF Office - Zambia	Lusaka													
	Designing of data collection	WF Office - Zambia	Lusaka													
	Field visit	WF Office - Zambia	Southern, Northern, Northwestern, Muchinga, Eastern													
	Analysis	WF Office - Zambia	Lusaka													
	Reporting	WF Office - Zambia	Lusaka													
Renovate NRDC Lab																
	Planning meetings	WF Office & NRDC	Lusaka													
	Procurement plan	WF Office & NRDC	Lusaka													
	Actual lab setting up	WF Office & NRDC	Lusaka													
	Ethical securing	WF Office	Lusaka													
	Reporting	WF Office	Lusaka													
Partner engagement																
	Consultation meeting	WF office & Partner	Lusaka, Northern, Northwestern, Muchinga, Eastern Southern													

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IMPLEMENTATION PLAN – OVERALLTIMELINE & WORK LOCATION

MAP OF ZAMBIA

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IMPLEMENTATION PLAN – OVERALL TIMELINE & WORK LOCATION

Activity	Sub Activity	Organiser	Location	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Laboratory experiments																
	Designing of experiment															
	Procurement of materials															
	Setting of experiment															
	Collection of Data															
	Writing and Publication															
	Publications															
Field trials experiments																
	Designing of experiment	WF office & Partner	Lusaka													
	Procurement of materi	WF office & Partner	Lusaka													
	Setting of experiment	WF office & Partner	Lusaka, Northern, Northwestern, Muchinga, Eastern Southern													
	Collection of Data	WF office & Partner	Lusaka													
	Writing and Publication	WF office	Lusaka													
	Publications	WF office	Lusaka													

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IMPLEMENTATION PLAN – OVERALLTIMELINE & WORK LOCATION

Activity	Sub Activity	Organiser	Location	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Project start up engagement																
	Scoping of stakeholder	WF Office - Zambia	Lusaka, Southern, Northern, Northwestern, Muchinga, Eastern													
	planning	WF Office - Zambia	Lusaka													
	Invitation letters	WF Office - Zambia	Lusaka													
	Setting the launch	WF Office - Zambia	Lusaka													
	Reporting															
Recruitment of PhD and MSc student																
	Advertising	WF Office - Zambia	Lusaka													
	Selection Process	WF Office - Zambia	Lusaka													
	Reporting	WF Office - Zambia	Lusaka													
Scoping assessment of feed ingredient																
	Planning meeting	WF Office - Zambia	Lusaka													
	Designing of scoping	WF Office - Zambia	Lusaka													
	Field Visits	WF Office - Zambia	Southern, Northern, Northwestern, Muchinga, Eastern													
	Analysis of samples	WF Office - Zambia	Lusaka													
	Reporting	WF Office - Zambia	Lusaka													

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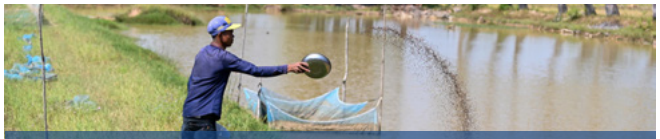

DEVELOPMENT AND SCALING OF SUSTAINABLE FEEDS FOR RESILIENT AQUATIC FOOD SYSTEMS IN SUB-SAHARAN AFRICA (FASA)

Aaqillah Amr Mohd Amran & Rodrigue Yossa

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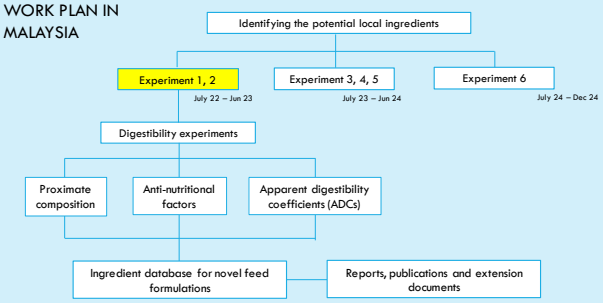
WORK PLAN IN MALAYSIA



DETAILED PLANNING OF WORK IN MALAYSIA

1. Introduction
2. Work Plan in Malaysia
3. Team Members
4. Digestibility Experiments
5. Work Timeline

PROXIMATE ANALYSIS

Proximate Analysis, dm	Analysis	Reference
Dry Matter (g/100g)	Gravimetry method	Harris et al. (1977)
Crude Protein (g/100g)	in-house Method CLWI-TEC-M003 Malaysian standard MS 1194:1991	DOSM (1991)
Crude Lipid (g/100g)	in-house Method CLWI-TEC-M004 Malaysian standard MS 1194:1991	Cunniff (1997)
Crude Fiber (g/100g)	in-House Method CLWI-TECM005 Malaysian standard MS 1194:1991	Cunniff (1997)
Ash (g/100g)	in-house Method CLWI-TEC-M001 Malaysian standard MS 1194:1991	Horwitz (2000)
Carbohydrate (g/100g)	carbohydrate = dry matter - crude protein - crude lipid - ash	
Gross Energy (kcal/100 g)	in-house Method CLWI-TEC-M007 Malaysian standard MS 1194:1991	Sullivan & Carpenter (1993)

INTRODUCTION

- Following ingredients scoping studies, lab analyses and digestibility experiments of multiple samples of local ingredients and existing fish feeds will be conducted
- Based on the feedback, Ingredient database will be created and inserted in FeedFormulation software.

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ANTI-NUTRITIONAL FACTORS

To reduce the levels of these anti-nutrient factors. Several processing techniques and methods such as **fermentation, germination, debranning, autoclaving, soaking** etc. are used to reduce the anti-nutrient contents in foods

TEAM MEMBERS – PENANG HQ

- Aaqillah Amr Mohd Amran
- Nurul Huda Ahmad Fatan
- Muhammad Rahimi Ramli
- Ning Shahira
- Rodrigue Yossa

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APPARENT DIGESTIBILITY COEFFICIENT (ADC)

ADCnutrient-ngr = ADCtest + ((1-s) Dref/sDingr) (ADCtest-ADCref)

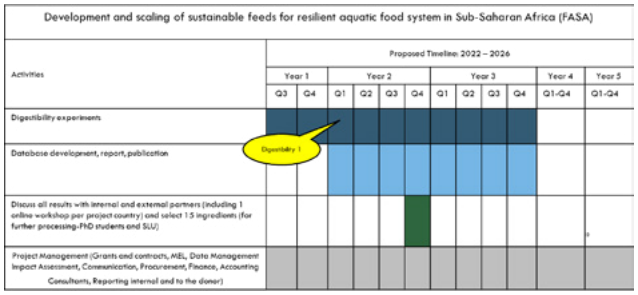
Where: ADCnutrient-ngr = Apparent digestibility coefficient of the nutrients contained in the test ingredient

Bureau & Hua (2006); NRC (2011)

WORK PLAN IN MALAYSIA

Conduct digestibility experiments of ingredients

Work timeline



Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Dr. Kartik Baruah

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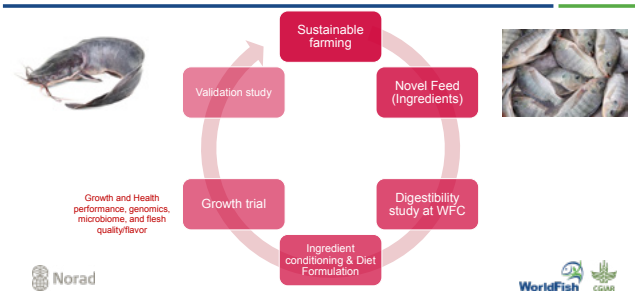
General layout of the PhD thesis:



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PhD Activities and timeline

Activities	Timeline
Recruit 2 PhDs (Zambia and Nigeria	Year 2 (Q2)
Conduct experiments to prioritise 15 ingredients: biochemical analysis of ingredients	Year 2 (Q1) – Year 3
Digestibility study at WorldFish	Year 1 (Q3) – Year 3 (Q4)
Develop and use processing techniques to improve quality of 15 ingredients	Year2 (Q3) – Year 3 (Q1)
Quality check the improved ingredients, and formulate and produce fish feed, and lab trial	Year 2 (Q3) – Year (Q4)
Conduct validation study on farm	Year 3(Q3) – Year 4 (Q4)
PhD Defense	Year 4(Q2) – Year 5 (Q2)

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PhD studies at SLU and beyond

1. Recruitment of PhD students – WorldFish and SLU:
   - advertisement jointly by WFC & SLU
   - registration at SLU
   - Doctoral courses – 30 credit courses at SLU (statistics, ethics..)
   - Lab works at SLU
   - Validation study at their home country
   - Writing and PhD thesis

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PhD studies at SLU and beyond

1. Digestibility trial Project goals ?
2. Feed Formulation and Feed Quality analysis ?
3. Nutrient requirement study ?
4. Genetically improved strain or Wild Type ?
5. Growth and Health study at the experimental scale
6. Validation study at the home country – sample collection and analysis ?
7. Information on any potential stress – infection, handling stress, transportation stress etc.
8. Storage of the feed

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Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Dr. James Ocheme Apochi
Dr. (Mrs.) Ibiyo L. M. O.
Dr. (Mrs.) Iretioluwa Caroline Ayoolalusi

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Project key facts

- ❑Present knowledge and available data on local ingredients with respect to chemical composition, prices, seasonality in Nigeria will be obtained from this project.
- ❑Fish feeds production in Nigeria would significantly increase.
- ❑Production of affordable and quality fish feeds using locally available ingredients.

Outline

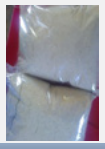
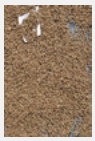
1. Project title
2. Project key facts
3. Project goals
4. Project components
5. Partnerships

Presently with a population of about 220millions and 923,768 sq meters

Project Key facts contd.

- ❑ Formulation of a balanced diet that would meet the needs of the fish species at a more economical cost.
- ❑ Improved nutritional quality of fish feed to enhance optimum growth of fish which will contribute to increase in fish farmers incomes and alleviate poverty.

1. Scoping studies on the type, price and seasonality of local ingredients used in fish feeds in Nigeria.


Maize, Clupeid fishmeal, Sun dried 6mm fish feed sample and bagged fish feed previously produced from locally available ingredients

Project goals

- **To conduct assessment studies that will fill in data gaps on locally available ingredients.**
- **Generate necessary background information for the development and scaling of low-cost, highly nutritious, sustainable feeds.**
- **To increase productivity and profitability as selected ingredients would be used to formulate fish feed.**

2. Re-evaluation of Nutrients requirements of improved strains of Tilapia and African Catfish using locally available ingredients in Nigeria


Oreochromis niloticus

Clarias gariepinus

Goals Contd.

- To determine the nutritional requirements {methionine, lipids, vitamin C, calcium and phosphorus} of improved strains of catfish and tilapia.
- To increase output and improve fish farmers' income.
- To improve feed value chain through dissemination of knowledge acquired.

Introduction

- ➢ High cost of feed ingredients and aquafeed produced in Nigeria has been a great concern for fish farmers, feed producers, small holder fish farms and other stakeholders. Greater numbers of fish farmers are moving out of business because the input cost outweighs the profit which is attributed to the high cost of feed ingredients.
- ➢ It is important to know and regularly assess the available feed ingredients and their chemical composition for better productivity. The feed ingredients assessment is long overdue because since the work of Eyo (2001) in feedstuff assessment in Nigeria, there has not been a comprehensive revisit up till date.
- ➢ Intervention of World fish through CORAF is timely and commendable in the development and production of farm made feeds using locally available ingredients that are sustainable.

Project components

- Literature review.
- Virtual inception meeting to plan out modality of the project.
- Scoping studies to collect samples.
- Analysis of the collected ingredients and fish feeds available in selected urban and local markets in the 6 geopolitical zones and climate hazards related to their use in the short, medium and long run in Nigeria.

Project Components Contd.

- Scoping study will be carried out through assessment survey of selected states per every Geopolitical zone with a total of twenty two (22) states and FCT chosen to obtain knowledge and current nutrient composition of available feed ingredients in Nigeria to increase data in use for fish feeds project.
- Every available ingredient will be collected in the selected local and urban markets with the assistance of field personnel in each of the state and locality.

Project components Contd

- The resulting data will update the existing data of the National Research Council of the United States of America, which is widely used, and will be included in a new WorldFish database available to stakeholders across Africa and beyond.
- Workshops will be organized and conferences attended to share results generated from the research.

Project Components Contd.

- Out of 36 states and FCT in Nigeria the scoping studies will cover 23 selected states across the Country as approved by WorldFish.
- Three months for sampling and data collection and two months for analysis and write up. The selected states are as follows:

North Central: Benue, Nasarawa, Niger, and Plateau States, as well as the Federal Capital Territory.

Ph.D Student's Component

- The Ph.D student research on growth performance studies on the use of five novel ingredients selected from the ingredients collected, analysed and processed from the scoping studies will also be carried out in the last quarter of years three and whole of year four of the projects.
- The demonstration research will be carried in Fish Farmer's farm with enough ponds: ponds for each species will be used by the student.
- Workshop will also be carried out.

Project Components Contd.

North East: Adamawa, Borno, Taraba, and Yobe States.
North West: Kaduna, Kano, Sokoto, and Zamfara States.
South East: Abia, Ebonyi, and Imo States.
South South: Akwa Ibom, Delta, and Rivers States.
South West: Ekiti, Lagos, Ondo and Oyo States.

- Questionnaires will be prepared and administered in the field to collect data on types, current prices and seasonality of the fifteen (15) or more feed ingredients. Data on major producers of the available feed ingredients will also be collected.

Partnerships

- Farmers and Ingredients marketers
- Fish feed Millers and fish farmers.

Project components Contd.

- Samples of the available fish feeds in use in the selected localities will also be collected.
- Bulking of the similar local ingredients will be carried out and composite samples will be taken for all the available ingredients collected and the chemical analysis will be done at Malaysia by WorldFish.
- Write up and Development of ingredient database

Thank You For Your Attention

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Project Components Contd.
Project 2: Re-evaluation of Nutrients requirements in improved strains of Tilapia and African Catfish using locally available ingredients in Nigeria.

- Investigation of nutrient requirements in improved strains of tilapia and African catfish.
- Amino acids (methionine), Lipids, vitamins, and minerals requirements will be investigated.
- Sampling and Chemical analysis is a strong components.
- Four experiments each on Tilapia and African catfish will be carried out in first three years of the project in Nigeria.

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

CHRYSANTUS MBI TANGA

Norad

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Detailed Planning of Work in Kenya

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project agreements with WF																				
Start-up meetings																				
Recruit new staff																				
Recruit 10 MSc																				
Start-up workshop																				
1.1.1.1: Conduct literature review of relevant research documents and protocols																				
1.1.1.2: Design scoping studies for each country																				
1.1.1.3: Data collection (including sample ingredients) and analysis																				

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Target Sites

USENGE FISH CAGES LAKE VICTORIA, SIAYA COUNTY

WorldFish CGIAR

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.1.1.4: Report preparation and publication																				
1.5.1.1: Design research protocols																				
1.5.1.3: Secure animal ethics approval																				
1.5.1.4: Conduct 12 tilapia experiments and 8 catfish experiments in project countries																				
1.5.1.5: Analyse data and samples																				
1.5.1.6: Research report preparation and publication and addition of results to WF's Better Management Practices guidelines (BMPs)																				
1.5.1.7: Develop new WF database of essential nutrient requirements in improved strains of tilapia and African catfish																				
2.1.2.1: Organise and facilitate 1 online stakeholder workshop per country																				

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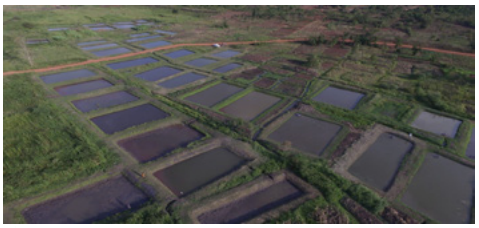
Target Sites

100, 300M² PONDS IN SAMIA, BUSIA COUNTY NEAR LAKE VICTORIA



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Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.1.2.2: Reports preparation and dissemination																				
2.1.3.1: Synthesize all findings on ingredients generated so far to enable prioritisation																				
2.1.3.2: Discuss all results with internal and external partners (including 1 online workshop per project country) and select 15 ingredients																				
2.1.3.3: Develop and use processing techniques to improve the quality of the 15 local ingredients as needed (e.g., fermentation, soaking, drying, detoxification, etc.)																				
2.1.3.4: Quality check the improved ingredients																				
2.1.3.5: Formulate fish feeds using software																				
2.1.3.6: Produce 9 experimental fish feeds																				
2.1.4.1: Design and validate research protocols																				
2.1.4.2: Conduct validation experiments on-farm																				

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Target Sites

Kenya Marine and Fisheries Research Institute (KMFRI), Sagana, Nyeri County

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Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.1.4.3: Analyse the data and produce reports																				
2.1.4.4: Hold workshops to share and discuss results																				
2.2.1.1: Develop database with a feed formulation-application/tool(FeedCalculator)																				
2.2.1.2: Develop a mobile version of the database and integrate into existing mobile apps widely used by farmers (including social media apps such as WhatsApp)																				
2.2.1.3: Hold an online workshop in each project country to obtain feedback from key project partners on initial design																				
2.2.1.4: Finalise both tools based on feedback from key project partners																				
2.3.1.1: Conduct 3 in-person workshops (1 for each project country) and 1 online workshop																				
2.3.1.2: Develop overall printed booklets/manuals																				
2.3.1.3: Develop and insert a unique set of 9 fish feeds per country in the booklet based on the novel ingredients (a total of 27 unique feeds)																				

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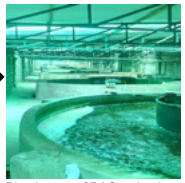
Target Sites

Kamuthanga Aqua Fish Farm in Machakos County

Africa's first certified fish farm with EcoMark Africa label from ARSO using Recirculating Aquaculture System (RAS)



Plug-in type of RAS technology

WorldFish CGIAR

Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.3.2.1: Organise and facilitate 4 training workshops per country (2 online and 2 in-person)																				
2.3.2.2: Reports preparation and dissemination																				
3.1.1.1: Organise and facilitate 2 stakeholder workshops per country (total of 6)																				
3.1.1.2: Report preparation and dissemination																				
3.2.1: Develop innovation platforms for bringing key scaling stakeholders together																				
3.2.2: Identify and set up demonstration sites and model farms																				
3.2.3: Host farmer field days on demo sites and model farms																				
3.2.4: Build partnerships with cooperatives to test and use novel feeds																				
3.2.4: Support establishment of new feed services and businesses by young people, farmers, etc																				

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Activities	Proposed timeline: 2022 -2026																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3.2.5: Support small-scale millers to develop new product based on project's innovations																				
3.2.6: Build partnerships with NGOs, private sector, and extension service providers to incorporate project's knowledge and innovations to aquaculture farmers																				
3.3.2.1: Develop and publish factsheets (online and printed), BMPs, and project report																				
3.3.2.5: Design and conduct context-specific outreach to target end-users (farmers and millers) to support scale-up																				
3.3.2.6: Develop scaling potential outside of project by identifying additional scaling opportunities																				

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Partnerships

1. Kenya Marine and Fisheries Research Institute (KMFRI)
2. Kamuthanga Fish Farm, Machakos, Kenya
3. Victory Farms Ltd, Kenya (Private sector)
4. National Universities (e.g., University of Eldoret etc)
5. JABALI FISH FARM (JABALI FISHERIES TRADERS)
6. Beach Management Units (BMU), County Government
7. Kenya Bureau of Standards (KEBS)

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Appendix F : Revised Implementation Plan

The first revision on the implementation plan/work plan - 2022.

The modifications are red color. The "X" in the timeline represent the deletion, meaning the project activity will not be delivered during that period

Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA)

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project start-up activities																						
Conduct internal WF project management start-up meetings	WF project management unit	WF staff involved in project (as needed for each meeting)																				
Negotiate, prepare, and sign project agreements with key partners	WF project management unit	SLU; ICIPE; CORAF; NARS																				
Conduct general project management start-up meeting (including partners)	WF project management unit	Victor Siamudaala; Sunil Siriwardena; 3 local research scientists (1 per project country - WF, ICIPE, CORAF); SLU; NARS; ICIPE; CORAF																				
Develop hiring plan for project	WF HR team	Victor Siamudaala; Sunil Siriwardena; ICIPE; CORAF																				
Recruit new staff	WF HR team	Victor Siamudaala; Sunil Siriwardena; ICIPE; CORAF																				
Recruit 2 PhD students (Nigeria & Zambia) and 10 master's students (Kenya)	SLU; WF	3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				
Conduct project start-up workshops (1 global and 1 per project country for a total of 4)	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena, CORAF; ICIPE; NARS; Aller Aqua Africa; local cooperatives of feed millers and fish farmers																				
Develop detailed project communications plan, project messaging guide, and project templates	WF communications specialist	Florine Lim; WF communications team																				
Develop detailed monitoring, evaluation, and learning (MEL) plan	WF MEL specialist	WF MEL team; Rodolfo Dam Lam																				
Outcome 1: Enhanced capacity of at least two stakeholder groups in each of the 3 target countries to integrate best practices toward a more sustainable feed sector, and to adopt new knowledge on nutrient requirements of multiple improved strains of tilapia and African catfish																						
Output 1.1: New knowledge on type, price, and seasonality of local ingredients used in animal (fish) feeds produced in 3 focus countries and made available within and outside the focus countries																						
Activity 1.1.1: 3 scoping assessments (1 per project country)																						
Subactivity 1.1.1.1: Conduct literature review of relevant research documents and protocols	Local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa, CORAF); SLU	X																			
Subactivity 1.1.1.2: Design scoping studies for each country	Local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa, CORAF); SLU	X																			
Subactivity 1.1.1.3: Data collection (including sample ingredients) and analysis	Local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; Saadiah Ghazali; research scientists (ICIPE, Aller Aqua Africa, CORAF); SLU	X	X																		

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Subactivity 1.1.1.4: Report preparation and publication	Local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa, CORAF); Postdoc Scientist; SLU																				
Output 1.2: Viable opportunities and pathways for women and youth more integrated into and benefits from the fish feed sectors identified in 3 focus countries and made widely available, with a focus on feeds derived from (novel) local ingredients																						
Activity 1.2.1: 3 gender and social assessments (1 per project country)																						
Subactivity 1.2.1.1: Conduct literature review of relevant policy, research, and country documents	Gender Consultant	WF gender team; associates to gender team	X																			
Subactivity 1.2.1.2: Design gender and social assessment for each country	Gender Consultant	WF gender team; Victor Siamudaala; Sunil Siriwardena; associates to gender team	X																			
Subactivity 1.2.1.3: Data collection and analysis	Gender Consultant	WF gender team; Victor Siamudaala; Sunil Siriwardena; associates to gender team; Saadiah Ghazali	X																			
Subactivity 1.2.1.4: Report preparation and publication	Gender Consultant	WF gender team; associates to gender team		X																		
Output 1.3: Strategies and opportunities to increase environmental sustainability and climate resilience in the fish feed landscape in 3 focus countries identified and made widely available, with a focus on feeds derived from (novel) local ingredients																						
Activity 1.3.1: 3 climate change and environmental assessments (1 per project country)																						
Subactivity 1.3.1.1: Conduct literature review of relevant policy, research, and country documents	Climate change consultant	WF climate team; associates to climate team	X																			
Subactivity 1.3.1.2: Design climate change and environmental assessments for each country	Climate change consultant	WF climate team; Victor Siamudaala; Sunil Siriwardena, national meteorological services; associates to climate team	X																			
Subactivity 1.3.1.3: Data collection and analysis	Climate change consultant	WF climate team; Victor Siamudaala; Sunil Siriwardena, national meteorological services; associates to climate team; Saadiah Ghazali	X																			
Subativity 1.3.1.4: Report preparation and publication	Climate change consultant	WF climate team; associates to climate team		X																		
Output 1.4: New knowledge on market trends and commercial viability of feeds derived from (novel) local ingredients produced in 3 focus countries and made widely available																						
Activity 1.4.1: 3 market assessments (1 per project country)																						
Subactivity 1.4.1.1: Conduct literature review of relevant policy, research, and country documents	Scaling specialist	None	X																			

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Subactivity 1.4.1.2: Design market assessments for each country	Scaling specialist	Victor Siamudaala; Sunil Siriwardena	X																			
Subactivity 1.4.1.3: Data collection and analysis	Scaling specialist	Victor Siamudaala; Sunil Siriwardena; Saadiah Ghazali	X																			
Subactivity 1.4.1.4: Report preparation and publication	Scaling specialist	Victor Siamudaala; Sunil Siriwardena																				
Output 1.5: New knowledge and data on nutrient requirements of improved strains of tilapia and African catfish produced, validated, and made widely available																						
Activity 1.5.1: Investigate nutrient requirements in improved strains of tilapia and African catfish																						
Subactivity 1.5.1.1: Design research protocols	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa); SLU																				
Subactivity 1.5.1.2: (Zambia specific) Renovate wet lab at NRDC Zambia/Recirculating Aquaculture System (RAS)	Local research scientist in Zambia	Rodrigue Yossa; Khairul Rizal Abu Bakar	X																			
Subactivity 1.5.1.3: Secure animal ethics approval	3 local research scientists (1 per project country - WF and/or partner organisations)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa); feed technologist expert and fish nutritionist (both professors from academic partner/university)																				
Subactivity 1.5.1.4: Conduct 12 tilapia experiments and 8 catfish experiments in project countries	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa); Postdoc Scientist; SLU																				
Subactivity 1.5.1.5: Analyse data and samples	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa); SLU																				
Subactivity 1.5.1.6: Research report preparation and publication and addition of results to WF's Better Management Practices guidelines (BMPs)	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa); SLU																				
Subactivity 1.5.1.7: Develop new WF database of essential nutrient requirements in improved strains of tilapia and African catfish	3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; Saadiah Ghazali; research scientists (ICIPE, Aller Aqua Africa); SLU																				
Outcome 2: Quality of at least 15 local ingredients has been improved through various processing techniques and the ingredients are used by stakeholders in the 3 target countries, including local millers and farmers, to produce 9 novel, cost-efficient feed formulations, to improve aquaculture productivity and resilience.																						
Output 2.1: New data and knowledge on local ingredients generated, used in the formulation of novel fish feeds, and made widely available																						
Activity 2.1.1: Conduct experiments to prioritise 15 ingredients																						
Subactivity 2.1.1.1: Conduct biochemistry analyses of ingredients samples collected for output 1.1	SLU	SLU																				
Subactivity 2.1.1.2: Conduct digestibility experiments of ingredients samples collected for output 1.1	Posdoc Scientist	Nurulhuda Fatan; research assistant; laboratory technician (all in Penang)																				

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Subactivity 2.1.1.3: Database development and research report preparation and publication	Posdoc Scientist	Nurulhuda Fatan; Saadiah Ghazali; research assistant; laboratory technician (all in Penang); SLU																				
Activity 2.1.2: Stakeholder consultations (1 online workshop per country) to discuss results of activity 2.1.1 and potential benefits, risks, challenges, and hazards to the use of local ingredients																						
Subactivity 2.1.2.1: Organise and facilitate 1 online stakeholder workshop per country	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; Nurulhuda Fatan; research scientists (ICIPE, CORAF, Aller Aqua Africa); SLU																				
Subactivity 2.1.2.2: Reports preparation and dissemination	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Research scientists (ICIPE, CORAF, Aller Aqua Africa); SLU																				
Activity 2.1.3: Produce ingredients and co-formulate fish feeds																						
Subactivity 2.1.3.1: Synthesize all findings on ingredients generated so far to enable prioritisation	Rodrigue Yossa	3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				
Subactivity 2.1.3.2: Discuss all results with internal and external partners (including 1 online workshop per project country) and select 15 ingredients	Rodrigue Yossa	Gender Consultant; Climate change Consultant; scoping consultant; research scientists (ICIPE, CORAF, Aller Aqua Africa); SLU																				
Subactivity 2.1.3.3: Develop and use processing techniques to improve the quality of the 15 local ingredients as needed (e.g., fermentation, soaking, drying, detoxification, etc.)	SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); research scientists (ICIPE, Aller Aqua Africa, CORAF); Postdoc Scientist; local cooperatives of feed millers																				
Subactivity 2.1.3.4: Quality check the improved ingredients	SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); research scientists (ICIPE, Aller Aqua Africa, CORAF); Postdoc Scientist; local cooperatives of feed millers																				
Subactivity 2.1.3.5: Formulate fish feeds using software	SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); research scientists (ICIPE, Aller Aqua Africa, CORAF); Postdoc Scientist; local cooperatives of feed millers																				
Subactivity 2.1.3.6: Produce 9 experimental fish feeds	Local cooperatives and feed millers	SLU; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); Postdoc Scientist; research scientists (ICIPE, Aller Aqua Africa, CORAF)																				
Activity 2.1.4: Validate 9 formulated fish feeds through 6 on-farm pilots (2 per country)																						
Subactivity 2.1.4.1: Design and validate research protocols	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); local cooperatives of fish farmers and feed millers; research scientists (ICIPE, CORAF, Aller Aqua Africa); Postdoc Scientist;																				
Subactivity 2.1.4.2: Conduct validation experiments on-farm	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); local cooperatives of fish farmers and feed millers; research scientists (ICIPE, CORAF, Aller Aqua Africa)																				
Subactivity 2.1.4.3: Analyse the data and produce reports	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); Saadiah Ghazali; local cooperatives of fish farmers and feed millers; research scientists (ICIPE, CORAF, Aller Aqua Africa); Postdoc Scientist;																				
Subactivity 2.1.4.4: Hold workshops to share and discuss results (1 workshop per country)	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); local cooperatives of fish farmers and feed millers; research scientists (ICIPE, CORAF, Aller Aqua Africa)																				
Subactivity 2.1.4.5: Finalise and defend PhD theses	SLU; WF	2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Output 2.2: Databases and digital solutions developed and used by farmers for formulating and adapting new local feeds on a "real-time" basis																						
Activty 2.2.1: Develop an open access database (FeedCalculator) for feed ingredients, fish feeds, and nutrient requirements, including mobile version/apps																						
Subactivity 2.2.1.1: Develop database with a feed formulation application/tool (FeedCalculator)	Single Spark	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF); Saadiah Ghazali; ICIPE; CORAF; Aller Aqua Africa; Postdoc Scientist; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Subactivity 2.2.1.2: Develop a mobile version of the database and integrate into existing mobile apps widely used by farmers (including social media apps such as WhatsApp)	Single Spark	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF) ; ICIPE; CORAF; Aller Aqua Africa; Postdoc Scientist; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Subactivity 2.2.1.3: Hold an online workshop in each project country to obtain feedback from key project partners on initial design	Single Spark	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF) ; ICIPE; CORAF; Aller Aqua Africa; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Subactivity 2.2.1.4: Finalise both tools based on feedback from key project partners	Single Spark	Rodrigue Yossa; 3 local research scientists (1 per project country - WF, ICIPE, CORAF) ; ICIPE; CORAF; Aller Aqua Africa; Postdoc Scientist; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Output 2.3: Knowledge and capacity improved of millers, farmers, and other stakeholders to use novel ingredients to create the most affordable, highest quality fish feeds that take into account context-specific circumstances and needs																						
Activity 2.3.1: Develop printed booklets/manuals for ingredients and fish feeds and make available to the public																						
Subactivity 2.3.1.1: Conduct 3 in-person workshops (1 for each project country) and 1 online workshop	Rodrigue Yossa	Postdoc Scientist; Nurulhuda Fatan; 3 local research scientists; CORAF; ICIPE; Aller Aqua Africa; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Subactivity 2.3.1.2: Develop overall printed booklets/manuals	Rodrigue Yossa/Communications specialist	Postdoc Scientist; Nurulhuda Fatan; 3 local research scientists; CORAF; ICIPE; Aller Aqua Africa; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Subactivity 2.3.1.3: Develop and insert a unique set of 9 fish feeds per country in the booklet based on the novel ingredients (a total of 27 unique feeds)	Rodrigue Yossa	Postdoc Scientist; Nurulhuda Fatan; 3 local research scientists; CORAF; ICIPE; Aller Aqua Africa; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya)																				
Activity 2.3.2: Hold workshops to train feed millers and fish farmers on ingredients, feeds, practices, databases, booklets/manuals																						
Subactivity 2.3.2.1: Organise and facilitate 4 training workshops per country (2 online and 2 in-person)	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	Rodrigue Yossa; Postdoc Scientist; Nurulhuda Fatan; Aller Aqua Africa; CORAF; ICIPE; Single Spark; Victor Siamudaala; Sunil Siriwardena; representatives of NARS																				
Subactivity 2.3.2.2: Reports preparation and dissemination	3 local research scientists (1 per project country - WF, ICIPE, CORAF)/SLU	Rodrigue Yossa; Postdoc Scientist; Nurulhuda Fatan; Aller Aqua Africa; CORAF; ICIPE; Single Spark; Victor Siamudaala; Sunil Siriwardena; representatives of NARS																				
Subactivity 2.3.2.3: Digital announcements of the workshops and their benefits via radio, WhatsApp, and social media	WF communications specialist	Florine Lim; WF communications team																				
Outcome 3: 5,000 farmers directly or indirectly linked to the project access, test, and use novel fish feeds and feed solutions using the knowledge and innovations developed by the project, with support of a range of strategic scaling partners and other stakeholders																						
Output 3.1: Integrated knowledge for enabling the scaling environment (including exploring barriers and bottlenecks to scaling), and strategies for scaling up the use of novel feeds and feed management approaches in the 3 target countries co-developed with stakeholders and used to guide selection of country scaling strategies																						

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 3.1.1: Annual assessments of enabling and constraining factors for scale-up (1 per project country at the end of years 1, 2, 3, 4)																						
Subactivity 3.1.1.1: Design scaling assessments for each country (redesign/update for each year as needed)	Scaling specialist	Victor Siamudaala; Sunil Siriwardena; WF gender lead; Essam Mohammed																				
Subactivity 3.1.1.2: Data collection and analysis, including online stakeholder workshops (1 workshop per country at the end of year 1 and 1 recap workshop at the end of year 4 for a total of 4)	Scaling specialist	Victor Siamudaala; Sunil Siriwardena; WF gender lead; Essam Mohammed; Saadiah Ghazali																				
Subactivity 3.1.1.3: Report preparation and publication	Scaling specialist	Victor Siamudaala; Sunil Siriwardena; WF gender lead; Essam Mohammed																				
Activity 3.1.2: Stakeholder consultations to codevelop scaling strategies																						
Subactivity 3.1.1.1: Organise and facilitate 2 stakeholder workshops per country (total of 6)	Scaling specialist, 3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa; CORAF); SLU																				
Subactivity 3.1.1.2: Report preparation and dissemination	Scaling specialist, 3 local research scientists (1 per project country - WF, ICIPE, CORAF)	Victor Siamudaala; Sunil Siriwardena; research scientists (ICIPE, Aller Aqua Africa; CORAF); SLU																				
Output 3.2: Strategic partnerships for scaling the use of the project's innovations and knowledge built and operational with a range of partners in the focus countries (sub-activities to be co-developed with scaling partners and as part of scaling assessments)																						
Activity 3.2.1: Develop innovation platforms for bringing key scaling stakeholders together	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.2: Identify and set up demonstration sites and model farms	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.3: Host farmer field days on demo sites and model farms	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.4: Build partnerships with cooperatives to test and use novel feeds	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.4: Support establishment of new feed services and businesses by young people, farmers, etc	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.5: Support small-scale millers to develop new product offerrings based on project's's innovations	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Activity 3.2.6: Build partnerships with NGOs, private sector, and extension service providers to incorporate project's knowledge and innovations into their offerrings to aquaculture farmers	Scaling specialist	WF team, CORAF, ICIPE, millers, farmers, NGOs, extension service providers, private sector, financial service providers, and other scaling partners																				
Output 3.3: Strategic capacity development and public awareness campaigns delivered in order to widely disseminate knowledge, innovations, and tools developed by the project																						
Activity 3.3.1: Stakeholder consultations to codevelop scaling strategies																						

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Subactivity 3.3.1.1: Develop first draft of policy brief	Policy consultant; Rodrigue Yossa	All participating project scientists																				
Subactivity 3.3.1.2: Hold online workshop and receive feedback on draft	Rodrigue Yossa	All participating project scientists																				
Subactivity 3.3.1.3: Finalise policy brief and publish	Rodrigue Yossa	All participating project scientists																				
Activity 3.3.2: Disseminate knowledge through workshops, conferences, and mass media																						
Subactivity 3.3.2.1: Develop and publish factsheets (online and printed), BMPs, and project report	Rodrigue Yossa/WF communications specialist	3 local research scientists (1 per project country - WF, ICIPE, CORAF); SLU; Postdoc Scientist; 2 PhD students (Nigeria & Zambia); 10 master's students (Kenya); ICIPE; CORAF; WF communications team																				
Subactivity 3.3.2.2: Hold 10 online workshops to promote scale-up	Rodrigue Yossa	Representatives of CORAF; WF communications team; Scaling specialist																				
Subactivity 3.3.2.3: Produce a "benefit story," a short, animated video that summarizes the diverse benefits to farmers and millers of using local, sustainable ingredients	WF communications specialist	Representatives of CORAF; WF communications team																				
Subactivity 3.3.2.4: Produce television and radio programming on project results	WF communications specialist	Representatives of CORAF; WF communications team																				
Subactivity 3.3.2.5: Design and conduct context-specific outreach (based on assessments in output 1.5) to target end-users (farmers and millers) to support scale-up	Representatives of CORAF/Scaling specialist	Representatives of NARS; Postdoc Scientist; 3 local research scientists (1 per project country - WF, ICIPE, CORAF); ICIPE																				
Subactivity 3.3.2.6: Develop scaling potential outside of project by identifying additional scaling opportunities	Scaling specialist	Representatives of NARS; Postdoc Scientist; 3 local research scientists (1 per project country - WF, ICIPE, CORAF); CORAF; ICIPE																				
Cross-cutting/regular activities																						
Procurement and transfer of project materials	WF logistics team	3 local research scientists (1 per project country - WF, ICIPE, CORAF); Victor Siamudaala; Sunil Siriwardena; ICIPE; CORAF; SLU																				
Annual project meetings (rotating countries)	Rodrigue Yossa; Project management unit	1 representative from each partner organisation (travelling to location of meeting)																				
Monthly internal WF meetings	Rodrigue Yossa; Project management unit	All participating WF staff																				
Regular project phone calls/online meetings	Rodrigue Yossa	3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				
MEL check-in/data updates on the MEL platform	WF MEL specialist	MEL team; Rodolfo Dam Lam; 3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				
Annual outcome monitoring studies	WF MEL specialist	MEL team;, 3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				

Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Develop annual project donor reports	Project management unit; Rodrigue Yossa	3 local research scientists (1 per project country - WF, ICIPE, CORAF); WF MEL specialist																				
Mid-term project review (external)	Consultant; Rodrigue Yossa	Rodrigue Yossa, WorldFish PMU, SLU, ICIPE, CORAF																				
Final project review (external)	Consultant; Rodrigue Yossa	Rodrigue Yossa, WorldFish PMU, SLU, ICIPE, CORAF																				
Annual external audit	External Auditors; WorldFish Finance Team	Rodrigue Yossa, WorldFish PMU, SLU, ICIPE, CORAF																				
Communications activities (in addition to project start-up and outcome 4)																						
Develop and release project launch press release	WF communications specialist	Florine Lim; WF communications team																				
Develop project webpage and update regularly	WF communications specialist	Florine Lim; WF communications team																				
Fish-for-thought events (themed lectures and talks)	WF communications specialist	Florine Lim; WF communications team																				
Produce 4 blog posts per year	WF communications specialist	Florine Lim; WF communications team																				
Produce 2 social media updates per month	WF communications specialist	Florine Lim; WF communications team																				
Produce 2 case/success stories per year	WF communications specialist	Florine Lim; WF communications team		X																		
Produce 1 photo story per year	WF communications specialist	Florine Lim; WF communications team																				
Develop a PPT/video abstract for key journal articles/publications	WF communications specialist	Florine Lim; WF communications team																				
Publish and circulate project newsletters	WF communications specialist	Florine Lim; WF communications team																				
Publish an op-ed for key project highlights	WF communications specialist	Florine Lim; WF communications team																				
Project close-out activities																						
Project close-out ceremony/meeting	Project management unit; Rodrigue Yossa	All participating partners																				
Outcomes, Outputs, Activities, & Subactivities	Lead(s)	Associates (co-deliverers)	Proposed Timeline: 2022 - 2026																			
			Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Endline evaluation	MEL specialist	MEL team																				
Produce final monitoring, evaluation, and learning report	WF MEL specialist	WF MEL team; Rodrigue Yossa; Rodolfo Dam Lam; 3 local research scientists (1 per project country - WF, ICIPE, CORAF)																				
Produce final project donor report	Project management unit; Rodrigue Yossa	3 local research scientists (1 per project country - WF, ICIPE, CORAF); Postdoc Scientist;																				

About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving aquatic food systems, including fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world.

The WorldFish headquarters is in Penang, Malaysia, with regional offices across Africa, Asia and the Pacific. The organization is a member of CGIAR, the world's largest research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security and improving natural resources.

For more information, please visit www.worldfishcenter.org