

ICAR-CIFA promoting Kalong-Kapili for opening new avenues to strengthen aquaculture in Northeast region of India

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Aquaculture production has increased steadily across India, driven by the adoption of diversified systems that raise yields per unit area. Continuous expansion has been possible through extension services that transfer technologies to farmers, promoting aquaculture as an accessible and sustainable farming practice. These services ensure that aquaculture remains viable by providing technical support and demonstrating practical methods. Aquaculture supplies aquatic protein, supports rural livelihoods, and generates income in villages across the region. ICAR-CIFA (Indian Council of Agricultural Research-Central Institute of Freshwater Aquaculture) has contributed substantially to transforming fishing communities from subsistence farming to vibrant local economies. Non-governmental organisations (NGOs) play a vital role in this transformation, reaching rural communities and promoting sustainable livelihoods through

diverse activities. This article describes the role of Kalong-Kapili, an NGO in Assam, in developing aquaculture across the north-eastern regions of India. With support from CIFA, Kalong-Kapili has worked to make aquaculture a viable tool for reducing poverty and malnutrition.

Kalong-Kapili - playing a key role in strengthening rural aquaculture

Kalong-Kapili began operations in 2007 at Bagibari village in Kamrup Metropolitan district of Assam, India, with the goal of creating sustainable livelihood opportunities among villagers. Mr Jyotish Talukdar, the organisation's Director, recognised that Assam possesses diverse water bodies including large



Farmer holding a chitala.

wetlands, beels, jheels, rivers, ponds, canals and lakes, most of which are perennial or annual, with some seasonal. These water bodies represented untapped resources that could be used for fish production. Assam's population traditionally eats fish and has knowledge of fishing and fish farming. India's aquaculture sector has grown substantially in recent years to meet increasing fish demand. Population growth and rising demand for fish have led to intensification of production. CIFA has promoted aquaculture to meet demand for aquatic protein as wild fisheries resources have declined due to unsustainable exploitation. At this juncture, CIFA encouraged Mr Talukdar and his colleagues to pursue aquaculture for rural development through sustainable livelihood programmes. Supported by CIFA, Kalong-Kapili has worked to utilise water resources for aquaculture with technical support and capacity building.

Capacity building - an initial step to train human resources

Kalong-Kapili established a 'field laboratory' at Bagibari village. The field laboratory was designed as a one-stop knowledge centre to disseminate information among stakeholders. Facilities developed for acquiring aquaculture knowledge include diverse programmes coordinated through structured systems, which include:

Aquaculture support system:

- Solar panels for electricity supply.
- Solar systems for grow-out culture ponds.

- Breeding facilities including breeding pools and hatching pools.
- Rearing facilities comprising spawn rearing tanks, fry and fingerling rearing nursery ponds.
- Culture facilities with ponds of different sizes for grow-out culture from table-sized fish to marketable size.
- Ornamental fish breeding unit.

Feeding support system

- Feed mill.
- Pellet feed production capacity of 100 kg daily.
- Operational guidance manual for farmers and entrepreneurs.

Pond management system:

- Guidelines displayed on signboards in local language for step-by-step learning.
- Application of raw cow dung in appropriate amounts.
- Fertiliser application rates per unit area.
- Timing of fertiliser application per unit area.
- Pond water management for plankton production.

Advanced aquaculture facility system:

- Recirculatory aquaculture system (RAS).



Solar system operated in grow-out culture pond

- Specialised RAS for larval rearing.
- Biofloc.
- Aquaponics setup.
- Live food preparation unit.
- Solar fish dryer.
- Fish library.
- Fish museum.

Provision of learning system:

- Training hall (area, classroom, computer system, etc.).
- Conference hall/
- Training hostel (accommodation, washrooms, pantry, etc.).
- Dining hall.
- Computer centre with internet connection.
- Laboratory for soil and water analyses.
- Disease diagnostic unit.

Learning programmes: needs based and problem focused

Aquaculture has evolved from simple pond culture to sophisticated systems as technology has advanced. Recognising the limitations of traditional pond-based farming, practitioners have equipped existing water bodies with modern facilities for optimal resource use. Many smallholder farmers meet their food, nutrition and income requirements using backyard water bodies. Some integrate fisheries with other farming systems, planting vegetables, horticultural crops and keeping poultry on pond dykes. Proportionate resource allocation leads to sustainable pond management, which requires careful stewardship of natural resources including air, water, soils and biodiversity. With technical support from CIFA, Kalong-Kapili provides practical methods for sustainable crop and farm management to stakeholders through the following activities:

- Improved farming practices: Farmers receive training in scientific fish farming. Guidance on sustainable and climate-resilient aquaculture is provided to increase productivity.
- Climate resilience: Farmers receive training on climate-resilient aquaculture to assess vulnerability to climate change and adopt practices that mitigate adverse impacts.
- Disease management: Farmers learn to identify fish diseases caused by different pathogens and manage them effectively.
- Access to resources: Information on technological advances for scientific fish farming practices is provided.



Solar panel for electricity supply.



Breeding pool.



Feed mill.

- Empowerment: Farmers are equipped with skills that build confidence for decision-making in improved aquaculture practices.
- Income generation: Farmers improve livelihoods and increase income by adopting sustainable and effective scientific aquaculture practices.

Aquaculture Field School (AFS) at Bagibari

The AFS is a school without walls. It is an innovative, farmer-centred aquaculture extension approach that emphasises technology transfer, training provision and promotion of good practices in technical areas of aquaculture. It guides farmers on site selection, breeding and seed production, feeding, pond water management and fish health. Effective extension services play a role in increasing aquaculture production for economic development of rural fish farmers. The concept of extension service has broadened beyond simple 'transfer of technology' to encompass human resource development that focuses on learning and empowering farmers. ICAR-CIFA supports Kalong-Kapili to promote farmer-to-farmer learning, thereby advancing horizontal extension. The curriculum integrates scientific methods of aquaculture including site selection, fish culture practices and marketing. It covers various farmer levels and disseminates technologies for seed production of carp, catfish, air-breathing fish and ornamental fish. An 'Aquaculture Technological Park' with live displays of various enterprises is being established to provide more focused and practical learning at a one-stop aquaculture facility.

Benefits of AFS: learning together

AFS benefits farmers in several ways, including knowledge sharing, skill development in scientific fish farming techniques, experience sharing and acquisition of practical experience through training.

- Improved productivity: Farmers can increase fish production and productivity per unit area by learning best management practices.
- Promote sustainability: Farmers can learn sustainable practices that provide stable production without harming the pond environment for future generations.
- Enhanced livelihood: Farmers can learn and adopt scientific farming methods to improve their standard of living.
- Increased income: Farmers can increase income by adopting scientific aquaculture.
- Knowledge sharing: Farmers can exchange experiences and learn from each other to develop knowledge-based information that may be tested at field level.
- Best management practices (BMPs): Farmers can share information to adopt best management practices for improving yields.



Managing pond water for plankton production.

- Eco-friendly approaches: Farmers are encouraged to develop eco-friendly approaches to aquaculture by reducing environmental impacts.

Role of Kalong-Kapili: disseminating knowledge from farmer to farmer

ICAR-CIFA established the first Aquaculture Field School (AFS) in the North East Region at Bagbari in association with Kalong-Kapili. The primary aim of AFS is to empower fish farmers in the region through comprehensive learning, knowledge sharing and technical guidance. The school's campus is well equipped with all essential facilities, providing an ideal learning environment. Participants are encouraged to freely express their opinions and engage in discussions. Kalong-Kapili has highly qualified resource persons who consider each trainee's expectations, attitudes and experiences during training, and deliver training through individualised modules. AFS is a unique facility with residential training capabilities established under one roof. Over time, AFS has conducted various training programmes, including residential sessions, exposure visits and day-long programmes for fish farmers. AFS emphasises training of farmers following structured criteria and guidelines for Community Resource Person (CRP) training. These initiatives have been made possible with support from ICAR-CIFA; the Department of Fisheries, Government of Assam; GIZ; and NABARD.



Specialised RAS for larval rearing.



A bio-floc system.



Aquaponics
 Aquaponics is an integrated, eco-friendly, closed-loop wastewater approach for food production which integrates aquaculture and hydroponics to create a symbiotic environment.

Normal scale	Medium Scale/Kalong Kapili
Area	1000 sqm
Number of tanks or harvest area	200/Week
Harvest quantity	8 kg/week
	200kg/week

Advantages:

- Reduces water usage by 90% (water conservation) which contributes to 50% gain (total 2 Year training production)
- Year-round production
- Healthier organic crops
- Has less reliance on fertilisers and pesticides, minimises waste
- 3 times reduction in pest/disease system

Principle:
 Aquaponics is a closed-loop approach of food production where the waste of fish (ammonia) becomes the nutrient for the crops to grow, and the nutrient rich water is recycled back to the fish. The fish waste in the form of ammonia is broken down by nitrifying bacteria such as Nitrosomonas and Nitrobacter and further into nitrites. Nitrites can be toxic when taken up by the plants and thereby clean the water and the filtered water is pumped back into the system.

No.	Water parameter	Optimum Range
1	Temperature	20-30°C
2	pH	6.5-8.5
3	Ammonia	0.0-0.5 ppm
4	Nitrite	0.0-0.5 ppm
5	Nitrate	0.0-50 ppm
6	Salinity	0-5 ppm

SOLAR-BASED AQUAPONICS
 Specification:

Fish species	Rupchanda
Total fingerlings stock	650
Tank	6m diameter, 1m
Heilea air blower	1hp (90W=120LPM)
PUMPS (11w)	2m ³ /hr plants in (for RAS)
Plants bed	1m (50 plants capacity)
Shade net	90%
Tank Volume	28,000L
Effective Depth	2.7 feet
Maximum depth	3 feet

Aquaponics setup operated with solar system.

Facilities and services of AFS

- Advanced and innovative programmes on sustainable aquaculture and natural farming following agro-ecological principles.
- Database-integrated aquaculture programmes providing access to trainee farmers.
- Breeding unit under network hatchery recognised by NFDB (National Fishery Development Board).
- Demonstration unit for sustainable aquaculture and natural farming.
- Laboratory and internet facilities for trainees and visitors.
- Qualified and experienced resource persons.
- Aqua-tourism.
- Infrastructure: Training hall equipped with modern learning techniques, separate dormitories for male and female participants, hygienic kitchen with dining hall, medical unit, baby care unit, washrooms, etc.



Live food preparation unit.

Extension services of Kalong-Kapili: helping farmers realise their goals

Kalong-Kapili takes initiatives towards social responsibility by providing reasonable remuneration for labour in aquaculture. It has developed value chain initiatives for overall efficiency and profitability. The organisation encourages local participation in aquaculture development so that community engagement serves as a tool for knowledge sharing. It provides farmers with market linkages that enable them to sell products with profitable margins. It has worked to involve more women to ensure that women's empowerment drives inclusive development. For successful execution of extension programmes, Kalong-Kapili has adopted the following measures.

- Meetings: Regular meetings among farmers to share experiences, information, skills and knowledge.
- Farmers' groups: Formation of farmers' groups to facilitate learning, information sharing and decision-making.
- Community events: Organisation of community events, workshops and training sessions to bring farmers together.



Solar fish dryer.



A view of soil and water analysis.



Soil and water analysis for female trainees.

- Decision-making process: Allowing farmers to participate in decision-making processes and share information with others.
- Social media: Engagement on various social media platforms to connect farmers and share information.
- Online forums: Creation of online forums or groups for discussion, knowledge sharing and collaboration.
- Stakeholder engagement: Collaboration with other agencies to provide farmers with access to resources and expertise.
- Networking: Building partnerships with organisations and networks to expand reach.
- Mentorship: Sharing knowledge from experienced farmers to new farmers through various programmes for technical guidance.
- Collaboration: Collaboration with farmers' organisations with different farming practices to promote collaborative activities.
- Farmer-to-farmer exchange: Promotion of peer-to-peer learning by facilitating knowledge sharing and exchanges.

Support services of Kalong-Kapili: from near to far

Kalong-Kapili extends its services across the entire north-eastern region, including Assam, Meghalaya, Manipur and Arunachal Pradesh, India. Integrated aquaculture, including fish-cum-pig, fish-cum-poultry, fish-cum-duck and fish-cum-rice farming, along with horticultural crop plantation - is common in the north-eastern region.

Borbeel cluster, Assam

The tribal population of Borbeel was poorly developed. People possess potential water bodies that were not utilised. Kalong-Kapili has changed their lives through continuous intervention. The integrated approach to aquaculture, horticulture and agriculture has benefitted 400 families. Fish farming was introduced for the first time in that

remote area and has changed the living standards of beneficiaries. Many tangible changes have transformed their lives through provision of modern facilities including approach roads, marketing outlets for aquaculture products and horticultural crops, and support for farmers to travel from home to markets. For long-term benefit, areca nut plantations, pig sties and piglets have been supplied.

Lohit cluster, Arunachal Pradesh

An integrated tribal development project was introduced in Lohit district to support 200 families through integrated and sustainable aquaculture practices. The project includes aquaculture, kitchen gardens on the dykes of backyard ponds and horticultural crop plantations. Women's participation is prominent, ensuring women's empowerment through skill development. Additionally, nine village planning committees were developed, leading to creation of the Lohit Integrated Tribal Development Cluster Committee. This programme provides environmental, social and economic benefits.

Lower Siang cluster, Arunachal Pradesh

Kalong-Kapili replicated the Lohit cluster programme to support 200 families in Lower Siang, Arunachal Pradesh. Beneficiaries have applied scientific knowledge under the project to develop orchards, kitchen gardens, backyard pond farming, piggery and other allied activities. Crops are chosen carefully to ensure a steady flow of income in a sustainable manner for short-term,

intermediate and long-term benefits. Beneficiaries have learnt to utilise resources through an integrated farming approach.

Women's empowerment

Kalong-Kapili empowers women through a range of aquaculture development initiatives. It forms self-help groups (SHGs) among women to provide gainful employment and empowerment. The Umbrella Programme for Natural Resource Management (UPNRM) was introduced to motivate women to participate in climate-smart fisheries programmes. Kalong-Kapili adapted NABARD's (National Bank for Agriculture and Rural Development) 'Grand model' to a 'Business model' through the replacement of bottom-dwelling fish with freshwater prawns. Under this programme, 200 fish ponds around Bagibari were developed through landscape changes with participation of village women. Active involvement of enthusiastic women in aquaculture has provided access to economic benefits, which has begun to reflect in qualitative improvements in their livelihood standards.

Impact of Kalong-Kapili: human resource generation

Kalong-Kapili has trained 10,000 people comprising both youth and women throughout Assam and the north-eastern region as part of aquaculture skill



Aquaculture Technological Park.

development. It provides two residential training courses: three-day and ten-day programmes on sustainable aquaculture practices, with a focus on 'learning by doing' designed to emphasise practical and field-oriented classes alongside theoretical discussion on site. In addition, non-residential programmes on scientific aquaculture are conducted as day-long sessions for local farmers. Kalong-Kapili organises workshops, exposure visits, special lectures, interaction meetings and knowledge-exchange programmes by invited

speakers for the benefit of stakeholders, including undergraduate and postgraduate students, entrepreneurs, hatchery owners, progressive farmers and smallholder farmers. Kalong-Kapili has trained more than 30,000 stakeholders and indirectly reached more than 100,000 people.



Trainees learn both sustainable aquaculture and climate resilient farming.



Learning through aquaculture field school for women participants.



Learning through aquaculture field school for participants sponsored by NABARD.



Integrated tribal development project.



Empowering women through three days residential training.



Empowering women through training.



Truck loaded fish feed supplied by CIFA to distribute fish farmers.



CIFA distributed fish feed to farmers.



Learning through aquaculture field school for student participants.

Aquaculture resource generation: potential impact of Kalong-Kapili

Kalong-Kapili owns 20 hectares of water area used for fish cultivation. In 2024, it produced fish seeds comprising 1.32 billion spawn, 630 million fry and 530 million fingerlings. With its guidance, farmers practise cultivation of high-yielding varieties including Jayanti rohu, rohu, improved catla, freshwater prawn, pabda, chital and amur carp with Indian major carps (IMC). It is also promoting single stocking with multiple harvesting, multiple stocking with multiple harvesting, and multiple stocking with cycling harvesting. It has extended support to flood-prone and drought-affected areas. It has advised farmers to stock seed at 8,000-10,000 per hectare for cultivation periods of 8-10 months. IMC is harvested when individual fish reach 1.0 kg, which costs Rs 300 (US\$3.65). Farmers harvest on average 5,000 kg per hectare, which is economically beneficial.

CIFA's aquaculture outreach programme through Kalong-Kapili

CIFA began implementing a government of India scheme for developing aquaculture and improving livelihoods of people in poverty. Activities include identifying beneficiaries, providing skill training and supplying critical inputs such as fish seed, fish feed and other materials to under-privileged people in unreached areas to demonstrate the benefits of scientific fish culture. With help from Kalong-Kapili, CIFA selected 200 farmers for this programme who own water bodies in West Karbi Anglong, Assam. Previously, people in that area were forest-dependent dwellers who did not practise agriculture. They collected forest resources including non-timber forest products to sustain their livelihoods. Kalong-Kapili trained them in aquaculture practice and CIFA provided key aquaculture inputs. Each beneficiary received 1,000 IMC fingerlings and 100 kg of fish feed. Final harvest is awaited. Karbi Anglong possesses potential water resources for aquaculture as a community practice, guided by Kalong-Kapili. The demonstration of scientific practices is expected to generate interest among other people in the region and boost fish production.

Conclusion

The adoption of innovative and improved fish farming approaches supports sustainable livelihoods among people in the north-eastern region of India. This is essential for mitigating environmental threats posed by intensification and commercialisation of aquaculture. Sustainable aquaculture is gaining attention and is regarded as a means of providing aquatic protein, balanced nutrition and livelihoods for small-scale farmers in India. Sustainable aquaculture ensures ecological balance and environmental conservation. Addition of more fish to household diets promotes nutritional security and improves dietary quality. Aquaculture serves as a central focus for consistent income generation through community-driven sustainable practices, as demonstrated in the north-eastern region by Kalong-Kapili. With technical support from CIFA, Kalong-Kapili guides farmers in adopting polyculture and composite fish farming integrated with plant crops and animal husbandry that recycles farm resources as fertiliser inputs from multiple crops. Since its inception, Kalong-Kapili has championed the causes of people in poverty. By joining forces with this organisation, CIFA has expanded its aquaculture outreach efforts considerably. Newer approaches to aquaculture, tailored to the north-east region, are finding greater acceptance by people and, as a consequence, bringing positive changes to their livelihoods.

ICAR-CIFA distributing fish seed to farmers.

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