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ICAR-CGIAR W3 Research Collaboration

Annual Report for the period April 2021 to March 2022

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About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving 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. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of [CGIAR](#), the world's largest global partnership on agriculture research and innovation for a food secure future.

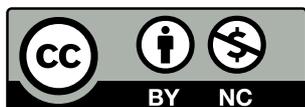
Acknowledgments

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List of acronyms

CGIAR	Consultative Group on International Agricultural Research
CIFA	Central Institute for Freshwater Aquaculture
CIFRI	Central Inland Fisheries Research Institute
CIFT	Central Institute for Fisheries Technology
ICAR	Indian Council of Agricultural Research
LCA	Life Cycle Analysis
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
SOP	Standard Operating Procedures
SA	Sustainable aquaculture
SNP	Supplementary Nutrition program
SSF	Small-scale fisheries
VCN	Value chains and nutrition
WCD	Women and Child Development

1. Executive summary

The CGIAR is a global research partnership for a food-secure future. It works through 15 global research centres located worldwide. WorldFish is part of One CGIAR, the world's largest agricultural innovation network. WorldFish is the only center in One CGIAR with 45 years of experience in fisheries and aquaculture research in low-and middle-income countries. ICAR, as the nodal body, has signed Memorandum of Understanding or Agreement with 12 CGIAR Centres. Indian Council of Agricultural Research (ICAR) and WorldFish have signed a MOU in July 1996. Under the MOU and subsequent MOAs, ICAR is providing funding support under W3 to establish long term research collaboration between the two organizations in the areas of sustainable aquaculture (SA), small scale fisheries (SSF) and value chains and nutrition (VCN). This collaboration seeks alignment of research priorities of three major ICAR research institutions, namely Central Institute of Freshwater Aquaculture (CIFA) with SA flagship, Central Inland Fisheries Research Institute (CIFRI) with SSF Flagship and Central Institute for Fisheries Technology (CIFT) with VCN flagship of WorldFish. Agricultural research and education in India is precisely undertaken in the areas of mutual interest identified in the Work Plans, which are developed for five years. An annual meeting of the Heads of CGIAR centres in India is held with the senior officers of the ICAR in which all the ongoing programmes are discussed and priorities are decided considering the national requirements and the areas where the CGIAR centres could assist the ICAR institutions and agricultural universities to address the existing as well as the emerging issues. The Annual Report 2021 provides a summary of salient outputs and outcomes of the joint R&D activities of WorldFish with 3 premier ICAR Fisheries Institutions namely CIFA, CIFRI and CIFT.

2. Introduction

2018: ICAR W3 Work Plan agreement for the year 2018 was signed by the DGs of ICAR and WorldFish on *3rd May 2018*. The purpose of the 2018 ICAR W3 work plan agreement under the broad framework of 1996 MOU between ICAR and WorldFish were to (a) facilitate in-depth scientific interactions between 3 research programs of WorldFish (Sustainable Aquaculture, Small Scale Fisheries, Value chains and Nutrition) and the three ICAR Fisheries research institutions (CIFA, CIFRI and CIFT), and (b) Co-development of a 5 year (2019-2023) work program. In order to meet the purpose of the 2018 agreement and co-develop a five year joint research program following activities were implemented in 2018.

1. Theory of Change Workshop from 16-18 July 2018 in CIFA, Bhubaneswar.
2. Series of scientific exchange visits in Oct 2018 for research teams from CIFA to WorldFish Penang, CIFT to WorldFish Cambodia and CIFRI to WorldFish Bangladesh
3. Two day ICAR-WorldFish Research strategy synthesis workshop in WorldFish, Penang from 26-27 Nov 2018
4. Thematic areas of Research cooperation under the five year joint research program
 - ICAR(CIFA) and WorldFish (Sustainable Aquaculture)
 - Yield gap analysis and on farm performance evaluation of genetically improved varieties (e.g. rohu and freshwater prawn)
 - Life cycle analysis of carp and pangassius farming systems in India
 - ICAR(CIFRI) and WorldFish (Resilient small-scale fisheries)
 - Fish productivity enhancement from wetlands and flood plains
 - ICAR(CIFT) and WorldFish (value chains and nutrition)

- Fish consumption patterns of rural and urban consumers
- Development of specific fish products for the first 1,000 days of life – pregnant and lactating women and young children 6-24 months of age

Details of 2018 work done are captured in the recently published ICAR-CGIAR report (**Ref: ICAR 2019, Annual Report, ICAR-CGIAR Centres, Partnerships for science-led Agriculture**). Based on the outcomes of technical activities, consultations and workshops conducted in 2018, a 5 year (2019-2024) joint collaborative research program was developed and presented to the ICAR-CGIAR Annual Review meeting on 24th and 25th Jan 2019 and the same was approved. The five-year research strategy (2019-2024) between ICAR (CIFA, CIFRI and CIFT) and WorldFish was signed as a MOA by ICAR and WorldFish on 2nd Jan 2019.

2019 and 2020: Year 1 and 2: The 5 year joint research was designed as an evolving and dynamic research activity to harness the research potential of ICAR researchers and WorldFish and address topics of regional and global relevance. Research under Sustainable Aquaculture in collaboration with ICAR (CIFA) mainly covers (a) Life cycle analysis of carp and pangassius farming systems in India (b) Yield gap analysis and on farm performance evaluation of genetically improved varieties (e.g. rohu and freshwater prawn). Research under small scale fisheries in collaboration with ICAR (CIFRI) mainly covers (a) Productivity enhancement from inland wetlands and flood plains and research under value chains and nutrition in collaboration with ICAR (CIFT) mainly covers (a) Fish consumption patterns of rural and urban consumers and (b) Development of specific fish products for the first 1,000 days of life – pregnant and lactating women and young children 6-24 months of age. The work done report for the year 2019 was presented to the ICAR-CGIAR virtual Annual review meeting held on 4th May 2020 and the same was approved. The work done report for the year 2020 was presented to the ICAR-CGIAR virtual annual review meeting held on 3/4th Feb 2021 at the NASC complex and the same was approved. The details are captured in the recently published ICAR-CGIAR report (**Ref: ICAR 2020, Annual Report, ICAR-CGIAR Centres, Partnership for science-led Agriculture**).

3. Work done report for Year 3 (2021) of the 5 year (2019-2023) Joint work program

1. ICAR-CGIAR Annual Review Meeting

ICAR-CGIAR Annual Review meeting was held on 7th Feb 2022 at the NASC Complex to review work done in Calendar year 2021 and work plan for Calendar year 2022. WorldFish participated in the virtual review meeting and presented details of all activities undertaken by WorldFish in 2021 with three ICAR Fisheries Institutions namely CIFA, CIFRI and CIFT (Annex 1). The research collaboration is well aligned with impact areas of ICAR, WorldFish and One CGIAR as can be seen from the below table.

Institution/Program	Thematic Area	Impact area

ICAR(CIFA) and WorldFish (Sustainable Aquaculture)	<ul style="list-style-type: none"> • Environment foot print analysis (LCA) of carp and pangassius farming systems in India • Yield gap analysis and on farm performance evaluation of genetically improved varieties (e.g. rohu and freshwater prawn) 	(a) Climate adaptation and mitigation (b) Poverty reduction, livelihoods and jobs
ICAR(CIFRI) and WorldFish (Resilient small-scale fisheries)	<ul style="list-style-type: none"> • Productivity enhancement from wetlands, beels and flood plains • Governance mechanisms for inland water bodies including conservation of SIS and nutrition-sensitive fish food systems 	(a) Environmental health and biodiversity (b) Gender equality, youth and social inclusion
ICAR(CIFT) and WorldFish (value chains and nutrition)	<ul style="list-style-type: none"> • Fish consumption patterns of rural and urban consumers • Development and piloting of specific fish products for the first 1,000 days of life – pregnant and lactating women and young children 6-24 months of age 	(a) Nutrition, health, and food security

The research design and activities implemented in 2021 has set the stage for accomplishing the envisaged research outputs over the next 2 years leading to important outcomes and impacts. The following section provides the details of work done in 2021.

2. Sustainable Aquaculture

Research under this theme covering the following areas is designed and implemented by researchers from ICAR (CIFA) and Sustainable Aquaculture Program of WorldFish (Annex 2 CIFA PPT).

- Life cycle analysis of carp and pangassius farming systems in India
- Yield gap analysis and on farm performance evaluation of genetically improved varieties (e.g. rohu and freshwater prawn)

(a) During 2021, additional data were collected on carp farming system and pangasius farming system from Chhattisgarh, Andhra Pradesh and Odisha for LCA study. During March 2021 data on IMC and striped catfish farming systems was collected from Chhattisgarh and Andhra Pradesh. During April -September visit could not be undertaken due to the severe second wave of Covid-19 and restrictions in travel. However, during November -December 2021, 64 IMC farms have been visited in three districts of Odisha (Balasore, Khurda and Puri) and data on culture practice and the basic details have been collected through extensive interview.

(b) A one-day online data analysis workshop was organized on 18 November 2021. Dr. Patrik Henrikson was the lead expert in the workshop. There was fruitful interaction between the expert and the CIFA team on LCA study.

(c) Performance Assessment of genetically improved rohu: Data from 50 Jayanti Rohu and 25 non-Jayanthi Rohu production systems were collected to study the performance assessment of Jayanti rohu, additional data collected from Assam (90 farms) and West Bengal (40 farms).

(d) Performance Assessment of genetically improved freshwater prawn: Base line data of 50 scampi farmers from West Bengal; 30 farmers from AP were collected. Performance of GI-Scampi from 15 farmers from 5 districts in Odisha were also collected.

(e) ICAR-CIFA organized two awareness workshops on “Improved variety of carps and freshwater prawn for enhancing farmers’ income” during 15 & 16 December 2021 for fish farmers and hatchery owners of Assam under ICAR-WorldFish collaborative project. The awareness workshops were conducted to sensitize the fish farmers, hatchery owners and other stakeholders on the importance of quality fish seed and adoption of improved variety of carps (Jayanti rohu and improved catla) and freshwater prawn (CIFA-GI Scampi) in enhancing the farmer’s income.

(f) On 15 December 2021, 50 farmers participated in the workshop at Kalong Kapili, Bogibari, Kamrup, Guwahati, Assam along with Shri. Jyotish Talukdar, Director of NGO Kalong Kapili.

(g) On 16 December 2021, another 50 farmers along with MLA from Nalbari District Shri. Jayanta Malla Baruah, District Fisheries Officer, Nalbari Shri. Trailokya Saloi and Shri. Debajit Barman, proprietor of Debajit farm attended awareness workshop on “Improved variety of carps and freshwater prawn for enhancing farmers’ income”.

(h) In West Bengal one Awareness workshop on “Genetically Improved Variety of Carps and Freshwater Prawn for Higher Production and Income” was organized in collaboration with Sasya Shyamala KVK, Sonarpur, West Bengal on 18.12.2021. A total of 62 fish farmers and entrepreneurs participated in the awareness program.

(i) One research manuscript titled 'On-farm Performance Assessment of Genetically Improved Scampi (CIFA-GI Scampi™) in Carp-Scampi Polyculture System in Odisha, India' was submitted for publication

2021 CIFA/WF Sustainable Aquaculture Summary Progress

Activity	2021 Work Done
Research team building (9 member research team)	Series of online training/workshop/data analysis sessions completed to enhance cross learning and build strong research team for LCA studies, performance assessments, and genetics data analysis in CIFA. Field level awareness and capacity building workshops and FGDs on the benefits of genetically improved varieties of rohu and scampi in Assam and West Bengal
Life Cycle Analysis of farming systems	Additional datasets collected on carp and pangasius farming systems from Chhattisgarh, Andhra Pradesh and Odisha, state-wise profile of farming systems characterized, preliminary data analysis completed using LCA tools and software. On station LCA study of intensive and semi-intensive systems underway to validate the field data and inferences
Performance of genetically improved Jayanathi Rohu	Data collected from farmers (101) practicing polyculture of carps with Jayanti rohu or unimproved rohu from Odisha, Assam and West Bengal. Improved Jayanathi rohu farmers obtained 31.1% higher production.
Performance of improved freshwater prawn	Data from 14 districts in Odisha (46 farms) collected. CIFA-GI Scampi showed 53% higher growth rate, 91% higher yield, 27% less production cost, 52% higher rate of return on investment. Performance of CIFA-GI Scampi (G12) was also evaluated through on farm demonstration in 5 districts of Odisha documenting an average production of 593kg/ha compared to non-improved scampi (218kg/ha)

3. Resilient Small-Scale Fisheries

Research under this theme covering the following areas is designed and implemented by researchers from ICAR (CIFRI) and Resilient small-scale fisheries Program of WorldFish (Annex 3 CIFRI PPT).

- Productivity enhancement from inland wetlands and flood plains

(a) Baseline data was collected and analyzed on fish consumption patterns of beel dependent communities

(b) Implementation of Social Behavioral Change Communication (SBSC) measures for better beel management

(c) Continuation of pen culture and CBF for sustainable production enhancement

(d) Pen culture demonstration with *Labeo bata* as candidate species

(e) Small Scale fisheries development activities were carried out in five wetlands of West Bengal and in one wetland of Assam through a participatory mode.

(f) Basic data on primary productivity, plankton, benthos, chlorophyll, water and soil quality etc. was collected to work out beel productivity in the Pre-monsoon and Monsoon season.

(g) The IMC raised in pen was released in the beel with the objective to enhance the beel production

(h) Two stakeholder's meetings were conducted with beel fishers about 67 beel fishers, the beel governing body participated in the meetings

(i) Initiatives for nutrition sensitive wetland fisheries development has been taken up by introducing self-recruiting *Punitus sarana* stocking in the selected wetlands. About 356 fishers of various beels were sensitized on SIS conservation measures

2021 CIFRI/WF SSF Summary Progress

Activity	2021 Work Done
Pen culture technology	Dissemination of pen culture technology for enhancing beel productivity through community participation. In-situ rearing of minor carp (bata) and <i>Systemus sarana</i> as climate resilient nutritive fish. In-situ conservation of SIS.
Management protocols for beel governance	Developed management guidance for enhancing food and nutritional security of beel dependent communities (Beledanga beel in WB and Borkona beel in Assam). Productivity increased from 478 kg/ha to 707 kg/ha (WB)
Fish consumption pattern of beel dependent communities	Completed fish consumption studies of beel dependent communities including importance of small indigenous species (34.7g/day/person in Assam and 53g/day/person in WB). SIS contribution is 67%.
Other global engagement	IHH (illuminating hidden harvest from inland fisheries), nutritional profiling of fishes and global database
Publications	<ul style="list-style-type: none"> (a) Characterization of small-scale wetland fisheries and validation of interventions to meet SDGs (Infographic). (b) Model for efficient management and governance of SIS in wetlands (Infographic) (c) Research papers and book chapters (3)

4. Value Chains and Nutrition

Research under this theme covering the following areas is designed and implemented by researchers from ICAR (CIFT) and value chain and nutrition Program of WorldFish (Annex 4 CIFT PPT).

- Fish consumption patterns of rural and urban consumers
- Development of specific fish products for the first 1,000 days of life – pregnant and lactating women and young children 6-24 months of age

(a) Completed survey on fish consumption pattern in Wayanad, Malappuram districts of Kerala, Chamrajnagar and Dakshin Kannada districts of Karnataka and Khurda and Cuttack districts of Odisha.

(b) Inclusion of fish and fish-based products in school feeding programme in 50 Anganwadi Centres of Mayurbhanj District, Odisha to children of age 3-6 years. 3850 kg of dried fish and 742.5kg dried fish powder were supplied on monthly basis to school children of Odisha at 50 anaganwaadis

(c) Nutrient profiling of fish-based products was done

(d) Fish incorporated protein rich functional food mix for 1000 days children was developed. Microbial analysis of products developed was done.

(e) Technology for protein enriched functional food was transferred to M/S Aracia Pvt Ltd., a private entrepreneur.

(f) Technology for the development of iron fortified fish soup powder has been transferred to Kerala Nutraceuticals Pvt Ltd., Cochin, Kerala

(g) Technology transferred for dry fish and dried fish powder was transferred to M/S Ocean harbour Pvt Ltd, a private entrepreneur

2021 CIFT/WF VCN Summary Progress

Activity	2021 Work Done
Fish Consumption Surveys	Fish consumption survey of rural and urban consumers in Meghalaya, Odisha, Karnataka and Kerala completed, data analysed and written up for publication (purchase and consumption behaviour and practice)
Product Intervention studies (Piloting of fish inclusion in SNP through 50 Anganawadi Centers for 6 months from April-Sept 2021)	Ten Solar dryers installed and operationalized at Odisha including training of WSHG members for producing hygienic dried fish Dried fish powder (743Kg) and dried fish (3850Kg) supplied to Anganawadi centers in Odisha as a collaborative program between Worldfish, Govt. of Odisha and ICAR-CIFT in collaboration with Mission Shakti of WCD
Scaling nutrition-sensitive technologies through private sector partnership	Technology for dried fish powder transferred to M/S Ocean Harbour Pvt Ltd Technology for protein enriched functional food transferred to M/S Aracia Pvt Ltd, Technology for development of iron fortified soup powder transferred to Kerala Nutraceuticals Pvt Ltd, Cochin, Kerala.
Product Development for first 1000 days	Consumer preference studies and Development of Fish Incorporated protein rich Functional Food Mix completed

5. Planned Activities that could not be completed in 2021

Several key activities (e.g. international travel, workshops and training programs) planned as part of the 2021 work plan could not be conducted due to the global covid health crisis and travel restrictions.

6. Activities carried out in India with funding support from other agencies and donors

FARD Odisha

Technical collaboration with FARD Department, Government of Odisha: Technical support in the areas of sustainable aquaculture, value chains and nutrition and inland small-scale fisheries. Major focus on fish farming in GP tanks by WSHGs, carp-mola polyculture, circular cage culture of IMC in reservoirs, early and year round breeding of IMCs, captive nurseries, GIFT tilapia farming and hatchery, enabling convergence between FARD, WCD and Panchayat Raj departments. Supporting the government in the implementation of the fisheries policy of the state. **FARD project completed in March 2022.**

USAID Project

Scaling nutrition-sensitive aquaculture and fisheries in Odisha: Nutrition-sensitive aquaculture and fisheries technologies being promoted in 3 districts of Odisha in a convergence mode with several developmental departments; piloting of fish inclusion in ICDS programs through signing of a MOU with WCD and Mission Shakti; WSHGs producing fish products using solar dried fish. Strongly supported by the Directorate of Fisheries (FARD) and WCD departments. **Project completed in March 2021.**

World Bank

Technical support to World Bank supported Assam Agriculture and Rural Transformation Project (APART): Technical support to ARIAS and Directorate of Fisheries in key project interventions aimed at increasing productivity and enhancing the benefits of fisheries and aquaculture to human nutrition. Supporting 10 deliverables. Four CGIAR centers are providing support to this project covering 8 agriculture value chains.

MPEDA/RGCA Project

Establishment of a satellite nucleus of the GIFT strain at Rajiv Gandhi Center for Aquaculture (RGCA), India: Technical support for genetic improvement program of GIFT in India, data analysis of GIFT, provision of mating design and dissemination of germplasm across the country. MOA signed in Feb 2019. Phase II Feb 2019-Mar 2024

GIZ-SIS Project

Taking nutrition-sensitive carp-SIS polyculture technology to scale: The project has 4 components: (1) Assess factors influencing the adoption of carp-SIS polyculture technology under by previous projects. (2) Develop protocols for the mass production and transport of seed of up to five nutrient-rich SIS; (3) Validate business models for reproduction and distribution of SIS species in partnership with private seed supply enterprises; and (4) Technical training and outreach to ensure integration into public and private investments for further scaling. Inception workshop completed. Project will be implemented in Odisha and Assam in close partnership with ICAR (CIFA, CIFRI), state fisheries departments and Universities in Assam and Odisha.

7. Publications

Research Paper:

- Das, B., Roy, A., Som, S., Chandra, G., Kumari, S., Sarkar, U., ... & Pandit, A. (2021). Impact of COVID-19 lockdown on small-scale fishers (SSF) engaged in floodplain wetland fisheries: evidences from three states in India. *Environmental Science and Pollution Research International*, 1-12
- Asha K.K., Suseela Mathew, Prasad M.M. and Ravishankar C.N. Intake of iron-enriched fish powder improved the levels of hemoglobin of adolescent girls in West Jaintia Hills District of Meghalaya, India. *Communicated-Journal of Public Health Nutrition (Impact Factor: 3.52, NAAS Rating: 8.53)*
- Sajeev, M.V., Radhakrishnan, A., Mohanty, A.K., Joshy, C.G., Ali, V.A., Gopika, R., Mathew, S. and Ravishankar, C.N., 2021. Factors Influencing the Fish Consumption Preferences: Understandings from the tribes of Wayanad, Kerala. *Indian Journal of Extension Education*, 57(4), pp.23-27.

Book Chapters in Global scan by TBTI

- Roy, A. and Das, B. K. (2022). Resource degradation and conflicts affecting small-scale wetland fishers of West Bengal, India. In: Kerezi, V. & Chuenpagdee, R. (Eds.) *Blue Justice For Small-Scale Fisheries: A Global Scan*, Volume 3. TBTI Global Publication Series, St. John's, NL, Canada
- DebRoy, P., Das, B. K., Parida, P.K., Roy, A. & Chakraborty, S. (2021). Economic injustice in small-scale wetland Fisheries in West Bengal, India. In: Kerezi, V. & Chuenpagdee, R. (Eds.) *Blue Justice For Small-Scale Fisheries: A Global Scan*, Volume 2. TBTI Global Publication Series, St. John's, NL, Canada

Leaflet

- Small Scale fisheries in Wetlands for Livelihood and Nutritional security

Research Papers communicated

- Das, Basanta; Borah, Simanku; Bhattacharjya, Birendra; Karnatak, Gunjan; Yadav, Anil; Rabha, Nilmani; Priyadarshini, Priyanka; Pandit, Arun; Parida, Pranaya; Roy, Aparna; Sahoo, A; Behera, Bijay; Das, A.K. Evaluating growth, production and economics of small indigenous fish *Labeo bata* in pens for enhancing livelihood of small scale fishers in floodplain wetland. Communicated to *Aquaculture Research*
- Aparna Roy; Basanta Kumar Das; Pranaya Kumar Parida; Gunjan Karnatak; Simanku Borah; Arun Pandit; Bijay Kumar Behera; Uttam Kumar Sarkar; Archan Kanti Das; Amiya Kumar Sahoo; B. K Bhattacharya; Purna Chandra. Sustainable management of small and indigenous fishes in wetlands of Lower Gangetic Plains through improved governance using a new approach. Communicated to *Biodiversity and Conservation*
- Fazil, T.S, Akshay, P, Anandan, R, Suseela Mathew, C.N. Ravishankar. (2021). HPLC-FLD estimation of Tocopherols in fish oils, vegetable oils, and butter: a comparative profiling. Communicated to *Food Chemistry*

8. Funding Details

ICAR W3 Funds Received for collaborative research with ICAR (CIFA, CIFRI, CIFT)

Month and Year	Amount Received
May 2018	USD 127,449
April 2019	USD 155,434
April 2020	USD 135,187
June 2021	USD 171,320

9. Summary Work plan for 2022 Calendar Year

Institution/Program	Activity
ICAR(CIFA) and WorldFish (Sustainable Aquaculture)	A: Continue Life cycle studies for different farming systems covering key farming states B: Continue performance and yield gap analysis work for genetically improved varieties
ICAR(CIFRI) and WorldFish (Resilient small-scale fisheries)	A: Continue work on productivity enhancement strategies from wetlands and flood plains including conservation of SIS B: Continue work on inclusive and equitable governance mechanisms for open inland water bodies (e.g. Beels)
ICAR(CIFT) and WorldFish (value chains and nutrition)	A: Continue work on fish consumption patterns of rural and urban consumers B: Continue development and piloting of specific fish products for the first 1,000 days of life C: Collaborate with WorldFish on piloting fish inclusion in ICDS SNP programs in different states of India

10. Work Plan from April 2022-March 2023

The expected outputs of Y4 work and their alignment to collaboration objectives, including key activities and timelines are summarized in the below table.

Sl. No.	Activity	Deliverables	Apr-June 2022	July-Sep 2022	Oct-Dec 2022	Jan-Mar 2023
A	Sustainable Aquaculture					
A1	LCA Studies of Carp polyculture systems and Pangas culture systems in India					
1.1	Cleaning and compilation of LCA data collected from 2019 and 2021	Cleaned data set				
1.2	Collection of additional primary and secondary data to fill the gaps from Odisha and Chattisgarh on cage farming systems of pangasius and tilapia	Additional data set				
1.3	On-station study on Life Cycle Analysis of semi intensive and intensive production	Validation of field data				

	system of carps to verify and validate the field data					
1.4	Data analysis using LCA tools and software	Data analysis report				
1.5	Drafting of joint research papers with CIFA as lead authors	Draft Research Paper				
1.6	Submission of research paper	Research Paper				
1.7	Mitigation measures and development of Better Management Practice (BMP)	BMP manuals				
A2	Performance assessment of genetically improved Jayanti rohu					
2.1	Cleaning and compilation of performance data collected in 2019 and 2020	2019 and 2020 data set				
2.2	Collection of additional primary and secondary data to fill the gaps	Additional data set				
2.3	Data analysis using performance assessment tools and software	Data analysis report				
2.4	Drafting of joint research papers with CIFA as lead authors	Draft research paper				
2.5	Submission of research paper	Research paper				
A3	Performance assessment of genetically improved freshwater prawn					
3.1	Cleaning and compilation of performance data collected in 2021	2021 data set				
3.2	Collection of additional primary and secondary data to fill the gaps	Additional data set				
3.3	Data analysis using performance assessment tools and software	Data analysis report				
3.4	Drafting of joint research papers with CIFA as lead authors	Draft paper				
3.5	Submission of research paper	Research paper				
A4	Exchange visits, training programs, workshops, conference participation					
4.1	Genetics data analysis training program in Penang	Training report				
4.2	Hands on training on LCA data analysis using latest available software	Capacity development on LCA data analysis				
4.3	LCA and Futures Forecasting workshop in CIFA, Odisha	Workshop report				
4.4	Awareness workshops on advantages of adopting BMP through farmer-Scientist interaction meet, seminars, workshops etc.	Workshop reports				
4.5	Awareness workshops on advantages of culturing genetically improved varieties for increasing production and income.	Workshop reports				
4.3	Participation of CIFA researchers in regional or international science events	Visit/event reports				
B	Resilient Small scale fisheries					
B1	Improving beel productivity					
1.1	Cleaning and compilation of baseline productivity data collected for two beels in 2021 and 2022	2021 and 2022 data sets				
1.2	Identification of key risk factors and interventions needed for improving productivity	List of key risk factors and suggested interventions				
1.3	Replication of Grass Carp Model in selected beel/wetland ecosystem	Intervention implementation plan				
1.3	Implementation of interventions through the beel management body	Intervention implementation plan				
1.4	Monitoring and documentation of performance of beels using a integrated assessment framework	MEL report				
1.5	Draft report preparation for converting to a joint research paper with CIFRI as lead authors	Draft report/Draft Research paper				
B2	Improving beel governance					
2.1	Compilation of baseline socio-economic and governance data collected for two beels in 2021-2022	data set				
2.2	Identification of key risk factors and interventions needed for improving beel governance mechanisms	List of key risk factors and suggested interventions				
2.3	Implementation of SIF governance interventions through the beel management body	Intervention implementation plan				
2.4	Monitoring and documentation of governance mechanisms	MEL report				

2.5	Draft report preparation for converting to a policy brief with CIFRI as lead authors	Draft Policy brief				
B3	Maximizing nutritional outcomes from beels					
3.1	Design a structured study to understand the baseline fish consumption patterns of communities using the beel	Baseline fish consumption pattern of beel communities				
3.2	Implement SBCC programs to communities depending on the beel	SBCC material				
3.3	Introducing 'Nutrismart' species <i>Systemus sarana</i> model in selected wetlands	Implementation plans				
3.4	Design an end line study to collect information on fish consumption behaviour and quantify changes in fish consumption pattern	End line study report				
B4	Exchange visits, training programs, workshops, conference participation					
4.1	Data analysis and paper writing visit to WorldFish (Penang)	Training report				
4.2	2 day workshop on beels with focus on aquatic food systems and nutritional outcomes in CIFRI	Workshop report				
4.3	Participation of CIFRI researchers in regional or international science events	Event/conference report				
C	Value Chains and Nutrition					
C1	Fish consumption surveys					
1.1	Cleaning and compilation consumption survey data collected in 2020 and 2021	2020 and 2021 data set				
1.2	Report preparation on fish consumption survey analysis of different states	Indicators used and data analysis report				
1.3	Drafting of joint research papers with CIFT as lead authors	Draft paper				
1.4	Submission of research paper to a peer reviewed journal	Final research paper				
C2	Fish product development for "first 1000 days"					
2.1	Development of functional food for children of first 1000 days at pilot scale and validation	Scientific product description, validation				
C3	Intervention studies in Meghalaya, Odisha, Karnataka, Kerala					
3.1	Designing of fish inclusion pilot studies in Odisha	Study design				
3.2	Collection of data on selected indicators from control and intervention population	Data sets on fish intervention studies on fish soup powder, fish noodles				
3.3	Data analysis and writing up report/paper	Data analysis and draft report				
C4	Exchange visits, training programs, workshops, conference participation					
4.1	Fish consumption data analysis and use of global indicators - training program in Penang	Training report				
4.2	Participation of CIFT researchers in regional or international science events	Conference/event report				

11. List of Annexures

1. WorldFish and ICAR (CIFA, CIFRI, CIFT) joint presentation of progress for 2021
2. CIFA Sustainable Aquaculture Progress report for 2021
3. CIFRI Resilient small-scale fisheries progress report for 2021
4. CIFT Value Chains and nutrition progress report for 2021

About WorldFish

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving 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. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future.

For more information, please visit www.worldfishcenter.org