Inclusion of dried small fish in the ICDS Supplementary Nutrition Programme

Pilot Study in Odisha, India

Towards a new dawn

ଓଡ଼ିଶା ସରକାର
ସତ୍ୟମେବ ଜୟତେ
ओडिशा शासन

WorldFish

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Lists of Abbreviations

ADI	Average Daily Intake
AG	Adolescent Girls
ANM	Auxiliary Nurse Midwife
APPI	Azim Premji Philanthropic Initiatives
ASHA	Accredited Social Health Activist
AWC	Anganwadi Centre
AWS	Anganwadi Sahayikas
AWW	Anganwadi Worker
CDPO	Child Development Project Officer
CFTRI	Central Food Technological Research Institute
CIFT	Central Institute of Fisheries Technology
CSIR	Council of Scientific and Industrial Research
CTCRI	Central Tuber Crops Research Institute
DHA	Docosahexaenoic acid
DMF	District Mineral Fund
DSWO	District Social Welfare Officer
EPA	Eicosapentaenoic acid
FARD	Fisheries and Animal Resource Development Department
FSSAI	Food Safety and Standards Authority of India
GP	Gram Panchayat
H&FW	Health and Family Welfare department
HCM	Hot Cooked Meal
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Services
ICMR	Indian Council of Medical Research
IPP	India Partnership Programme
KGBV	Kasturba Gandhi Balika Vidyalaya
KISS	Kalinga Institute of Social Science
MDM	Mid-Day Meal

MoU	Memorandum of Understanding
MS	Mission Shakti
MSME	Ministry of Micro, Small and Medium Enterprises
MSSRF	M.S Swaminathan Research Foundation
NFHS	National Family Health Survey
NIN	National Institute of Nutrition
NRC	Nutrition rehabilitation Center
ODOP	One District One Program
ONAP	Odisha Nutrition Action Plan
OUAT	Odisha University of Agriculture & Technology
PLW	Pregnant and Lactating Women
PR &DW	Panchayati Raj & Drinking Water Department
RDA	Regular Dietary Allowance
S&ME	School & Mass Education
SAM	Severe, Acute Malnutrition
SBCC	Social and Behaviour Change Communication
SNP	Supplementary Nutrition Programme
SOP	Standard Operating Procedure
SOPAN	Strategy for Odisha's Pathway to Accelerated Nutrition
SSEPD	Social Security and Empowerment of Persons with Disabilities
TAG	Technical Expert Advisory Group
THR	Take Home Ration
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
WCD	Women and Child Development Department
WSHG	Women Self-Help Group

Executive summary

To tackle the opioid crisis of undernutrition of the state, the Government of Odisha has launched several nutrition-specific and nutrition-sensitive schemes and interventions in recent years. One such major service is the Supplementary Nutrition Programme (SNP) under the Integrated Child Development Services (ICDS) which aims to improve the health and nutrition of children aged 6 months to 6 years, as well as pregnant and lactating women and adolescent girls. The government is promoting nutrition by providing Hot Cooked Meals (HCM) and Take-Home Rations (THR), which are supplied through different Anganwadi Centers of the state.

Aquatic foods, especially fish, have long been regarded as a rich source of animal protein and micronutrients, and, therefore, considered a key constituent of nutritious diets. With a common goal of enhancing the nutritional outcomes from aquatic foods and to assist in accelerating progress on reducing malnutrition in hard-to-reach tribal communities, USAID and WorldFish along with other partner organizations such as Fisheries and Animal Resources Development (FARD) and Indian Council of Agricultural Research and Central Institute of Fisheries Technology (ICAR-CIFT) collaborated with the Women and Child Development Department and Mission Shakti (WCD & MS) of the government of Odisha to pilot the inclusion of small fish and fish-based products in the SNP. Subsequently, a Memorandum of Understanding (MoU) was signed by WorldFish and WCD & MS on 10th November 2020. Specifically, this piloting involves the inclusion of small fish powder in HCM for 3-6-year-old children and dried small fish in THR for Pregnant and Lactating Women (PLW) and 14-18-year-old Adolescent Girls (AG). Based on an approved Standard Operating Procedure (SOP), the pilot has been implemented in 50 Anganwadi Centers of Kaptipada block, Mayurbhanj district and the duration of the project was 6 months starting from April 2021 to September 2021. Based on feedback and acceptance received from the community of the inclusion of dried fish-based products in SNP, as well as enhanced understanding on nutritional outcomes from aquatic foods congregated from the pilot, this nutrition-sensitive approach can be adopted and scaled to ameliorate the undernutrition scenarios across Odisha.

1. Introduction

Achieving sustainable, equitable and large-scale improvements in food and nutrition security is amongst the greatest global challenges. Odisha is a state in eastern India with a population of 42 million people, making it the country's eleventh most populated state and home to India's biggest tribal community. Malnutrition continues to be the prevalent problem in Odisha, though there have been significant improvements in food production and advancements in science during the last five decades. Recently published National Family Health Survey-5 (NFHS-5) (2019-2021) data shows that 31% of children under the age of five in Odisha are stunted and 18.1% are wasted and 29.7% of children are underweight. Unexpectedly 64.2% of children under the age of five are anaemic compared to 44.6% in 2015-2016 (NFHS-4) with significant urban-rural differences. The dual burden of malnutrition coupled with poverty is more prevalent in tribal areas and the inadequate nutritional status of women and adolescent girls remains a major contributor to child stunting and undernutrition.

To combat the scourges of malnutrition, the Government of Odisha has launched several nutrition-specific and nutrition-sensitive schemes and interventions in past years. In 2016, the Odisha government launched the Odisha Nutrition Action Plan (ONAP), which outlines a multi-sectoral approach to reduce malnutrition with a particular focus on women and children from hard-to-reach tribal districts. This commitment was strongly reiterated in the recent Strategy for Odisha's Pathway to Accelerated Nutrition (SOPAN 2020). One such major service is the Supplementary Nutrition Programme (SNP) under the Integrated Child Development Services (ICDS) which aims to improve the health and nutrition of children aged 6 months to 6 years, as well as pregnant and lactating women and intend to bridge the gap between the Recommended Daily Allowance (RDA) and Average Daily Intake (ADI). The government of Odisha is promoting nutrition by providing Hot Cooked Meals (HCM) and Take-Home Rations (THR), which are supplied through different Anganwadi Centers of the state.

School feeding programs offer an opportunity to improve nutrition during this crucial developmental period, with evidence of animal-source foods improving growth, cognition, and behavioral outcomes for school children. Aquatic foods, especially fish, have long been valued as a rich source of animal protein and, therefore, considered a key constituent of nutritious diets. Fish, especially small fish are rich in micronutrients like vitamin A, vitamin B12, calcium, iron, zinc, fatty acids and animal protein. When consumed as part of a meal, fish can increase the absorption of iron and zinc from other foods. Essential fatty acids, including DHA (docosahexaenoic acid) and EPA

(eicosapentaenoic acid), which are only found in fish, are critical for pregnant and lactating women as well as young children, as they are vital for cognitive development in the first 1000 days of life.

With a common goal of enhancing the nutritional outcomes from aquatic foods and to assist in accelerating progress on reducing malnutrition in hard-to-reach tribal communities, USAID and WorldFish along with other partner organizations such as Fisheries and Animal Resources Development (FARD) and Indian Council of Agricultural Research-Central Institute of Fisheries Technology (ICAR-CIFT) collaborated with the Women and Child Development Department and Mission Shakti (WCD & MS) of the government of Odisha to pilot the inclusion of small fish and fish-based products in the SNP. The USAID-IPP project ended during March 2021 and the closure workshop was held on 28th May 2021, pilot program pursued leveraging resources (technical, human, and financial) from FARD and ICAR W3. Subsequently, a Memorandum of Understanding (MoU) was signed by WorldFish and WCD & MS on 10th November 2020. Specifically, this piloting involves the inclusion of small fish powder in HCM for 3-6-year-old children and dried small fish in THR for Pregnant and Lactating Women (PLW) and 14-18-year-old Adolescent Girls (AG). Based on an approved Standard Operating Procedure (SOP), the pilot has been implemented in 50 Anganwadi Centers of Kaptipada block, Mayurbhanj district and the duration of the project was 6 months starting from April 2021 to September 2021.

1.1. Scope of the pilot project

The broader scopes of the pilot project are pointed out below:

- To improve the dietary diversity and micronutrient intakes of women and children involved in the SNP.
- Test the acceptability of dried fish products (e.g., taste) with children aged 3-6 years, pregnant women, lactating mothers, adolescent girls.
- To understand the acceptability and adroitness of fish products by Anganwadi Centre workers (AWW) and Anganwadi Sahayikas (helpers).
- To understand the perception of caregivers and beneficiaries of the program on the consumption, usage, and storage of fish products.
- To create awareness among the beneficiaries, community members and the ICDS staff on the benefits of small fish consumption for the first 1000 days of life using social behavioral change communication.
- To understand the feasibility of inclusion of fish-based products in the ICDS-Supplementary nutrition program.

- To understand various socio-cultural practices like cooking and feeding patterns in the households in the study area during the implementation period.
- To understand the cooking practices concerning fish-based food products distributed under the pilot program.
- To identify the pros and cons involved in logistics (transportation, distribution, and storage) of the fish-based products.

Figure 1. MoU signing ceremony with WCD Department, Government of Odisha and WorldFish for inclusion of fish-based product in SNP.

2. Steps and road map of the pilot project

The pilot Initiative to include small fish in the SNP of ICDS involves a series of steps in the form of discussions, multi-stakeholder consultations, meetings, and exposure visits. The salient step and roadmap of the pilot program since inception to implementation are summarized below:

1. Before introducing fish-based products in the SNP program, the project conducted a trial incorporating, fresh small fish, dried small fish, and fish powder in the meal of Kalinga Institute of Social Sciences, Bhubaneswar – KISS mega kitchen during 2018. The panel test and composition of dried fish and fresh small fish indicated the suitability of the product for large-scale studies and further mid-day meal programs.

2. The initial linkage with the institutional feeding program was started with the WCD & MS Department and Social Security and Empowerment of Persons with Disabilities (SSEPD) of Govt. of Odisha during 2019. The project introduced fresh small fish in 13 special schools and 11 childcare institutions covering 2336 children in Odisha.

3. After a successful trial in KISS and the institutional feeding program, the experiences including different kinds of literature of scientific research on the benefit of fish nutrition for human beings were shared by WorldFish to Principal Secretary and other senior officers of WCD & MS.

4. As a result, WCD & MS Department recommended Panchayati Raj and Drinking Water Department (PR & DW), Odisha to invite WorldFish for attending "International Consultation Promoting Nutrition -sensitive Approaches and Linking agriculture, health & nutrition towards malnutrition free Odisha" on 18th October 2019. In this context, a presentation on "Sharing the experience of linking fishery with nutrition and Scaling Nutrition-sensitive Fish Agri-Food Systems in Odisha" was made.

5. A high-level strategic policy workshop on "Maximizing Nutritional Outcomes in Odisha through Fish" was conducted on 5th November 2019 at WorldFish headquarters in Penang, Malaysia followed by a field visit to Cambodia to observe carp-mola polyculture and nutrition activities for senior officials from

the Government of Odisha including Development Commissioner-cum-Additional Chief Secretary, Agriculture Production Commissioner-cum-Additional Chief Secretary, Principal Secretary, WCD & MS Department, Commissioner-cum-Secretary, FARD Department.

6. As part of the cross-country learning exposure visits, 11 nos. of Odisha government officials from three convergence departments (FARD, WCD & MS and Odisha Livelihood Mission) participated in a weeklong Bangladesh exposure visit from 30th January to 04th February 2020.

7. WorldFish under the Odisha State Nutrition Secretariat became one of the key members of the Technical Expert Advisory Group on Nutrition (TAG), WCD & MS Department.

8. WorldFish became one of the partnering organizations to support the Government of Odisha for new initiatives like “SOPAN” (Strategy for Odisha’s Pathway to Accelerated Nutrition), targeting 125 nutritionally challenged hard to reach blocks, “ODISHA 2020-2025” under WCD & MS Department in promoting nutrition-sensitive approaches and linking agriculture, health and nutrition.

9. Subsequently, WorldFish participated in the State level Technical Expert Advisory Group on Nutrition (TAG) on 25th February 2020 under the chairmanship of Director ICDS. In this meeting including other decisions, TAG on Nutrition committee decided for Piloting of Hot Cooked Meals (HCM) with fish to be taken in Mayurbhanj district by WorldFish and approved for awareness generation of ICDS functionaries across all districts on benefits of fish-based nutrition.

10. Another meeting of the Technical Advisory Group on Nutrition was organized by WCD & MS Department on 28th August 2020. Besides WorldFish, officials from UNICEF, WFP, ICMR-NIN, APPI, MDM, Department of S & ME, Department of H & FW, CSIR-CFTRI, CTCRI, OUAT were present. It was approved by the nutrition committee of the TAG to include children of 3-6 years, pregnant women, lactating mothers, and adolescent girls in the pilot program.

11. Department of WCD & MS, Odisha approved a proposal from WorldFish for implementation of the project - “Piloting inclusion of nutritious small fish in diets of pregnant women and lactating mother under the 1000 days approach and among pre-school children of 3-6-year age group and adolescent girls among tribal communities through a partnership approach in Odisha”.

12. Subsequently, A MoU was signed by WorldFish and WCD & MS on 10th November 2020. Additional Chief Secretary cum Development Commissioner, Principal Secretary WCD&MS, Commissioner cum Director Mission Shakti, Commissioner cum Secretary F&ARD. Director of Fisheries, Director of ICDS & Social Welfare, Joint Secretary ICDS & POSHAN, project team, USAID and other international agencies were present at the signing ceremony.

13. On 25th February 2021, the MoU for the inclusion of small fish in the SNP program was signed by **Honorable Chief Minister Sri Naveen Patnaik** as a part of 5T initiative of the government of Odisha.

Figure 2. THR distribution by CDPO at Kaptipada block, Mayurbhanj district.

3. Development of SOP for the pilot program

WorldFish experts in consultation and support from the state and district ICDS staffs, prepared Standard Operating Procedure (SOP) for inclusion of small fish in SNP program. This document was prepared in line with existing implementation guidelines for Odisha's Supplementary Nutrition Program and international criteria for sustainably improving the nutritional content of state-delivered meals. The SOP document was submitted to WCD & MS during the month of June 2020 and approved by the TAG committee of WCD. The document was also translated into local Odia language for the use of ICDS and health functionaries.

The objective of the SOP is to give concise instructions for effective implementation of the pilot program. It includes:

- Overview of inclusion of small fish in SNP via hot cooked meal and take-home rations
- Orientation procedures for ICDS staffs, village level health staffs, community members and nutrition messaging.
- How to transport fish powder to AWC and THR to beneficiaries
- How to store fish-based products safely and hygienically
- How to incorporate fish powder in hot cooked meal, their cooking and serving process
- Survey form for third party evaluators for conducting organoleptic test, nutrition analysis, taste trials and plate waste for both HCM and THR
- How to assess AWC staffs experience incorporating the fish-based products into the THR.
- How to assess the experience of PLW/AG in using the dried fish from THR.

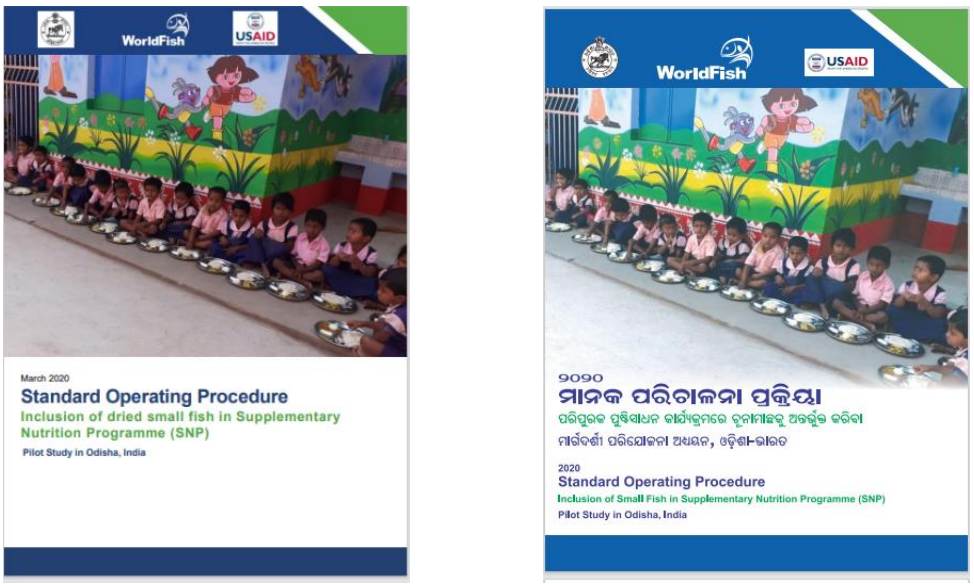

Figure 3. Standard Operating Procedure (SOP) for inclusion of small fish in SNP program.

4. Study site and target beneficiary

4.1. Selection of study sites

After a series of meetings and discussions with the Commissioner cum Secretary and other state-level senior officials from WCD & MS Department, Government of Odisha, it was decided to conduct a pilot program in one of the tribal districts of Odisha. Mayurbhanj is one of Odisha's tribal districts, with 58.58% of the tribal population in the district, compared to 22.85% across the state with a high degree of undernutrition. According to the NFHS-5 (2019-2021), 36.7% of children under the age of five in the Mayurbhanj district are stunted and 28.5% are wasted and 45.9% of children are underweight. Unexpectedly 71.7% of children under the age of five are anaemic. Therefore, the Kaptipada block of the Mayurbhanj district was chosen for commissioning the pilot. Kaptipada block is one of the highly tribal-dominated blocks with 66.60% of the population belonging to Scheduled Tribe. Nevertheless, Mayurbhanj district was one of the project locations of WorldFish commissioned USAID-IPP project, where nutrition-sensitive carp-mola polyculture system was demonstrated during 2017-2021.

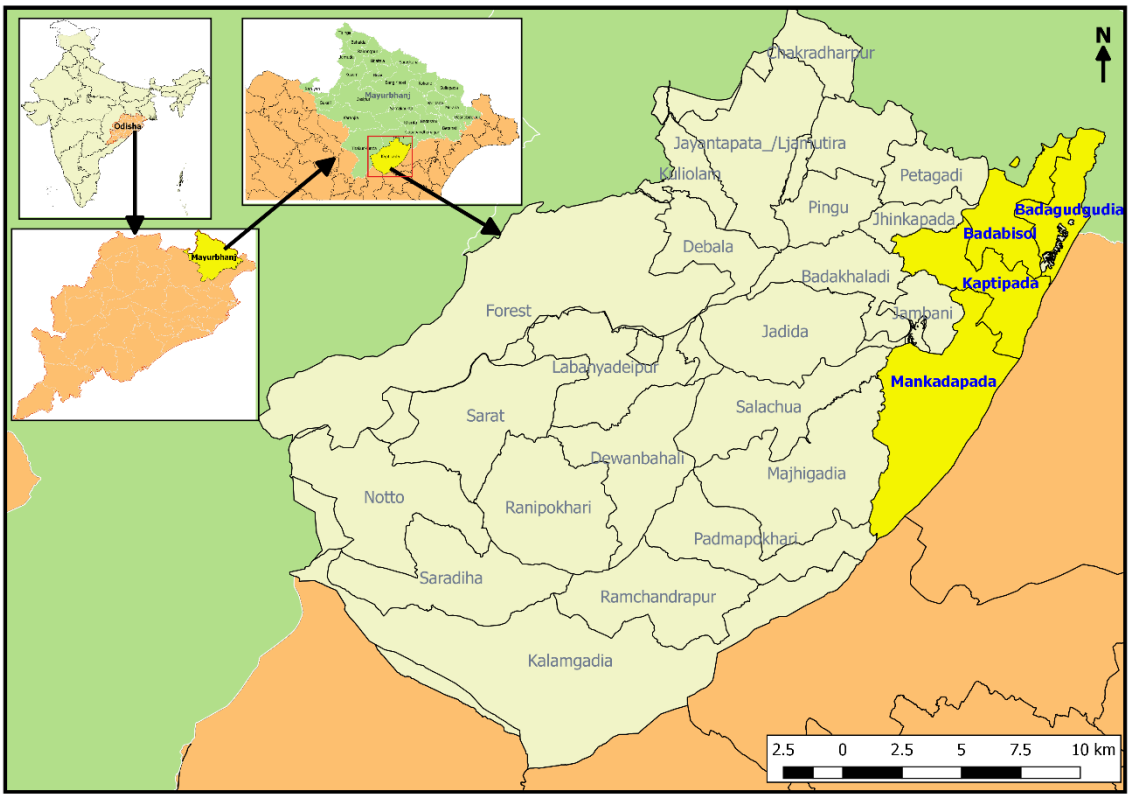

Figure 4. Map of the pilot study site, Mayurbhanj district of Odisha.

4.2. Selection of Anganwadi Centre

The pilot project selected 50 AWCs from 2 sectors namely Bisol (39 AWCs) and Kaptipada (11 AWCs) of Kaptipada block, Mayurbhanj. The 50 AWCs are distributed throughout the four-gram panchayats: Badabisol, Badagudgudia, Mankadapada and Kaptipada. The selection of AWC involved a series of steps as follows:

- A district-level meeting was held with District Collector, District Social Welfare Officer, Programme Officer, all Child Development Project Officers, and all district-level staff on 29th January 2021 at Mayurbhanj. The meeting was chaired by Ms. Anu Garg IAS, Principal Secretary WCD & MS. Joint Secretary ICDS, State Financial Advisor WCD & MS. The Project Manager gave a brief presentation on the details and plan of the pilot program.
- Two project-level meetings with CDPO and Supervisors of the ICDS Kaptipada project were held during January 2021, to discuss the finalization of 50 AWCs to be included in the piloting program. The detailed data on the ICDS beneficiaries, i.e., Children 3-6 years, Adolescent girls, Pregnant women, and Lactating mothers were collected.
- Following consultation with ICDS officials, it was agreed to distribute the fish-based items for the pilot program through a local Women Self Help Groups that produce and distribute ICDS THR to AWCs. For this purpose, a visit was made to Baba Aleswar WSHG THR producer group of Bisol Sector, Khaprapal village, Kaptipada, Mayurbhanj District, with the help of the concerned Sector Supervisor, and the responsibility was provided.

Table 1: Target beneficiaries under the pilot program.

Target Beneficiaries	Total Sample
Children 3-6 years	1208
Pregnant women	186
lactating mother	284
Adolescent Girls (out of school age 14-18 years)	329
Total	**2007**

4.3. Entitlements under the pilot program

The pilot program involved the inclusion of fish powder in Hot Cooked Meals for 3–6-year-old children and dried small fish in Take Home Rations for pregnant and lactating women (PLW) and 11–18-year-old Adolescent Girls (AG). The quantity of fish powder and dried fish was calculated based on the Dietary guidelines for Indians 2011 of Government of India. For initial one month the dried fish powder was added to children's daily curry as part of the HCM. But later due to increase in Covid-19 cases, fish powder was also included in the distribution list of THR.

Table 2. Entitlements under the pilot program.

	Hot Cooked Meal	Take Home Ration
Beneficiary	3-6-year-old children	10-18-year-old AG 19-49-year-old PLW
Product	Fish powder	Dried small fish
Quantity entitled	**15 g / child / day**	25g / 10-15-year-old AG / day 40g / 16-18-year-old AG / day 40g / 19-49-year-old PLW / day

Figure 5. THR distribution by AWC workers to lactating mother.

5. Development of dried fish-based product

Fish drying is an age-old practice in Odisha and is primarily concentrated in coastal districts. It is, however, often blamed for poor handling, drying and hygienic condition. Furthermore, there is a severe scarcity of certified dried fish products in Odisha where the quality of the product can be assured. Against this backdrop and considering food safety issues in the feeding program, WorldFish signed an MoU with ICAR-CIFT, Cochin for the production and supply of hygienic and certified dried small fish and fish powder.

5.1. Fish-based product development

Anchovies are an excellent raw material for dried fish or fish-based products. These are small marine fish that grow up to 20 cm in length and prefer warmer waters around the world. Anchovies are members of the Engraulidae family, which includes 144 species divided into 17 genera and found in the Atlantic, Indian, and Pacific Oceans. Anchovies are typically classed as oily fish, but they are a fantastic source of omega-3 fatty acids, which are beneficial to the brain and heart, especially for children. The raw material used for the development of dried fish and fish powder is Indian Anchovy fish (*Stolephorous* spp.).

At ICAR-CIFT Cochin, the dried fish and fish powder production process was standardized, and the technology was given to a private company called Ocean Harbour Private Limited. The raw material (anchovy) obtained for product development was completely cleaned to remove any extraneous elements and was then prepared for sorting and drying. The sorted and dried sample was then pulverized to obtain the fine powder, which was then vacuum packed for long-term preservation.

The products were scientifically processed using the energy-efficient and eco-friendly solar dryers developed by ICAR-CIFT. The quality of the solar-dried fish was excellent in terms of hygiene, nutrient retention, aroma, and taste, as it eliminated all the disadvantages of conventional open sun drying, and was free from the attack of dust, rain, insects, and microorganisms. Lower and uniform levels of moisture were achieved for products when compared to the conventionally dried products. The product was certified by the Food Safety and Standards Authority of India (FSSAI). The nutrition composition of dried fish and dried fish powder is given in Table 3.

Table 3. Nutrition composition of dried fish and dried fish powder.

Nutrient (per 100 g)	Dried Fish	Fish Powder
Energy (calorie)	680	690
Protein (g)	70.23	69.50
Fat (g)	9.02	8.20
Calcium (g)	3.99	3.91
Vitamin A (Retinol) (µg)	14.12	13.95
Vitamin B2 (ng)	0.10	9.36
Sodium (g)	1.80	1.70

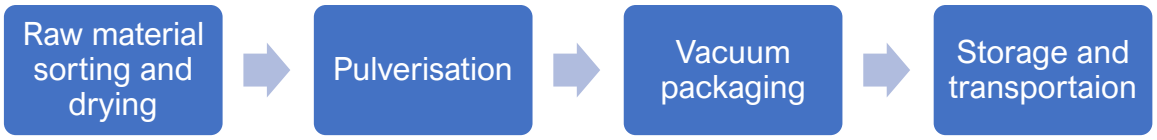

Figure 6. Process of development of dried fish powder

For the preliminary assessment, 3 kg dried fish and 2 kg dried fish powder was bought from ICAR-CIFT in March 2021. The quality of the products was checked by the officials from FARD, WCD & MS and field functionaries from ICDS and AWCs. A recipe demonstration using the products was done during the training program to the ICDS functionaries.

5.2. Cost and economic viability of products

The raw material was obtained for Rs. 100-150 per kilogram, which is less expensive than other high-nutrient fish, and the final processed items are sold for Rs.50.40/150 g for dry anchovy powder and Rs. 133.00/480 g for dried fish.

The dried and powdered anchovies were supplied to 50 Anganwadi Centers of Mayurbhanj District, Odisha during March, April, May, June, July, and August in 2021. In total, 2301kg of dried small fish and 1450kg of dried fish powder was used in the pilot program. A total of 4,794 packets of dried anchovy fish and 8,000 packets of dried anchovy fish powder were supplied to the beneficiaries of the program.

Table 4. Quantity of products supplied to the beneficiary.

Beneficiary	Product type	Total numbers of beneficiary	Total quantity /month	Total quantity /6 month	Number of packets supplied
Children 3-6 years	Dried fish powder	1208	220.00 kg	1449.6 kg	8000
Pregnant women/lactating mother	Dried fish	470	225.60 kg	1353.6 kg	2820
Adolescent Girls (out of school-age 14-18 years)	Dried fish	329	157.92 kg	947.52 kg	1974
Note: Average weight of the dried fish packet is 480 g. The average weight of the dried fish powder packet is 150 g.					

5.3. Logistics and storage of the fish-based product

WorldFish Odisha coordinated all the transportation and distribution activities of fish-based products from ICAR-CIFT to THR distributing WSHG to AWCs and finally to the intended beneficiaries.

In discussion with officials from ICDS Mayurbhanj, Baba Aleswar WSHG THR producer group Kaptipada, Mayurbhanj, was selected for storage, distribution of fish-based products along with other THR products. The group was selected based on their interest, past experience working with AWCs for THR distribution, availability of product storage facility, distance from the pilot area. The project provided a 50L capacity storage container to the group for storing the fish powder packets. The project paid certain amount to the selected group every month for storing of the fish-based products and distribution of the products to the AWCs.

The complete logistics and storage details are discussed below:

- The hygienically produced, certified fish products were packed at Cochin, Kerala and transported via train to Cuttack, Odisha during the last week of every month.
- Products from Cuttack were transported to the pilot district via local vehicle and stored by Baba Aleswar THR producer group, Khaprapal, Kaptipada block of Mayurbhanj.
- Before ending of the month, the products were distributed by Baba Aleswar WSHG to all the 50 AWCs using the local transportation vehicle. Receiving

and Distribution receipts were maintained by the THR distributing WSHG as per the guideline of ICDS.

- AWCs were provided with 50 L capacity plastic containers along with polyethylene to store the products. They were also given with serving spoon to measure the powder while cooking HCM.
- As per the ICDS THR guideline, the products were distributed to the beneficiaries every 1st day of the month. The fish-based products were distributed along with other ICDS products (Chattua, eggs, laddu etc.) to the selected beneficiaries.
- WorldFish also ensured quality inspection of the fish products by Jaanch committee upon delivery.
- Initial one month i.e., during April 2021, only the dried fish were distributed as THR for consumption of pregnant and lactating women (PLW), LM and AG. The dried fish powder was mixed with the regular menu of the ICDS and given as HCM to the children. Due to the global covid-19 pandemic, as per the revised guideline of WCD month of May 2021 onwards, the dried fish powder was also included in the THR.
- The surplus products received on the particular month were stored with Baba Aleswar WSHG and were used in next two months.

Figure 7. Distribution of dried fish product to the adolocent girls during home visit.

Figure 8. Dried fish and fish powder developed by CIFT for inclusion in SNP.

Figure 9. Storage of dried fish product in plastic containers.

Figure 10. Transportation and logistics of dried fish product at Odisha.

Figure 11. Adoloscenet girls and pregnant women are receiving the dried fish-based product.

6. Capacity building

6.1. Training of officials involved in the pilot program

Training on SOP for inclusion of dried small fish in SNP were conducted from 24-28th February 2021 in 5 batches at Mission Shakti Conference Hall, Kaptipada. The training program was inaugurated by District ICDS Programme Officer Mayurbhanj in presence of the Block Development Officer, Kaptipada and Child Development Officer, Kaptipada. In total 202 trainees participated which included Anganwadi workers, Anganwadi Sahayika (helper), Jaanch committee, Mothers committee members, lead WSHG, Female Health Workers, ASHA of the pilot area and Supervisors, Child development project officer (CDPO) and Block Fisheries Officer. Further these ICDS staffs rendered awareness and training on fish inclusion at the community level.

Following topics were discussed during the program:

- Status of malnutrition in the district and knowledge sharing on the health benefits of fish as part of a diversified diet.
- Methods of incorporating fish-based products in the existing SNP program as per the standard operating procedure prepared by WorldFish.
- Different SBCC material available pertaining to fish-based nutrition were shared with the participants.
- Shared knowledge on dried fish and fish powder and their nutritional benefits.
- Storage protocols for the fish-based products to maintain its quality.
- How to include fish power in the Hot Cooked Meal (HCM) for 3-6-year-old children.
- How to include fish in the Take Home Ration (THR) for Pregnant and Lactating Women (PLW) and 14-18-year-old Adolescent Girls (AG).

Following Social and Behavior Change Communication (SBCC) materials were shared with the training participants:

- Tiki Mausi Mascot video on Fish Based nutrition in first 1000-day of human life
- Video on benefits of small fish consumption
- Video on Fish and Nutrition
- 2 Audio jingles on Benefits of small fish consumption
- SOP for inclusion of dried small fish in SNP- Odia version
- Brochure on “Small fish Big Benefits”
- Calendar on Fish based nutrition product
- Video on small fish Recipe demonstration

Nutritional messaging through Tiki Mausi Mascot Video

The mascot- 'Tikki Mausi' aims to change the behavior of common people and make them aware about child and woman's nutrition and development in every household was launched by Department of Women & Child Development and Mission Shakti, Government of Odisha, in collaboration with United Nations International Children's Emergency Fund (UNICEF). The project used this mascot to spread awareness on importance of fish and fish-based nutrition of children and women to larger population.

It is known that pilot programs accompanied by community level promotion campaigns such as videos are more successful because the videos create a talking point for the community and improve uptake of the initiative. The video was used in training and awareness programs and can be accessed using the link. https://www.youtube.com/watch?v=UwdR8BmU1C4

6.2. Community-level awareness

From March to April 2021, regular community-level awareness was conducted by the project's local volunteers, field staff the project with the support of AWC supervisors, Anganwadi center workers. The community members especially the mothers/caregiver of children, pregnant women, lactating mothers, and adolescent girls were given awareness on the following topics:

- Benefits of small fish and their regular consumption on the first 1000 days of life.
- Recipe demonstration using dried small fish and dried small fish powder.
- Guidance on different options and possibilities of using the fish powder and dried fish.
- Details of the product, their shelf-life and how to store them for retaining its quality.
- The recommended quantity of the products and frequency of consumption.

During the awareness program all the audiovisuals were shown to the community members. Also, the SBCC materials were shared via WhatsApp to the beneficiaries having access to smartphones.

6.3. Handholding support to AWCs staff

All the AWCs were given handholding support during the feeding day. AWC Sahayikas (helper) were guided on the method of inclusion dried fish powder for HCM. Regular feedback from the AWCs were recorded.

Figure 12. Different views on training and capacity development program under the pilot project.

6.4. Development of fish-based product recipe book

The project documented all the small, dried fish powder and dried fish recipes prepared at community level by mothers/caregivers of the children and family members of the pregnant, lactating women and adolescent girls. The recipe book was

shared with the state officials from WCD and CDPO Mayurbhanj for the feedback. Upon receiving the feedback, the recipe book was finalized.

Table 5. Local vegetable recipes using dried small fish powder at Odisha.

Sl. No.	Common names	Vernacular names
1	Fish powder in Malabar Spinach mustard curry	Maccha gunda poi rai tarkari
2	Sun dried raw mango curry with fish powder	Maccha gunda ambula rai tarkari
3	Fish Dalma maccha gunda dalma	Maccha gunda dalma
4	Egg curry with fish powder	Anda machha gunda tarkari
5	Vegetable mix curry with dried fish powder	Maccha gunda misrita ghanta tarkari
6	Fish powder in pumpkin leaf-tomato curry	Boitalu Saag- maccha gunda-bilati tarkari
7	Yellow split pea lentil-fish powder curry	Gunda Maccha Dali
8	Fish powder-cabbage curry	Bandha Kobi-maccha gunda tarkari
9	Fish powder-potato roast	Alu-gunda maccha patrapoda
10	Fish powder cooked with elephant apple	Oou maccha gunda tarkari
11	Potato-fish powder-tomato thick gravy	Alu-maccha gunda-tamatar kasa
12	Malabar spinach leaves with fish powder fritters	Poi patra- maccha gunda bara

Table 6. Local vegetable recipes using dried small fish at Odisha.

Sl. No.	Common names	Vernacular names
1	Colocasia leaf tangy curry with small, dried fish and hog plum	Saaru saga-ambada-sukhila maccha tarkari
2	Gongura leaf with dried small fish curry	khata palanga chuna maccha tarkari
3	Dried Small fish fry	Sukhila maccha bhaja
4	Dried small fish tangy curry	Sukhila maccha tentuli khatta
5	Dried small fish cuury with mustard paste	Sukhila chunna maccha besara

Figure 13: Print media coverage on the pilot program.

Figure 14. SBCC materials published under the project.

7. Monitoring and evaluation of the pilot feeding program

The feeding program on a pilot basis was started from the 1st of April 2021 on the eve of Utkal Diwas and the dried fish powder was served in their HCM to the children from the age group 3-6 years in all 50 AWCs. The THR containing dried fish was distributed to the selected beneficiaries of pregnant, lactating, and adolescent girls by the AWCs in presence of CDPO, Supervisor, Jaanch Committee and project staff including volunteers. For one month all the selected 50 AWCs served fish powder mixed with regular HCM menu to the children. Later, due to the global pandemic of Covid -19, the government ordered to close all the AWC and instructed to supply the products to the doorstep along with other THR.

The project supervised all the activities of the pilot program to understand the acceptability among children, pregnant, lactating mother and adolescent girls and their method of cooking etc.

7.1. Monitoring by project staff

The project engaged one Project Manager, two Technical Analysts, one Nutrition Field Assistant and three GP-level volunteers to monitor and execute the pilot program.

Responsibility of GP level volunteer:

The volunteers along with sector-level supervisor regularly visited the AWCs and beneficiary household for providing handholding support to the following activities:

- Coordination with the THR distributing WSHG and the AWCs for distribution of fish-based products to the beneficiary households on a timely basis.
- Proper storage and handling of the fish-based products at the distribution level, AWCs and beneficiary households.
- Ensuring the products are consumed within the shelf-life period.
- Guiding the AWWs, mothers and caregivers in including recommended quantity of fish-based products in the regular curry during the process of cooking and frequency of inclusion of products in a month.
- Maintain records on the beneficiary-specific data on the number of products distributed, cooking method, local fish recipes, frequency of the feeding etc.

Responsibilities of technical analyst and nutrition field assistant:

- Provide handholding support to all the 50 AWCs, mothers and caregivers on regular basis through visits as well as through telephonic calls.
- Attending sector level and GP level meetings on regular basis to discuss issues related to the feeding program, exchanging good practices, sharing key messages related to fish consumption with the Anganwadi workers.
- Ensuring the on-time delivery of the product from the THR distributing WSHG to the AWCs and then to the beneficiaries.
- Awareness and training to the community on the benefits of inclusion of fish in the diet, storage of fish products through the dissemination of SBCC materials.
- Record various fish-based culinary from AWCs and community level.
- Sharing key messages on benefits of fish consumption on human nutrition through WhatsApp messages, audio-visuals etc.

Responsibilities of Project Manager:

- Coordination with the state, district, and project WCD officials for smooth implementation of the pilot program as per the SOP.
- Coordination with the ICAR-CIFT in Cochin on the purchase of fish-based products and ensuring that they reach their intended recipients securely.
- Time to time meetings with senior officials from WCD and updating the project progress.
- Supervising field activities on regular basis.
- Training of ICDS staff including CDPO, supervisor, AWW, Sahayikas, Jaanch committee members, mothers committee members, ANM and ASHA workers on the standard operating procedure for inclusion of fish-based products in the supplementary nutrition program.
- Analysis and documentation.

7.2. Monitoring by ICDS team

During July 2021, as per the direction from District Collector, Mayurbhanj, the District Social Welfare Officer, Mayurbhanj, Sub-Collector, Udala subdivision, together with CDPO conducted a monitoring field visit to the beneficiary households. The monitoring team interacted with beneficiaries at the community level, ICDS staff at AWCs and Jaanch committee members. The report of the monitoring team was reviewed by the District Collector and submitted to the Commissioner-cum-Secretary of the WCD & MS Department for appraisal.

Figure 15. District ICDS monitoring team visited the project site.

7.3. Third-party monitoring and evaluation

As per the suggestion from WCD, the Government of Odisha, it was decided to conduct the pilot evaluation by a third-party national level agency. WorldFish engaged M.S Swaminathan Research Foundation as a third-party evaluator of the pilot program. The team has conducted baseline, midline and end-line survey of the program and has submitted their evaluation report. The summary of the evaluation report is depicted below:

Baseline study

The goal of the baseline study pilot is to understand the preference and acceptability of HCM provided in SNP among the children in order to integrate fish-based products into the diets of preschool children, adolescent girls and children from tribal villages in Odisha. This study also helps to understand the dietary diversity and micronutrient intakes of women and children involved in the SNP. The summary of the baseline study stated below:

- The attributes of egg curry are usually good to neutral in children's opinions on organoleptic properties.

- Children dislike vegetable curry because of its unappealing colour.
- There is more waste of rice with egg and vegetable curry. It is primarily due to children's aversion to boiled eggs in vegetable curry.
- Many of the kids reported that eating eggs on a daily basis is boring and unpleasant.
- Dal rice was preferred by the children in a few of the AWCs over any other variation.

Figure 16. Baseline survey by MSSRF team.

End-line study

The objective of the end-line study is to understand the acceptability of fish powder and dried fish products among the tribal communities in different AWCs of Odisha.

- Children savoured the consumption of vegetable and egg curry containing dried fish powder.
- Although the taste of the vegetable curry with fish powder improved, the texture was still a problem.
- Due to the change in taste with the addition of dry fish powder, plate waste with rice, egg, and vegetable curry was reduced compared to the baseline.
- The majority of the youngsters finished their food plate with vegetable curry with fish powder and reported happiness with the variety of flavours.

- The majority of pregnant and lactating women and adolescent girls felt that appearance, colour, smell, the taste is acceptable and easy to swallow.
- All groups of adolescent girls and pregnant and lactating women found that the use of dried fish in vegetable curry is straightforward to use and store.
- The majority of pregnant and breastfeeding women, as well as adolescent girls, reported a significant preference for dried fish in their weekly meals. There was broad agreement that dried fish was safe and hygienic, and on the amount of fish to eat per meal in order to maintain excellent health.
- Almost all of the AWCs said the dried fish powder was simple to store and that it was delivered on schedule each month, with enough for HCMs at each center. The success of the intervention appears to be aided by supply chain assurance.

Figure 17. AWC staff is serving fish powder mixed curry to the children.

8. Observation and lesson learned

8.1. Fish powder inclusion in meals of 3 to 6 years children

Following observations were made during the 1st month of the program implementation.

- More food plate waste was noted in the first week of the program's introduction. Due to the strong fishy odour in the curry, several children were hesitant to eat. Each child was given 15 g of dry fish powder. When the necessary amount of dry fish powder was added to the curry, the consistency of the gravy thickened, causing the youngsters to be hesitant to eat the curry due to its pungent odour. As a result, it was suggested that the quantity be reduced to 8-10 g with a soupy consistency. In comparison to the first week, there was reduced plate waste the next week.
- The project began providing small sachets of spice powder in the second week, which increased the taste and were immensely enjoyed by the children. The addition of spice to curry improved the taste and acceptance of the dish among children.
- The ICDS program includes a provision for children to consume lemon as a source of Vitamin C. The project advised all AWS to add a few drops of lemon juice to the fish curry after it was cooked to enhance the flavour. It was observed that adding tomatoes and drops of lemon juice to fish powder curry enhanced the acceptability among children.
- In some centres, the AWS cooked better recipe which was liked by children.
- When the AWW and AWS paid attention to and fed the very young children, better consumption was noticed.
- To the curry with dried fish powder, adding the proper quantity of vegetables was essential.
- Many children disliked the dried fish powder in the egg curry rather they preferred mixing of dried fish powder in vegetable curry.
- The HCM mixed with dry fish powder, which was given to the children on a regular basis in AWC, enhanced the children's desire to eat a large amount of food.
- It was observed that Anganwadi workers and AWS found dry small fish powder convenient to utilize and store during the preparation of hot cooked meals at the AWC level.

- Overall, the majority of children in general categories were shown to be less interested in consumption due to the odour of fish powder, although consumption was seen to be increasing among tribal children who were less privileged.
- Reduced spices and oil were found to be the cause of less acceptance by children during the production of hot prepared meals at the AWC level, and the cooking art of AWS had a positive impact on their food acceptability.
- Dried fish powder inclusion in regular curry of children have increased the intake of their regular quantity of diet.

Figure 18. AWC Sahayika is preparing dried fish-based curry for children.

Figure 19. Plate waste observation after feeding.

Figure 20. AWC worker is assisting children to eat.

8.2. Fish powder inclusion at household level as a THR

Soon after the government order for closing the AWC due to COVID-19 pandemic, the project ensured the timely supply of fish powder products as THR from 1st week of May 2021. Initially, a meeting of AWC employees was held at the GP level, where they shared their experiences and lessons learned over the first month of the pilot program. For the second time, the project trained all AWCs staffs to perform a community-wide awareness program and house visits to persuade mothers and caregivers of children, as well as family members, to include dry fish powder in their diet. Project volunteers

and staffs also supported the ICDS staff in awareness and home visits. Then, at the AWC level, ICDS and project staff showed the usage of dried fish powder, storage, and other topics to the group of mothers and caregivers of children. Additionally, a few Sahayikas with superior culinary talents shared their knowledge and views with the mothers. The major observations are as followed:

- For the first 2-3 times, everyone in the home tried dried fish powder in regular curries and ate it with the kids. They began feeding the children after they were satisfied with the quality and flavour. To achieve this, dried fish powder was lightly cooked in oil and then put into a children's curry.
- After a few days, both mother and child caregivers expressed confidence in using fish powder in their children's everyday meals when they cooked at home.
- According to the SOP, children should be given dried fish powder five times a week, from Monday to Friday. Non-vegetarian dishes are only served on specific days of the week in Odisha due to religious beliefs. The feeding program on Mondays and Thursdays was compensated on weekends.
- The dried fish powder, together with the other veggies, lentils, and eggs provided by THR, was savoured by mothers.
- In some household, mothers were keen to feed the dried fish powder to children even below 3 years age.
- Adding tomatoes and drops of lemon juice to fish powder curry enhanced the acceptability among children.
- Children below 3 years also consumed more quantity of food including fish powder when fed by mother and caregivers.
- In many regions, mothers and caregivers were secure in using dried fish instead of fish powder in their children's diets.

8.3. Observation with respect to the pregnant, lactating and adolescent girl

It is observed that, the taste preference of adolescent girls, pregnant and lactating women on dried small fish curry as THR was very much accepted.

- Majority of the adolescent girls and women liked the dried small fish curry with their own cooking process.
- The majority of pregnant, lactating women and adolescent girls thought that appearance, colour, smell, and taste of fish powder amalgamated vegetable curry was very good and easy to swallow.

- Majority of pregnant, lactating, and adolescent girls strongly agreed to the ease of use, store, adding dried fish to weekly meal, safe and hygiene, quantity of fish to consume per meal.
- Dried fish inclusion in regular curry of adolescent girls, pregnant and lactating women have increased the intake of their regular quantity of diet.
- In the beginning of the intervention, it was observed that the whole cooked recipe was consumed by all the family members and slowly they started to consume the same recipe for own need.

Figure 21. Pregnant women are consuming dried fish distributed under the pilot.

8.4. Constraints and challenges:

At ICDS level

- The feeding time of AWC is 9 AM. The time gap of breakfast and lunch in AWCs was too short to generate hunger in them.
- The newly joined children are not acquainted with the feeding programs in AWCs.
- The method of cooking differs from centre to centre so differences in acceptance was also seen among the children.

- In some centre, some children were accompanied by their mother during the feeding hours. They were not confident about the dried fish powder and were uncertain about the acceptability of their children. The parents used to influence the opinion and as a result it was having an impact on both the ICDS staff as well as children.

Fish product development and logistics

- Although Odisha is a major epitome of dry fish production, but it often subjected to food safety and certification issues. Therefore, fish-based products used in the pilot program were procured from ICAR-CIFT, Cochin. Collection of dried fish product from far-flung locations to Odisha is found to be the major hindrance which can limit the viability of long-term scaling.
- Maintaining the hygienic condition and storage of the dried fish product during the wet season was a cumbersome chore.
- Due to complex and long supply chain, the price of the dried fish product for the end users is eventually increased.
- Certification and proper packaging of locally made fish product was time-taking and complex procedure.
- Government usually fixes institutional prices for the HCM and THR menu for each beneficiary. Therefore, economic viability of fish-based product to be included in SNP should be matched with government price criteria.
- The current costs of dried fish as well as fish powder was found to be Rs.9.00 and Rs. 5.40, respectively, which can be reduced if the product is processed locally.

Table 7: Comparison of nutritive value of chicken egg and dried fish and fish powder.

Name of the nutrient	Chicken egg	Dried Fish	Fish Powder
Cost (Rs.)	6.00	9.00	5.40
Protein (g)/100 g	10.5	70.23	69.5
Fat (g)/100 g	8.0	9.02	8.20
Calcium (mg)/ 100 g	2.5	3.99	3.91
Sodium (g)/ 100 g	1.05	1.80	1.70
Vitamin A (µg)/ 100 g	8	14.12	13.95
Note: Cost of egg indicates the price of single chicken egg as recommended. Price of dried fish indicates the price of 30g of dried fish as recommended. Price of dried fish indicates the price of15g of dried fish powder as recommended.			

9. Overall upshots of the pilot and recommendations

Aquatic food especially fish is well recognized as a powerful tool to eradicate poverty and malnutrition throughout the developing world. Considering the plethora of undernutrition coupled with impoverishment in Odisha, inclusion of dried fish-based product in institutional feed program such as SNP for the impecunious tribal communities shows us a new opportunity. Amidst some constraints, the project advocates the following recommendations for the long-term sustainability of the venture:

- A survey conducted by the USAID-IPP project during 2018 shows the abundant availability of marine different small fishes from the coastal districts of Odisha. These can be utilized to produce hygienic dried fish and fish-based products. Besides this, Odisha harbours rich indigenous freshwater small fish species which could be explored for dried fish production.
- Production of fish-based products locally can reduce the time and cost and also provide livelihood opportunity to the vulnerable fisher community. The project has introduced 10 numbers of hygienic solar dryers in 6 coastal districts of Odisha. These have been managed by the WSHGs formed under Mission Shakti. Further to scale up the program, the MSME department of Government of Odisha in convergence with Mission Shakti and FARD is promoting 100 numbers of polyhouse solar driers under the One District One Product (ODOP) program.
- The WSHGs or the entrepreneurs should be encouraged to produce hygienic, FSSAI certified fish-based products like dried small fish balls, dried fish chutneys, pickles, papad, mixed with soya, dried fish biscuits, wafers etc. These WSHGs can be linked to the school feeding program.
- Dried fish powder has several advantages like easy to produce, store and transport but some research needs to be done for developing age-specific products from dried fish powder.
- Social marketing campaign to promote fish nutrition, dietary diversity, and food safety on child growth under first 1000 days of human life.
- Collaboration with other academic and research institution like OUAT, College of Fisheries Rangeilunda for product development and capacity building program.

- In the weekly meal program, considering the importance of inclusion of food diversity in the diet, the implementers should serve eggs, fish and veg items on different days alternatively rather than giving every non-veg items on the same day.
- Fish-based product can be incorporated in the feeding program in residential tribal children school under ST & SC Department with support of District Mineral Fund (DMF) and in Kasturba Gandhi Balika Vidyalaya (KGBV) under Department of School and Mass Education.
- WCD and Health and Family Welfare Department in convergence mode may promote inclusion of small fish at the Nutrition Rehabilitation Centres (NRC) where Severely Acute Malnutrition (SAM) is prevalent.
- Under SOPAN - a transformative strategy of WCD & MS Department for improving nutrition outcomes in hard to reach 125 blocks of 22 districts in the state, the WCD Department may decide to scale-up the initiatives through targeted state-driven scheme for 125 nutritionally challenged blocks in a phase wise manner.

Figure 22. Fish can eradicate malnutrition and poverty among tribals in Odisha.

10. Project outreach and scaling

The following events were transpired as project outreach and scaling activities:

1. Dr Arun Padiyar, Project Manager, Odisha WorldFish gave a virtual presentation on Scaling Nutrition-sensitive Fish Agri-Food Systems in Partnership with Government of Odisha at USAID Multi-Sectoral Nutrition Global Learning and Evidence exchange (MSN-GLEE) during March 2021.
2. Dr Arun Padiyar, Project Manager, Odisha WorldFish Project gave a presentation on Nutrition-sensitive aquatic food systems boost access to nutritious foods in Odisha, India during April 2021.
3. Ms. Anu Garg, IAS, Principal Secretary, Department of Water Resources, Government of Odisha, represented India at UN Food Systems Pre-Summit Affiliated Session on July 26, 2021, and gave a presentation on Aquatic foods for healthy people & planet: Fish Based Nutrition for Children & Women in Odisha, India.
4. Ms. Anu Garg, IAS, Principal Secretary, Department of Water Resources, Government of Odisha spoke on Fish Based Nutrition for Children and Women in Odisha, India at The People and Sea Conference: Organised by The Centre for Maritime Research (MARE), The Netherlands on 2nd July 2021.
5. Ms. Anu Garg, IAS, Principal Secretary, Department of Water Resources, Government of Odisha, gave a presentation on Aquatic foods for healthy people & planet: Fish Based Nutrition for Children & Women in Odisha, India organised by World Food Prize Foundation on 19th October 2021.
6. National Fisheries Development Board (NFDB) celebrated Poshan Maha-2021 (Month of nutrition) during September 2021. The pilot program for inclusion of small fish in SNP programme was discussed in 3 various topics given below
    - 6 September 2021-Consumption of fish and other aquatic foods for improving food and nutrition security
    - 17th September 2021- Fish as nutritional food
    - 19th September 2021-Domestic fish consumption: supporting food and nutritional security in the North-eastern states of Odisha
7. Dr. Baishnaba Charan Ratha participated a webinar titled “Nutritional security through value added fisheries product” organized by Bigyan Chatana Mancha, Odisha on 27th October 2021
8. Refresher course for teaching faculty on Indigenous knowledge system and Fish, held under UGC - HRDC Utkal University, Odisha, 8th February 2022.

Towards a new dawn

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