Bundesministerium
für Ernährung
und Landwirtschaft

CALL ACRONYM

"Forschungskooperationen zur Welternährung" Research co-operation for global food security and diversified agriculture for a balanced nutrition in Sub-Saharan Africa.

Project Acronym: "ICH LIEBE FISCH"

Title of the project: Improving Community Health-Nutrition Linkages through Solar Energy Based Fish and Crop Integrated Value Chains.

country/countries	Malawi
funding agency	Federal Ministry of Food and Agriculture - BMEL
project management	Federal Office for Agriculture and Food – BLE
project coordinator	Fraunhofer Research Institution for Marine Biotechnology and Cell Technology (EMB)
project partner(s)	1. Fraunhofer Research Institution for Marine Biotechnology and CellTechnology (EMB) 2. Association for Marine Aquaculture mbH (GMA)

	3. Lilongwe University of Agriculture & Natural Resources, Aquaculture and Fisheries Science Department (LUANAR-AQF) 4. Lilongwe University of Agriculture & Natural Resources, Department of Human Nutrition and Health (LUANAR-HNH) 5. Lilongwe University of Agriculture & Natural Resources, Department of Food Science and Technology (LUANAR-FST) 6. Quantum for Urban Agriculture and Environmental Sanitation (QUALIVES) 7. Innovative Fish Farmers Network Trust (IFFNT)
project budget	1.708.071,20 €
project duration	1st of. March 2016 – 31st of December 2020
key words	Aquaculture, aquaponics, solar powered hatchery, fish breeding programs, hybridisation, fish, fish larvae, fish seedlings, tilapia, chambo, "all-male" populations, fish feed, insect proteins, integrated aqua-agriculture (IAA), vegetable production, health status, social status, malnutrition, food diversity, capacity building, training, cooking classes, networks
background	Traditionally Malawi is a nation where a lot of fish has been consumed. However, the main foodstuff has now become corn porridge (Nsima). The overfishing of Lake Malawi since the beginning of the 1990s has resulted in fish in general being hardly affordable for most people in Malawi. Especially the most desired tilapia species *O. karongae*, "Chambo" in the national language, got too expensive. Against this background, the primary objective of the "I love fish" project was to improve the supply of fish and vegetables to the rural population and to increase the added value. This was intended to improve food security and the health status of the village communities involved and to expand their earning potential. The project has also addressed another significant problem area, which is the bad quality of local fish feed for growing and adult fish. One option is the production of insect larvae, which can be used in Malawi for the production of very cheap but valuable animal protein. This approach is now being pursued in the last project year until the end of 2020.
objective	In detail, the focus was on the following project objectives: i. Improvement of the production of native tilapia species through more efficient rearing conditions and the production of "all male" fingerlings ii. the construction of a solar powered larval rearing facility to improve the supply of juvenile fish, especially *O. karongae* (Chambo) iii. the implementation of integrated aqua-agriculture (IAA) in order to use the excrements produced by fish in the ponds as nutrients for plant breeding by irrigation with pond water. iv. the introduction and dissemination of aquaponics technology in Malawi (integrated fish and vegetable farming in circulating systems)

	v. the production of high-quality proteins from the rearing of BSF larvae from organic residues to produce high quality but low-cost fish feed vi. the implementation of training courses to provide expert knowledge and capacity building in rural communities vii. the study of the health status and nutritional habits of families in rural areas, especially those of children and elderly people, before and after the implementation of the project measures viii. supporting the establishment of a network and knowledge platform to promote the exchange between the different municipalities and thus ensure the sustainability of the project even beyond the projects´ life time.
results	The most important project results: i. The installation and commissioning of the first solar power-supported hatchery in Malawi for the intensive rearing of low-cost fish seedlings for rural fish farmers has been successfully completed. In the second breeding season the hatchery has already produced seedlings close to the initially estimated production capacity (0.75 million) and could be operated continuously without disturbances except for a technical failure of the inverter (warranty repair). The seedling production of Bunda College Farm could already be increased by 40% in the 2019/20 season due to the hatchery. By optimizing the processes, a production of more than 1 mill. seedlings per hatching season is possible. The hatchery also supports the breeding of tilapia hybrids, focusing on the production of "all male" cohorts, as these use the feed more efficiently and grow faster. ii. Some of the farmers who participated in the training course for the operation of the hatchery are now building small hatcheries of their own, following the same pattern as the one built by the project, and want to produce seedlings as an additional source of income and sell them in the local area. iii. The training courses on optimised pond management and the support with materials and feed have led to a 4-7-fold increase in the efficiency of fish production per season, depending on the region. The breeding selection results have contributed to an increase in fish production. iv. The implementation of training courses for integrated aqua-agriculture (IAA), when applied consistently, has led to a significant improvement in vegetable production among rural aquaculture farmers. In the village communities participating in the project, the evaluation of the data from the endline survey revealed a significantly higher standard of living compared with the data from the baseline survey.

	v. Several training courses were conducted on the topics of wholefood nutrition and the production of new products from fish, especially for children and adolescents. In addition to women, men from the community councils and also school children participated in the training. In practical exercises it was shown which different foods can be produced from fish, maize and cassava in order to improve the acceptance of fish and thus the nutritional conditions, especially among small children. Through these measures, a considerable increase in the nutritional diversity available to the participating village communities was achieved. vi. On the farm of Bunda College and at Benga Parish (missionary community) in the district of Nkhotakota two aquaponic plants were built and put into operation. In addition to the simple barrelponics system (aquaponics system made of plastic barrels), which was built and tested during the project, the two large systems now produce vegetables and fish in routine operation. The systems are also used for training purposes. Training courses were held in March 2019 and June 2019, more are to follow. vii. The aquaponic technology has raised great interest in Malawi in connection with the training courses. The master student trained in the aquaponics project has founded a start-up company to advise and support farmers in Malawi in the installation and operation of aquaponic systems. Aquaponic technology is particularly suitable in Malawi for growing vegetables in the dry season. The water requirement is only about 5% compared to traditional vegetable growing in fields. viii. Expanded clay balls are the optimal substrate for the plant beds in an aquaponic plant. As this type of substrate is not available in Malawi and would have to be imported, the project initiated an expanded clay ball production. With the production techniques developed by the project at Benga Parish, expanded clay balls are now produced by a small cooperative in the Nkhotakota district and sold at a fraction of the import price. ix. Within the scope of the project "I love fish" 4 master theses and a dissertation were produced. x. In addition to the village communities originally selected in the project, it was possible, albeit to a lesser extent, to involve other farmers in the training courses and to establish new networks between the village communities and individual farmers. For example, the project attracted the attention of a German/Malawian couple in Nkhandwe Village in the Nkhotakota district through the project´s website. They run the "Nkhotakota Pottery Lodge" and feel committed to improving the living conditions of the surrounding villagers. A group of farmers from the village community was invited to attend the training courses on solar-powered aquaculture and healthy nutrition. Furthermore, contact was made with an experienced farmer (Mr. Mysali) and he was more intensively involved in the project, as he had already worked with IAA in the past and was therefore able to tell the local farmers first-hand about the advantages of this technology during a network meeting. xi. Other network partners and external (voluntary) supporters of the project:

	• The director of the national office of the NGO "Welthungerhilfe", Johannes Kaltenbach, contacted the project in November 2018 to inform himself about the work done until then. Possibly the "Welthungerhilfe" will take up the barrelponic systems as an option and support the construction of such systems in some villages. • Mrs. Brit Hartmann from the association abacus e.V. from Rostock contacted the project via EMB. The association is also active in Malawi, more precisely at Benga Parish, through a project sponsored by the Federal Institute for Vocational Education and Training, and sent a trainee to support the work at Benga Parish in 2019. It was agreed that he would also support the "I love fish" project work. This trainee facilitated significantly the compilation of the aquaponic system at Benga perish. • The project contacted representatives of GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH), who are also active in the field of aquaculture in Malawi. An employee of GIZ took part in one of the workshops on aquaculture and intensive larvae rearing of endemic tilapia species in the solar powered indoor hatchery. • Furthermore, there is contact to employees of the organisation World Fish, who informed themselves about the contents of the project and visited the hatchery at Bunda College. • At the end of 2018, a contact was established with a potential volunteer (Thorsten Knörr), who, inspired by the ZDF documentary about the project, had applied to work in the "I love fish" project. In cooperation with Benga Parish it was then possible to send this volunteer to the mission for about two months. Mr. Knörr made great contributions to the project and the Parish from June to the beginning of August 2019. Among other things, he took up the idea of producing the expanded clay ball substrate in Malawi for the plant beds of the aquaponic systems and established a clay ball production at Benga Parish.
recommendations	Recommendations resulting from the experiences in the project: i. The cooperation with Benga Parish (Missionary Community of Saint Paul the Apostle from the Diocese of Lodwar) has proved to be extremely helpful and fruitful in the course of the project; in future projects, the formation of networks involving institutions such as NGOs, development aid organisations or governmental organisations of the respective countries should be given even greater emphasis. ii. The involvement of participating communities should be undertaken at an earlier stage, during the project planning. The participating communities should be involved in the planning and thus be motivated to support the implementation of the measures more strongly.

iii. A fundamental problem in sub-Saharan Africa that goes beyond the achievable goals of this project is the loss of food through rotting. The FAO estimates that about 37% of food is lost to consumption due to a lack of preservation methods. Since the rural population in Malawi does not have refrigeration or freezing facilities, there is almost no possibility to preserve food for a longer period of time. Due to the high seasonality, fruits and vegetables in particular are only available for a short time. Another important step towards a safe basic supply of healthy food is therefore the implementation of preservation methods in Malawi. This would have several positive aspects, such as the production of jams and sun-dried fruits which could not only be produced for own consumption, but could also be sold. Fresh fish that is only available for a short time after harvesting could be preserved for a longer period. In addition, the daily expenditure of time for the procurement of fresh food could be reduced. Especially against the background of the expected negative consequences of the Corona Pandemic for developing countries like Malawi, such measures, which support the storage of food through preservation techniques are very helpful and urgently needed.

iv. In connection with item iii, requirement analyses are recommended for the adequate supply of essential micronutrients such as vitamins and minerals, and measures are recommended to close the resulting supply gaps.

illustrations

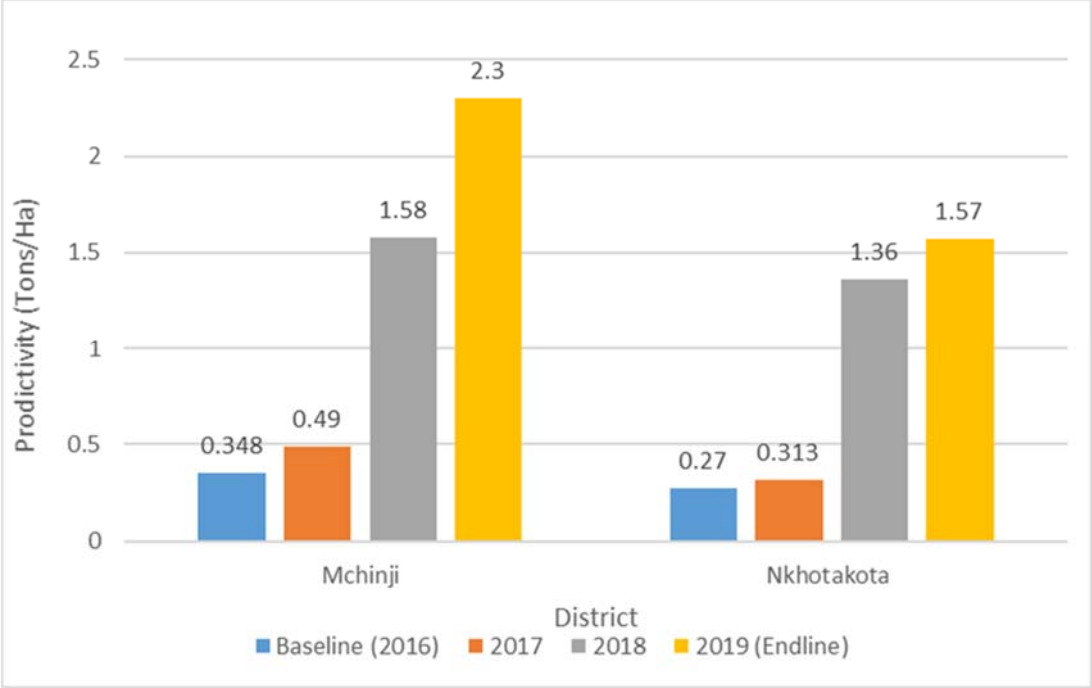

Fig. 1: Changes in the productivity of the participating fishclubs in Nkhotakota and Mchinji over the project 3-year lifespan. The farmer in Mchinji were ahead with their experience in aquaculture at the commencement date of the project compared to the farmer in Nkhotakota.

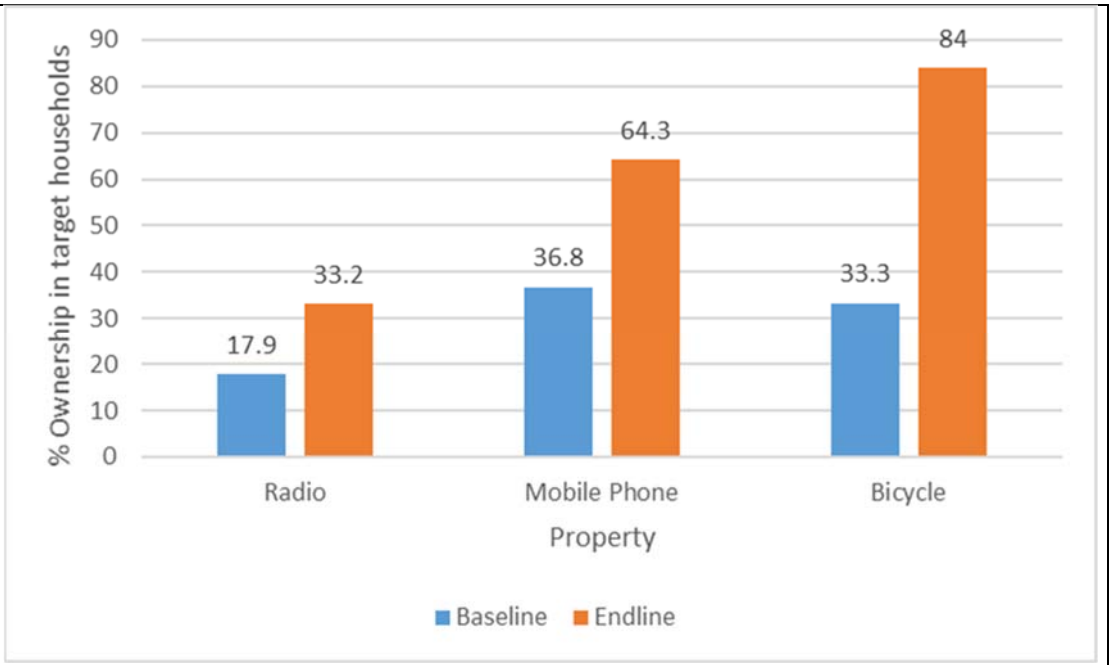

Fig. 2: Changes in ownership of assets in the households targeted by the "Ich Liebe Fisch"-Project.

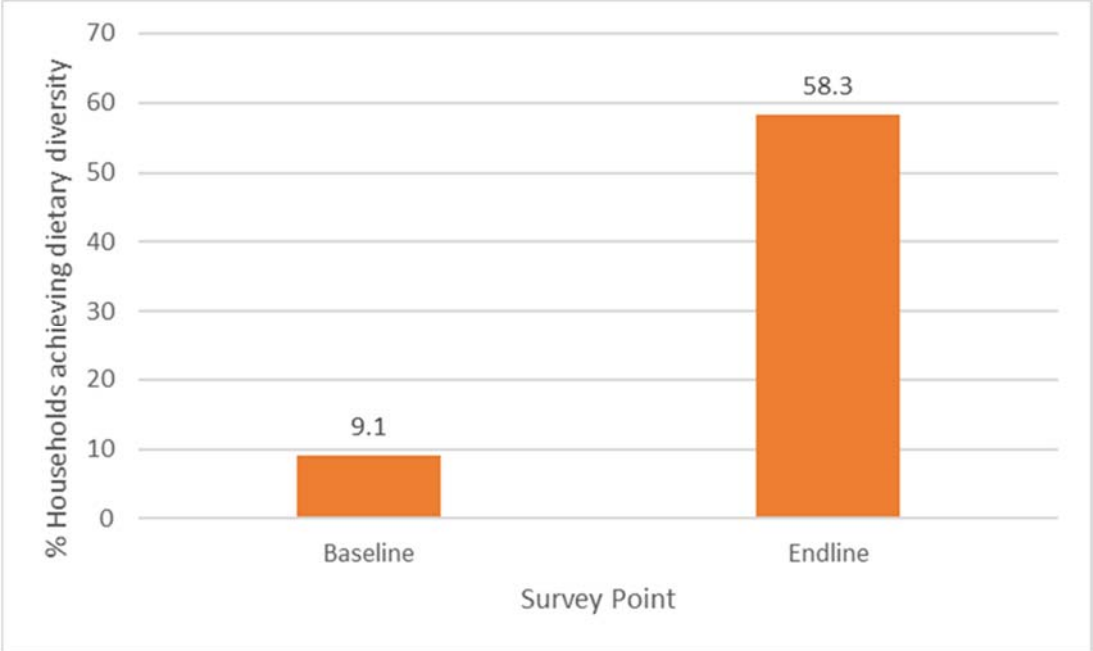

Fig. 3: Percentage of households achieving high dietary diversity at end line compared to baseline among households in target communities.

photos



Von links nach rechts: Vorlesungen im Trainingskurs zum Betrieb der Brutfischanlage am Vormittag. "Hands on"-Training. Teilnehmer bestimmen die Wasserqualität in der Hatchery (Ammonium, Nitrit, Nitrat, pH). Messung von Sauerstoff und Temperatur.



Von links nach rechts: Setzlinge für die Teiche der Farmer von der Bunda Farm. Transport der Setzlinge zu den Teichen der Farmer. Temperaturanpassung der Transportbeutel vor dem Aussetzen.



Von links nach rechts: Das Aquaponicsystem auf dem Gelände der Farm vom Bunda College. Blick über die Pflanzenbetten kurz nach dem Aufbau (noch ohne Substrat). Trainingskurs in Aquaponic, hier Demonstration der Barrelponics-Variante.



Von links nach rechts: Gruppenbild mit den Farmern die an der Exkursion zu der Farm von Mr. Mysali teilgenommen haben. Mr. Mysali berichtet über seine Erfahrungen mit Fischzucht und IAA. Neben Fisch werden auf der Farm auch Gemüse und Früchte produziert und mit Teichwasser gedüngt.











Oben, von links nach rechts: Anpassung der Tanks für den Pumpensumpf der Aquaponicanlage. Wie links oben. Tonkugelproduktion mit Dorfmitgliedern auf dem Gelände vom Benga Perish. 2.Reihe von oben, von links nach rechts: Aufstellung der Pflanzenbetten. Optimierter Brennofen für die Tonkugeln. Aquaponicanlage mit Pflanzenbetten aus im Benga Perish produzierten Blähtonkugeln.. 3.Reihe von oben, von links nach rechts: Volontär T. Knörr mit Mitarbeitern des Benga Parish. Volontär vom Verein abacus e.V. aus Rostock bei der Schulung von Mitarbeitern des Benga Parish. Fertig konfigurierte Aquaponicanlage. Aquaponicanlage im Benga Parish. 4.Reihe von oben, von links nach rechts: Kontrolle des Pflanzenwachstums in der Aquaponicanlage. Trainingskurs Aquaponic in der Anlage am Benga Parish. Gesunde Gemüsepflanzen im Pflanzenbett aus Tonkugeln (Mustard-Blätter, Mpriru, das erste Mal unter Aquaponicbedingungen aufgezogen).



Von links nach rechts: Abschlussmeeting zum ersten Abschnitt des "Ich liebe Fisch"-Projekts Ende September 2019, mit einem symbolischen Handschlag zur Übergabe der Hardware zwischen Ariana Bystry (Projektadministration, BLE) und Dr. Agnes Mwangwera (Bunda Campus Director). Gespräche zwischen den Dorfbewohnern und Ariana Bystry sowie mit einem Distrikt-Fischereibeamten (rechts, Dr. Rakers, A. Bystry).



Von links nach rechts: Fischernte in einer Partnercommunity im Mjinchi-District (Chikondi Fisch-Club). Die Fische werden stichprobenartig vermessen und die Messungen für die weitere Auswertung sofort digitalisiert. Typische Grösse der geernteten Fische bei dieser Community nach einer 5-6-monatigen Abwachsperiode (etwa 120-170g). Das Bild zeigt einen O. shiranus.



Von links nach rechts: Fischernte in einer Partnercommunity im Mjinchi-District (Chikondi Fisch-Club). Ein Junge freut sich über einen Fisch den er beim Abfischen im Ablaufgraben gefangen hat. Der Schatzmeister des Fisch-Clubs zählt seine Einnahmen vom Fischverkauf. Frischer Fisch für die Dorfbewohner.