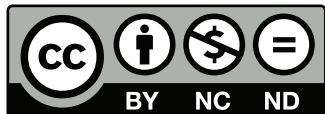




Citation

This publication should be cited as: WorldFish. 2019. Annual Report 2018. Penang, Malaysia: WorldFish. Annual Report: 2019-12.

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Contents

WorldFish at a glance	ii
Message from the Board Chair and the Director General	1
Big splashes in 2018	2
2018 highlights	3
Our contribution to the Sustainable Development Goals	8
Where we work	10
From research to impact	11
Living our values	24
Communicating science knowledge and evidence	26
Selected publications	27
Our partners	29
Our investors	30
Financial overview	31
Leadership and governance	33
Our people	35
Acronyms	36
WorldFish offices around the world	37



WorldFish is an international, not-for-profit research organization that works to reduce hunger, malnutrition and poverty by improving fisheries and aquaculture. With a 40-year track record of leading-edge science, we generate research evidence and innovations to inform sustainable practices and inclusive policies that enable better livelihoods and healthier diets for millions of poor people, particularly women, who depend on fish for food, nutrition and income in the developing world. We do this by partnering with an extensive network of national research institutions, universities, NGOs, development agencies, the private sector and other actors to develop and test practical, innovative solutions for sustainable fishing and fish production, processing and trade. By working together in this way, we ensure that the poorest and most vulnerable communities can share in economic growth, nourish their families and sustainably manage precious natural resources in the face of climate change and other challenges.

WorldFish is a member of CGIAR, the world's largest global partnership on agriculture research and innovation for a food secure future. Headquartered in Penang, Malaysia and with regional offices across Africa, Asia and the Pacific, WorldFish leads the cross-disciplinary CGIAR Research Program (CRP) on Fish Agri-Food Systems ([FISH](#)).

Our vision

A sustainable food future through fish

We envision productive, sustainable and equitable fisheries and aquaculture sectors, making fish a route out of poverty for producers, processors and traders, and an affordable, nutritious and accessible food source for poor consumers in the developing world.

Our mission

WorldFish is dedicated to eradicating poverty, hunger and malnutrition among the millions of people who depend on fish for food, nutrition and income in the developing world. Our mission is to deliver scientific evidence and transformational innovations for sustainable development impact through multidisciplinary collaboration and unique partnerships across the public and private sectors.

Our goal is to improve the health and welfare of fish producers, processors, traders and consumers to promote resilience, adaptability and environmental sustainability in the face of climate change, and to empower women and youth, in particular, to take part and share in the benefits of the emerging blue economy.

What we do

WorldFish provides fish-dependent households, the private sector, policymakers, civil society organizations, investors and development actors with rigorous scientific evidence to shape action, policies and practices for the sustainable development of fisheries and aquaculture. Capacity building, co-creation, learning and dialogue are the primary ways in which we share our research and engage with stakeholders to inform effective policies, programs and investments that contribute to productive, sustainable and resilient fish agri-food systems.

We are supported by a diverse network of investors aligned with common goals. Our research is designed to address specific challenges within the global 2030 sustainable development agenda. Our work is rooted in multidisciplinary science and food systems thinking. It is guided by national priorities and the capacity development needed to improve agricultural research and extension systems, and it is enhanced by our unique ability to convene and broker novel partnerships with development actors and the private sector as a mechanism to scale innovations and impact.

Our beneficiaries

WorldFish works to benefit poor producers and consumers, women and children in Africa, Asia and the Pacific. We focus our research activities in regions where there are high levels of poverty and food and nutrition insecurity and where fisheries and aquaculture are vital sources of nutrient-rich protein and livelihoods.

Specifically, our research on aquaculture focuses on sustainable increases in production, ensuring that poor



fish farmers, their families and communities receive direct nutritional and economic benefits. Our small-scale fisheries research targets fishery-dependent households and communities and the traders and consumers of the fish they catch. Through our work on value chains and nutrition, we aim to increase the availability, accessibility and consumption of nutrient-rich fish by poor consumers, with particular emphasis on women and children in the first 1000 days of life (from conception to the child's second birthday).

Cutting across all our work is a focus on gender, entrepreneurship and climate change. Our gender research identifies strategies that influence social norms and bridges the gaps in women's access to and control of productive assets and resources. Our youth-responsive research aims to increase opportunities for safe, rewarding employment and entrepreneurship in inclusive and sustainable aquaculture and fisheries value chains.

Shaping agri-food systems with fish



The **CGIAR Research Program on Fish Agri-Food Systems (FISH)** is a global research partnership led by WorldFish. In collaboration with research partners, beneficiaries and stakeholders, FISH supports resilient fish agri-food systems that deliver sustainable increases in socially and gender-inclusive production and equitable distribution of nutritious fish to those most in need. Highlights of the progress made by the program in 2018 are presented here. The full FISH annual report is available at fish.cgiar.org.

- New [FISH evidence](#) showed that **775 million people** are highly dependent on **marine fisheries**, providing the basis for more targeted management and policy interventions for vulnerable small-scale fishing communities.
- **Three countries** deployed a new **FISH online tool** for disease risk assessment.
- **67,687 people** received short-term **training through FISH**, of which **25,270 (37 percent)** were women.
- Research to enhance understanding of **youth engagement** in aquaculture and **small-scale fisheries** was conducted in **eight countries** and will inform the FISH youth strategy, due out in 2019.
- **Foresight modeling** work in Africa generated critical understanding of future fish supply-demand trends, providing **important insights** for strategic planning and investments in aquaculture and capture fisheries across the continent.



MESSAGE FROM THE BOARD CHAIR AND THE DIRECTOR GENERAL

In 2018, we made notable progress toward our ambition to position fish firmly at the heart of discourse, policy and practice currently shaping the global thinking on transforming food systems, paying closer attention to nutrition and healthier diets, and informing the path toward an inclusive and sustainable blue economy.

With growing global attention for nutrition-sensitive food-based production systems, we undertook several new strategic partnerships and organizational initiatives that are sharpening the delivery aspects of [our strategy](#), which we launched in 2017.

For us, this shift in global attention means we must continue to build on the work we have already started to focus not only on generating research that informs sustainable production of volumes of fish at prices accessible to the poor but also on supplying better quality fish rich in micronutrients, ensuring that future generations have a bright, healthy future. Thinking of fish from a holistic food systems perspective, as opposed to thinking of fish as just a commodity, presents exciting opportunities for innovative research-for-development initiatives and policy and investment options as we seek to build more effective partnerships across the public and private sectors.

Our recent [agreement](#) with the Food and Agriculture Organization of the UN (FAO) is indicative of this holistic thinking. In the developing world, fish offer vast untapped

potential for feeding billions and nourishing nations, alongside many socioeconomic opportunities to improve livelihoods and the sustainability of our planet. Our growing body of robust [scientific knowledge](#) combined with the FAO's policy-influencing capacity and reach aims to enhance the well-being of millions of consumers, producers and fisheries-dependent people worldwide.

The emerging [blue economy](#) provides additional opportunities for us to build a stronger case for fish within the global development agenda and to promote evidence-based solutions to the sustainable and equitable use of marine and aquatic resources. This is a crucial part of our contribution to multiple Sustainable Development Goals (SDGs) but particularly SDG 14 (Life below water), to which we are uniquely positioned among the 15 CGIAR centers to contribute.

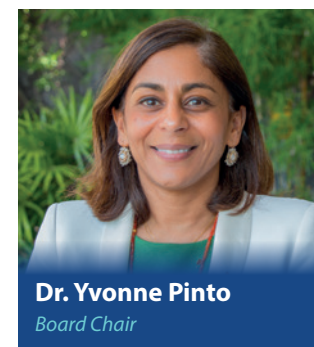
However, ensuring that all users benefit from the growth of the blue economy requires new thinking, new information and greater collaboration between less traditional partners. This was the message we took to several high-profile events, including Our Ocean Conference in Bali, Indonesia and the first global Sustainable Blue Economy Conference in Nairobi, Kenya.

As part of our efforts to raise the profile and impact of our research evidence, we made significant progress in implementing our open access and open data policies, with 73 percent of the 63 peer-reviewed articles published in 2018 now freely available for others to use, learn from and

translate into action. We also launched a new website to highlight activities carried out within the framework of the CGIAR Research Program on Fish Agri-Food Systems ([FISH](#)), which we lead in collaboration with several multidisciplinary partners. The body of FISH research, including a widely shared [paper](#) in *Nature Climate Change*, is providing critical understanding of fish in food systems and shaping thinking around responses to meet the growing global demand for fish in the face of climate change and other challenges.

These and other changes—such as improved organizational learning and innovation and more coordinated and strategic engagement with a broader range of stakeholders—were reflected in our activities and events throughout the year, many of which are highlighted in this report.

The progress we achieved was made possible by the unfailing support and commitment of our partners and investors, to whom we extend our sincere thanks. We look forward to our continued collaboration as we work to deliver a step change in the way we—and other development actors—think about transforming global food systems through fish.



Dr. Yvonne Pinto
Board Chair



Dr. Gareth Johnstone
Director General

USD17.2 MILLION
INVESTED BY OUR
TOP 5 DONORS

179 ACTIVE
PARTNERSHIPS WITH
86 NEW ONES 

27  **NEW**
PROJECTS

Big splashes in 2018

52 COUNTRIES
INCLUDED IN **ILLUMINATING
HIDDEN HARVESTS** STUDY
ON THE CONTRIBUTION
OF SMALL-SCALE FISHERIES 

124 
PUBLICATIONS

73% OF PEER-REVIEWED 
ARTICLES
ARE **OPEN ACCESS**

 **3** COUNTRIES WITH
FISH GENETICS
RESEARCH PLATFORMS IN OPERATION

 **65**
JOURNAL
ARTICLES

3 SCIENCE PAPERS WITH
**ALTMETRIC
ATTENTION
SCORE** 



2018 HIGHLIGHTS

Fish continues to rise on the global development agenda. During 2018, we made a strong case for the role of fish in healthier nutrient-rich diets, increased incomes and improved job and entrepreneurship opportunities, particularly for women and young people, as well as the conservation, protection and restoration of critical natural resources—both on land and below water. We did this by generating and disseminating scientific evidence to shape action, policies and practices for the sustainable development of fisheries and aquaculture.



Influencing the global blue economy agenda

We are seeing evidence of new thinking, new information and new alliances emerging in the blue economy space. However, these often lack scientific rigor and substance, creating substantial opportunities for our research to build cross-sectoral bridges for an inclusive and sustainable blue economy that is good for people and our planet.

This was precisely the point we raised at Our Ocean Conference from 29–30 October in Bali, Indonesia and the first global Sustainable Blue Economy Conference from 26–28 November in Nairobi, Kenya, where Dr. Gareth Johnstone, Director General, WorldFish, was the keynote speaker.

We are collaborating with the FAO and Duke University on the [Illuminating Hidden Harvests](#) study, which aims to bring to light the social, economic, environmental and governance contributions of small-scale fisheries globally. The first paper of the study, focusing on nutrition, was [published](#) in 2018 and provides methodological recommendations for 52

“People and their needs must remain at the forefront of new research, new policies and new thinking on the subject of the blue economy. As an international organization with a **unique research mandate** and a mission to provide evidence-based solutions, our research on fish, fisheries and aquaculture is meant to outline win-win opportunities for local communities, for policymakers, for the private sector and civil society actors alike. **We are in this together.** Our research offers a way to help increase transparency around and accountability for our shared responsibility, to develop and implement inclusive public-private policies and investments and to support a sustainable future blue economy without wrecking our blue planet, where **everyone shares equally in the benefits and opportunities.**”

Dr. Gareth Johnstone,
Director General, WorldFish

country case studies to be implemented in 2019. This piece of critical new research will culminate in a major synthesis report in 2020 and is expected to have a major influence on the way policy and investment interventions are designed to support the sustainable and inclusive development of small-scale fisheries.



WorldFish is also shaping the global agenda for a sustainable ocean economy. Several of our scientists led by our Honorary Fellow [Eddie Allison](#) are part of the Expert Group developing a series of 15 thematic 'blue papers' for the newly established [High-level Panel](#) for a Sustainable Ocean Economy. The panel, consisting of 13 heads of state led by Norway and supported by the UN Secretary General's Special Envoy for the Ocean, seeks to advance a new contract between humanity and the sea that protects the ocean and optimizes its value to humankind. The aim is to generate scientific evidence for developing, catalyzing and supporting solutions for ocean health and wealth in policy, governance, technology and finance.

The Expert Group to the panel held its [first meeting](#) during the Science for Ocean Action conference from 20–21 November in Bergen, Norway. The blue papers will inform the development of the Scientific Synthesis Report on a Sustainable Ocean Economy, which will be released at the 2020 UN Ocean Conference in Lisbon, Portugal and will articulate the fundamental role that the ocean economy can play in achieving the SDGs.



Advancing food systems thinking

Our strategic research has to date focused on increasing supplies of sustainably produced fish from aquaculture and enhancing the social, economic and environmental benefits to the poor and vulnerable from small-scale fisheries. Recognizing the important role of fish agri-food systems and fish in global food systems, we are building

our thinking and research portfolio in this area, particularly with reference to nutritional outcomes and development of inclusive value chains.

Our collaborative research work with the International Rice Research Institute ([IRRI](#)) and International Water Management Institute ([IWMI](#)) on integrated rice-fish systems is helping to transform the rice and water sectors in Asia and generating the scientific evidence to inform critical policy changes that prioritize nutrition and health for vulnerable communities, particularly women and children in the first 1000 days. We are also working closely with local government and market actors to increase incomes and entrepreneurship opportunities in the fisheries sector, particularly for women and young people.

Global leader in sustainable aquaculture research

WorldFish continued to strengthen its global lead in sustainable aquaculture, with three genetics research platforms now fully operational. In 2018, we successfully produced new generations of genetically improved farmed tilapia (GIFT) in Malaysia, of the Abbassa strain tilapia in Egypt, and of rohu carp and base populations of catla and silver carp in Bangladesh. Other notable successes include biosecurity improvements in Egypt and Bangladesh, the tracking of disease outbreak in Malaysia as a world first and the accelerated dissemination of best management practices for improved strains of tilapia across Africa and Asia.

Big role in small-scale fisheries

The successful rebid for funding of our small-scale fisheries research in 2017 helped to increase the visibility of our small-scale fisheries work in 2018. This was supported by a substantive growth in partnerships, contributing to the capacity of young scientists, new funding opportunities, including a USD 1.5 million investment from the [Oak Foundation](#), and a successful publications record that is increasing our science output. A WorldFish-led [paper](#) in *Nature Climate Change* provided a new approach to build and analyze adaptive capacity of coastal communities across five domains. The paper had the highest Altmetric attention score (284)—an indicator of how much and what type of attention a research output has received—of all our publications in 2018 and was widely shared across 11 news networks and 479 tweets.

Other top-scoring publications related to small-scale fisheries, with a strong showing for gender-oriented papers, included a [paper](#) on gender-transformative approaches to reduce inequality and postharvest fish losses. The paper built on earlier research on the [gender-transformative approach](#), which we have been pioneering in fisheries and aquaculture since 2012.

Growing recognition of fish for nutrition

Too often, global reports on agriculture make marginal reference to fish and its contribution to livelihoods and the food and nutrition security of billions of people in the developing world. This year, we officially joined a coalition of 60 governments, influential individuals and organizations that have formed Scaling Up Nutrition ([SUN](#)), a global movement to end malnutrition in all its forms by 2030. Our goal as partners in SUN is to put fish—and the related nutrition research evidence we are gathering in developing countries—firmly on the global nutrition agenda.

To this end, we convened the Global Workshop on Nutrition-sensitive Fish Agri-Food Systems in Siem Reap at the end of December 2017 in collaboration with the International Fund for Agricultural Development, the European Union and the Royal Government of Cambodia. The event brought together major investors such as the World Bank, the Bill & Melinda Gates Foundation, the Japan International Cooperation Agency, the United States Agency for International Development (USAID) and over 150 participants from 20 countries to discuss the shift to food systems thinking and the important role of fish in securing better nutrition and health outcomes, particularly for women and children.

The gathering provided a platform to present evidence that fish is becoming the investment choice for reducing malnutrition, and that this needs to be better reflected in global policy discussions and development interventions.



*“People recognize that **fish is an especially nutritious food**—this is widely understood. What is less well known is **how critical fish is to the diets of the poor** in many countries where we work. Using fish more comprehensively can **help achieve food security** that is sustainable and highly effective in **advancing our nutrition goals**.”*

Dr. Robert Bertram,
Chief Scientist for USAID’s Bureau for Food Security



Our research on value chains and nutrition received a significant boost with the new USD 24.5 million grant from USAID to implement the [Feed the Future Bangladesh Aquaculture and Nutrition Activity](#). The project uses a market systems approach to leverage co-investment with private sector actors for inclusive and sustainable aquaculture development. Aside from working with local communities to promote nutrition knowledge and consumption of healthier diets incorporating fish, the project aims to expand income and entrepreneurship opportunities for at least 400,000 men, women and young people.

Growing partnerships for fish

This year, we developed 86 new partnerships. At the global level, the [memorandum of understanding](#) with the FAO, which was signed at the 33rd Session of the Committee

on Fisheries ([COFI](#)) from 9–13 July in Rome, Italy, is strengthening our capacity to influence global policy on a range of sustainable development issues.

We are also pursuing closer links with the private sector. An agreement with the global aquafeed manufacturer [Skretting](#) is laying the foundations for a long-term research program that can link favorable traits in tilapia to Skretting feed formulations. This has exciting potential to increase the profitability of small-scale fish farmers, particularly in Africa.

At the national level, we signed an agreement with the Indian Council of Agricultural Research (ICAR) to produce a comprehensive five-year integrated research program for funding consideration by ICAR. India is one of our scaling countries. The ongoing projects in Odisha, an eastern state on the Bay of Bengal, are designed around scaling of key WorldFish technologies, including carp-mola polyculture and the inclusion of nutrient-rich fish in the diets of women and children, which have been tested and validated in focal countries such as Bangladesh.

We collaborate with several CGIAR centers, research programs and platforms. A highlight of the collaboration

with the Platform for Big Data in Agriculture was our participation in the 2018 [Inspire Challenge](#), where one of our teams working in Timor-Leste won one of the five awards. The USD 100,000 grant that came with the award will support research on establishing an integrated data pipeline for small-scale fisheries. The pipeline will use novel, linked information and communications technologies to develop an open-source, scalable system to map small-scale fisheries production over time and space.

Leveraging new investments in fish

Investors are increasingly recognizing the unique role and value of fish in helping to meet many of the SDGs. WorldFish is leading the implementation of the Aquaculture Compact, one of 15 compacts within the Technologies for African Agricultural Transformation ([TAAT](#)) initiative. Funded by the African Development Bank from 2018–2021, the initiative seeks to make Africa self-sufficient in key commodities and scale proven technologies across 22 countries.

“Every day, about 40 million small-scale fishers go out fishing, yet virtually none of these activities or yields are documented. This long-standing global data deficiency underpins SDG 14—Life below water—but can now be solved by small, mobile and affordable information and communications technologies.”

Dr. Alex Tilley,
WorldFish scientist and 2018 Inspire Challenge winner

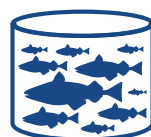
In 2018, we secured a USD 11.5 million investment from the Bill & Melinda Gates Foundation to generate knowledge and research evidence on the role of sustainable aquaculture for increasing incomes, diversifying diets and empowering women in Bangladesh and Nigeria. The investment brings fish into the foundation's agriculture portfolio for the first time.

In Egypt, we launched [Empowering Women Fish Retailers](#). The European Union-funded project will generate research evidence for successful market-based interventions that will support 100 existing women retailers and the establishment of 50 new women-led enterprises. These aim to expand entrepreneurship opportunities for women, improve business profitability, create new jobs and increase fish-based incomes.

Meanwhile, a new project in Zambia, funded by the Norwegian Agency for Development Cooperation, is targeting small-scale commercial fish farmers and [young aquaculturalists](#) as part of national priorities to build relevant technical, practical and vocational skills for decent work, entrepreneurship and lifelong learning.

As new projects got underway, several others came to an end, including the major European Union-funded [FishTrade for a Better Future](#). The project generated critical knowledge and data that are now informing the development of fish trade across 21 countries in Africa. Notably, our engagement with regional and national governments led to some significant policy shifts around fish product standards and trade facilitation. These [shifts](#) will open up new avenues for faster, safer cross-border fish trade, thus helping to improve food and nutrition security, health and livelihoods for millions of people across Africa.

IMPACTS BY 2022



5M

producer households adopt improved breeds, feeds, fish health and best management practices



3.5M

people assisted to exit poverty through gender-inclusive livelihood improvements



2.4M

fewer women, men and children suffering from deficiencies in essential micronutrients



3.3M

hectares of ecosystems restored through productive and equitable management



4.7M

more women of reproductive age consuming an adequate number of food groups



4.8M

metric tons of fish farmed annually with improved climate resilience and reduced environmental impact

Partnerships for delivery

Aside from **leading the CGIAR Research Program on Fish Agri-food Systems (FISH)**, WorldFish works closely with other CGIAR centers and contributes to seven other CRPs, including Agriculture for Nutrition and Health ([A4NH](#)); Climate Change, Agriculture and Food Security ([CCAFS](#)); [RICE](#); Roots, Tubers and Bananas ([RTB](#)); Policies, Institutions and Markets ([PIM](#)); and Water, Land and Ecosystems ([WLE](#)). **We also collaborate with** the CGIAR's [Platform for Big Data in Agriculture](#), the [Excellence in Breeding Platform](#) and the [Collaborative Platform for Gender Research](#).

OUR CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOALS

WorldFish is part of the global effort to eradicate poverty, hunger and malnutrition and reverse environmental degradation, as well as many complex global challenges reflected in the 2030 Sustainable Development Goals (SDGs). Ten of these SDGs are particularly pivotal to our work and mission.



Globally, approximately 800 million people depend on fisheries and aquaculture for their livelihoods. WorldFish works to create opportunities in sustainable and productive fisheries and aquaculture to help lift out of poverty people who rely on fish for their income, livelihoods and well-being.



Fish offers untapped potential to meet increasing demand for safe, nutritious food by a growing population. By developing fisheries and aquaculture in an environmentally and socially responsible way, WorldFish seeks to improve the availability of and access to diverse, nutrient-rich diets incorporating fish.



Fish, particularly small fish, are rich in micronutrients like vitamin A, iron, calcium, zinc and essential fatty acids. WorldFish strives to make quality fish available and affordable to the poor in developing countries, particularly women and children in the first 1000 days. Our research informs strategies for combating under- and malnutrition and for preventing public health issues, such as stunting and other non-communicable diseases related to poor diets and nutritional deficiencies.



Rural women play a vital role in fisheries and aquaculture as fishers, farmers, processors and traders. However, they often have unequal access to the resources and services they need to be successful. WorldFish works to address gender inequalities and their underlying factors in order to improve the fish-based livelihoods of women, who in turn amplify the benefits of these livelihoods for their children, families and communities.



WorldFish research shows that adopting new technologies alone is not enough to improve productivity. Using natural resources efficiently, pursuing innovation and having access to knowledge, networks or credit to invest in business and other entrepreneurial activities, especially for poor women and youth, are also vital and central to our contribution to this SDG, particularly in Small Island Developing States.



WorldFish works closely with national actors to enhance local capacities for scientific research and technological innovation in fisheries and aquaculture. We also support the integration of small-scale fish producers and enterprises into national, regional and global value chains and markets.



In the face of a growing world population and the impacts of climate change, there is an increasing imperative to do more and better with less. WorldFish works to achieve sustainable management and efficient use of natural resources and to reduce waste and loss along fish value chains.



13 CLIMATE ACTION

Overfishing, ineffective management practices, industrial development, agricultural pollution and the impacts of climate change have reduced fish stocks. WorldFish conducts cutting-edge genetics research on improved and resilient fish species and promotes a sustainable approach to fisheries and aquaculture to ensure that enough nutritious fish are available for future generations.



14 LIFE BELOW WATER

Ensuring that all users benefit equitably from marine and aquatic resources requires new thinking, new information and greater collaboration between less traditional partners. Among the 15 members of the CGIAR, WorldFish is uniquely positioned to contribute to this SDG. We focus on generating evidence-based solutions that inform policies and practices relating to sustainable ocean governance and the development of an inclusive and people-centered blue economy, with special attention for the value and contribution of small-scale fisheries.

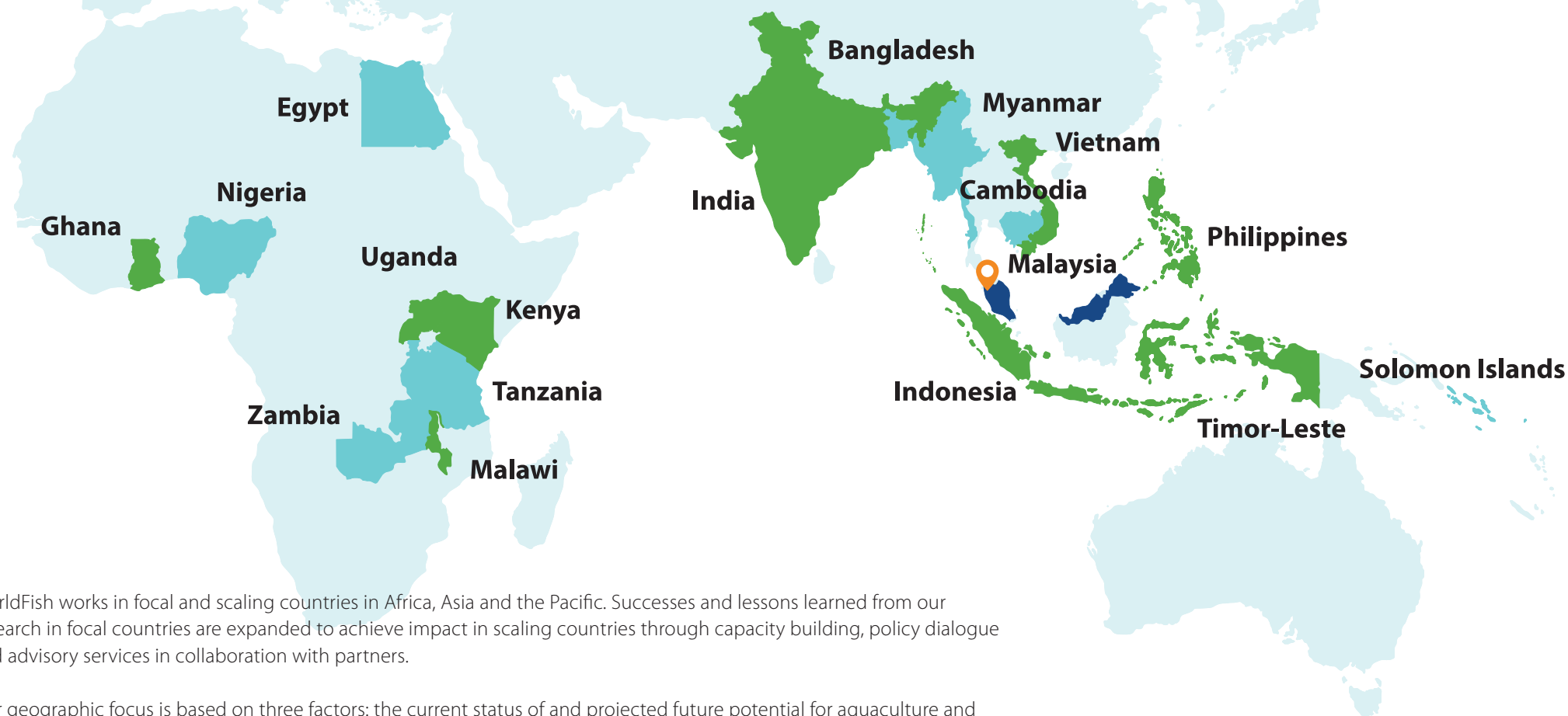


15 LIFE ON LAND

The results of many land-based activities, such as pollution, plastics, deforestation and livestock waste, are affecting, altering or destroying oceans, lakes and other inland aquatic ecosystems and habitats. Preserving life below water (SDG 14) also requires the adoption of environmentally sustainable practices on land. WorldFish research is informing interventions to reduce waste and loss in fish handling and processing, to conserve and restore degraded ecosystems in inland and coastal environments and to develop gender-responsive practices and technologies for innovative small-scale aquaculture systems with low environmental impact.



WHERE WE **WORK**



WorldFish works in focal and scaling countries in Africa, Asia and the Pacific. Successes and lessons learned from our research in focal countries are expanded to achieve impact in scaling countries through capacity building, policy dialogue and advisory services in collaboration with partners.

Our geographic focus is based on three factors: the current status of and projected future potential for aquaculture and small-scale fisheries in developing countries; the probability that we can effectively respond to demands for research and deliver impacts at scale; and striking a balance between the needs of regions where fish production and supply chains are more developed and must adapt, versus regions where they are less developed and offer great promise to transform those countries' development futures. Notably, we work in five (Bangladesh, India, Malawi, Nigeria and Tanzania) of the 10 countries with the highest number of people living in extreme poverty—a total of around 180 million people.

■ FOCAL COUNTRIES
■ SCALING COUNTRIES
■ HEADQUARTERS



FROM **RESEARCH** TO **IMPACT**

REDUCED POVERTY THROUGH IMPROVED FISH-BASED INCOMES AND LIVELIHOODS



Around 800 million people depend on fisheries and aquaculture for their livelihoods. The very poor often rely on fishing as a primary source of income and are particularly vulnerable when fish stocks decline. We focus on mitigating risks to livelihoods and contributing to income generation and employment by supporting increased productivity from fisheries and aquaculture through innovative technologies and sustainable practices along with reduced waste in fish value chains.

Going to market with low-cost, fish-based innovations



■ *Solomon Islands, Timor-Leste*

Poverty, vulnerability and inequality persist in many sectors of Pacific Island society. Women, men and youth frequently have limited opportunities to improve well-being outside of natural resource exploitation and, in many cases, current livelihoods do not offer a pathway out of poverty and food insecurity.

Development investments often deliver ‘white elephants’—costly and poorly integrated infrastructure that is left unused. In coastal communities in Solomon Islands and Timor-Leste, we are helping to strengthen people’s own inventive solutions or build on their existing assets to enhance fish-based livelihoods, as this [video](#) shows.

In the village of Beacou in Timor-Leste, we worked with a women’s group to develop and market [fish-based products](#). The women buy sardines as soon as they are landed and clean, scale and prepare them for sale. Their recipe uses locally grown garlic, red onion and peppercorns. The cooked sardines are placed in glass jars that can be stored, distributed and sold at markets. The fish are eaten whole with bones—a local delicacy that supports micronutrient intake, for example from minerals in the bones.

The emphasis in [this project](#) was on co-identifying the opportunities that people see as immediately available, then working together to explore these opportunities in practice. We opted to work with the women in Beacou because they are well organized and have financial skills from earlier development initiatives. They had the knowledge on how to cook the fish but required assistance to catalyze their ideas into a small-business enterprise.

In Solomon Islands, we work with a network of women’s savings clubs with over 1000 members in Malaita Province. Their idea was to test whether [solar-powered freezers](#) for storing fish and other foods could improve their livelihoods in an area that is decades away from grid electrification. We arranged three solar-powered freezers in three different villages as pilots. The groups have targets for how much they need to save to show that they are on a trajectory to replace any machine parts within their expected lifetime. For example, a battery lasts for about five years.

Four months into the pilot, two of the groups had saved twice their target amount. The women store their food in the freezer and make money from renting out freezer space in the village. Freezer committees now operate small-scale

enterprises in nine remote villages. At the end of 2018, a total of 278 unique customers had used the freezers to store foods, and the freezer committees had earned in excess of USD 2800 (the cost of one freezer). As the freezer technology becomes cheaper and more available, it could transform remote Pacific Island food systems.

Transforming lives through sustainable small-scale aquaculture



■ Egypt, Nigeria

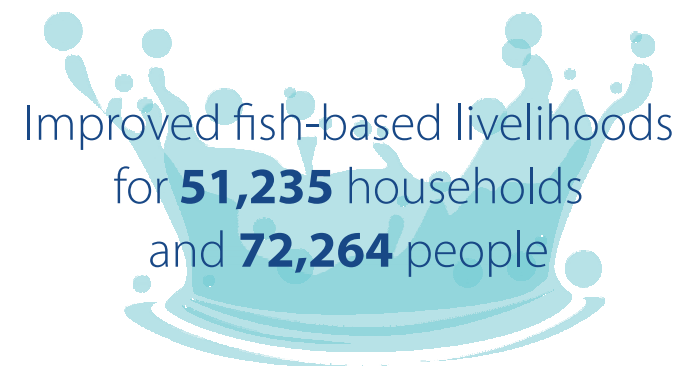
Increasing market demand for fish is transforming the lives of small-scale farmers in Nigeria and shows significant promise to drive rural development across Africa. That was the message of an April 2018 report by the United Kingdom's All-Party Parliamentary Group on Agriculture and Food for Development (APPG AgDev), which calls for the expansion of aquaculture in Africa to combat poverty, hunger and malnutrition. The report, [Aquaculture for Smallholder Farmers](#), states that research by WorldFish and others will be a key factor in realizing this potential.

Africa is well suited to small-scale aquaculture because of the large number of river systems across the continent. However, the aquaculture sector remains largely

undeveloped, says John Linton, Commercial Director at the Natural Resources Institute, which contributed to the APPG report and is a managing partner of [FISH](#). Research led by the Natural Resources Institute found that a [market-led approach](#) to aquaculture is a key driver of success, as evidenced by the thriving aquaculture sectors in Egypt and Nigeria, which produce most of Africa's 1.7 million metric tons of farmed fish. In Eriwe village in Nigeria, for example, smallholders grow catfish in ponds set across 150 hectares of land. Today, there are 57 cooperative groups with 1000 members. The average annual production from each group's two ponds is 16 metric tons, which generates between USD 10,000 and USD 15,000 gross profit—a huge amount of money in Nigeria.

“In this and similar circumstances, smallholder aquaculture is not simply profitable, it is transformational. These fish farmers, who were previously subsistence farmers living hand to mouth, now have an income that enables them to create better lives for themselves and their families.”

John Linton,
Commercial Director, Natural Resources Institute



Between 2005 and 2014, Africa's total aquaculture output tripled. Production continues to grow, meaning there is scope for millions more people to engage in and benefit economically and nutritionally from the sector.

To realize these benefits, the APPG report recommends investment in research and knowledge transfer, like that being done by WorldFish. Since 2017, we have been researching ways to enhance the productivity, profitability and sustainability of aquaculture in Africa. This work resulted in 2018 in the publication of several key papers, establishing, among others, the [nature of genotype-by-environment interactions](#) in adaptation of genetically improved farmed tilapia (GIFT) to different geographies and environments. These publications provide an important foundation for applying genomic selection tools to breed new traits into tilapia to reduce disease risks and enhance resilience and productivity in future.

LESS HUNGER AND MALNUTRITION FOR IMPROVED HEALTH THROUGH FISH



Factors such as low incomes, insufficient fish supplies and inefficiencies in value chains constrain access by poor consumers to highly nutritious and affordable fish products. Postharvest losses are a particularly widespread challenge, as is a lack of information on good nutrition. We apply a food systems approach as well as social- and behavior-change communications, where appropriate, to help feed billions and nourish nations in the developing world.

Netting nutrition gains through integrated rice-fish farming systems



■ Cambodia

Missing out on nutritious food at a young age can have long-term impacts on physical and cognitive development and can increase the risk of poor health as an adult. Acute malnutrition, stunting and micronutrient deficiencies have been estimated to cost Cambodia up to USD 266 million annually, or 1.7 percent of gross domestic product.

Our [policy work](#) around wild fish conservation and research into improved management of 140 community fish refuges (CFRs) is enabling small-scale fishers to meet the food and nutrition needs of their families.

CFRs are natural or humanmade ponds that hold water throughout the year and provide a dry season refuge for brood fish. In the dry season, these refuges become disconnected from permanent natural water bodies. In the wet season, when water levels rise, the fish migrate out of the CFRs to the rice fields and floodplains to spawn and feed.

Fishing is prohibited year-round in the CFRs, but rice fields become open access fishing grounds when inundated. Rice field fisheries contribute up to 28 percent of Cambodia's capture fisheries and are a promising sub-sector to increase catches and meet the domestic demand for food.

Despite their importance to rural livelihoods, integrated rice-fish farming systems were largely neglected as a focus of detailed research until the advent of the innovative CFR approach. Our [research](#) shows that CFRs, with better management, can significantly improve fish productivity of the rice field environment as soon as one year after the intervention.

Due to their accessibility to many nearby households, these improved environments are an important source of nutritious fish and fish-based foods. They are particularly beneficial for lactating mothers and other caregivers who experience poverty and vulnerability.

Our monitoring shows that people supported by this project are applying good practices to conserve and increase fish stocks and improve nutrition. In one year, the amount of fish caught increased by 30 percent, and the proportion of children under five eating nutrient-rich small fish increased by 50 percent.

Families also sell their surplus harvests, generating additional income that can be spent on other food items, medicines and their children's education. By 2021, more than 296,000 people are expected to have benefited from the project's integrated approach.

Promoting consumption of nutrient-rich fish products to prevent malnutrition in women and children



■ *Malawi, Tanzania, Zambia*

Poor nutrition during the first 1000 days of life—from conception to the child's second birthday—can result in permanent developmental problems. The Demographic and Health Surveys conducted in Malawi (2015–2016) and Zambia (2013–2014) showed that 37 percent and 40 percent respectively of children under five suffer from stunting, which results from chronic malnutrition.

As research suggests that fish is usually consumed only by adults, we are working with our partners in communities in three African countries to improve the quality and diversity of diets for all family members, through the creation of innovative and locally acceptable, nutrient-rich fish products. Small fish species are dried and turned into a powder, using

simple processing methods (mortar, pestle and sieve) to fortify local recipes. Fish powder is especially useful for inclusion in the diets of young children, beginning with complementary feeding at six months of age.

Fish are rich in vitamin B12, calcium, iron, zinc, fatty acids and animal protein, and some small fish are especially rich in vitamin A. Essential fatty acids, some of which are only found in fish, are critical for pregnant and lactating women and young children, as they are vital for cognitive development in the first 1000 days.

In Malawi and Zambia, we [conducted](#) focus group discussions about locally available foods and food preferences. We then tested the acceptability of fish powder through cooking demonstrations and sensory evaluations of dishes prepared from locally adapted recipes. Based on this initial success, we were invited to talk to women from Zambia and Tanzania about nutrition in the first 1000 days.



The women were given a hands-on demonstration of home production of fish powder and preparation of dishes promoted by the National Food and Nutrition Commission of Zambia. When the cooking was completed, participants were invited to taste each of the two dishes and feed them to children over six months old. The women and children enjoyed the dishes. The women noted that an additional benefit of the fish powder is that it can be 'hidden' in dishes to lessen the fishy smell, which was reported to make pregnant women nauseous.

Future research will include nutrient analyses of fish powders processed using different drying, smoking and powdering methods as well as appropriate methods and tools to promote the adoption of fish powder at community and national level.

139,895 women and children
were better nourished,
of which **16,558** were
women of reproductive age

MORE SUSTAINABLE FISH AGRI-FOOD SYSTEMS



In the face of climate change and other threats, we recognize the need to restore degraded fish agri-food systems and manage them more sustainably. We use life-cycle assessment to quantify the environmental impacts of aquaculture production and identify solutions for the development of sustainable aquaculture systems. In small-scale fisheries, we work to integrate local-scale action research on tenure systems with analysis of broader institutions and policies for governance, contributing to equitable resource use and restoration of agroecosystems in both inland and coastal environments.

Sharing learning and building incentives to conserve the hilsa fishery



■ Myanmar

For Myanmar's small-scale coastal and inland fishing communities, the hilsa fish is a vital resource. Fishing hilsa employs over 1.5 million people in the country's most impoverished areas and provides a crucial source of food for many more.

Hilsa can live for up to five years and will spawn three times in that period. Due to overfishing and habitat destruction, however, hilsa rarely survive beyond three years, and juveniles are often caught on their return to the sea after around five

months in freshwater nursing grounds. As a result, stocks are declining. The decline is dramatic: in 2011–2012, the hilsa fishery generated an estimated USD 45 million. By 2015, that figure had dropped to USD 15 million.

We are working with local partners, including the Myanmar Department of Fisheries, and hilsa fishing communities to develop a cost-effective, scientifically researched and participatory incentive-based fisheries management mechanism that will ensure the long-term sustainability of the hilsa fishing sector.

The work builds on the ECOFISH-BD project, which helped to enhance the effectiveness of incentive-based [hilsa fishery management in Bangladesh](#). The project also aims to promote co-learning opportunities between Bangladesh and Myanmar, which share the hilsa resource.

*“The project is providing **valuable up-to-date research** into the current status of the hilsa fishery in the Ayeyarwady Delta and will soon be able to put a **total economic value on this important fishery.**”*

U Khin Maung Maw,
Director General, Myanmar Department of Fisheries

In the first year, monthly studies were undertaken to record the maturity of hilsa to determine the egg-laying periods during which the fish need to be better protected. These were combined with a series of participatory social studies to ask fisherfolk about their perceptions regarding the fishery over the last decade.

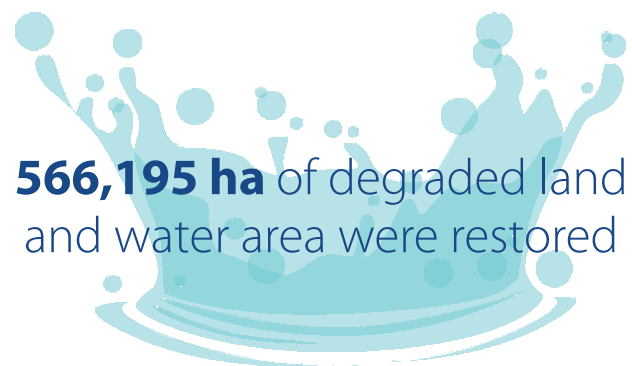
Incentives designed to ensure that the closed season during spawning is respected will include a series of awareness-raising activities coupled with training in alternative income-generating activities.

Tackling the plastic plague in coastal communities



■ Kiribati, Solomon Islands, Timor-Leste, Vanuatu

In the remote village of Adara on Timor-Leste's Atauro Island, men and women have long relied on fishing as the primary source of income. But fishing is not always possible because of rough weather or other threats. With partners, we have been [supporting the community](#) to set up a small ecotourism venture to develop an island-first locally managed marine area. This has helped to attract tourists to snorkel and dive on the newly protected area of reef wall in front of the village, providing a much-needed new source of income.



Worryingly, this income is being affected by marine litter, mostly plastic. Every minute globally, the equivalent of one dump truck of plastic enters our oceans. Fish and other animals often mistake plastic for food, causing them to choke or get sick by ingesting it. This is a concern for villagers, who rely on fish for animal protein.

Marine litter is just one of many pressures facing the Adara villagers and eroding the benefits provided by small-scale fisheries globally. Other pressures include competition with industrial fisheries, increasing pollution from land activities, climate change, environmental degradation and rapid coastal development.

Improved management and participation by fishers in management processes is crucial to improve livelihood resilience and the sustainability of fisheries resources. Research that focuses on some of these vulnerabilities and seeks to build the resilience of small-scale fisheries is therefore a key focus of our work.

In Timor-Leste, we [worked](#) with local fishers to adapt and test the design of nearshore fish-aggregating devices (FADs). This has enabled fishers to catch more oceanic fish with less effort, helping to reduce reliance on vulnerable reef resources and enhance livelihoods. Research in Solomon Islands, Kiribati and Vanuatu aims to improve fisheries governance in these countries. Learnings from this research will be scaled across the Pacific region to ensure fish remains a vital source of food, income and nutrition.

In addition to on-the-ground research, we are partnering with the FAO and Duke University to [assess](#) the contribution of small-scale fisheries to food security, nutrition and poverty reduction globally. The work is a continuation of the [Hidden Harvest study](#) released in 2012—arguably the most comprehensive research effort to quantify the economic importance of small-scale fisheries on a global scale.

The updated study, due out in 2020, will help draw the attention of decision- and policymakers to small-scale fisheries, which are often underreported and undervalued in governance and policy decisions and in discussions of food futures. At the same time, it is hoped that increased recognition of the importance of small-scale fisheries will spark action by individuals to reduce the use of disposable plastics such as bags, bottles, straws and food packaging.

INFORMING ACTION ON CLIMATE CHANGE



Climate change impacts fisheries and aquaculture directly, by influencing production quantities and efficiency, or indirectly, by impacting the market price of fish or the costs of goods and services required by the fisheries and aquaculture sectors. Our research on climate change therefore seeks to provide new knowledge on mitigation and adaptation strategies to build resilience among poor fish-dependent populations across Africa, Asia and the Pacific.

Implementing gender-sensitive adaptation strategies in the fragile Lake Chilwa Basin



■ Malawi

The impacts of climate change and variability pose unprecedented challenges to the governance of fish agri-food systems. At the same time, the effects of climate change are felt differently by men and women. Thus, women need different strategies from men to enable them to adapt. This is the finding of research we carried out as part of the Lake Chilwa Basin Climate Change Adaptation Program ([LCBCCAP](#)). The program emphasized empowering both women and men using a gender-transformative approach (GTA) to make their livelihood choices environmentally, economically and socially sustainable.

This approach, which WorldFish has been [pioneering](#) in fisheries and aquaculture since 2012, firstly aimed to influence positive change in norms, attitudes, beliefs and practices related to gender roles. Secondly, it aimed to strengthen the role of women in decision-making in various contexts, ranging from households to local government.

To achieve the desired transformation, we formed and strengthened 100 GTA platforms in the Lake Chilwa Basin. The platforms were organized to provide space for local discussions and share best adaptation practices from a gender perspective. From the 100 platforms, the program trained 70 (38 women and 32 men) GTA champions, who in turn facilitated 30 community GTA seminars. The seminars helped men and women to realize and act on traditional norms and beliefs that only favor men.

In addition, the program promoted economic empowerment activities primarily targeting women (without excluding men) to reduce economic inequality. These mainly involved processing and marketing fish products. [Solar fish dryers](#) and energy-efficient fish smoking kilns were constructed to increase the value of fish products and reduce postharvest losses.

The LCBCCAP case is included in the [book](#) *Socio-Ecological Resilience to Climate Change in a Fragile Ecosystem – The Case of the Lake Chilwa Basin, Malawi*. Co-edited by WorldFish scientist Joseph Nagoli, it provides a review of the research and interventions carried out as part of the program.

The program is one of the first to apply the [ecosystem approach](#) on such a wide temporal and spatial scale and provides key lessons for the protection of other fragile

ecosystems threatened by climate change. It is also the first such comprehensive research dedicated to the Lake Chilwa Basin since 1979. The book was launched during the WorldFish-sponsored 6th Pan-African Fish and Fisheries Association International Conference, held from 24–28 September in Mangochi, Malawi.

Reducing the carbon footprint of farmed shrimp with better feeding and management practices



■ Vietnam

Around 34 percent of the world's shrimp production comes from Southeast Asia. In these tropical countries, shrimp farms often result in the removal of mangrove forests. Mangrove trees grow in areas of waterlogged soils, where fine sediments accumulate due to slow-moving waters. In these environments, mangroves hold large amounts of carbon that is stored for centuries, mostly below the ground. The majority of this is released when the mangrove is transformed into aquaculture ponds.

However, the rate of mangrove conversion to aquaculture ponds has greatly reduced over the last decade, a key reason being that an increasing number of countries are recognizing

the many ecosystem services these forests provide. In Thailand and Vietnam, for example, greater efforts are being made to conserve the remaining mangrove forests, by prohibiting ponds from being established in mangrove areas.

The assumed lifetime of a shrimp pond is another important consideration, as emissions are annualized or amortized over this time period. The longer a pond can be used, the less land is needed and, consequently, the lower the overall carbon footprint of farmed shrimp will be. Some [research](#) suggests that shrimp ponds are only actively used for between five and 10 years.

Our [research](#) with partners in Vietnam found that extensive shrimp farms, where shrimp are farmed in relatively large ponds at low density and with few inputs, are used for 50 years or more. Even in intensive systems, where shrimp are raised at high densities on commercial feeds, improved feeding and management practices have greatly improved the long-term productivity of ponds.

Today, more than half of all farmed shrimp is produced in semi-intensive or intensive production systems, with high stocking densities of up to 35 metric tons per hectare. Despite this, some carbon footprint estimates are based solely on low-yielding extensive systems. In addition, large volumes of wild shrimp, crabs and fish are harvested from these systems. This fact is sometimes overlooked when calculating a shrimp's carbon footprint, resulting in the shrimp, which is a co-product in mixed-mangrove systems, being allocated all the greenhouse gas emissions related to the mangrove removal. Our research showed that when co-production is considered, the carbon emissions allocated to shrimp are often half or less of the overall emissions.



However, with no slowdown expected in global demand for shrimp, which is driven mostly by consumers in developed countries, efforts to improve the productivity and sustainability of shrimp farming in developing countries will become ever more important.

So far, the evidence indicates that we are on the right track. The value of mangroves is increasingly being recognized and efforts by WorldFish and others to train farmers are leading to better feeding regimes and management practices, all of which can reduce the carbon footprint of farmed shrimp.

EMPOWERED WOMEN AND YOUTH



Achieving impacts at the scale of our ambition can only happen by leveraging the dynamism of private enterprise and creating new jobs and better economic opportunities, particularly for women and youth.

We work in fisheries and aquaculture value chains to tap the vast potential offered by fish processing and trade, the supply of inputs such as locally produced feed and seed for aquaculture, and the marketing and distribution of nutritious fish-based products for maternal and child health.

Photovoice: A high-impact research method that empowers women



■ Malawi

The use of photos and comments by research participants to tell their own stories, known as photovoice, is a fast, cost-effective and high-impact research method, making it a valuable tool for gender and other social scientists in fisheries and aquaculture. The method was the focus of a special workshop at the WorldFish-sponsored [7th Gender in Aquaculture and Fisheries Conference](#) in Bangkok from 18–21 October.

Photovoice is increasingly being used as a research method that gives research participants cameras to take photos on loosely worded themes and, usually, write accompanying comments in a diary. Findings of photovoice projects are typically presented in exhibitions, to inform decision-makers of outcomes of projects or to highlight issues needing to be addressed.

As a participatory method, photovoice offers considerable promise for capturing the unique perspectives of vulnerable, uneducated and marginalized populations, such as women in fisheries, because of its flexibility in design and use of photography as a means of language—sometimes a barrier in standard social methods such as questionnaire surveys.

In the small-scale inland capture fishery of Lake Chilwa, Malawi, photovoice was used to capture the perceptions of men and women fishers regarding their fish-related activities, the benefits obtained and challenges experienced. A modified version of the assessment was produced to improve the understanding of gender in the sector and included a one-to-one interview with participants to develop narratives around photographs.

The method produced rich data on the value of the sector for food and nutrition security and reduced vulnerability. Fishers highly valued their fish-related activities and outlined that through fish-related income they were able to meet their household food needs and diversify livelihoods.

In addition, through discussions on prioritization of challenges, fishers identified climate variability and the associated impacts of low fish availability. The method captured the complexity of context-specific factors and produced policy-relevant results that highlight the hidden value and challenges in small-scale inland capture fisheries and help make the role of women more visible. With the increased interest in previously overlooked aspects of gender in small-scale fisheries and aquaculture research, results like these could not be timelier.

Private sector collaboration boosts youth opportunities



■ Zimbabwe

After a month of intensive, hands-on practical learning, students from across Southern Africa completed the first Aquaculture Vocational Mentorship Course, held at the Lake Harvest company in Zimbabwe.

Located on Lake Kariba, Lake Harvest is the largest aquaculture farm in Zimbabwe and one of the largest in the Southern African Development Community (SADC). The participating students were drawn from Lesotho, Malawi, Namibia, Tanzania, Zambia and Zimbabwe.

The [vocational course](#), which we ran in collaboration with Chinhoyi University of Technology and Lake Harvest, aims to promote aquaculture development in Africa by improving the practical application of university education, ensuring that graduates have sufficient practical experience to work on or run a fish farm after graduation. The course objectives and learning outcomes were designed in such a way that, at the end of the month, the students were expected to have:

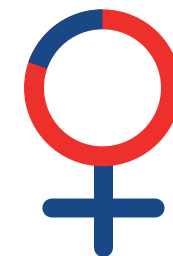
- increased basic understanding and appreciation of aquaculture practices, fish rearing and management;
- gained hands-on, practical experience in freshwater aquaculture and fish farming through placement at fish farms on Lake Kariba;
- understood the intricacies and complexities of carrying out successful fish farming projects and programs;
- implemented the knowledge acquired to help support aquaculture development in Africa by growing the aquaculture industry in their respective countries.

By partnering with Chinhoyi University and other higher education institutions, we are augmenting the skills of new graduates to develop science-based models that can help in aquaculture research and development in the SADC. Across the region, we are working with several universities to help align their aquaculture research and teaching with the [SADC Regional Aquaculture Strategy and Action Plan \(2016–2026\)](#).



29 TRAINING PROGRAMS
IN 21 COUNTRIES

242,256
PARTICIPANTS
80% WOMEN



TRAINING TOPICS



- 🐟 HOUSEHOLD-BASED POND AQUACULTURE
- 🐟 NATIONAL FISH HEALTH MANAGEMENT STRATEGY
- 🐟 IMPROVED PRODUCTION TECHNOLOGY
- 🐟 CLIMATE-SMART TECHNOLOGY
- 🐟 CLIMATE ADAPTATION AND LIVELIHOOD PROTECTION

BUILDING LOCAL CAPACITY IN LINE WITH NATIONAL DEVELOPMENT PRIORITIES



We believe capacity development is a key enabler for sustainable long-term impact. We work with local stakeholders along our research-to-development impact pathway to assess capacity needs and intervention strategies, taking into account national development priorities. We build scientific research capacity by mentoring and supporting young scientists and researchers pursuing master's or doctoral degrees, by promoting South-South collaboration, by encouraging dissemination and adoption of practical skills and knowledge, and by developing innovative learning materials and approaches that are gender and youth sensitive, such as those employed at the WorldFish-run [Africa Aquaculture Research and Training Center](#) in Abbassa, Egypt (see box on page 23).

Modified Secchi disk improves management practices for farmers with low or no numeracy skills



■ Sierra Leone

A modified Secchi disk to measure water transparency in ponds and determine the amount of plankton is helping smallholders in [Tonkolili District](#), one of Sierra Leone's poorest and most nutritionally insecure regions, to farm fish as part of profit-oriented agribusinesses.

Plankton causes the pond water to turn green and serves as natural food for the fish. A Secchi disk, which consists of a circular plate painted with alternating black and white quadrants, is typically mounted on a numerically graduated string and lowered into the water. The depth at which it is no longer possible to tell the difference between the black and white parts of the disk is taken as a measure of the transparency of the water.

Farmers with low or no numeracy skills are unable to take or interpret the traditional reading. As a result, the version used in Sierra Leone was modified to ensure farmers, regardless of their education level, could benefit from the technology.

The numerically graduated string was replaced with a color-coded string that farmers use to differentiate the various levels of transparency and availability of plankton according to depth. The technology is inexpensive, easy to use and made with locally available materials.

“The Secchi disk has been very helpful not just to us as farmers but also to the other household members as it helps us to decide if the pond water is green or not. The colors in the string help us to determine when to add fertilizer to the pond.”

Mabinty Sankoh,
fish farmer, Sierra Leone

In addition to receiving training on the importance of using a Secchi disk during fish production and how to interpret the color code to determine the amount of plankton in their pond water, farmers have learned what actions to take when the water transparency of their ponds reaches each color.

In collaboration with our partners, we produced three videos covering the [use of the modified Secchi disk](#), [good pond management](#) (specifically testing for pH) and [developing fish marketing plans](#). Available in English and Temne, the videos will be incorporated into farmer learning and extension activities implemented by the local government and other development actors.

New digital platform to provide vital information for aquaculture value chain actors



■ Bangladesh

A [new agreement](#) with ACI Agribusiness, a leading aggregator of agri inputs in Bangladesh, will enable us to provide timely and affordable access to digital advice to small-scale fish farmers and their local service providers. The agreement is in line with our increasing use of digital technologies for both information collection and

dissemination to support decision-making and capacity building.

Rupali, which we are jointly developing with ACI Agribusiness and the USAID-funded [Feed the Future Bangladesh Aquaculture and Nutrition Activity](#), will be helpful to retailers and dealers of feeds, aqua chemicals and pond mechanization equipment, hatchery owners, fish wholesalers, officials and researchers of government and non-governmental extension services.

For fish farmers, Rupali will assist in all aspects of aquaculture from stock planning to taking the end-product to market. It is expected that fish farmers will be able to increase their productivity and profitability by following the platform's advice. The target is to have 7500 users in the first year and 45,000 or more in the second year.

By increasing access to information for fish farmers and other actors in the aquaculture value chain, Rupali will help the sector to become more efficient and responsive to the needs of Bangladeshi consumers, while ensuring the financial sustainability of both small-scale and larger scale operators.

Users will be able to access Rupali, which is due to be launched in the second half of 2019, via a mobile app, website, SMS and outbound and inbound call center. ACI Agribusiness will initially implement the platform in five districts in south-west Bangladesh—Bagerhat, Khulna, Gopalganj, Satkhira and Jessore—the first three of which have productivity below the national average. We will provide management, monitoring and evaluation support as well as transfer aquaculture-related global best practices.

Building vibrant sustainable aquaculture and fish value chains in Africa

Since its establishment in Abbassa, Egypt in 1998, the [Africa Aquaculture Research and Training Center](#) has facilitated an increasing exchange of scientific knowledge and learning and built the capacity of thousands of government officers, fish farmers, aquapreneurs, extension agents and university faculty, students and researchers from 108 countries across Africa, Asia and the Pacific. The center has also played an instrumental role in shaping the success of Egypt's aquaculture sector. It continues to attract strong international and regional interest from multinational companies that are partnering with us for research and capacity development in aquaculture and fish value chains.

In 2018, participants from ten countries in the Economic Community of West African States attended trainings at the center under the Technologies for African Agricultural Transformation ([TAAT](#)) initiative, which seeks to scale proven technologies across 22 countries. WorldFish is leading the implementation of the Aquaculture Compact of the initiative, which is funded by the African Development Bank. Skretting, a global private sector aquafeed manufacturer, also renewed its long-standing collaboration with the center on new research on novel feed, market dynamics and consumer demand to boost fish-based business and opportunities throughout Africa.

LIVING OUR VALUES

WorldFish is founded on the values of integrity and trust, fairness and equity, excellence and innovation, and teamwork and partnership. We aspire to be an organization that is built to learn and respond rapidly to change by optimizing the flow of information, encouraging experimentation and organizing as a network of staff and stakeholders motivated by a shared purpose.



Integrity and trust



We are honest, open and accountable with the resources invested in us, and we deliver on our commitments.

Fairness and equity



We respect and celebrate diversity and actively challenge social and gender inequities that impede progress toward our goals.

Excellence and innovation



We pursue high standards of scientific and professional rigor and embrace impartial evaluation, critical reflection, learning and adoption.

Teamwork and partnership



We seek to leverage our complementary strengths within teams and across institutional boundaries to achieve the greatest impacts.

In 2018, we launched several initiatives that support our commitment to living our values across the organization.

Saying no to single-use plastics

We kicked off the 'no single-use plastics' campaign to raise awareness about the impact of single-use plastics, particularly in marine environments, and eliminate them in the office by providing staff with reusable plastic water bottles and encouraging the use of tiffin carriers for takeaway lunches. We also negotiated with our external caterers to stop using single-use plastics at work events. The initiative was successfully adopted at the head office in Penang, and several country offices are following suit.

Gender equality in the workplace

We made significant progress on our commitment to fairness and equity. We increased the number of [women in science](#) by 10 percent to just under 40 percent. At the end of 2018, women accounted for 60 percent of staff in the management category, while the number of women in the Executive Team increased from 20 percent to 30 percent.

Innovation and Learning Lab

In March, a cross-functional team within WorldFish came together to form an Innovation and Learning Lab. The team used a data-driven methodology to identify and address challenges in project start-up and on-time delivery of contractual requirements—both priority organizational challenges. Two pilot tests were designed that will inform a range of recommendations to improve performance in 2019. The initiative was well received, with a 25 percent improvement in on-time reporting six months after the lab was formed.

Building science capacity and quality

Science capacity is central to our ability to deliver our strategy. Building science capacity was a priority in 2018, with a target of 47 science staff by the end of the year, an increase of 20 percent. Coupled with this was the introduction of more flexible human resources systems. Key scientists are now working across different country programs, sharing skills and facilitating knowledge transfer, particularly from Asia to Africa.

Our investment in science capacity was supported by a stronger focus on research quality for our own and partner scientists. These efforts will draw on some of the methods piloted in the Innovation and Learning Lab, bringing together scientists to look at underlying science quality issues and test data-driven innovations for improvement.

Monitoring and evaluation

The appointment of a dedicated monitoring and evaluation leader and the adoption of the award-winning Monitoring, Evaluation and Learning Platform ([MEL](#)) is facilitating our capacity to monitor progress toward outputs, outcomes and impacts as well as improving our overall research management capacities. The platform will be fully operational in 2019, and training is planned to support organization-wide implementation.

Fish for Thought

We revamped and rebranded our Fish for Thought events with exciting new and interactive formats to enable greater sharing of data, knowledge and learning across different science disciplines, different projects and country offices in various geographic locations as well as between WorldFish staff and other external research and development professionals, experts, strategic partners and investors. The goal is to use these events to enhance the quality, outreach and impact of our research work, foster an organizational culture of proactive knowledge sharing, learning and innovation and position WorldFish as a research and thought leader on sustainable aquaculture and fisheries development.

COMMUNICATING **SCIENCE KNOWLEDGE AND EVIDENCE**

We believe that effective communication of our research and the scientific evidence we produce is critical for making a difference to the people whose livelihoods, in both the developing and developed world, depend on and are shaped by fish.

Those who support our work understand through communication that our research is relevant because it helps shape solutions to many pressing development challenges. At the same time, effective communication enables others to translate our science into actions—from discourse and advocacy to practice and policy.

Expanding digital reach

In 2018, we began developing a comprehensive communications and marketing strategy that will increase our recognition as a global leader in fisheries and aquaculture research and raise the profile and impact of our research evidence. The strategy will be driven by a stronger focus on new and digital media and the behavior-change communications approach employed by the development sector to effect lasting societal change.

We launched the [FISH website](#) and a dedicated FISH social media strategy. FISH has its own [Facebook](#) and [Twitter](#) accounts to complement the WorldFish presence on

[Facebook](#), [Twitter](#) and [LinkedIn](#). At the end of 2018, we had 40,575 total followers across all our social media channels and increased the number of new followers by 44.5 percent compared to 2017.

For the first time, we established a global network of communications specialists affiliated with WorldFish projects and/or country offices, with guidance and support from the Communications and Marketing team in Penang. The network meets monthly to share experiences, knowledge and learning, identify strategic communications opportunities and plan innovative communications products and digital campaigns. This year, these campaigns included [World Food Day](#) (16 October) and [World Fisheries Day](#) (21 November). Their aim was to promote specific research achievements and contributions to various target audiences in the context of the wider global conversations taking place around these days.

Our external communications efforts were complemented by more coordinated and regular internal communications to support innovation, learning and knowledge sharing across the organization. This was facilitated by the widespread adoption of MS Teams, cloud-based team collaboration software.

2.5
MILLION
PEOPLE

**SOCIAL MEDIA
OUTREACH**

746
STORIES

ABOUT OUR WORK AND
WORLD FISH
IN INTERNATIONAL NEWS

 **479**

TWEETS MENTIONED
A PAPER
IN **NATURE**
CLIMATE CHANGE

667.5
MILLION
MEDIA REACH 

 **14**

INTERNATIONAL
MEDIA STORIES
ON **PRIVATE SECTOR**
AGREEMENT WITH
SKRETTING



44.5% INCREASE
IN **SOCIAL MEDIA**
FOLLOWERS

 **265,881**
VIEWS

SELECTED PUBLICATIONS

The following is a selection of key publications from 2018. Find all our publications and research outputs on our [website](#).



Cinner JE, Adger WN, Allison EH, Barnes ML, Brown K, Cohen PJ, Gelcich S, Hicks CC, Hughes TP, Lau J et al. 2018.

Building adaptive capacity to climate change in tropical coastal communities.

Nature Climate Change 8:117–123.

DSpace: <http://hdl.handle.net/20.500.12348/667>

DOI: <https://doi.org/10.1038/s41558-017-0065-x>



To minimize the impacts of climate change on human well-being, governments, development agencies and civil society organizations have made substantial investments in improving people's capacity to adapt. To date, these investments have tended to focus on a very narrow understanding of adaptive capacity. Here, the authors propose a new approach to build adaptive capacity across five domains.



McCauley DJ, Jablonicky C, Allison EH, Golden CD, Joyce FH, Mayorga, J and Kroodsma D. 2018.

Wealthy countries dominate industrial fishing.

Science Advances 4(8):eaau2161.

DSpace: <http://hdl.handle.net/20.500.12348/2339>

DOI: <https://doi.org/10.1126/sciadv.aau2161>



This article reports patterns of industrial fishing effort for vessels flagged to higher and lower income nations, using analyses of high-resolution fishing vessel activity data. Insights from these analyses can strategically inform important international- and national-level efforts to ensure equitable and sustainable sharing of fisheries.



Henriksson PJG, Belton B, Jahan KM, Rico A. 2018.

Measuring the potential for sustainable intensification of aquaculture in Bangladesh using life-cycle assessment.

PNAS 115(12):2958–2963.

DSpace: <http://hdl.handle.net/20.500.12348/715>

DOI: <https://doi.org/10.1073/pnas.1716530115>



Life-cycle assessment is operationalized here as a tool to evaluate a range of environmental impacts resulting from the intensification of aquaculture production in Bangladesh and a subset of trade-offs among them. These findings are used to identify simple improvements in farm management practices that can make the intensification of aquaculture more sustainable and avoid some of the environmental pitfalls of agriculture and livestock production.



Selig ER, Hole DG, Allison EH, Arkema KK, McKinnon MC, Chu J, de Sherbinin A, Fisher B, Glew L, Holland MB et al. 2018.

Mapping global human dependence on marine ecosystems.

Conversation Letters 12(2):e12617.

DSpace: <http://hdl.handle.net/20.500.12348/2225>

DOI: <https://doi.org/10.1111/conl.12617>



The authors created a new conceptual model to map the degree of human dependence on marine ecosystems based on the magnitude of the benefit, susceptibility of people to a loss of that benefit and the availability of alternatives. The model showed that more than 775 million people are highly dependent on marine fisheries, providing the basis for more targeted management and policy interventions for vulnerable small-scale fishing communities.



Jansen MD, Ha TD, Mohan CV. 2018.

Tilapia lake virus: a threat to the global tilapia industry?

Reviews in Aquaculture 1–15.

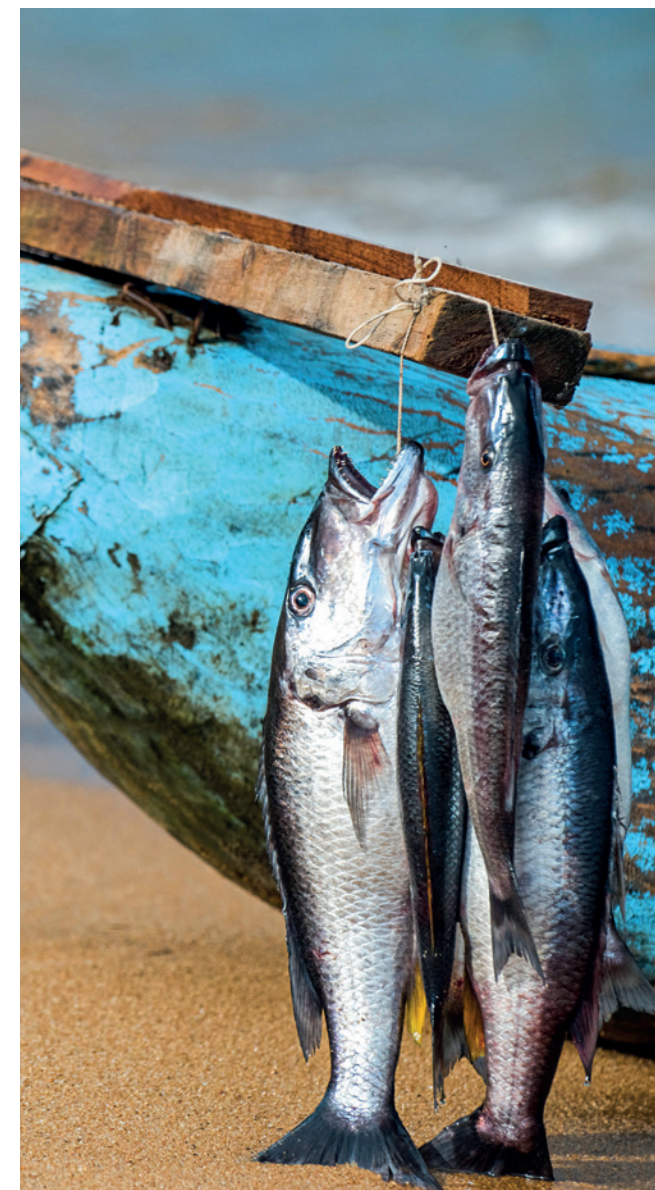
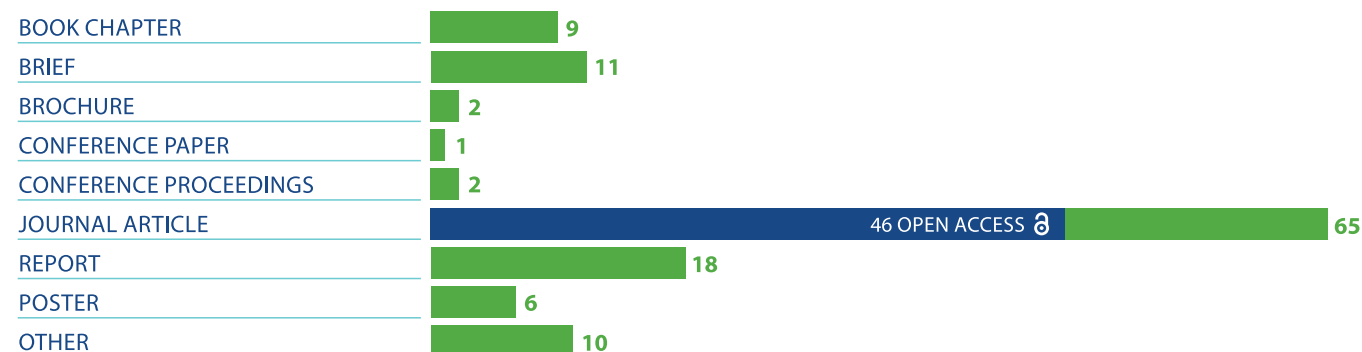
DSpace: <http://hdl.handle.net/20.500.12348/717>

DOI: <https://doi.org/10.1111/raq.12254>



Tilapia lake virus (TiLV) is a recently described virus affecting wild and farmed tilapines. Currently, there are severe knowledge gaps relating to TiLV and no effective, affordable vaccines available. This paper summarizes the published scientific information on TiLV and highlights important issues relating to its diagnosis, mitigation and control measures.

2018 publications by type | Total: 124



OUR PARTNERS

Our work is rooted in multidisciplinary science and food systems thinking. It is guided by national priorities and the capacity development needed to improve agricultural research and extension systems; it is enhanced by our unique ability to convene and broker novel partnerships with development actors and the private sector as a mechanism to take innovations through to impact at scale.

We had 179 active partnerships in 2018, 86 of which were new. At the global level, an [agreement](#) with the FAO aims to enhance the well-being of millions of consumers, producers and fisheries-dependent people worldwide by combining our research skills and experience with the FAO's policy-influencing capacity and reach.

In addition, the number of private sector partners rose from nine in 2017 to 32 in 2018. A [new agreement](#) with the global aquafeed manufacturer Skretting will help to accelerate the scaling of tried and tested technologies and best management practices. Initially focusing on Egypt and Zambia, the partnership will pave the way for fish to boost more nutritious diets and secure livelihoods across the African continent.



OUR INVESTORS

Our research is designed to address specific challenges within the global 2030 sustainable development agenda (see page 8). Our work is funded by an extensive network of investors committed to tackling these challenges. Thanks to their generous support, we are helping to eradicate poverty, hunger and malnutrition among the millions of people who depend on fish for food, nutrition and income in the developing world.

Advanced research institutes

- Australian Centre for International Agricultural Research
- International Institute for Environment and Development
- National Institute of Water and Atmospheric Research
- Skretting Egypt
- Winrock International

Governments

- Assam Rural Infrastructure and Agricultural Services Society
- Bangladesh Local Government Engineering Department
- Bureau of Agricultural Research, Department of Agriculture, Philippines
- Department for International Development, United Kingdom
- Department of Agriculture, Forestry and Fisheries, South Africa
- Department of Agriculture Research and Education, India
- Department of Foreign Affairs and Trade, Australia
- Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH

- European Commission
- Federal Ministry for Economic Cooperation and Development, Germany
- Fisheries and Animal Resources Development Department, Odisha, India
- Fisheries Research Institute, Malaysia
- International Development Research Centre
- Irish Aid
- Ministry of Agriculture and Land Reclamation, Egypt
- Ministry of Economic Affairs, the Netherlands
- Ministry of Foreign Affairs and Trade, New Zealand
- Ministry of Foreign Affairs, Japan
- Ministry of Foreign Affairs, Norway
- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
- Norwegian Agency for Development Cooperation
- Swedish International Development Cooperation Agency
- Swiss Agency for Development and Cooperation
- United States Agency for International Development

Financial institutions

- Asian Development Bank
- Critical Ecosystem Partnership Fund
- International Fund for Agricultural Development
- Livelihoods and Food Security Fund
- The Mohamed bin Zayed Species Conservation Fund

Foundations

- Bill & Melinda Gates Foundation
- Fondation Ensemble
- Foundation for Ecological Security
- Foundation for Rural Enterprises & Ecology Development of Mindanao
- Oak Foundation
- Walton Family Foundation

International organizations

- Centre de Coopération Internationale en Recherche Agronomique pour le Développement
- CGIAR Trust Fund
- Food and Agriculture Organization of the UN
- IDH the Sustainable Trade Initiative
- International Centre for Environmental Management
- US Soybean Export Council
- World Bank
- World Food Programme

Non-governmental organizations

- Conservation International
- Farm Africa
- Plan International
- Save the Children
- Synergos
- Solomon Islands Association of Community Learning Centres
- Solomon Islands Community Conservation Partnership

Private sector

- Euroconsult Mott MacDonald
- Msingi East Africa Limited
- Skretting

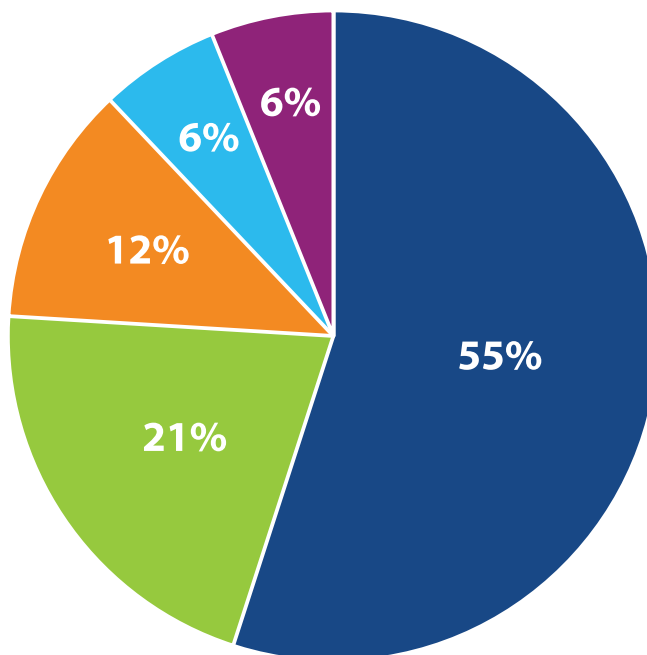
Regional organizations

- Pacific Community
- Pacific Islands Forum Secretariat

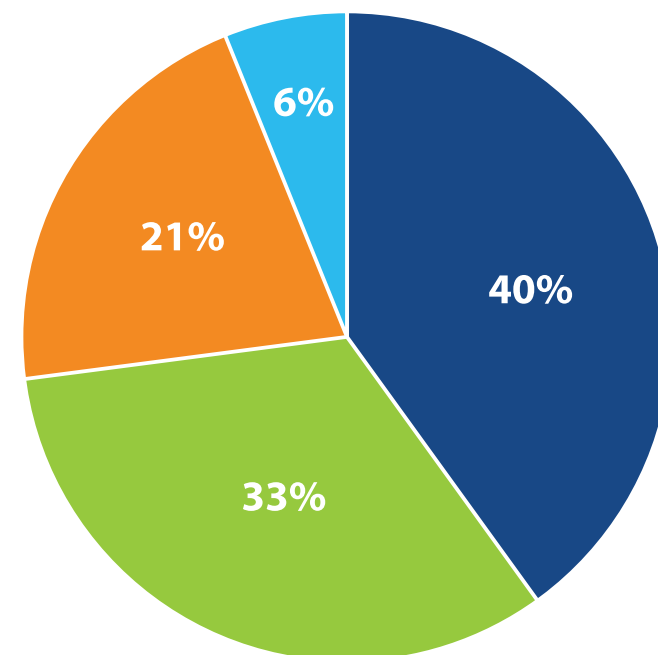
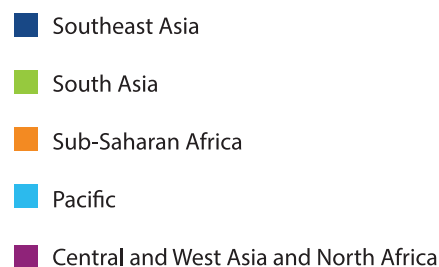
FINANCIAL OVERVIEW

We are committed to managing our finances efficiently and transparently. This section provides an overview of our financial position for the year ended 31 December 2018. Full audited financial statements are available on our [website](#).

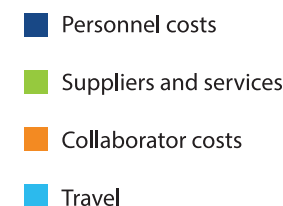
In 2018, we continued to diversify our funding base to reflect emerging opportunities in the research-for-development space as well as evolving investor interest, particularly in nutrition-sensitive fish-based systems. We signed 37 new contracts to the value of USD 50 million. The majority of this was with traditional investors (USD 31.4 million). Funding provided by the philanthropic sector was valued at USD 14.4 million. This was influenced largely by our new engagement with the Bill & Melinda Gates Foundation although there were several other philanthropic investors, including the Oak Foundation. International financing institutions provided USD 3.7 million in funding for future expenditure. We received smaller contributions from emerging economies and the private sector, the latter being a key growth area we are actively pursuing.



WORLD FISH EXPENDITURE BY REGION, 2018



WORLD FISH EXPENDITURE BY COST CATEGORY, 2018





STATEMENT OF FINANCIAL POSITION (USD '000)

	<i>As of 31 Dec 2018</i>	<i>As of 31 Dec 2017</i>
ASSETS		
Cash and cash equivalents	10,555	14,614
Accounts receivable	6,100	4,026
Other current assets	277	253
Capital assets	516	605
TOTAL ASSETS	17,448	19,498
LIABILITIES		
Accounts payable	6,653	8,154
Accruals and provisions	1,480	1,089
Other current liabilities	57	45
Non-current liabilities	430	473
TOTAL LIABILITIES	8,620	9,761
NET ASSETS	8,828	9,737
TOTAL LIABILITIES AND NET ASSETS	17,448	19,498

STATEMENT OF OPERATING ACTIVITIES (USD '000)

	<i>For the years ended 31 December</i>	<i>2018</i>	<i>2017</i>
REVENUE			
Grants	29,070	24,718	
Other income	223	997	
TOTAL REVENUE	29,293	25,715	
EXPENSES			
Research	19,261	17,093	
Administration, support and other	10,941	8,647	
TOTAL EXPENSES	30,202	25,740	
NET DEFICIT	(909)	(25)	

LEADERSHIP AND GOVERNANCE

Our [leadership team](#) is a diverse, global group of leaders who bring decades of experience in scientific research, international and organizational development and communications.

Board of Trustees

The Board of Trustees approves the center's long-term organizational strategy, annual plan of work and budget and research agenda, monitors progress toward the achievement of the center's mission, sets and approves programs and policies and financial regulations, exercises oversight of investment and risk management and ensures compliance with relevant legal and regulatory requirements. It also has scientific oversight and fiduciary responsibility for the implementation of [FISH](#).

Executive Team

The Executive Team comprises the Director General, the Director of the CGIAR Research Program on Fish Agri-Food Systems and Aquaculture and Fisheries Sciences, the Director of International Partnerships and Program Delivery, the Director of Communications and Marketing, the Director of Finance and IT and the Director of Human Resources and Administration. The Director General is delegated by the Board of Trustees to implement the organizational strategy, programs, policies and plans. The



Executive Team works together to realize the strategy, research agenda and organizational vision for WorldFish and take decisions on issues that affect the organization across various functions at all levels.

Global research leaders

The global research leaders are responsible for the overall coordination and management of our research agenda. The team reviews the annual work plans developed at country and regional levels to ensure consistency with our strategic goals and allocate appropriate budget.

Country directors

The country directors are accountable for the leadership and management of our country programs. Working collaboratively with our global research and functional leaders, country directors deliver an integrated research-for-development program that addresses national priorities and organizational goals, strengthens institutional and partner capabilities across the aquaculture and fisheries sectors, including building capacities, policy influence and evidence-based research capabilities.



OUR PEOPLE

Board of Trustees

- Yvonne Pinto, Board Chair, Agricultural Learning and Impact Network (ALINE), United Kingdom

Africa

- Ayman Anwar Ammar, Central Laboratory for Aquaculture Research (CLAR), Egypt
- Baba Yusuf Abubakar, Board Vice-Chair, University of Abuja, Nigeria
- Abdou Tenkouano, West and Central Africa Council for Agriculture Research and Development (CORAF), Senegal

Asia-Pacific

- Tony Haymet, Chair of the Governance Committee, Scripps Institution of Oceanography, Australia
- Hee Kong Yong, Chair of the Audit Committee, ASEAN Advisory, Malaysia
- YBhg. Dato'Haji Munir Haji Mohd Nawi, Department of Fisheries, Malaysia

Europe

- Anthony Long, Chair of the Governance Committee, Belgium (resigned 7 May 2018)
- Gareth Johnstone, ex-officio member, Director General, WorldFish

North America

- Cristina Rumbaitis del Rio, independent consultant, United States (joined 1 October 2018)

Executive Team

- Gareth Johnstone, Director General
- Michael Phillips, Director, CGIAR Research Program on Fish Agri-Food Systems and Aquaculture and Fisheries Sciences
- Zarinah Davies, Director of Human Resources and Administration
- David Shearer, Director, International Partnerships and Program Delivery
- Tana Lala-Pritchard, Director of Communications and Marketing
- Marc-Antoine Baïssas, Director of Finance and IT Systems (interim)

Global research leaders

- John Benzie, Sustainable Aquaculture Program Leader
- Philippa Cohen, Resilient Small-scale Fisheries Program Leader
- Shakuntala Thilsted, Value Chains and Nutrition Program Leader
- Cynthia McDougall, Gender Research Leader
- Cristiano Rossignoli, Monitoring and Evaluation Leader

Country directors

Africa

- Harrison Charo Karisa, Country Director, Egypt and Nigeria
- Sloans Chimatiro, Country Director, Zambia and Tanzania

Asia

- Malcolm Dickson, Country Director, Bangladesh
- Yumiko Kura, Country Director, Cambodia
- Michael Akester, Country Director, Myanmar

Pacific

- Delvene Boso, Country Director, Solomon Islands

ACRONYMS

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
APPG AgDev	All-Party Parliamentary Group on Agriculture and Food for Development
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CFR	community fish refuge
COFI	Committee on Fisheries
CRP	CGIAR research program
FAO	Food and Agriculture Organization of the UN
FAD	fish-aggregating device
FISH	CGIAR Research Program on Fish Agri-Food Systems
GIFT	genetically improved farmed tilapia
GTA	gender-transformative approach
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture

ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
LCBCCAP	Lake Chilwa Basin Climate Change Adaptation Program
MEL	monitoring, evaluation and learning
PIM	CGIAR Research Program on Policies, Institutions and Markets
RICE	CGIAR Research Program on Rice Agri-Food Systems
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SUN	Scaling Up Nutrition
TAAT	Technologies for African Agricultural Transformation
USAID	United States Agency for International Development
WLE	CGIAR Research Program on Water, Land and Ecosystems

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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.

For more information, please visit www.worldfishcenter.org