



# AQUATIC FOODS FOR HEALTHY PEOPLE AND PLANET

—  
2030 Research and Innovation Strategy



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2030 Research and Innovation Strategy



Penang, Malaysia, 2020

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# FOREWORD



**Yusuf Abubakar**  
Board Chair



**Gareth Johnstone**  
Director General

Since its establishment in 1975, WorldFish has come a long way from being a fisheries research center within the University of Hawaii. We have become a global research and innovation institution whose contributions to the sustainable development of fisheries and aquaculture in low- and middle-income countries are internationally recognized. Over that time, we have seen immeasurable growth in our knowledge of how sustainable fisheries and aquaculture contribute to climate mitigation and adaptation, biodiversity, nutrition and public health, and improved livelihoods of women, men and young people. Our work has enhanced the lives of millions, providing evidence-based solutions to real-world problems through a vast network of national and international partners across research, policy, business, civil society and local communities in Africa, Asia and the Pacific.

In 2020, our 45th anniversary provided the opportunity to take stock of our impact and also reflect on our achievements and the lessons we have learned along the way. In a world that keeps changing, it is clear to us that the best way to keep thriving is to embrace change. For only through continuous adaptation and reinvention can we stay relevant and ahead of the curve. For this reason, our original mandate has broadened to include larger aspects of aquatic food systems and their essential role in sustaining human well-being and the health of our planet. We recognize that to address complex 21st century challenges we must embrace a transformation approach for food, land and water systems to deliver broad access to affordable, sufficient, healthy diets and decent employment within environmental limits.

As we take our longstanding tradition of scientific excellence and partnerships for sustained innovation forward into the next decade, this strategy charts a new course for future research on aquatic food systems in response to the global call to action for transformational change of our food systems. More than ever, we believe robust and applicable scientific knowledge is required to overcome the incumbent institutional, social, cultural, economic and political barriers that keep us from radically realigning efforts to end hunger and malnutrition and meeting the other targets of the 2030 Sustainable Development Goals (SDGs).

We believe fish and other aquatic foods must occupy a central place in the global agricultural research agenda, which has traditionally focused on land-based crops and livestock. With this strategy, we are poised to expand thinking, multidisciplinary research and cross-sector partnerships with fellow One CGIAR centers and with other national and international partners in favor of a more ambitious, game-changing agenda for agricultural research and innovation that supports implementation of the SDGs at both country and global levels. Going forward, our work will be guided by our new mission: “to end hunger and advance the Sustainable Development

Goals by 2030 through science and innovation to transform food, land and water systems with aquatic foods for healthier people and planet.” Our strategy to 2030 provides a guiding framework for our work on transforming sustainable food systems in collaboration with an innovation ecosystem of partners. Using this framework, we will explore, identify and articulate sustainable food system transformation approaches, scenarios and game-changing innovations at the intersection of research, technology, markets, policies and social mobilization across disciplines and sectors. Our research on aquatic food systems, and on the forces that help or hinder transformational change, will guide and support national and global efforts to tackle climate change, protect nature and biodiversity, sustain livelihoods and boost human nutrition and well-being.

In Part I, our strategy measures the pulse of the fast-changing world around us. It offers “our vision for an inclusive world of healthy, well-nourished people and a sustainable blue planet, now and in the future.” We believe this vision can be realized through our unique proposition on the important but largely overlooked role of aquatic foods in meeting the critical challenges associated with the SDGs, as well as those outlined in the 2030 Research and Innovation Strategy of One CGIAR, the world’s largest agricultural innovation network, to which we belong.

In Part II, the strategy articulates our transformative agenda for research on aquatic food systems and its focus on three crucially important areas: (1) climate resilience and environmental sustainability, (2) social and economic inclusion, and (3) nutrition and public health. Our shift toward food systems research takes into account all four dimensions of capital (natural, produced, human and social) in food systems, from production through to consumption. Through extensive consultation and assessment of challenges in target geographies and communities, we have built on the areas of work where WorldFish has a strong legacy of impact. We have also canvassed new opportunities based on emerging food system trends.

In Part III, the strategy lays out the path for our own organizational transformation. We recognize that to respond effectively to change and deliver relevant research solutions at scale for sustainable system transformation at all levels, we must be prepared to reinvent ourselves. Additionally, our response to the COVID-19 pandemic had led us to devise a new organizational strategy and business model that reimagines the ways in which we must operate to successfully weather shocks and uncertainties, and thrive in the future. Our focus will be on mobilizing world-class capabilities and resources. This will sharpen the agility and responsiveness of our operations, help us adapt to new ways of working and collaboration, and secure more funding for scientific research on aquatic food systems as well as strengthen our long-term financial sustainability.



***Aquatic foods must occupy a central place in the global agricultural research agenda, which has traditionally focused on land-based crops and livestock.***



***This task is critical to ensure a full representation of the food system, address the complex links among food, land and water systems, and unlock an ocean of opportunities in an emerging blue economy that must prioritize social inclusion and equity.***

WorldFish is the only center in One CGIAR with 45 years of experience in fisheries and aquaculture research in low- and middle-income countries. Through our position within One CGIAR, alongside our noteworthy contribution to SDG 14: Life Below Water, we add particular value to the quest of transforming global food systems toward healthy and sustainable diets that work for people and the planet. We believe that this quest is simply not possible to achieve without the opportunity to examine, quantify and include the contributions of aquatic food systems. Our priority is to better integrate fish and aquatic foods into the global agricultural research agenda and link the latter to the blue economy and ocean space, whose assets such as fisheries, shipping lanes and tourism are worth USD 24 trillion. This task is critical to ensure a full representation of the food system, address the complex links among food, land and water systems, and unlock an ocean of opportunities in an emerging blue economy that must prioritize social inclusion and equity.

As a globally networked organization, our operations are embedded into a larger innovation ecosystem of partners, both within One CGIAR and beyond. We are guided by our values of “Learning, Excellence, Accountability and Diversity.” We remain committed to delivering research of the highest quality, integrity and impact, and to nurturing a diverse constellation of partners for sustained innovation. And we carry this commitment across various disciplines and sectors at both national and international levels.

Our commitments to people and to building a high-performing organizational culture put a premium on the diversity of talents, skills and backgrounds required to deliver our best work. Digital transformation will power new ways of working and collaborating with each other and with partners, as well as our learning, growth and innovation. We have set the bar high for ourselves through our commitment to significantly reduce the carbon footprint and environmental impact of our operations. In addition, we recognize the crucial importance of communicating the results of our scientific discoveries widely and effectively. This guides and supports important decisions—from household to global levels—that affect people’s quality of life and the future of our planet.

The ideas we have set forth here are bold and ambitious. We invite all our research and funding partners, staff and stakeholders within One CGIAR and beyond to embark with us on this exciting new journey of aquatic foods for healthy people and planet. On behalf of the Board of Trustees, we are proud to present this strategy to the global community.

Sincerely,

**Yusuf Abubakar**  
Board Chair

**Gareth Johnstone**  
Director General

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# ACKNOWLEDGMENTS

This document was researched, developed and written by Tana Lala-Pritchard and Gareth Johnstone, under the guidance of the WorldFish Board of Trustees. It includes contributions from a core team of researchers, including Michael Phillips, Shakuntala Thilsted, Essam Mohammed, Edward Allison and Benjamin Belton. Additional insights, data and comments were provided by Yvonne Pinto, John Kurien, Hampus Eriksson, Cristiano Rossignoli, John Benzie, Philippa Cohen, Cynthia McDougall, Mohan Vishnumurthy Chadag, Arun Padiyar, Marion Barriskell, Zarinah Davies and Katy Moore.

The team produced a number of outputs, including an annotated outline with detailed guidance and a strategy map and framework for research and institutional transformation following multistakeholder consultation with the Board of Trustees, WorldFish staff and national and international partners at both country and global levels. This yearlong process included input from the 2019 WorldFish Science Week; several workshops on key research areas, priorities and geographies; a series of open virtual dialogues on aquatic food systems; a global analysis of target audiences and relevant public and policy issues; the investors forum on the Fish for Africa Innovation Hub; and open learning sessions on strategy development for research and innovation.

This strategy would not have been possible without the generosity of the Bill & Melinda Gates Foundation, which funded our comprehensive organizational development exercise. We are grateful to Aly-Khan Jamal and Mads Holme and their respective Dalberg and Red Associates teams. They worked closely with us and provided critical insights that have enabled us to articulate an exciting transformative agenda for research on aquatic food systems and to present a concrete roadmap for our own organizational transformation. This two-pronged strategy is critical to our institutional transition toward One CGIAR and our aspiration to become the go-to global thought leader on aquatic food systems within One CGIAR and in the wider scientific community.

Finally, our appreciation extends to Marc Ventresca of Saïd Business School at the University of Oxford. He provided special guidance on cutting-edge theory and best practices on strategy development for disruptive innovation, organizational transformation and thought leadership.

Additional support with production, visuals and design was provided by the WorldFish communications and marketing team.

# THE BIG FACTS ON AQUATIC FOODS



**204 million  
tons**

The volume of **aquatic food production** by 2030.

**\$ 264  
billion**

The value of aquatic food production through **aquaculture** in 2018.

**\$ 24  
trillion**

The value of the **ocean economy**, including fisheries, shipping lanes and tourism.

**3.3  
billion**



Number of people getting **20%** of their **animal protein** from eating aquatic foods.

**17%**



Percentage of all **animal protein** consumed globally that comes from **aquatic foods**.

**\$ 164  
billion**



The **global export value** of fish alone in 2018, making aquatic foods among the world's **top traded commodities**.

**\$ 70  
million**



The estimated market size of the **plant- and cell-based aquatic food sectors** by 2030.

**2  
billion**



Number of people suffering the **triple burden of malnutrition** who can benefit from the life-changing option of consuming **nutrient-rich** aquatic foods.

**1000  
days**



Aquatic foods are dense in **micronutrients**, which are essential to cognitive development in the first **1000 days of a child's life**.



Aquatic foods naturally contain **healthy omega-3 fats** that are difficult to obtain from land-based food sources, such as crops and livestock.

The intake of **omega-3** fatty acids from fish and aquatic foods is associated with **lower risk of cardiovascular disease and obesity**.

When consumed as part of a **balanced diet**, fish can increase the absorption of **essential minerals**, such as iron and zinc, from other foods.



84%

Percentage of global **protein** sourced from the sea that comes from **wild fisheries**.

50%

Percentage of the total global catch from **small-scale fisheries**.

800 million

Number of people around the world who depend on **small-scale fisheries** and **aquaculture** for their livelihoods.

60%

Percentage of the world's farmed fish in 2018 produced through **inland aquaculture**.

70%

Percentage of the planet that is covered by the **ocean**, which houses 80% of all **life on earth** while **sequestering carbon** and providing **half of the world's oxygen**.

60 million

Number of people engaged in the primary sector of **fisheries** and **aquaculture** in 2018.

66%

Percentage of **fishstocks** currently within **biologically sustainable** levels, compared to 90% in 1990.

\$ 22.5 billion

**The annual loss of** discarded fish alone.

1 in every 2

Workers in the primary and secondary sectors of fisheries and aquaculture who are **women**.



The weight of **ocean plastics** will exceed the weight of all fish by 2050, unless **coordinated multistakeholder actions** to curb plastic pollution are taken.

**35%** of the global harvest from fisheries and aquaculture is **lost or wasted**.

They are crucial to aquatic food systems, providing **labor, innovative ideas** and **entrepreneurship**.

40%

The estimated decline in **tropical fish catch** globally by 2050, unless actions to curb **CO<sub>2</sub> emissions** are taken.



Production of aquatic foods has a **much lower carbon footprint** and far **fewer biodiversity impacts** compared to production of crops and livestock.

90%

Percentage of all **small-scale fishers** living in low- and middle-income countries in the Global South.

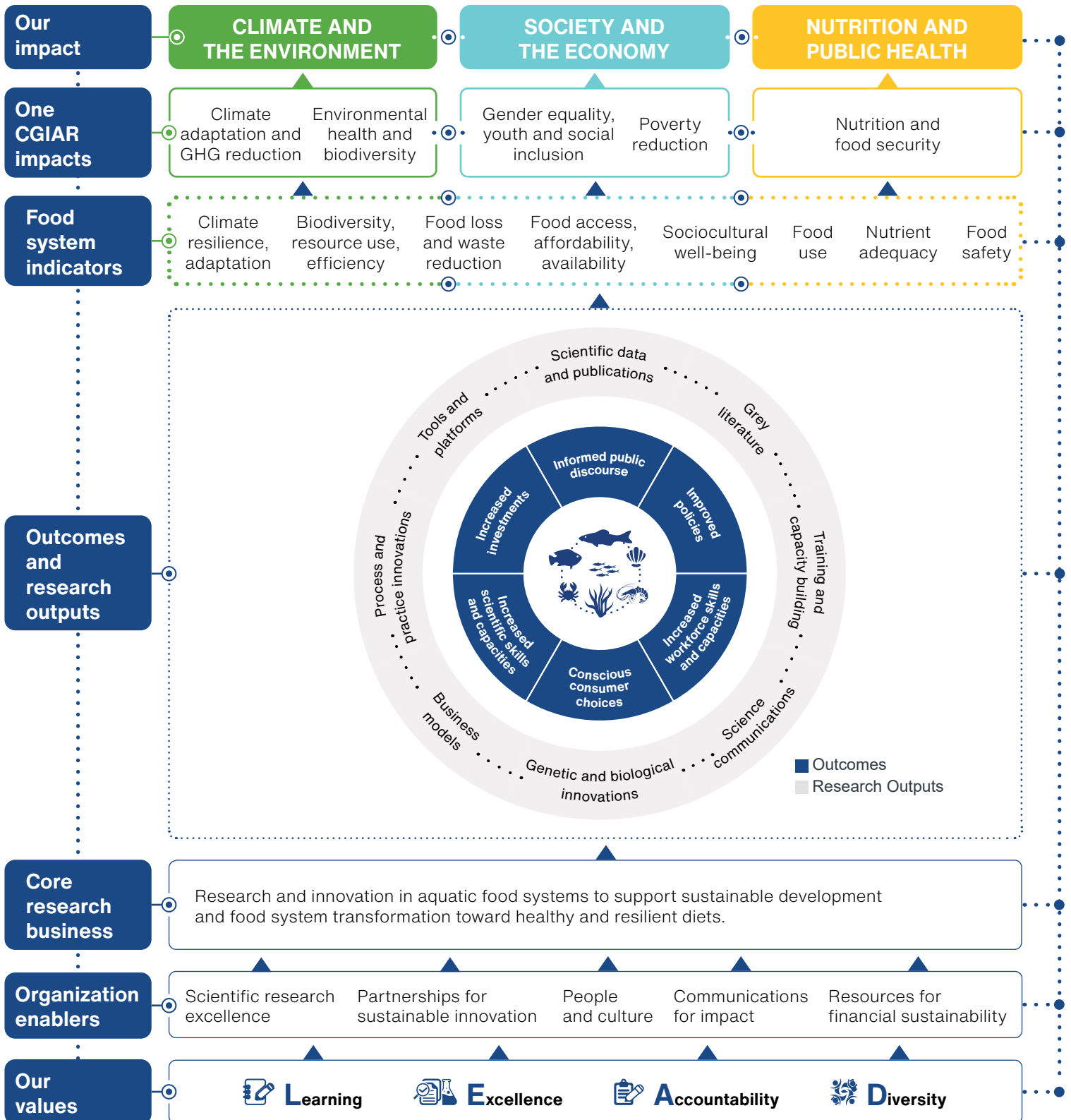
# OUR STRATEGY AT A GLANCE

## Our vision

An inclusive world of healthy, well-nourished people and a sustainable blue planet, now and in the future.

## Our mission

To end hunger and advance sustainable development by 2030 through science and innovation to transform food, land and water systems with aquatic foods for healthier people and planet.





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# GLOSSARY

<b>Aquaculture</b>	The farming of aquatic animals (such as finfish, crustaceans, molluscs, etc.) and aquatic plants (mostly algae) using or within freshwater, sea water, brackish water or inland saline water.
<b>Aquatic foods</b>	Animals, plants and microorganisms that are farmed in and harvested from water, as well as cell- and plant-based foods emerging from new technologies.
<b>Aquatic food systems</b>	The complex web of all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, aggregation, processing, distribution, preparation, consumption and disposal of food products that originate from wild and capture fisheries, aquaculture and/or cell- and plant-based alternatives emerging from new technologies, and parts of the broader economic, societal and natural environments in which they are embedded. It encompasses the entire range of actors and their interlinked value-adding activities from production all the way to consumption, as well as the outcomes of these activities, including those related to nutrition, public health, food security, social and economic prosperity, and environmental sustainability.
<b>Blue economy</b>	An emerging but contested concept which encourages better stewardship of “blue” resources from both freshwater and marine spaces, including the ocean, seas, coasts, mangroves, lakes, rivers, and underground water. It encompasses a range of productive sectors, including fisheries, aquaculture, tourism, transportation, shipbuilding, energy, bioprospecting, and underwater mining and related activities. It aims for improvement of human well-being and social equity, while significantly reducing impact on the environment.
<b>Fisheries</b>	The sum of activities leading to harvesting fish through wild capture or through aquaculture production in saltwater or freshwater. A fishery is typically defined in terms of the people involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities, or a combination of the foregoing features.
<b>Healthy and sustainable diets</b>	Diets with low environmental impacts that contribute to food and nutrition security and to healthy life for present and future generations. They are protective and respectful of biodiversity and ecosystems, culturally acceptable and accessible, economically fair and affordable, and nutritionally adequate, safe and healthy—all while optimizing natural and human resources.
<b>Impact</b>	A fundamental and durable change in the condition of people and their environment brought about by a project or intervention.
<b>Innovation</b>	The process of introducing and taking to scale new ideas, products, services and solutions capable of facilitating impact.
<b>Innovation system</b>	The interlinked set of people, processes, assets and social institutions that enable innovation.
<b>Ocean economy</b>	The sum of the economic activities of ocean-based industries, together with the assets, goods and services provided by marine ecosystems. The interdependency of ocean-based industries and marine ecosystems combined with increasingly severe climate change threats to the health of the ocean have led to growing recognition of the need for an integrated approach to sustainable use and management of the ocean in ways that keep it healthy, productive, safe, secure and resilient.
<b>Research</b>	Generation and communication of data, information and knowledge on an empirical basis.
<b>Science</b>	Rigorous hypothesis-based research.
<b>System</b>	A set of interacting entities and processes that form a complex whole.
<b>System transformation</b>	A major shift in the governance and functioning of a system that brings about significant positive change for the majority of people in the system.

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# LIST OF ABBREVIATIONS

<b>A4NH</b>	Agriculture for Nutrition and Health
<b>AARTC</b>	Africa Aquaculture Research and Training Center
<b>AAS</b>	CGIAR Research Program on Aquatic Agricultural Systems
<b>ACIAR</b>	Australian Centre for International Agricultural Research
<b>AfDB</b>	African Development Bank
<b>ANCORS</b>	Australian National Centre for Ocean Resources and Security
<b>ASARECA</b>	Association for Strengthening Agricultural Research in Eastern and Central Africa
<b>ASEAN</b>	Association of Southeast Asian Nations
<b>AU</b>	African Union
<b>BFRF</b>	Bangladesh Fisheries Research Forum
<b>BFRI</b>	Bangladesh Fisheries Research Institute
<b>BMGF</b>	Bill & Melinda Gates Foundation
<b>CAADP</b>	Comprehensive Africa Agriculture Development Programme
<b>CCAFS</b>	CGIAR Research Program on Climate Change, Agriculture and Food Security
<b>CCARDESA</b>	Centre for Coordination of Agricultural Research and Development for Southern Africa
<b>CEFAS</b>	Centre for Environment, Fisheries and Aquaculture Science
<b>CELAC</b>	Community of Latin American and Caribbean States
<b>CFS</b>	United Nations Committee on World Food Security
<b>CIAT</b>	International Center for Tropical Agriculture
<b>CIFOR</b>	Center for International Forestry Research
<b>CIP</b>	International Potato Center
<b>CIRAD</b>	French Agricultural Research Centre for International Development
<b>COMESA</b>	Common Market for Eastern and Southern Africa
<b>CORAF</b>	West and Central African Council for Agricultural Research and Development
<b>CRP</b>	CGIAR Research Program
<b>DFID</b>	Department for International Development
<b>EAC</b>	East African Community
<b>ECCAS</b>	Economic Community of Central African States
<b>ECOWAS</b>	Economic Community of West African States
<b>FAO</b>	Food and Agriculture Organization
<b>FARA</b>	Forum for Agricultural Research in Africa
<b>FIRST</b>	Fisheries Resource Information System and Tools
<b>FISH</b>	CGIAR Research Program on Fish Agri-Food Systems
<b>GAIN</b>	The Global Alliance for Improved Nutrition
<b>ICARS</b>	International Centre for Antimicrobial Resistance Solutions

<b>ICCCAD</b>	International Centre for Climate Change and Development
<b>ICLARM</b>	International Center for Living Aquatic Resources Management
<b>ICSF</b>	International Collective in Support of Fishworkers
<b>IFAD</b>	International Fund for Agricultural Development
<b>IIED</b>	International Institute for Environment and Development
<b>IITA</b>	International Institute of Tropical Agriculture
<b>ILRI</b>	International Livestock Research Institute
<b>IFPRI</b>	International Food Policy Research Institute
<b>IoT</b>	Internet of things
<b>IMR</b>	Institute of Marine Research
<b>IRRI</b>	International Rice Research Institute
<b>IWMI</b>	International Water Management Institute
<b>JCU</b>	James Cook University
<b>LEAD</b>	Learning, Excellence, Accountability and Diversity
<b>LSHTM</b>	London School of Hygiene & Tropical Medicine
<b>MARE</b>	Centre for Maritime Research
<b>MEL</b>	Monitoring, evaluation and learning
<b>MOU</b>	Memorandum of understanding
<b>MSU</b>	Michigan State University
<b>NACA</b>	Network of Aquaculture Centres in Asia-Pacific
<b>NARES</b>	National agricultural research and extension systems
<b>NOC</b>	National Oceanography Centre
<b>NORAD</b>	Norwegian Agency for Development Cooperation
<b>NRI</b>	Natural Resources Institute
<b>RBM</b>	Results-based management
<b>SAARC</b>	South Asian Association for Regional Cooperation
<b>SADC</b>	Southern African Development Community
<b>SDG</b>	Sustainable Development Goal
<b>SUN</b>	Scaling Up Nutrition
<b>TBTI</b>	Too Big to Ignore Network
<b>UBC</b>	University of British Columbia
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNICEF</b>	United Nations Children’s Fund
<b>USAID</b>	United States Agency for International Development
<b>USDA</b>	United States Department of Agriculture
<b>UW</b>	University of Washington
<b>WFP</b>	World Food Programme
<b>WHO</b>	World Health Organization
<b>WUR</b>	Wageningen University & Research

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Photo credit: Chosa Mweemba/WorldFish



PART I



**RESPONDING  
TO CHANGE**



---

# OUR BLUE PLANET IS CHANGING

In recent years, a global call to action has emerged for a food systems transformation to healthier and sustainable diets. Public and private sector actors have joined forces to argue that the full realization of the 2030 Agenda for Sustainable Development will only be possible if we change the current ways of producing, distributing and consuming food to sustain health and well-being for people and our planet, now and in the future.

Scientists have been warning for decades that increasing temperatures, extreme weather events and dramatic shifts in ecosystems can unleash a range of public health problems. These problems are global and wide-ranging: infectious diseases caused by microorganisms and carried by insects; water- and foodborne diseases from floods; airborne pathogens resulting from droughts; and air pollution or increasing contact between wildlife, farmed animals and humans. The case could not have been made clearer by the massive wildfires that engulfed the world's largest tropical wetlands in the Amazon rainforest or the locust plague in East Africa in 2020. And then came the COVID-19 pandemic, which brought the world to a standstill and left us scrambling for innovative solutions. It has become the public health emergency that is testing (perhaps like no other event before it) our collective capacity to respond effectively to large-scale existential threats. It has altered the way we live and the way we think about our relationship with nature.

Growing inequality has become an instrument of political populism, exclusion and xenophobia. At the same time, the #MeToo and #BlackLivesMatter movements are giving voice to women and men across the world to denounce the ubiquity of gender and racial violence and discrimination. Young activists like Greta Thunberg have become poster children for unprecedented social mobilization on climate change. Many individuals, companies, organizations, cities and countries have started to take extraordinary actions to become green and reduce their carbon footprint.



Photo credit: Noor Alam/WorldFish

Our world as we know it—the physical, the digital and the biological—is constantly being shaped by new trends, threats and opportunities, affecting all disciplines, communities, industries and governments. They are changing the way we live and work, and even challenging the very idea of what it means to be human. In a complex, fast-changing world of ongoing shifts in ecosystems, politics, markets, social and cultural norms, and technology and digital transformation, making the right choices can be a daunting task. In the age of “fake news” and “alternative facts,” the COVID-19 emergency is there to remind us that good choices must be informed by solid scientific evidence and innovations. Disruptive technologies in the private and public sectors have been giving rise to unprecedented innovation and new ways of doing business through public-private partnerships. These technologies co-create shared value for the benefit of both business and society, while sustaining our natural resources within the boundaries of our precious blue planet.

A rising tide of companies, nonprofits, social entrepreneurs, international organizations and civil society actors is eager to tap into the considerable potential of the “blue economy” or the “ocean economy.” The hope is to generate clean and inclusive growth, new and better jobs, and unparalleled innovation to meet the global goals of the 2030 Agenda for Sustainable Development. More than ever, bold policy and investment decisions are needed to enable an effective food systems transformation toward healthier and sustainable diets and to make changes in governance frameworks for shared prosperity and sustainable management of scarce resources. They are also needed to make shifts in consumer behavior and choices and in good business practices with positive impacts on communities and the environment.

The [2030 WorldFish Research and Innovation Strategy: Aquatic Foods for Healthy People and Planet](#) reflects our commitment to do our part in making bold decisions possible. It is through science that we will help to illuminate sound paths toward a sustainable food systems transformation with aquatic foods and to meet the goals of the 2030 Agenda for Sustainable Development in all three of its dimensions—social, economic and environmental.



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# OUR VISION, MISSION AND RESEARCH WORK

WorldFish is a nonprofit research and innovation institution that creates, advances and translates scientific research on aquatic food systems into scalable solutions with transformational impact on human well-being and the environment. We are part of One CGIAR, the world's largest agricultural innovation network, whose mission is to "end hunger by 2030 through science to transform food, land and water systems under threat of climate change." Within One CGIAR and the wider global agricultural research agenda, we have a unique research mandate that focuses on the role and contributions of aquatic food systems to the 2030 SDGs.

Our mission is focused on SDG 2: Zero Hunger but pays special attention to SDG 14: Life Below Water, and we leverage both of these goals to score progress on other multiple SDGs. Our work explores the potential of aquatic food systems as an important source of food and their role in the global transformation of food systems toward healthier and sustainable diets in the face of climate change.

Globally, aquaculture is the world's fastest growing food production sector, and fish and aquatic foods are the most traded food commodity. Our work plays a critical role in realizing their potential for sustainable development in low- and middle-income economies. Our research on the value of small-scale fisheries to social, environmental, economic and governance contributions at local, regional and global scales supports the efforts of national governments to implement SDG 14: Life Below Water.

We believe research on aquatic food systems is critical to meeting shared global aspirations for establishing inclusive, efficient, sustainable, nutritious and healthy food systems capable of achieving the SDGs by 2030. However, research alone cannot provide people with more and better food, improve environmental sustainability or reduce climate risk. We recognize that transformative change requires our work to be situated within an innovation ecosystem of partners, stakeholders, networks, assets and institutions to turn research into demand-driven products, services and solutions at scale. This is critical to accelerating the speed of innovation in food, land and water systems to meet the increasing challenges of climate change, hunger, malnutrition, poverty, social inequality and environmental degradation.

## **Our vision**

An inclusive world of healthy, well-nourished people and a sustainable blue planet, now and in the future.

## **Our mission**

To end hunger and advance sustainable development by 2030 through science and innovation to transform food, land and water systems with aquatic foods for healthier people and planet.



Success in our world depends on ensuring research is relevant, credible, legitimate and effective (ISDC 2020), as well as open and accessible to everyone. It is research like this that will guide, inspire and build knowledge, know-how and capacities for innovation and transformative action from public and private sector actors and institutions at all levels of the food system. Across disciplines and sectors, our approach to research and innovation connects and empowers women, men and young people for change for the long term. Research excellence and engagement with national and international partners are at the heart of our efforts to set new agendas, build capacities and support better decision-making to drive sustainable development in low- and middle-income countries in Asia, Africa and the Pacific.

WorldFish has a global presence in **20 countries** in **3 continents** with **460 staff** representing **30 nationalities**.

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Our research and innovation work spans climate change, food security and nutrition, sustainable fisheries and aquaculture, the blue economy and ocean governance, One Health, genetics and AgriTech, and it integrates evidence and perspectives on gender, youth and social inclusion. We work with government agencies, fishers, aquatic food producers, processors and consumers, community representatives, advanced research institutes, extension agents, civil society groups, businesses and social entrepreneurs. It is through our close collaboration and dialogue with our partners that we can accelerate the process of putting aquatic food systems on a low emissions pathway and enhance the adaptive capacities of the people, institutions and industries that depend on them. Our ultimate goal is to ensure sustainable and resilient food systems that deliver more diverse, healthy, sufficient and affordable diets with aquatic foods, and to improve livelihoods and greater social equality, within planetary and regional environmental boundaries.

Over the past 45 years, WorldFish has firmly established itself as a global leader in research and innovation in sustainable aquaculture and fisheries. Our work has enhanced the lives of millions of low- and middle-income people who depend on aquatic food systems for food, nutrition, livelihoods and overall well-being. Our work is supported by a diverse network of funders and investors aligned to shared goals for positive social, economic and environmental impact. Our teams of science experts and professionals are deployed and conduct work where the greatest sustainable development challenges can be addressed through holistic aquatic food systems solutions.

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# WHAT ARE AQUATIC FOODS?

Aquatic foods are aquatic animals and plants grown in or harvested in the wild from water for food or feed, and their synthetic substitutes. They include the following:



## Finfish

Fish as normally understood (e.g. tilapia), which are called finfish to distinguish them from shellfish, which technically are not classed as fish.



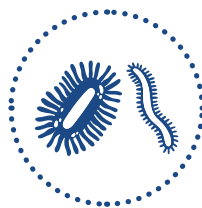
## Shellfish

Any aquatic animal whose external covering consists of a shell, either crustacea (e.g. shrimps) or molluscs (e.g. oysters).



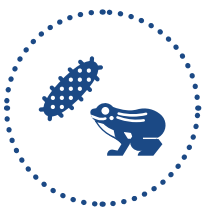
## Aquatic Plants

Includes aquatic plants (e.g. watercress) as well as algae (e.g. seaweed) which are typically not classified as plants.



## Aquatic Feeds

Any of the above categories and other single-celled organisms (e.g. yeasts) used as animal feed.



## Other Aquatic Foods

Certain niche categories, notably echinoderms (e.g. sea cucumbers) or amphibians (e.g. frogs).



## Synthetic Substitutes

Whole or component substitutes for any of the above, produced in environments outside their normal biological context (e.g. surimi or plant- or cell-based alternative aquatic food protein).

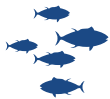
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# WHAT IS AN AQUATIC FOOD SYSTEM?

An aquatic food system is a complex web of:



**Elements** refer to the environment, people, inputs, processes, infrastructures, institutions, etc.



**Activities** relate to the production (from wild fisheries, aquaculture and synthetic substitutes), processing, distribution, preparation, consumption and disposal of aquatic foods.



**Outcomes** are the results of these activities, such as nutrition, health and food security, but also socioeconomic and environmental outcomes.

We use the definition of “food system” by the High Level Panel of Experts on Food Security and Nutrition (HLPE) (2017): an aquatic food system is a complex web made up of elements, activities and the outcomes of these activities.

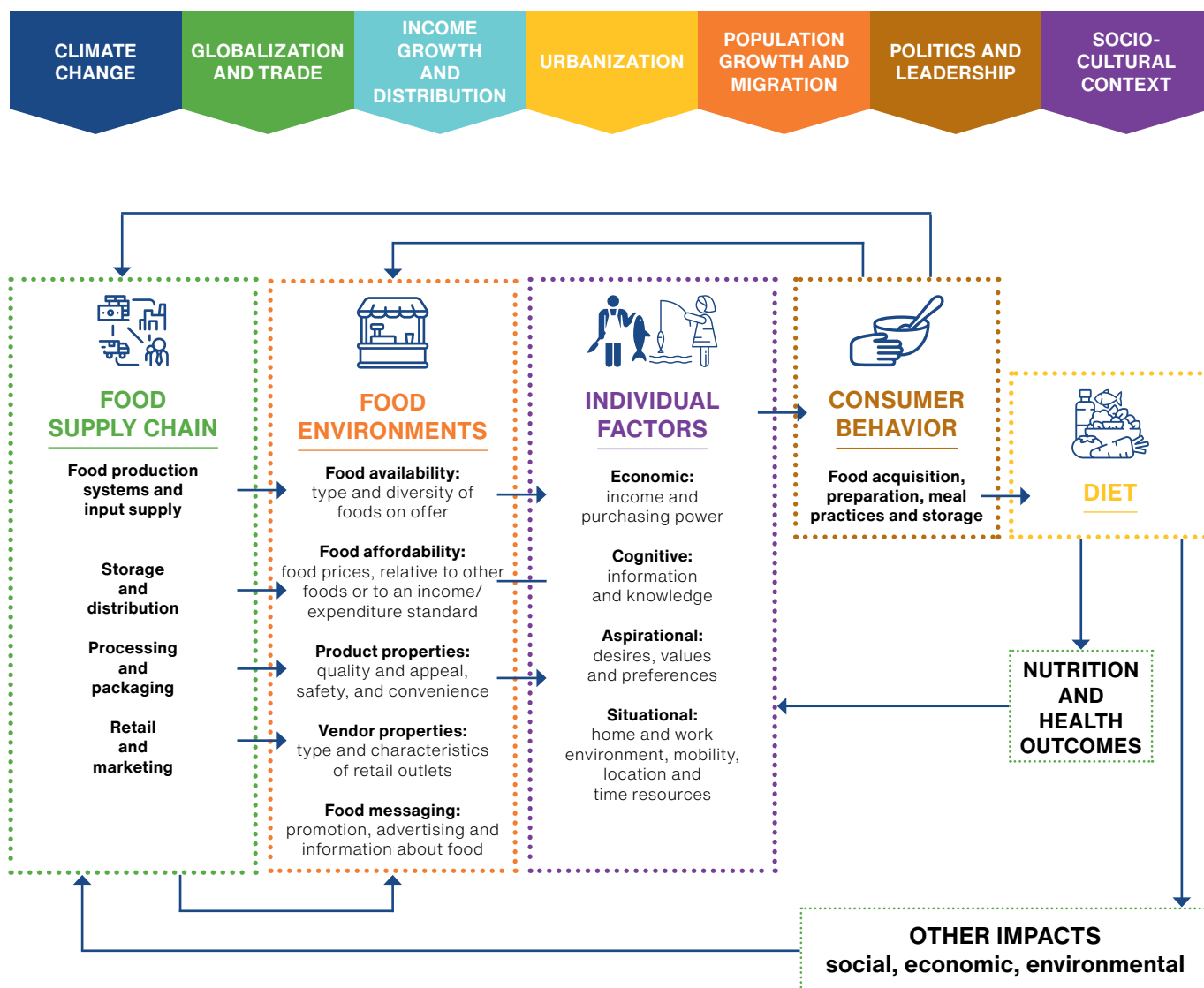
An aquatic food system is sustainable when it ensures food security and nutrition for all in such a way that does not compromise the economic, social and environmental bases to generate food security and nutrition for future generations. Food security and nutrition in this case is not only an outcome but also as an enabling condition of sustainability, and should not be considered a trade-off variable. Aquatic food systems also exist within other systems, such as farming systems, agricultural ecosystems, economic systems and social systems. Within those are further subsets of water systems, energy systems, financing systems, marketing systems, policy systems, culinary systems and so on.

Aquatic food systems, their drivers, actors and elements do not exist in isolation but interact with one another and with other systems, such as tourism, agriculture, health, energy, communications and transportation systems. An aquatic food system includes all the people and activities that play a part in growing, transporting, supplying and, ultimately, eating aquatic foods. These processes also involve elements that often go unnoticed, such as food preferences and resource investments.

Aquatic food systems influence diets by determining what kinds of aquatic foods are produced. They also influence what kinds of aquatic foods people want to eat and are able to access. Issues concerning aquatic food systems include (1) the governance and economics of aquatic food production, (2) its sustainability, (3) the degree to which aquatic foods are wasted, (4) how production of aquatic foods affects the natural environment, and (5) how aquatic foods impact individual and population health.

Population health is a critical factor in addressing aquatic food system challenges, especially as nutrition-related chronic diseases such as obesity, diabetes, cardiovascular disease and some forms of cancer are major contributors to the global burden of disease.

An aquatic food system includes different parts (Figure 1) that shape it and can lead to both positive and negative outcomes. These parts include food supply chains, food environments, individual factors, consumer behavior and external drivers or push and pull factors.



Source: adapted from HLPE. 2017.

**Figure 1.** Different parts of the aquatic food system.



# GLOBAL TRENDS AFFECTING FOOD SYSTEMS

The evolving global context demands a systems transformation approach for food, land and water systems. In devising our strategy, we considered a number of key trends influencing food systems globally. They relate to diverse issues across the environmental, social, economic and technology dimensions of food systems sustainability.



## URBANIZATION

By 2050, more than two-thirds of the world will live in urban areas, making feeding cities a key challenge.



## INEQUALITY

Protests are increasing against systems that perpetuate wealth and social inequality, and concentration of power in fewer hands.



## CULTURE

Food supply chains are now catering to an increasingly diverse range of cultural and religious beliefs.



## CLIMATE CHANGE

The increasing number of natural disasters, extreme weather events, ocean acidification and shocks like the COVID-19 pandemic disrupt every aspect of food systems from production to consumption.



## FOOD PRODUCTION

Responsible for 26 percent of global greenhouse gas emissions, food production is a key driver of the overshoot in planetary boundaries.



## PLASTIC POLLUTION

Plastic waste adversely affects land, freshwater and marine ecosystems and potentially human health.

**Figure 2.** Food system trends.



### CONVENIENCE

Consumers show increasing preference for convenient and ready-to-eat foods to save time and energy.



### ECONOMIC PROGRESS

The global recession associated with the COVID-19 pandemic has stalled economic growth and led to marked regression in key sustainable development indicators.



### FOOD PRICE

Food prices strongly influence the livelihoods and dietary choices of producers, farmers, traders, processors and consumers.



### DEMOGRAPHICS

Age and wealth demographics influence eating habits and consumer choices at individual and household levels.

SOCIETY

ECONOMY



### COVID-19 PANDEMIC

The pandemic has led to unprecedented disruption in social and economic life, aside from the loss of human life and persisting challenges to public health, food systems and supply chains.



### FOODBORNE DISEASES

Every year, unsafe food in low- and middle-income countries costs USD 110 billion in medical expenses and lost productivity.



### GLOBALIZATION

Changing global trade flows feature more competition from emerging markets.



### NUTRITION, HEALTH, SUSTAINABILITY NEXUS

Interest is growing to align nutrition, public health and environmental sustainability through the lens of healthy and resilient diets.



### GROWING COMPLEXITY

A complex, uncertain and fast-changing environment threatens food supplies and requires food system actors to respond and adapt quickly.



### SOCIAL MEDIA

More than 4.5 billion people now use the internet, while social media users have passed the 3.8 billion mark.



### FOOD, ENERGY, WATER NEXUS

Growing research and investment interest in the water-energy-food nexus serves as a framework for achieving long-term resource security.

ENVIRONMENT

TECHNOLOGY



### DIGITAL REVOLUTION

The explosion of big data, the internet of things (IoT) and digital technologies offers opportunities for smart, resilient and sustainable food systems.



### WATER POLLUTION

Eutrophication, pollution and degradation of water bodies and ecosystems is on the rise.



### ALTERNATIVE PROTEINS

Innovative alternative sources of protein (e.g. insects, fungi or tissue culture) are replacing conventional animal protein and shaping new markets and consumer preferences.



### THE DIGITAL DIVIDE

A contested cyberspace of hugely diverse interests fuels the debate about digital inclusion and internet governance beyond infrastructure.

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# TACKLING GLOBAL CHALLENGES WITH AQUATIC FOODS

WorldFish is part of the global effort to end hunger and malnutrition, eradicate poverty and address climate change, as well as a number of other interrelated challenges expressed in the 2030 SDGs.

The way we grow, catch, store, transport, process, trade, market, promote and consume food from land and water is central to solving critical global challenges and leveraging progress on a number of SDGs. Most of the world's population eats too little, too much or the wrong combination of food. This comes at an unsustainable cost to our health and well-being, the economy and the environment.

Aquatic foods, alongside land crops and livestock, are a significant part of the equation for healthy and sustainable diets within our planetary boundaries.

Our vision, mission and institutional strategy for research on aquatic food systems are aligned with One CGIAR. Our work contributes to the majority of the SDGs, but remains primarily focused on tackling five global challenges targeted for collective impact by One CGIAR as a collective.

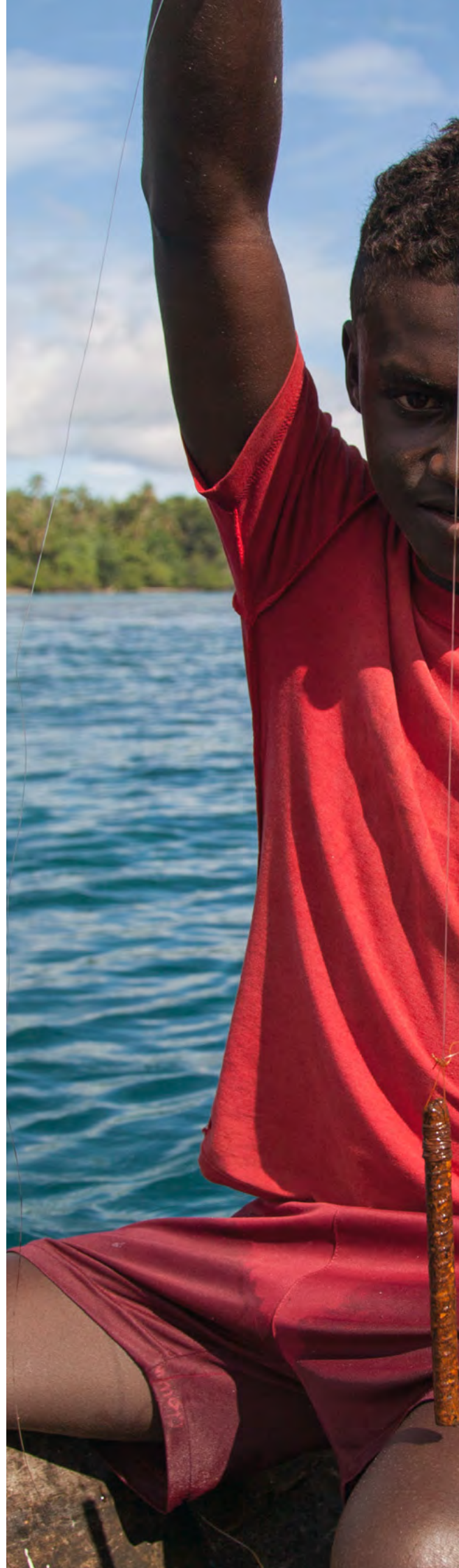






Photo credit: Filip Milovac/WorldFish

## One CGIAR impact areas

### 1. Nutrition and food security

Almost 690 million people (8.9 percent) went hungry in 2019. This number is estimated to grow to between 773 million and 822 million by the end of 2020 because of the food and economic crisis related to the COVID-19 pandemic. High costs and low affordability also mean billions cannot eat healthily or nutritiously. Two billion people do not have regular access to safe, nutritious and sufficient food, and diet-related noncommunicable diseases (such as obesity, cardiovascular disease, cancer and diabetes) are increasing in all regions. If current trends continue, SDG 2: Zero Hunger will not be achieved by 2030.

### 2. Gender equality, youth and social inclusion

Women make up half the workforce and play a prominent role in fisheries and aquaculture economies around the world. They face many inequities in wages and access to productive resources, technology and market. Their work and economic contributions continue to go unrecognized in official statistics, sector policies and development programs. More than 85 percent of the 1.2 billion young people in the world live in low- and middle-income countries, and many of them face limited opportunities for employment, skills development or entrepreneurship. Agriculture, including fisheries and aquaculture, is generally perceived by young people as not the most attractive proposition for decent work, fulfilling livelihoods and well-being.



## One CGIAR 2030 success metrics

Deliver affordable healthy diets to 8.5 billion people, ending hunger and malnutrition for the 2 billion who suffer from macro and micronutrient deficiencies, and reducing diseases related to food systems by one-third.

Close the gender gap in access to resources, information and power for the 750 million women who work in food, land and water systems, and offer decent opportunities to 267 million young people who are not in employment, education or training.

These five challenges are closely linked to the SDGs, particularly SDG 2: Zero hunger and SDG 14: Food Below Water, which are the mission-focus of the 2030 WorldFish Research and Innovation Strategy on aquatic food systems.



**Table 1.** Five global challenges for impact.



### 3. Poverty reduction, livelihoods and jobs

Nearly half of the world's population live on less than USD 5.50 a day (the poverty line in upper-middle-income countries). One-quarter live on less than USD 3.20 a day (the poverty line in lower-middle-income countries) and about 689 million people live on less than USD 1.90 a day (extreme poverty). The COVID-19 crisis has made things worse by pushing close to half a billion people back into poverty. Across the world, the fisheries and aquaculture sector is a major source of employment. In 2018, an estimated 59.5 million people were engaged in the primary sector of fisheries and aquaculture. The COVID-19 crisis has already had a disproportionate impact on the poorest and most vulnerable through job loss, loss of remittances, inability to afford healthy and nutritious foods, and disruptions in services such as education and health care.

Provide living incomes to 1.5 billion people working in food systems, and lift 500 million people above the USD 1.90 a day poverty line.

### 4. Climate adaptation and greenhouse gas reduction

The oceans and coasts provide critical ecosystem services, such as carbon storage, oxygen generation, food and income generation. Coastal ecosystems like mangroves, salt marshes and seagrasses play a vital role in carbon storage and sequestration. Per unit of area, they sequester carbon faster and far more efficiently than terrestrial forests. When these ecosystems are degraded, lost or converted, massive amounts of carbon dioxide (an estimated 0.15–1.02 billion tons every year) are released into the atmosphere or the oceans. Their continued destruction undermines climate mitigation efforts and threatens food security and nutrition for more than 3 billion people who rely on aquatic foods as their primary source of animal protein and other essential nutrients. By virtue of their geography, big ocean states, otherwise known as small island nations, are left physically and fiscally vulnerable to the impacts of climate change, despite having contributed least to it.

Turn agriculture and forest systems into a net sink for carbon dioxide, and implement all national adaptation plans globally.

### 5. Environmental health and biodiversity

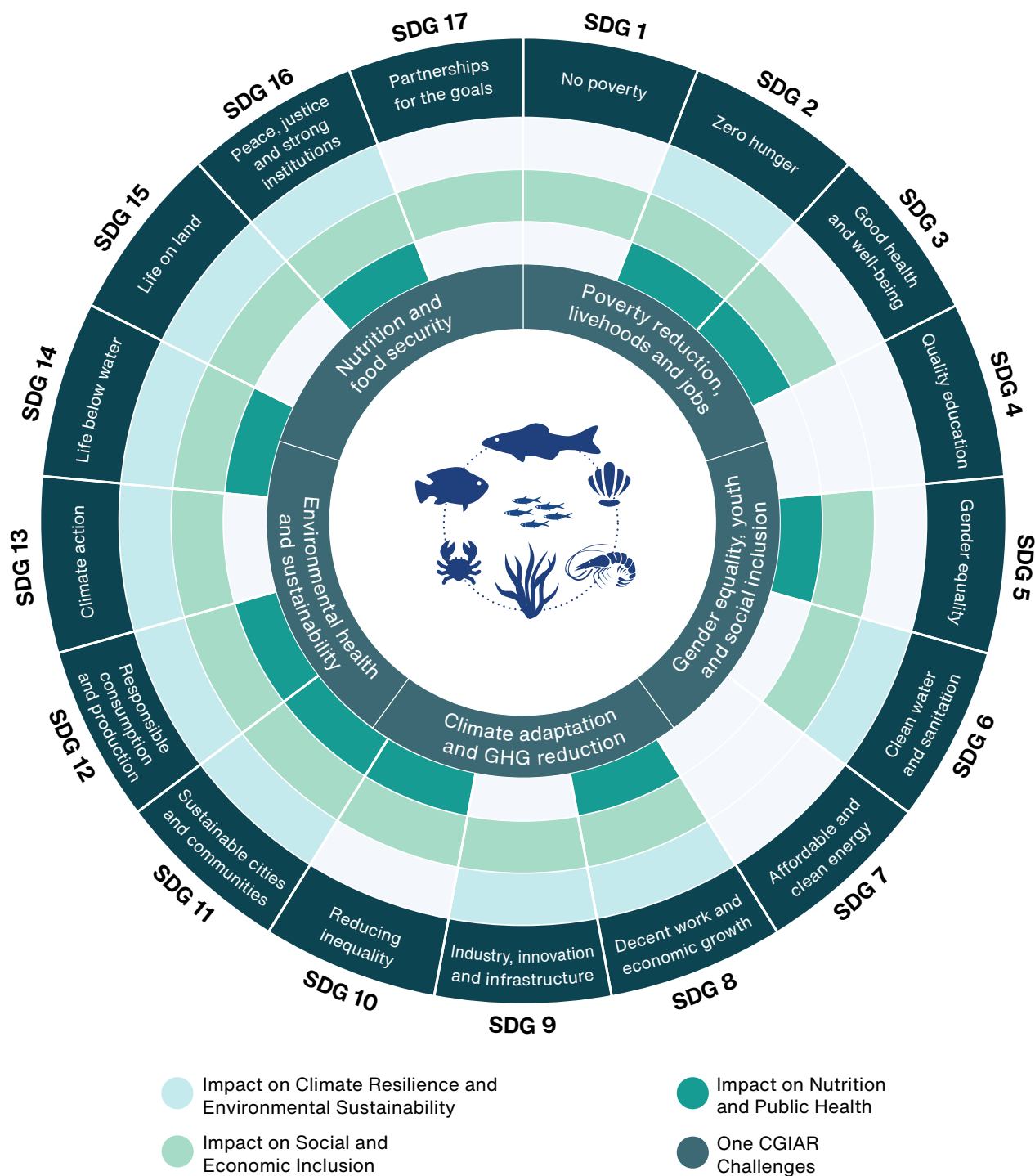
Approximately 65 percent of the world's population live within 159 km of shoreline, with population growth estimated at 75 percent by 2025. For inland and coastal regions, the ocean provides a unique set of goods and services to society, including moderating climate, processing waste and toxicants, and providing food, medicines and employment for millions of people. Marine biodiversity is being lost at an unprecedented rate as a result of human activities, both direct and indirect, on land and in the water. The percentage of fishstocks within biologically sustainable levels has dropped from 90 percent to 65.8 over the past three decades.

Stay within planetary and regional environmental boundaries: consumptive water use of under 2500 km<sup>3</sup> per year (with a focus on the most stressed basins), zero net deforestation, and nitrogen application of 90 Tg (with a redistribution toward low-input farming systems).



# AQUATIC FOODS AND SUSTAINABLE DEVELOPMENT

The specific links between our research work on aquatic food systems, the five One CGIAR impact areas, and the SDGs are illustrated in Figure 3.



**Figure 3.** Contribution of aquatic foods to One CGIAR impact areas and the 2030 SDGs.

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# OUR UNIQUE PROPOSITION

The world faces the enormous challenge of feeding 9.8 billion people by 2050. Providing affordable, safe, nutritious food for all is an increasing challenge due to the scale of demand and the increasing threat of climate change (FAO et al. 2020). The COVID-19 pandemic is the latest shock to bring to the forefront fundamental weaknesses in existing global food systems, while taking us further away from the 2030 SDGs (BMGF 2020). Amid growing social inequality and unrest, and with 690 million people worldwide going to sleep hungry every day, we need to fundamentally rethink the way food is grown, produced and distributed.

Aquatic foods offer a viable nutritious and sustainable alternative that is traditionally overlooked in the global agricultural research agenda, which supports sustainable development at country and global levels. Already, about 3.3 billion people worldwide obtain about 20 percent of their average per capita intake of animal protein from fish and aquatic foods (Weeratunge et al. 2013). With more investment in better management and technological innovation, research shows that the ocean and related aquatic food systems can provide over six times more food than they do today. This would be more than two-thirds of the animal protein needed to feed the future global population (Costello et al. 2020).

Aquatic foods are rich in numerous vitamins, minerals, omega-3 fatty acids and other nutrients essential to cognitive development and human health. They could also offer a critical solution for the two billion people worldwide who suffer the triple burden of malnutrition, with women and children poised to benefit the most. Moreover, compared to other animal-source foods, many aquatic foods offer multiple nutritional benefits at a lower environmental cost than many land-based animal production systems (Hilborn et al. 2018a).

Fish and other aquatic foods are among the world's most traded food items, with a total export value of USD 164 billion globally in 2018. They are a highly nutritious food group of major social, cultural and economic significance. They are also big business—the kind of business that does not always favor those most dependent on aquatic food systems for their food, nutrition, incomes and general sociocultural well-being (Hicks et al. 2019a).

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***Aquatic foods are rich in numerous vitamins, minerals, omega-3 fatty acids and other nutrients essential to cognitive development and human health.***



Photo credit: Chosa Mweemba/WorldFish

Globally, our appetite for aquatic foods shows no signs of slowing (FAO 2020), and changing climate conditions and unexpected shocks, like the COVID-19 pandemic, cause major disruptions in social and economic activities. In a world like this, a diverse range of actors will need guidance and sound scientific data and knowledge to understand the complexity and severity of these issues and to formulate comprehensive responses. Countries looking to meet the SDGs by 2030 need evidence and support to (1) reduce the cost of nutritious aquatic foods, (2) make healthy diets with diverse aquatic foods affordable for everyone, and (3) enable vulnerable—and often invisible—women, men and young people working in aquatic food systems to earn decent incomes that enhance their own health and well-being.

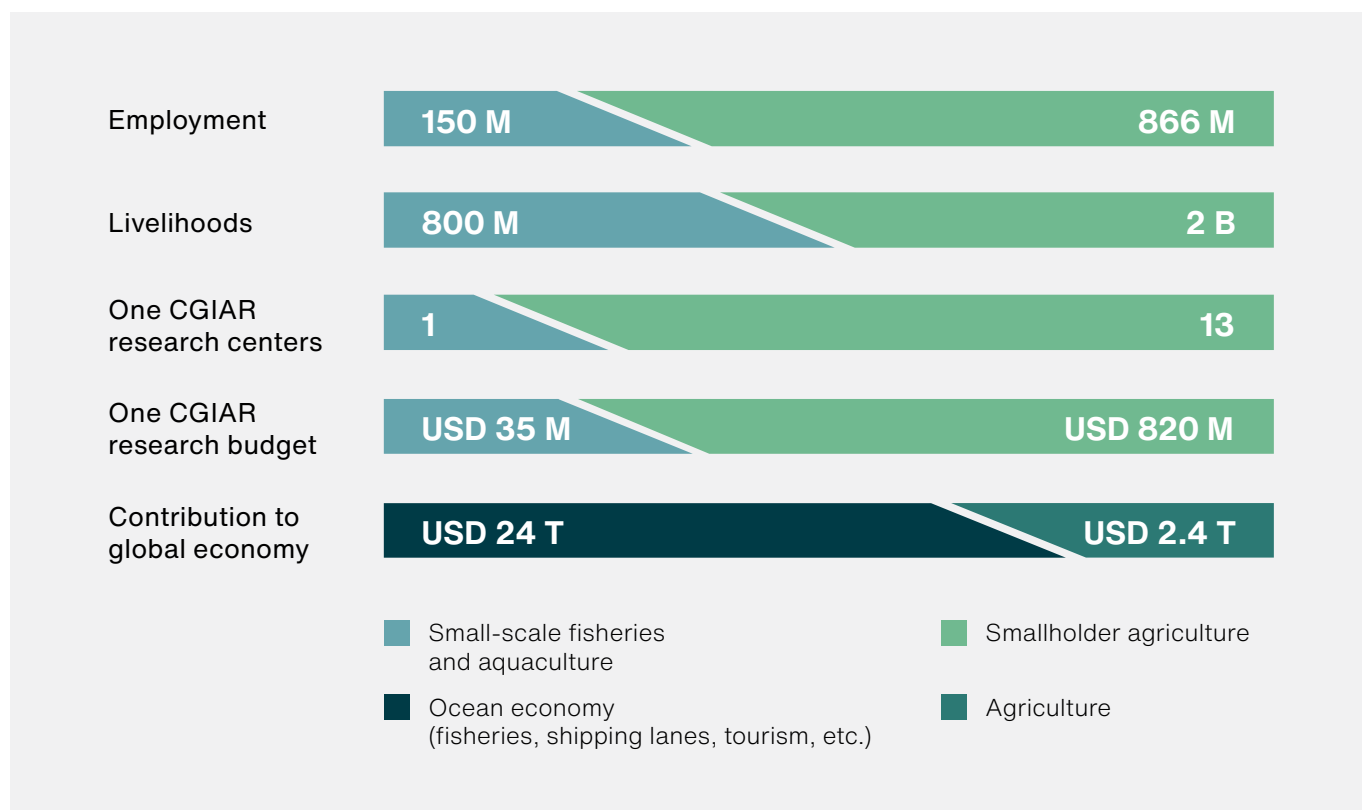
The future contribution of aquatic foods to the global food supply depends on a range of ecological, economic, policy and technological factors (Costello 2019). It also depends on a set of integrated strategies and actions that balance conservation and restoration efforts with food systems transformation efforts (Leclère et al. 2020), across land and water. Delivering healthy and sustainable diets cannot come at the cost of the earth and our health. Our argument is simple. A global food systems transformation toward healthy and sustainable diets that work for people and the planet is not possible without the opportunity to examine, quantify and include the contributions of aquatic food systems to the quest.

Our priority is to ensure greater integration of fish and aquatic foods into the global agricultural research agenda. Aquatic food, in particular, must be linked to the blue economy and ocean space, whose assets such as fisheries, shipping lanes and tourism are worth USD 24 trillion and produce an annual value of USD 2.5 trillion from their outputs (Hoegh-Guldberg 2015; Österblom 2020). This is critical to ensure a full representation of the food system and to address the complex links between food, land and water systems. It is also critical if we are to unlock opportunities for billions of women, men and young people in low- and middle-income countries through an inclusive and people-centered blue economy and ocean governance.

The Green Revolution, which focused primarily on land crops and livestock, has led to improved food security, nutrition and livelihoods for billions of people over the past 70 years. However, with emphasis on increased crop productivity, its benefits are marked by geographical disparities (Pingali 2012), as well as significant health and environmental costs (Aguilar-Rivera 2019). The next great transformation must therefore involve a transition toward food, land and water systems that are equitable and inclusive, as well as healthy, resilient and sustainable.



The potential impact of linking the global agricultural research and innovation agenda to the blue economy and the ocean space is illustrated in Table 2.



Source: adapted from the *CGIAR System Annual Performance Report 2019*, CGIAR System Organization (2019) and *Reviving the Ocean Economy*, WWF (2015).

**Table 2.** Potential for impact with aquatic foods research.

We must rethink production, distribution and consumption of food from both land and water. This requires us to change country and global policies and institutions that enable current agricultural and industrial activities. The practices of over 500 million smallholder farmers must also change, as well as the way in which 7.6 billion women, men and children consume food every day. We believe aquatic food systems have an important role to play in meeting the shared global aspiration of establishing inclusive, efficient, sustainable, nutritious and healthy food systems capable of achieving the SDGs without costing the earth. Considering the estimated 10:1 rate of return on investment, both research and innovation in aquatic food systems, as an important part of the wider One CGIAR agricultural research agenda, are central to impacts at scale and critical to national and global efforts to tackle climate change, protect nature and biodiversity and boost human nutrition and well-being (Alston 2020).

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# FOCUS GEOGRAPHIES AND COMMUNITIES



Over the past 45 years, WorldFish has been building strong and long-lasting partnerships. We have partnered with national governments, local communities, civil society organizations, entrepreneurs and businesses in countries with high dependence on fish and other aquatic foods for food security and nutrition, as well as jobs, livelihoods and economic growth.

Our global footprint represents more than 20 countries of research interest across Africa, Asia and the Pacific. In many of these countries, we have a physical presence and our research teams are placed to work alongside national agricultural research institutions or relevant government ministries. Together, we support and strengthen local capacities and skills for scientific research and data, as well as research-to-policy program development, management and implementation. At the regional level, our work with One CGIAR partners connects us to key regional economic actors and intergovernmental organizations that shape discourse, policy and practices for sustainable development across the continent.

Over the next 10 years and within One CGIAR centers, our intention is to expand our geographical footprint in key countries and communities in Africa, Asia, the Pacific, and Latin America and the Caribbean, where our work can make a difference to persisting development challenges.

Through the use of global assessment indicators, we have defined our priority countries. These are nations where research on aquatic food systems can have a significant impact on millions of people whose livelihoods and futures are dependent on aquatic foods. They also are heavily impacted by the five One CGIAR grand challenges:

1. Nutrition and food security
2. Poverty reduction, jobs and livelihoods
3. Gender equality, youth and social inclusion
4. Climate adaptation and greenhouse gas reduction
5. Environmental health and biodiversity



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# AFRICA

Africa faces extreme poverty and food and nutrition security challenges. More than 40 percent of the population lives on less than USD 1.90 a day, and nearly one in three Africans do not have enough to eat. Demand for food will grow as the continent's population is set to double to 2.4 billion by 2050. African cities are already the fastest growing in the world. By 2050, the continent will be home to up to 15 megacities of more than 10 million inhabitants.

Fisheries and aquaculture represent a critical social safety net and source of food and nutrition, particularly in times of successive crop failures and poor agricultural harvests, or other humanitarian emergencies related to climate change or conflicts. The sector employs over 12 million people, a quarter of whom are women engaged in postharvest fish processing and trade activities. The economic impact of the COVID-19 pandemic has plunged the continent into its first economic recession in 25 years, resulting in a loss of jobs and incomes for one-third of the entire workforce.

On average, fish and aquatic food products account for 19 percent of animal protein intake among African consumers. However, consumption of fish and aquatic foods in Africa remains half the global average of 20.8 kg per capita annually. Wild capture fisheries supply most of the fish and aquatic foods, but they face enormous challenges of overexploitation and a lack of sustainable management. Illegal unreported and unregulated fishing costs West Africa alone USD 1.3 billion per year. With rising sea temperatures, harsher weather conditions and the migration of fish to cooler waters, climate change threatens aquatic food supplies locally.

The continent relies on imports to meet growing fish demand. Sub-Saharan Africa has the world's highest rates of vitamin A deficiency in children and iron deficiency in women, and populations in East and Southern Africa are chronically undernourished. And in West and Central Africa, people have the world's highest per capita incidence of foodborne diseases.

As an essential source of micronutrients and animal protein, safe and nutritious aquatic foods can help address these issues through increased consumption. The emergent aquaculture sector requires significant investment in skills, knowledge and inputs in order to take off. Investments in improved fisheries management systems and appropriate infrastructure are critical to enhancing resilience to the impacts of climate change and making aquatic foods accessible and affordable for low-income domestic consumers.



**\$ 24 billion**

Direct contribution of aquatic food systems to the African economy, as well as to food security and nutrition.

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#### **Countries of interest**

Egypt, Ghana, Kenya, Malawi, Mozambique, Nigeria, Senegal, Sierra Leone, Tanzania, Zambia

#### **Regional partnerships and unions**

AU, AfDB, ASARECA, CCARDESA, CAADP Reporting Framework, COMESA, CORAF, ECOWAS, ECCAS, EAC, FARA and SADC

#### **One CGIAR region**

Central and West Asia and North Africa (CWANA), West and Central Africa (WCA), East and Southern Africa (ESA)

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# ASIA

Despite its strong economic growth, Asia is home to an estimated 400 million people living in extreme poverty below USD 1.90 a day. The number of people living at the higher poverty line of USD 3.20 a day is 1.2 billion, which accounts for more than a quarter of the region's population. Asia is home to seven of the 10 most densely populated cities in the world, yet a large share of Asia's population still lacks access to basic infrastructure and services. Existing infrastructure development and growth patterns can lock cities into unsustainable consumption and production models for years to come.

The main human and environmental health challenges relate to poor air quality, the lack of a clean water supply, and mismanagement of waste and sanitation. Vitamin A, zinc and iron are three of the most significant micronutrient deficiencies, and they remain a serious public health risk in South and Southeast Asia. More than two-thirds of all wasted children under 5 years of age and approximately 83.6 million (55 percent) of all stunted children live in Asia.

The region is the world's largest producer of aquatic foods from both aquaculture and capture fisheries. Most of the growth comes from China and from countries in South and Southeast Asia. Overall, Asia is home to 85 percent of the world's fishers and aquaculture workers. Production from many small-scale operators in inland areas of the region often goes unrecorded. Currently, there is a rapid, ongoing shift in the supply of freshwater fish in Asia, from wild to farmed sources. This represents an important, yet poorly understood food transition with critical ramifications for addressing the region's sustainable development in the context of rapid urbanization, rising incomes and changing diets. Climate change poses a major threat, with an increase in flooding and salinization in coastal areas and major deltas, which are the region's densely populated food baskets. In addition, plastic pollution threatens marine biodiversity, and the estimated damage to key marine ecosystems in the region, including the Bay of Bengal, costs up to USD 13 billion annually.

Consumption of aquatic foods is growing in Asia. Several factors are driving this increase, including urban population growth, rising incomes, expanding international fish trade routes and a dramatic extension of fish production, especially from aquaculture. Southeast Asia has the highest rate of annual fish consumption in the world at over 35 kg per capita. Domestic consumers and their access to balanced, healthy diets with safe and affordable foods are as diverse in their preferences as the aquatic food products they consume due to local, cultural, economic and geographical differences. And demand for high-value fish species, which consume high-quality feeds, is increasing among urban populations.

To secure healthy and sustainable diets for all, more research and investment are required. What is needed are well-integrated policies, technologies, infrastructure and value chains that balance economic growth with considerations of food security and nutrition, gender and social inclusion, climate resilience and environmental protection.



**90%**

Percentage of the global production of farmed aquatic foods that comes from Asia.



**Countries of interest**

Bangladesh, Cambodia, India, Indonesia, Malaysia, Myanmar, Vietnam

**Regional partnerships and unions**

SAARC and ASEAN

**One CGIAR region**

South Asia (SA), South East Asia (SEA), the Pacific





Photo credit: Nohr Alam, WorldFish





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# THE PACIFIC

The Pacific region is an ocean of islands with mostly low- and middle-income countries populated by some of the world’s most at-risk societies. Poverty, exclusion and vulnerability are on the rise in Pacific island countries, with one in four individuals living below USD 1.90 a day (UNDP 2014).

Pacific communities are defined by their relationship to the ocean. The region is rich in natural wonders, cultures and traditional practices and boasts spectacular diversity. Aquatic foods are the backbone of Pacific island economies. Coastal fisheries generate food and income for low-income rural communities, particularly where formal markets and supply chains function poorly.

Economies are shifting from traditional systems built on the exchange of products to market-led cash-based ones. Young people are migrating from villages to find jobs in cities and abroad, leaving women, the very old and the very young behind. There is also a lack of broader development in a variety of areas, including infrastructure, communication, banking and public services. As a result, it is difficult and expensive to transport and distribute highly perishable fresh foods from the garden or the ocean to urban marketplaces. This has driven the growing influx and acceptance of refined, processed and nonperishable convenience foods, which have a long shelf life. Paradoxically, these foods are more affordable, accessible and available than domestically harvested fish and vegetables in urban settings.

According to the World Health Organization (WHO), nine of the 10 “most obese” countries of the world are in the Pacific. Noncommunicable diseases related to malnutrition are the leading cause of premature death and disability in the region—principally cardiovascular diseases, cancer, diabetes and chronic respiratory diseases. Several of the Pacific island countries also have a high prevalence of stunting in children under 5 years of age.

Population growth, pollution, overfishing and climate change threaten the future supply of aquatic foods and exacerbate food security and nutrition challenges in the region. Even though Pacific island communities contribute least to climate change, by virtue of their geography they are among the world’s most vulnerable people when it comes to severe climate impacts related to sea-level rises, changing temperatures and extreme natural events. These impacts will affect food and water security, loss of identity, climate-induced migration and threats to sovereignty.

In response, communities in the region are leading climate adaptation strategies. Often in combination traditional knowledge and practices with cutting-edge science, these strategies are building the resilience of their communities and ecosystems in the face of increasing climate risk. By necessity, Pacific islands are becoming hubs of innovation, where climate strategies can be piloted, refined and scaled to inform successful climate adaptation efforts in other large ocean states, as well as globally.

**50%**

Percentage of all households in the Pacific that depend on coastal fisheries for their primary or secondary income.

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**Countries of interest**

Solomon Islands,  
Timor-Leste

**Regional partnerships and unions**

Pacific Island Forum

**One CGIAR region**

South East Asia (SEA),  
the Pacific





Photo credit: Hampus Eriksson/WorldFish





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# LATIN AMERICA AND THE CARIBBEAN

More than 80 percent of people in Latin America and the Caribbean (LAC) live in cities, but this rapid urban growth in the region poses challenges. These include profound social-economic inequality, limited mobility, pollution, increased vulnerability to natural hazards, poor urban planning, high levels of unemployment, crime and weak institutional and fiscal capacity, among others.

On average, one in five people in the region live in chronic poverty, and every year 600,000 people die due to diseases related to poor diets, such as diabetes, hypertension and cardiovascular diseases. Inadequate diets are associated with more deaths than any other risk factor. In addition, the rates of both childhood and adolescent obesity tripled between 1990 and 2016.

People in LAC have the lowest annual per capita consumption of fish worldwide at only 9.8 kg. This stands in stark contrast to the region being a net exporter of fish and aquatic foods and a large aquaculture producer. Peru is the world's top producer and exporter of fishmeal and fish oil. Since 1980, aquaculture production in LAC has increased 100-fold, and the sector employs 3.8 million people. Meanwhile, small-scale fisheries support livelihoods, employment and food security of more than 2.3 million people in marine, brackish and freshwater environments. They contribute to environmental stewardship in the region, which is known for its rich biodiversity and endemic species. The Amazon basin alone is home to more than 3000 fish species and represents one in every 10 freshwater fish caught worldwide. Households in the Brazilian Amazon obtain 30 percent of the family income from fishing. Yet despite their high social and economic relevance in the region, small-scale fisheries are characterized by a history of inequality, social exclusion and invisibility in key policies.

By 2030, production from both aquaculture and fisheries in the region is expected to grow by 24 percent, from 12.9 million tons to 16 million tons. While food availability in the LAC region is sufficient to meet the energy needs of its entire population, there are worrying trends. Per capita consumption of sugar and fats is higher than the recommended range for a healthy diet, while the availability of fish and aquatic foods per capita is the lowest in the world.

Research and investments are required to support the adoption of healthy eating habits and changes in public policies. The purpose is to create sustainable and nutrition-sensitive food systems that provide healthy aquatic foods for all, while preserving land and aquatic food ecosystems through sustainable use of natural resources, and improved techniques for food production, storage and processing.

**3000**

Number of fish species in the Amazon basin alone, representing one in every 10 freshwater fish caught worldwide.



**Countries of interest**

Colombia, Honduras, Mexico, Peru

**Regional partnerships and unions**

CELAC

**One CGIAR region**

Latin America and the Caribbean (LAC)



Photo credit: WorldFish



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# WHO BENEFITS FROM OUR WORK

In our focus countries, many women, men and young people are engaged in small-scale fisheries and/or small and medium aquaculture, as producers, consumers of aquatic foods, and workers and business owners in related value chains. They are the principal focus of our work.

These groups often remain marginalized, underserved or overlooked despite the important contributions they make to local and national economies and food security. Our research informs policy, market, institutional and technological innovations that prioritize rights and access to natural resources, land, assets, technologies, public services and finance so that people in these groups can determine their own lives and futures.

Working as a networked organization is what supports our multistakeholder engagement approach. We use formal and informal approaches, participatory research methods, space for dialogue, and proactive engagement in the wider innovation ecosystem. Together, they enable different actors with various skillsets, experiences, and sector and discipline backgrounds to connect, learn and exchange knowledge and to co-create solutions.

A snapshot of how different groups of stakeholders benefit from our work on aquatic food systems is provided on pages 28-30.

**90%**

Percentage of all small-scale fishers living in low- and middle-income countries in the Global South.

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## **SMALL-SCALE FISHERS, FARMERS, PRODUCERS, PROCESSORS, TRADERS AND CONSUMERS**

- These actors gain greater access to knowledge, inputs, finance, innovations and business opportunities that boost incomes, create jobs, reduce loss and waste, and improve nutrition, health and well-being.
- People living in low- and middle-income countries gain greater availability, accessibility, variety and consumption of aquatic foods.
- Consumers in low- and middle- income countries make better and informed choices about aquatic foods as part of healthy and sustainable diets.
- Local knowledge, needs, voices, priorities and perspectives of people dependent on aquatic food systems shape the development of an inclusive and people-centered blue economy and ocean governance.



## **LOCAL COMMUNITY AND DEVELOPMENT ACTORS**

- Local actors participate in and contribute to cutting-edge research on sustainable aquatic food solutions that deliver multiple benefits for vulnerable and disadvantaged communities.
- They gain access to open-source scientific and practical knowledge on best practices and low-cost technologies to shape community-based solutions.
- Research guides and supports the development of social protection schemes, community development programs and interventions based on the latest scientific evidence, data and decision-making tools.
- Greater knowledge and expertise are shared and transferred between communities, civil society organizations, social entrepreneurs, local development actors and our scientists and partners, accelerating sustainable and inclusive transformation at all levels of the food systems.



## **SCIENTIFIC COMMUNITY IN LOW- AND MIDDLE-INCOME COUNTRIES**

- Scientists in the Global South benefit from increased engagement and collaboration with WorldFish, One CGIAR and partners in the wider international scientific community.
- New research and development projects focus on aquatic food systems and related issues, such as nutrition, climate change, public health, gender and social inclusion.
- Critical data, insights and perspectives from scientists and communities in the global South are increasingly included in global policy and change agendas.
- Greater knowledge and expertise are shared and transferred between scientific institutions in the Global South and North, sustaining continued innovation and accelerating food systems transformation.



## PUBLIC SECTOR

- Policymakers at all levels increase knowledge and understanding of scientific evidence on aquatic foods and use innovative data-driven tools related to shaping multisectoral policy and investment decisions with interrelated social, economic and environmental impact.
- Policymakers increasingly recognize the significant role of aquatic food systems in meeting national SDG targets on climate action, gender equality, nutrition, decent work, responsible consumption, etc.
- They strengthen their own research and policy development capacities on issues related to aquatic food systems.
- They learn about innovative solutions in other communities and geographies and are able to adopt, adapt and implement these in their own contexts.
- They benefit from increased networking opportunities with science, market and other actors with critical knowledge, tools and resources required to develop shared solutions with aquatic foods to deliver multiple social, economic and environmental benefits.
- Statistical information systems on aquatic foods, at national, regional and global levels, are improved and developed for better policies and decisions.



## ONE CGIAR

- A more inclusive and relevant global research agenda on food, land and water systems includes aquatic food systems and the billions of people dependent on them.
- Research, engagement and investment opportunities are expanded with new public and private sector collaborations through greater focus on aquatic food systems research.
- One CGIAR's relevance and influence in the world is increased through stronger connection to important future food areas related to the blue economy.



## MEDIA AND THE GENERAL PUBLIC

- Media at all levels shape public opinion, discourse, narratives and individual behaviors and change agendas based on objective and impartial scientific facts, knowledge and insights.
- Research helps to inform public debate, dispel myths and misconceptions about key issues of critical public interest, and to inspire action for a sustainable food systems transformation at all levels.
- Increased interest and engagement with science helps to shape better narratives, improve discourse and brighten futures with aquatic food systems.



## PRIVATE SECTOR

- Businesses, local cooperatives and social entrepreneurs in low- and middle-income countries benefit from increased scientific knowledge, networks and collaboration on new aquatic food technologies, practices and innovations ripe for scaling and development.
- A growing aquatic foods sector in low- and middle-income countries benefits from a skilled workforce and entrepreneurs armed with the latest scientific knowledge and training in aquatic foods technologies and best practices.
- Engagement with researchers, policymakers and other critical stakeholders allows for new discoveries and sustained innovation at the cross-section of sectors and disciplines.
- New jobs and entrepreneurship opportunities are created in an inclusive blue economy that is powered by digital technology.
- Research guides the development of market-based standards and certifications for nutritious aquatic food products that are socially and environmentally responsible.



## YOUNG SCIENTISTS, INNOVATORS AND ENTREPRENEURS

- Young women and men in low- and middle-income countries build skills, knowledge, capacities and gain access to critical development opportunities and resources to shape their future careers in academic, policy or business.
- They gain exposure and real-world experience from involvement in cutting-edge research and development projects in aquatic food systems.
- Young innovators and entrepreneurs develop policy, market and technology solutions based on scientific evidence.
- They receive support and mentorship from world-class scientists and are given access to prestigious science, policy and business networks through WorldFish, One CGIAR and other public and private sector partners.



## INVESTORS, PHILANTHROPIC ACTORS AND DEVELOPMENT AGENCIES

- Investors across the public and private sectors discover and fund winning science, technology, policy and market innovations in aquatic food systems that deliver multiple and inclusive outcomes for improved health and nutrition, climate action, environmental protection, etc.
- Scientific data, knowledge and evidence support the business case for increased investments, research and innovation in aquatic food systems.
- Critical investment decisions on policy, market and consumer incentives to fulfill the sustainable development potential of aquatic food systems are guided by sound evidence.



PART III

A TRANSFORMATIVE  
AGENDA FOR  
RESEARCH ON  
AQUATIC FOOD  
SYSTEMS



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# THE UNTAPPED POTENTIAL OF AQUATIC FOODS

Our agenda for research on aquatic food systems reflects the call for a radical transformation of food systems by the HLPE. Transforming food systems to deliver healthier and more sustainable diets is imperative if we are to meet the needs of all within the means of the planet. This will ensure that no one falls short on life's essentials, while making sure we do not overshoot the earth's life-supporting systems (Raworth 2017), which are the "planetary boundaries" (Rockström 2009). This imperative reflects and is intensified by the context of climate change, the growing triple burden of malnutrition, and widening economic inequality.

Aquatic food systems are an extremely important but historically undervalued component of the global food system and their role in improving nutrition and sustaining healthy diets (Thilsted 2016). Aquatic foods share three sets of important characteristics that lend them an outsized role in meeting the grand challenge of transforming the food system to deliver better human and environmental health outcomes.

Aquatic foods are highly diverse (Tlustý et al. 2019). They also tend to have much lower average resource use and environmental impact profiles than land-based animal-source foods such as beef and pork (Willett 2019; Froehlich 2018; Hilborn et al. 2018b). For instance, beef cattle create greenhouse gas emissions that are eight times greater on average than those from farmed fish (Poore and Nemecek 2018). In addition, fish are cold-blooded, so they are able to convert protein and energy to body mass more efficiently than warm-blooded terrestrial animals. Most feed ingredients used to raise farmed fish are by-products of crop production, such as rice bran and oil cake. At least one-quarter of all fishmeal is now obtained from fish processing waste, which contributes significantly to the circular economy (Stevens et al. 2018). Seaweeds and filter feeding molluscs, such as mussels, are grown without any feeds or fertilizers and can sequester carbon dioxide and improve water quality by stripping nutrients (Fodrie et al. 2017). When well managed, wild stocks of fish and other aquatic animals are important renewable resources that can be harvested indefinitely at sustainable levels.

## ENVIRONMENT

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## LIVELIHOODS

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Fisheries and aquaculture are important sources of jobs, employment and income for millions of people in Africa, Asia and around the world (Phillips et al. 2016; World Bank 2008). Employment is full- and part-time, and both direct (for fishers or farmers) and indirect (for workers in and owners of a plethora of small and medium enterprises that provide supporting services along aquatic food value chains) (Hernandez et al. 2018). Fisheries can serve as an important social safety net, absorbing seasonal surpluses of labor (Béné et al. 2010). They can also be more lucrative for participants than alternative sources of employment and can provide investment capital for other household enterprises (Allison and Mvula 2002). Women account for approximately half of the people employed in fisheries globally when work onshore is also included (Weeratunge et al. 2011). Aquaculture typically generates much higher returns than crops such as rice, contributing to the sector's rapid growth. It is also often more labor intensive than seasonal agriculture, which creates demand for jobs year-round both on- and off-farm (Filipski and Belton 2018), including for many young people.

## NUTRITION

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Fish and aquatic foods are the main animal-source food consumed by more than a billion “fish dependent” people. They are an irreplaceable source of micronutrients, essential fatty acids and high-quality protein for the most vulnerable in many of the world's lowest-income countries in Africa, Asia and the Pacific (Golden et al. 2016; Hicks et al. 2019b). In these regions, there is an outsized contribution of aquatic foods to diets and micronutrient intakes in low- and middle-income countries. This makes maintaining and increasing their accessibility and availability key to addressing undernutrition. Moreover, aquatic foods are the primary source of omega-3 fatty acids. These are essential for cognitive development, and they reduce the risk of noncommunicable diseases. They also have an important role to play in combating the risks associated with overweight and obesity, making them a healthy alternative to red meat and poultry (He 2009).

Aquatic food systems have enormous potential as a lever for transformation toward a more sustainable and equitable global food system. A series of critical challenges described on page 34 undermine their current positive contributions or prevent them from delivering their full transformative potential.

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## KEY CHALLENGES TO AQUATIC FOOD SYSTEMS

- **Impacts of climate change** affect the productivity and viability of fisheries and aquaculture. These include higher water temperatures, salinity, severity and frequency of droughts and floods, and ocean acidity, all of which can increase vulnerability and risk and erode productivity, profitability and resilience (Barange et al. 2018).
- **Infrastructure development and land use change** such as dam construction, conversion of biodiverse habitats like wetlands and mangroves, as well as overfishing and pollution, are sometimes consequences of aquatic food production and can seriously threaten its future viability.
- **Competition for resources** used in the production of feeds (including land and freshwater used to grow terrestrial crops) and forage fish make it essential to use and allocate existing resources more efficiently and equitably and reduce loss, waste and environmental externalities.
- The “**blue acceleration**” of **escalating competition for space** in the oceans for purposes as diverse as undersea mining, tourism and conservation (Jouffray et al. 2020) make it essential to advocate for equity and justice in the emerging blue economy to prevent the exclusion of fishers and other traditional users from access to aquatic resources on which they depend (Cohen et al. 2019).
- **Work in aquatic food supply chains** can be risky or dangerous and is sometimes highly exploitative, as revealed by a series of recent “slavery scandals” (Marschke and Vandergeest 2016). Opportunities to participate productively in aquatic food production are not accessible to all, with gender and other forms of identity sometimes serving as a basis for social exclusion.
- In some low- and middle-income countries with high levels of aquatic food consumption, **changing food environments** and shifting opportunity costs of time are encouraging consumption of less healthy food. This requires a shift to more convenient product forms to sustain optimal levels of consumption.
- **Aquatic animal diseases** are an increasing challenge for aquaculture and a major cause of risk, instability and financial loss in the sector. Aquatic animal health is linked to human health through the use of antibiotics and antimicrobial resistance (Cabello et al. 2013), while **food safety** is a key factor driving the restructuring and governance of aquatic food supply chains in middle-income countries, with potentially inequitable outcomes for smaller producers (Belton et al. 2020).
- **Declining availability and diversity of wild aquatic foods** also threatens food and nutrition security.



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## RESEARCH PRIORITIES FOR ACTION

Our research response is designed explicitly to address the types of challenges described on page 34. As a result, our strategy on research and innovation will contribute to the sustainability of aquatic food systems specifically and food systems in general, and unlock opportunities to transition and shift these to deliver healthy, resilient diets and shared prosperity for all.

Our transformative agenda for research on aquatic food systems will focus on three main areas of impact that are crucially important: (1) climate resilience and environmental sustainability, (2) social and economic inclusion, and (3) nutrition and public health (Figure 4). The shift toward food systems research takes into account the four dimensions of natural, produced, human and social capital in food systems, from production through to consumption (Kumar 2010).

Our research activities are structured around nine priority actions that respond to the five One CGIAR impact areas and the SDGs. These actions deliver measurable impacts through an integrated set of indicators to evaluate and track progress toward healthy and resilient diets and food systems sustainability, which is a critical step in building national transformative pathways (Chaudhary et al. 2018).

Drawing on an extensive consultation and assessment of challenges in the focus geographies and communities described in Part I of the strategy, we have built on the areas of work where WorldFish has its strongest value proposition and legacy of impact. Based on emerging trends, we have canvassed new opportunities, particularly in the areas of the blue economy, big data and digital technologies, alternative proteins, circular economy approaches to food loss and waste, as well as One Health considerations for people, animals and the environment.





### **IMPACT: CLIMATE RESILIENCE AND ENVIRONMENTAL SUSTAINABILITY**

- 1.1 Enable sustainable production of diverse aquatic foods
- 1.2 Cut down on loss and waste
- 1.3 Enhance climate resilience and reduce greenhouse gas emissions

### **IMPACT: SOCIAL AND ECONOMIC INCLUSION**

- 2.1 Leave no one behind with an inclusive and people-centered blue economy
- 2.2 Improve the availability, accessibility and affordability of aquatic foods for all
- 2.3 Support sustainable livelihoods, decent work and well-being

### **IMPACT: NUTRITION AND PUBLIC HEALTH**

- 3.1 Inform consumer demand for healthy and nutritious aquatic foods
- 3.2 Ensure aquatic foods are safe and healthy for human consumption
- 3.3 Prioritize nutrition and health for vulnerable and marginalized people

**Figure 4.** Research priorities for action.

Details of these priority actions for research, including activities, related food system sustainability indicators, links to the five One CGIAR impact areas and the SDGs, as well as key One CGIAR and other partners, are outlined in the next section.

## IMPACT AREA 1

# CLIMATE RESILIENCE AND ENVIRONMENTAL SUSTAINABILITY

### Strategic research objective 1

To discover, develop, test, adapt and promote science-based innovations, technologies and practices that reduce climate risk through sustainable use and management of aquatic resources.

#### Food system sustainability indicators

Climate resilience, adaptation, mitigation • ecosystem stability and services • biodiversity • conservation and sustainable use of natural resources • reduction in food loss and waste

#### One CGIAR impact areas

Climate adaptation and greenhouse gas reduction • environmental health and biodiversity

#### SDGs



About 3.3 billion people worldwide rely on wild-caught and farmed aquatic foods as their main source of animal protein (FAO 2020). The livelihoods of millions of people depend on marine and freshwater resources and related ecosystem services. These ecosystems are under immense pressure due to overexploitation, habitat degradation, greenhouse gas emissions, agricultural and industrial land conversion, depleted water resources, plastic and runoff pollution, and the unsustainable way in which food is generally produced and consumed. These climate change pressures exacerbate the situation through gradual warming, ocean acidification and changes in the frequency, intensity and location of extreme events. In turn, these negatively impact the productivity of aquatic resources across multiple trophic levels. Studies show that actions to curb greenhouse gas emissions are critical to prevent the estimated 40 percent decline in tropical fish catch globally by 2050 (Lam 2020). On the other hand, up to 35 percent of fisheries and aquaculture production is either lost or wasted (FAO 2020). Coupled with continued overconsumption and rising incomes in transitional economies, this will put further strain on the environmental sustainability of food systems (HLPE 2014).

The compounded impacts of climate change and unsustainable use of marine and freshwater ecosystems are compromising their provisioning and general life support services. Our work will focus on reversing this trend and accelerating the transition to ecosystem restoration. Food system approaches will provide the market framing for research on aquatic food production (including marine and inland fisheries, aquaculture and integrated land and water farming). We will generate evidence and innovations to reduce food loss and waste, build climate resilience and put aquatic food production systems on a low emissions pathway toward environmental sustainability. We will also address the challenges facing small-scale fishers, fish farmers, processors and traders who are unable to leverage market opportunities due to a low asset base, exposure to risks, geographical isolation and social exclusion.

## PRIORITY ACTION 1.1

### Enable sustainable production of diverse aquatic foods



Diverse food production systems provide the foundation for dietary diversity, food system resilience and environmental sustainability. Diversity has multiple benefits at multiple nodes within the food system, from smallholder integrated farming systems, to small-scale fisheries, through to globally traded aquatic foods. Scientific evidence to inform policy and investment decisions is critical here. Research will identify innovative solutions to sustainably harvest and produce diverse aquatic foods from capture fisheries and aquaculture, as well as integration with land-based food production systems.

Inland and coastal fisheries are vital to the nutrition, food security and livelihoods of millions of people in low- and middle-income countries. Since 1990, the percentage of fishstocks within biologically sustainable levels has dropped from 90 percent to 65.8 (FAO 2020). Although progress is being made globally in improving fisheries management, many fisheries within low- and middle-income countries remain poorly managed. Despite their importance to large numbers of people around the world and the significance of the threats they face, fisheries continue to receive limited attention from policymakers. This is because a large proportion of fish in developing countries is supplied by small-scale fisheries, whose contribution is often unaccounted for in national statistics. Moreover, short-term profits are often prioritized at the expense of long-term viability due to limited incentives and misallocated investments. Building on our groundbreaking work with the Food and Agriculture Organization (FAO) and Duke University on Illuminating Hidden Harvests (WorldFish n.d.), we will continue to work with diverse stakeholders to advance understanding of the value of capture fisheries and increase efforts to capture their contributions in national accounts. We will use quality data to inform policy and investment decisions, align incentives and investments, and co-host platforms for dialogue at national, regional and global levels. This will accelerate the transition toward socially inclusive and environmentally sustainable capture fisheries.

Aquaculture is the fastest growing food-producing sector in the world. Since 1970, it has averaged an annual growth rate of 7.5 percent (FAO 2020), and it is becoming a key source of sustainable animal-source foods. Meeting future demand will require sustainable intensification of aquaculture systems and scaling of game-changing aquaculture innovations in those countries facing fish and aquatic food deficits, while managing any social and environmental risks. Our work with private and public partners will focus on three areas: (1) generating knowledge and tools for sustainable feeds and feed systems, (2) preventing and controlling animal diseases, and (3) enhancing the environmental sustainability of aquaculture production systems, while ensuring improved nutrition, health and socioeconomic outcomes for all.



Our groundbreaking work on genetically improved and resilient fish breeds, including application of innovative genomic technologies, will continue. We will work with partners to ensure improved breeds are accessible and widely disseminated, while examining critical market forces, including certification schemes, to shape, inform and incentivize transformation toward sustainable aquatic food systems, from production to consumption. At the global level, as part of the Committee on Fisheries (COFI) Advisory Working Group on Aquatic Genetic Resources and Technologies, we will continue to support the development and implementation of the Global Plan of Action on Aquatic Genetic Resources for Food and Agriculture, in partnership with FAO.

Finally, we will seek to integrate aquatic food production into water and land systems at landscape and watershed levels in ways that sustain and diversify food production within environmental limits. Promising research, such as the integration of fish into water management schemes, nature-based solutions, nutrition-sensitive approaches to integrated farming systems of crops, livestock and aquatic foods, will be scaled to increase sustainable production of diverse aquatic foods and to improve outcomes for millions of people who depend on them for nutrition, health, jobs and livelihoods.

**One CGIAR partners**  
IWMI, ILRI, CIFOR, CIP

**Research partners**  
Roslin Institute, CIRAD,  
JCU, WUR, CEFAS,  
national research partners

**Policy and advocacy partners**  
FAO, IFAD,  
ministries in partner countries

## PRIORITY ACTION 1.2

### Cut down on loss and waste



Thirty-five percent of the global harvest from fisheries and aquaculture is lost or wasted. The value of discarded fish alone is estimated to be worth USD 22.5 billion per year (FAO 2020). Aside from the environmental imperative to improve the sector's efficiency and sustainability, tackling loss and waste in aquatic foods offers other opportunities to address related losses in nutrition, livelihoods and public health. This can be accomplished through innovative technologies, products and services that are supported by appropriate policies, regulatory frameworks, capacity building and improved infrastructure, as well as access to markets. However, critical gaps in data and knowledge must be tackled to minimize and, where possible, eliminate loss and waste across aquatic food supply chains in low- and middle-income countries. We will work with partners to fill these gaps, as well as identify and evaluate innovation opportunities to co-develop new commercially viable products, services and markets to unlock new value from loss and waste.

We will work with multidisciplinary and cross-sector partners to establish an open innovation lab for co-designing and accelerating disruptive market, product, technology and social innovations. These innovations will provide multiple benefits for low- and middle-income producers, farmers, processors and consumers of aquatic foods. In addition, we will work to incubate and scale promising research with public and commercial partners representing fisheries, tourism, restaurant, food and beverage, cosmetics, pharmaceutical and other sectors. We will explore novel methods of engagement with various stakeholders to increase awareness about loss and waste in aquatic food systems and influence behaviors and investments toward eliminating it.

**One CGIAR partners**  
IFPRI

**Research partners**  
NRI, University of Greenwich,  
Johns Hopkins University

**Policy and advocacy partners**  
FAO

**PRIORITY ACTION 1.3**

Enhance climate resilience and reduce greenhouse gas emissions



Aquatic food systems are complex nonlinear systems that involve multiple actors and varying networks and interactions. The complex interrelated impacts of climate change and aquatic food systems, and their implications for ecological, economic and social systems, can only be understood and addressed through an integrated systems approach. This requires a shift from the traditional “single issue” approach toward holistic approaches that consider multiple systemic challenges at once. These include access to technology, market systems development, regulatory frameworks, finance and power asymmetries.

We will continue to generate data and knowledge on the key vulnerabilities and adaptation priorities for critical global hotspots where dependency on aquatic resources and ecosystems is high. We will work in close collaboration and dialogue with advanced research institutions, national and international policymakers, small-scale fishers, farmers and community representatives, civil society groups, businesses and social entrepreneurs. Together, we will identify, design and evaluate interventions and innovation opportunities where aquatic foods play a key role in putting food systems on a low emissions pathway.

We will also employ resilient market systems development approaches to ensure that vulnerable communities that depend on fisheries and aquaculture are not only able to withstand shocks and cope with the next climate risk, but are also able to make critical investments and build relationships instrumental to their success. Research will focus on improving understanding of how these communities can attain and enhance their long-term resilience to climate change and achieve economic prosperity without compromising the ecological integrity of aquatic ecosystems and resources.

Transitioning to climate resilient aquatic food systems requires significant investments in research and innovations that can help reduce greenhouse gas emissions, minimize climate risk and enhance long-term resilience in aquatic food systems. In particular, small-scale fisheries and aquaculture are characterized by a chronic finance gap, while access to the limited finance available is challenging for those who need it the most. Therefore, research will focus on identifying potential climate finance options from both public (e.g. fiscal allocations) and private (e.g. impact investing) sources. It will also support local communities that depend on aquatic food systems to increase their knowledge, understanding and capacities to access different sources of climate finance.

At the global level, we will work with partners to generate evidence on the role of sustainable aquatic food systems in attaining greater synergy between human and ocean health, and ensure their contribution is captured and reflected in critical climate policies, such as the UN Framework Convention on Climate Change (UNFCCC) outcome documents, which have persistently failed to recognize the contribution of “healthy and sustainable diets” as a low emission pathway (Gralak et al. 2020).

**One CGIAR partners**  
CCAFS, IWMI

**Research partners**  
UBC, IIED, NOC (UK)

**Policy and advocacy partners**  
ICCCAD, FAO

## IMPACT AREA 2

# SOCIAL AND ECONOMIC INCLUSION

### Strategic research objective 2

To generate compelling scientific evidence that persuades critical decision-makers and market actors—at all levels—to implement inclusive policies and investments in aquatic food systems for shared prosperity and well-being.

Over 90 percent of food producers are small-scale, and they dominate maritime employment. They include significant populations of full- and part-time fishers and fish farmers on the world's agriculturally productive deltas and floodplains. These producers support highly dispersed networks of small-scale aquatic food processors and traders, who in turn support the food and nutrition security of billions of the coastal, riparian and urban poor, including those not well connected to global and commercial food markets. In many low-income communities, consumer access to healthy foods is difficult and prohibitively expensive (Global Nutrition Report 2020).

The continued functioning of aquatic food systems depends on two factors: (1) maintaining access to “blue space” for millions of small-scale and commercial actors, and (2) maintaining the quality of the aquatic and marine environment that supports their livelihoods. Research is needed on the best ways to maintain or restore access to productive blue spaces by Indigenous Peoples, traditional fishing communities and new entrants in search of viable livelihoods.

Improvements in the livelihoods and well-being of women and men engaged in the aquatic food sector and in their incentives to participate in critical governance processes are key. These depend on the existence of a supportive and enabling policy environment and investment climate. There are several promising initiatives to build upon, such as the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), led by FAO and widely endorsed by fisherfolk organizations. Various other fisheries and aquaculture stewardship initiatives encourage sustainability and equity and the emergent blue economy. Yet, most of these policy initiatives are in the early stages. Early lessons from transition processes toward sustainability require further research on effective strategies that support gender, youth and social inclusion, as well as shared prosperity and well-being for all.

#### Food system sustainability indicators

Food access • food affordability  
• food availability • sociocultural well-being

#### One CGIAR impact areas

Gender equality, youth and social inclusion • poverty reduction, livelihoods and jobs

#### SDGs





Covering more than 70 percent of the surface of our planet, the ocean and seas provide half of the world's oxygen, sequester carbon dioxide and serve as home to 80 percent of life on earth. Globally, the value of key ocean assets has been estimated at USD 24 trillion and the value of derived services at between USD 1.5 trillion and 6 trillion per year (Österblom et al. 2020).

Together, the ocean, seas and marine resources provide nutritious food and support whole communities and millions of livelihoods around the world. Yet, we collect only 2 percent of our food from the ocean. We have already started to link our traditional research work on fisheries and aquaculture with the blue economy and the ocean space. This will help advance understanding of the global human-ocean system across social and natural sciences, as well as different sectors of the economy (Cohen et al. 2019; Bennett et al. 2019). Our research with partners shows that current access to ocean benefits and resources, as well as exposure to harms, is distributed inequitably (Österblom 2020).

This results in negative effects that vary across contexts and communities. They impact the environment and human health and limit financial opportunities. They lead to loss of livelihoods and create challenges to food security and nutrition for vulnerable groups. Decision-makers lack the data and information necessary to implement equitable solutions that do not further disadvantage the marginalized, the disempowered and those otherwise unable to equally access or benefit from the ocean and the emerging blue economy.

We are already connecting with and mobilizing an international and transdisciplinary network of researchers to generate and integrate evidence with human-centered tools, perspectives and narratives. This will bridge the gap between policymakers and public and private sector investors on the one hand and the people most dependent on aquatic food systems on the other. Our findings will continue to inform policies, institutions and investment decisions that lead to system-level transformations. The purpose of these transformations is to fully recognize the diverse uses and users of aquatic environments, their contributions to society and the interrelated issues of climate change, One Health, human rights, justice and equity, gender and social inclusion, and shared prosperity.

At the global level, we will include the interests and priorities of small-scale fishers and fish farmers in the ocean governance agenda. We will also expand the conversation beyond conservation and economic growth to consider the ocean as an important source of food and human well-being for generations to come. To accomplish both of these goals, we will actively leverage our scientific expertise and evidence, convening power, international policy-research network and links with the High-Level Panel for a Sustainable Ocean Economy.

## PRIORITY ACTION 2.1

Leave no one behind with an inclusive and people-centered blue economy



### One CGIAR partners

IFPRI, IWMI

**Research partners**  
Nippon Foundation Nereus Program, JCU, TBTI Network, University of Lancaster, ANCORS Wollongong University, Center for Sustaining Seafood, UW

**Policy and advocacy partners**  
FAO, ICSF, NACA, High Level Panel for a Sustainable Ocean Economy, Friends of Ocean Action, Freshwater Alliance

## PRIORITY ACTION 2.2

Improve the availability, accessibility and affordability of aquatic foods for all



Aquatic foods are highly traded internationally (Asche et al. 2015). But in most of the geographies where we work, value chains that deliver food to domestic consumers are far more important in terms of volumes of food produced and consumed, and numbers of people employed (Bush et al. 2019). Historically, most research on aquatic foods has been focused on fishers and farmers. This overlooks the importance of actors in the “hidden middle” of the supply chain who provide essential services to producers and enable the flow of affordable aquatic foods to consumers (Tezzo et al. 2020).

Many aquatic food value chains in our focus geographies are undergoing rapid growth and technological change in response to drivers such as urbanization and associated shifts in demand. At present, these chains are comprised mainly of small and medium enterprises. Value chains organized in this way tend to be inclusive in the sense that barriers to entry for smaller actors are relatively low. However, the fragmented nature of such chains makes them hard to regulate. This characteristic makes it difficult to institute environmental, food safety or labor standards, and traceability (Belton et al. 2020). The complexity and rapidly changing nature of aquatic food value chains means that their significance and characteristics are often poorly understood, and little is known about their resilience to systemic shocks, such as climate change and the COVID-19 pandemic.

Drawing on the expertise of WorldFish and its partners, research in this area consists of rigorous interdisciplinary mixed-methods assessments of the structure, conduct and performance of aquatic food supply chains. The key is to understand how value chains operate in terms of economic organization, governance, power dynamics, technical and environmental performance, and contributions to human well-being.

Deepening our understanding of these areas can provide evidence-based recommendations for policy and market actor interventions that support more equitable, inclusive and sustainable outcomes for all. More importantly, knowledge of value chain dynamics can inform actions and innovations by different stakeholders to retain and increase nutrition along the entire aquatic food value chain (Fanzo and Downs 2017) as depicted in Figure 5.

### **One CGIAR partners** IFPRI, CIAT

**Research partners**  
MSU, University of Manitoba, WUR,  
USAID, Innovation Lab for Fish,  
University of Stirling

**Policy and advocacy partners**  
USAID, FAO, IFAD



Source: adapted from Downs and Fanzo 2016.

**Figure 5.** Points to increase and retain nutrients along aquatic food value chains.

Digital innovations play an increasingly important role in shaping the behavior of actors in aquatic food supply chains and in developing new modes of value chain governance. These innovations are altering the nature of and possibilities for value chain research. A “Blue” Big Data Revolution and growing AgriTech investments can support the delivery of a flexible, intelligent and transparent (FIT) food system. A FIT data-driven food system can optimize the way in which aquatic foods are harvested, farmed, traced, processed, traded, stored, transported, marketed, distributed and made accessible and safe for human consumption. We have already developed a number of award-winning pilot FIT type projects in small-scale fisheries, aquatic animal health, finfish genetics and value chain analysis of aquatic food markets. They make use of big data, artificial intelligence, remote sensing, cloud computing and machine learning and enable us to generate more precise research insights that are representative at larger scales.



## PRIORITY ACTION 2.3

### Support sustainable livelihoods, decent work and well-being



A food system is sustainable if its producers, processors, distributors and consumers have adequate income, decent work and live dignified, fulfilled lives. Efforts have been made to foster more sustainable supplies of aquatic foods through regulation aimed at improving resource management and productivity and reducing negative environmental impacts (Bush et al. 2018). However, these efforts have overlooked the social dimensions of sustainability, including well-being, human rights and gender equality. This unbalanced understanding of the relationship between social and environmental sustainability has begun to shift as labor conditions in aquatic food systems have come under closer scrutiny, following exposés highlighting labor abuses in fisheries and aquaculture supply chains (Marschke and Vandergeest 2016).

More positively, well-being has gained prominence as an alternative means of conceptualizing and assessing progress against human development goals, in recognition of the limitations of using economic growth as an indicator of social progress (Gough and McGregor 2007; Stiglitz et al. 2009). Following this lead, fisheries researchers have adopted well-being as a means of accounting for the diverse contributions that fisheries make to the livelihoods and communities of fishers and fish farmers (Weeratunge et al. 2013). Our work in this area seeks to foster sustainable livelihoods that are founded on decent work and contribute to enhanced social well-being in all its dimensions: relational, subjective and material. The scope of our research on fisheries and aquaculture is expanding to pay closer and more explicit attention to workers and working conditions in aquatic value chains. This will help generate greater public awareness of related policy issues and public and private regulations.

Drawing on conceptualizations of well-being, research will examine more closely the human dimensions of livelihoods that depend on aquatic food systems. This will help account for the diverse meanings and associations experienced by people participating in aquatic food system activities (e.g. sense of belonging, satisfaction or exclusion), and how these vary according to the identity of those involved (e.g. women and men, migrants and citizens), the roles they perform and their degree of agency and control over resources.

Improving the lives of women and men engaged in aquatic foods sector does not just stop with them; it translates into benefits for their children, families, communities and the nations to which they belong. Critical research is needed to identify entry points for building more satisfying, equitable and empowered livelihoods, and measuring the outcomes and impact in a more multidimensional and people-centered manner.

#### One CGIAR partners

IFPRI, IWMI, CIFOR, IITA

#### Research partners

School of International Development,  
University of East Anglia,  
Cornell University, MARE,  
University of Amsterdam

#### Policy and advocacy partners

USAID, FAO, IFAD

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## IMPACT AREA 3

# NUTRITION AND PUBLIC HEALTH

### Strategic research objective 3

To advance and increase scientific knowledge and public awareness and understanding of the nutrition, safety and health benefits of aquatic foods.

Combating malnutrition (in all its forms) and diet-related noncommunicable diseases represents one of the greatest global health challenges. Policymakers, businesses and civil society and consumers are increasingly concerned about the links between food system sustainability, nutrition and public health concerns. Solutions require joined-up responses between the scientific community and the public and private sectors. Nutrient-rich aquatic foods offer a life-changing option for the 2 billion people suffering the triple burden of malnutrition. The intake of omega-3 fatty acids from fish is associated with lower risk of cardiovascular disease and obesity. Aquatic foods present an important but largely overlooked solution.

Gaps in the quality and availability of reliable nutritional data make it difficult to determine what people consume around the world, particularly in low- and middle-income countries. With our partners in the global [Blue Food Assessment](#), we are making progress in showcasing how the diversity of aquatic foods contributes to nutrition and public health, fuels local and national economies and plays an essential role in the shift toward sustainable, healthy food systems. Results will be released ahead of the UN Food System Summit 2021. Our aim is to galvanize ambitious new actions, innovative solutions and plans in order to maximize the benefits of aquatic foods across the entire 2030 Agenda for Sustainable Development.

At the global level, we will continue to leverage our research results, convening power, and wide policy-research network, as well as our voice in the HLPE. This will help set, align and advocate for policies and actions that include aquatic foods in the global nutrition agenda and related policies. At the country level, our work continues to inform national dietary guidelines and recommendations on diverse, healthy and sustainable aquatic foods. It also strengthens research skills and capacities to integrate aquatic food interventions in national policies for improved health, nutrition and environmental sustainability.

#### Food system

##### sustainability indicators

One health • food nutrient adequacy • food safety • food use

#### One CGIAR impact area

Nutrition and food security

#### SDGs



## PRIORITY ACTION 3.1

### Inform consumer demand for healthy and nutritious aquatic foods



Fish and many other aquatic foods are a great source of low-fat quality protein. Packed with numerous vitamins, fatty acids, minerals and other nutrients, they are essential to good nutrition and health. Many aquatic foods are an excellent source of B12, or Cobalamin, which is necessary for making DNA, creating energy in our cells, and particularly for supporting cognitive development in the first 1000 days of a child's life. When consumed as part of a balanced diet, fish can increase the absorption of essential minerals such as iron and zinc from other foods. The head, viscera and backbones, which make up 30 to 70 percent of the fish, have the highest concentration of micronutrients, but often are the less valued and preferred parts by consumers.

Consumer preferences for fish and aquatic food vary according to a range of factors. A person's gender, level of education and income, as well as the physical characteristics of fish and aquatic foods, knowledge and ease of cooking, appearance, taste and smell factors play a role in how willing consumers are to consume aquatic foods. The role of food environments in shaping consumer preferences, food purchasing, the quality of diets, and diet-related health outcomes in low- and middle-income countries remains understudied but is gaining increasing policy attention (Turner et al. 2018).

Research in this area and on the health and nutrition value of balanced diets that include aquatic foods will guide the development of safe, convenient and healthy aquatic food products that meet and inform consumer demand and reach those who need them the most. Our work will focus primarily on women, children in the first 1000 days of life, and adolescents who require high levels of multiple essential nutrients for good health and development. We will continue to scale a number of successful pilot innovations in [Bangladesh](#), [Cambodia](#) and India on aquatic food products developed, marketed and distributed in partnership with development agencies, food industry actors, local governments and civil society organizations. These aquatic food products include convenient complementary foods, snacks and condiments. They are made of highly nutritious small fish and seaweed along with fish chutneys and powders to fortify the diets of women and young children suffering from malnutrition and for use in feeding programs for school children and refugees.

We will work with local actors to increase awareness on the health and nutrition benefits of aquatic foods, using successful social and behavior change communication approaches from the health sector. Our research evidence will inform supply-side interventions to (1) produce quality, healthy and sustainable aquatic food products (2) promote [nutrition-sensitive aquaculture and polyculture systems](#), and (3) prevent the [loss of aquatic food quantity](#) and quality through innovative [loss and waste technologies and improved practices](#) as well as [integrated farming systems](#) with fish, rice and vegetables for balanced, nutritious and sustainable diets.

#### One CGIAR partners

IFPRI, CIP, AfricaRice, IRRI, IWMI

#### Research partners

WUR, University of Ibadan, BFRF, BFRI, USAID Food Safety Innovation Lab, Cornell University

#### Policy and advocacy partners

USAID, BMGF, DFID, GAIN, World Bank, African Development Bank, Asian Development Bank, ACIAR, national and regional governments



The safety of food is an important health, social and economic issue. The impact of unsafe food in low- and middle-income economies costs about USD 110 billion in medical expenses and lost productivity each year (Jaffee et al. 2019). Contaminated food causes foodborne diseases, and these occur at all stages of the production, delivery and consumption chain. They can result from several forms of environmental contamination, including water, soil or air pollution, as well as unsafe food storage and processing.

Our research to ensure the safety of aquatic foods for human consumption is governed by the principles of [One Health](#). They recognize that human and animal health are interdependent and bound to the health of the ecosystems they exist in, as the COVID-19 pandemic has made strikingly clear. We will continue to carry out scientific risk assessments and related risk management guidelines and communications for all stakeholders in aquaculture and fisheries, including producers, processors, traders, handlers, consumers and policymakers. The goal is to improve their knowledge and capacities to prevent and control foodborne diseases and increase the safety of aquatic foods through improved standards, policies and investments.

We will engage across sectors and disciplines from aquaculture and fisheries production and value chains, public health, environmental health, and animal health and welfare. We recognize that risk and disease pathways require complex interactions with many partners having different knowledge and experience than we have. In our research, we will prioritize the needs of women, people in the informal sector, and marginalized communities.

In terms of animal health, we will build upon our groundbreaking research work on fish health and antimicrobial resistance to assess the health of both farmed and wild harvested animals and plants, and the One Health implications of increasing aquaculture production and productivity. In partnership with social innovators and the private sector, we will continue to scale up innovative epidemiological tools, such as our award-winning [Lab-in-a-backpack](#). Powered by big data and AgriTech, it is set to revolutionize control of disease outbreaks in fish farming.

## PRIORITY ACTION 3.2

Ensure aquatic foods are safe and healthy for human consumption



### One CGIAR partners

One CGIAR AMR Hub, ILRI, IFPRI, IWMI, CRP on A4NH

### Research partners

CEFAS, LSHTM, USAID Innovation Lab for Fish, Royal Veterinary College, University of Exeter, ICARS, Norwegian Veterinary Institute, Stockholm Resilience Centre, University of Queensland

### Policy and advocacy partners

The Fleming Fund, Ending Pandemics, INFOFISH, NACA, FAO, WHO, regional networks in Africa

### **PRIORITY ACTION 3.3**

#### Prioritize nutrition and health for vulnerable and marginalized people



Multiple essential nutrients from aquatic foods (Bogard 2015) are critical to human health and to cognitive development in children in their first 1000 days. Yet research shows that they are slipping through the hands of millions of malnourished people living in coastal communities (Hicks et al. 2019a). Aquatic foods are currently caught off the West African coast, the Pacific and the Caribbean. This food source is sufficient to meet the nutritional needs of the people living within 100 km of the sea, especially those who suffer from high levels of deficiency in zinc, iron and vitamin A.

Building on this work, research in this area will seek to unravel the complex picture of international and illegal fishing, seafood trade, and cultural practices and norms that stand in the way of good nutrition and health for millions of people suffering from malnourishment and noncommunicable diseases in low- and middle income countries. Our insights will inform key shifts in policies, investments and sustainable development interventions. These are required to prioritize nutrition and health for marginalized women, men and children who live in extreme poverty and are internally or externally displaced by conflict, violence or the impacts of climate change.

Research will focus on developing aquatic food solutions to mitigate the dire impacts of COVID-19 on the nutrition and health of this population group. We will continue to work closely with private and public sector actors to ensure affordable and culturally acceptable aquatic foods and related nutrition information are included in food assistance programs, social protection schemes, humanitarian emergency responses, school feeding programs, and maternal and child health programs. Research will generate and evaluate evidence of outcomes to critically assess interventions, provide lessons and insights on aquatic food pathways and influence policies and investments for securing nutrition and health for vulnerable and marginalized people in low- and middle-income countries.

**One CGIAR partners**  
IFPRI, CIP, IWMI

**Research partners**  
WUR, University of Copenhagen, IMR

**Policy and advocacy partners**  
WFP, FAO, UNICEF, SUN,  
USAID, USDA, NORAD,  
national and regional governments







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# INCREASING THE SPEED OF INNOVATION

Research alone cannot provide people with more and better food, improve environmental sustainability or reduce climate risk. Success in our world depends on ensuring research is relevant, credible, legitimate and effective (ISDC 2020). Research must be open and accessible to everyone so that it guides, inspires and builds knowledge and capacities for transformative action from actors and stakeholders at all levels of the food system. Moreover, the speed of innovation in food, land and water systems needs to accelerate to meet global challenges associated with the increasing threat of climate change and environmental degradation, as well as social exclusion and poverty.

We recognize that transformative change requires our work to be situated within an innovation ecosystem of partners, stakeholders, networks, assets and institutions to turn research into demand-driven products, services and solutions at scale. Examining the deep structural factors and impact pathways that lead to system transformations is critical, and it starts with four keys areas: (1) the worldviews and values of actors that give the system its orientation, (2) the social structures and institutions that manage system feedbacks and parameters (Ives 2020; Abson et al. 2017), (3) the forces that help or hinder change, and (4) investments in the means to accelerate system transformation at different levels (Herrero et al. 2020). We must embrace new ways of thinking about research and innovation, as well as innovative ways of co-creating, learning, engaging and collaborating with diverse partners and stakeholders to deliver concrete and measurable impacts at scale.

In response to the call of the HLPE for a radical transformation of food systems, including land and water systems, we have adopted an eight-point transformative action framework that draws on the latest literature for increasing the speed of research-based innovations in partnership with public and private sector actors (Herrero et al. 2020).

## 01

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### Identify transition pathways

This requires rigorous evaluation of alternative technology, policy, societal and economic development scenarios, the roles aquatic foods play in them, and the actions needed to support movement toward food systems sustainability. And it is necessary for achieving multiple benefits across the five SDG-focused grand challenges outlined by One CGIAR.

## 02

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### Transform mindsets

Development of effective research knowledge or technology is no guarantee for social acceptance due to deeply engrained biological, psychological and cultural relationships to food. Engaging different food system actors will expand learning and understanding on aquatic foods and their role in food system transformation toward healthy and sustainable diets.



# 03

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## Enable social license and stakeholder dialogue

Investment in novel lab-grown fish or plant-based fish substitutes, genetically improved or new farmed aquatic food species and related production systems is tied to social license, technology acceptability, and know-how to facilitate uptake. Extensive public dialogue and consideration for responsible innovation are key here to ensure that public knowledge and opinion—particularly for food systems actions with less education in low-income countries—are guided by the best science available.

# 05

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## Design market incentives

Transformational innovations are often context and technology specific, and barriers to scaling and uptake differ widely in different markets. Innovation incubators and accelerators often play a key role in bringing novel solutions to market. Research on critical market incentives and potential instruments is critical to support food system transformation. These include tax breaks, patents, temporary monopolies or the design and financing of innovation hubs and incubators in the aquatic food sector.

# 07

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## Build trust among food sector stakeholders

Transformation requires consensus and support from many actors within the food system that are connected through complex economics and social networks. They include fishers, farmers, consumers, food companies, civil society actors and government. Creating trust is central to build shared values and secure broad-based collaboration on different technology choices and food system outcomes, such as sustainability, social inclusion, justice and equity, environmental impact and economic benefits.

# 04

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## Change policies and regulations toward food systems sustainability

Expectations about future policies are essential for both public and private investments in technological and system change. Although there could be public acceptance or a call for change, existing rules and norms can block uptake of new ideas that foster food systems sustainability. Research on social equity and governance can identify the means to ensure policies and regulations are guided by both public opinion and expert science.

# 06

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## Ensure stable finance

Technologies associated with aquatic foods often involve a physical product that is subject to production seasonality and complex regulations. These pose diffusion challenges because the financial environment does not reward the “fail fast and restart/iterate” model. Moreover, research and development cycles are quite long for a broad range of technologies, such as genetically improved finfish. Coupled with AgriTech opportunities, creative investment solutions in partnership with public and private sectors are critical to ensuring appropriate and longer-term finance for research and innovation as a prerequisite to food system transformation.

# 08

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## Safeguard against undesirable effects

Sometimes, the unintended consequences of a new policy or investment framework designed to harness the potential of new knowledge or technology can be overlooked, especially where public acceptance and the regulatory landscape remains to be determined. Research on gender, human rights, social exclusion and vulnerability, as well as on the environmental impacts of aquatic food production, can help shed light on these issues, ensure impacts are thoroughly evaluated, and provide recommendations that safeguard against undesirable effects on the poorest and most vulnerable communities who depend on aquatic resources and related value chains.

This transformative action framework builds on firm foundations of our research work with partners in fisheries and aquaculture as main aquatic food production systems, as well as our genetics gains, digital technologies and social and policy research. It complements the wider One CGIAR efforts to develop a more ambitious transformative research agenda that links food, land and water systems together and brings about measurable positive change across all five One CGIAR challenges and areas of impact.



Source: adapted from Herrero et al. 2020.

**Figure 6.** Increasing the speed of innovation toward sustainable aquatic food systems.

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# ACCELERATING TRANSFORMATION WITH AQUATIC FOOD FUTURES

*Prospects and Challenges of Fish for Food Security in Africa* and *Fish to 2050 in the ASEAN Region* are examples of two landmark studies generating important foresights and people-centered scenarios into aquatic food futures to inform policies and investment decisions in low- and middle-income countries. We will build on these foundations to generate new systematic, interdisciplinary and holistic studies of social and technological advancement and other environmental trends to help set the direction for aquatic food futures of shared prosperity and inclusive growth.

## **Aquatic Food Futures Lab to spark innovation and social change**

We will create an Aquatic Food Futures Lab to bring together a multidisciplinary team of researchers and innovators, policymakers, social entrepreneurs, business strategists, philanthropists, technology enthusiasts and creative communicators who all share a deep passion for building a more sustainable, healthy, equitable and humane future with aquatic foods.

We will enable greater understanding of the socioeconomic and environmental costs and benefits for policy and investment decisions in aquatic foods at various food system levels. In addition, we will provide national governments and development actors with concrete scenarios for making informed choices. Powered by an inclusive digital platform, the Aquatic Food Futures Lab will have the features of a networked innovation ecosystem, with informal softer structures that support learning and cross-fertilization of ideas across teams and partners, engaging women, young people and marginalized groups in particular.

To shape the social change agenda and spark transformative change, we will translate the scientific findings of our future research into compelling stories across many mediums: pages, stages, packages, farms, and even chefs and dining room tables. Transforming valuable foresight into actionable insight, the lab will be a catalyst for co-created innovations in markets, policies and institutions. These innovations will improve evidence-based decisions, strengthen the skills, knowledge and capacities in aquatic foods research and value chains, and increase investments in sustainable and inclusive aquatic food solutions.



## Fish for Africa Innovation Hub

In Africa, fish has unfortunately often been overlooked and underestimated in securing food, nutrition and health outcomes, especially for malnourished women and children. Aquaculture and fish value chains support the livelihoods of an estimated 12.3 million people across the continent. In sub-Saharan Africa, where extreme poverty is on the rise and projected to hit 416 million by 2030, the vast inland waters and coastlines are home to a small but rapidly growing aquaculture sector. Aquatic food systems and value chains hold great promise for addressing food security and nutrition needs in the region, while boosting progress on gender equality and enabling sustainable economic development in the face of climate change.

Work is already underway to establish a Fish for Africa Innovation Hub. We are building on our success with partners in transforming Egypt's aquaculture sector over the past 20 years, and there is growing continental demand for data, knowledge, training capacity development, new jobs, businesses and entrepreneurship opportunities in both fisheries and aquaculture. Designed as a public-private partnership, the hub aims to spark and scale co-created scientific, policy and market innovations. These will catalyze transformational change in the continent's food systems and create inclusive opportunities in the emerging blue economy, particularly for women and young people.

## Global Index on Aquatic Foods and a flagship publication

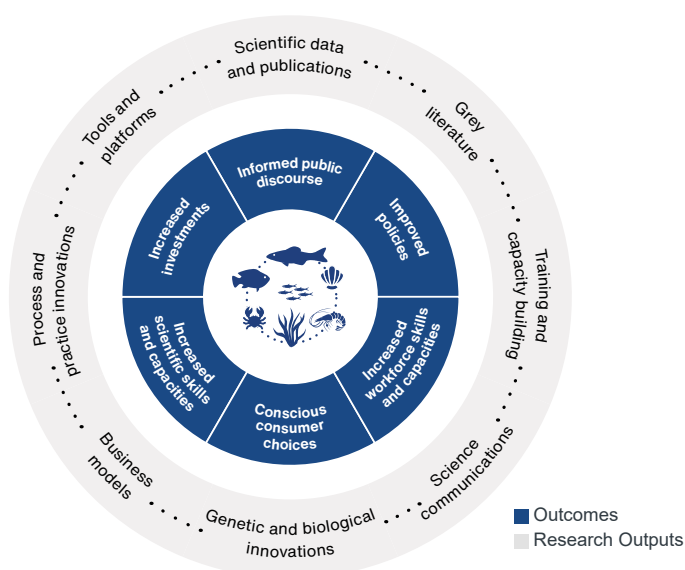
Reflecting data and insights across all elements of food systems sustainability, we will work with One CGIAR and other partners to establish the Global Index of Aquatic Food Systems, to be published every 2 years. This will be a primary scientific research and communications output designed to fill existing gaps in knowledge and understanding of aquatic food systems. It will provide policymakers, public and private sector investors, civil society actors, media, the general public, and the people and communities who depend on sustainable fisheries and aquaculture with an objective and comprehensive view of aquatic food systems in low- and middle-income countries, including policy and investment briefs on specific issues of interest.

To engage a diverse spectrum of audiences and stakeholders, a global public information and digital communications campaign will accompany the index, publication and related policy and investment briefs. The global report will primarily target policymakers and decision-makers. But it will also seek to be agenda setting and relevant to experts, academics, students, the media and the general public to ensure our research insights are translated into broad transformative action on aquatic food systems.

# FROM RESEARCH TO OUTCOMES AND IMPACT

Our 10-year institutional strategy for research on aquatic food systems to 2030 provides a guiding framework for exploring and identifying sustainable food systems transformation approaches and scenarios at the intersection of research, technology, policies, markets and social innovations across different disciplines and sectors. The framework provides the conceptual underpinnings and operational approaches that guide how programmatic decisions will be made based on a clear intent to achieve specific results. These include how new and existing research programs and projects on aquatic food systems will learn and adapt to retain their relevance and focus in making the shift toward aquatic food system research and innovation. The framework applies to all future research programs, projects and engagement by WorldFish with partners within One CGIAR and the wider scientific community. The strategy will be accompanied by a strategic results framework that is aligned with the One CGIAR Research Strategy 2020–2030. It will identify transformation pathways, from research outputs and outcomes all the way to impacts, that take into account the four dimensions of natural, produced, human and social capital in food systems, from production through to consumption (Kumar 2010).

An integrated set of indicators will assess the collective impact of the research activities. These indicators will help to evaluate and track progress toward the sustainability of diets and food systems, which is a critical step in building national transformative pathways (Chaudhary et al. 2018). The research outputs and outcomes (Figure 7) are designed to address the five One CGIAR global challenges and the social, economic and environmental dimensions of the 2030 SDGs. Their related indicators will serve as yardsticks for monitoring results, evaluation and learning to enable adaptive management, innovation and effective partnerships.



**Figure 7.** Types of outcomes and research outputs.

This approach will allow us to identify synergies that can result in win-win outcomes while remaining vigilant and transparent about difficult trade-offs. We will track and evaluate six types of intermediate outcomes as critical pathways to our three broad areas of impact described earlier:



**Informed public discourse:** Research on aquatic food systems leads to increased awareness and shifts in attitudes, perceptions and norms at different levels.



**Improved policies:** Research on aquatic food systems results in positive changes in formal and informal policies at local, country and international levels, as well as strengthened institutions and inclusive planning and decision-making processes for different actors at all levels.



**Increased investments:** Research on aquatic food systems leads to positive changes in investment decisions that prioritize the needs of women, men and young people who depend on aquatic foods for food, nutrition, livelihoods and well-being.



**Increased scientific skills and capacities:** Research on aquatic food systems strengthens individual and organizational capacities for science of the highest quality in low- and middle-income countries.



**Increased workforce skills and capacities:** Research on aquatic food systems strengthens individual and organizational capacities for business, entrepreneurship and other income-generating activities.



**Conscious consumer choices:** Research on aquatic food systems shifts demand for aquatic foods in line with customer trends and preference for improved nutrition and environmental sustainability.

Our pioneering gender-transformative approaches will be integrated at all levels into all our research programs and projects. This will ensure equitable and socially inclusive outcomes for women, men, young people and marginalized communities in our focus countries in Africa, Asia, the Pacific, and Latin America and the Caribbean.

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# RESULTS-BASED MANAGEMENT FOR LEARNING, ACCOUNTABILITY AND IMPACT

WorldFish will improve integrated program planning and resource allocation that focus on performance and management effectiveness. To accomplish this, we will continue to build on the achievements of the results-based management (RBM) approaches and the award-winning monitoring, evaluation and learning (MEL) system introduced in 2016 through implementation of the CGIAR Research Program on Fish Agri-Food Systems (FISH). This supported a positive shift in our organizational culture and in the way research programs and projects are designed, and activities and deliverables are monitored, implemented and reported, with emphasis on results and impacts.

We will continue to mainstream RBM in five main areas of management:

- 1 Strategic management:** This is focused on the vision and strategic framework guiding the adoption of RBM as a management strategy. It includes having a change management plan and an appropriate accountability framework for RBM implementation.
- 2 Accountability and learning management:** In this area, the focus is on monitoring, evaluation and reporting, and on a data and information management system, as well as knowledge sharing and learning.
- 3 Operational management:** Here, the focus is on what the organization does in terms of strategic planning, programming and resource management, including human and financial resources, as well as physical and virtual assets.
- 4 Change management:** This area focuses on a culture of results through internalization and capacity development, leadership and using results as part of developing a learning organization.
- 5 Responsibility management:** This area focuses on partnerships to attain outcomes and collective impact that will facilitate collective accountability, both vertical and horizontal, across WorldFish and with core implementing partners.

Progress will be monitored and evaluated through quarterly and annual reviews and tracked through an institutional strategy scorecard and a results framework for all research programs and projects on aquatic food systems.



The following principles will be applied to all five areas of RBM:

- vision and clarity of the desired end product or impact
- causal links in a hierarchy of results (inputs, activities, outputs, outcomes, impact) based on a theory of how change happens, yet with the understanding that all hypotheses are subject to margins of error
- systems operations going beyond the linear, causal logic of closed systems, considering context, espousing “equifinality” (the principle that, in open systems, a given end state can be reached by many potential means or trajectories) and addressing risks to and conditions for success in achieving higher-level results
- performance measurement for transparency, consensus-building based on a common perspective on results, and accountability
- performance monitoring for single-loop learning
- evaluation for double-loop learning and direction-setting.

These principles echo the imperatives set out in the 2030 Agenda for Sustainable Development and the One CGIAR Research Quality Framework. They include systems operations, integrated and interdependent ways of working for collective outcomes and impact, as well as horizontal and vertical accountability and the development of a dynamic and resilient learning organization.



Our intention is to continue using RBM approaches for the following:

- Demonstrate the effectiveness of the R4D investments in aquatic food systems.
- Increase accountability by helping shift the focus of planning, budgeting, reporting and oversight from how things are done to what is accomplished and looking at the return of the investments.
- Mainstream learning, both from success and failure, into the program management cycle to enhance an adaptive management and improved performances.
- Build ownership at all levels of the implementation of the program with national and international partners from projects to countries where the strategy will be implemented.
- Support advocacy, communications and resource mobilization by generating the required scientific data and evidence to support them.

In line with our gender equality commitments, we will ensure gender is mainstreamed and integrated into all aspects of program planning, implementation and reporting. Activities and results will be examined for their gender relevance. Both qualitative and quantitative data will be identified to measure impacts on gender equality. Annual plans of work and budget and reports will be produced and shared publicly to increase transparency, accountability and learning.

Our comprehensive RBM system is supported by the award-winning MEL platform to capture performance results in real time and at different levels, from research outputs and knowledge products to SDGs. Partners, funders and the general public will have timely access to evidence and progress against objectives.





A large number of small, dark fish swimming in a red-tinted tank. The fish are densely packed, creating a swirling pattern. The background is a solid, vibrant red color.

# PART III

# A CHANGE AGENDA FOR ORGANIZATIONAL TRANSFORMATION

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# REINVENTING OURSELVES

Over the past 45 years, WorldFish has firmly established itself as a global leader in research and innovations in sustainable aquaculture and fisheries. Our work has enhanced the lives of millions, solving real-world problems through an extensive network of partnerships and multidisciplinary research collaborations across Africa, Asia and the Pacific.

Over the next 10 years, we aspire to become a world-class research and innovation organization that creates, advances and translates scientific research on aquatic food systems. The purpose of the research is to accelerate the sustainable transformation of global food systems toward nutritious diets that sustain the health of people and the planet. We recognize the importance of responding effectively to external change and delivering relevant research solutions at scale for sustainable transformation at all levels. To do this, we must be prepared to reinvent ourselves. In responding to the COVID-19 pandemic, we have devised a new organizational strategy and business model that reimagines the ways in which we will operate in the next decade to successfully weather the uncertainties of the future and thrive.

Our focus will be on mobilizing our world-class capabilities and resources. This will sharpen the agility and responsiveness of our business operations, help us adapt to new ways of working and collaboration and ensure long-term financial sustainability and more funding for scientific research on aquatic food systems.

As a networked organization embedded in a larger innovation ecosystem of partners, including One CGIAR, our model of operation and beyond is guided by our values that stand for Learning, Excellence, Accountability and Diversity (LEAD).



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# OUR VALUES

We recognize that our scientific work and impact in the world is enhanced when we bring together a diversity of backgrounds, skills, disciplines, talents and partnerships that inform the way we work and shape our organizational culture and workplace, as well as our aspiration to be a global thought leader.

Our work is guided by our LEAD values:



**L**earning: We are relentlessly curious and seek to learn from challenges and from others. We embrace discovery, adaptation and growth. We rely on data and evidence to deepen our understanding, make the best decisions and drive bold innovation.



**E**xcellence: Science of the highest quality and professional standards are the foundation for all we do. We actively partner with others who share our passion for excellence and impact.



**A**ccountability: We take ownership of our work and promptly correct mistakes to the greatest extent possible. We honor our commitments to partners and to each other. We measure ourselves against the highest standards of integrity and fiscal responsibility, and we are open and transparent in communicating our results.



**D**iversity: We recognize it takes people with different ideas, talents, disciplines and backgrounds to make our work stand out. We encourage differing perspectives, healthy debate and an inclusive environment for all, and at every level, to create solutions to complex problems.

In order to transform ourselves into a world-class research and innovation organization fit for the fast-paced change of the 21st century, we have identified five critical organization enablers (Figure 8) which entail a set of commitments under each. These commitments will guide key short- and long-term interventions to support the process of organizational transformation in the timeframe of this strategy.



**Figure 8.** Five organization enablers for effective research and innovation.

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# SCIENTIFIC RESEARCH EXCELLENCE

Over the next 10 years, we aspire to become the go-to think tank for credible, cutting-edge knowledge, data and evidence on aquatic food systems in One CGIAR and in the wider scientific and policy community. We will increasingly translate scientific research on aquatic food systems into scalable solutions with impact on human health and nutrition, climate change, environmental sustainability, gender equality and social justice, poverty and other sustainable development issues.

## COMMITMENTS

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Our philosophy and practices on scientific research will be guided by three key commitments:

1

**Research excellence:** We will design, implement and deliver scientific research of exceptional quality and ethical integrity on aquatic food systems across natural and social sciences, and in line with the One CGIAR Quality of Research for Development Framework.

2

**Research growth:** We will expand scientific knowledge and understanding of aquatic food systems and their contribution to sustainable development solutions by securing more research, partnerships and funding commitments within One CGIAR and beyond.

3

**Research impact and influence:** We will maximize the cultural, social, economic and environmental benefits derived from our research on aquatic food systems, and increase the impact and influence of aquatic food systems research in One CGIAR, in the global agricultural research agenda and in the sustainable development agenda, at national and global levels.





Photo credit: Film, Thailand/WildFish



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# PARTNERSHIPS FOR SUSTAINED INNOVATION



At WorldFish, we believe multidisciplinary and cross-sector collaboration is at the heart of scientific discovery and the formulation of innovative solutions for tackling complex problems of great significance to human well-being and environmental sustainability. We have a strong legacy of working in partnership with a broad range of actors who play an important role in co-creating demand-driven research and translating scientific data and evidence into action.

Our partnerships span all levels of governance, from global level decision-making to national, subnational and household levels. They include international institutions, global conventions and regional bodies, policymakers, scientists at One CGIAR, partner research and academic organizations, national agricultural research and extension systems (NARES), business leaders and entrepreneurs, local and regional planners, community and civil society organizations, and fisher and fish farmer households.

Over the next 10 years, we aspire to build and nurture a global movement of partners and stakeholders across the public and private sectors. Together, we will research, fund and support a transformative agenda that recognizes the growing importance of aquatic foods in global agricultural research, the transformation of global food systems and the achievement of the SDGs.

As custodians of research, skills and knowledge of aquatic food systems in One CGIAR, we will build and convene critical research collaborations and partnerships that enable successful links with land-based food systems within and outside One CGIAR.

## COMMITMENTS

Our philosophy and practices on impact-oriented partnerships for innovation and sustainability will be guided by three key commitments:

# 1

**Mission and impact-oriented partnerships:** We will engage and deepen collaboration with core partners along the research-for-development continuum to successfully deliver on the vision of the WorldFish’s 10-year institutional strategy for research on aquatic food systems and on the wider mission of One CGIAR toward “ending hunger by 2030 – through science and innovation to transform food, land and water systems in a climate crisis.”

# 2

**Innovation ecosystem of partners:** We will build and nurture an innovation ecosystem of partners along the public and private sector spectrum, with diverse skills, knowledge, tools and mindsets to co-create shared value and sustainable societal and environmental impact through joint projects and investments that are guided by scientific evidence and innovation.

# 3

**Business development and entrepreneurship:** We will build the organizational muscle, capacity and mindset for business development and entrepreneurship to engage the support of like-minded private sector actors who share our commitment to translating scientific knowledge, assets and discoveries into product, business and market innovations with positive social, economic and environmental impacts.



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# PEOPLE AND CULTURE

As part of One CGIAR, we are committed to fair, safe and inclusive workplaces. Our diversity powers our innovation. It is critical for our mission. We are driven by our LEAD values and strive to be a thriving and inclusive community of diverse people committed to learning and innovation, and with passion for making a difference in the world. We believe in multiple perspectives coming together to generate new ideas and develop new ways of doing things. This collective intelligence will set us apart in being able to address the complex problems we seek to solve with an ability to understand the trade-offs, and in doing so make better decisions.

We will continue to build an organizational culture with strong foundations in 21st-century skills and core competencies. This will enable us to exude excellence and thought leadership, to accomplish work in partnership with others for sustainable innovation and impact and to meet our commitments to people, partners and the environment.

## COMMITMENTS

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Our philosophy and practices on people and culture will be guided by three key commitments:

1

**Attract and retain high-performing talent:** To maintain and enhance our scientific and professional strengths, we will recruit and support talented people of outstanding potential at all levels in line with our organizational values and our 21st-century core competencies framework. We will enhance the efficiency and quality of our human resources services and continuously improve our hiring and talent development strategies to effectively attract, reward and retain high-performing talent applicants, and to ensure equality of opportunity for all.

2

**A high-performance culture with foundations on learning, growth and innovation:** We will invest in building an organizational culture that helps us to collectively achieve high levels of performance and results consistently over time. Empowered and engaged people focused on constant learning and growth will be the trademark of who we are and what we can do together. This will help us pioneer new thinking and implement bold innovations that provide solutions to real-world challenges.

3

**Gender, diversity and inclusion:** These are more than just words to us. They are fundamental principles guiding how we build our teams, cultivate leaders and create an inclusive organization that is the right fit for every person inside of it and also mirrors the diverse communities we serve.





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Photo credit: Habibul Haque/WorldFish



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# COMMUNICATIONS FOR IMPACT

Research alone is not enough to turn data, insights and innovations into concrete action and tangible impacts on the ground. WorldFish is an international research and innovation organization with a world-class reputation for scientific excellence and a vast network of impact-oriented partners. As such, we believe it is our duty to effectively engage with society and proactively share and communicate the results of our research work beyond the scientific community. This is critical to shaping solutions to real-world challenges.

To us, communication is a critical 21st-century skill. It is a strategic organizational function that allows us to provide a tangible return on society's trust and continued investment in science and in us as a vibrant community of scientists who care about the meaningful impact of our work in the real world. It also plays an important role in how staff, partners and stakeholders interpret the cultural landscape of our organization in terms of who we are, what we stand for, what we value and why our mission matters. Aside from helping the public appreciate the wonder, pleasure and critical importance of science to our lives, communicating scientific discoveries and research evidence effectively is critical to important decisions from household to global levels that affect our quality of life and the future of our planet.

Over the next 10 years, we will use evidence-based communications to make aquatic foods part of the conversation to address critical sustainable development challenges. At the same time, we will note the rightful place and contribution of aquatic food systems to the global call to action for a food systems transformation to healthier and sustainable diets.

Our philosophy and practices of communications, in varied forms and mediums, will be guided by three key commitments:

## COMMITMENTS

**1 Advocacy and strategic outreach:** We will resource and use evidence-based communications for advocacy and strategic outreach to stimulate increased public awareness of and policy discourse on aquatic foods, as well as public and funders' interest in the mission and research work of WorldFish, One CGIAR and our partners.

**2 Internal communications:** We will strengthen communications internally to ensure shared understanding of the organizational vision, mission, values and research work to (a) stimulate an open and high-performance culture of learning, knowledge sharing and innovation (b) facilitate increased collaboration across disciplines, functions and geographical locations, and (c) celebrate individual, team and organizational achievements.

**3 Digital transformation:** We will use innovative information and communication technologies and data-rich technology platforms to share, translate and communicate research data, knowledge and insights with the largest numbers and broadest kinds of internal and external stakeholders in fast, compelling, engaging and cost-effective ways. We will also enhance learning, new ways of working and digital savvy leadership at individual, team and organizational levels.



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# RESOURCES FOR FINANCIAL SUSTAINABILITY

We recognize that effective mobilization and control over our resources underpins all our aspirations of success. We will be diligent in stewarding our resources to ensure the financial and environmental sustainability of the organization and to continue to invest in research on aquatic food systems and organizational development in the future.

## COMMITMENTS

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Our philosophy and practices on effective and sustainable mobilization and management of our resources will be guided by four key commitments:

1

**Long-term financial sustainability:** We will develop an innovative business model that allows us to protect and grow our income. We will outline a strategic plan of action to new business development and impact-oriented partnerships to diversify our funding sources, support long-term research activities and ensure our financial sustainability.

2

**Efficient and agile financial and business operations:** We will strengthen our customer orientation approach to all financial and business operations. This will enable us to swiftly and efficiently meet the demands of different constituencies within and outside our organization and also increase our ability and agility to respond to unforeseen disruptions and changes in the external environment.

3

**State-of-the-art physical and digital infrastructure:** We will improve the physical and virtual workplace to bring together researchers, partners and staff from different backgrounds, disciplines and geographies. This will enable them to create, learn and innovate and will also improve digital literacy for discovering, evaluating, visualizing, sharing and communicating important research and business insights. It will also help us use IT systems effectively and foster a sense of inspired community.

4

**Minimize our carbon footprint and environmental impact:** We will develop and implement a comprehensive environmental sustainability policy as well as metrics to guide our actions. This will reduce the carbon footprint and the environmental impact of all our research and business operations.





Photo credit: Habibul Haque/WorldFish

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# BUILDING ON SOLID FOUNDATIONS

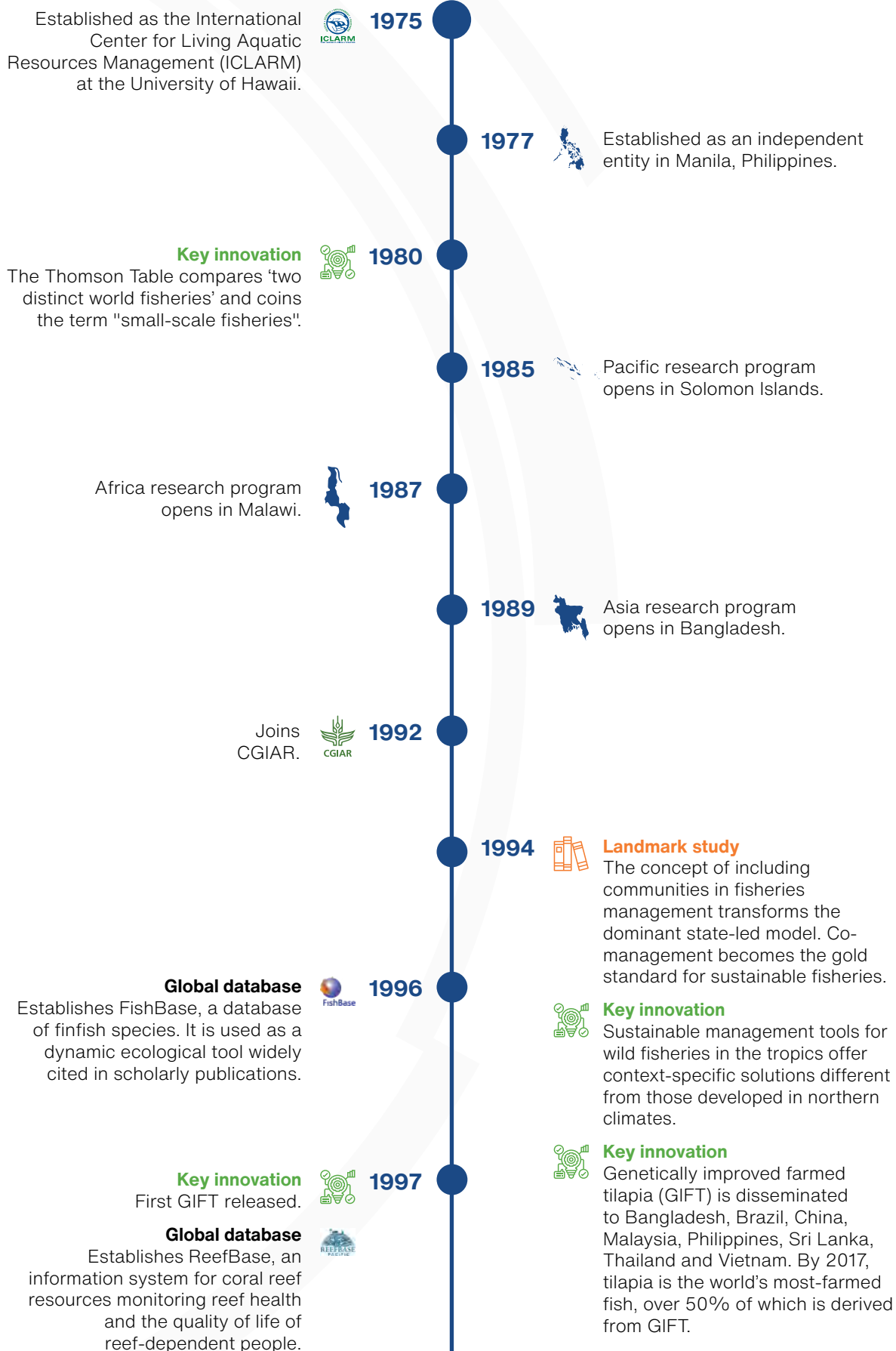
Real transformation in isolation is very rare. It takes context and experience to spark and inform innovation, including many important partners and stakeholders, to bring science-based solutions to bear fruit in the real world. Our vision for this comprehensive 10-year institutional strategy for research on aquatic food systems builds on our past achievements and accomplishments.

Over the past 45 years, we have amassed a wealth of knowledge and expertise in fisheries and aquaculture and established a vast network of over 250 partners in many low- and middle-income countries across Africa, Asia and the Pacific. During this time, we have learned that to create truly disruptive ideas and accelerate innovation and transformation at speed and at scale, we must capitalize on existing knowledge, build on our past achievements and lessons learned, and leverage our diverse network of partners across the public and private sectors.

We have already made our mark in the world with many innovations, landmark studies and global information databases. These have helped advance scientific thinking, increase public knowledge and spur social and economic development in many low- and middle-income countries in Asia, Africa and the Pacific.

A quick summary of our achievements is presented in the timeline on pages 76–78.

# A brief history of WorldFish and its achievements





**Integrated aquaculture technologies platform**  
 First of 12 global fish breeding programs established at AARTC. The GIFT program kickstarts Egypt's aquaculture growth.

**Policy engagement**  
 Chairs the High-Level Panel of External Experts to the UN Committee on Fisheries addressing governance and food security challenges.

**WorldFish**  
 New brand name adopted.

**Global and regional database**  
 Launches Fisheries Resource Information System and Tools (FiRST), a data management system for trawl survey data. FiRST software is used to set up TrawlBase, containing historical survey results from 10 Asian countries.

Egypt producing WorldFish improved tilapia becomes the world's eighth-largest aquaculture producer.

**Landmark study**  
 Findings show the importance of small fish to low-income households, arguing in nutritional terms small fish are more similar to fruit and vegetables than to poultry, cattle.

**Landmark study**  
*Blue Frontiers* study provides a comprehensive analysis of global aquaculture across major species and farm production systems. Leads CGIAR Research Program on Aquatic Agricultural Systems (AAS).

**Key innovation**  
 Nutrition-sensitive aquaculture plays a lead role in food systems management in Bangladesh.

**1998**  
 Establishes the Africa Aquaculture Research and Training Center (AARTC), a regional center for genetics innovation in Abbassa, Egypt.

**2000**  
 Establishes new headquarters in Penang, Malaysia.

**2002**

**2003**  
**Landmark study**  
 Publishes *Fish to 2020: Supply and Demand in Changing Global Markets* the first quantitative study on fisheries policy issues in food and agriculture.

**2004**

**2005**  
**World Food Prize**  
 Dr. Modadugu Vijay Gupta, a WorldFish biologist and fisheries scientist, is awarded for work on low-cost aquaculture through GIFT.

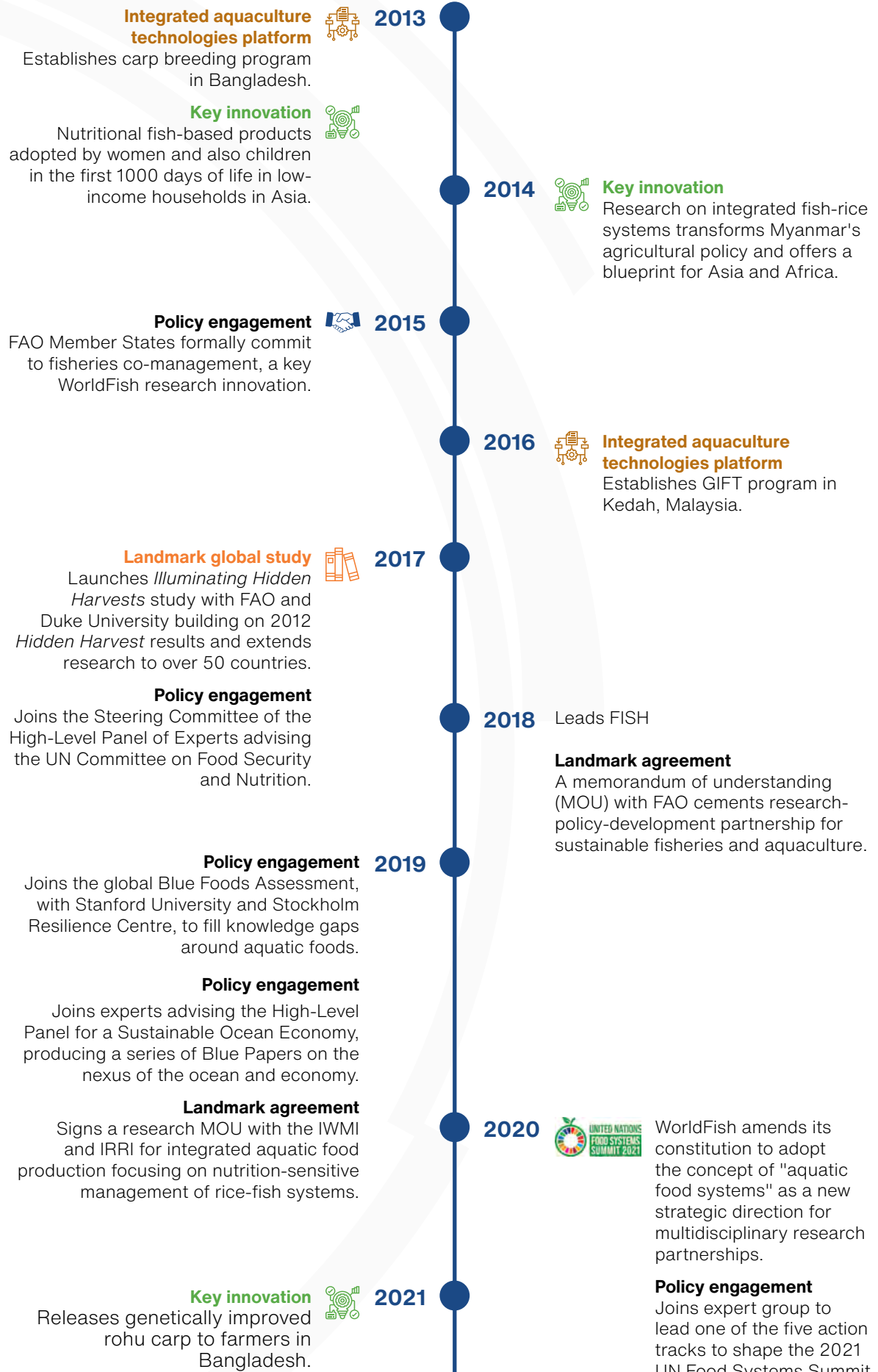
**2008**

**2010**  
 Bangladesh becomes the world's fifth-largest aquaculture producer, using improved technologies developed by WorldFish.

**2011**

**2012**  
**Key innovation**  
 Rice-field fisheries management integrating sustainable management of water, rice and aquatic foods is developed by WorldFish and adopted in Cambodia.

**Landmark study**  
*Hidden Harvest: The Global Contribution of Capture Fisheries* is published with WorldBank and FAO.



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## About WorldFish

WorldFish is a nonprofit research and innovation institution that creates, advances and translates scientific research on aquatic food systems into scalable solutions with transformational impact on human well-being and the environment. Our research data, evidence and insights shape better practices, policies and investment decisions for sustainable development in low- and middle-income countries.

We have a global presence across 20 countries in Asia, Africa and the Pacific with 460 staff of 30 nationalities deployed where the greatest sustainable development challenges can be addressed through holistic aquatic food systems solutions.

Our research and innovation work spans climate change, food security and nutrition, sustainable fisheries and aquaculture, the blue economy and ocean governance, One Health, genetics and AgriTech, and it integrates evidence and perspectives on gender, youth and social inclusion. Our approach empowers people for change over the long term: research excellence and engagement with national and international partners are at the heart of our efforts to set new agendas, build capacities and support better decision-making on the critical issues of our times.

WorldFish is part of One CGIAR, the world's largest agricultural innovation network.