

# FAN

FAO Aquaculture Newsletter



## In this month's issue

▶ FAN coming of age!	ii	▶ Rice-fish farming in Sub-Saharan Africa	40
▶ Towards the fourth Global Conference on Aquaculture	14	▶ Towards guidelines on sustainable aquaculture	55
▶ Actions undertaken by Peru against the Tilapia Lake Virus	35	▶ Leveraging on aquaculture to improve global nutrition	63



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Tilapia pond in lake Itasy, Madagascar

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## FAN coming of age!

Dear reader,

It is with immense pleasure that I am writing this editorial for the 60<sup>th</sup> issue of FAN. Twenty-seven years ago, in June 1992, the FAO Aquaculture Newsletter was first published by the Inland Water Resources and Aquaculture Service of FAO's Fisheries Department. Yes, "Fisheries Department" was the full name at that time, and it was going to take another 15 years for "Aquaculture" to be included in our Department's name.

Since then, the sector has progressed in many ways, and in fact has changed dramatically. Despite some good questions as to its real and perceived growth, the "mantra" that aquaculture has surpassed capture fisheries production years ago and has been the food production sector with the strongest growth in the last five decades remains valid.

Looking at this development from an FAO perspective, some key milestones and activities come to mind:

- The agreement on the Code of Conduct for Responsible Fisheries and its provision on sustainable aquaculture in 1995, and subsequent development of global technical guidelines for industry and policy-makers;<sup>1</sup>
- The convening of Global Aquaculture Conferences – the *Millennium Conference* in 2000, *Farming the Waters for Food and People* in 2010, and the forthcoming *Aquaculture for Food and Sustainable Development* in 2020 – to address opportunities and challenges faced by the sector;
- The establishment of the FAO Committee on Fisheries' Sub-Committee on Aquaculture (COFI SCA) in 2001, a unique intergovernmental body serving as a platform for FAO Member States to discuss aquaculture-related issues of global relevance;
- The development of numerous tools to support the sustainable development of aquaculture (FAO National Aquaculture Legislation Overviews,<sup>2</sup> Aquaculture Feed and Fertilizer Resources Information System,<sup>3</sup> National Aquaculture Sector Overviews,<sup>4</sup> Aquatic Genetic Resources,<sup>5</sup> Cultured Aquatic Species fact sheet,<sup>6</sup> World Aquaculture Performance Indicators,<sup>7</sup> etc.);
- The regional aquaculture reviews since year 1997;<sup>8</sup>
- The finalization of the first ever *State of the World's Aquatic Genetic Resources for Food and Agriculture*;<sup>9</sup>
- FAO's collaboration with the Government of Norway, who launched the first Global Action Network under the Decade of Action on Nutrition, titled "Sustainable Food from the

1. [www.fao.org/fishery/publications/technical-guidelines/](http://www.fao.org/fishery/publications/technical-guidelines/)
2. [www.fao.org/fishery/collection/nalo/](http://www.fao.org/fishery/collection/nalo/)
3. [www.fao.org/fishery/affris/](http://www.fao.org/fishery/affris/)
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5. [www.fao.org/aquatic-genetic-resources/](http://www.fao.org/aquatic-genetic-resources/)
6. [www.fao.org/fishery/culturedspecies/search](http://www.fao.org/fishery/culturedspecies/search)
7. [www.fao.org/fishery/statistics/software/wapi/](http://www.fao.org/fishery/statistics/software/wapi/)
8. [www.fao.org/fishery/regional-aquaculture-reviews](http://www.fao.org/fishery/regional-aquaculture-reviews)
9. [www.fao.org/3/CA0454EN/ca0454en.pdf](http://www.fao.org/3/CA0454EN/ca0454en.pdf)

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Oceans and Inland Waters for Food Security and Nutrition".

FAO has the responsibility to serve its Members, the countries. As a specialized United Nations agency, FAO's wide-ranging capacities, long experience working with development actors, and unique expertise in the three dimensions of sustainable development can assist countries reaching humanity's great challenge of achieving the Sustainable Development Goals and implementing the 2030 Agenda for Sustainable Development. Food security is central in all of this. Food security, as defined by the United Nations' Committee on World Food Security, means *"that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life"*. The focus of the world community has shifted, maturing from an earlier perspective on volume and stability of food supplies into embracing the wider story, bringing together demand and consumption, issues of access by vulnerable people, trade-offs and negative impacts on the environment, and understanding aquaculture products' role as a safe and nutritious food. We have come a long way since this concept was adopted, but we are still far from an adequate recognition of the importance of aquatic food in the global debate. Fish needs to be part of a healthy diet, and aquaculture has an increasingly important role to play when it comes to closing the supply-demand gap and ensuring food security for all. Understanding

this better, and communicating the science to a wider public, will be an important part of our engagement in the "Blue Food Assessment" which is currently being initiated with Friends of Ocean Action, World Resources Institute and partners to complement findings in the EAT Lancet Report from a Blue Food perspective.

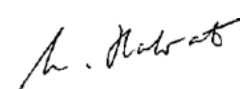
This issue is being published ahead of an important intergovernmental event, the 10th Session of the COFI SCA, to be held in Trondheim, Norway, from 23 to 27 August 2019. There, Member States will discuss many important issues, such as how their self-assessment of the aquaculture sector's development can help other Members, the need for sustainable aquaculture guidelines, a pathway for improving aquatic biosecurity, and the role of innovations in achieving sustainable growth.

FAN was born out of the need to regularly inform a wide range of stakeholders about aquaculture development, especially in developing countries, to disseminate news about the many and diverse FAO field projects, and to inform about FAO global activities developed at headquarters. Reading through past issues of FAN – available at [www.fao.org/fishery/publications/fan](http://www.fao.org/fishery/publications/fan) – can be a fascinating journey that will provide you with a unique and historic perspective of aquaculture development over almost three decades. It may also stimulate our thinking when it comes to the preparation of another milestone

event – organized by FAO and the Network of Aquaculture Centres in Asia-Pacific (NACA) in collaboration with China's Ministry of Agriculture and Rural Affairs and hosted by Shanghai's Ocean University – the Global Aquaculture Conference 2020 *Aquaculture for Food and Sustainable Development* to be held in Shanghai, China, from 26 to 30 October 2020. You will find information on this and other events in this issue of FAN, and we hope you will find it relevant and useful.

I would like to take this opportunity to thank all the contributors, editors and other staff who have made this and previous issues possible, and overall you, the readers, who we look forward to serving in the future, and who we hope will continue to provide valuable feedback so that we can constantly improve in achieving our vision of creating a world in which responsible and sustainable use of aquaculture resources makes an appreciable contribution to human well-being, food security and poverty alleviation.

Today, and for future generations.



**Matthias Halwart**

Head – Aquaculture Branch

FAO Fisheries and Aquaculture Department

E-mail: [Matthias.Halwart@fao.org](mailto:Matthias.Halwart@fao.org)



# CONTENTS

## ■ Editorial

FAN coming of age!

ii

## GLOBAL AQUACULTURE UPDATES

6

### ■ From the Statistician's Desk

Brief overview of world aquaculture production – An update with latest available 2017 global production data

6

### ■ From the Fish Health Specialist's Desk

FAO continues its technical assistance to reduce risks and enhance capacity to counter TiLV

9

### ■ Meetings/events

FAO Sub-Committee on fish trade

12

The eighteenth session of the Committee for inland fisheries and aquaculture of Africa (CIFAA) set to take place in Mali

12

Towards the fourth Global Conference on Aquaculture in 2020 – Aquaculture for Food and Sustainable Development

13

Celebrating a quarter century of the Code of Conduct for Responsible Fisheries

14

Seaweed (*Caulerpa* sp.) sold on Bolinao market (Philippines)

Observing the international year of artisanal fisheries and aquaculture in 2022, and the 2<sup>nd</sup> International Day for the Fight against Illegal, Unreported and Unregulated (IUU) Fishing

14

Aquatic genetic resources – towards a global plan of action

15

The COFI advisory working group on aquatic genetic resources and technologies

16

The international promotion programme workshop on social impact of rice-fish farming, Shanghai, China

17

## AQUACULTURE UPDATES BY REGION

18

### ■ Asia-Pacific

FAO regional consultation on antimicrobial resistance risk in aquaculture in Asia-Pacific

18

FAO expert group meets in Palermo to better understand the risks of antimicrobial resistance in aquaculture

19

Support upscaling of innovative rice-fish and climate-resilient tilapia farming in Asia-Pacific

21

Promoting “aquatic diversification” of ricefield environments for food and nutrition security in the Lao People's Democratic Republic

22

FAO assistance to Palau and the Federated States of Micronesia on biosecurity

23

### ■ Europe

Capacity-building on allocated zones for aquaculture in the Mediterranean and the Black Sea

24

NACEE: a Central and Eastern European network for information exchange and cooperation

26

### ■ Near East and North Africa

FAO supports Sudan fisheries and the aquaculture sector

27

L'aquaculture tunisienne: vers une production aquacole diversifiée

28

Appui de la FAO à l'élaboration des stratégies de développement de l'aquaculture en Algérie et au Maroc

29

### ■ Latin America and the Caribbean

Advancing aquaponics in the Caribbean

31

Technological innovation in mussel seed collection: a response to climate change from fishing communities in southern Chile

33

Recent efforts and actions undertaken by Peru against the tilapia lake virus (TILV)

35



Periphyton-based aquaculture (Acadja-Bamboo pond) in Gagnoa (Côte d'Ivoire)

# CONTENTS

## ■ Sub-Saharan Africa

Aquaculture integrated with horticulture takes northeast Nigeria by surprise	36
Could marine aquaculture be an alternative livelihood option for vulnerable coastal fisher communities?	37
La FAO appuie le développement de l'élevage de tilapia en cages flottantes au Cameroun	38
The Southern Africa Development Community and FAO join hands to strengthen development and management of fisheries and aquaculture	39
Rice-fish farming in Sub-Saharan Africa	40
Decent jobs for youth and improved food security through development of sustainable rural enterprises	41
Strategy model for decent youth employment in aquaculture and related value chains	42

## THEMATIC ARTICLES 43

Contribution of aquaculture to total fishery production: the 50-percent mark	43
Agroecology in aquaculture	46
The gender triad, a new paradigm for gender mainstreaming in aquaculture	48
Microalgae in aquatic animal feeds	50
The sustainable development goals and the economic contribution of fisheries and aquaculture	51
Evaluating the impact of aquaculture on natural radioactivity in diets	53
Towards guidelines on sustainable aquaculture	55
Guidance on social issues relative to human and labour rights in fisheries and aquaculture value chains	56
Future food system and diets: where is the fish?	57

## MISCELLANEOUS 59

Let's talk about fish. Promoting aquaculture through social media channels	59
Towards an updated ISSCAAP classification to better suit the needs of aquaculture	61
Leveraging on aquaculture to improve global nutrition	63
Remembering our colleague, Joanna Toole	65

## NEW STAFF PROFILES 66

## NEW PUBLICATIONS 67

## CALENDAR OF EVENTS 71



An aquaculture farm in Antananarivo, Madagascar

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# GLOBAL AQUACULTURE UPDATES



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## Brief overview of world aquaculture production An update with latest available 2017 global production data

In March 2019, FAO released the Global Aquaculture Production Statistics Dataset 1950–2017 for public access, together with that of capture fisheries production. The latest FAO statistics have recorded world total aquaculture production, including aquatic plants, at 111.9 million tonnes in live weight in the year 2017, with the total off-farm value estimated at USD 249.6 billion. Out of the 204 currently existing countries and territories registered in the FAO global aquaculture statistics database, 198 of them were active in production operations in 2017. The level of aquaculture production recorded varies greatly among the producing countries across the world, with three countries reporting less than a tonne of production to mainland China, which produced over 60 million tonnes.



Written by:

**Xiaowei Zhou**  
FAO Fisheries and Aquaculture  
Department, Rome, Italy  
E-mail: Xiaowei.Zhou@fao.org

- World aquaculture production in 2017 consisted of 80.1 million tonnes of aquatic animals (USD 237.5 billion), 31.8 million tonnes of aquatic plants (USD 11.8 billion) (Figure 1), and 2.2 thousand tonnes of non-food products (USD 186 million).
- Farmed aquatic animals were comprised of 53.4 million tonnes of finfish (USD 139.7 billion), 17.4 million tonnes of molluscs (USD 30.4 billion), 8.4 million tonnes of crustaceans (USD 61.1 billion) and 893 900 tonnes of other aquatic animals (USD 6.6 billion).
- The great majority of farmed aquatic plants were marine macroalgae, commonly referred to as seaweeds, while a much

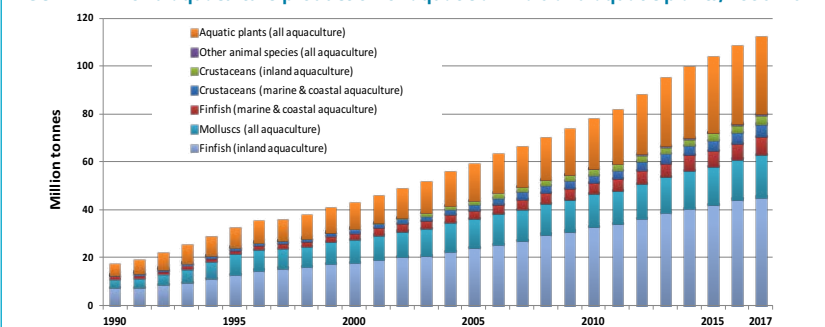
smaller quantity of microalgae was also produced.

- The non-food products recorded in the global database include only pearls and ornamental shells of molluscs.

Compared to the 1950–2016 global dataset released in 2018, the world aquaculture production level in 2016 was adjusted downwards by 3.6 million tonnes for aquatic animals in this latest dataset, due primarily to the retroactive revision of historical data from China, the world's largest aquaculture producer (see Box 1).

The contribution of aquaculture as a proportion of total production of aquatic animals has now reached 46.4 percent, although

FIGURE 1 – World aquaculture production of aquatic animals and aquatic plants, 1990–2017



it varies greatly between regions (Figure 2). When production from China, the world's largest aquaculture producer, is excluded, only 30.2 percent of total fish production is derived from aquaculture in the rest of the world.

Inland aquaculture of finfish species was the most important sector in the world aquaculture of aquatic animals. The production of 45.6 million tonnes of finfish from inland aquaculture represented 56.9 percent of world total aquaculture production

of aquatic animals in 2017 (see Table 1). Farming in earthen ponds remains the most important culture method for aquatic food production.

The development of cage and pen culture worldwide appears to have come to the crossroads with two opposite directional trends appearing, particularly in the case of cage and pen culture in the freshwater environment. Many aquaculture countries are emerging as major regional producers thanks to the spread of cage culture in lakes and reservoirs, including some African countries, Saudi Arabia and some socio-economically underprivileged communities in Bangladesh and India. In contrast, cage and pen culture farmers are facing tougher regulations on cage farming in some countries, with some facilities being removed from public waters due to adjusted priorities relative to the environment and relatively reduced focus on the volume of production (e.g. China, Indonesia and the Philippines).

The pace of technology development in recirculating aquaculture systems (RAS) and the increase in real applications by aquaculture farmers in production have accelerated compared to a decade ago. Though developed countries are taking the lead in the application of RAS, it is also spreading in developing countries where local conditions allow.

Production records 1950–2017 indicate that aquaculture production has been recorded for a total of 608 species items. A species item refers to a single species, a group of species (where identification to the species level is not possible) or a hybrid.

The species composition of aquaculture production differs greatly among regions (see Table 1). Among all the species farmed, tilapias are the most widely produced, with production

### BOX 1 – Revision of historically recorded or published statistical data

The review and retroactive revision of historically recorded or published fisheries and aquaculture statistical data is known to be a standard procedure carried out by responsible competent authorities in some countries, but does not occur in other countries. No obvious uniformity of governing rules is observed among the revision practicing countries. National exercises to revise or adjust previously published data vary in the statistical areas of the data in question, the affected period and in the frequency of such exercises. In some countries, it is carried out annually (e.g. Japan, Norway and Thailand), over certain multi-year periods (e.g. Australia, Canada and China), or on an *ad hoc* basis as and when needed (e.g. Albania and Brazil).

Timely and proactive reporting to FAO of adjusted historical data by national authorities is always greatly appreciated and is seen as a most welcome cooperative effort of FAO member countries. Such actions support the continuous improvement of the quality and reliability of global statistics that FAO is mandated to collect, validate and release publicly, serving the need for data supporting global perspectives. For countries that fail to report national data directly to FAO, national official data obtained previously through alternative channels are replaced with officially revised historical data when they become available to FAO. Historical estimates made and recorded by FAO for countries and territories without data are also subject to revision by FAO according to the need and based upon analysis and assessment of newly available information and evidence, collected from various sources using a mix of different methodologies and tools.

Although most revisions executed on historical data by countries or by FAO result in the change, in upward or downward directions, in the total national production quantity and value, some revisions lead to more specific changes, such as (i) adjusting the relative importance of species in the national production; (ii) correcting the misidentification of species; (iii) correcting misclassified culture environment or production area; and (iv) applying improved factors for conversion from processed weight to live weight equivalent of certain species from certain countries.

The newly released FAO Global Aquaculture Production Statistics Dataset 1950–2017 carries many revisions of historical data. In both absolute and relative terms, the most important revisions to note are those revisions reported by mainland China for its five-year production data for 2012–2016, including the revisions performed by FAO for an additional three years (2009–2011) for China. Against the overall downward adjustment, some novel non-traditional species were adjusted upwards for 2016. The historical data revision in China was a joint exercise of the national fisheries authority and the national statistics authority planned for every ten years, but also incorporated data from its third national agriculture census for 2016. The next review and revision is envisaged after a further ten years. As a specific example of the type of revision made by FAO, newly available scientific evidence was used in the upward revision of production data in wet weight of Japanese kelp farmed in China (since 1952) based on a new conversion factor of “6.76” instead of “5.0” used previously for converting dry weight to wet weight.

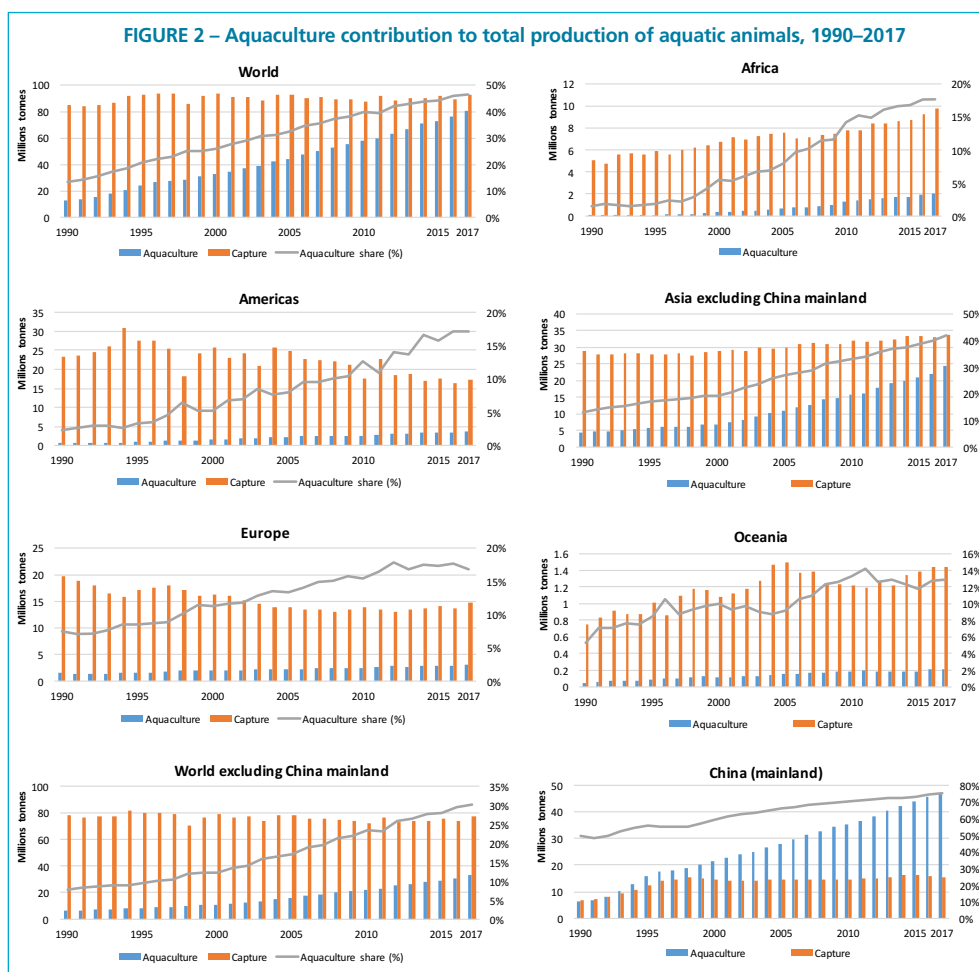
The historical data revisions carried out by other reporting countries, or for non-reporting countries by FAO, have less impact on global level analyses, but can nevertheless be very pronounced at national levels, especially for some smaller producing countries such as Albania or Afghanistan.

in countries from South Africa to Poland and from Latin America to Ontario in Canada and from brackish ponds and cages in nearshore coastal zones to geothermal heated ponds 4.3 kilometres above sea level in Tibet, China.

In 2017, the top ten aquaculture producers (excluding aquatic plants and non-food products) were China (46.8 million tonnes), India (6.2 million tonnes), Indonesia (6.2 million tonnes), Viet Nam (3.8 million tonnes), Bangladesh (2.3 million tonnes), Egypt (1.5 million tonnes), Norway (1.3 million tonnes), Chile (1.2 million tonnes), Myanmar (1 million tonnes) and Thailand (0.89 million tonnes). The top ten producers collectively produced 71.2 million tonnes, contributing 88.9 percent to the world total production by quantity in 2017.

World aquaculture production of aquatic animals enjoyed an average annual growth rate of 5.9 percent during 2001–2010. The annual growth rate has relaxed in the last seven years (2011–2017) to an average of 4.8 percent per year.

The collection of aquaculture production statistics worldwide remains a big challenge. For the year 2017, over 90 countries and territories (45 percent) did not respond to FAO's request for aquaculture statistics. Among the reporting countries and territories, some national data had problems in consistency, completeness and accuracy. The Fisheries and Aquaculture Statistics and Information Branch (FIAS)



is working closely with member countries in national statistics capacity building to improve data quality. The result will be reflected in the FAO global dataset 1950–

2018 to be released in March 2020 and will be used for status and trend analysis in the next issue of SOFIA.

TABLE 1 – Aquaculture production of main groups of food fish species by continent, 2017 (thousand tonnes, live weight)

	Africa	Americas	Asia	Europe	Oceania	World
<b>Inland aquaculture</b>	<b>204.41</b>	<b>115.26</b>	<b>4 587.04</b>	<b>51.03</b>	<b>0.60</b>	<b>4 958.35</b>
<b>Aquatic animals subtotal</b>	<b>204.40</b>	<b>115.25</b>	<b>4 579.68</b>	<b>51.02</b>	<b>0.60</b>	<b>4 950.96</b>
1. Finfish	204.39	108.82	4 197.45	51.01	0.58	4 562.25
2. Crustaceans	0.01	6.39	308.48	0.01	0.02	314.91
3. Molluscs	0.00	0.00	22.41	0.00	0.00	22.41
4. Other aquatic animals	0.00	0.05	51.35	0.01	0.00	51.40
<b>Aquatic plants (Cyanobacteria and microalgae)</b>	<b>0.01</b>	<b>0.01</b>	<b>7.36</b>	<b>0.02</b>	<b>0.00</b>	<b>7.39</b>
<b>Marine and coastal aquaculture</b>	<b>17.00</b>	<b>243.88</b>	<b>5 702.48</b>	<b>249.99</b>	<b>22.82</b>	<b>6 236.18</b>
<b>Aquatic animals subtotal</b>	<b>3.35</b>	<b>242.20</b>	<b>2 546.20</b>	<b>249.82</b>	<b>20.91</b>	<b>3 062.48</b>
1. Finfish	2.26	101.98	479.09	186.31	8.46	778.10
2. Crustaceans	0.60	79.30	448.81	0.03	0.62	529.37
3. Molluscs	0.48	60.93	1 580.52	63.27	11.83	1 717.02
4. Other aquatic animals	0.01	0.00	37.78	0.20	0.00	37.99
<b>Aquatic plants (seaweeds/macroalgae)</b>	<b>13.65</b>	<b>1.68</b>	<b>3 156.28</b>	<b>0.18</b>	<b>1.91</b>	<b>3 173.70</b>
<b>Total aquaculture</b>	<b>221.41</b>	<b>359.15</b>	<b>10 289.52</b>	<b>301.03</b>	<b>23.42</b>	<b>11 194.53</b>
<b>Aquatic animals subtotal</b>	<b>207.76</b>	<b>357.46</b>	<b>7 125.88</b>	<b>300.84</b>	<b>21.51</b>	<b>8 013.44</b>
1. Finfish	206.65	210.80	4 676.54	237.32	9.04	5 340.34
2. Crustaceans	0.62	85.69	757.29	0.04	0.64	844.27
3. Molluscs	0.48	60.93	1 602.93	63.27	11.83	1 739.43
4. Other aquatic animals	0.01	0.05	89.13	0.21	0.00	89.39
<b>Aquatic plants</b>	<b>13.66</b>	<b>1.69</b>	<b>3 163.64</b>	<b>0.19</b>	<b>1.91</b>	<b>3 181.09</b>



# FAO continues its technical assistance to reduce risks and enhance capacity to counter TiLV

Building on the information provided in FAN Issue 59,<sup>1,2,3,4</sup> we hereby report some further developments regarding FAO's continuing efforts in providing technical assistance requested by FAO Member States and other relevant stakeholders. Our efforts also reflect FAO's response to the strong concerns about the tilapia lake virus (TiLV) disease, as expressed during the ninth session of the Committee on Fisheries/ Sub-Committee on Aquaculture (COFI-SCA), held in Rome in October 2017.<sup>5</sup>

## Enhancing capacity/risk reduction of emerging tilapia lake virus to African tilapia aquaculture

The project GCP/RAF/510/MUL, funded by the Africa Solidarity Trust Fund, includes six countries, namely, Angola, Egypt, Ghana, Kenya, Nigeria and Uganda. A Project Inception Workshop (PIW), held in Nairobi, Kenya, from 23 to 24 October 2018, presented details about the project to participating countries and relevant stakeholders, and



Delegates in the intensive TiLV course in Kisumu, Kenya

provided the current state of knowledge on the disease and the risks it presents to African tilapia aquaculture. It also introduced the project background, objectives, scope, components and outputs; discussed project implementation mechanisms; and identified potential bottlenecks and/or risks in project implementation (especially at the national level) and recommended ways to avoid such risks. Some 34 delegates attended, including representatives from academia and producers, FAO Representations and staff from headquarters, and TiLV experts.

The participants enhanced their knowledge on various aspects of TiLV pertaining to its emergence and current distribution, pathology and diagnostics, prevention, risks and risk management, aquatic animal disease surveillance and requirements. They also learned some aspects of socio-economic impact assessment methods and the FAO emergency

management tools. Country delegates presented detailed implementation plans, including requirements, components, timelines, risks and responsibilities. All materials relevant to the meeting can be downloaded at [www.fao.org/fishery/static/news/TiLVProject/listoflinks.html](http://www.fao.org/fishery/static/news/TiLVProject/listoflinks.html).

Following on from the PIW, a 10-day intensive training course on TiLV was held from 4 to 13 December 2018 in Kisumu, Kenya. The course consisted of 14 sessions, which included 35 expert presentations, field visits, laboratory activities and four interactive working group exercises. The participants acquired the currently available technical information on the biology, pathology, diagnostics, surveillance and economics, farm-level management of TiLV and emergency preparedness.

1. [www.fao.org/3/ca2325EN/ca2325en.pdf](http://www.fao.org/3/ca2325EN/ca2325en.pdf)
2. [www.fao.org/3/a-i7326e.pdf](http://www.fao.org/3/a-i7326e.pdf)
3. [www.fao.org/fishery/nems/41072/zh](http://www.fao.org/fishery/nems/41072/zh)
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5. [www.fao.org/3/i8886t/i8886T.pdf](http://www.fao.org/3/i8886t/i8886T.pdf)



Written by:

**Melba G. Bondad-Reantaso**  
FAO Fisheries and Aquaculture  
Department, Rome, Italy  
E-mail: [Melba.Reantaso@fao.org](mailto:Melba.Reantaso@fao.org)

**Kathy F.J. Tang-Nelson**  
Associate Research Professor  
University of Arizona  
E-mail: [Ktangnelson@gmail.com](mailto:Ktangnelson@gmail.com)

**Elena Irde**  
FAO Consultant  
E-mail: [Elena.Irde@fao.org](mailto:Elena.Irde@fao.org)  
FAO Fisheries and Aquaculture  
Department, Rome, Italy

At the end of the training course, the delegates prepared a detailed country-level implementation of their TiLV National Action Plans (NAPs), including planned diagnostics, surveillance (including field surveys and laboratory activities), information dissemination, national consultation and emergency preparedness. Implementation is expected to be carried out between the second quarter of 2019 and the first quarter of 2020. Details of the training course can be found at [www.fao.org/fishery/nems/41135/zh](http://www.fao.org/fishery/nems/41135/zh).

**Prevention and control of TiLV**

In 2018, FAO published a TiLV Expert Knowledge Elicitation (EKE) Risk Assessment<sup>6</sup> with the objectives of: (i) determining the extent of biosecurity risks associated with the spread of TiLV into TiLV-free zones/countries and the spread within countries where the disease is already established; and (ii) identifying biosecurity measures to manage these risks.

The summary findings of the EKE risk assessment are:



Delegates in the intensive TiLV course in Kisumu, Kenya, actively participated in a range of course activities

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1. The risk of TiLV spreading in the absence of control measures:
  - from infected countries to North America or Pacific Island countries and territories = moderate;
  - within a country where it is already present = very high;
  - from infected countries to other countries in Asia (including East and South Asia), Africa or South America = high.
2. The risk of spread through live fish movement pathway = high.
3. The risk of spread through trade in uncooked chilled/

frozen whole fish and fish products (such as fish fillets) pathway = low.

It should be noted that this assessment is intended to assist countries in setting risk management policies that address concerns about the potential spread of TiLV and should be considered as a guide only. The scope of this assessment is restricted to an estimation of the risks associated with the intranational or international movement of live fish, or the trade in raw chilled or frozen whole fish or fish products.

The EKE risk assessment also concluded the following:

1. The five **most effective measures** to reduce the risk of TiLV **spreading internationally**:
  - Prohibition of live tilapia imports based on risk assessment.
  - Importation of live tilapia only from populations tested and certified to be TiLV-free, with post-arrival testing of imported live tilapia to verify effectiveness of health controls in source/exporting countries.
  - Quarantine and post-arrival testing of imported live tilapia shipments.

**Update on the current status of TiLV**

Country	First occurrence (year)/grey literature or scientific report (year)	OIE notification (year) as emerging disease
Israel	2009/2014	2017
Ecuador	2011/2014	
Colombia	Not known/2016	
Thailand	2015/2017	2017
Uganda	2015/2018	
United Republic of Tanzania	2015/2018	
Egypt	2016/2017	
India	2016/2017	2017
Indonesia	2016/2018	
Taiwan Province of China	2017/2018	2017
Philippines	2017/no scientific report yet	2017
Malaysia	2017/2018	2017
Peru	2017/2019	2018
Mexico	2018/no scientific report yet	2018
USA	2018	2019

Note: OIE = World Organisation for Animal Health.

6. [www.fao.org/3/ca2325EN/ca2325en.pdf](http://www.fao.org/3/ca2325EN/ca2325en.pdf)

- Surveillance of establishments with imported fish and implementation of strict biosecurity and emergency response arrangements in these establishments.
  - Immediate TiLV surveillance of all major tilapia breeding facilities and fry/fingerling dissemination centres.
2. The five measures considered generally **most feasible**:
- Immediate notification of unexplained tilapia mortalities to competent authorities.
  - Basic biosecurity practices at the farm level (e.g. good record-keeping, quick action at first signs of abnormal fish behaviour, sick/dead fish disposal, control of fish movement, control of facility access, and disinfection of farm vehicles and equipment).
  - Immediate investigation of unexplained mortalities.
  - Basic husbandry practices (e.g. appropriate stocking density, maintaining good water quality, good nutrition, culturing same age group, avoiding entry of wild fish or potential vectors in earthen pond system and maintaining good farm records).
  - Surveillance of establishments with imported fish and implementation of strict biosecurity and emergency response arrangements in these establishments.
3. The five measures most **effective** to reduce the risk of TiLV **spread within countries**:
- Prohibition of live tilapia movement out of infected/ buffer zones or from zones of uncertain health status.
  - Basic biosecurity practices at the farm level (e.g. good record-keeping, quick action at first signs of abnormal fish behaviour, sick/dead fish disposal, control of fish movement, control of facility access, and disinfection of farm vehicles and equipment).
  - National emergency disease response system targeting TiLV.
  - Immediate notification of unexplained mortalities to competent authorities.
  - Immediate TiLV surveillance of all major tilapia breeding facilities and fry/fingerling dissemination centres.
4. The five measures considered generally **most feasible**:
- Immediate notification of unexplained mortalities to competent authorities.
  - Basic biosecurity practices at the farm level (e.g. good record-keeping, quick action at first signs of abnormal fish behaviour, sick/dead fish disposal, control of fish movement, control of facility access, and disinfection of farm vehicles and equipment).
  - Immediate investigation of unexplained mortalities.
  - Basic husbandry practices (e.g. appropriate stocking density, maintaining good water quality, good nutrition, culturing same age group, avoiding entry of wild fish or potential vectors in earthen pond system and maintaining good farm records).
  - Basic biosecurity practices at the farm level (e.g. good record-keeping, quick action at first signs of abnormal fish behaviour, sick/dead fish disposal, control of fish movement, control of facility access, and disinfection of farm vehicles and equipment).
  - Immediate investigation of unexplained mortalities.
  - Immediate notification of unexplained mortalities for early warning to neighbouring farms.
  - Basic husbandry practices (e.g. appropriate stocking density, maintaining good water quality, good nutrition, culturing same age group, avoiding entry of wild fish or potential vectors in earthen pond system and maintaining good farm records).

Vaccines against TiLV are currently under development by KoVax Ltd, Israel, Phibro-Aqua Animal Health Corporation and several researchers in Israel, Thailand and Ecuador/Peru.

- National level risk management measures targeting international trade must also be based on risk analysis (consistent with OIE standards) and be commensurate with the level of risk reduction needed to meet the country's appropriate level of protection (ALOP).
- The outcomes of this risk assessment present a basis for prioritizing action on TiLV, including risk assessment and national competent authority and industry sector level measures to manage TiLV risks, be they for TiLV-free or already affected countries.
- Countries considering implementing risk management measures should therefore consider all options and decide on the suite of measures that best suits local circumstances, noting that no single measure alone is likely to bring a meaningful level of risk reduction.
- There is a need for gap analysis and expanding national and international efforts in building aquatic animal health and aquaculture biosecurity capacity.

## FAO Sub-Committee on fish trade

International trade is one of the main catalyzers of economic and social development worldwide, with positive corollaries for income distribution, food security and poverty alleviation. Fish and fishery products play a major role in this share of international trade, with an exceptional positive pattern of income generation and inclusiveness since most of the products originate from developing countries.

The FAO Committee on Fisheries Sub-Committee on Fish Trade (COFI-FT) is the most important global forum for consultations between countries on technical and economic aspects of international trade of fish and fishery products. It will have its next biennial session in November this year in Vigo, Spain.



*Written by:*

**Marcio Castro de Souza**

*E-mail: Marcio.Castrodesouza@fao.org*

**Audun Lem**

*E-mail: Audun.Lem@fao.org*

*FAO Fisheries and Aquaculture Department, Rome, Italy*

During the sessions, countries are informed of fishery statistics and economics. Important aspects of relevance and impact on international trade and market access issues are always discussed, particularly quality and safety, and the regulatory interlinkages between biodiversity conservation and trade.

In addition, serving as a technical consultation forum of fish trade and economics, COFI-FT also has a unique role in preparing and smoothing out specific issues for the analysis and the deliberation of the FAO Committee on Fisheries. In recent years, many important topics have been initially addressed at COFI-FT, such as catch documentation schemes, ecolabelling guidelines and issues associated with biodiversity conservation and trade.

At the 2019 Session of COFI-FT, topics such as “trade in fisheries services” and “social responsibility of fish and aquaculture value chains” will also be presented for analysis by countries. For more information on the work being developed by FAO on social responsibility, please visit our website at [www.globefish.org](http://www.globefish.org).

## The eighteenth session of the Committee for Inland Fisheries and Aquaculture of Africa (CIFAA) set to take place in Mali

The Seventeenth Session of the Committee for Inland Fisheries and Aquaculture of Africa (CIFAA), held in Banjul, the Gambia, from 9 to 11 May 2017, acknowledged that many issues currently limit the effectiveness of the Committee, including a weak institutional structure, low participation of members at the sessions, and inadequate financial and technical resources. Mali offered to host the Eighteenth Ordinary Session during the second semester of 2019, and thus this will be a very important step to reinforce the CIFAA. The agenda includes the following topics:

- Capacity and suitability of inland waterbodies for cage farming;
- Roles of subregional lakes and river bodies in inland fishery management;
- Impact of Nile tilapia trade: imported versus locally produced fish;
- Sustainability of aquaculture production (profitability versus socio-economic considerations);
- Fish diseases and environmental constraints;



*Written by:*

**Ndiaga Gueye**

*FAO Regional Office for Africa, Accra, Ghana*

*E-mail: Ndiaga.Gueye@fao.org*



Board of the 18<sup>th</sup> Session of the Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)

- Integrated aquaculture farming systems to make production more profitable.

The Aquaculture Network for Africa (ANAF) will also be discussed, following the endorsement of the proposal to integrate ANAF within the African Union structure, as this option has less cost implications for the countries. The session will also solve the legal status of the Network as well as membership issues since the African Union is already a formal organization of which all African nations are members. A regional consultation on the development of Sustainable Aquaculture Guidelines, which FAO has been asked to develop by the Sub-Committee on Aquaculture of the Committee on Fisheries, may also be organized in connection with the CIFAA session.

# Towards the fourth Global Conference on Aquaculture in 2020

## Aquaculture for Food and Sustainable Development

In 1976, FAO held its first global conference on aquaculture in Kyoto, Japan, triggering the recognition of aquaculture as a significant food production sector and exploring opportunities for the development of the sector. This was followed by the global conferences "Aquaculture in the Third Millennium" in Bangkok, Thailand, in 2000, and "Farming the Waters for People and Food" in Phuket, Thailand, in 2010.

With aquaculture now providing more than half of the global aquatic food supplies, and increasingly contributing to the sustainability of integrated food systems, FAO, in partnership with the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Government of China, is organizing the fourth **Global Conference on Aquaculture 2020** to be held in Shanghai, China, from 26 to 30 October 2020, to review the achievements and challenges in world aquaculture development and build consensus on a way forward for sustainable development of the sector.

The objectives of the **Global Conference on Aquaculture 2020** are to:

- 1) review the present status and trends in aquaculture development;
- 2) evaluate the progress made in the implementation of the **Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 and the Phuket Consensus**;
- 3) address emerging issues in aquaculture development;
- 4) assess opportunities and challenges for future aquaculture development;
- 5) build consensus on advancing aquaculture as a global, sustainable and competitive food production sector.



Written by:

**Xinhua Yuan**

FAO Fisheries and Aquaculture Department, Rome, Italy

E-mail: [Xinhua.Yuan@fao.org](mailto:Xinhua.Yuan@fao.org)

The **Global Conference on Aquaculture 2020** will bring together a wide range of stakeholders, i.e. government, academia, training, research, industry and many others, to the conference.

You are cordially invited to attend the conference and share your innovative contributions.

More information about the Global Conference on Aquaculture 2020 will be made available at: [www.aquaculture2020.org](http://www.aquaculture2020.org).



Plenary keynote in Phuket 2010 Global Conference on Aquaculture



### SEE ALSO

NACA/FAO. 2001. Aquaculture in the third millennium. In R.P. Subasinghe, P.Bueno, M.J. Phillips, C. Hough, S.E. McGladdery & J.E. Arthur, eds. *Technical Proceedings of the Conference on Aquaculture in the Third Millennium*, Bangkok, Thailand, 20–25 February 2000. NACA, Bangkok, and FAO, Rome. 471 pp. (also available at: [www.enaca.org/?id=413](http://www.enaca.org/?id=413)).

FAO/NACA. 2012. Farming the waters for people and food. In R.P. Subasinghe, J.R. Arthur, D.M. Bartley, S.S. De Silva, M. Halwart, N. Hishamunda, C.V. Mohan & P. Sorgeloos, eds. *Proceedings of the Global Conference on Aquaculture 2010*, Phuket, Thailand, 22–25 September 2010. FAO, Rome, and NACA, Bangkok. 896 pp. (also available at: [www.fao.org/3/i2734e/i2734e.pdf](http://www.fao.org/3/i2734e/i2734e.pdf)).

## Celebrating a quarter century of the Code of Conduct for Responsible Fisheries

We'll be kicking off an exciting year in 2020, celebrating the twenty-fifth anniversary of the FAO Code of Conduct for Responsible Fisheries. Adopted unanimously at the FAO Conference on 31 October 1995, the Code of Conduct provides principles and standards applicable to the conservation, management and development of fisheries and aquaculture.

The Code of Conduct has also resulted in numerous technical guidelines for responsible fisheries and aquaculture, International Plans of Action and additional instruments and measures that support countries with implementing the Code of Conduct.



Written by:

**Audun Lem**

E-mail: [Audun.Lem@fao.org](mailto:Audun.Lem@fao.org)

**Kimberly Sullivan**

E-mail: [Kimberly.Sullivan@fao.org](mailto:Kimberly.Sullivan@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy

Following the call by FAO's Committee on Fisheries (COFI) in 1991 to develop new concepts for responsible, sustained fisheries, 170 FAO member countries took part in its drafting. The Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries and aquaculture, and the interest of all those concerned with the fisheries sector.

Throughout 2020, FAO and partners will be spotlighting success stories and best practices in promoting responsible and sustainable fisheries and aquaculture during the first quarter century of the Code of Conduct for Responsible Fisheries. And at COFI in July 2020, a special event will celebrate the 25 year anniversary.



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## Observing the International Year of Artisanal Fisheries and Aquaculture in 2022, and the 2<sup>nd</sup> International Day for the Fight against Illegal, Unreported and Unregulated (IUU) Fishing

A proposal to declare 2022 as the International Year of Artisanal Fisheries and Aquaculture and 5 June as the International Day for the Fight against IUU Fishing was unanimously endorsed by the 32<sup>nd</sup> Session of the Committee on Fisheries, by the 155<sup>th</sup> Session of the FAO Council in December 2016, and by the 72<sup>nd</sup> Session of the United Nations General Assembly in December 2017. The General Assembly also invited FAO to serve as lead agency in coordinating activities.

The International Year of Artisanal Fisheries and Aquaculture will help focus attention on the small-scale men and women who comprise 90 percent of the world's fisheries and aquaculture workforce. This year is also the second time we observe an international day dedicated to IUU issues, taking into account the entry into force, on 5 June 2016, of the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal,



Written by:

**Audun Lem**

E-mail: [Audun.Lem@fao.org](mailto:Audun.Lem@fao.org)

**Kimberly Sullivan**

E-mail: [Kimberly.Sullivan@fao.org](mailto:Kimberly.Sullivan@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy



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Artisanal aquaculture farm in Barra do Turvo, Brazil

Unreported, and Unregulated Fishing, adopted by FAO in 2009. The entry into force of this agreement marks a historic event: the first international, legally binding treaty specifically aimed at ending IUU fishing. The aim of this international day is to raise awareness about the threat that illegal fishing poses to our environment, to food security and to the livelihoods of coastal communities.



SEE ALSO

Twitter: [#FightIUUFishing](https://twitter.com/FightIUUFishing)

[www.twitter.com/hashtag/fightiufishing](https://www.twitter.com/hashtag/fightiufishing)

# Aquatic genetic resources – Towards a Global Plan of Action

The progress on the development of a report on the *State of the World's Aquatic Genetic Resources for Food and Agriculture* (SoW-AqGR) has been reported in previous issues of FAN. The Report itself is now finalized and will be published and launched in the coming months. The Report was always intended to present a snapshot of the existing global situation for Aquatic Genetic Resources (AqGR) for food and agriculture and to act as a catalyst for further actions to improve the conservation, sustainable use and development of these vital resources. The Report has certainly raised awareness on AqGR and provided some interesting findings, to be summarised in the next issue of FAN, which can underpin and facilitate future actions to improve global management of these important resources.

A final draft of the SoW-AqGR report was presented to the Seventeenth Session of the Commission on Genetic Resources for Food and Agriculture (the Commission) held in Rome in February this year. The Report was well received by the Commission which recommended finalization of the Report and its In Brief summary and that these should be published and widely distributed. The Commission also established its Ad Hoc Technical Working Group (ITWG-AqGR) as a regular



Written by:

**Graham Mair**

FAO Fisheries and Aquaculture  
Department, Rome, Italy

E-mail: [Graham.Mair@fao.org](mailto:Graham.Mair@fao.org)



Professional staff of the Fisheries and Aquaculture Department and the Commission present details of the progress on the report and a summary of its key findings to delegates of the Commission in February this year

Intergovernmental technical working group and recognized the value and importance of its close collaboration with the Committee on Fisheries (COFI) and its Sub-Committee on Aquaculture as well as its Advisory Working Group on Aquatic Genetic Resources and Technologies. A further significant output from the meeting was a request from the Commission for FAO to develop a Global Plan of Action (GPA) for consideration by the ITWG-AqGR and the Commission at their next sessions. Work on the development of a GPA on the conservation, sustainable use and development of AqGR has already commenced. This process will involve, over the next 18 months, cooperation with COFI and its subsidiary bodies and, funding resources permitting, consultation with FAO member countries through a series of regional consultations.

The development of a GPA elevates the importance of this work and increases the prospects

for securing funding in support of related activities. GPAs already exist for genetic resources in other agricultural sectors. FAO has initially secured funding from the Government of Germany for a project on the development of a Registry of Farmed Types of AqGR, which is now underway.

The contribution of all those involved in the development of the SoW-AqGR is gratefully acknowledged and FAO will be reliant on continuing support from member country representatives during the development of this global plan.



## The COFI Advisory Working Group on aquatic Genetic Resources and Technologies

This is the only Advisory Working Group (AWG) of the FAO Committee on Fisheries (COFI) illustrating the importance of aquatic genetic resources and technologies in fisheries and aquaculture. The AWG was first formed in 2015, has met face to face on two occasions and has also held meetings online. The main initial activity for the AWG was to support the FAO Fisheries and Aquaculture Department's work on the preparation of the *State of the World's Aquatic Genetic Resources for Food and Agriculture*. With the Report now complete and awaiting publication it is tempting to think the work of the AWG is done but far from it! With the Commission on Genetic Resources for Food and Agriculture requesting FAO to prepare a Global Plan of Action for conservation, sustainable use and development of aquatic genetic



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Written by:

**Graham Mair**

E-mail: [Graham.Mair@fao.org](mailto:Graham.Mair@fao.org)

**Matthias Halwart**

E-mail: [Matthias.Halwart@fao.org](mailto:Matthias.Halwart@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy



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resources, it is evident that the Report is seen as a catalyst for further action and thus, in reality, the work of the AWG has only just begun. The membership of the AWG is currently being renewed and the next meeting is planned to coincide with the 10<sup>th</sup> session of the COFI Sub-Committee on Aquaculture in August 2019 in Norway. The AWG will not only support FAO in the development of a Global Plan of Action over the next two years but will also support activities under a new project on the development of a Registry of Farmed Types of AqGR, funded by Germany, which is now underway. The members of the AWG are thanked for their support in getting the Report to completion and FAO looks forward to continuing its work with the AWG to deliver appropriate follow up actions building on the key findings of the Report.



### SEE ALSO

Further details of the AWG can be found at:  
[www.fao.org/aquatic-genetic-resources/working-groups/awg/en/](http://www.fao.org/aquatic-genetic-resources/working-groups/awg/en/)



# The international promotion programme workshop on social impact of rice-fish farming, Shanghai, China



Participants of the International Promotion Programme on Social Impact of Rice Fish Farming

The International Promotion Programme Workshop on Social Impact of Rice-Fish Farming, jointly organized by FAO and Shanghai Ocean University (SHOU), was held in Shanghai, China, from 4 to 8 December 2018. The event came a few weeks after the Montpellier, France, workshop on Advancing Integrated Agriculture-Aquaculture through Agroecology (FAN 59), where it brought together 17 international experts and country representatives from France, Japan, Indonesia, the Lao People's Democratic Republic, Myanmar, the Philippines, Uganda and Viet Nam, 30 Chinese experts and extension officers, and over 50 SHOU teachers and students.

The objectives were to provide an exchange platform for better understanding the social impacts of rice-fish farming worldwide, such as poverty reduction, indigenous arts and cultures, and nutrition-sensitive and gender dimensions, to describe the diversity of the social dimensions of rice-fish farming, and to increase the awareness on the benefits of innovative agro-aquaculture systems.

Two side events were also organized: a "Flash Presentation of Young Scientists", where students presented their thesis research, and a field visit to the Qingtian "rice-fish coexistence" Globally Important Agricultural Heritage System

(GIAHS), which highlighted the huge cultural and economic potential of such integrated systems.

The integrated rice-fish farming system not only provides a double harvest of rice and fish in the same unit of land, but it also contributes to protecting the traditional/indigenous culture and art, increases employment, contributes to poverty alleviation, allows for the inclusiveness of women and youth, increases food supply, enhances local diet diversity, and protects biodiversity. This system has great potential for scaling up worldwide, particularly in mountain-terraced lands and in low-lying land areas.



Written by:

**Xinhua Yuan**

E-mail: [Xinhua.Yuan@fao.org](mailto:Xinhua.Yuan@fao.org)

**Roxane Misk**

FAO Intern

E-mail: [Roxane.Misk@fao.org](mailto:Roxane.Misk@fao.org)

**Yin Fu**

FAO Intern

E-mail: [Yin.Fu@fao.org](mailto:Yin.Fu@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy



Field trip in Town of Fangshan, Qingtian County, Zhejiang Province, China



Qingtian "rice-fish coexistence" Globally Important Agriculture Heritage System (GIAHS)

# AQUACULTURE UPDATES BY REGION



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## FAO regional consultation on antimicrobial resistance risk in aquaculture in Asia-Pacific

Asian aquaculture has achieved rapid growth in production in the past four decades, which has contributed significantly to people's nutrition and livelihoods in the region. In the present context, the sector faces various challenges. Increasing public concern over issues related to environment and human health is one of them, particularly antimicrobial resistance (AMR). Along with the general trend of intensification in aquaculture for higher productivity and economic efficiency, an increasing occurrence and severity of cultured animal diseases have become a major threat in culture operations, which has been addressed through different



*Written by:*

**Weimin Miao**

*FAO Regional Office for Asia and the Pacific, Bangkok, Thailand*

*E-mail: Weimin.Miao@fao.org*

approaches, including the use of antimicrobials. Largely due to food safety concerns in the trade of cultured aquatic animals, there has been significant improvements in the control of using antimicrobials in aquaculture production in the region, including an increasingly long list of banned or restricted use antibiotics for aquaculture. However, their overuse or unnecessary use still impose a significant risk of antimicrobial resistance to human and environmental health.

As part of the effort of FAO to implement its action plan on AMR, a number of global and regional initiatives have been carried out to address AMR in fisheries and aquaculture. These initiatives generally had limited country coverage and engagement in the aquaculture sector.

The FAO Regional Office for Asia and the Pacific organized

a regional consultation on AMR risk associated with aquaculture in Asia in collaboration with the Network of Aquaculture Centres in Asia-Pacific (NACA) as the entry point to assist the Member Countries in the region. The regional consultation aimed to disseminate available knowledge on AMR, to assess antimicrobial use (AMU) and its governance in Asian aquaculture and the associated AMR risk, to identify the immediate actions to address the issue and the long-term strategy to mitigate AMR risk related to Asian aquaculture and to contribute to the formulation of an AMR regional surveillance guideline. For the regional consultation preparation, eight country case studies assessed AMU in aquaculture and its governance and ongoing country efforts to address AMR associated with aquaculture in the region.

The regional consultation convened in Bangkok, Thailand, from 4–7 September 2018 was

attended by 53 participants representing both aquaculture and animal health management sectors in 17 countries, the World Organisation for Animal Health, NACA, WorldFish, the United States Agency for International Development and FAO. It effectively shared up-to-date knowledge and information on issues with AMU and AMR in aquaculture and the progress in addressing the issues. The countries extensively exchanged information on AMU and its governance in aquaculture and

the progress made in addressing AMR. Major constraints and gaps in effective mitigation of AMR risk associated with aquaculture were identified, and immediate actions recommended, as well as a strategy to address them. In addition, the regional consultation developed the framework for AMR monitoring and surveillance in Asia, including a regional guideline on sampling approaches, laboratory testing and data management. The regional consultation is also the first collaborative effort between

the regional fisheries team and the team of a USAID-funded regional project in addressing animal health-related issues.

As one of the outcomes from the regional consultation, a regional Technical Cooperation Programme project has been formulated and approved to support India, Indonesia and Viet Nam to build the capacity in mitigating an AMR risk associated with aquaculture. The proceedings of the regional consultation are being finalized as an FAO publication.

## FAO expert group meets in Palermo to better understand the risks of antimicrobial resistance in aquaculture

FAO's Aquaculture Branch (FIAA), Department of Fisheries and Aquaculture, convened an Expert Group Meeting from 26 to 29 November 2018 in Palermo, Italy. The meeting engaged in a scoping exercise to increase the understanding on the risks of antimicrobial resistance (AMR) in aquaculture. After setting the scene with technical presentations, the Expert Group performed a risk profiling of two important bacterial pathogen



Experts from candidate FAO Reference Laboratory for Aquaculture Biosecurity (including AMR) from China, India and the United States of America

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groups: *Vibrio parahaemolyticus* and *Streptococcus* spp.

One of the main conclusions of the expert meeting pertaining to the use of risk analysis as a decision-making tool for assessing the risk of AMR in aquaculture was that risk profiling, as outlined in the Codex, provides a useful guidance, but it would be helpful to review and adapt as appropriate this guidance to

profiling for aquatic AMR risk analysis. Risk profiling of the above two bacterial pathogens revealed that, in both cases, the AMR risks they posed were likely to be low and thus conducting a full risk assessment was not recommended. Strain differentiation and pathogenicity, as outlined in the Codex, are essential in understanding the AMR risks posed by bacteria affecting aquaculture production.



Written by:

**Melba G. Bondad-Reantaso**  
E-mail: [Melba.Reantaso@fao.org](mailto:Melba.Reantaso@fao.org)

**Elena Irde**  
FAO Consultant  
E-mail: [Elena.Irde@fao.org](mailto:Elena.Irde@fao.org)

**Bin Hao**  
Associate Professional Officer  
E-mail: [Bin.Hao@fao.org](mailto:Bin.Hao@fao.org)  
FAO Fisheries and Aquaculture  
Department, Rome, Italy

Discussions on the potential development of a proposal to contribute to the multisector project “Towards Reducing Aquaculture-based AMR Through a Cross-sectoral Approach” followed. A consensus was reached to develop a project concept – “Towards Improving the Scientific Evidence Base on AMR in Aquaculture” – through a multisector approach that will include *Streptococcus* spp. and mesophilic aeromonads as the bacterial agents for investigation, as these pathogens are important to both animal and human health. These two bacterial agents are important tilapia pathogens, the second largest species group globally produced in aquaculture, which contributes significantly to global food and nutrition security.

#### FAO Reference Centers for Aquaculture Biosecurity (including AMR)

A short meeting of the FAO Reference Centers for Aquaculture Biosecurity (including AMR), participated by China, India and the United States of America, discussed a joint work programme that included activities within the scope of the FAO Action Plan on AMR (awareness, evidence, governance and practices), including joint resource mobilization.

The reference centers candidates are:

- China:
  - Pearl River Fisheries Research Institute, Chinese Academy of Fisheries Science (Dr J. Lan).
  - Yellow Sea Fisheries Research Institute, Chinese Academy of Fisheries Science (Dr W. Yingeng and Dr Z. Zheng).
- India: Nitte University (Dr Iddya and Dr Indrani Karunasagar).
- United States of America: Mississippi State University (Dr Patricia Gaunt).
- United Kingdom of Great Britain and Northern Ireland: Centre for Environment,

Fisheries and Aquaculture Science (Cefas) (Dr D. Verner-Jeffreys): Cefas is part of the United Kingdom application.

External and internal requirements for designation are under way. The next meeting of the Expert Group and the reference centers is planned to be in China in September 2019, to be hosted by the Yellow Sea Fisheries Research Institute in Qingdao, China, and will discuss issues related to alternatives to antimicrobials and establishing a demonstration farm with low or zero use of antibiotics.



AMR/RA/AH experts debate on risk of AMR in aquaculture



#### SEE ALSO

##### Relevant links to AMR

Relevant links to news and materials related to implementation of the AMR in aquaculture project FMM/RAS/298/MUL can be found below; these include the outcomes of three regional workshops held in Mangalore, India, Putrajaya, Malaysia, and Singapore, as well as a blog.

[www.fao.org/fishery/nems/41001/ar](http://www.fao.org/fishery/nems/41001/ar)

[www.fao.org/fishery/nems/40956/en](http://www.fao.org/fishery/nems/40956/en)

[www.fao.org/fishery/nems/40929/en](http://www.fao.org/fishery/nems/40929/en)

[www.fao.org/antimicrobial-resistance/news-and-events/news/news-details/en/c/1029658](http://www.fao.org/antimicrobial-resistance/news-and-events/news/news-details/en/c/1029658)

[www.fao.org/blogs/blue-growth-blog/helping-countries-to-tackle-amr-in-aquaculture/en](http://www.fao.org/blogs/blue-growth-blog/helping-countries-to-tackle-amr-in-aquaculture/en)

## Support upscaling of innovative rice-fish and climate-resilient tilapia farming in Asia-Pacific

Asian aquaculture faces a number of challenges, including the need for improved utilization of natural resources and increased resilience of small farmers in the context of climate change. In an effort to support Member Countries to address these, FAO supported various field projects through the implementation of the Regional Initiative on Blue Growth in Asia-Pacific, which included a demonstration of innovative rice-fish farming in Indonesia and innovative rice-shrimp farming in Viet Nam, and a Technical Cooperation Programme project for building resilience of tilapia farmers in the Philippines from 2014 to 2016.

In order to consolidate and scale up the results from earlier FAO supported initiatives, the FAO regional project "Promote Scaling-up of Innovative Rice-Fish Farming and Climate-Resilient Tilapia Pond Culture Practices for Blue Growth in Asia" (TCP/RAS/3603) has been implemented in five Asian countries, Bangladesh, Indonesia, the Philippines, Sri Lanka and Viet Nam, to disseminate and demonstrate innovative rice-fish farming and climate-resilient tilapia pond culture practices. The project aimed to deliver: (i) knowledge products and training materials for innovative rice-fish farming and climate-resilient tilapia farming practices; (ii) strengthened technical capacity for adopting the identified innovative aquaculture farming practices and the successful farm

demonstration of innovative and climate-resilient aquaculture farming practices; (iii) specific country strategies and national project concept notes for scaling up the innovative/climate-resilient farming practices; and (iv) enhanced public awareness and enabling environment for scaling up of the innovative/climate-resilient aquaculture farming practices in the participating countries.

The regional inception workshop was held in Bangkok, Thailand, in May 2017. It was conducted to build common understanding of the project, to share country background information, and to develop a project implementation work plan at the country and regional level. The project supported the development of technical guidelines for innovative rice-fish and climate-resilient tilapia farming and conducted regional training on these topics. At the country level, the project supported the national inception workshops for awareness-raising and planning implementation of activities. Training of selected farmers and local technical staff was conducted on innovative rice-fish farming in Indonesia and Viet Nam and climate-resilient tilapia farming in Bangladesh, the Philippines and Sri Lanka. The project supported Bangladesh, the Philippines and Sri Lanka to conduct a farm demonstration of climate-resilient tilapia farming, and Indonesia and Viet Nam to demonstrate innovative rice-fish farming, which involved some 150 farmers in total and covered an area of some 20 hectares. As the most important project activity, the farm demonstration was successfully completed in four participating countries by January 2019. The

results of the demonstration well showcased the advantage and merits of an innovative rice-fish farming system and climate-resilient tilapia farming practices and their potential contribution to improved productivity, economic efficiency and sustainable rice and fish production. With project support, each country team developed a project proposal for scaling up the innovative rice-fish or climate-resilient tilapia farming at the national level.

In order to evaluate project implementation and disseminate knowledge, experiences and lessons generated from the project and share the perspectives of other Asian countries who were not included in the project, a regional workshop was organized from 15 to 17 January 2019 in Yogyakarta, Indonesia. The workshop was attended by the national project teams of the five project countries and representatives from nine non-project Asian countries, the Network of Aquaculture Centres in Asia-Pacific and FAO. The regional workshop comprehensively evaluated project implementation at the regional and country levels and extensively shared the successes and lessons learned from country-level implementation, particularly the farm demonstration among all the participants. The field visit to the Indonesian project sites well showcased the results from the farm demonstration of innovative rice-fish farming, how local rice farmers were motivated to adopt the new integrated agri-aquafarming system and how they benefited from the new farming practices. The workshop also identified the major constraints and gaps in scaling up the new farming system/practices in the region and the actions and strategy to expand the project outcomes. The technical documents and selected country reports will be published as an FAO publication in late 2019 for wide dissemination in the region.



Written by:

**Weimin Miao**

FAO Regional Office for Asia and the Pacific Bangkok, Thailand

E-mail: [Weimin.Miao@fao.org](mailto:Weimin.Miao@fao.org)

## Promoting “aquatic diversification” of ricefield environments for food and nutrition security in the Lao People’s Democratic Republic



Integrated rice-fish farming

The Government of the Lao People’s Democratic Republic is accelerating efforts to graduate from least developed country status by 2024.

Most of the country’s poorest communities members are subsistence small-scale farmers, who rely on the sustained production of plants and animals from ricefield environments and areas of scrub forest that usually surrounds them. These environments are often their only source of food and income generation, producing the basic staple rice, as well as some, mainly native, livestock. Communities also gather wild foods from these environments, such as native aquatic animals (fish, crabs, frogs,



Written by:

**Chanthaboun Sirimanotham**

Lao Department of Livestock and Fisheries

E-mail: [Sirimanotham.59@gmail.com](mailto:Sirimanotham.59@gmail.com)

**Nick Innes-Taylor**

Development Advisory Group

E-mail: [Nickudon@gmail.com](mailto:Nickudon@gmail.com)

**Matthias Halwart**

FAO Fisheries and Aquaculture Department, Rome, Italy

E-mail: [Matthias.Halwart@fao.org](mailto:Matthias.Halwart@fao.org)

etc.), mushrooms, insects, and a range of wild plants and medicinal herbs. These wild resources are especially important to the nutrition security of poorer families and are particularly important to the nutrition of young women and children.

However, as populations have increased, food production from these environments has rapidly declined due to deforestation and farming practices that have become increasingly destructive to the natural environment. Many rural communities now find they can no longer sustain themselves using traditional farming and gathering practices.

With support from FAO, the Department of Livestock and Fisheries (DLF) of the Laotian Ministry of Agriculture and Forestry has recently piloted a new approach to help poor communities transition their ricefield environments into a more productive, biologically diverse and efficient farming landscape. It aims to respond to the immediate needs of poor communities by helping them to produce an additional crop of farmed fish in their existing rice fields (rice-fish culture). By following simple recommendations, a typical family can produce a year’s supply of high-quality fish protein within a relatively short period of time (four to five months). This intervention provides an immediate boost to the nutrition security of these poor communities, but also, importantly, motivates farmers to change other aspects of their farming system.

Additional DLF recommendations include promoting water conservation (e.g. through the construction of small hand-dug fish ponds), organic household vegetable production (important for the improved nutrition of young women and children), and improved husbandry techniques for native livestock (manure is an important source of recycled nutrients). Developing a community culture of learning, experimentation and communication, as well as building the capacity of district agricultural extension officers, is also an important part of the DLF approach.

Overall, the DLF approach aims to kick-start a process of farm diversification and intensification, which can then be maintained by the communities themselves, with the support of local agricultural extension officers and other development partners. It was developed in collaboration with poor communities (140 families) in five provinces of the country (representative of different agroecologies). A joint DLF/FAO review in 2018 concluded the approach has considerable potential for combating hunger and malnutrition in the country on a wider scale, and funds are now being sought by DLF and FAO to scale up this initiative to the national level over a three-year period.



Small hand-dug ponds improve nutrition

# FAO assistance to Palau and the Federated States of Micronesia on biosecurity

FAO's assistance to aquaculture biosecurity to the Pacific Island Countries and Territories continues to date with a recently completed Technical Cooperation Programme facility for Palau titled "Strengthening Biosecurity Capacity of Palau" and an ongoing project for the Federated States of Micronesia titled "National Aquatic Animal Health and Biosecurity Strategy".

The first project achieved the following: (i) preparation of the draft Aquatic Biosecurity Regulations for Aquatic Organisms and the draft Biofouling Management Regulations; (ii) a National Consultation that discussed the draft regulations; and (iii) the preparation of a Framework for a Biosecurity Database. All these are captured in a report,<sup>1</sup> which also contains several lists of recommendations arising from the various project activities. The most urgent of all recommendations is that: "Recent introductions and transfers of live aquatic animals (both legal and illegal) are highly unsafe and have unnecessarily put future aquaculture development and local biodiversity at risk due to the possibility of introducing serious exotic pathogens and the possible genetic and ecological impacts of introduced and transferred species. The



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FAO is assisting Pacific island countries and territories to strengthen biosecurity

Government of Palau should take immediate steps to correct these practices. All introductions and transfers of live aquatic animals should be prohibited until such time as the draft Aquatic Biosecurity Regulations have been enacted and such species have been considered through the mechanisms contained therein".

The second project has an expected output of developing a National Strategy on Aquatic Animal Health and Biosecurity. Using the FAO guidelines within the context of the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB), a new initiative being developed and promoted by FAO and partners, the following activities have been undertaken during a planned mission to Pohnpei, in the Federated States of Micronesia, from 20 to 27 May 2019:

- Conduct a gap analysis.
- Develop the strategy framework.

- Review the legal framework on aquatic animal health;
- Review the current Biosecurity Bill;
- Conduct a preliminary aquaculture sectoral assessment and develop a national pathogen list;
- Conduct a 2.5-day risk analysis training course;
- Assess the current aquatic animal health laboratory;
- Conduct a 1-day national workshop to present the findings of the field mission and the final draft of the strategy.



Written by:

**Melba G. Bondad-Reantaso**  
FAO Fisheries and Aquaculture  
Department, Rome, Italy  
E-mail: [Melba.Reantaso@fao.org](mailto:Melba.Reantaso@fao.org)



## SEE ALSO

Fisheries and Aquaculture Circular:  
[www.fao.org/publications/card/en/c/CA1969EN](http://www.fao.org/publications/card/en/c/CA1969EN)

1. [www.fao.org/publications/card/en/c/CA1969en](http://www.fao.org/publications/card/en/c/CA1969en)

# Capacity-building on allocated zones for aquaculture in the Mediterranean and the Black Sea

The expansion of aquaculture in the Mediterranean and the Black Sea has highlighted the need to implement measures and concrete actions to better integrate aquaculture within coastal areas. In 2012, the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) adopted guidelines on allocated zones for aquaculture (AZAs), raising awareness among the Mediterranean and Black Sea bordering countries on the relevance of planning for aquaculture.

An AZA is a coastal area where the development of aquaculture has priority over other uses and therefore will be primarily dedicated to this activity. The concept of AZA results from zoning processes within the framework of marine spatial planning; it involves coordination among different stakeholders and is based on a participatory approach. Establishing AZAs is key for the development and integration of aquaculture activities in a coastal area, as it enables



Written by:

**Linda Fourdain**

E-mail: [Linda.Fourdain@fao.org](mailto:Linda.Fourdain@fao.org)

**Housam Hamza**

E-mail: [Housam.Hamza@fao.org](mailto:Housam.Hamza@fao.org)

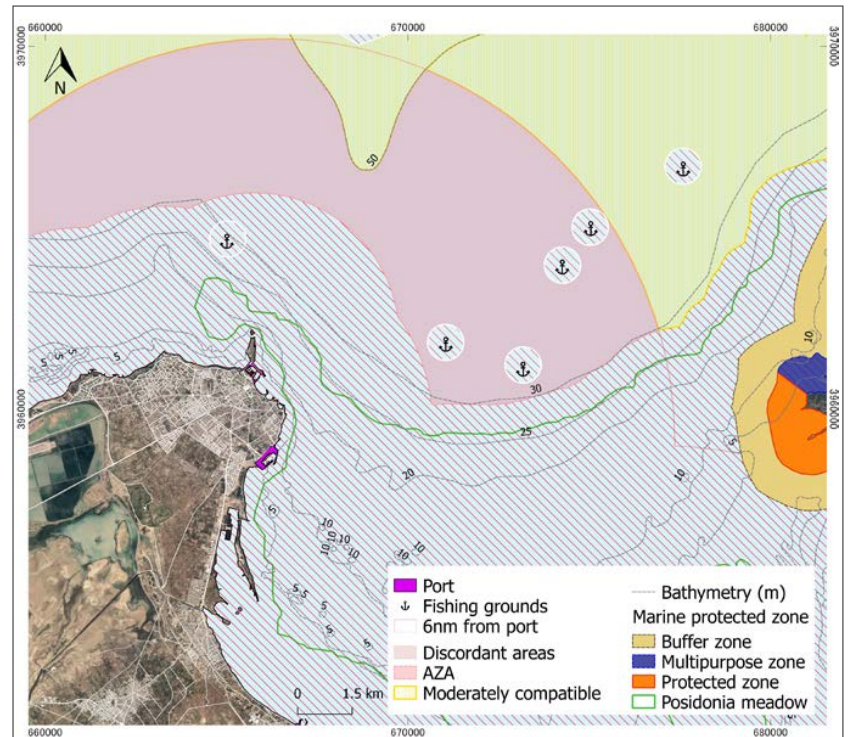
**Dominique Bourdenet**

E-mail: [Dominique.Bourdenet@fao.org](mailto:Dominique.Bourdenet@fao.org)

**Fabio Massa**

E-mail: [Fabio.Massa@fao.org](mailto:Fabio.Massa@fao.org)

FAO General Fisheries Commission  
for the Mediterranean, Rome, Italy



Compatible zones for aquaculture activities identified during the process of AZA establishment in the Bay of Monastir (Tunisia)

to identify suitable sites for aquaculture while preventing and avoiding conflicts among users.

Within the framework of its strategy for the sustainable development of Mediterranean and Black Sea aquaculture, the GFCM has been carrying out a series of activities to support the implementation of AZAs in the region, delivering training, national capacity-building programmes, technical cooperation and knowledge tools.

## Information and knowledge-sharing

The GFCM has been actively supporting national capacity-building towards the establishment of AZAs. In particular, support has been provided through the organization

of seminars in Montenegro and Turkey (2013), Albania and Georgia (2015), Tunisia (2016, 2017 and 2018) and Morocco (2017, 2018 and 2019). Within the framework of these activities, special attention was given to the use of models to assess carrying capacity, to geographic information systems, as well as on the design and development of environmental monitoring programmes (EMP).<sup>1</sup>

## Technical cooperation on the establishment of an AZA in the Bay of Monastir, Tunisia

Technical cooperation was carried out in 2016–2018 to support the establishment of an AZA in the Bay of Monastir. Several field missions took place to gather necessary information and data for the establishment of the AZA



and to follow up on progress and tools applied. The results obtained covered multiple topics related to AZA establishment: spatial delineation of compatible zones, interactions with small-scale fisheries and marine protected areas; estimation of production carrying capacity; advice on an EMP; and identification of potential integrated multi-trophic aquaculture (IMTA).

#### Demonstrative training on environmental carrying capacity models applied to marine aquaculture

Two demonstrative trainings were organized in 2018 and in 2019 within the framework of a memorandum of understanding between Morocco and the GFCM. Experts on carrying capacity from the University of Ca' Foscari in Venice, Italy, provided support to staff from the National Agency for the Development of Aquaculture (ANDA). Practical sessions were organized where participants simulated growth (using the R-Aquaculture package),<sup>2</sup> performed modelling of transport and deposition of solid cage emissions, and simulated shellfish production carrying capacity.

#### **Knowledge tools for sustainable aquaculture development**

To facilitate the understanding and use of AZAs across the Mediterranean and the Black Sea, the GFCM developed a knowledge base, made available for all GFCM aquaculture stakeholders, including decision-makers from regional, national and local administrations, research and academic institutions, farmers and other coastal users.

#### A guide for the establishment of coastal zones dedicated to aquaculture in the Mediterranean and Black Sea

A guide was prepared with the aim to maximize and harmonize technical and scientific knowledge on the establishment of AZAs in the Mediterranean and the Black Sea. It is complemented by an AZA toolkit.

#### AZA toolkit

The AZA toolkit aims to provide practical information on the processes, benefits and management of AZAs. The toolkit offers information on general and specific concepts, and its contents are tailored to the specificities of the Mediterranean and Black Sea basins. It is composed of seven factsheets, addressing the following components: (1) aquaculture definition and stages of production; (2) floating cages for finfish farming; (3) species reared; (4) GFCM resolution on the guidelines on AZAs; (5) environmental monitoring programme; (6) IMTA; and (7) sustainability indicators to assess aquaculture development.

#### Guidelines for the streamlining of aquaculture authorization and leasing processes

The overall objective of the guidelines is to support member countries in streamlining authorization and leasing processes within the framework of the implementation of AZAs. They provide guiding principles and minimum common criteria in the region.

#### Practical guide to the understanding and use of geographic information systems (GIS) in the establishment of AZAs

This practical manual contains information to facilitate and foster

understanding and use of GIS and remote sensing in aquaculture site selection, planning and management.

#### **Looking ahead**

National capacity-building is still needed in the Mediterranean and the Black Sea, as there is still a regional demand to support the implementation of AZAs. In addition to the technical assistance carried out by the GFCM, other countries such as Albania, Lebanon, Libya, Jordan and Ukraine, among others, requested specific training and technical cooperation on implementing AZAs and on the use of GIS.

The GFCM will keep providing technical support in the region towards sustainable aquaculture development as it contributes to local economic development and food security. Cooperation will be pursued with countries in the region in implementing AZAs, supporting national plans, and unlocking development potential while fostering dialogue and coordination among coastal users.



#### SEE ALSO

A strategy for the sustainable development of Mediterranean and Black Sea aquaculture. FAN 58. April 2018 (available at [www.fao.org/3/i9200en/i9200EN.pdf](http://www.fao.org/3/i9200en/i9200EN.pdf)).

FAO, 2018. *Report of the forty-first session of the General Fisheries Commission for the Mediterranean*. Budva, Montenegro, 16–20 October 2017 (available at [www.fao.org/3/I8500EN/i8500en.pdf](http://www.fao.org/3/I8500EN/i8500en.pdf)).

GFCM website: [www.fao.org/gfcm](http://www.fao.org/gfcm)

GFCM, 2012. *Resolution GFCM/36/2012/1 on guidelines on allocated zones for aquaculture* (available at [www.fao.org/gfcm/decisions/en](http://www.fao.org/gfcm/decisions/en)).

1. EMP for marine cage finfish farming is a flexible and adaptable functional tool intended as a record-keeping system for documenting series of information and values of environmental parameters relevant to aquaculture activities, which will be used to perform periodic environmental assessment and monitoring.

2. [www.rstudio.com](http://www.rstudio.com)

# NACEE: a Central and Eastern European network for information exchange and cooperation

The Network of Aquaculture Centres in Central and Eastern Europe (NACEE) was established in November 2004 in Szarvas, Hungary, to facilitate the integration of Central and Eastern Europe's research and development sector into the European Research Area. After a period of informal operation, NACEE was officially registered in Hungary as an international non-governmental organization in 2010. Currently, it has 38 institutional and individual members from nine countries.

One of NACEE's main tasks is to facilitate information exchange among its members, as well as with other institutions and organizations. NACEE has an official liaison status with FAO, and maintains relations with many key aquaculture organizations. The most important ones are the European Network for Training and Technology Transfer in Aquaculture (AquaTT), the European Aquaculture Society, the European Aquaculture Technology and Innovation Platform (EATIP), the European Fisheries and Aquaculture Research Organisations (EFARO), the European Union, the International Organisation for the Development of Fisheries in Eastern and



Written by:

**Laszlo Varadi**

*E-mail: Laszlo.Varadi@akvapark.hu*

**Peter Lengyel**

*E-mail: Peter.Lengyel@gov.hu*

*Network of Aquaculture Centres in Central and Eastern Europe, Szarvas, Hungary*

Central Europe (EUROFISH), the Federation of European Aquaculture Producers and the Network of Aquaculture Centres in Asia-Pacific (NACA).

In addition to the annual Directors' Meetings, NACEE has organized a number of professional meetings, conferences, workshops and exchange visits of farmers, researchers and policy-makers, among which the regularly held international conferences of young researchers play a special role. The last conference, held in 2017 in Gorki, Belarus, was attended by 40 participants from 13 countries. NACEE has also participated in the compilation of professional reviews of the region's aquaculture, such as the European aquaculture review presented at the Global Aquaculture Conference in Phuket, Thailand (2010), in cooperation with FAO, the European Aquaculture Society (EAS) and NACEE.

Besides membership fees, project funds play an increasing role in the financing of the network. In 2014, NACEE successfully implemented an FAO project on the evaluation of aquatic genetic resources of Belarus, the Republic of Moldova and Ukraine, and currently, a project on fish feeding in Central Asia is being prepared. NACEE is also a consortium member of the European Union Horizon 2020 TAPAS (Tools for Assessment and Planning of Aquaculture Sustainability) project, where it is mostly responsible for dissemination tasks.

Although NACEE is a regional network, it also has an inter-

regional role linking institutions, farms and individuals from Eastern Europe with their Western European partners. In spite of efforts of national governments and the European Union, there is still a gap between the two regions, for example, in terms of economic development, basic infrastructure and services, and knowledge of foreign languages. Eastern European aquaculture is underrepresented in European aquaculture projects and initiatives, as well as in international conferences and publications. NACEE has contributed to bridge the gap through the various activities mentioned previously; however, there is still a lot to be done.

NACEE also plays a role in the development of inter-regional cooperation between Europe and Asia. NACEE and NACA have established reciprocal associate membership in each other's organizations. The basis of the cooperation is freshwater pond aquaculture, important both in Eastern Europe and Asia. The main area of the cooperation is the exchange of information, although member institutions of NACEE and NACA have also established bilateral collaboration that includes exchange of experts and joint research projects.

NACEE is open to develop collaboration with other regional networks and is ready to assist the initiative of FAO, aiming at the development of inter-regional collaboration among aquaculture networks on a global level.

# FAO supports Sudan fisheries and the aquaculture sector

Sudan has vast marine and inland resources that offer strong potential for sustainable fisheries and aquaculture development, as well as significant opportunities for both public and private investment. Nonetheless, the country's potential in fish production has yet to be fully explored.

FAO assisted the Government of Sudan in preparing a practical, action and investment-oriented Review of the Fisheries and Aquaculture Sector in 2018, and earlier this year initiated the preparation of the Fisheries and Aquaculture Investment Plan. Several consultations with stakeholders have taken place in the past eight months, culminating with the latest consultation workshop to ensure that the views, concerns and recommendations of the value chain actors and representatives of the States are duly reflected into the sector review report.

The FAO support to the Sudan fisheries sector fits under the FAO Blue Growth Initiative and the FAO, World Bank, and African Development Bank "African Package for Climate-



Participants of the National Consultation Workshop

resilient Ocean Economies" partnership. Several partners have indicated their willingness to support the sector under the economic diversification and transformation agenda, applying the blue economy concept and approach. The ongoing sector review and the investment plan will serve the policy and strategic planning of the country to achieve the Sustainable Development Goals (SDGs), notably SDG 1, 2, 8 and 14. A need exists for the allocation of resources to the fisheries sector, and the creation of an enabling environment to attract both domestic and foreign investors to the sector.

In a national consultation workshop that gathered over 80 participants representing all sectors, including value chain actors, ministries, research, academia, financial institutions, stakeholders further recommended:

- The Sudan Fisheries and Aquaculture Investment Plan be prepared under a participatory, inclusive and iterative process involving all stakeholders.
- A multistakeholder Steering Committee be established

- rapidly to spearhead the preparation and validation of the Sudan Fisheries and Aquaculture Investment Plan.
- Call upon the Government of Sudan, the donor community, and technical and financial partners of Sudan to provide enhanced support to the fisheries and aquaculture sector, including for the preparation of the Fisheries and Aquaculture Investment Plan in 2019.



## SEE ALSO

The State of World Fisheries and Aquaculture 2018:  
[www.fao.org/3/I9540EN/i9540en.pdf](http://www.fao.org/3/I9540EN/i9540en.pdf)

Sustainable fisheries and aquaculture for food security and nutrition report:  
[www.fao.org/3/a-i3844e.pdf](http://www.fao.org/3/a-i3844e.pdf)

Blue Growth blog:  
[www.fao.org/blogs/blue-growth-blog/en/](http://www.fao.org/blogs/blue-growth-blog/en/)



Written by:

**Ana Menezes**

FAO Fisheries and Aquaculture Department, Rome, Italy

E-mail: [Ana.Menezes@fao.org](mailto:Ana.Menezes@fao.org)

**Haydar Fersoy**

E-mail: [Haydar.Fersoy@fao.org](mailto:Haydar.Fersoy@fao.org)

**Marc Fantinet**

E-mail: [Marc.Fantinet@fao.org](mailto:Marc.Fantinet@fao.org)

FAO Regional Office for the Near East and North Africa, Cairo, Egypt



Fishing harbor in Sudan

# L'aquaculture tunisienne: vers une production aquacole diversifiée

**M**editerranean aquaculture is currently facing economic difficulties as a result of the competition between countries and some market saturation. Tunisia invested in the sector and is currently promoting the diversification of production as an answer to the crisis. National research is investigating the domestication of several high-value indigenous fish, whereas exotic species have also been introduced, namely, tilapia and whiteleg shrimp. FAO is supporting the Tunisian Government by conducting an environmental impact and biosecurity assessment.

**L'**aquaculture méditerranéenne a développé la production et la commercialisation de plusieurs espèces de poissons, mollusques et crustacés, en répondant aux exigences technico-productives et aux attentes des marchés. La dorade royale (*Sparus aurata*), le loup (*Dicentrarchus labrax*), le maigre (*Argirosomus regius*), la moule méditerranéenne (*Mytilus galloprovincialis*), les huîtres plates et creuses (*Ostrea edulis*, *Crassostrea gigas*) et les palourdes (*Ruditapes decussatus*, *Ruditapes philipinarum*, *Venerupis pullastra*) sont considérés comme



Written by:

**Esma Bounouh**

FAO Consultant

E-mail: [Esma.Bounouh@fao.org](mailto:Esma.Bounouh@fao.org)

**Valerio Crespi**

E-mail: [Valerio.Crespi@fao.org](mailto:Valerio.Crespi@fao.org)

FAO Sub-regional Office for North Africa, Tunis, Tunisia



Les enceintes d'élevage sont entretenues par une main d'œuvre très qualifiée  
Rearing facilities are maintained by a skilled labour force

les espèces les plus maîtrisées sur le plan technique. Pourtant, l'aquaculture méditerranéenne vit actuellement une crise de croissance. Sous l'effet combiné d'un environnement fortement concurrentiel et d'une surproduction latente, on assiste à la fragilisation de l'ensemble de la filière. Dans ce contexte, la diversification des espèces élevées est considérée comme une action prioritaire à mettre en place. Cette approche vise à compléter l'offre des produits de la pêche qui peuvent être saisonniers ou rares en élevant les espèces les plus connues et appréciées par les consommateurs.

La Tunisie est l'un des premiers pays du sud de la Méditerranée à avoir investi dans le secteur aquacole, en élaborant des plans et stratégies de développement et en instaurant des mesures incitatives pour les investisseurs privés, telles que des aides financières ou la création d'un Centre Technique d'Aquaculture. Grâce à cette politique, l'aquaculture en Tunisie a connu une nette croissance durant la dernière décennie, près de 17% par an en volume. La production est ainsi passée de 3 mille tonnes en 2007 à 22 mille tonnes

dix ans plus tard et le secteur emploie actuellement plus de 2 000 personnes. Les principaux systèmes de production sont :

- la pisciculture marine : 15 mille tonnes dont 98% sont issues de 24 fermes aquacoles spécialisées en loup et dorade produites en cages flottantes. Un projet d'engraissement de thon rouge (*Thunnus thynnus*) génère aussi 218 tonnes chaque année. Les investissements en pisciculture marine représentent 98% du total des investissements en aquaculture.
- l'aquaculture continentale pratiquée dans 29 barrages extensifs et 3 fermes intensives de tilapia (18 tonnes par an).
- la conchyliculture de moules et d'huîtres : 115 tonnes par an / 7 fermes.
- l'algoculture : 5 projets de spiruline (4 tonnes de spiruline sèche).

Conscientes des risques liés à la crise économique actuelle, les autorités compétentes ont engagé un travail d'actualisation du plan national de développement de l'aquaculture et la diversification est un des nouveaux axes stratégiques.

L'Institut National des Sciences et Technologies de la Mer a

ainsi lancé des programmes de recherche sur ce thème. Une station expérimentale d'élevage de tilapia dans les eaux géothermales du Sud a été créé à Béchima (Gabes) et des travaux destinés à maîtriser l'élevage d'espèces à haute valeur commerciale comme les muges (*Mugil cephalus* et *Chelon labrosus*), les soles (*Solea aegyptiaca* et *Solea sinegalensis*), la palourde (*Ruditapes decussatus*), le maigre (*Argyrosomus regius*) ou la sériole couronnée (*Seriola dumerili*) ont été initiés avec succès.

Une expérience pilote d'élevage de la crevette à pattes blanches

(*Litopenaeus vannamei*) a aussi été lancée en 2014 à Malloulech (Mahdia) dans le cadre d'une collaboration avec la République Populaire de Chine. Cinq cycles ont été réalisés entre 2014 et 2017 avec une production qui a atteint 2 tonnes par cycle. Toutefois, le transfert de la technologie aux investisseurs du secteur privé reste encore limité, faute d'étude d'impact environnemental et sanitaire.

En 2019, la Direction générale de la Pêche et de l'Aquaculture a adressé une requête à la FAO pour bénéficier de son expertise dans l'évaluation des opportunités de développement de la crevetticulture. L'intervention actuelle de la FAO consiste donc à fournir un appui technique pour l'évaluation des impacts environnementaux et la biosécurité du système d'élevage de crevettes.



#### SEE ALSO

Fiches d'informations sur les espèces aquatiques cultivées:  
[www.fao.org/fishery/culturedspecies/search](http://www.fao.org/fishery/culturedspecies/search)

## Appui de la FAO à l'élaboration des stratégies de développement de l'aquaculture en Algérie et au Maroc

With its arid climate, its projected population growth and the water scarcity issue, the Near East and North Africa (NENA) region needs a coordinated regional approach to increase fish production and consumption, rural employment and sustainable use of natural resources. In this context, marine aquaculture and freshwater production systems based on integrated aquaculture can be considered as a new alternative means to produce animal protein with high nutritional value. FAO is supporting Algeria and Morocco in promoting aquaculture through the elaboration and implementation of national strategies that contribute to ensure food security, poverty reduction and sustainable management of aquatic resources.

L'aquaculture marine et les systèmes de production basés sur l'aquaculture intégrée à l'agriculture (IAA) sont considérés comme des activités



La dorade royale, un poisson apprécié par le consommateur tunisien  
 Gilthead seabream, a fish very much appreciated by the Tunisian consumer

particulièrement pertinentes pour produire les protéines animales de haute valeur nutritionnelle essentielles pour les populations les plus vulnérables de la région du Proche-Orient et de l'Afrique du Nord (NENA). Dans ce contexte, la FAO aide l'Algérie et le Maroc à élaborer leurs stratégies de développement de l'aquaculture.

#### L'aquaculture en Algérie

L'Algérie dispose de 1 620 km de côtes et de 100 000 ha de

plans d'eaux potentiellement valorisables à des fins aquacoles. Les zones exploitées sont consacrées à deux types



Written by:

**Valerio Crespi**

E-mail: [Valerio.Crespi@fao.org](mailto:Valerio.Crespi@fao.org)

**Esma Bounouh**

FAO Consultant

E-mail: [Esma.Bounouh@fao.org](mailto:Esma.Bounouh@fao.org)

FAO Sub-regional Office for North Africa, Tunis, Tunisia

d'aquaculture, l'aquaculture marine avec 14 zones identifiées et l'aquaculture continentale avec 6 zones. La production nationale avoisine les 4 000 tonnes, issues à 50 pour cent de 28 fermes aquacoles marines élevant du loup (*Dicentrarchus labrax*), de la dorade royale (*Sparus aurata*), du maigre (*Argyrosomus regius*) et de la moule (*Perna perna*). Le reste provient de l'aquaculture continentale, répartie sur 18 fermes, 58 concessions de barrages et lacs collinaires et 708 agriculteurs pratiquant la pisciculture intégrée. Les principales espèces sont la carpe commune (*Cyprinus carpio*), le tilapia du Nil (*Oreochromis niloticus*) et le poisson chat nord-africain (*Clarias gariepinus*).

Durant la dernière décennie, le Ministère de l'agriculture, du développement rural et de la pêche (MADRP) a activement promu la pêche et l'aquaculture, en associant toutes les parties prenantes. La stratégie nationale de développement de la pêche et de l'aquaculture Aquapêche découle d'une démarche prospective à l'horizon 2035, élaborée avec l'appui de différentes agences onusiennes : le Programme des Nations unies pour le développement (PNUD), la FAO, et l'Organisation des Nations unies pour le développement industriel (ONUDI). L'Algérie a aussi mobilisé des moyens financiers, humains et matériels ainsi que des mesures incitatives à l'investissement dans le secteur aquacole.

### La filière aquacole marocaine

L'aquaculture au Maroc est ancienne et bénéficie de nombreux atouts. La production reste pourtant marginale, avec seulement 1 000 tonnes par an. Actuellement, l'activité est majoritairement artisanale. Dix-sept entreprises, soit 85 pour cent

des fermes actives produisent moins de 100 tonnes/an.

L'aquaculture est positionnée sur le créneau de la production durable et c'est une filière prioritaire de la stratégie *Halieutis*, lancée en 2009. Pour sa mise en œuvre, l'Agence Nationale pour le Développement de l'Aquaculture (ANDA) a initié un plan d'action ambitieux, notamment pour ce qui concerne la réglementation, l'aménagement du littoral et l'incitation à l'investissement. Le gouvernement marocain a aussi conclu un partenariat avec la FAO pour l'élaboration d'une nouvelle stratégie aquacole qui prenne en compte les acquis et trace les perspectives qui permettront au secteur d'atteindre les objectifs qui lui ont été assignés à l'horizon 2030.

Les résultats obtenus entre 2008 et 2016 à travers la coopération fructueuse entre la FAO et le gouvernement algérien ont contribué à l'élaboration d'une stratégie nationale pour le développement de l'aquaculture marine et continentale, notamment l'aquaculture intégrée à l'agriculture en milieu désertique. Le cadre réglementaire régissant l'aquaculture marine a été révisé et une analyse approfondie des différents défis a été réalisée, aboutissant à la rédaction de fiches techniques pour des fermes modèles d'aquaculture marine

(loup et dorade royale en cages flottantes) et de conchyliculture (moules en filières). La FAO a aussi permis à l'Algérie de cerner les principales contraintes techniques, zootechniques, économiques et sociales de la pisciculture, de dresser un bilan des potentialités et des lacunes de l'aquaculture continentale et désertique et d'élaborer des modèles de fermes aquacoles d'eau douce en milieu aride.

Avec le Maroc, l'appui de la FAO a permis de réaliser une appréciation de l'action globale de l'ANDA et de ses réalisations sectorielles au cours de ses cinq premières années d'existence, ainsi que de leur alignement avec les instruments internationaux régissant le développement durable du secteur. Un nouveau cadre stratégique a aussi été proposé à l'ANDA.

Que ce soit au Maroc ou en Algérie, le secteur aquacole présente un potentiel indiscutable, ainsi qu'un cadre réglementaire et institutionnel de qualité, favorable aux investisseurs. Il n'en demeure pas moins que les défis restent importants, notamment sur le plan commercial, et que l'appui politique des deux gouvernements reste indispensable pour permettre aux deux pays d'atteindre les objectifs ambitieux qu'ils se sont donnés.



### SEE ALSO

Aquaculture marine marocaine: Potentiel et nécessités de développement. [depf.finances.gov.ma/etudes-et-publications/](http://depf.finances.gov.ma/etudes-et-publications/)

Le développement de l'aquaculture en Algérie en collaboration avec la FAO. [www.fao.org/3/ca2769fr/CA2769FR.pdf](http://www.fao.org/3/ca2769fr/CA2769FR.pdf)

Vingt ans d'aquaculture en Afrique du Nord : évolutions, bilan critique et avenir. [www.cahiersagricultures.fr/articles/cagri/full\\_html/2016/06/cagri160117/cagri160117.html](http://www.cahiersagricultures.fr/articles/cagri/full_html/2016/06/cagri160117/cagri160117.html)

Agence Nationale pour le Développement de l'Aquaculture. [www.anda.gov.ma/](http://www.anda.gov.ma/)

*Support to the National Agency for Aquaculture Development (ANDA) in Morocco.* FAO Aquaculture Newsletter No 57 (September), pp. 24. [www.fao.org/3/a-i7851e.pdf](http://www.fao.org/3/a-i7851e.pdf)

# Advancing aquaponics in the Caribbean

Aquaponics, a combination of aquaculture and hydroponics, is expanding, and this simple idea is gaining traction worldwide on scales ranging in size from table-tops to hectares. It enjoys a global groundswell of interest and support from farmers, consumers, teachers and governments. In the Caribbean, the birthplace of aquaponics, several converging factors make aquaponics an especially exciting opportunity: youthful populations can use aquaponics to efficiently co-produce fish and vegetables, creating value and livelihoods through import substitution while at the same time addressing consumer demand for healthy, local food by using techniques that are more efficient, less damaging and more climate resilient.

Aquaponics fits within the larger paradigm of agroecology, and provides a pathway to realize the sustainable intensification of food and agriculture. Aquaponics reintroduces biological complexity into agricultural systems, closely guided by knowledge co-creation and sharing processes that aim to maximize synergies. In other words, aquaponics does more, with less. More healthy fish and vegetables, more opportunity for education and empowerment, and more value, are produced with less land, less water, and fewer chemicals.



Written by:

**Austin Stankus**

FAO Sub-regional Office for the Caribbean, Bridgetown, Barbados

E-mail: [Austin.Stankus@fao.org](mailto:Austin.Stankus@fao.org)

FAO has been supporting the advancement of aquaponics in the Caribbean since around 2014. Through the regional TCP project *Towards a Caribbean Blue Revolution* in Antigua and Barbuda, Bahamas, Barbados, and St. Kitts and Nevis, FAO trained farmers and extension agents through an intensive, hands-on workshop at a commercial aquaponic system in Antigua. Following the training, beneficiary farmers were supported to design, procure and construct demonstration aquaponic systems through public-private partnerships. Systems were designed to earn USD 1 000 per month, but at the same time to serve as a location for free national trainings for selected participants. Privately-run workshops can be prohibitively expensive for average farmers, whereas these trainings, guided by FAO and implemented by the local farmers, will help share the lessons learned through the projects, and support expanding the interest in the wider community. An added benefit is the co-creation and dissemination of knowledge, including data on productivity and financial elements. These data will be provided to FAO from these functioning, commercial systems to address the most common question: is aquaponics profitable?

The profitability of aquaponics was the subject of a workshop



Students of the Bahamas Agriculture and Marine Science Institute posing next to a newly constructed aquaponic system based on the FAO Aquaponic Manual

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held in Christ Church, Barbados in December 2018 entitled *Advancing Aquaponics Through Strengthened Value Chains* ([www.fao.org/3/ca4335en/ca4335en.pdf](http://www.fao.org/3/ca4335en/ca4335en.pdf)). This workshop, consisting of lectures, participatory group sessions and hands-on activities supported by aquaponics and value chain experts concluded with several findings and recommendations. Although technical production skills are generally strong among veteran farmers, incoming farmers need technical backstopping and training programmes for basic production technologies. There are no more than 10–20 aquaponic farmers in any Caribbean country, of which only 1–5 are commercially oriented, however, strong interest and awareness exist. Improving connections with consumers, especially hotels and restaurants serving the tourist sector, and ensuring that farmers can meet the specific demands will enable farmers to take advantage of this lucrative market sector. Somewhat unexpectedly, the value of fish sales were reportedly higher than vegetable sales by a factor of 2:1. Overall, no farmers reported problems with sales, and indeed most participants believe that



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Kristina Adams of Adams Aqualife (Barbados) presenting the newly constructed aquaponic demonstration facility to national and international participants during an FAO workshop

markets can absorb increased production.

Access, availability and affordability of inputs are the biggest blocking issues to further development of the aquaponic sector. Expensive startup costs were discussed during the workshop, and financial data provided to FAO will help inform investment mechanisms to support new farmers.

Through the GEF supported *Climate Change Adaptation on the Eastern Caribbean Fisheries Sector Project (CC4FISH)*, FAO is supporting seven Caribbean SIDS with capacity building and technical support to adapt to the effects of climate change and making the sector better prepared for natural disasters. Some of this work is specifically dedicated to aquaponic development, and in addition to furthering and expanding the demonstration and training described above. In addition, the project will develop a supplement to the widely popular FAO Technical Manual on small-scale aquaponics, drafted with partners to address the Caribbean situation.

One of the key lessons from FAOs work on aquaponics is

that one must identify locations and communities that would benefit most from aquaponics, and even more importantly, where aquaponics is not appropriate. In situations where aquaponics is promising, FAO supports the important step of implementing awareness campaigns (e.g. demonstration systems, agriculture fairs, school systems, cooking competitions) and engaging with the market sector. On a production side, local adaptation of best practices and technical guidelines allow for development and documentation of scalable, profitable systems, and FAO's role is to facilitate knowledge sharing of these developments. For example, during the Bahamas Agriculture and Marine Science Institute aquaponic course students lead the adaptation of the step-by-step instructions in the FAO manual to a design better suited to the Bahamas environment. One pleasantly unexpected result of the FAO projects was a spontaneous and self-organized movement towards the establishment of an Caribbean Aquaponic Association, an informal network to share information and lessons among

practitioners (interested people may contact the author for more information).

Many development organizations work in the aquaponics sector; international organizations such as the United Nations Development Programme, Inter-American Institute for Cooperation on Agriculture, United States Agency for International Development, and FAO work together with non-governmental organizations, Government agencies, private farmers and local charities. Each organization is encouraged to ensure long-term, ongoing technical support for farmers, ideally from local experts experiencing similar agroecological realities. It is essential to include not only technical production techniques, but also feasibility analyses, development of business plans, and value chain development to increase market leverage and overall profitability for these farmers. Finally, all are urged to work towards the harmonization of policy across sectors to support the enabling environment, and empower farmers' access to technology and finance opportunities.

Aquaponics is making headway as a grassroots, bottom-up movement, with social benefits reinforcing the financial and environmental impacts. Development partners have an important role in shaping the path that aquaponics development will take, but should be cognizant that this farmer-driven movement is bigger than any single organization. To this effect, FAO remains committed to, and looks forward to supporting, all those dedicated to the advancement of Caribbean aquaponics.



# Technological innovation in mussel seed collection: a response to climate change from fishing communities in southern Chile

The Chilean mussel industry is well established in the southern region of Los Lagos. In the past decade, this mariculture subsector has seen significant growth in terms of landings, increasing from 60 708 tonnes in 2003 to 338 847 tonnes in 2017. The industry, which has reached an export volume of 79 330 tonnes valued at USD 210 million (free on board), has placed Chile as the world's second largest mussel producer and leading exporter.

The rapid development of the mussel farming industry has been driven by the growing demand for mussel products in international markets. France, Italy and Spain, along with the Russian Federation and the United States of America, are the principal market destinations for farmed Chilean mussels, collectively receiving about 70 percent of all exports. The industry consists of 619 companies managing a total of 1 115 authorized mussel farming concessions, which occupy a combined sea surface area of 13 005 hectares. The majority



Mussel farming in Southern Chile

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of the operators consist of micro and small enterprises (89 percent) that operate through marine concessions granted to natural persons, fisher organizations and/or registered companies.

The mussel industry currently generates over 17 000 jobs, equivalent to 4 percent of the employment in the region, and contributes 7 percent to the regional gross domestic product, equivalent to the combined gross contribution from the forestry and agricultural sectors.

The industry is entirely based on the supply of seed material collected from natural mussel beds. Hence, the expansion and long-term sustainability of the sector and the associated livelihoods are highly dependent on the successful management of the wild resources and the adaptation of these resources to any environmental changes. Because of the natural distribution of the mussel beds in the various

concessions, the crucial stage of spat collection is almost entirely taken care of by fisher organizations managing the above-mentioned concessions. These concessions are mainly located in Reloncavi Bay and the Gulf of Ancud (i.e. these areas are located in the northern reaches of the interior sea between Chiloé Island and the mainland to the east).

The small fishing community of El Manzano, located in the commune of Hualaihué, traditionally lives off fishing the dwindling stocks of southern hake (*Merluccius australis*) and the collection of commercial benthic resources. This community is one of the four pilot sites nationwide taking part in a Global Environment Facility (GEF) project focused on strengthening the adaptive capacity of the artisanal fishing and aquaculture sectors to climate change. The GEF project under the Ministry



Written by:

**Alessandro Lovatelli**

E-mail: [Alessandro.Lovatelli@fao.org](mailto:Alessandro.Lovatelli@fao.org)

**Cecilia Godoy**

FAO Consultant

E-mail: [Cecilia.Godoy@fao.org](mailto:Cecilia.Godoy@fao.org)

FAO Regional Office for Latin America and the Caribbean  
Santiago, Chile

**Jorge Contreras**

FAO Consultant

E-mail: [Jorcon64@yahoo.es](mailto:Jorcon64@yahoo.es)

of the Environment and the Undersecretary of Fisheries and Aquaculture, and implemented by FAO, also focuses on implementing technical fishing and farming improvements and assisting coastal communities to increase their capacity to adapt and be more resilient to the effects of climate change.

The capture of mussel seed began by using hardwood poles, which were then replaced, and still in use today, with strips of anchovy mesh produced from old and disused pelagic fishing nets. One of the adaptation actions supported and implemented by the project has focused on improving the process of capturing wild mussel seed in order to increase the supply of

seed to the ongrowers as a whole and to improve the overall income of the fisher organizations. In this regard, the project introduced the use of seed collectors made of new and reusable material, allowing to optimize this stage.

These were deployed in December 2018 and January 2019, and the preliminary results have been encouraging in terms of the quantity and uniformity of the seed collected. Being originally fishers, the economic diversification within this fishing community towards small-scale aquaculture will undoubtedly help fishers to better cope

with changes in the availability of traditionally harvested resources as a result of overexploitation and changes in fish distribution and abundance due to environmental change. Mussel seed collection, which is vital in sustaining the current mussel farming industry, now offers more opportunities to the younger generation of fishers.



Distinct material used as seed collector



Location of the mussel producing area



Natural mussel beds in El Manzano

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# Recent efforts and actions undertaken by Peru against the tilapia lake virus (TiLV)

When FAO released its special alert report no. 338 in May 2017 on the global emergence of tilapia lake virus (TiLV) disease,<sup>1</sup> the national fish health authority of Peru launched an emergency plan that first confirmed the presence of the virus in the country in February 2018, and then focused its efforts on reducing the impact on the national aquaculture industry.

Tilapia is a key component of food security, as almost all production is aimed at local consumption. In 2017, the department of San Martín (center-west region of Peru) accounted for 50 percent of the national production of this species, with 2 665 tonnes. However, TiLV has severely affected the industry – production fell by 40 percent, with 100 percent losses in some farms, and consumption reduced by 30 percent at the regional level.



Written by:

**Muriel Gómez-Sánchez**

E-mail: [Muriel.Gomez@sanipes.gob.pe](mailto:Muriel.Gomez@sanipes.gob.pe)

**Katherine Zapata**

E-mail: [Katherine.Zapata@sanipes.gob.pe](mailto:Katherine.Zapata@sanipes.gob.pe)

**Carlos Smith**

E-mail: [Carlos.Smith@sanipes.gob.pe](mailto:Carlos.Smith@sanipes.gob.pe)

**Erick Reategui**

E-mail: [Erick.Reategui@sanipes.gob.pe](mailto:Erick.Reategui@sanipes.gob.pe)

Organismo Nacional de Sanidad  
Pesquera – SANIPES

**Alessandro Lovatelli**

FAO Regional Office for Latin  
America and the Caribbean  
Santiago, Chile

E-mail: [Alessandro.Lovatelli@fao.org](mailto:Alessandro.Lovatelli@fao.org)

**Melba G. Bondad Reantaso**

FAO Fisheries and Aquaculture  
Department, Rome, Italy

E-mail: [Melba.Reantaso@fao.org](mailto:Melba.Reantaso@fao.org)

Before this event, the aquaculture sector had played down the importance of biosecurity and good aquaculture practices, as these were considered unnecessary and costly, despite the requirements of the new General Law on Aquaculture since 2015. In this context, the emergency plan coordinated actions between the regional authorities and the producers through ad hoc working groups. The strategy included health education, monitoring and control of the main tilapia seed producers and biosecurity measures, such as: restriction of interregional movement of live tilapias in all their life stages; sale and/or distribution of tilapia fingerlings only permitted if polymerase chain reaction results were negative; restriction of entry of unauthorized personnel to production centres; implementation of disinfection areas for vehicles, shoes and hands; strengthening of good aquaculture practices; implementation of passive surveillance in farming centres; implementation of cleaning and disinfection measures for infrastructure and materials.

In addition, zoning was established to strengthen health surveillance and establish joint prevention, control and mitigation measures. Areas of high surveillance (AHS) were implemented within a 5 km radius around an outbreak, and



Application of biosecurity measures at a tilapia fish farm

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surveillance zones within a 10 km radius around an AHS.

The strengthening of these actions would not have been possible without the FAO support for 2 peruvian delegates to attend the Intensive Training Course on Tilapia Lake Virus (TiLV) organized by FAO in Guangzhou, China, in June 2018, where technical information was provided by international experts and active networking encouraged among the participants and experts. This allowed FAO expert Dr Win Surachetpong from Thailand to visit Peru in November 2018, sharing his experience with local producers and training the health authority on molecular diagnosis and TiLV farm level biosecurity. The active surveillance implemented during 2018 allowed to reduce the TiLV prevalence, which went from 23 percent (April) to 4.8 percent (December), as a result of the emergency plan implementation.

The department of San Martín has great potential for aquaculture development, and although it was strongly affected by this disease, the experience acquired by the producers has strengthened them technically and socially.

1. [www.fao.org/3/a-i7326e.pdf](http://www.fao.org/3/a-i7326e.pdf)

# Aquaculture integrated with horticulture takes northeast Nigeria by surprise



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Catfish effluents fertilize horticulture crops

An estimated 100 000 Nigerian fishers from the Lake Chad region had to leave for safer places during the Boko Haram insurgency, so the idea arose to introduce fish culture in their camps. Many hurdles had to be taken to convince the project designers to include the fish component in a large European Union-financed project entitled “Restoring and promoting sustainable agriculture-based livelihoods for food security and nutrition improvement in Borno State”.

A former FAO project in Nigeria facilitated youth employment by providing circular glass-fibre fish tanks, with a volume of about 3 cubic metres, to selected youth. These youth were supposed to manage 500 catfish fingerlings and rear them until they reached consumption size. One of the lessons learned was that the individual approach was not

ideal, and that a peer-to-peer element should be included in the project so that youth could learn from each other. Therefore, a cluster approach is currently being applied: a group of ten tanks for ten

beneficiaries, who work together to produce as much fish as possible. Initially, the project will provide feed and fingerlings, but eventually the cooperatives (still to be formed) will have to purchase the inputs themselves. The advantage of culturing catfish is that they can breathe atmospheric air and thus this feature allows high densities in relatively small tanks. Feeding 500 fish to saturation will produce significant quantities of excrement, which can create a toxic environment for the fish but can be used to irrigate horticultural activities with fertile water. It is interesting to observe the collaboration between the refugees and the host communities in growing fish and tomatoes, beans and other crops. At present, five clusters of ten tanks have been distributed to the communities, who have prepared the land with authorization from the village chiefs. The results of the pilot tanks are overwhelming, as the high temperatures in northeast

Nigeria seem to be conducive for catfish growth – and a bumper harvest is expected soon, not only of fish but also of additional crops. The fish will not only be for immediate consumption, but also for trading. In order to add maximum value to the product, the so-called FAO Thiaroye Technology (FTT) smoking kilns will be introduced in the communities for safe and fuel-efficient processing of catfish, and that is another story we will report on in the next issue of FAN.

Fish tanks for catfish culture integrated with horticulture appeared to be a productive combination in a country like Nigeria where fish feed and fingerlings are locally available. Five clusters of ten tanks is like a drop in the lake. The formula deserves rapid upscaling for increased food and nutrition security and for integration of internally displaced persons in their host communities. The initiative will also prevent youth from joining militant groups. The FAO Representative, European Union and government officials officially inaugurated the first five clusters in the first week of April 2019. The beneficiaries enthusiastically welcomed the initiative, which was widely covered by the media.



Written by:

**Martinus Van der Knaap**

E-mail: [Martinus.VanDerKnaap@fao.org](mailto:Martinus.VanDerKnaap@fao.org)

**Muhammed Ahmed**

E-mail: [Muhammed.Ahmed@fao.org](mailto:Muhammed.Ahmed@fao.org)

FAO Regional Office for Africa

West Africa Team, Accra, Ghana



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The project increased self-reliance and self-confidence of beneficiaries

## Could marine aquaculture be an alternative livelihood option for vulnerable coastal fisher communities?

**Thorough assessments are being undertaken for marine aquaculture as an adaptation option for coastal communities within the three countries of the Benguela Current Fisheries System, namely Angola, Namibia and South Africa.**

The aquaculture sector has been frequently cited as being a suitable alternative livelihood or adaptation option to climate change for vulnerable coastal fisher communities whose livelihoods depend on the sea. However, marine aquaculture is technically very challenging, requiring substantial skills and resources to produce high-value species. It is thus not suitable as an artisanal small scale alternative livelihood option for communities, but can provide quality jobs in remote coastal locations.

Angola possesses an outstanding environmental endowment for the culture of finfish, shellfish and shrimp ranging from warm temperate to tropical zones, but there are limited established commercial marine ventures due to various factors, including Angola's macroeconomic and fiscal policies, a lack of commercial aquaculture experience, a small local market, high production costs and barriers to export. However, the Angolan government has also implemented some supportive government policies, strategies and institutions relevant to aquaculture development, and has established a regulatory framework and public sector human capacity base to support aquaculture development.

With about 300 people employed in the sector, a commercial aquaculture sector does exist in Namibia although it is relatively small. Developments have resulted in the establishment of a unique commercial aquaculture sector producing oysters, abalone and mussels. Namibia has a strong



Oyster processing done by women in Lüderitz

competitive advantage with its aquaculture policies, legal frameworks, institutional capacity, excellent infrastructure, well-established fishing and seafood processing companies, good trade ties with most of the neighboring countries and international markets as well as some world-class aquaculture products. The fattening of oysters by the Lüderitz farmers is supplying a premium product famous for its quality and unique flavors. Unlike Walvis Bay that is regularly confronted with sulphur eruptions and harmful algal bloom closures, Lüderitz is not exposed to these natural events, but the bay is shallow and relatively small, limiting production to oyster farming only.

Although South Africa has a marginal physical environment for marine aquaculture with only one sheltered embayment and few land based sites, commercial marine aquaculture emerged during the 1980s. To date, the established commercial aquaculture sector produces abalone, mussels, oysters and pilot scale sea-run trout, employing 11 000. The value chain is supported by a comprehensive set of government policies, a regulatory framework, sophisticated financial sector and well-developed capital market as well as a sound human capacity base in the public and private sectors. Marine aquaculture in South Africa is set to grow organically from its sound base. A reality is that access to finance remains a fundamental constraint as the local banks and other sources of finance are wary of aquaculture due to the many business failures that have occurred.

This is a persistent problem, not just in South Africa but regionally. It is therefore important that we exercise caution in assuming that aquaculture, in particular marine aquaculture could replace declining fishery jobs and livelihoods. This will require careful planning, re-defining aquaculture for coastal communities and partnering with commercial aquaculture value chains by means of strategies such as community-public-private cooperation, collaborations and partnerships.



Written by:

**Vasco Schmidt**

FAO Sub-regional Office for Southern Africa,  
Harare, Zimbabwe

E-mail: [Vasco.Schmidt@fao.org](mailto:Vasco.Schmidt@fao.org)

**Katrina Hilundwa**

FAO/Benguela Current Commission  
"Enhancing Climate Change Resilience in the Benguela  
Current Fisheries" project

E-mail: [Katrina@benguelacc.org](mailto:Katrina@benguelacc.org)

**Peter Britz**

Rhodes University, Grahamstown, South Africa

E-mail: [P.britz@ru.ac.za](mailto:P.britz@ru.ac.za)

# La FAO appuie le développement de l'élevage de tilapia en cages flottantes au Cameroun

**Since 2013, FAO supports Cameroon in the development of tilapia cage farming and monosex fry production**



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Pêche des cages (Fleuve Nyong à Mbalmayo)

Malgré un important réseau hydrographique, et des conditions naturelles particulièrement favorables au développement de l'aquaculture, la production aquacole du Cameroun a plafonné ces vingt dernières années à un niveau inférieur à 2 000 tonnes/an. Pour répondre à la forte demande intérieure (440.000 tonnes de poisson par an) et au déficit croissant de la balance commerciale en produits halieutiques (293 millions USD en 2015), le Gouvernement camerounais a initié au milieu des années 2000 des politiques volontaristes de développement de l'aquaculture commerciale, avec l'appui de la FAO.

Dans le cadre de la mise en œuvre de ces politiques, la FAO a accompagné des essais pilotes de développement de l'aquaculture de tilapia en cage (*Oreochromis niloticus*). Des études de faisabilité ont été réalisées dès 2013 et à partir de 2015, un projet a



Written by:

**Lionel Kinadjian**

Bureau Sous-Régional de la FAO pour l'Afrique Centrale, Libreville, Gabon

E-mail: [Lionel.Kinadjian@fao.org](mailto:Lionel.Kinadjian@fao.org)

permis d'étendre ce système de production dans 5 régions : sur le fleuve Nyong à Mbalmayo (Région du Centre), sur le lac Bambalang à Ndop (Région du Nord-Ouest), sur le fleuve Nkam à Yabassi (Région du Littoral), sur le fleuve Nyong

à Atok (Région de l'Est) et sur la retenue artificielle d'eau de Lagdo à Garoua (Région du Nord).

L'objectif était d'améliorer la production piscicole nationale et de réduire les importations à travers l'introduction de systèmes de production aquacole intensifs économiquement rentables, socialement équitables, respectueux de l'environnement et techniquement maîtrisés par les promoteurs intéressés. Une cinquantaine de personnes ont été formées et ont contribué au montage des cages, à leur installation et à leur maintenance sur les sites retenus.

Le projet a également permis d'empoissonner 37 500 alevins de tilapia dans 11 cages flottantes et d'acquérir des aliments pour conduire un cycle d'élevage expérimental. Plus de 300 acteurs (pêcheurs, pisciculteurs, agents d'encadrement...) ont bénéficié de formations aux techniques d'élevage en cages flottantes. Des géniteurs de tilapia de qualité certifiée, produits par le Centre National de Formation Zootechnique Vétérinaire et Halieutique de Foumbam, ont été mis à la disposition de 10 Producteurs Privés d'Alevins (PPA).

Le projet a en outre permis de réaliser plusieurs études à caractère technique et économique sur l'élevage en cage et sa rentabilité au Cameroun. Une évaluation des coûts des intrants et du matériel ainsi qu'un recensement des principaux fournisseurs ont été réalisés. L'ensemble de ces données constituent pour les éleveurs et les investisseurs potentiels, des outils d'aide à la décision et d'orientation importants. Le projet a également favorisé l'engagement de plusieurs opérateurs privés dans l'élevage de poissons en cages flottantes, notamment CAMFISH à Bambalang, CAP FORT à Mbalmayo et la ferme SIAP à Bagangté, ainsi que le développement d'un partenariat avec le Projet de Promotion de l'Entrepreneuriat Aquacole au Cameroun financé par le FIDA.

La FAO poursuit son soutien au développement durable du sous-secteur aquacole au Cameroun en fournissant des appuis dans la région de l'extrême nord sur fonds propres et avec le soutien financier du Gouvernement irlandais. Le financement à venir de la Banque Africaine de Développement (Projet de développement des chaînes de valeur de l'élevage et de la pêche) devrait aussi permettre le renforcement du cadre de gouvernance du secteur et l'appui au financement des opérateurs privés.



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Ferme aquacole CAMFISH Lac Bambalang à Ndop

# The Southern Africa Development Community and FAO join hands to strengthen development and management of fisheries and aquaculture



SADC working group held during the World Fisheries day 2018

The Southern Africa Development Community (SADC) Technical Committee on Fisheries has developed and recommended for ministerial approval the Best Practices Guidelines for Aquaculture Management in the region. The tool, which addresses key environmental and social impact issues common to all aquaculture activities, is vital for the development and management of the fisheries sector in the SADC.

The guidelines are not prescriptive in terms of providing performance-based metrics; rather, they should be used by SADC Member States as a reference for drafting their own detailed best management practices specific to their environments, candidate species and production systems. The process of developing the guidelines with Member States began in 2018 through a collaboration between SADC and FAO. A number of Member States have already started applying

the regional guidelines developed within their management systems, so as to promote an economically, socially and environmentally responsible sector development.

In addition to the best practices guidelines, another tool was developed by the SADC with the support of FAO, to help Member States monitor the implementation of the SADC Protocol on Fisheries and, consequently, to encourage progress and actions by Member States towards its implementation. The technical committee urged Member States to work with the Secretariat and FAO to roll-out implementation of the SADC Protocol on Fisheries.

The Protocol covers 31 Articles with nine thematic areas, namely, Protocol arrangements and responsibilities; management of resources; illegal, unreported and unregulated fishing; artisanal, subsistence and small-scale commercial fisheries; aquaculture; management and protection of the aquatic environment; human resources development; trade and investment; and science and technology.

FAO and WorldFish supported the SADC with the Platform for Genetics and Biodiversity Management in Aquaculture through a German-funded project. This project was established partly with the aim of leading and developing a set of protocols to guide sustainable genetic

improvement research and development programmes in Africa and in particular the SADC region, notably with Malawi and Zambia.

The technical committee meeting was held in Windhoek, Namibia, and attended by almost 58 participants representing 13 SADC Member States, including Botswana, Comoros, the Democratic Republic of the Congo, Eswatini, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, United Republic of Tanzania, Zambia and Zimbabwe, as well as a number of national, regional and subregional institutions.

FAO remains committed towards supporting the SADC Secretariat, as well as the fisheries bodies in the region, in capture fisheries (marine and freshwater resources) and in the aquaculture development and management sectors.

## More about fisheries and aquaculture in the SADC region

- The fisheries and aquaculture sectors employ a total of about 2.6 million people of the SADC population.
- The sectors account for an estimated 3.5 percent of the region's gross domestic product (GDP) and 11 percent of the region's agriculture GDP.
- The region consumes about 12.5 kg per capita of fish, up from 11.3 kg/year. More than 95 percent of this production comes from a diversified capture fisheries subsector, which has been stagnating in the past 10 years or so, at around 2.5 million tonnes, but has recently increased to 2.92 million tonnes.



Written by:

**Vasco Schmidt**

FAO Sub-regional Office for Southern Africa, Harare, Zimbabwe

E-mail: [Vasco.Schmidt@fao.org](mailto:Vasco.Schmidt@fao.org)

## Rice-fish farming in Sub-Saharan Africa

Rice-fish farming refers to the concurrent or rotational farming of rice and fish. Interestingly, the majority of fish farmers have heard about rice-fish culture; however, this is not the case for most rice farmers. This communication aims at sharing some experiences in FAO projects in West Africa, in places where one would not expect such a combination. The article briefly discusses the results from projects in irrigated rice production in Burkina Faso, Mali and Uganda, and in a rainfed scheme in Guinea-Bissau.

In all rice-fish projects covered by this article, the pilot initiatives showed that indeed fish in the rice fields can reduce the impact of pests and pathogens that affect rice production negatively, as well as reducing the use of fertilizers. In Burkina Faso, the “traditional” rice fields without stocked fish surrounded a project’s test plot.<sup>1</sup> Not only did farmers observe that the experimental paddy produced more and better quality rice, also the birds from the skies knew where to find the plot. At the end of the season, the pilot project resulted in more rice PLUS the fish than the other rice farmers could achieve.

In Mali, 43 rice-fish plots resulted in a total of 96.8 tonnes of rice and 14.9 tonnes of fish. It should be noted some plots had been invaded by wild fish, but that was no problem for the farmers. In



Written by:

**Martinus Van der Knaap**

FAO Regional Office for Africa  
West Africa Team, Accra, Ghana

E-mail: [Martinus.VanDerKnaap@fao.org](mailto:Martinus.VanDerKnaap@fao.org)

one area, a production of 4 tonnes of fish per hectare had been realized.<sup>2</sup>

Uganda produced very detailed figures. The Chinese South-South Cooperation project in Uganda introduced rice hybrids combined with tilapia, and the yields are definitely worth mentioning. According to project staff, the presence of fish in the rice fields increased rice harvests by 5 to 10 percent. On top of that, hybrid rice varieties tested at the same time yielded five times the traditional rice production. In different rice fields, fish survival rates varied from 80 to 85 percent and fingerlings grew up to 100 to 150 grams during the rice life cycle.

In Guinea-Bissau, the rice-fish farming project was undertaken on the mudflats near mangrove forests.<sup>3</sup> Rice field preparation traditionally is done before the rainy season, by building dykes that retain water before it runs off into the *bolons*, the creeks within the mangrove forests. The community farmers received assistance in digging a fish-retention pond as well as canals around the perimeter of the rice fields. The canals were stocked with locally produced tilapia fingerlings. The results were encouraging, although no quantitative data have been collected. The villagers absorbed the new technology and will repeat the method in the forthcoming rainy season.

In general, it can be stated that this technique is a success, although insufficient data exist to quantify the success. The



sensitization of the farmers deserves improved as well as systematic data collection. Even though no data were collected, we know from other parts of the world that rice farmers growing fish in their fields significantly reduce, if not completely eliminate, the use of pesticides to protect their fish, resulting in a more environment friendly mode of production. At this stage, no scientific conclusions should be drawn, but there are positive signs in all the projects that food and nutrition are increased by combining rice production with fish rearing.

The combination of rice and fish in West Africa may be considered a success and deserves further attention, especially in irrigated rice schemes. Upscaling at selected sites should be organized, but with proper full-time guidance before this methodology is further advertised. The additional water in the rice field increased the resilience of the farmers in case of insufficient water supply.

It is recommended that a project be implemented with proper data collection so that a scientific foundation is laid for upscaling and additional sensitization. The fish farmer field school approach should be further strengthened.

1. TCP/BKF/3501: Validation et dissémination de systèmes intégrés d'aquaculture-agriculture à travers l'approche champs-écoles des producteurs.
2. UNJP/MLI/047/UNJ : Programme de développement des capacités de production aquacole résiliente et durable adaptée aux changements climatiques et à la variabilité climatique au Mali.
3. TCP/GBS/3604: Validation et dissémination de systèmes intégrés d'aquaculture-agriculture (rizipisciculture et autres) à travers l'approche « Champs-Écoles des Producteurs ».



# Decent jobs for youth and improved food security through development of sustainable rural enterprises

Unemployment is a major challenge in Zambia, and young women and men are the most vulnerable: 28 percent of the 20–24 year olds are unemployed as well as 16 percent of the 25–29 year olds. The Government of Zambia has thus prioritized the creation of employment as a key outcome of its National Development Plan. Yapasa is an FAO/International Labour Organization (ILO) initiative funded by the Swedish International Development Cooperation Agency (Sida), aligned with this National Development Plan; its main goal is to contribute to the creation of decent jobs and food security for young women and men in rural Zambia through the promotion of micro, small and medium-scale enterprises.

The Yapasa project used the Market Systems Development (M4P) approach to address the systemic constraints limiting participation of young people in agribusiness. The identified constraints include limited access to financing, quality inputs, transparent markets, appropriate information and low skills, limiting policy, legal and regulatory frameworks. Therefore, the project focused on a facilitation approach by supporting agribusinesses and other entities that have capacity and that target existing markets.



Written by:

**Vasco Schmidt**

FAO Sub-regional Office for  
Southern Africa,  
Harare, Zimbabwe

E-mail: [Vasco.Schmidt@fao.org](mailto:Vasco.Schmidt@fao.org)



Aquaculture farm in Zambia

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The business initiatives supported include smallholders and hence reduce some market entry barriers/constraints for the poor, especially rural young women and men. In accordance with M4P facilitation principles, the project worked with government, civil society organizations and private sector players to address the constraints through the development of business models that include youth in soybean production, aquaculture and later in horticulture.

At the end of 2018, the project had supported 14 626 enterprises throughout the project life to improve their performance in production and sales, of which 8 057 enterprises were youth owned – 5 500 were owned by young men and 2 557 by young women. The project also created 5 487 additional jobs or full-time equivalent jobs, of which 2 227 were for youth – 1 491 for young men and 736 for young women. Although the project fell short of the 4 000 youth jobs target, the achievement is close to the proportion of youth in the overall Zambian labour force. Yields in aquaculture-supported initiatives

of the project have increased over four times (from 1.5 tonnes/ha per annum to 7 tonnes/ha per annum).

The project also supported the Aquaculture Development Association of Zambia (ADAZ), an association that includes farmers (commercial and smallholders), hatchery operators, feed processors and fish traders (local and importers). Through the association, Yapasa supported two major dialogue events among the stakeholders in order to understand the main challenges affecting the sector and then developed a plan of action to address the issues facing the aquaculture sector.

The project has successfully facilitated the establishment of private-sector driven input distribution models, commodities marketing models that have significantly contributed to improved access to quality inputs and markets. The close working arrangements between FAO and ILO, delivering on a joint work plan with flexible budget allocation modalities has contributed to successful implementation of the project.

# Strategy model for decent youth employment in aquaculture and related value chains



In memory of Mr SÔ Ussumane, a nuclear farmer from ASTF project in Guinea Bissau. Mr SÔ was always willing to help youth realize their potential in life be it through aquaculture farming, cassava or any other enterprise. Mr SÔ, will be dearly missed by all of us, we will miss his optimism, generosity and big happy laugh

Two consultative meetings on the “Regional level strategy model for decent youth employment in aquaculture and related value chains” took place in Addis Ababa, Ethiopia (December 2017), and Bissau, Guinea-Bissau (September 2018), within the framework of the Africa Solidarity Trust Fund (ASTF) projects (GCP/SFE/001/MUL and GCP/RAF/254/MUL).

Participants shared their experiences on aquaculture, poultry and cassava value chains and identified interventions to be undertaken by governments, international organizations, the private sector, youth organizations and other stakeholders. Participants also made recommendations to guide the design of a strategy model for decent youth employment creation in aquaculture and related value chains.

The strategy model was derived from the analysis of both the lessons learned from the ASTF project implementation and the policies and strategies



Written by:

**Ana Menezes**

E-mail: [Ana.Menezes@fao.org](mailto:Ana.Menezes@fao.org)

**Elisabetta Martone**

E-mail: [Elisabetta.Martone@fao.org](mailto:Elisabetta.Martone@fao.org)

**Pierre Murekezi**

E-mail: [Pierre.Murekezi@fao.org](mailto:Pierre.Murekezi@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy

related to the creation of decent and sustainable employment in Burkina Faso, Burundi, Kenya, Ivory Coast, Ghana, Guinea-Bissau, Nigeria Rwanda, Senegal and Uganda as well as experiences from other FAO implemented projects in Sub-Saharan Africa, in close collaboration with relevant stakeholders from the participating countries.

The main contents of the strategy model include the vision, mission, strategic objectives, guiding principles, priorities, and the role of the public and private sectors. It will be adopted and adapted at the country and regional levels to facilitate skills development and creation of decent rural employment

opportunities for youth in the aquaculture sector. It will also contribute to FAO's strategic work to reduce rural poverty by bringing together the work streams on youth employment and sustainable aquaculture development.

An FAO fisheries and aquaculture technical paper will be published in 2019 to introduce the model and provide guidance on developing a strategy model on youth employment in aquaculture at the national and regional levels.

This document is the latest of a series of FAO publications dedicated to aquaculture planning, governance and employment.



## SEE ALSO

*Aquaculture planning: policy formulation and implementation for sustainable development.*  
[www.fao.org/3/i1601e/i1601e00.htm](http://www.fao.org/3/i1601e/i1601e00.htm)

*Policy and governance in aquaculture: lessons learned and way forward.*  
[www.fao.org/3/a-i3156e.pdf](http://www.fao.org/3/a-i3156e.pdf)

*Improving governance in aquaculture employment: a global assessment.*  
[www.fao.org/3/a-i3128e.pdf](http://www.fao.org/3/a-i3128e.pdf)

*Aquaculture governance and sector development.*  
[www.fao.org/3/a-i7797e.pdf](http://www.fao.org/3/a-i7797e.pdf)

*Contract farming and public-private partnerships in aquaculture: lessons learned from East African countries.*  
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# THEMATIC ARTICLES



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## Contribution of aquaculture to total fishery production: the 50-percent mark

With fast-increasing importance in the world food production systems, aquaculture is often compared to the still larger but levelled off capture fisheries. Much attention has been paid to the 50-percent mark where farming exceeds fishing in the total farmed and wild production of aquatic species. For example, *The State of World Fisheries and Aquaculture 2018* projects that “the share of farmed species in global fishery production (for food and non-food uses)” would “exceed that of wild species for the first time in 2020” (SOFIA, 2018, p. 184).<sup>1</sup> The projection does not account for aquatic plants in global fishery production.

Indeed, if aquatic plants are included for comparison, aquaculture production has already exceeded global capture fisheries production since 2013. Aquatic plants recorded in the FAO global database are mostly seaweeds, and they contribute significantly to production tonnage as they are “heavy” items being quantified in live weight or equivalent. Thus, the practice of excluding them in the comparison between aquaculture and capture fisheries production is understandable. Yet, it is worth taking a deeper look at the 50-percent mark by species group and at the regional and national levels.

### **Aquaculture’s share in total farmed and wild production by major groups of aquatic species**

Before 1970, aquaculture was below capture fisheries in production for all major species groups (categorized by ISSCAAP

divisions).<sup>2</sup> It has progressively surpassed the 50-percent mark for nearly all the major species groups: for aquatic plants since 1970, freshwater fishes since 1986, molluscs since 1994, diadromous fishes since 1997, and crustaceans since 2014, leaving marine fishes being the only exception (Figure 1).

In 2017, the share of aquaculture in global fishery production was higher or much higher than the 50-percent mark for these major species groups: freshwater fishes (81 percent), diadromous fishes (75 percent), crustaceans (55 percent), molluscs (73 percent), and aquatic plants (97 percent).

In contrast, aquaculture contributed only 4.5 percent of global farmed and wild production of marine fishes in 2017. Marine fishes are the largest species group, accounting for 71 percent of the 94 million tonnes of global



Written by:

**Junning Cai**

E-mail: [Junning.Cai@fao.org](mailto:Junning.Cai@fao.org)

**Xiaowei Zhou**

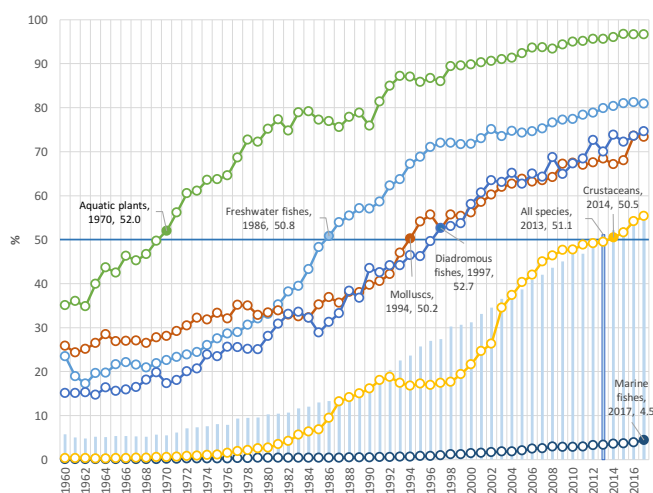
E-mail: [Xiaowei.Zhou@fao.org](mailto:Xiaowei.Zhou@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy

1. FAO. 2018. *The State of World Fisheries and Aquaculture 2018*. Rome. [www.fao.org/3/I9540EN/i9540en.pdf](http://www.fao.org/3/I9540EN/i9540en.pdf)

2. The International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) includes nine ISSCAAP divisions, among which freshwater fishes, diadromous fishes, marine fishes, crustaceans, molluscs and aquatic plants are deemed major species groups in this article. [www.fao.org/tempref/FI/DOCUMENT/cwp/handbook/annex/AnnexS2listISSCAAP2000.pdf](http://www.fao.org/tempref/FI/DOCUMENT/cwp/handbook/annex/AnnexS2listISSCAAP2000.pdf)

**FIGURE 1 – Share of farmed species in global aquaculture and fisheries production by ISSCAAP Division of aquatic species (1960–2017)**



Data source: FAO Global Fishery and Aquaculture Production Statistics v2019.1.0 published through FishStatJ (March 2019; [www.fao.org/fishery/statistics/software/fishstatj/en](http://www.fao.org/fishery/statistics/software/fishstatj/en)).

Note: Constructed by the FAO WAPI Aquaculture Production Module (WAPI-AQPRN); see Figure 5.2 in WAPI-AQPRN v.2018.1 for a prototype. [www.fao.org/fishery/statistics/software/wapi/en](http://www.fao.org/fishery/statistics/software/wapi/en)

capture production and 34 percent of the 206 million tonnes of global production of capture and aquaculture combined in 2017. Thus, the small share of marine fishes in global aquaculture production (only 2.8 percent in 2017) makes aquaculture’s overall contribution to global fishery production less impressive than that revealed by examining individual species groups.

With all species included (except for species that are mostly measured by number instead of tonnage for production statistics, such as crocodiles, dolphins and whales), aquaculture’s share in global fishery production has been over the 50-percent mark since 2013 and reached 54 percent in 2017 (Figure 1). Yet, for fish and seafood (including finfish, crustaceans, molluscs and miscellaneous aquatic animals, but excluding aquatic plants and miscellaneous aquatic animal products), the aquaculture share is only 46 percent in 2017.

**Aquaculture’s share in total farmed and wild production at the regional level**

Aquaculture’s over 50 percent share in global wild and farmed production of aquatic species in

2017 (54 percent to be exact) is primarily attributable to Asia (Table 1), which accounts for 74 percent of global farmed and wild production (92 percent and 53 percent in aquaculture and capture fisheries, respectively).

Aquaculture in developing regions as a whole accounts for 61 percent of their total production in 2017 (Table 1).<sup>3</sup> This reflects the dominance of aquaculture in Asia (68 percent of its total fishery production), whereas the aquaculture share in other developing regions is well below the 50-percent mark: Africa (19 percent), Latin America and the Caribbean (20 percent) and the Pacific Islands (3 percent).

**TABLE 1 – Aquaculture’s share in total farmed and wild production at the regional level**

Region	Year 2017		
	Aquaculture production in each region (tonnes)	Each region’s share in world aquaculture production (%)	Aquaculture’s share in total farmed and wild production in each region (%)
<b>World</b>	<b>111 946 623</b>	<b>100.00</b>	<b>54.45</b>
Developed regions	4 873 717	4.35	16.21
Developing regions	107 072 906	95.65	61.00
Least developed countries	4 119 845	3.68	29.71
Landlocked developing countries	445 937	0.40	25.31
Small Island Developing States	71 530	0.06	4.06
<b>Africa</b>	<b>2 214 143</b>	<b>1.98</b>	<b>18.53</b>
Sub-Saharan Africa	737 668	0.66	8.70
Eastern Africa	343 672	0.31	14.19
Middle Africa	7 711	0.01	0.61
Southern Africa	8 062	0.01	0.78
Western Africa	369 222	0.33	9.96
Northern Africa	1 485 475	1.33	42.24
<b>Americas</b>	<b>3 591 458</b>	<b>3.21</b>	<b>16.76</b>
Latin America and the Caribbean	2 960 084	2.64	20.28
Caribbean	36 710	0.03	11.89
Central America	395 950	0.35	16.22
South America	2 527 424	2.26	21.34
Northern America	631 374	0.56	9.24
<b>Asia</b>	<b>102 896 169</b>	<b>91.92</b>	<b>67.51</b>
Central Asia	56 638	0.05	41.82
Southern Asia	9 177 843	8.20	49.84
Eastern Asia	68 598 598	61.28	76.30
South-Eastern Asia	24 652 001	22.02	58.15
Western Asia	411 088	0.37	26.16
<b>Europe</b>	<b>3 010 268</b>	<b>2.69</b>	<b>16.63</b>
Eastern Europe	339 088	0.30	6.08
Northern Europe	1 757 837	1.57	19.96
Southern Europe	644 095	0.58	30.04
Western Europe	269 249	0.24	17.03
<b>Oceania</b>	<b>234 586</b>	<b>0.21</b>	<b>13.97</b>
Australia and New Zealand	210 495	0.19	25.58
Pacific Islands	24 091	0.02	2.81

Data source: FAO Global Fishery and Aquaculture Production Statistics v2019.1.0 published through FishStatJ (March 2019; [www.fao.org/fishery/statistics/software/fishstatj/en](http://www.fao.org/fishery/statistics/software/fishstatj/en)).

Note: Constructed by the FAO WAPI Aquaculture Production Module (WAPI-AQPRN); see Table 2.1 in WAPI-AQPRN v.2018.1 for a prototype. [www.fao.org/fishery/statistics/software/wapi/en](http://www.fao.org/fishery/statistics/software/wapi/en). Production including all species measured in tonnage.

3. According to the United Nations designation, developed regions include Europe, Northern America, Australia, Japan and New Zealand, whereas other countries or territories are considered developing regions.

Compared to other developing regions (except for developing regions in Asia), the least developed countries and landlocked developing countries have a relatively high aquaculture share in their total production (30 percent and 25 percent, respectively). This reflects the dearth of capture fisheries resources in these countries. Small Island Developing States, on the other hand, have the lowest aquaculture share in their total production (only 4 percent), reflecting their abundant marine capture fisheries resources relative to their small populations.

Aquaculture in developed regions as a whole accounts for only 16 percent of their total production in 2017. Among individual developed regions, Australia and New Zealand (as a georegion) and Japan have a relatively high aquaculture share (26 percent and 24 percent, respectively), whereas the share is lower for Europe (17 percent) and the lowest for Northern America (9 percent).

### Aquaculture's share in total production at the national level

Only 40 countries out of the 196 countries (or territories)<sup>4</sup> with aquaculture production in 2017 recorded in FAO's global statistics system passed the 50-percent mark for farming over fishing in their national total farmed and wild production (Figure 2). Yet, these 40 countries account for 51 percent of the world population in 2017.

Nearly half of the 196 countries (96 to be exact) are below the 10-percent mark (79 countries below the 5-percent mark), yet the 96 countries collectively accounted for 19 percent of the world population and less than 1 percent of global aquaculture production in 2017.

Among the top-10 countries with the largest total farmed and wild

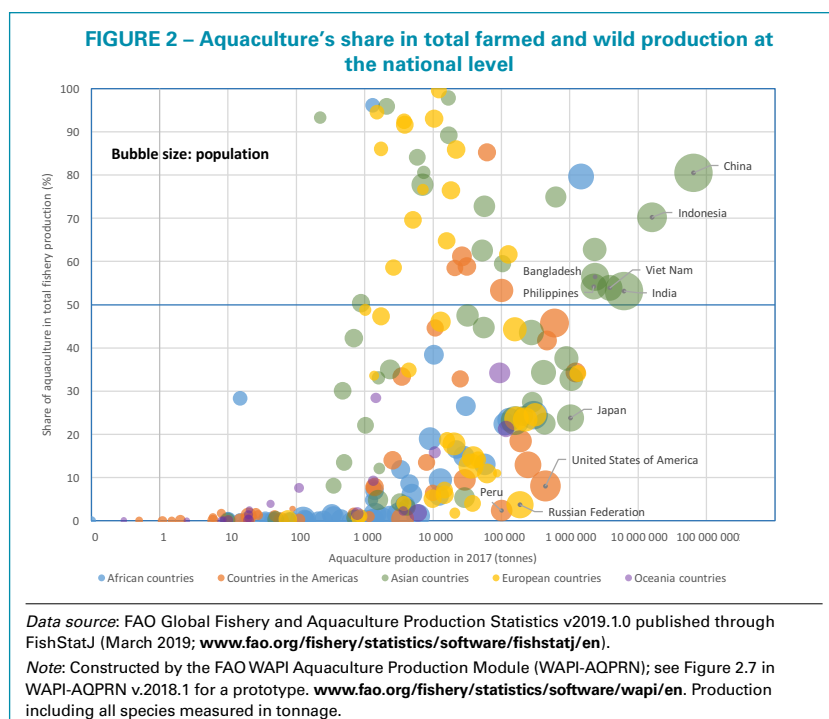
production in 2017, six exceed the 50-percent mark (i.e. China 81 percent, Indonesia 70 percent, India 53 percent, Viet Nam 54 percent, Bangladesh 56 percent and the Philippines 54 percent); the other four are still well below the 50-percent mark (i.e. Japan 24 percent, the United States of America 8 percent, the Russian Federation 4 percent and Peru 2 percent) (Figure 2).

### Summary

The champions and key stakeholders of aquaculture are often pleased with the sector's overall global performance and look forward to a time when global aquaculture production exceeds that of capture fisheries even without the inclusion of aquatic plants. However, this analysis reveals that the impressive aquaculture growth over past decades may not be visible in many places worldwide because of the greatly imbalanced aquaculture production contribution and growth when considered in the context of species groups and at the regional and national levels.

The experience of aquaculture development in Asia (growing nearly 9 percent a year from less than a half million tonnes in 1950 to over 100 million tonnes in 2017) is encouraging and being repeated in some other developing regions. The aquaculture growth rate since the turn of the millennium (2000–2017) is 9.8 percent for Africa, 7.5 percent for Latin America and the Caribbean, 9.3 percent for the least developed countries, and 11 percent for landlocked developing countries. However, aquaculture growth in some developing regions (e.g. Small Island Developing States) and in developed regions in general is yet to accelerate.

The encouraging evidence of booming aquaculture in both advanced and less advanced fish farming regions and the development and expansion of novel and niche species, together with the ongoing stagnation of capture fishery yields, foretell that the 50-percent mark will be surpassed by more and more countries and will soon become a historical milestone of aquaculture growth.



4. Unless specified otherwise, in this article the term country includes non-sovereign territory.

# Agroecology in aquaculture

In a context of emerging uncertainties, limited resources and increasing environmental degradation, it is becoming widely accepted that new food production systems will be needed to meet the demand of a growing rural and urban population, while satisfying increasingly demanding consumers, preserving natural resources and adapting to climate change.

Agroecology is an integrated approach that simultaneously applies ecological and social principles to the design and management of food and agricultural systems in order to optimize the interactions between plants, animals, humans and the environment. It is not new, as the term was first used in the 1920s to refer more restrictively to “the application of ecology to agriculture”, but since then it has developed and become frequently used around the world.

Unlike other approaches like climate-smart agriculture that are objective-driven, agroecology is a principle-driven approach that encompasses many different visions of development, as highlighted by some twenty definitions that FAO captured in its website on agroecology. In an attempt to operationalize and upscale agroecology, FAO identified 10 principles on which most, if not all, approaches to agroecology rely.



Written by:

**Matthias Halwart**

E-mail: [Matthias.Halwart@fao.org](mailto:Matthias.Halwart@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy

**Lionel Dabbadie**

CIRAD Scientist

E-mail: [Lionel.Dabbadie@fao.org](mailto:Lionel.Dabbadie@fao.org)

**Malcolm C.M. Beveridge**

United Kingdom

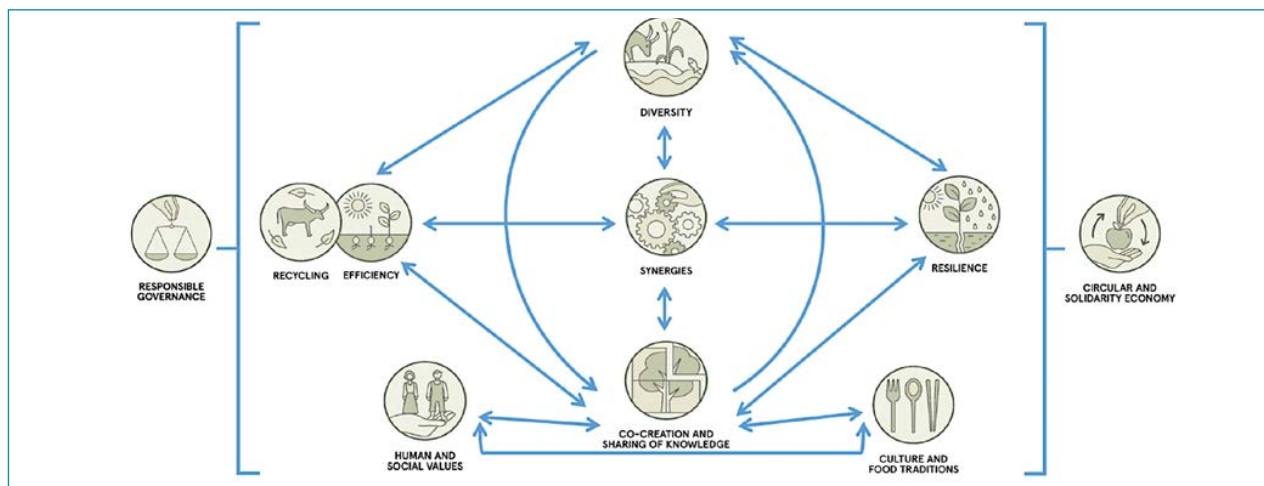
E-mail: [MalcomBeveridge925@gmail.com](mailto:MalcomBeveridge925@gmail.com)



Integrated pig and fish farming (common carp, tilapia) in Southern Brazil

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- Diversity: Diversification is key to agroecology transitions to ensure food security and nutrition while conserving, protecting and enhancing natural resources.
- Co-creation and sharing of knowledge: Adoption and upscaling of innovations in aquaculture respond better to local challenges when they are co-created through participatory processes.
- Synergies: Building synergies enhances key functions across food systems, supporting production and multiple ecosystem services. Aquaculture can be designed to generate and enhance ecosystem services as well as consume them.
- Efficiency: Innovative agroecology practices produce more while using less external resources. This is particularly critical for aquaculture, too. Wastes and losses can be reduced or production per unit of resource consumed, increased. Examples include selective breeding for feed consumption efficiency, recirculated aquaculture systems where aquaculture wastewater can even be used to grow salad and other crops in aquaponic systems.
- Recycling: More recycling means agricultural production with lower economic and environmental costs. Aquaculture can be incorporated into farming systems to utilize wastes from crop and livestock production or to supply nutrient-enriched wastewater for irrigation (e.g. desert aquaculture in countries such as Egypt).
- Resilience: Diversification of agriculture systems to include aquaculture can help build resilience of people, communities and ecosystems to external shocks, including climate change.
- Human and social values: Protecting and improving rural livelihoods, equity and social well-being is essential for sustainable food and agricultural systems.
- Culture and food traditions: By supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems.
- Responsible governance: Sustainable food and agriculture requires responsible and effective governance



mechanisms at different scales – from local to national to global.

- Circular and solidarity governance: Circular and solidarity economies that reconnect producers and consumers provide innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development.

The traditional, centuries-old integrated agriculture-aquaculture (IAA) is a good example of successful agroecology, and because the sector evolves dynamically, the principles of agroecology are still highly relevant for managing the transitions to more adaptive, efficient and resilient integrated systems. Although the ecological bases of traditional IAA have been extensively studied, the new systems are frequently poorly known and should deserve a thorough assessment of their comparative performance in relation to the ten principles of agroecology. A new multisector evaluation methodology is thus currently being developed by the FAO agroecology working group to allow for this.

But agroecology does not target a specific aquaculture model. Even though centuries-old traditional practices are by nature more compliant than industrial aquaculture with agroecology

principles, transition towards agroecology is relevant for all as it allows to bring solutions to some of the constraints that current production models are facing. In Ireland, for example, farmed Atlantic salmon production has fallen substantially in recent decades. The national strategic plan for the sector has ambitions to grow cage farming of Atlantic salmon, but rather than trying to compete on price with much larger producing countries, it must conform to the country's ambitions to be one of the most important producers of high-quality, organic foods in the European Union and complement tourism. It thus seeks to encourage the development of small, sensitively sited, family-owned organic salmon farming and seafood processing businesses, embodying many of the principles of agroecology. Tourists undertaking the Wild Atlantic Way, Ireland's spectacular coastal route, are also encouraged to engage with artisanal aquaculture producers – of seaweed, oysters, mussels and salmon – as part of the experience. Other European Union national aquaculture plans show

similar integration within a Blue Economy framework and include agroecology elements.

As a framework for sustainable development, agroecology is now high on the international development agenda to look for local solutions, to keep farmers in the field with improved livelihoods and a better quality of life, and to cope with planetary boundaries. A major challenge, however, remains: its upscaling. Farmers' awareness and knowledge-sharing are frequently mentioned as a major limitation for this. Approaches based on farmer-to-farmer learning and sharing are generally recognized as highly efficient in this regard. Agroecology also seems to be beneficial for small-scale farmers, but the risk of adoption is not negligible and some stakeholders may prefer to be less profitable but with more secure options ("staying poor to stay secure"). Thus, the specific constraints of small-scale farmers need to be better documented. With this, agroecology in aquaculture has the potential to support the transition towards new models that will allow the sector to fulfil its challenges.



#### SEE ALSO

Agroecology Knowledge Hub: [www.fao.org/agroecology/home/en/](http://www.fao.org/agroecology/home/en/)

FAO Video: [www.youtube.com/watch?v=rwdH813SehU](https://www.youtube.com/watch?v=rwdH813SehU)

Advancing Integrated Agriculture-Aquaculture through Agroecology. FAN 59. October 2018: [www.fao.org/3/CA2325EN/ca2325en.pdf](http://www.fao.org/3/CA2325EN/ca2325en.pdf)

# The gender triad, a new paradigm for gender mainstreaming in aquaculture

Over nineteen million people are engaged in aquaculture worldwide,<sup>1</sup> with women making up half of the workforce in the primary sector, and a greater proportion when pre-harvesting, post-harvesting and marketing sectors are included in statistics. However, women often occupy the most unstable roles, are assigned poorly paid or unpaid positions, and are often under-recognized, suffering from invisibility within workplaces, households and communities. This highlights the need to rethink systems to deliver sustainable development for all, by addressing the inequalities faced by women working in aquaculture.

Changing the current paradigm requires to conduct a gender analysis from which a thorough gender strategy should emerge. This should consist of an analysis of gender dynamics underlying production, within the workplace, within households and across the community. This includes the reporting on the importance of perceptions, essential to break the cycle of invisibility and to allow equitable access to knowledge.

## The Gender Triad

FAO published its gender policy in 2013 and has since used and implemented various methodological approaches



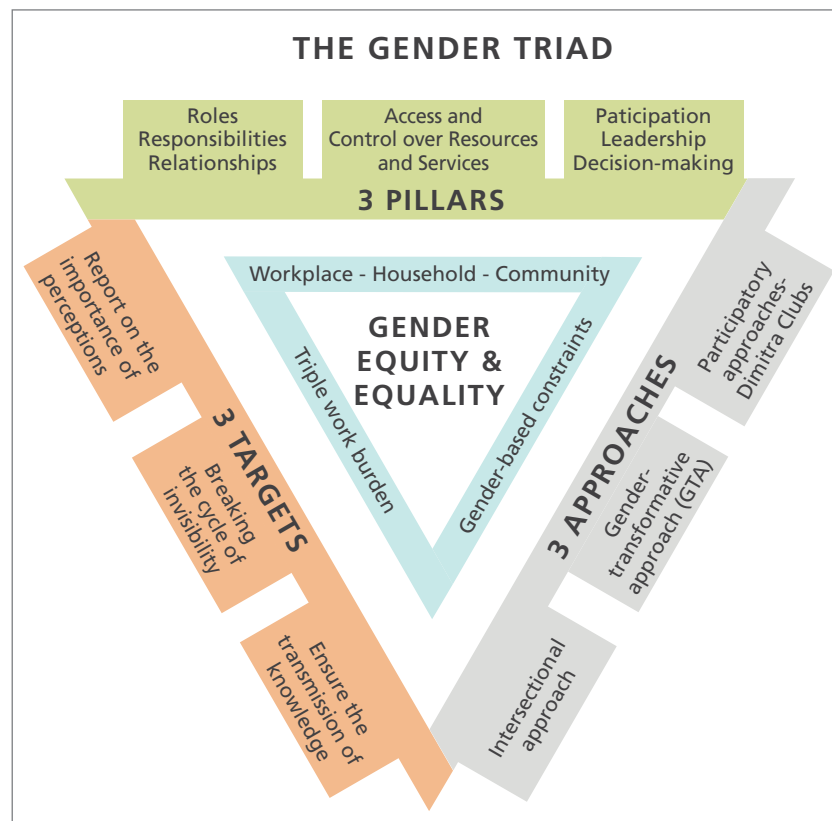
Written by:

**Roxane Misk**

FAO Intern

E-mail: [Roxane.Misk@fao.org](mailto:Roxane.Misk@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy



to address gender inequality.<sup>2</sup> These approaches, which all focus on the three pillars that compose a gender analysis, can be complementary and interconnected. Together, they cover the three levels of analysis (workplace, household and community levels) essential to understand the work burden of fishermen and fisherwomen. Collectively they highlight three targets as mentioned above (perceptions, invisibility and knowledge access). Thus gender, as it is developed in FAO literature, seems to be structured around the number three. This gives birth to the concept of the Gender Triad, which brings together all the key elements to be addressed when it comes to gender mainstreaming and gender analysis.

Gender refers to the socially constructed roles, behaviours, activities and attributes considered as appropriate for women and men and can result in discrimination. Other discrimination based on race, ethnicity, religion, sexual orientation, socio-economic status, age or disability can also arise<sup>3</sup>. *Intersectional Approaches* make room for intersecting those factors, to reflect the complexity of identities and the discriminations related to them. They are particularly useful in aquaculture, a sector that involves complex relationships between activities and actors.<sup>4</sup> *The Gender Transformative Approach (GTA)* seeks to address the underlying causes deeply rooted in gender norms and behaviours, power



relations and social institutions. Participatory approaches, such as *FAO Dimitra Clubs*,<sup>5</sup> consist of groups of women, men and young people who gather to discuss, make decisions and take action to resolve their problems at the community level. They enhance networking and include access to relevant information and communication that is responsive to their needs and builds their autonomy and the decision-making capacity of the members.

### The scope and potential for gender inclusiveness in pond aquaculture and rice-fish farming

Aquaculture is considered a good opportunity for the inclusion of women in the workplace, as it can be carried out with minimal daily workload and is frequently located close to homesteads, thus reducing travel constraints and associated risks of violence. An FAO and WorldFish case study conducted in 2017 in Bangladesh showed that pond aquaculture facilitates women's decision-making on the consumption and provision of nutritious food. More equitable power relations within some households were established due to women's participation in income after being trained. An increased use and control of resources and income by women has been observed following their engagement in aquaculture, as well as an improvement of awareness of their rights and self-confidence.<sup>6</sup> Pond aquaculture can also contribute to women's empowerment by reducing their dependence on their husbands and other family members, and increasing the respect accorded to them. To a certain extent, aquaculture training helps rural women plan for their future and stand up for their life choices. This includes key aspirations for their children to be educated and

successful, as well as buying land, paying off debt and investing in new businesses.

Similarly, integrated rice-fish farming allows women to increase household income and improve their visibility and empowerment. Culturing fish in rice fields provides an additional source of income used to meet family consumption needs and to support children's education. This was confirmed in an FAO study conducted in 2017 that explored the gender dimensions of rice-shrimp culture in the Philippines.<sup>7</sup> This study emphasized the need to look beyond core productive activities to complementary activities such as vegetable production, where women are very active and could be targeted with technology. This system involves greater risks and challenges compared to

double rice cropping, but these are outweighed by the social and economic benefits that arise.

The Aquaculture Branch at FAO is following a similar path by designing a survey aimed at collecting sex-disaggregated data on rice-fish farming in the Honghe Hani Terraces of Yunnan Province in Southern China. The objective is therefore to support the implementation of inclusive techniques for women and to work towards gender equity and gender equality.



Asset ownership, control and access mapping exercise with Hindu women's group in Bangladesh

© CGIAR RESEARCH PROGRAMME ON FISH, AGRICULTURE AND FOOD SYSTEMS (FISHERY)/WORLD FISH



### SEE ALSO

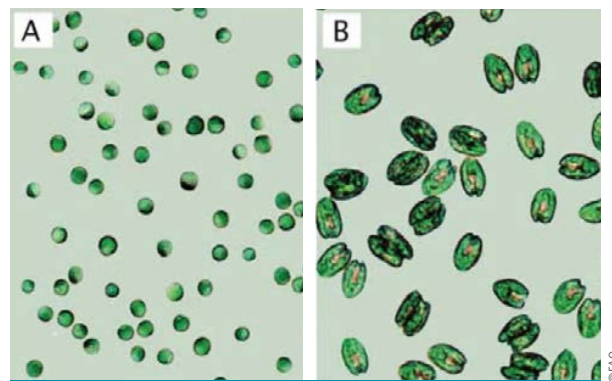
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# Microalgae in aquatic animal feeds

Fishmeal and fish oil are important aquafeed ingredients due to their unique nutritional profiles and excellent bioavailability across a wide range of farmed food fish species. However, the rapid expansion of aquaculture during the past decades has fuelled concerns regarding the overexploitation of some wild fish stocks. Although aquaculture innovation has led to a significant reduction in the amounts of fishmeal and fish oil used in aquaculture feeds, an undesirable result has been a declining nutritional value of farmed products for human consumption. Therefore, finding alternative aquafeed ingredients with a comparable nutritional value to fishmeal and fish oil remains high on the research agenda for sustainable aquaculture, and microalgae have a strong potential in this regard.

The nutritional value of microalgae can vary substantially between species, due to production methods or processing into functional aquafeeds. The microalga *Chlorella sorokiniana* and the cyanobacterium *Spirulina platensis* have similar levels of strongly bioavailable crude protein and essential amino acids to

anchovy fishmeal. Some marine microalgae such as *Nannochloropsis*, *Isochrysis* and *Schizochytrium* can produce large quantities of the n-3 polyunsaturated fatty acids (PUFAs), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), making them good candidates to replace fish oil in aquaculture feeds. Despite higher initial investments and running costs and a greater need for maintenance, photobioreactors offer a greater control of environmental conditions than open ponds, including temperature, pH, salinity and nutrient contents. The quantity of carbon, nitrogen (N) and phosphorous (P) present, as well as the N:P ratio, can significantly affect growth rates, as well as the quality and quantity of the macronutrients produced. This is especially useful when producing a fish oil replacement, as the amount of PUFA produced, as well as the EPA:DHA ratio, can vary significantly and should be optimized to fit fish nutritional requirements and for flesh composition. The nutritional value of several microalgae strains can be increased by using molecular techniques, including genomics, proteomics and lipidomics, as well as genetic modification. Before these production systems become operational on a large scale, it will be necessary to carry out further *in vivo* digestibility experiments in fed species, including proximate analyses of food fish tissues,



Photomicrographs of two algal species commonly cultured in hatcheries, *Isochrysis* sp. (A) and *Tetraselmis* sp. (B) showing the relative difference in cell size

and to solve any subsequent issues due to the presence of antinutritional factors.

The current market demand for microalgae is still limited because of the ready availability and low price of fishmeal. Further research must be carried out to identify optimal environmental culture conditions for several microalgae species in order to guarantee their nutritional and economic values. The bioavailability of microalgae meals and oils should be assessed in several food fish species. Research should be undertaken to ensure the efficiency of production systems, including the use of integrated systems, as well as harvesting and lipid extraction techniques.

In order for microalgae to replace a substantial quantity of the fishmeal and fish oil used in global aquaculture, production will need to be upscaled significantly. It will be necessary to build awareness amongst potential stakeholders and set some guidelines and legislation to ensure that the microalgae produced are safe and nutritious, sustainably produced, and readily affordable for use in a number of markets and regions.



Written by:

**Sebastian Sims**

FAO Intern

E-mail: [Sebastian.Sims@fao.org](mailto:Sebastian.Sims@fao.org)

**Oluwafemi Ajayi**

FAO Consultant

E-mail: [Oluwafemi.Ajayi@fao.org](mailto:Oluwafemi.Ajayi@fao.org)

**Rodrigo Roubach**

FAO Fisheries and Aquaculture  
Department, Rome, Italy

E-mail: [Rodrigo.Roubach@fao.org](mailto:Rodrigo.Roubach@fao.org)

# The sustainable development goals and the economic contribution of fisheries and aquaculture

The 2030 Agenda for Sustainable Development is built on 17 Sustainable Development Goals (SDGs), which are global objectives that all members of the United Nations have agreed to pursue and implement.

The SDGs are shaping the development agendas of countries, setting a new policy framework focused on ending all forms of poverty, reducing inequality and tackling climate change, with inclusive development at the heart of all policies. There are 17 SDGs, with 169 targets and 232 related indicators that monitor progress in social, economic and environmental development.

FAO is currently the custodian agency responsible for monitoring and reporting on four of the indicators related to SDG 14, which aims to “conserve and sustainably use the oceans, seas and marine resources for sustainable development”.

Recently, FAO succeeded in establishing an internationally recognized methodology for indicator 14.7.1, which monitors

the economic contribution of marine resources to national economies through fisheries by calculating sustainable fisheries as a percentage of gross domestic product (GDP).

## **SDG 14**

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

### **SDG 14.7.1**

By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism.

### **Indicator 14.7.1**

Sustainable fisheries as a percentage of GDP in small island developing States, least developed countries and all countries.

The methodology designed by FAO is built on international standards, namely, GDP, the value added of fisheries and the biological sustainability of fish stocks. All of these inputs are utilized by international agencies, policy makers and public bodies, among others, for informing decision making and planning.

GDP represents the value of final goods and services produced by a country. When conducting analysis at a sector level, such as was done for fisheries, the value added gives a representative figure for the size of an industry within a country's economy.

Regarding the biological sustainability of fish stocks, FAO

has been assessing trends since 1974, with current coverage of 584 fish stocks globally (about 70 percent of global landings). Statistics on global fish production and stock status are main outputs from FAO, and are utilized in internationally recognized publications, such as *The State of World Fisheries and Aquaculture* (SOFIA) and the *Review of the State of World Marine Fishery Resources*.

An indicator to monitor the economic contribution of sustainable fisheries may provide a better picture of the real importance of fisheries in national economies, ensuring a more balanced allocation of resources that may benefit the sector. During the development of this methodology, many countries endorsed this aspect of recognizing the importance of the fish sector to the economy.

Given the global nature of the SDGs, indicator 14.7.1 was developed to be applicable to as many countries as possible, while keeping to a minimum any additional reporting requirements for countries by using internationally accepted and already available inputs for the calculation.

This indicator integrates economic contribution with sustainability. The direct value of fish from marine capture fisheries is obtained from national accounts. This figure is then adjusted by the regional sustainability of fishing grounds fished by individual countries to obtain the value of sustainable marine fisheries.



Written by:

**William Griffin**

E-mail: [Michael.Griffin@fao.org](mailto:Michael.Griffin@fao.org)

**Weiwei Wang**

E-mail: [Weiwei.Wang@fao.org](mailto:Weiwei.Wang@fao.org)

**Marcio Castro de Souza**

E-mail: [Marcio.CastrodeSouza@fao.org](mailto:Marcio.CastrodeSouza@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy

However, the current SDG indicator 14.7.1 only deals with marine capture fisheries.

Aquaculture is financially significant for many countries, and looking to the future this is likely only to increase. In 2016, aquaculture represented 53 percent of global fish production, with total first sale value at USD 232 billion, equivalent to two-thirds of total sales (FAO. 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals*. Rome). With the current global expansion of aquaculture production, its essential role for food security in developing countries and Small Island developing States is only increasing.

The differences that exist between marine capture, inland capture and aquaculture are such that any indicator trying to monitor them as one would lead to inadequate analysis of each. They are individually important enough to merit separate consideration, and require incorporation of their unique characteristics.

Greater awareness of fisheries and aquaculture will allow governments to set better policies, and to craft measures tailored to the sector, ultimately improving fisheries governance and management such that the sustainable use of resources is fostered.

Fish and fish products are economically significant, regardless of whether originating from wild capture or from aquaculture. While economic contribution should not be taken as the sole importance of a sector, it is none the less vital to understand the base economic contribution of fisheries and aquaculture. The significance of the fisheries and aquaculture sector extends to employment, social aspects such as gender issues, and food security. In addition, upstream activities, such as post-harvest processing, are significant and may be more important to many countries than the value of fish as a primary resource.

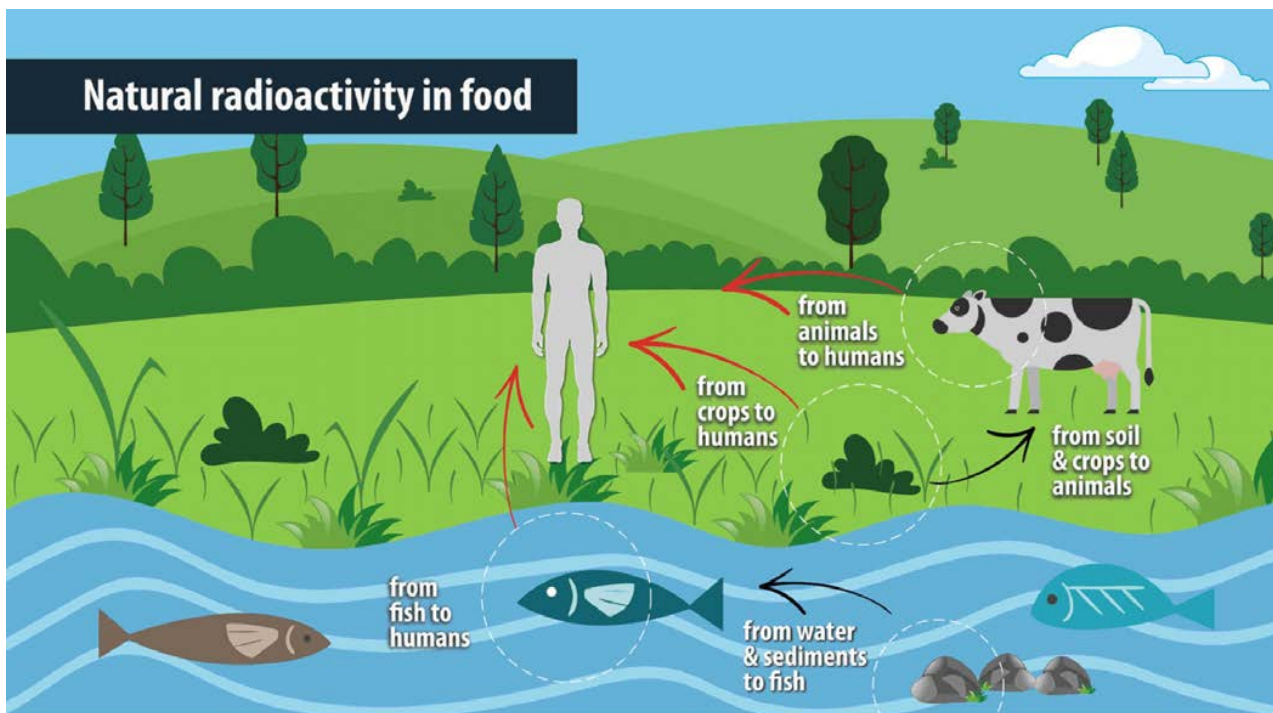
A similar indicator developed specifically to monitor the

economic contribution of aquaculture to the national economy, and as a proportion of the primary sector (agriculture, fisheries and forestry), could help direct policy initiatives, which will be particularly important given the continued upward trend of aquaculture production.

The current framework established by FAO for indicator 14.7.1 is able to provide a robust and internationally applicable measure for the economic contribution of sustainable marine capture fisheries. This approach may provide a good base for the creation of a new indicator that is able to calculate the economic contribution of aquaculture. The inclusion of such a vital and growing sector within the SDGs work plan will assist governance of the fisheries and aquaculture sector, while also ensuring that the pillars of the SDGs are upheld, namely leaving no one behind while promoting the sustainable use of the resources and sustainable economic activities.



# Evaluating the impact of aquaculture on natural radioactivity in diets



While extensive research has been carried out on the transfer of artificially produced radionuclides from animal feeds to animal products and their behaviour in aquatic ecosystems, much less is known about the behaviour of naturally occurring radionuclides. Recently, the International Atomic Energy Agency and FAO have jointly considered the possible impact of aquaculture on the radiation doses received by consumers. Radioactive material is naturally present in the environment since

the formation of the Earth many millions of years ago. These so-called "radionuclides" \* are present in variable amounts in all rocks and soil and can be transferred to crops and then consumed by humans and by domestic and wild animals. In the freshwater and marine environments, radionuclides can also accumulate in different primary producers on the aquatic food chain, i.e. phytoplankton and zooplankton organisms, and are found to some extent in all fishery products.

Historically, little attention has been given to the presence of naturally occurring radionuclides in foods, despite the fact that they are the dominant source of radiation dose from the diet.<sup>1</sup> However, in 2018, the International Atomic Energy Agency, together with FAO and

the World Health Organization, commissioned work to assess how relevant these levels of radionuclides in different foods and the resulting distribution of radiation doses received.

The concentrations of naturally occurring radionuclides are highly variable both within and between food groups. The radiation dose that individuals will receive from the diet is also highly variable, depending on food preferences. The radionuclide/food group combinations that often dominate in terms of radiation dose are radium-226 in cereals and polonium-210 in fisheries products. The highest concentrations of polonium-210 are normally found in molluscs, followed by crustaceans, and small and large fish. The reasons for this are not fully understood, but in the case of molluscs, it



Written by:

**Rodrigo Roubach**

FAO Fisheries and Aquaculture  
Department, Rome, Italy

E-mail: [Rodrigo.Roubach@fao.org](mailto:Rodrigo.Roubach@fao.org)

**Tony Colgan**

International Atomic Energy Agency

E-mail: [T.Colgan@iaea.org](mailto:T.Colgan@iaea.org)

\* Radionuclides are atoms that emit radiation as they undergo radioactive decay through the emission of alpha particles ( $\alpha$ ), beta particles ( $\beta$ ), or gamma rays ( $\gamma$ ).

may be due, at least in part, to its feeding mechanism. Higher concentrations are often observed in species in the marine environment compared with freshwater ecosystems.

Historically, most fishery products have been sourced from the wild, but over the past decades, the aquaculture industry has grown substantially and now represents more than half of the worldwide production.<sup>2</sup> This contribution is expected to increase in the future, in line with the demands of an increasing worldwide population for protein and the inability to significantly expand wild caught supply.

Around half of the world aquaculture production is artificially fed. In such cases, one would anticipate that the concentrations of radionuclides in the flesh would be more related to the concentrations in the feed than to those in the environment. In farmed Atlantic salmon produced in Norway, the concentrations of polonium-210 are over 50 times lower than in other marine fish.<sup>3</sup> However, in the same study, the concentrations of lead-210 observed in Atlantic salmon and other marine finfish were similar. A study on the radionuclide content of artificially fed marine and freshwater fish in Spain also reported very low concentrations of polonium-210.<sup>4</sup> However, one should not read too much into these observations – the scientific literature on the concentrations of naturally occurring radionuclides in farmed fishery products and the transfer from different feeds and

under different feeding regimes is extremely sparse.

Given the increasing importance of the aquaculture industry and its economic value in many countries, a better understanding of the behaviour of both naturally occurring and artificially produced radionuclides could be of considerable benefit in ensuring the continued high quality of the product.

Controlling the radionuclide content of fish feed is a useful means of ensuring that applicable food standards can be met. The implications for radiation exposure from the diet are not so important at the global level, but may be at the national and “heavy consumer” level.

In summary, limited published data suggest that the concentration of the radionuclide polonium-210, an important contributor to radiation doses from the diet, in farmed fish that are fed artificially may be lower

than that in fish captured in the wild. Among all fish products, molluscs normally contain the highest concentrations of polonium-210; as molluscs are normally not fed artificially, the concentrations in wild and farmed animals would be expected to be similar. Controlling the radionuclide content of fish feeds can ensure that the corresponding radionuclide concentrations in the animals remain low.

Given the increasing importance of the aquaculture industry, more laboratory and field studies would clearly be beneficial, especially considering the diversity and forms of aquaculture production systems and species being produced. However, for monitoring programmes, it may not always be possible to differentiate between wild and farmed species (not always advertised in markets or shops).



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# Towards guidelines on sustainable aquaculture

During the last session of the FAO Committee on Fisheries (COFI), the Committee stressed the increasing importance of aquaculture for food security and nutrition, improved livelihoods, poverty alleviation, income generation, as well as job creation and trade, especially for small-scale producers, and aquaculture's potential to meet the growing demand to fill the gap in global fish supply. In conjunction with the sustainable management of fisheries, the increasing reliance on aquaculture requires substantial effort to be put into fostering the sustainable development of aquaculture production. From the FAO Code of Conduct for Responsible Fisheries and its related instruments to the 2013 launch of the Blue Growth Initiative, FAO has actively supported ways to balance economic growth, social development, food security, and sustainable use of aquatic living resources on global, regional and national levels. However, due to the particularities of countries and regions, aquaculture development has not been uniform and shows different practices and norms, some of which are detrimental to the environment and socio-economic fabric, but also many

others that have advanced the sector. For this reason, it was noted that there is a growing need for implementation of best practices in aquaculture in many countries and regions. COFI thus recommended that FAO develop global guidelines for sustainable aquaculture development.

During the last few decades, aquaculture growth has been exponential, and this trend will need to continue to sustain the provision of food and livelihoods to a population of more than 9 billion people by the year 2050, while also addressing the disproportionate impacts of climate change and environmental degradation. Although successful, aquaculture development has sometimes come with social and environmental costs, including unsustainable water or natural feed use, mangrove destruction and biodiversity loss. With the growing importance of aquaculture, the cumulative effects of the industry started to become significant, at least in some regions. Moreover, despite its global success, the disparity in the level of aquaculture sector development and uneven production distribution remain significant among countries within regions and across the world.

Nonetheless, many countries have implemented various strategies in support of successful and sustainable aquaculture development, some of which include technology-intensive innovations, innovative governance, certifications and other good practices. Harnessing the opportunity of aquaculture production in a sustainable manner that is responsive to environmental

and anthropological challenges requires the establishment of enabling policy frameworks to foster the adoption of sound aquaculture production practices. The last Ninth Sub-Committee on Aquaculture of COFI called for identifying such initiatives and for documenting and compiling them into Sustainable Aquaculture Guidelines (SAG) aimed at helping countries to achieve a better implementation of the Code of Conduct for Responsible Fisheries (CCRF), while engaging and enabling their aquaculture sector to effectively participate in the implementation of the 2030 Agenda for Sustainable Development.

A first review has identified the gaps between the existing FAO guidance and tools and the provisions included in the CCRF and the 2030 Agenda. A draft of the scope, content and methodology for SAG has been developed, which will be further discussed during a Global Expert Consultation that took place in June 2019 in Rome. It is suggested for SAG to include three components:

- Component 1: Possible pathways towards successful implementation of sustainable aquaculture in different regional contexts, based on case studies of accomplishments in comparable settings or regions.
- Component 2: A series of practical thematic modules describing the rationale and attributes for approaches and practices on each specific topic, the existing guidelines and the key recommendations for successful implementation and capacity development, based on the achievements and



Written by:

**Rodrigo Roubach**

E-mail: [Rodrigo.Roubach@fao.org](mailto:Rodrigo.Roubach@fao.org)

**Ana Menezes**

E-mail: [Ana.Menezes@fao.org](mailto:Ana.Menezes@fao.org)

**KwangSuk Oh**

E-mail: [KwangSuk.Oh@fao.org](mailto:KwangSuk.Oh@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy

**Lionel Dabbadie**

CIRAD Scientist

E-mail: [Lionel.Dabbadie@fao.org](mailto:Lionel.Dabbadie@fao.org)

difficulties highlighted by case studies.

- Component 3: A series of case studies describing the process, the accomplishments and the constraints, to illustrate the possible pathways and thematic factsheets.

The thematic modules of the SAG will cover both the aquaculture farms and their wider environments (e.g. at the sector, value chain, landscape, territory, country and region levels). At the farm level, the thematic modules will focus on business management, site selection, risk assessment and mitigation measures, system construction, engineering or rehabilitation, environmental impact management, farm operation, biosecurity and aquatic health management, market access, food safety and quality management,

animal well-being, decent and safe work, and special business operations, including aquaculture-based fisheries, capture-based aquaculture, and offshore and high-seas aquaculture.

Beyond the farm level, the thematic modules will focus on governance, sector and value-chain performance, specific capacity of the State on monitoring the sustainable development of the sector,

integration, synergies and trade-offs between aquaculture, surrounding ecosystems and other stakeholders, data and statistics, communication and knowledge exchange, and resource sharing.

After the Global Expert Consultation, the proposed approach will be discussed by member states at the 10<sup>th</sup> Session of the COFI Sub-Committee on Aquaculture to be held in Trondheim, Norway.



#### SEE ALSO

COFI Sub-Committee on Aquaculture. [www.fao.org/cofi/aq/en/](http://www.fao.org/cofi/aq/en/)

The 2030 Agenda and the Sustainable Development Goals: The challenge for aquaculture development and management. FAO Fisheries And Aquaculture Circular FIAA/C1141. [www.fao.org/3/a-i7808e.pdf](http://www.fao.org/3/a-i7808e.pdf)

Transforming Food and Agriculture to achieve the SDGs: 20 interconnected actions to guide decision-makers. FAO, Rome 2018. [www.fao.org/3/I9900EN/i9900en.pdf](http://www.fao.org/3/I9900EN/i9900en.pdf)

FAO Technical Guidelines for Responsible Fisheries available in support to Sustainable Aquaculture Development. [www.fao.org/fishery/publications/technical-guidelines/en](http://www.fao.org/fishery/publications/technical-guidelines/en)

## Guidance on social issues relative to human and labour rights in fisheries and aquaculture value chains

In 2018, at the 33<sup>rd</sup> Session of the FAO Committee on Fisheries (COFI), Member Countries decided that guidance on social sustainability should be developed in cooperation with relevant stakeholders, including industry and fish workers' associations, building on the experience from the development of the OECD-FAO Guidance for Responsible Agricultural Supply Chains. The issue of social conditions and decent work was discussed for the first time at the 16th Session of the FAO COFI Sub-Committee on Fish Trade with full consensus among Member Countries about the importance and relevance of human and labour rights.

In line with the mandate from COFI to promote social sustainability in fisheries and aquaculture



Written by:

**Mariana Toussaint**

E-mail: [Mariana.Toussaint@fao.org](mailto:Mariana.Toussaint@fao.org)

**Audun Lem**

E-mail: [Audun.Lem@fao.org](mailto:Audun.Lem@fao.org)

FAO Fisheries and Aquaculture Department, Rome, Italy



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value chains, a number of Dialogues are being organized this year to inform relevant stakeholders on the ongoing work of the draft FAO Guidance on Social Responsibility that is being developed for presentation to the FAO COFI Sub-Committee on Fish Trade (COFI-FT) in November 2019. These Dialogues provide a unique opportunity for FAO to present the draft guidance to stakeholders in the sector and for participants to provide feedback, comments, suggestions and inputs. Thus, concerns and gaps can be addressed, making the final document more inclusive and robust when submitted to COFI-FT.



# Future food system and diets: where is the fish?



Since 1961, the average annual increase in global apparent food fish consumption (3.2%) has outpaced population growth (1.6%) and this growth rate has exceeded that of the growth rate of meat consumption from all terrestrial animals combined.<sup>1</sup> Virtually all of the increase in fish consumed since 1980 has come from aquaculture, which has the highest growth rate of all food production systems over the last 5 decades. The 2017 High Level Panel of Experts report reiterated how fish remains one of the best sources of high-quality protein, omega-3 fatty acids, and micronutrients for poor and food insecure populations worldwide. However, this cornerstone of diets worldwide is threatened by, and contributes towards,

freshwater and marine ecosystem degradation.

Recent published literature on healthy diets from sustainable food systems provide new scientific targets for our global nutrition and food systems, recognizing that fish play a unique role. Defining an optimal level of animal-source foods (ASFs) consumption in these reports has been a challenge, especially when considering varied consumption patterns across countries, and the complex impact of ASFs on both human and environmental health.

Surprisingly, while nutrition stands high on the global political agenda, it only attracts a fraction of development aid globally. In a world where an estimated 821 million people – approximately one out of every nine – are undernourished and require stable access to high-quality foods, it remains unclear how, where, and in what quantity fish can fit into a sustainable global food system.

Agricultural research has sought to fill this knowledge gap, and in January, the EAT-Lancet Commission report set out to identify how sustainable food systems could remain within planetary boundaries.<sup>2</sup> In lieu of specific goals for individual foods, species or commodities, the established boundaries were considered for the food system as a whole. A comparison of future production estimates with the healthy reference diet shows a potential production-consumption gap. Subsequent discussions between FAO and multiple authors of the commissioned report are ongoing, in attempt to support the positive message of sustainable food systems while accurately portraying the crucial role of fisheries and aquaculture in such efforts.

Globally, fish (referring here also to fish products) provide an average of only about 34 calories per capita per day. However fish should be considered in a broader



Written by:

**Elizabeth Graham**

E-mail: [Elizabeth.Graham@fao.org](mailto:Elizabeth.Graham@fao.org)

**Oluwafemi Ajayi**

FAO Consultant

E-mail: [Oluwafemi.Ajayi@fao.org](mailto:Oluwafemi.Ajayi@fao.org)

FAO Fisheries and Aquaculture

Department, Rome, Italy

1. FAO. 2018. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome. Licence: CC BY-NC-SA 3.0 IGO. [www.fao.org/3/i9540en/i9540EN.pdf](http://www.fao.org/3/i9540en/i9540EN.pdf)

2. Willet, W *et al.* 2019. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. The Lancet Commissions. Volume 393, Issue 10170, P447-492, February 02, 2019

context than only an energy source. The dietary contribution of fish is significant in terms of high-quality, easily digested animal proteins. Fish proteins are essential in the diet of some densely populated countries where the total protein intake is low, and are particularly important in diets in small island developing States (SIDS). But beyond protein, even small quantities of fish can provide crucial essential fats and micronutrients, such as iron, iodine, vitamin D and calcium, which are often lacking in vegetable-based diets. Experts agree that the positive effects of high fish consumption largely outweigh the potential negative effects associated with contamination or other safety risks.<sup>3</sup>

The variance of different pescetarian diets is remarkable, and remains underexplored. This limits our capacity to define what diets rich in fish would imply for planetary health. Showing nutritional potential in fish has historically been a challenge, but today we face further hurdles with increasingly intensive aquaculture production methods, some with greater use of crop-based feedstuffs and lower fishmeal and fish oil inclusion rates, which is likely to influence both positively or negatively the nutrient content (particularly fat content and fatty acid profiles). Consumption of safe and sustainable aquaculture products from a human nutrition viewpoint should be encouraged and promoted, but impacts of aquaculture should be monitored to better make the case for its role in nutrition.

Environmental impacts of both capture fisheries and aquaculture

can vary significantly, depending on a range of factors including species, production and harvesting modes. These are issues on which FAO is actively engaged, and with continued support across sectors, supported by related work such as the EAT-Lancet findings, we continue to improve food security outcomes and fisheries and aquaculture output. However, the EAT-Lancet Commission report is a recent example of how challenging it can be to translate science into a “blue foods” context.

As long as fisheries and aquaculture production and value chains are isolated from nutrition-sensitive and socio-economic-political considerations, we will lack the scientific basis to adequately meet nutritional needs with food from aquatic environments. Knowledge and data is historically lacking, but more so is the international platform and political will to merge fish production and consumption within the agricultural context at large, embedding it as an integral part to a global food system.

Looking forward, a growing share of fish production is expected to be destined for human consumption (around 90 percent). The driving force behind this increase will be a combination of rising incomes and urbanization, linked with the expansion of fish production and improved distribution channels. World food fish consumption in 2030 is projected to be 20 percent (or 30 million tonnes live weight equivalent) higher than in 2016.<sup>1</sup> However, it is predicted that its average annual growth rate will be slower in the projection period

(+1.2 percent) than in the period 2003–2016 (+3.0 percent), mainly because of reduced production growth, higher fish prices and a deceleration in population expansion.

In per capita terms, the world's fish consumption is expected to reach 21.5 kg by 2030, up from 20.3 kg in 2016, with the highest growth being in Latin America (+18 percent), followed by Asia and Oceania (+8 percent each), while a decrease of -2 percent is projected for Africa<sup>1</sup>. This decline in consumption for a continent struggling with a high prevalence of undernourishment could mean ripple effects for the entire food system, and represents one highlighted space where fisheries and aquaculture stands to promote healthy diets and lives, or disappear from.

FAO will continue to work with research partners and policymakers to raise awareness of the integral role fish play in food systems worldwide, most visibly this year at the International Symposium on Fisheries Sustainability held in Rome, 19-21 November. With this goal of strengthening the science and policy interplay across fisheries production, management and trade, the first day will include a session dedicated to food security and nutrition, where experts will bring evidence and dialogue to bear for a new envisioning of fisheries in the future food system. While the symposium will focus on capture fisheries, the importance of aquaculture to future food security and nutrition will be embedded in this Day 1 session. Those interested in the session's scope, as well as subsequent outcomes, can contact the authors herein.

3. FAO & WHO. 2011. Report of the Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption, Rome, 25–29 January 2010. FAO Fisheries and Aquaculture Report No. 978. Rome.

# MISCELLANEOUS



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## Let's talk about fish

### Promoting aquaculture through social media channels

Communication has changed radically in recent years, particularly with the advent of social media. While many industries have moved rapidly to utilize the new media, others have been slower to embrace the changes. Some scientific and research organizations and international organizations have been among the slower adopters of these new media in promoting their day-to-day work. Nevertheless, the opportunities to reach broader audiences and to spark discussion and interest around topics such as aquaculture development should encourage us all to be sharpening our social media skills.

FAO Fisheries and Aquaculture Department has long placed an emphasis on traditional communication, widely disseminating our publications and reports, issuing press releases, publicizing our events and meetings through our web site, and collecting best practices and examples of successful projects in publications, such as the one you are reading now. FAO's FAN celebrates 27 years of publication, a testimony to the great interest in aquaculture stories across the community.

But how can we use social media to reach out to that dedicated aquaculture community, while also attracting new audiences to the subject? Although FAO Fisheries and Aquaculture uses corporate social media accounts to reach out on Instagram, Facebook, LinkedIn and Facebook, we began managing our own Twitter account - @FAOfish - in 2011. This is an extremely active account, through which we aim to

reach out to practitioners, partner organizations and research institutions, government partners and those interested in all issues fisheries and aquaculture. The nature of Twitter, however, allows us to reach out to communities far beyond "the usual suspects".

While our fisheries and aquaculture experts are generally



Social media provide new opportunities for direct communication and stakeholders engagement



Written by:

**Kimberly Sullivan**  
FAO Fisheries and Aquaculture  
Department, Rome, Italy  
E-mail: [Kimberly.Sullivan@fao.org](mailto:Kimberly.Sullivan@fao.org)

eager to click into our latest reports and publications or want to be informed about upcoming meetings or workshops, through our photos and storytelling, we have a real opportunity to take advantage of social media to reach out to those who may know little about aquaculture, but are curious to learn more.

A women's cooperative running a successful aquaculture project in Kenya may appeal to gender experts looking for success stories and ideas to replicate in their own regions. Water specialists or those who love innovation and technology may be drawn to south-south collaboration on aquaponics projects across the Near East, as countries share knowledge and expertise about how to use scarce water resources wisely – farming fish while also growing lettuce, fruits and other vegetables. An example of a marine spatial planning activity in Latin America may spark ideas about the need for greater dialogue in their next projects among those working in shipping, tourism, local administrative planning members and policy makers. Nutrition experts may be fascinated by a story from inland Haiti, where poor communities began fish farming alongside horticultural activities, both to earn additional income and to provide important food and nutrition security to their families. These are the individuals we should be working to reach.

Through social media stories, told through photos, blog stories like those in our FAO Blue Growth blog, films and radio podcasts, and disseminated through social media channels such as @FAOfish, we have the

potential of reaching the wider development community and engaging individuals to better promote the important work being undertaken in the aquaculture sector. These stories should be designed to attract those who may not have any expertise in the field, but who nevertheless can be important allies when planning future aquaculture activities and extending knowledge about the sector to a wider development community.

One of the commonly voiced concerns about social media is the prevalence of #FakeNews. While some concerns may be valid, social media can also (perhaps surprisingly) act as a springboard for an exchange of science and thoughtful dialogue among various stakeholders. Through carefully crafted content, social media could be an ideal platform for working to eliminate some of the outdated or misunderstood ideas still surrounding aquaculture. How often do we hear concerns that aquaculture doesn't benefit poor communities in developing countries, or that it is not a nutritious part of healthy diets, or that it devastates local environments? It should be our commitment as practitioners to meet these concerns with success



stories that illustrate the key role the sector plays for often vulnerable communities and how careful planning can ensure aquaculture activities are well integrated into local ecosystems.

As the sector grows in importance, we owe it to the wider community to ensure we are actively promoting aquaculture with accurate and inspiring stories that illustrate the key role aquaculture can play around the world. Most practitioners in the aquaculture sector are enthusiastic about their work. It's time we reached beyond our aquaculture communities to convey this enthusiasm to wider audiences, and social media activity is a great way to spearhead that process. @FAOfish looks forward to supporting efforts to promote aquaculture stories from around the globe.



#### SEE ALSO

Twitter: @FAOfish

Blue Growth blog: [www.fao.org/blogs/blue-growth-blog/](http://www.fao.org/blogs/blue-growth-blog/)

COFI Aquaculture on Twitter: [www.twitter.com/hashtag/cofiacquaculture?f=tweets](https://www.twitter.com/hashtag/cofiacquaculture?f=tweets)

Flickr: [www.flickr.com/photos/faonews/albums/72157688295252023](https://www.flickr.com/photos/faonews/albums/72157688295252023)

COFI Aquaculture (2017): [www.youtube.com/watch?v=yunKn3gH0Lk](https://www.youtube.com/watch?v=yunKn3gH0Lk)

Countries and regional perspectives on aquaculture (2017): [www.youtube.com/watch?v=LhzvicBPCsl](https://www.youtube.com/watch?v=LhzvicBPCsl)

Integrated aquaculture-agriculture and agroecology (2018): [www.youtube.com/watch?v=rwdH813SehU](https://www.youtube.com/watch?v=rwdH813SehU)

# Towards an updated ISSCAAP classification to better suit the needs of aquaculture

The International Standard Statistical Classification of Aquatic Animals and Plants, or ISSCAAP, is a classification system designed to categorize aquatic species based on their taxonomy, biological characteristics and economic importance. It divides the wild caught or farmed species into nine Divisions, and further into Groups under each Division. The number of Groups (called ISSCAAP Groups) varies from three to a maximum of nine under each Division, according to the current ISSCAAP in use since 2000.

ISSCAAP is the default classification used for disseminating FAO's global fisheries and aquaculture statistics through the popular FishStatJ and the FAO Yearbook of Fishery and Aquaculture Statistics. The report of *The State of World Fisheries and Aquaculture (SOFIA)* and other FAO information products also use ISSCAAP classification for data-based status and trend analysis on fisheries and aquaculture development.

The existing ISSCAAP, established almost two decades ago, is outdated, especially with regard to aquaculture. Several Divisions with high relevance to aquaculture, in terms of the number of farmed species and their corresponding production volumes, are in need of an



Written by:

**Xiaowei Zhou**

FAO Fisheries and Aquaculture Department, Rome, Italy

E-mail: Xiaowei.Zhou@fao.org

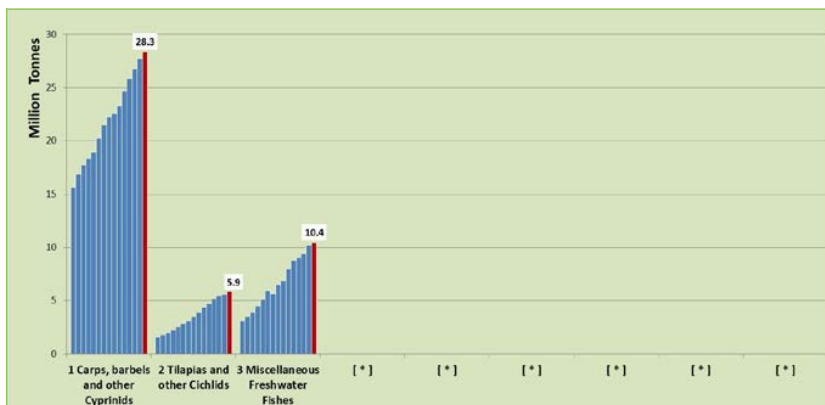


FIGURE 1 – World aquaculture production of ISSCAAP Division 1 for Freshwater Fishes, sorted by three Groups according to the classification in current use. The 15 bars of each Group represent the years from 2003 to 2017. (unit: tonnes)

increased number of Groups. For instance, freshwater fish species accounted for 66 percent of the world production of all farmed aquatic animals in 2017, while the existing ISSCAAP divides all freshwater fishes into three Groups only, namely, carps, tilapias and miscellaneous freshwater fishes (Figure 1). It is highly desirable to create additional Groups such as freshwater catfishes, snakeheads, freshwater perches and basses, because they differ significantly from others in terms of farming

practices like feeding and water management (Figure 2).

With reference to the above mentions, revisions proposed to update the current ISSCAAP are to be presented for discussion at the 26th Session of the Coordinating Working Party on Fishery Statistics. The proposed new ISSCAAP, with changes and expansion highlighted, is listed here, attempting to obtain additional comments and suggestions from FAO aquaculture newsletter readers.

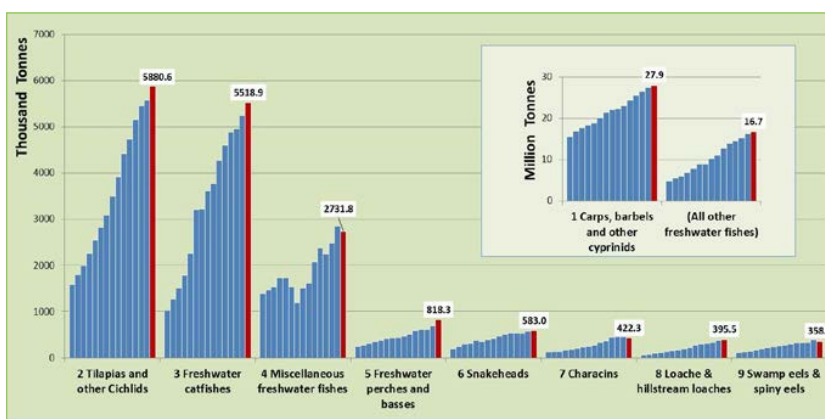


FIGURE 2 – World aquaculture production of ISSCAAP Division 1 for Freshwater Fishes, sorted by nine Groups according to the proposed classification update. The 15 bars of each Group represent the years from 2003 to 2017. (unit: tonnes)

## Proposed new ISSCAAP classification

### 1. FRESHWATER FISHES

Carps, barbels, river suckers  
Loaches and hillstream loaches  
Tilapias and other cichlids  
Freshwater catfishes  
Freshwater perches anabasses  
Snakeheads  
Characins  
Swamp eels and spiny eels  
Miscellaneous freshwater fishes

### 2. DIADROMOUS AND EURYHALINE FISHES

Sturgeons, paddlefishes  
Anguilla eels  
Salmons, trouts, smelts  
Shads  
Milkfish, mullets  
Euryhaline puffer fishes  
Miscellaneous diadromous and euryhaline fishes

### 3 MARINE FISHES

Flounders, halibuts, soles and other flat fishes  
Cods, hakes, haddocks  
Miscellaneous coastal fishes  
Miscellaneous demersal fishes  
Herrings, sardines, anchovies  
Tunas, bonitos, billfishes  
Miscellaneous pelagic fishes  
Sharks, rays, chimaeras  
Marine fishes not identified

### 4. CRUSTACEANS

Freshwater shrimps and prawns  
Freshwater crayfishes  
Miscellaneous freshwater crustaceans  
Marine crabs, sea-spiders  
Lobsters, spiny-rock lobsters  
King crabs, squat-lobsters  
Marine shrimps and prawns  
Krill, marine planktonic crustaceans  
Miscellaneous marine crustaceans

### 5. MOLLUSCS

Freshwater molluscs  
Abalones, winkles, conchs and other sea snails  
Oysters  
Sea mussels  
Scallops, pectens  
Clams, cockles, arkshells and other bivalves  
Squids, cuttlefishes, octopuses  
Miscellaneous marine molluscs

### 6. WHALES, SEALS AND OTHER AQUATIC MAMMALS

Blue-whales, fin-whales  
Sperm-whales, pilot-whales  
Eared seals, hair seals, walruses  
Miscellaneous aquatic mammals

### 7. MISCELLANEOUS AQUATIC ANIMALS

Frogs, salamanders and other amphibians  
Turtles  
Crocodiles, alligators and caimans  
Sea-squirts and other tunicates  
Horseshoe crabs and other arachnoids  
Sea-urchins and other echinoderms  
Sea cucumbers  
Marine worms  
Miscellaneous aquatic invertebrates

### 8. MISCELLANEOUS AQUATIC ANIMAL PRODUCTS

Pearls, mother-of-pearl, shells  
Corals  
Sponges

### 9. AQUATIC PLANTS

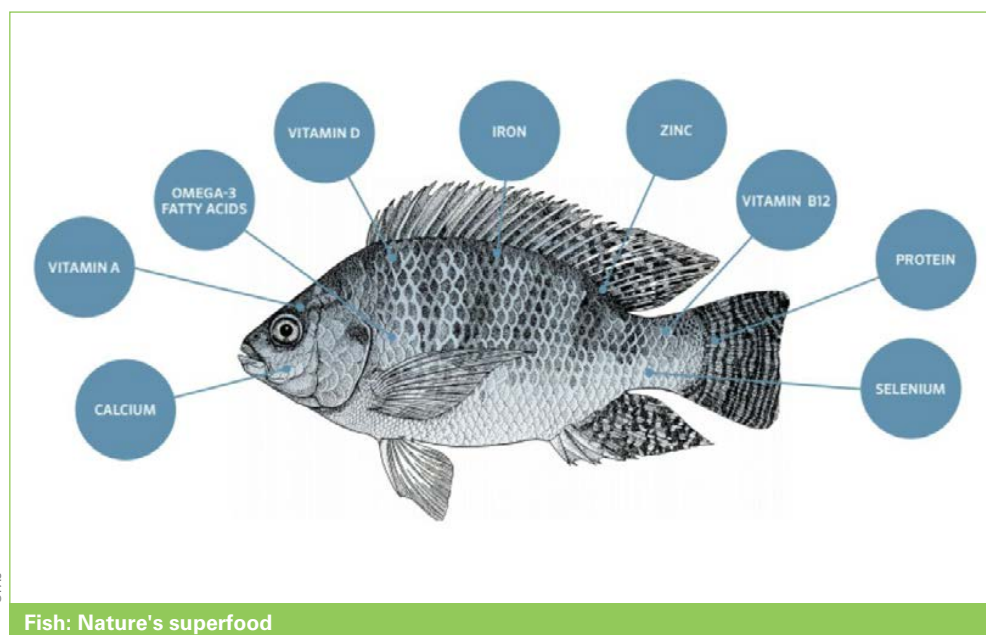
Brown algae  
Red algae  
Marine macro green algae  
Aquatic Cyanobacteria (blue-green algae)  
Miscellaneous aquatic micro-algae  
Miscellaneous aquatic macrophytes



#### SEE ALSO

The ISSCAAP in current use is available at:  
[www.fao.org/tempref/FI/DOCUMENT/cwp/handbook/annex/AnnexS2listISSCAAP2000.pdf](http://www.fao.org/tempref/FI/DOCUMENT/cwp/handbook/annex/AnnexS2listISSCAAP2000.pdf)

# Leveraging on aquaculture to improve global nutrition



Fish: Nature's superfood

is widely recognized that consumption of even small quantities of fish makes a significant contribution to the nutritional quality of the diets of malnourished populations. In terms of access, the global average price of fish from aquaculture is slightly below that of capture fisheries in recent years when compared to the prices in the 1990s and early

In recent years, attention has been focused on addressing the global challenges of hunger, malnutrition and impaired health – hoping to solve the attendant consequences, such as reduced economic productivity, impaired cognitive development and hindered educational performance, and losses in household resources from increased health-care costs due to diet-related illnesses. Several action plans have been targeted at addressing these global challenges; however, fish has been strikingly missing from most

of the strategies, especially in regions where it could potentially have the largest impact on food and nutrition outcomes.

Though there has been a downward trend in capture fisheries output in recent years because of plateaued production, an alternative and complementary aquaculture source could provide the amount of fish needed to meet the demand of the growing world population. Of the 202 currently existing countries and territories with aquaculture production recorded by FAO, 194 have been active producers in the past years. Since 2014, aquaculture has provided more fish for human consumption than capture fisheries, and by 2030, it is expected to contribute 60 percent of the total fish available for human consumption.

Fish from an aquaculture source are rich in nutrients just as their capture fisheries counterparts. It

2000s.<sup>1</sup> Furthermore, with culture condition considerations, the environmental impact of aquaculture production could be easily controlled within sustainable means. Advancements in culture technology and knowledge have been instrumental in the adoption of aquaculture to complement supply from capture fisheries to meet the demand for fish in the predominant capture fisheries regions that are most affected by drop in catches; aquaculture also serves as a safety net during seasonal fish bans when fish are allowed to breed.

Much emphasis has been placed on production outputs and other innovations to support increased production with little efforts towards the end result of better nutrition outcomes. Nutrition is the hidden part of this contribution. Expanding

1. SOFIA. 2018. *The State of World Fisheries and Aquaculture*. [www.fao.org/3/I9540EN/i9540en.pdf](http://www.fao.org/3/I9540EN/i9540en.pdf)



Written by:

**Oluwafemi Ajayi**

E-mail: [Oluwafemi.Ajayi@fao.org](mailto:Oluwafemi.Ajayi@fao.org)

**Elizabeth Graham**

E-mail: [Elizabeth.Graham@fao.org](mailto:Elizabeth.Graham@fao.org)

**Yin Fu**

E-mail: [Yin.Fu@fao.org](mailto:Yin.Fu@fao.org)

FAO Fisheries and Aquaculture  
Department, Rome, Italy

the role of aquaculture in meeting the progress towards ending hunger and all forms of malnutrition is as important as the focus on increasing production. Similarly, we have not seen much of aquaculture being explicitly integrated into food systems. It is one of the obscure parts of our food system that needs to be brought into focus. Acknowledging the expansion of aquaculture practice globally, there is the need to look into the drivers of transformative food systems that will adopt sustainable aquaculture practices to promote dietary diversity across different demographic groups.

Aquaculture is uniquely positioned to be one of the driving forces needed to address the nutrition challenges that we face in the world today. Consumption and inclusion of fish from aquaculture in diets is a major step in achieving this, but it is not enough; we have to look further and conceptualize the linkages between aquaculture and nutrition.

Understanding pathways and creating synergies between aquaculture and nutrition as influenced by the governance of food systems, climate change and value chain systems are key to upgrading aquaculture influence on nutrition. These could be achieved by measuring the impact of aquaculture interventions on

2. The Chicago Council on Global Affairs. 2015. *Healthy food for a healthy world: leveraging agriculture and food to improve global nutrition*. [www.thechicagocouncil.org/sites/default/files/GlobalAg-HealthyFood\\_FINAL.pdf](http://www.thechicagocouncil.org/sites/default/files/GlobalAg-HealthyFood_FINAL.pdf)
3. Pandey, V.L., Mahendra Dev, S. and Jayachandran, U. 2016. Impact of agricultural interventions on the nutritional status in South Asia: a review. *Food policy*, 62: 28–40. [www.ncbi.nlm.nih.gov/pmc/articles/PMC4952527](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4952527)

nutrition and health so as to identify areas of strengths and gaps that need more attention, and by incorporating nutrition-sensitive aquaculture systems in food systems policies to foster long-term commitments towards achieving regional and global nutrition goals. Other steps involve capacity building in processing, storage and trade in aquaculture products, including sensitivities to the needs of small-scale aquaculture practitioners; reducing losses and wastes to the barest minimum; and ramping up public-private partnerships in advancing nutrition-sensitive aquaculture approaches for the triple benefits of nutrition, health and better livelihoods.<sup>2</sup>

Although the pathways from aquaculture to nutrition are evolving and dynamic, multiple pathways still exist through which aquaculture can influence nutrition outcomes. Improving the economic status of fish farmers (poverty reduction) and their consideration for usage of their harvest, either for home consumption, sales, or both, could influence their outlook on nutrition. Additionally, income obtained from working on aquaculture production activities and spent on nutritious food could have substantial impact in reducing malnutrition. Agricultural policies and food prices could influence supply, affordability and access to aquaculture products and the socio-economic status of women within the household –

and household decision making could influence the nutritional status of women and children in the short and the long term.<sup>3</sup> Finally, considerations to adequately prepare the next generation of leaders (youth) on food and nutrition security strategies through education and awareness programmes on nutrition issues should also feature on the global agenda.

As we monitor progress towards achieving better nutrition goals through aquaculture, we should start to look at the specific contributions of these pathways, taking consumption pattern, dietary habits and production mechanisms into consideration. More so, as more rural farmers are engaged in innovative aquaculture practices (integrated agriculture-aquaculture systems, aquaponics, integrated multi-trophic aquaculture) to increase fish production for household consumption and livelihood options. There is also a need to set and monitor targets for nutrition outcomes and to further understand the nutritional roles of fish in their household's dietary diversity.

Considering the continuous increase in the global population, strengthening aquaculture management regimes, albeit through sustainable means, is very important in meeting the sustainable development goal of ending global hunger.



#### SEE ALSO

FAO and EU. 2016. *Strengthening sector policies for better food security and nutrition results: fisheries and aquaculture*. Policy Guidance Note 1. Rome. [www.fao.org/3/a-i6227e.pdf](http://www.fao.org/3/a-i6227e.pdf)



## Remembering our colleague, Joanna Toole

FAO and its Fisheries and Aquaculture Department was deeply saddened to learn we lost a dear colleague in the tragic crash of Ethiopian Airlines flight 302 near Addis Ababa on 10 March 2019. Joanna Toole was travelling to Nairobi to represent the FAO Fisheries and Aquaculture Department at the UN Environment Assembly.

Joanna, a British national, was a tireless advocate for ocean conservation issues, and worked frequently with FAO over the years before joining FAO Fisheries. While working with civil society organizations, she collaborated closely with FAO on many joint efforts addressing issues such as marine debris, plastic pollution, ghost gear, and guidelines for the marking of fishing gear.

Joanna was a determined conservationist, focused on the protection of marine mammals and other wildlife. In her career she served as the Global Campaign Lead for World Animal Protection's campaign on marine debris. During this time, she was a co-founder of the Global Ghost Gear Initiative – a cross-sectoral alliance aimed at eliminating lost and discarded fishing gear that is abandoned in the seas.

This abandoned fishing gear is commonly known as “ghost gear” because it continues to trap marine life in its nets long after having been abandoned or lost. Because the nets are often made of plastic, they add to the plastic pollution in our oceans, and can remain in the oceans for many years.

Joanna brought the UN and environmental organizations together to establish pilot projects testing fishing gear marking, including one such example in Indonesia where Joanna worked with FAO and colleagues from the Global Ghost Gear Initiative, partnering directly with the Indonesian government and local small-scale coastal fisheries communities to introduce the fish gear marking of their gillnets. Successful pilot activities such as the work carried out in Indonesia help to ensure fishing gear marking can be carried out in these countries, without creating extra burdens to the communities.



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Joanna's work on these issues continued during her time at FAO. She was instrumental in the work carried out by the technical working group to negotiate the draft Voluntary Guidelines for abandoned, lost or otherwise discarded fishing gear, which emerged from the Expert Consultations in April 2016, and then the Technical Consultations in February 2018 and received final endorsement by FAO's Committee on Fisheries (COFI) in July 2018. The published guidelines have been dedicated to Joanna, in memory of all her key support to the process.

To her colleagues, Joanna was a consummate professional, dedicated to her work and passionate about ocean conservation issues. This passion was clearly evident whenever she spoke with the media or at meetings about issues such as ghost gear or plastic pollution in our oceans, and work underway to find concrete solutions to these pressing concerns. She believed strongly in collaborating across agencies, to supporting the livelihoods of fisheries communities around the world, and the power of the individual to help make the world a better place. Her loss was greatly felt in the hallways of FAO, where she made many close friends and had quickly become an integral part of its Fisheries and Aquaculture Department. We are saddened to lose such a dedicated colleague, and such a kind and caring young woman and friend.

# NEW STAFF PROFILES



© FAO/C. LAGANA

## Camilla Lagana

*Intern, Aquaculture Branch*

Camilla Lagana, an Italian national, has joined the Aquaculture Branch for a three-month internship. Camilla holds a bachelor's degree in simultaneous interpretation and translation from Università degli Studi Internazionali di Roma (UNIINT). Before she joined FAO, she had another internship with the private sector in the UK, where she worked for the Project Management Department providing assistance to customer service and planning and management. The experience in the UK has contributed to enhance her linguistic and professional abilities. During her internship at FAO, she will provide assistance to web analytics, preparation of policy briefs, and dissemination of information and knowledge products through social media and other mechanisms.

Camilla can be reached at:  
Camilla.Lagana@fao.org



© FAO/S. SIMS

## Sebastian Sims

*Intern, Aquaculture Branch*

Sebastian Sims, a British national, joined the Aquaculture Branch for a nine-month internship back in November 2018. Sebastian holds a Bachelor of Science degree in Marine Biology with Oceanography from the University of Southampton. He studied aquaculture and fish nutrition at the University of Bergen and worked at the Norwegian National Institute of Nutrition and Seafood Research to study how Atlantic salmon gene expression changed when the salmon were fed a novel aquafeed ingredient. He has also spent time at sea as a Pelagic Sampler on the Royal Research Ship *Discovery*.

Sebastian is providing support on aquatic animal feeds and on aquatic genetic resource management. He is reviewing the potential for microalgae to be used in aquafeed, and he will update the Aquatic Feed and Fertilizer Resources Information System database. He also provided logistical support for the finalization of *The State of the World's Aquatic Genetic Resources for Food and Agriculture*.

Sebastian can be reached at:  
Sebastian.Sims@fao.org



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## Yin Fu

*Intern, Aquaculture Branch*

Yin Fu, a Chinese national, joined the FAO Aquaculture Branch in November 2018 for a nine-month internship; her work focuses on nutrition-sensitive aquaculture.

In December 2018, she delivered a presentation on public health nutrition and integrated agriculture-aquaculture at the side event of the International Promotion Programme Workshop on Social Impact of Rice Fish Farming. At present, she is in charge of the design of the Social Impact Survey for rice-fish farming; summarizing aquaculture's contribution to eradicating hunger and malnutrition in support of the 10<sup>th</sup> Session of the COFI Sub-Committee on Aquaculture; and reviewing the EAT-Lancet report on seafood's role for sustainable, healthy diets. After this, Yin will also assist in policy analysis of aquaculture development based on the ecosystem approach to aquaculture for Blue Growth.

Yin holds a first-class double Bachelor of Science degree in Food Science and Technology from Jiangnan University, China, and from the University of Reading, England. She also holds a Master of Science with Distinction in Clinical and Public Health Nutrition from University College London, England. Yin is also the key inventor of an automatic oxygenation device for aquaculture and has gained a patent for it.

Yin can be reached at:  
Yin.Fu@fao.org



Tanjona, an integrated fish-crop-fruit system in Antananarivo (Madagascar)

# NEW PUBLICATIONS

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## Technical papers



FAO 2019

### Field guide to the culture of Tambaqui (*Colossoma macropomum*, Cuvier, 1816)

Woynárovich, A. and Van Anrooy, R. 2019. FAO Fisheries and Aquaculture Technical Paper No. 624. Rome, FAO.

Following a short introduction to the species and its closest commercially viable related species, namely pirapatinga (*Piaractus brachypomus*) and pacu (*Piaractus mesopotamicus*), this field guide provides practical information on the culture and reproduction of tambaqui (*Colossoma macropomum*). As a field guide it aims to support the understanding and dissemination of applicable technologies for the culture and reproduction of tambaqui, i.e. what should be done – as well as when and how it should be done – in order to achieve success in the artificial propagation as well as the fingerling and table fish production stages. The concise technical descriptions in this guide are accompanied by self-explanatory illustrations and a reader-friendly glossary of technical terms, which is important for tambaqui aquaculture farmers.

This publication was prepared with support from the FAO Technical Cooperation Programme (TCP/GUY/3501) project "Promotion of Small Scale Aquaculture in Guyana for Food Security and Rural Development". It is expected that this document will be of use for anyone working with tambaqui or planning to culture tambaqui.

The PDF version of this publication can be downloaded at the following web link:

[www.fao.org/3/CA2955EN/ca2955en.pdf](http://www.fao.org/3/CA2955EN/ca2955en.pdf)

For further information, please contact: [Raymon.VanAnrooy@fao.org](mailto:Raymon.VanAnrooy@fao.org)



FAO 2019

## Understanding and measuring the contribution of aquaculture and fisheries to gross domestic product (GDP)

Cai, J.N., Huang, H. and Leung, P.S. 2019. FAO Fisheries and Aquaculture Technical Paper No. 606. Rome, FAO.

The contribution of aquaculture and fisheries to gross domestic product (GDP) is one of the most widely used indicators of its economic performance. Despite strong interest in and great efforts made towards assessing the contribution of aquaculture and fisheries to GDP, there is a general lack of understanding or consensus on how to properly measure the sector's contribution to GDP and effectively use the measures for evidence-based policy and planning for sustainable aquaculture and fisheries development. This paper contributes to improving the understanding and measurement of aquaculture and fisheries' contribution to GDP by: (i) using input-output models (including mathematical formulas and numerical examples) to formulate and clarify a set of measures of aquaculture and fisheries' contribution to GDP; (ii) discussing alternative methods to estimate the measures under data-poor environments; (iii) suggesting an empirical methodology and general guidelines on the estimation and reporting of the measures; and (iv) exploring how to utilize the measures for evidence-based policy and planning. The conceptual framework and empirical methodology suggested in the paper will help move towards internationally established methodology, standards and guidelines on measuring aquaculture and fisheries' economic contribution.

The PDF version of this publication can be downloaded at the following web link:

[www.fao.org/3/CA3200EN/ca3200en.pdf](http://www.fao.org/3/CA3200EN/ca3200en.pdf)

For further information, please contact: [Junning.Cai@fao.org](mailto:Junning.Cai@fao.org)



FAO 2019

## Producción de semillas de la ostra perla *Pinctada imbricata* - Un manual práctico

### Production of pearl oyster *Pinctada imbricata* seeds - A practical manual

Lodeiros, C. y Lovatelli, A., coords. 2019.

FAO Documento técnico de pesca y acuicultura. No. 636. Roma, FAO.

El presente documento expone técnicas para la producción de semilla de la ostra perla, *Pinctada imbricata* (Röding, 1798), bajo condiciones controladas. Se suministra información básica de la especie que incluye la descripción general de su biología, anatomía, taxonomía, clasificación, hábitat y distribución geográfica, con aspectos de nutrición, reproducción y la descripción del ciclo de vida, particularmente el temprano, así como la infraestructura básica y necesaria de criadero o "hatchery" para el desarrollo de las técnicas expuestas de acondicionamiento de los reproductores, la fecundación, el desarrollo embrionario, el cultivo larvario y postlarvario y las etapas de fijación y crecimiento postlarvario hasta la obtención de semillas aptas para el cultivo en el exterior.

This document outlines the techniques for the artificial production of pearl oyster, *Pinctada imbricata* (Röding, 1798), seed under controlled conditions. Basic information of the species is provided, including the general description of its biology, anatomy, taxonomy, classification, habitat and geographical distribution. Essential aspects on nutrition, reproduction and early life stage developments are described along with the basic infrastructures of a hatchery. Appropriate technics on broodstock conditioning, gamete fertilization, embryonic development, larval and post-larval culture are described up to the point where seed material are obtained for on-growing in the field.

The document is available at:

[www.fao.org/3/ca4075es/ca4075es.pdf](http://www.fao.org/3/ca4075es/ca4075es.pdf)

The URL of the document is also accessible through:

[www.fao.org/documents/card/en/c/ca4075es](http://www.fao.org/documents/card/en/c/ca4075es)

For further information, please contact: [Alessandro.Lovatelli@fao.org](mailto:Alessandro.Lovatelli@fao.org)



FAO 2018  
**Aquaculture Development 9. Development of aquatic genetic resources: A framework of essential criteria**

Bartley, D.M., Halwart, M., Jeney, Z., Lal, K.K., Lucente, D., G.C. Mair, G.C. and Stankus, A. 2018. FAO. Technical Guidelines for Responsible Fisheries 5 Suppl. 9. Rome, FAO.

Aquatic genetic resources support and ensure the long-term viability of fisheries and aquaculture. However, developing and managing Aquatic Genetic Resources for Food and Agriculture (AqGR) is a complex undertaking for national stakeholders, with a combination of constraints that has hindered many countries from taking full advantage of the benefits of AqGR. In recognition of this complexity, the FAO Committee on Fisheries' (COFI) Advisory Working Group on Aquatic Genetic Resources and Technologies (Working Group) recommended that a framework of minimum requirements be developed to assist countries in the conservation, sustainable use and development of their AqGR.<sup>1</sup>

As a result, the FAO's Fisheries and Aquaculture Department, in consultation with the Working Group and with support from the Government of Germany, began to develop a "Framework of minimum requirements for sustainable use, management and conservation of aquatic genetic resources of relevance for aquaculture" (the Framework). The Framework can be used to help countries establish conditions necessary to begin to sustainably and responsibly conserve, use and develop their AqGR in line with national development and conservation goals and policies. The Framework is not an implementation document, but rather a needs assessment document that calls for national dialogue to develop an implementation strategy, and a review or revision of national policy and practice. Annexes are provided here to help with aspects of implementation.

The PDF version of this publication can be downloaded at the following web link:

[www.fao.org/3/CA2296EN/ca2296en.pdf](http://www.fao.org/3/CA2296EN/ca2296en.pdf)

For further information, please contact: [Graham.Mair@fao.org](mailto:Graham.Mair@fao.org)

<sup>1</sup> The conservation, sustainable use and development of AqGR would include the adoption of new species and development of genetically improved strains for aquaculture production, the technologies to monitor and assess genetic resources, and the management practices and policies that would ensure that production takes place in an environmentally responsible and socially acceptable manner.

FAO Circular



FAO 2018  
**Le développement de l'aquaculture en Algérie en collaboration avec la FAO – Bilan 2008-2016**

Gennari L., Crespi V. 2018. FAO. Circulaire sur les pêches et l'aquaculture No. 1176. Rome, FAO.

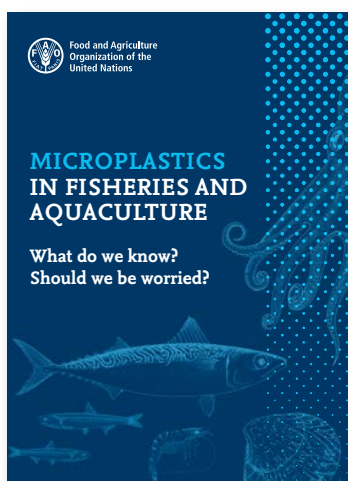
La présente Circulaire constitue le rapport de synthèse des résultats obtenus dans le cadre des projets de coopération technique entre le gouvernement algérien et la FAO qui se sont développés entre 2008 et 2016. Le document expose les étapes qui ont conduit à l'élaboration d'une approche et d'une méthodologie appropriées pour jeter les bases d'une politique de développement du secteur aquacole (aquaculture marine et d'eau douce) à l'échelle nationale. Le gouvernement algérien à travers le Ministère de l'agriculture, du développement rural et de la pêche a contacté la FAO, afin d'obtenir une assistance technique pour analyser le potentiel de développement de l'aquaculture marine le long de la côte et l'aquaculture d'eau douce en milieu désertique dans les wilayas du Sud.

Pour l'aquaculture continentale, des modèles de fermes aquacoles ont été élaborés afin de fournir des directives claires pour le démarrage d'une ferme aquacole (modèle de ferme, encadrement, intrants nécessaires, intégration avec l'agriculture, gestion de l'eau, etc.). Pour l'aquaculture marine trois fiches thématiques, notamment sur (i) le grossissement de bars et dorades en cages; (ii) grossissement de bars et dorades en bassins; et (iii) élevages des moules sur filières en mer, ont été développés comme instrument d'aide pour l'évaluation et la validation des projets à leurs différents stades de réalisation. Il apparaît évident qu'il y a un intérêt croissant des agriculteurs (petits et moyens) envers le développement d'une aquaculture intégrée à l'agriculture qui puisse garantir la diversification des productions locales et permettre une meilleure gestion/exploitation de l'eau.

The PDF version of this publication can be downloaded at the following web link:

[www.fao.org/3/CA2769FR/ca2769fr.pdf](http://www.fao.org/3/CA2769FR/ca2769fr.pdf)

For further information, please contact: [Valerio.Crespi@fao.org](mailto:Valerio.Crespi@fao.org)



## FAO 2019 Microplastics in fisheries and aquaculture. What do we know? Should we be worried?

Extended summary of Lusher, A.L., Hollman, P.C.H., Mendoza-Hill, J.J. 2017, FAO. *Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and implications for aquatic organisms and food safety*. Fisheries and Aquaculture Technical Paper. No. 615. Rome, FAO (also available at: [www.fao.org/3/a-i7677e.pdf](http://www.fao.org/3/a-i7677e.pdf)).

Microplastics are gaining an increasing focus both in the scientific literature and in the media. The fisheries and aquaculture sector is often pointed out as an important contributor to microplastics pollution and there are some concerns about ecological impacts, as well as the implications for fish consumers. FAO released a technical paper that takes stock of the scientific information available on this topic. This brochure highlights the main findings of the technical paper and targets a wide audience including policy makers, as part of the awareness raising on microplastics and demystification of the consequences for humans' health. The brochure explains the definition of microplastics and their origin. It provides an overview of the fate of microplastics in oceans and their impacts on the marine fauna. Results on microplastics implications for food safety are also summarized, together with the remaining gaps in the current knowledge. The brochure ends with a set of take-home messages.

*Extended summary available in Arabic, Chinese, English, French and Spanish at:*

*Arabic:* [www.fao.org/3/ca3540ar/ca3540ar.pdf](http://www.fao.org/3/ca3540ar/ca3540ar.pdf)

*Chinese:* [www.fao.org/3/ca3540zh/ca3540zh.pdf](http://www.fao.org/3/ca3540zh/ca3540zh.pdf)

*English:* [www.fao.org/3/ca3540en/ca3540en.pdf](http://www.fao.org/3/ca3540en/ca3540en.pdf)

*French:* [www.fao.org/3/ca3540fr/ca3540fr.pdf](http://www.fao.org/3/ca3540fr/ca3540fr.pdf)

*Spanish:* [www.fao.org/3/ca3540es/ca3540es.pdf](http://www.fao.org/3/ca3540es/ca3540es.pdf)

*For further information, please contact:* [Tarub.Bahri@fao.org](mailto:Tarub.Bahri@fao.org)



## FAO 2019 Uso de materias primas locales y no locales para alimentación de tilapias en sistemas de Acuicultura de Recursos Limitados (AREL)

Muñoz Ramírez, A.P. 2019. FAO.  
Panamá, Roma, FAO.

The "Use of local and non-local raw material for feeding of tilapias in resources-limited aquaculture systems (AREL, in its Spanish acronym) is a guide developed by FAO as a contribution for increase the resilience and profitable of AREL producers. The guide allow the small aquaculture producers to make their own balanced feed diet to minimal cost, increasing the profitability due that the cost of feed in these production systems is the higher cost (50–80 percent).

The guide has been developed for Mesoamerican countries, Cuba and Dominican Republic, due that share the local raw materials described in this guide. The document contain four chapters: chapter 1. It's an introduction for Artisanal fabrication of balanced feed diet for tilapia; chapter 2. Contain the nutritional facts of each raw material and a description; chapter 3. Introduce to general best practices in aquaculture; and chapter 4. Explain how use an Excel® programmed spreadsheet to design a balanced feed diet to minimal cost. In the excel spreadsheet you can adjust the cost of the raw material (kg) or the opportunity cost, due that this information could variate in the time, as well is possible adjust and fix the crude protein (%); Fats(%); gross energy (Kcal/kg); fiber among others. And have some suggestion for maximal inclusion of raw material to avoid anti-nutritional effects that could produce some raw material in huge quantities.

*The PDF version of this publication can be downloaded at the following web link:*

[www.fao.org/3/ca2671es/ca2671es.pdf](http://www.fao.org/3/ca2671es/ca2671es.pdf)

*For further information, please contact:* [Carlos.Pulgarin@fao.org](mailto:Carlos.Pulgarin@fao.org)

# CALENDAR OF EVENTS

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- AUG 2019** Tenth Session of the Sub-Committee on Aquaculture of the Committee on Fisheries (COFI)  
*Trondheim, Norway 23-27 August 2019 – Information: [www.fao.org/cofi/aq/en/](http://www.fao.org/cofi/aq/en/) ; [Matthias.Halwart@fao.org](mailto:Matthias.Halwart@fao.org)*
- 
- SEPT 2019** Eleventh session of the Scientific Advisory Committee on Aquaculture (CAQ)  
*Malaga, Spain, 10–12 September 2019 – Information: [Fabio.Massa@fao.org](mailto:Fabio.Massa@fao.org)*
- 
- SEPT 2019** Training on Doing Aquaculture as Business and Governance matters for the IGAD region  
*Addis Ababa, Ethiopia, 16-20 September 2019 – Information: [Ana.Menezes@fao.org](mailto:Ana.Menezes@fao.org)*
- 
- SEPT 2019** Regional consultation: Improve governance of aquaculture in Asia-Pacific  
*Bangkok, Thailand, September 2019 – Information: [Weimin.Miao@fao.org](mailto:Weimin.Miao@fao.org)*
- 
- OCT 2019** International workshop on technology innovation and social impact of Integrated Agro-Aquaculture  
*Shanghai, China, October, 2019 – Information: [Xinhua.Yuan@fao.org](mailto:Xinhua.Yuan@fao.org)*
- 
- OCT 2019** Regional meeting on analysis of value chains for select Mediterranean and Black Sea marine aquaculture products  
*Oran, Algeria, 7 November 2019 – Information: [Fabio.Massa@fao.org](mailto:Fabio.Massa@fao.org)*
- 
- NOV 2019** 17<sup>th</sup> Session of the COFI Sub-Committee on Fish Trade  
*Vigo, Spain, 25-29 November 2019 – Information: [Marcio.CastroDeSouza@fao.org](mailto:Marcio.CastroDeSouza@fao.org)*
- 
- NOV 2019** FAO International Symposium on Fisheries Sustainability – Strengthening the Science-Policy nexus  
*Rome, Italy, 19-21 November 2019 – Information: [www.fao.org/about/meetings/sustainable-fisheries-symposium/](http://www.fao.org/about/meetings/sustainable-fisheries-symposium/) ; [Claudia.AguadoCastillo@fao.org](mailto:Claudia.AguadoCastillo@fao.org)*

## NON FAO EVENTS

- AUG 2019** GLOW 9, an international conference. Great Lakes of the world: Emerging frontiers for the African Great Lakes. Promoting Blue Economy, Food Security and Conservation  
*Kisumu, Kenya, 5-7 August 2019 – Information: [www.aehms.org](http://www.aehms.org) ; [Martinus.Vanderknaap@fao.org](mailto:Martinus.Vanderknaap@fao.org)*
- 
- AUG 2019** Aqua Nor Exhibition  
*Trondheim, Norway, 20-23 August 2019. Information: [www.aqua-nor.no](http://www.aqua-nor.no) ; [mailbox@nor-fishing.no](mailto:mailbox@nor-fishing.no)*
- 
- SEPT 2019** World Seafood Congress 2019 – Seafood supply chains of the Future  
*Penang, Malaysia, 9-11 September 2019 – Information: [www.wsc2019.com](http://www.wsc2019.com)*
- 
- OCT 2019** Aquaculture Europe 2019 - Our Future: Growing from water  
*Berlin, Germany, 7-10 October 2019 – Information: [www.aquaeas.eu](http://www.aquaeas.eu)*
- 
- NOV 2019** INFOFISH World Shrimp Trade conference and exhibition. "Modelling for Sustainability"  
*Bangkok, Thailand, 12-14 Nov 2019 – Information: [shrimp.infofish.org](http://shrimp.infofish.org) ; [info@infofish.org](mailto:info@infofish.org)*

# FAN

FAO Aquaculture Newsletter

## Aquaculture Branch

Fisheries and Aquaculture Department

Food and Agriculture Organization of the United Nations

Viale delle Terme di Caracalla, 00153 Rome, Italy

E-mail: Lionel.Dabbadie@fao.org



The FAO Aquaculture Newsletter (FAN) is issued twice a year by the Aquaculture Branch (FIAA) of the FAO Fisheries and Aquaculture Department, Rome, Italy. It presents articles and views from the FAO aquaculture programme and discusses various aspects of aquaculture as seen from the perspective of both headquarters and the field programme. Articles are contributed by FAO staff from within and outside the Fisheries and Aquaculture Department, from FAO regional offices and field projects, by FAO consultants and, occasionally, by invitation from other sources. FAN is distributed free of charge to various institutions, scientists, planners and managers in member countries and has a current circulation of about 1 300 copies. It is also available on the FAO webpage: [www.fao.org/fishery/publications/fan](http://www.fao.org/fishery/publications/fan)

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