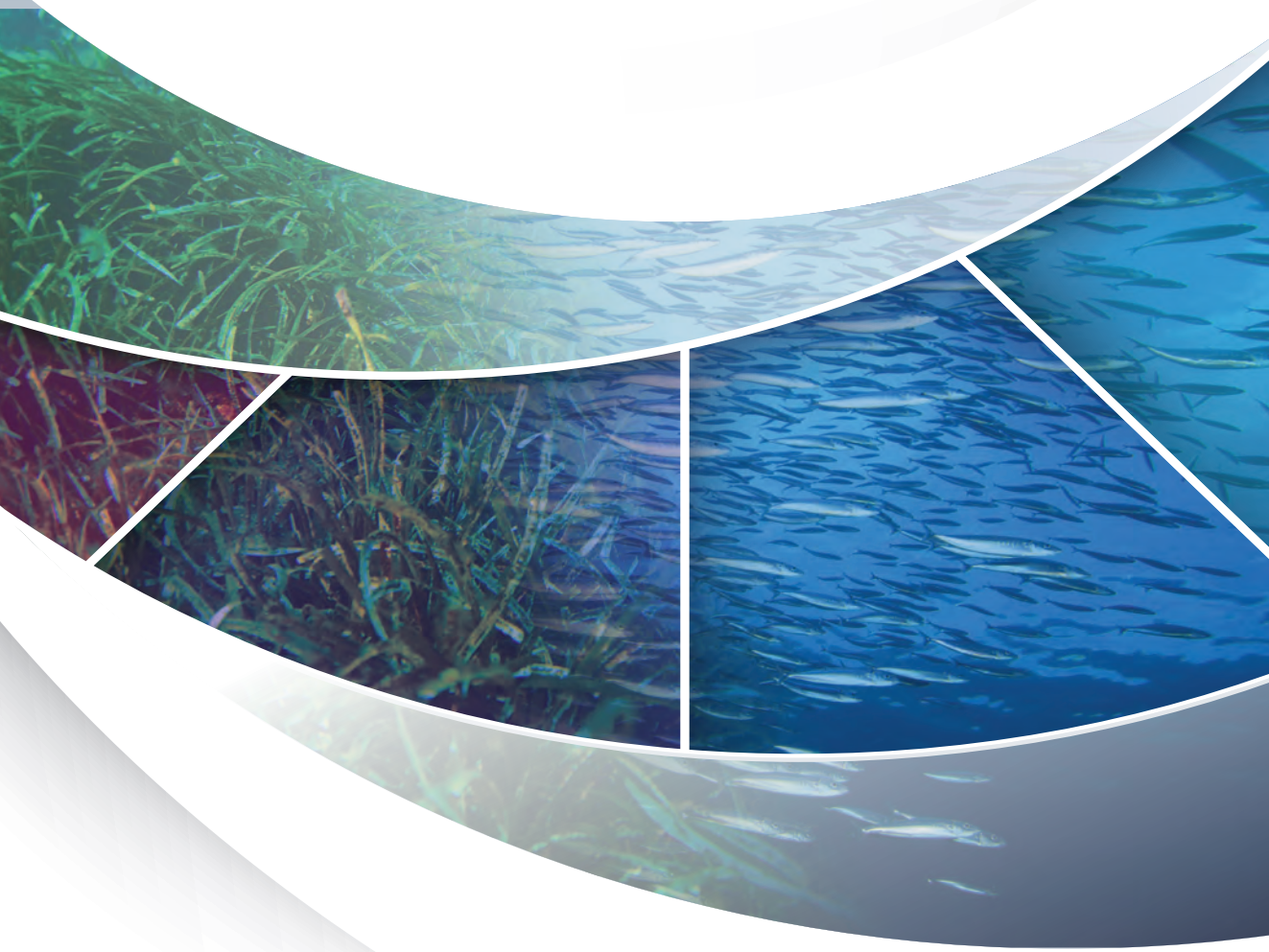
SEAFDEC Annual Report

2023



Southeast Asian Fisheries Development Center

SEAFDEC Annual Report

2023

Southeast Asian Fisheries Development Center

Preparation and Distribution of this Document

This SEAFDEC Annual Report 2023 was prepared by the Secretariat of the Southeast Asian Fisheries Development Center (SEAFDEC) in collaboration with the SEAFDEC Departments, namely: Training Department (TD), Marine Fisheries Research Department (MFRD), Aquaculture Department (AQD), Marine Fishery Resources Development and Management Department (MFRDMD), and Inland Fishery Resources Development and Management Department (IFRDMD). The SEAFDEC Annual Report 2023 is distributed to the SEAFDEC Member Countries and Departments, collaborating agencies, fisheries-related organizations, and to the public to promote the activities and achievements as well as the visibility of SEAFDEC.

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SEAFDEC Secretariat
Suraswadi Building, Kasetsart University Campus
P.O. Box 1046, Kasetsart Post Office Bangkok 10903, Thailand
Email: secretariat@seafdec.org

EXECUTIVE SUMMARY

The progress and achievements of SEAFDEC through the programs and activities undertaken from January to December 2023 were summarized in this SEAFDEC Annual Report 2023. The programs implemented by SEAFDEC were in line with the priority needs and policy directives of the Member Countries that were conveyed through the SEAFDEC Council and the SEAFDEC Program Committee, and were categorized into 1) Projects under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) Mechanism (22 projects, five of which not yet implemented in 2023 due to ongoing budget approval process); Departmental Programs (9 programs); and Other Program (1 program, not yet implemented in 2023 due to ongoing budget approval process). Moreover, these programs had also been aligned with the "SEAFDEC Strategies Towards 2030" adopted by the SEAFDEC Council in 2017, comprising six Strategies, namely: 1) Securing the sustainability of fisheries to contribute to food security, poverty alleviation and livelihood of people in the region; 2) Supporting the sustainable growth of aquaculture to complement fisheries and contribute to food security, poverty alleviation and livelihood of people in the region; 3) Ensuring the food safety and quality of fish and fishery products for the Southeast Asian region; 4) Enhancing trade and compliance of the region's fish and fishery products with market requirements; 5) Addressing cross-cutting issues, such as labor, gender and climate change, related to international fisheries; and 6) Empowering SEAFDEC to strengthen its roles in the region and to improve its services for the Member Countries.

While sustaining the implementation of the approved programs in 2023, SEAFDEC also continued to strengthen its cooperation and partnership with other international and regional organizations, national agencies of the Member Countries, as well as non-member governments that shared common interests toward sustainable development of fisheries and aquaculture, specifically in availing of their expertise and relevant resources for the programs and activities that are of mutual interest.

It is the hope of SEAFDEC that the SEAFDEC Annual Report 2023 would serve as a reference for the Member Countries, collaborating organizations, and the public in obtaining a better view of the roles, activities, and achievements of SEAFDEC in supporting the Member Countries in their respective efforts towards achieving sustainable development of fisheries and aquaculture in the Southeast Asian region.

MESSAGE FROM THE CHAIRPERSON OF THE SEAFDEC COUNCIL

In 2023, with the global alleviation of the COVID-19 situation, SEAFDEC has successfully resumed its normal operations. Most of SEAFDEC programs and projects were conducted in person, allowing for more effective implementation and engagement. We have observed that the stringent fisheries management measures enforced by several Member Countries over the past few years, aimed at ensuring the sustainable utilization of fishery resources and combating IUU fishing, have yielded positive results. The status of fishery resources in several waters of Southeast Asia has shown significant improvement. SEAFDEC's efforts in conducting relevant research and development, along with providing technical support and capacity building for our Member Countries, have been pivotal in this success. Our commitment to these initiatives has been instrumental in enhancing the effectiveness of fisheries management measures. We recognize that these efforts are crucial components in the broader strategy to ensure the long-term sustainability of our marine resources.

On behalf of the SEAFDEC Council, I would like to express my gratitude and congratulate SEAFDEC for its achievements in 2023. SEAFDEC has excelled not only in promoting sustainable marine capture fisheries but also in advancing the fisheries sector as a whole, including aquaculture, inland capture fisheries, post-harvest practices and trade.

The region's aquaculture subsector has significantly contributed to our progress, in line with global trends. This success is partly due to the innovative technologies developed by SEAFDEC for various aquatic species. Additionally, SEAFDEC has continued its efforts to address priority issues, particularly the replacement of fish-based ingredients in aquaculture feed and the management of aquatic animal health. Inland capture fisheries have also played a crucial role in ensuring food security and supporting livelihoods, especially in rural areas. SEAFDEC's initiatives, including habitat conservation and the promotion of fish passage to mitigate the impacts of cross-water obstacles, have been sustained over the past few years.

I am delighted to see that many of SEAFDEC's technologies focus on small-scale operators in the region. Extensive capacity-building activities have been conducted to promote sustainable fisheries management, including the continued promotion of the Ecosystem Approach to Fisheries Management (EAFM). We also recognize that enhancing food security from fisheries involves not only increasing production but also improving quality and safety. SEAFDEC's activities in this regard are highly commendable and well-recognized.

In witnessing and congratulating the successful implementation of SEAFDEC projects and activities in 2023, I would like to take this opportunity to express my appreciation to my colleagues Council Directors of SEAFDEC for their continued cooperation and dedication to the sustainable development of the region's fisheries sector. Moreover, on behalf of the SEAFDEC Council, I extend my gratitude to the SEAFDEC Secretariat and Departments, as well as our collaborating partners and donor agencies, for their unwavering support and cooperation throughout the year. At this juncture, I look forward to SEAFDEC continuing its endeavors and leading role in fostering regional cooperation in fisheries in the years ahead.

Mr. Wai Lin Maung
Director-General
Department of Fisheries of Myanmar
Chairperson of SEAFDEC Council for the Year 2023–2024

MESSAGE FROM THE SEAFDEC SECRETARY-GENERAL

The year 2023 was one of the challenging years for SEAFDEC. With several activities being impeded during 2020–2022 due to COVID-19, the activities of SEAFDEC this year were accelerated to ensure that our programs and projects achieve the outputs and outcomes as planned. In this year, the activities of SEAFDEC continued to focus on research, technology development, capacity building, and policy formulation toward sustainable utilization of fishery resources, responsible aquaculture development, and enhancement of fish food quality and safety for people in the region and worldwide.

One of the priority areas addressed through SEAFDEC projects continued to focus on combating IUU fishing. While the regional tools developed by SEAFDEC to support the ASEAN Member States in combating IUU fishing and relevant capacity building were sustained, the cooperation and collaboration with the Member Countries as well as relevant regional/international organizations were also fostered. As for the R&D and technological transfer through capacity-building activities, SEAFDEC endeavored to continue our activities toward ensuring sustainable development of fisheries (marine and inland), aquaculture, as well as post-harvest technologies to enhance not only the safety and quality of our fish and fishery products but also the competitiveness of the products from the region to international markets. These are in line with the SEAFDEC Strategies Toward 2030 with the vision of "Sustainable management and development of fisheries and aquaculture to contribute to food safety, poverty alleviation and livelihood of people in the Southeast Asian region."

It is important to note that the activities of SEAFDEC this year could not have been a success without close cooperation and collaboration from our Member Countries, especially through the Council Directors who provided guidance on our management and operations and the Program Committee who not only scrutinized and provided valuable inputs to implement our programs and projects in an effective manner but also adhere to the provisions of the Resolution and Plan of Action for Sustainable Fisheries for Food Security for the ASEAN Region Toward 2030. Moreover, I also wish to express appreciation to the Government of Japan for sustaining the support to SEAFDEC through the Japanese Trust Fund.

This year, SEAFDEC was in the process of formulation of several new regional projects which will commence very soon in 2024. We acknowledge that the cooperation of various organizations as well as non-member countries to provide technical and financial inputs is inevitable to our effort to promote sustainable development of fisheries and aquaculture in the region. On behalf of SEAFDEC, I reaffirm the commitment of SEAFDEC to take proactive roles in supporting our Member Countries toward achieving the sustained contribution from fisheries to food security for people in the Southeast Asian region.

Dr. Suttinee Limthammahisorn
Secretary-General

LIST OF ACRONYMS

ACDS	ASEAN Catch Documentation Scheme
AIT	Asian Institute of Technology
AMAF	ASEAN Ministers on Agriculture and Forestry
AMSs	ASEAN Member States
AQD	SEAFDEC Aquaculture Department
ASEAN	Association of Southeast Asian Nations
ASPIC	A Stock-Production Model Incorporating Covariates
ASSP	ASEAN–SEAFDEC Strategic Partnership
ASWGFi	ASEAN Sectoral Working Group on Fisheries
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch Per Unit Effort
DA-BFAR	Bureau of Fisheries and Aquatic Resources, Department of Agriculture, Philippines
DOF	Department of Fisheries
eACDS	Electronic ASEAN Catch Documentation Scheme
EAFM	Ecosystem approach to fisheries management
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FCG	Fisheries Consultative Group
FRA	Fisheries Research and Education Agency, Japan
GEF	Global Environmental Facility
GESI	Gender Equality and Social Inclusion
GIS	Geographic Information System
IFRDMD	SEAFDEC Inland Fishery Resources Development and Management Department
IUU Fishing	Illegal, Unreported and Unregulated Fishing
JAIF	Japan–ASEAN Integration Fund
JICA	Japan International Cooperation Agency
JIRCAS	Japan International Research Center for Agricultural Sciences
JTF	Japanese Trust Fund
LOA	Letter of Agreement
MCS	Monitoring, Control and Surveillance
MFRD	SEAFDEC Marine Fisheries Research Department
MFRDMD	SEAFDEC Marine Fishery Resources Development and Management Department
MMAF	Ministry of Marine Affairs and Fisheries, Indonesia
MOU	Memorandum of Understanding
NFRDI	National Fisheries Research and Development Institute, Philippines
NOAA	U.S. National Oceanic and Atmospheric Administration

PCA	Project Cooperation Agreement
PSM	Port State Measures
PSMA	Port State Measures Agreement
RDMA	Regional Development Mission for Asia, USAID
RFVR	Regional Fishing Vessels Record
RPOA	Regional Plan of Action
RS	Remote Sensing
SDGs	Sustainable Development Goals
SFA	Singapore Food Agency
SEAFDEC	Southeast Asian Fisheries Development Center
SEC	SEAFDEC Secretariat
SOM-AMAF	Senior Officials Meeting of the ASEAN Ministers on Agriculture and Forestry
SPEECTRA	Special Area for Conservation and Fish *Refugia*
SUFIA	Sustainable Fish Asia
SWG	Scientific Working Group
TOR	Terms of Reference
TD	SEAFDEC Training Department
TUMSAT	Tokyo University of Marine Sciences and Fisheries, Japan
UNEP	United Nations Environment Programme
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
US-DOI	U.S. Department of Interior
WWF-US	World Wildlife Fund, Inc.

CONTENTS

ABOUT SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous inter-governmental body established in 1967. SEAFDEC comprises 11 Member Countries, namely: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. The Center operates through the Secretariat located in Thailand and has five technical Departments, namely: Training Department, Marine Fisheries Research Department, Aquaculture Department, Marine Fishery Resources Development and Management Department, and Inland Fishery Resources Development and Management Department. The mandate of SEAFDEC as endorsed by the Forty-first Meeting of the SEAFDEC Council is *"to develop and manage the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities."*

SEAFDEC Secretariat

The SEAFDEC Secretariat is mandated to coordinate and oversee the general policy and planning of the Center, and acts as the focal point for channeling and implementing the decisions and resolutions of the SEAFDEC Council of Directors. In addition, the SEAFDEC Secretariat organizes regular SEAFDEC meetings to obtain directives and guidance from the Member Countries on the operations of the Center as well as regional technical consultations and meetings to address emerging issues as recommended by the Member Countries.

Training Department (TD)

Established in Thailand in 1968, TD has been focusing its efforts on the development of modern fishery techniques to aid regional fisheries in a more sustainable approach through the promotion of responsible fishing technologies and practices, exploration of resources, and advancement of the coastal fisheries management approach. Under the new Strategic Plan which was endorsed by the SEAFDEC Council in 2006, the structure and activities of TD have been adjusted to also cover the promotion of coastal fisheries management to ensure responsible resource utilization and sustainable livelihoods in coastal communities, and off-shore fisheries through the development of best fishing practices, and energy optimization technology to ensure a stable supply of food fish and reduce fishing pressure in coastal areas.

Marine Fisheries Research Department (MFRD)

MFRD was established in Singapore in 1969 and is responsible for promoting, undertaking, and coordinating research on fisheries post-harvest technology and furthering the development of the fish processing industry in the Southeast Asian region. Its tasks include research and development on fisheries post-harvest technology and practices such as fish processing technology to optimize the utilization of harvested fish and enhance the quality and safety of fish and fishery products. MFRD also develops technology-based analytical methods to assess seafood safety and quality and publishes several manuals as reference materials for the Member Countries.

Since 2007, the Post-Harvest Technology Centre of the Agri-Food and Veterinary Authority, Singapore (PHTC/AVA) has been serving as the collaborating center of SEAFDEC to undertake the activities of MFRD under the SEAFDEC Regional Programmes. However, with the formation of a new statutory board Singapore Food Agency (SFA) in 2019, the SFA continued to uphold the commitment of Singapore to implement the MFRD programmes through the Marine Aquaculture Centre serving as the new collaborating center.

Aquaculture Department (AQD)

Established in the Philippines in 1973, AQD has been carrying out activities in aquaculture research, technology verification, training, and information dissemination on a wide range of aquaculture disciplines, including broodstock management and seed quality improvement, promotion of responsible and environment-friendly aquaculture, diagnosis and control of aquatic diseases, aquaculture for stock enhancement, and culture of aquatic species under international concern. The aquaculture commodities covered by AQD include fishes, shrimps, mangrove crab, mollusks, seaweeds, and others. In addition, AQD also promotes good aquaculture practices and effective management of aquatic resources to support rural development and alleviate poverty.

Marine Fishery Resources Development and Management Department (MFRDMD)

MFRDMD was established in Malaysia in 1992 to conduct activities on marine fishery resources focusing on biological studies of commercially important fish species, resource assessment and management, and conservation and management of aquatic species under international concern, *e.g.* sharks and rays. MFRDMD also implements activities that support the Member Countries, especially in the compilation of information on small pelagic species and the establishment of indicators that could be used for the sustainable development and management of fisheries.

Inland Fishery Resources Development and Management Department (IFRDMD)

Established in 2014 in Indonesia, IFRDMD is tasked to carry out activities that support the sustainable development and management of inland capture fisheries. The activities of IFRDMD include the development of methodologies for data collection as well as monitoring and assessment of inland fishery resources to provide a scientific basis for the sustainable development and management of inland fisheries in the Southeast Asian region.

SEAFDEC COUNCIL OF DIRECTORS IN 2023

Chairpersons of the SEAFDEC Council

Mr. Haji Mohd Sufian bin Sulaiman *(until 3 January 2023)*
Dato' Adnan bin Hussain *(from 4 January to 8 May 2023)*
Mr. Wai Lin Maung *(since 9 May 2023)*

SEAFDEC Council and Alternate Council Directors

Brunei Darussalam

Council Director:	**Ms. Noraini Haji Anggas** *(until 31 January 2023)* Acting Director of Fisheries, Department of Fisheries **Ms. Wanidawati Tamat** *(since 1 February 2023)* Acting Director of Fisheries, Department of Fisheries
Alternate Council Director:	**Ms. Wanidawati Tamat** *(until 31 January 2023)* Acting Deputy Director of Fisheries, Department of Fisheries **Ms. Noor Dafinah Haji Jelani** *(since 1 February 2023)* Head of Policy and Planning Division, Department of Fisheries

Cambodia

Council Director:	**Mr. Ing Try** *(until 19 May 2023)* Deputy Director General, Fisheries Administration **Mr. Buoy Roitana** *(since 2 August 2023)* Deputy Director-General, Fisheries Administration
Alternate Council Director:	**Mr. Buoy Roitana** *(until 1 August 2023)* Deputy Director-General, Fisheries Administration **Mr. Suy Serywath** *(since 2 August 2023)* Deputy Director-General, Fisheries Administration

Indonesia

Council Director:	**Mr. Antam Novambar** Secretary General, Ministry of Marine Affairs and Fisheries
Alternate Council Director:	**Dr. I Nyoman Radiarta** Chairman of Marine and Fisheries Human Resources Development and Extension Agency, Ministry of Marine Affairs and Fisheries

Japan

Council Director:	**Ms. Miwako Takase** *(until 10 April 2023)* Councillor, Resources Management Department, Fisheries Agency of Japan **Mr. Fukuda Takumi** *(since 11 April 2023)* Councillor, Resources Management Department, Fisheries Agency of Japan

Alternate Council Director:	**Mr. Ishimaru Jun** Director, First Country Assistance Planning Division, International Cooperation Bureau, Ministry of Foreign Affairs

Lao PDR

Council Director:	**Mrs. Vilayphone Vorraphim** *(until 12 March 2023)* Director-General, Department of Livestock and Fisheries **Dr. Kaviphone Phouthavong** *(since 13 March 2023)* Director-General, Department of Livestock and Fisheries
Alternate Council Director:	**Dr. Kaviphone Phouthavong** *(until 12 March 2023)* Deputy Director-General, Department of Livestock and Fisheries **Dr. Phantavong Vongsamphanh** *(since 13 March 2023)* Deputy Director-General, Department of Livestock and Fisheries

Malaysia

Council Director:	**Mr. Haji Mohd Sufian bin Sulaiman** *(until 3 January 2023)* Director General, Department of Fisheries Malaysia **Dato' Adnan bin Hussain** *(from 4 January 2023)* Director General, Department of Fisheries Malaysia
Alternate Council Director:	**Mr. Haji Bohari bin Haji Leng** *(from 3 November 2023)* Deputy Director General of Fisheries (Development)

Myanmar

Council Director:	**Mr. Wai Lin Maung** Director-General, Department of Fisheries
Alternate Council Director:	**Mr. Myint Zin Htoo** Deputy Director-General, Department of Fisheries

Philippines

Council Director:	**Ms. Cheryl Marie Natividad-Caballero** *(until 17 January 2023)* Undersecretary for Agri-industrialization and for Fisheries, Department of Agriculture **Mrs. Drusila Esther E. Bayate** *(since 18 January 2023)* Undersecretary for Fisheries, Department of Agriculture
Alternate Council Director:	**Mrs. Drusila Esther E. Bayate** *(until 17 January 2023)* Assistant Director for Technical Services, Bureau of Fisheries and Aquatic Resources, Department of Agriculture **Atty. Demonsthenes R. Escoto** *(since 18 January 2023)* Director V, Department of Agriculture

Singapore

Council Director:	**Mr. Chan Hian Lim** Deputy Chief Executive Officer (Corporate, Industry & Technology), Singapore Food Agency
Alternate Council Director:	**Mr. Lim Huan Sein** *(until 31 January 2023)* Director of Aquaculture Department, Singapore Food Agency **Dr. Jiang Jun Hui** *(since 1 February 2023)* Director of Aquaculture Department, Singapore Food Agency

Thailand

Council Director:	**Mr. Chalermchai Suwannarak** *(until 30 September 2023)* Director-General, Department of Fisheries
Alternate Council Director:	**Mr. Taworn Thanjai** Deputy Director-General, Department of Fisheries

Viet Nam

Council Director:	**Dr. Tran Dinh Luan** Deputy Director General, Directorate of Fisheries
Alternate Council Director:	**Mrs. Nguyen Thi Trang Nhung** *(until 20 June 2023)* Deputy Director, Department of Science, Technology and International Cooperation, Fisheries Administration, Ministry of Agriculture and Rural Development **Mrs. Nguyen Thi Phuong Dung** *(since 21 June 2023)* Head of Science, Technology and International Cooperation Division, Department of Fisheries

SEAFDEC SENIOR OFFICIALS IN 2023

Secretary-General
Ms. Malinee Smithrithee (until September 2023)
Dr. Suttinee Limthammahisorn (since October 2023)
Deputy Secretary-General
Dr. Nakazato Tomoko

Training Department (TD)

Chief
Ms. Malinee Smithrithee (until September 2023)
Dr. Suttinee Limthammahisorn (since October 2023)
Deputy Chief
Dr. Nakazato Tomoko

Marine Fisheries Research Department (MFRD)

Chief, MFRD Programmes
Mr. Ong Yihang

Aquaculture Department (AQD)

Chief
Mr. Dan D. Baliao
Deputy Chief
Dr. Sayaka Ito

Marine Fishery Resources Development and Management Department (MFRDMD)

Chief
Mr. Abd. Haris Hilmi bin Ahmad Arshad
Deputy Chief
Dr. Masahito Hirota

Inland Fishery Resources Development and Management Department (IFRDMD)

Chief
Dr. Rudi Alek Wahyudin (until November 2023)
Mr. Andi Soesmono (Since December 2023)
Deputy Chief
Mr. Tomohito Shimizu

OVERVIEW OF SEAFDEC PROGRAMS IN 2023

The activities of SEAFDEC in 2023 were formulated and implemented in line with the policy directives given by the SEAFDEC Member Countries during SEAFDEC annual meetings, *i.e.* Forty-fifth Meeting of the SEAFDEC Program Committee (5–7 December 2022, Iloilo City, Philippines), Twenty-fifth Meeting of the Fisheries Consultative Group of the ASEAN–SEAFDEC Strategic Partnership (FCG/ASSP) (8–9 December 2022, Iloilo City, the Philippines), and Fifty-fifth Meeting of SEAFDEC Council (9 and 11 May 2023, online meeting).

Delegates attending the Fifty-fifth Meeting of the SEAFDEC Council organized through the virtual platform

Moreover, the development and implementation of the SEAFDEC programs and activities for 2023 have also been guided by regional and international fisheries policy frameworks, particularly the "*Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030*" adopted by the ASEAN Senior Officials and Ministers during the Special Senior Officials Meeting of the 41st Meeting of the ASEAN Ministers on Agriculture and Forestry on 5 August 2020, 42nd Meeting of the ASEAN Ministers on Agriculture and Forestry on 21 October 2020, as well as the Senior Official and Minister responsible for fisheries of Japan ad referendum. Furthermore, the programs and activities of SEAFDEC, especially those under the ASEAN-SEAFDEC Strategic Partnership (ASSP), also support the ASEAN in its efforts in the implementation of the "Strategic Plan of Action on ASEAN Cooperation on Fisheries 2021–2025."

The progress of implementation of the programs and activities in 2023 was considered and endorsed by the Forty-sixth Meeting of the SEAFDEC Program Committee organized on 20–22 November 2023 and the Twenty-sixth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) on 23–24 November 2023, both in Bali, Indonesia; and would be submitted to the SEAFDEC Council at its Fifty-sixth Meeting in 2024. Nonetheless, in this Annual Report, all SEAFDEC Programs and projects including those under the ASEAN-SEAFDEC Fisheries Consultative Group (FCG), the Departmental Programs, and Other Programs were categorized and reported based on the "SEAFDEC Strategies Towards 2030" adopted by the SEAFDEC Council at its Special Meeting in 2017.

National head delegates of the SEAFDEC Member Countries together with the SEAFDEC Secretary-General, Deputy Secretary-General, Department Chiefs, Deputy Chiefs, and Guest of Honor attending the Forty-sixth Meeting of the SEAFDEC Program Committee

National head delegates of the ASEAN–SEAFDEC Member Countries together with the SEAFDEC Secretary-General, SEAFDEC Deputy Secretary-General, and representative from the ASEAN Secretariat attending the Twenty-sixth Meeting of the FCG/ASSP

The programs and projects implemented by SEAFDEC in 2023 are shown below:

1) Projects under the ASEAN-SEAFDEC FCG/ASSP Mechanism

Project no.	Project Title	Lead Department	Funding Source
Strategy 1: Securing the sustainability of fisheries to contribute to food security, poverty alleviation and livelihood of people in the region			
1.	Sustainable Utilization of Fisheries Resources and Resources Enhancement in Southeast Asia	TD	JTF
2.	Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region	MFRDMD	JTF
3.	Management Scheme for Inland Fisheries in the Southeast Asian Region	IFRDMD	JTF
4.	Harmonization and Enhancing the Utilization of Fishery Statistics and Information	SEC	JTF
5.	Strengthening Regional Cooperation and Enhancing National Capacities to Eliminate IUU Fishing in Southeast Asia	TD	JTF
6.	ASEAN-JICA Capacity Building Project on IUU Fishing Countermeasures in Southeast Asia*	TD	JICA

Project no.	Project Title	Lead Department	Funding Source
7.	Small-scale Fisheries Management for Better Livelihood and Fisheries Resources	TD	JTF
8.	Responsible Fishing Technology and Practice	TD	JTF
9.	Regional Collaborative Research and Capacity Building for Monitoring and Reduction of Marine Debris from Fisheries in Southeast Asia	TD	JAIF
10.	Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region	MFRDMD	JTF
11.	Sustainable Utilization of Anguillid Eels in the Southeast Asian Region	IFRDMD	JTF
12.	Development of Stock Assessment Methods and Strengthening of Resources Management Measures for Tropical Anguillid Eel in Southeast Asia	SEC	JAIF
13.	Sustainable Management of Fisheries, Marine Living Resources and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities	TD	FAO/GEF and Norad
14.	Promoting the Blue Economy and Strengthening Fisheries Governance of the Gulf of Thailand through the Ecosystem Approach to Fisheries (GoTFish Project)*	TD	FAO/GEF
Strategy 2: Supporting the sustainable growth of aquaculture to complement fisheries and contribute to food security, poverty alleviation and livelihood of people in the region			
15.	Sustainable Aquaculture through Cost-effective Culture Systems, and Prompt and Effective Aquatic Animal Health Management	AQD	JTF
16.	Blue Horizon: Ocean Relief through Seaweed Aquaculture*	SEC in collaboration with AQD	WWF-US/GEF
17.	ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia (Phase 2)*	AQD	JAIF
Strategy 3: Ensuring the food safety and quality of fish and fishery products for the Southeast Asian region			
18.	Enhancing Food Safety and Competitiveness of Seafood Products	MFRD	JTF

Project no.	Project Title	Lead Department	Funding Source
Strategy 4: Enhancing trade and compliance of the region's fish and fishery products with market requirements			
19.	ASEAN-JICA Food Value Chain Development Project*	SEC	JICA
Strategy 5: Addressing cross-cutting issues, such as labor, gender and climate change, where related to international fisheries			
20.	Assistance for Capacity Development in the Region to Address International Fisheries-related Issues	SEC	JTF
Strategy 6: Empowering SEAFDEC to strengthen its roles in the region and to improve its services to Member Countries			
21.	Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2	TD	JTF
Special Project			
22.	USAID Southeast Asia Fisheries Partnership	SEC	USAID

*Projects not implemented in 2023 due to the ongoing budget approval process

2) Departmental Programs

Program no.	Program Title	Department	Funding Source
1.	Quality Seed for Sustainable Aquaculture	AQD	AQD*
2.	Healthy and Wholesome Aquaculture	AQD	AQD*
3.	Maintaining Environmental Integrity through Responsible Aquaculture	AQD	AQD*
4.	Meeting Socio-economic Challenges in Aquaculture	AQD	AQD*
5.	Collaborative projects with the Philippine Government	AQD	AQD*
6.	Promotion on Strengthening of SEAFDEC Visibility and Enhancing Human Capacity Building	TD	TD*
7.	Improvement of Fisheries Technology and Reduction of the Impact from Fishing Activities	TD	TD*
8.	USAID DOI International Technical Assistance Program (ITAP)	TD	USAID
9.	Implementing the Lower Mekong Fish Passage Initiative in Cambodia, Thailand, and Viet Nam	TD	USAID

* From the regular contributions of the respective host Governments

3) Other Program

Program no.	Program Title	Department	Funding Source
1.	Seminar-Workshop on Aquaculture Development in Southeast Asia (ADSEA)*	AQD	To be confirmed

* Project not implemented in 2023 due to the ongoing budget approval process

SEAFDEC PROGRAMS OF ACTIVITIES IN 2023

The programs of activities of SEAFDEC have been formulated and undertaken in response to the requirements of the Member Countries. This was the same for the year 2023, notwithstanding the need to consider the priority issues stipulated in the "*Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030*" adopted in 2020, and also adhere to the "*Resolution on the Future of SEAFDEC: Vision, Mission, and Strategies Towards 2030*" adopted by the SEAFDEC Council during its Special Meeting in 2017. Thus, the programs and activities carried out by SEAFDEC in 2022 had been structured in this Annual Report based on the "*SEAFDEC Strategies Towards 2030," i.e.* 1) Securing the sustainability of fisheries to contribute to food security, poverty alleviation and livelihood of people in the region; 2) Supporting the sustainable growth of aquaculture to complement fisheries and contribute to food security, poverty alleviation and livelihood of people in the region; 3) Ensuring the food safety and quality of fish and fishery products for the Southeast Asian region; 4) Enhancing trade and compliance of the region's fish and fishery products with market requirements; 5) Addressing cross-cutting issues, such as labor, gender and climate change, where related to international fisheries; and 6) Empowering SEAFDEC to strengthen its roles in the region and to improve its services to Member Countries. Moreover, there was also a cross-cutting project that could not be categorized into specific strategies, and therefore categorized as the "Special Project."

The results and progress of the programs and activities of SEAFDEC implemented in 2023 that include those under the ASEAN-SEAFDEC FCG/ASSP Mechanism, Departmental Programs, and Other Programs, are summarized as follows:

1. Strategy 1: Securing the sustainability of fisheries to contribute to food security, poverty alleviation and livelihood of people in the region

1.1 Assessment and management of marine fish stocks

Sustainable Utilization of Fisheries Resources and Resources Enhancement in Southeast Asia

FCG/ASSP Project no. 1

Fisheries resources are one of the primary sources of protein that contribute to the well-being and livelihoods of people making their contribution significant in the social and economic aspects. While the growing human populations over several decades created much more demand for fish and fishery products, the development of aquaculture and fishery-related industries resulted in further overexploitation of several aquatic species as well as the deterioration of marine habitats and ecosystems. Throughout the decades, SEAFDEC and its Member Countries have conducted activities at the national and regional levels aiming toward the sustainabe utilization and enhancement of marine and coastal fishery resources and the ecosystem, *e.g.* exploring underutilized offshore fishery resources, conducting fishery resources and environmental surveys, assessing stocks of economic aquatic species, installing tools for fishery resources enhancement, developing plans of action, organizing meetings, workshops and training courses, etc. Despite such efforts and with the continued increasing number of fishery vessels in the region, the marine catch statistics of several countries in the region still demonstrate a declining trend. The need

for sustainable utilization and enhancement of marine and coastal fisheries resources therefore continues to be an important challenge for the region.

In this connection, SEAFDEC/TD has been implementing the project "**Sustainable Utilization of Marine Fisheries Resources and Resource Enhancement in Southeast Asia**" with a duration from 2020 to 2024. The Project aims to strengthen the sustainable management of marine fishery resources in Southeast Asia by improving technical and research capacities through organizing training courses, meetings, and seminars; conducting fisheries and environment research surveys; promoting the application of the Fisheries Geographic Information System (FGIS) and Remote Sensing (RS); publishing guideline for evaluating the implementation of enhanced fisheries resources activities, etc.

In 2023, science-based skills and capacity of fisheries officers/researchers from the ASEAN Member Countries (AMSs) were improved through their participation in a series of training courses organized by TD, namely: 1) Regional Training Course on Data Collection and Bio-Statistic for Fishery (3–5 August 2023, Samut Prakan, Thailand), 2) Regional Training Course on Data-Limited Fish Stock Assessments Using R-Statistical Program (6–10 August 2023, Samut Prakan, Thailand); 3) Regional Practical Training Course on Google Earth Engine and Oceanographic Data Visualization (4–8 September 2023, Samut Prakan, Thailand); 4) Regional Training Course on Artificial Reefs Development Program (10–13 July 2023, organized in collaboration with SEAFDEC/MFRDMD in Terengganu, Malaysia); 5) Training Course on the Principles and Methods of Quantitative Echosounder EK80 (21–24 March 2023, Samut Prakan, Thailand). A total of 95 trainees attended these training courses. Their skill and knowledge of biostatistics, data collection, stock assessment, Google Earth Engine platform, artificial reefs site selection and design, and biomass estimation using the EK 80 were improved.

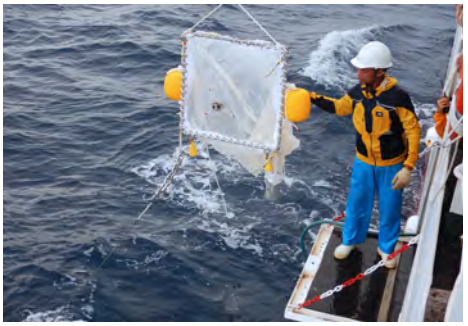
Regional Training Course on Data Collection and Bio-Statistic for Fishery (3–5 August 2023, Samut Prakan, Thailand)

Regional Training Course on Data-Limited Fish Stock Assessments Using R-Statistical Program (6–10 August 2023, Samut Prakan, Thailand)

Regional Practical Training Course on Google Earth Engine and Oceanographic Data Visualization `(4–8 September 2023, Samut Prakan, Thailand)

Training Course on the Principles and Methods of Quantitative Echosounder EK80 (21–24 March 2023, Samut Prakan, Thailand)

In 2023, the Project also supported the development of two research cruise plans for utilizing the SEAFDEC vessels. The first cruise plan was the collaborative cruise between TD and the Aquatic Resources Research Institute (ARRI) of Chulalongkorn University in Thailand to study marine debris in the Gulf of Thailand under the project "Formation of a Center of Excellence for Marine Plastic Pollution Studies in the Southeast Asian Seas." The cruise was conducted for eight days from 15 to 22 October 2023 with financial support from the Science and Technology Research Partnership for Sustainable Development (SATREPS) program of Japan.



Research cruise in collaboration with Chulalongkorn University, Thailand under the SATREPS project

Another cruise plan developed in 2023 was a collaborative cruise between TD and the Department of Fisheries (DOF) Brunei Darussalam to survey marine pelagic resources in the area that covers Zones 2, 3, and 4 of Brunei Darussalam waters as well as an oceanographic survey to assess the marine environment of the demersal and pelagic fish stocks in the on-shelf and off-shelf marine areas. The duration of this survey was proposed to be 50 days from 22 April 2024 until 10 June 2024.

Moreover, two marine debris research studies were carried out to seek proper ways to manage debris at the gillnetter fishing village and develop a model to estimate the density of floating marine debris in the river by using a passive visual observation record. In this regard, the "Workshop on Abundance Estimation of Marine Debris Using Pier Monitoring Data" was organized by TD on 23–24 September 2023 at the SEAFDEC Secretariat in Bangkok, Thailand. The debris data collected from the Chao Phraya River with the sampling site at the port of TD in Samut Prakan, Thailand were validated and analyzed. The Workshop also discussed the development of a floating marine debris density model.

Workshop on Abundance Estimation of Marine Debris Using Pier Monitoring Data (23–24 September 2023, Bangkok, Thailand)

The Project was also in the process of producing four publications to support combatting marine debris and resource enhancement, with the topics including 1) Composition of debris and its management within gillnet fishing communities in Rayong Province, 2) Temporal density estimation in the occurrence of floating debris in the Chao Praya River, 3) Guidelines for better practice approaches of fish enhancing devices in Southeast Asia, and 4) Environmental and socioeconomic impact of the FEDs (Fish Enhancing Devices) in coastal area.

Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region

FCG/ASSP Project no. 2

In 2023, SEAFDEC/MFRDMD continued implementing the regional project "**Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region.**" The Project implementation covers the period from 2020 to 2024 to evaluate the pelagic fish resources in the Southeast Asian region to establish a sustainable management strategy for the resources. Transboundary fish species, such as mackerels, tunas, and scads, are the major target species for this Project due to their high abundance in the waters of the AMSs and the need to establish efficient fisheries management strategies for the respective stocks. This Project also involves the genetic study of pelagic fish species in the region as well as a study of the life history of the species through age determination analysis. This Project has eight participating AMSs, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia,

Myanmar, Philippines, Thailand, and Viet Nam, responsible for providing information and fish samples for the Project.

In 2023 under the activity on "stock assessments and risk assessments for small pelagic fishes in the Southeast Asian region," MFRDMD continued to compile catch and effort data of three small pelagic species, namely: *Rastrelliger kanagurta*, *R. brachysoma*, and *Decapterus* spp., from the participating AMSs. In March 2023, MFRDMD staff together with experts, *Prof. Dr. Matsuishi Takashi* from Hokkaido University, Japan and *Dr. Supapong Pattarapongpan* from SEAFDEC/TD, conducted an in-house discussion on the constraints and methods for data analysis. The discussion came up with a method for standardization of catch and effort data and suitable data analysis that will be used in this Project.

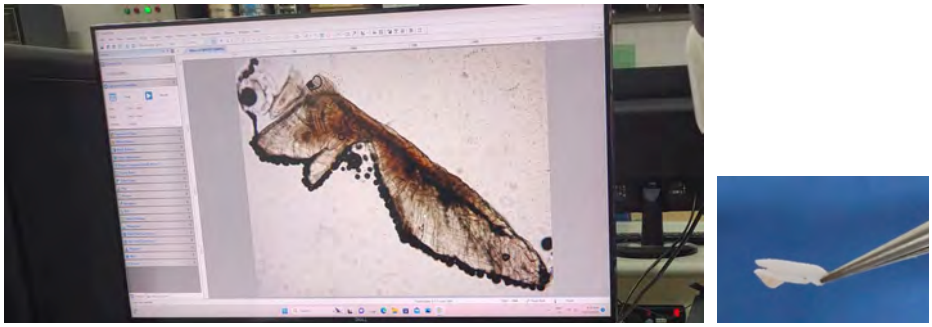
In-house discussion with the resource persons for the stock and risk assessments for small pelagic fishes in the Southeast Asian region

Under another activity on "stock assessments and risk assessments for major neritic tuna species in the Southeast Asian region," MFRDMD organized the "Regional Training on Stock and Risk Assessments of Two Seerfish Species in the Southeast Asian Waters" from 11 to 15 December 2023 in Kuala Lumpur, Malaysia. The participants of this Workshop were the members of the Scientific Working Group on Neritic Tunas Stock Assessment in the Southeast Asian Waters (SWG-Neritic Tuna), *Dr. Matsumoto Takayuki* as a resource person from the Fisheries Research and Education Agency (FRA) of Japan, and officials from TD and MFRDMD. In this Training, participants identified the current stock and conducted a risk assessment of two seerfish species, *i.e.* narrow-barred Spanish mackerel (*Scomberomorus commerson*) and Indo-Pacific king mackerel (*S. guttatus*) in the South China Sea (Western Pacific Ocean) and Andaman Sea (Eastern Indian Ocean) off the waters of the Southeast Asian region. Moreover, the participants enhanced their knowledge of CPUE standardization and stock assessment analysis using ASPIC, Kobe plot (stock status trajectory), risk assessment, and other applicable mechanisms or methods. They also learned how to manually build Kobe plots using R packages and ASPIC for the data on catch and effort of *S. commerson* and *S. guttatus*. The output from this Training will be published in 2024.

Participants of the Regional Training on Stock and Risk Assessment for Two Seerfish Species in the Southeast Asian Waters

Participants obtaining knowledge of stock and risk assessment of two seerfish species

MFRDMD also continued in 2023 the activity on "clarification of the stock structure for neritic tuna species (*Euthynnus affinis*) in the Southeast Asian region." DNA analysis was undertaken for 430 specimens using mitochondrial DNA *d-loop* region. The study suggested that *E. affinis* is a single population stock in Southeast Asia. However, due to unforeseen circumstances, the 100 specimens stored at the National Research and Innovation Agency (BRIN) of Indonesia were not analyzed and omitted from the analysis. Efforts were also enhanced throughout 2023 to accomplish laboratory-related activities such as embedding, sectioning, refining, mounting, and analysis of samples collected during 2021 and 2022. In total, 558 otolith samples of *E. affinis* were analyzed for annuli rings in 2021, and 669 samples were embedded, sectioned, polished, and mounted until December 2023. This laboratory work will continue for subsequent phases.



Processed kawakawa otolith under the microscope (left) and raw kawakawa otolith after the extraction process (right)

In 2023, MFRDMD published reports of two meetings, entitled "Second Core Expert Meeting on Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region" (organized on 28–29 September 2022) and "Seventh Meeting of Scientific Working Group on Neritic Tuna Fish Resources in the Southeast Asian Region" (organized on 23–24 August 2022). The hard copies of the reports were distributed to relevant persons and countries. As an alternative, the softcopy version can be found on the MFRDMD website at http://hdl.handle.net/20.500.12561/1930 and http://hdl.handle.net/20.500.12561/1929, respectively.

Report of the Second Core Expert Meeting on Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region

Report of the Seventh Meeting of Scientific Working Group on Neritic Tuna Fish Resources in the Southeast Asian Region

1.2 Assessment and management of inland fisheries

Management Scheme for Inland Fisheries in the Southeast Asian Region

FCG/ASSP Project no. 3

Inland fisheries play a crucial role in supporting the livelihoods of people, securing food, and providing economic opportunities, particularly in Southeast Asia. However, the sustainability of inland fisheries is often overlooked due to competing interests from other sectors such as agriculture, industry, and tourism. Despite their strategic importance, inland fisheries receive limited attention and investment, hindered by a lack of comprehensive data and challenges of integrated reporting. The sustainability of inland capture fisheries is intricately linked with the health of aquatic habitats and ecosystems. To address these challenges, SEAFDEC/IFRDMD emphasizes the need to improve fishers' livelihoods while maintaining biodiversity through innovative conservation approaches, such as promoting inland recreational fisheries. Additionally, enhancing the fisheries data collection and assessment methods are essential for monitoring fishery resources and supporting management decisions. By prioritizing these factors, better inland fisheries management can be achieved, ensuring the long-term sustainability of this vital resource. In 2023, IFRDMD continued to implement the ongoing project "**Management Scheme for Inland Fisheries in the Southeast Region**" which commenced in 2020 and is scheduled to complete in 2024. The Project covered two main outputs: 1) Policy and recommendations for inland fisheries management in Southeast Asia; and 2) Assemblage of fish catch data and information.

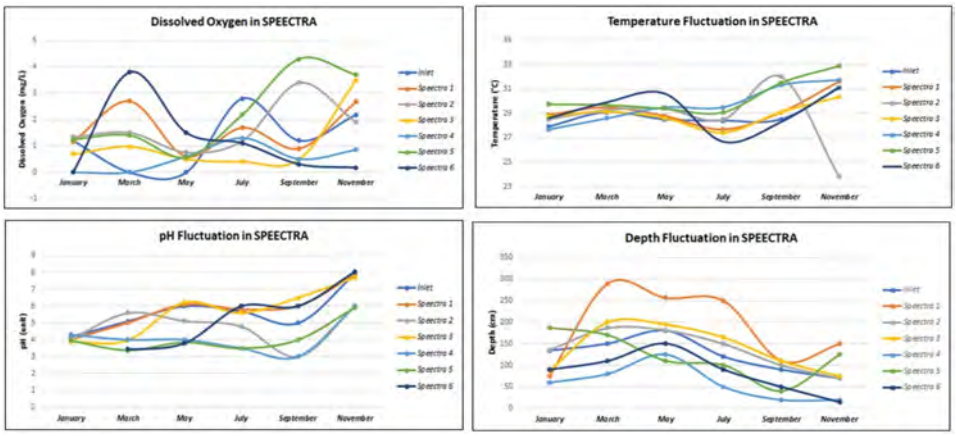
Under the first Project output, one of the highlighted initiatives of IFRDMD in enhancing the sustainability of inland fisheries is the development of the concept of "Special Area for Conservation and Fish *Refugia*" or SPEECTRA in collaboration with the Ministry of Marine Affairs and Fisheries of Indonesia. A pilot model of SPEECTRA was established in collaboration with the Research Institute for Inland Fisheries and Extension in Patra Tani

Village in South Sumatra Province, Indonesia in 2020, followed by monitoring of the area in terms of water quality and abundance of fish species during 2021–2022. To proceed with this initiative, IFRDMD extended this concept to other Southeast Asian countries by organizing a series of focus group discussions in Lao PDR on 13 March 2023, Thailand on 17 March 2023, Indonesia on 21 August 2023, and Malaysia on 16 October 2023 with the aims of strengthening collaboration, transferring knowledge, and obtaining feedback from the agency responsible for fisheries of the respective countries.

Series of meetings with the agencies responsible for fisheries of the AMSs

A peatland in Patra Tani Village in Indonesia was established with SPEECTRA with six adjacent ponds for several objectives, *i.e.* keeping suitable water conditions, providing sufficient food sources, and maintaining the diversity of the fish population. Obtaining scientific data to monitor the condition of the SPEECTRA is necessary to convince the public of the success of this new system and provide an overview of the system's response to environmental changes, mainly to extreme weather changes. For every two months from January to November 2023, IFRDMD monitored the water quality of the six ponds of the SPEECTRA and the inlet including dissolved oxygen (DO), temperature, pH, and water depth. Furthermore, fish catch quantity and species diversity were monitored in 2022 and 2023.

The lowest DO was observed at SPEECTRA 6 with a value of 0.17 mg/L in November, while the lowest average DO was at SPEECTRA 4 with an average value of 0.8 mg/L. The lowest water temperature was recorded at SPEECTRA 2 in November with a value of 23.84 °C which could be attributed to good forest cover and abundant photosynthetic processes. The lowest pH was at 3 in SPECTRA 3 which could be due to the influence of peat soil content with FeS minerals. It should be noted that low pH can increase the risk of poisoning and reduce the degradation process of substrates. The shallowest water depth occurred in November in SPEECTRA 4 and SPEECTRA 6 which was 25 cm during long, dry conditions, with only little water remaining. Drought is one of the critical points of SPEECTRA, as it is one of the systems that can mitigate the spread of forest fires in peatland areas.



Water quality, i.e. *dissolved oxygen, temperature, pH, and depth of SPEECTRA ponds and the inlet in Patra Tani Village in Indonesia monitored in 2023*

Monitoring of fish catch composition determines whether the SPEECTRA system is an effective approach for the protection of habitats and fish. The number of fish species caught in 2022 and 2023 was 11 and 12, respectively, with *Priptolepis grootii* as an additional species in the latter year. *Trichogaster trichopterus* was the most dominant species in 2022 accounting for 52.7 % of the total catch, while *Helostoma temminckii* was the dominant species in 2023 with 51.8 % of the total catch. Other significant compositional changes were the decrease in catch of *Channa striata* from 10.3 % in 2022 to 0.9 % in 2023, and the occurrence of *Priptolepis grootii*, which was not caught in 2022 but caught in 2023. The change in catch composition indicates that the ecosystem condition is healthy and is good for the fish population.

Fish catch quantity and species composition in SPEECTRA ponds in Indonesia in 2022 and 2023

Scientific name	2022		2023	
	Catch (g)	Percentage (%)	Catch (g)	Percentage (%)
Helostoma temminckii	1,552	7.7	7,575	51.8
Trichogaster trichopterus	10,573	52.7	2,581	17.7
Pristolepis grootii	-	-	1,085	7.4
Anabas testudineus	1,542	7.7	942	6.4
Trichopodus pectoralis	631	3.1	797	5.
Belontia hasselti	694	3.5	671	4.6
Puntius sp.	1,363	6.8	407	2.8
Clarias sp.	554	2.8	278	1.9
Channa striata	2,043	10.3	137	0.9

Scientific name	2022		2023	
	Catch (g)	Percentage (%)	Catch (g)	Percentage (%)
Mystus sp.	-	-	135	0.9
Rasbora sp.	141	0.7	15	0.1
Rasbora argyrotaenia	113	0.6	-	-
Betta sp.	866	4.3	1	0.01
Total	**20,072**		**14,624**	

From 2022 to 2023, IFRDMD also collected data on fishing activities carried out in the Mekong River by the local fishers in Kampong Cham Province, Cambodia.

Sampling site of fisheries data in Kampong Cham, Cambodia

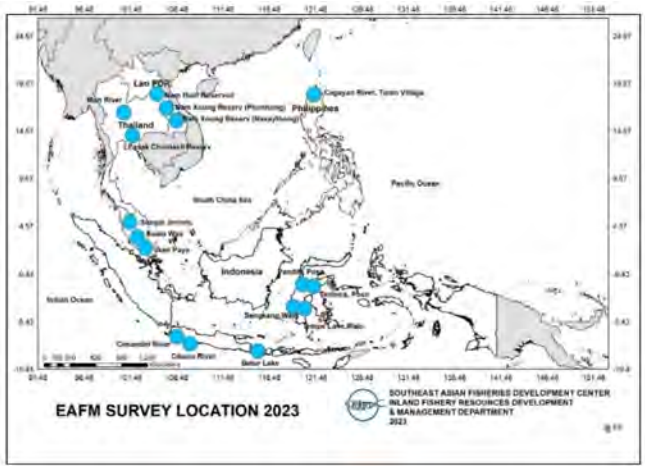
The data was obtained from the enumerators who are local fishers and captured fish using two kinds of fishing gear types, *i.e.* gillnets and cast nets. The data collected include daily activities indicating date and time of fishing, fishing location, type of fishing gear used, number of units of fishing gear, fish species composition, total catch, catch per species, fish species in the market, and fish prices. Results showed that fishing activities were conducted in several locations including the main river and its flooding exposure, such as oxbow lakes and other inundation areas. A total of 39 fish species were caught consisting of blackfish and whitefish groups. The dominant species were *Anabas testudineus* representing 28.3 % of total catch followed by *Trichopodus microlepis* (14.5 %) and *Henicorhynchus siamensis* (11.6 %). While *A. testudineus* and *T. microlepis* were recorded every month, other species occasionally caught also include *Henicorhynchus siamensis*, *Notopterus notopterus*, and *Oreochromis aureus*. The absence of some fish species could be due to various reasons, such as the high water levels, migration seasons, and fishing gear selectivity since each species has its uniqueness in adjusting to each environment.

Fish catch and fish species composition in the Mekong River Basin in Kampong Cham, Cambodia in 2022–2023

Common Name	Scientific Name	Total catch (kg)	Percentage (%)
Climbing perch	*Anabas testudineus*	131.6	28.3
Moonlight gourami	*Trichopodus microlepis*	67.3	14.5
Siamese mud carb	*Henicorhynchus siamensis*	53.75	11.6
Tilapia	*Oreochromis aureus*	35.35	7.6
Rainbow water snake	*Enhydris enhydris*	23.8	5.1
Trey ach kok	*Labiobarbus siamensis*	22.8	4.9
Peacock eel	*Macrognathus siamensis*	14.15	3.0
Dusky face carp	*Osteochilus lini*	13.65	2.9
Bronze featherback	*Notopterus notopterus*	13.25	2.9
Walking catfish	*Clarias batrachus*	9.65	2.1
Golden barb	*Barbodes semifasciolatus*	9.0	1.9
Striped snakehead	*Channa striata*	7.1	1.5
Silver barb	*Barbonymus gonionotus*	7.0	1.50
Asian redtail catfish	*Hemibagrus nemurus*	6.6	1.42
Trey kanchos chhnoht	*Mystus atrifasciatus*	6.3	1.35
Wallago	*Wallago leerii*	6.1	1.31
Siamese long fin carp	*Catlocarpio siamensis*	4.9	1.05
Clown featherback	*Chitala ornata*	4.2	0.90
Goldfin tinfoil barb	*Hypsibarbus malcolmi*	4.1	0.88
Striped catfish	*Platydoras armatulus*	4.0	0.86
Sailfin shark carb	*Oxynotus paradoxus*	3.6	0.77
Catopra	*Pristolepis fasciata*	2.3	0.49
Striped bony-lip carb	*Osteochilus vittatus*	2.2	0.47
Tinfoil barb	*Barbonymus schwanenfeldii*	2.1	0.45
Siamese flying fox	*Crossocheilus oblongus*	2.0	0.43
Giant featherback	*Chitala lopis*	1.2	0.26
Suvatti's barb	*Hypsibarbus suvattii*	1.1	0.24
Common carp	*Cyprinus carpio*	1.0	0.21
Southern striped raphael	*Platydoras armatulus*	1.0	0.21
Red tailed tinfoil	*Barbonymus altus*	0.9	0.19
Giant Barb	*Catlocarpio siamensis*	0.8	0.17
Siamese long fin carb	*Labeo* sp.	0.8	0.17

Common Name	Scientific Name	Total catch (kg)	Percentage (%)
Snakeskin gourami	*Trichopodus pectoralis*	0.4	0.09
Black sharkminnow	*Labeo chrysophekadion*	0.3	0.06
Pa mak ban	*Cosmochilus harmandi*	0.3	0.06
Hampala barb	*Hampala macrolepidota*	0.3	0.06
Swamp eel	*Monopterus albus*	0.2	0.04
Giant freshwater prawn	*Macrobrachium rosenbergii*	0.2	0.04
Lesser silver mud carb	*Scylla* spp.	0.2	0.04
Total		**465.5**	

For the second output on an assemblage of fish catch data and information in Southeast Asian countries, IFRDMD conducted a series of surveys to assess the status of inland fisheries by using the EAFM concept. Data collection was conducted in five countries, *i.e.* Indonesia (18–19 and 21–22 August 2023), Lao PDR (14–15 March 2023), Malaysia (17, 18, 20 October 2023), Philippines (7 December 2023), and Thailand (18–19 March 2023). The map showing the location of the study sites is shown below.



Study sites in Indonesia, Lao PDR, Malaysia, Philippines, and Thailand for assemblage of fish catch data and information in Southeast Asia

Data collection was carried out through interviews with key stakeholders including decision-makers, beneficiaries, fishers, consolidators, and fish processors, using a structured questionnaire categorized into EAFM domains (*i.e.* environment, fishing technology, social, economy, fish resources, governance, and stakeholders).

Implementing the Lower Mekong Fish Passage Initiative in Cambodia, Thailand, and Viet Nam

Departmental Program no. 9

SEAFDEC/TD in collaboration with the United States Department of the Interior (US-DOI), implemented from 2018 to 2022 the project "Implementing the Lower Mekong Fish Passage Initiative in Cambodia, Thailand, and Viet Nam." During the Project Close-out Meeting in 2022, a suggestion was made for TD to continue the collaboration with the

DOI-International Technical Assistance Program (ITAP) to conduct the activities using the remaining budget of this Project to enhance the capacity of human resources from the participating counties to monitor the effectiveness of the fish passage system. In 2023, TD therefore continued to support the participating countries to monitor and evaluate the fish passage efficiency under its Departmental Program "**Implementing the Lower Mekong Fish Passage Initiative in Cambodia, Thailand, and Viet Nam**." The duration of this Departmental Program is from 2023 to 2024.

Activities were undertaken on post-construction monitoring of the fish passage in Thailand at Huay Wang Chang Weir in Sang Khom District, Udonthani Province in 2023. A meeting was organized with local officers of the Inland Fisheries Research and Development Division of the Department of Fisheries (DOF) Thailand on 26 April 2023 to develop a monitoring work plan. The methodology to be used for monitoring the implementation and function of fish passages was based on the Fishway Monitoring Manual developed by the Mekong River Commission (MRC), *i.e.* for experimental design and sampling plan, sampling and data recording, and data analysis for assessing upstream attraction efficiency, upstream passage efficiency, and downstream passage. Surveys were conducted in collaboration between TD and staff of the DOF to study the abundance of fish at the upstream and downstream areas of fish passage using traps and gillnets at the beginning and during the peak of the flooding season.

At the beginning of the flooding season, it was found that 58 species of fish at the reservoir could swim across the fish passage with no injury and gained strength after swimming out of the passage. Most of them were in excellent condition and ready to spawn. Subsequently, the eggs hatched and during the peak of the flooding season, small fish were able to swim across the weir to the downstream water. Thus, many juvenile fish were found in the downstream areas. The fish length distribution of the fish that swam upstream and downstream crossing fish passage was small with the length between 12 mm and 390 mm. From the socioeconomic study of fish passage at Huai Wang Chang Reservoir, it was found that fish catch in this area has increased three years after the construction and the catch was used mostly for household consumption. The most common species caught were snakehead, carp, white minnow, serpent, catfish, cha-on, and dove minnow. The local community were satisfied with this fish passage for the increasing abundance and diversity of fish species. The community had more fish food and income, and the fish passage became a place for tourists to learn and study. At the end of 2023, the DOF Thailand submitted to TD the evaluation result of the efficiency of fish passage in Thai language which will be translated into English language by TD.

Staff from TD monitoring the effectiveness of fish passage at Huay Wang Chang Weir in Sang Khom District, Udonthani Province, Thailand

For Cambodia, follow-up activities to monitor the effectiveness of the fish passages were conducted on 25–29 July 2023 at four fish passages. For the Srei Snom Spillway in Stung Sreng Watershed, Siem Reap Province, it was found that the fish passage performed well. However, at the time of observation, the water level in the upstream area was not high enough to run the hydro function of the fish passage. The water level over the spillway was regulated by the local irrigation authority at the water gate. For the Kbal Hong Weir in Stung Pursat Watershed, Pursat Province, water overflow was observed at the weir that made all structures submerged. Fish sampling was not carried out yet in 2023 and this will be carried out in 2024 by the Fisheries Administration (FiA) of Cambodia using traps together with interviews with local fishers using cast nets and gillnets. For the Romlech I Spillway and Romlech II Spillway in Pusat Province, these two fish passages functioned well with high water flow and no sign of corrosion or cracks on their structures. However, one of the spillways did not fully operate due to the low water level which was controlled by the regulating gate which was installed in parallel with the exit gate of the fish passage. Therefore, the hydro function upstream is dependent on the fish passage design and opening of the regulating gate level. Fish sampling at these two fish passages was not carried out in 2023 but is being prepared to be done in 2024 by placing traps in the pool.

Staff from TD and FiA of Cambodia observing the fish passage in Cambodia

1.3 Compilation of scientific data and information to support policy formulation and management of sustainable fisheries

Harmonization and Enhancing the Utilization of Fishery Statistics and Information

FCG/ASSP Project no. 4

As widely recognized, fishery statistics and information are essential for policy planning and management of fisheries toward sustainability, and along the line of such concern, SEAFDEC has been undertaking initiatives in compiling fishery statistics from the countries bordering the South China Sea Area since 1978. Considering that the harmonization of data is important to facilitate the exchange and compilation of statistics at various levels, *i.e.* national, regional, and international levels, SEAFDEC, therefore, developed the "Regional Framework for Fishery Statistics of Southeast Asia" that includes the "standard definitions and classifications" that meet the international standards, and the "area of coverage" and "statistical usage" consistent with those of SEAFDEC criteria. Since 2008, the Regional Framework has been used for compiling the fishery statistics provided by the AMSs to SEAFDEC. Nonetheless, the recent developments, especially with respect to the new standards established by the FAO Coordinating Working Party (CWP) on Fishery Statistics, call for further harmonization of the Regional Framework. Therefore, the project "**Harmonization and Enhancing the Utilization of Fishery Statistics and Information**" was

implemented by the SEAFDEC Secretariat covering the period from 2020 to 2024. The goal of the Project is to facilitate the revision of the Regional Framework for Fishery Statistics of Southeast Asia to accommodate the updated global standards and enhance the utilization of fishery statistics data and information for policy planning and management of fisheries toward sustainability.

In 2023, SEAFDEC continued to coordinate with the AMSs and relevant organizations to support the submission of national statistics for regional/international compilation. To share views and experiences on data compilation and the situation of fishery statistics of the countries in the region, representatives from the SEAFDEC Secretariat attended the "Intersessional Meetings of Aquaculture and Fisheries Subject Groups" on 27–30 June 2023 in London, United Kingdom. The Intersessional Meeting also discussed the progress made by partners of the Coordinating Working Party on Fishery Statistics (CWP) in relation to its scopes and frameworks as well as the activities and achievements of the Aquaculture and Fisheries Subject Groups after the 27th Session of CWP held in 2022. Moreover, the representatives from the SEAFDEC Secretariat and TD also attended the "13th Meeting of FIRMS Steering Committee" also convened in London on 26–27 and 30 June 2023. The aim of the Meeting was to discuss the progress of the activities of FIRMS partners in improving the quality of data and information on the global monitoring and management of fisheries marine resources. During the Meeting, SEAFDEC provided updates on the activities of SEAFDEC related to data collection and stock assessment carried out during 2022–2023, as well as the results of the project "Collection of Research and Datasets from Data-poor Countries in Southeast Asia Related to SDG Indicator 14.4.1 and Formulation of a Thesaurus for Aquatic Genetic Resource" which was implemented by SEAFDEC in 2022 with the support of the Aquatic Sciences and Fisheries Abstracts (ASFA).

SEAFDEC representative (rightmost) at the 13th Meeting of FIRMS Steering Committee on 26–27 and 30 June 2023 in London, United Kingdom

Another continuing activity in 2023 was the revision of the Regional Framework for Fishery Statistics for Southeast Asia. In 2021 and 2022, SEAFDEC convened the "First and Second Regional Technical Consultations on Fishery Statistics and Information in Southeast Asia" that came up with suggestions including the revision of the Regional Framework, inclusion of new statistics (*i.e.* statistics on fish processing, fish trade (export and import), small-scale and commercial fisheries, fishers and fish farmers disaggregated by nationality and gender, and per capita fish consumption) for regional compilation as well as overall workplan for revising the Regional Framework. Thus, SEAFDEC proceeded with this initiative by organizing the "Third Regional Technical Consultation on Fishery Statistics and Information in Southeast Asia" on 22–24 August 2023 in Chiang Mai, Thailand. During the RTC, the discussion and agreement were made on the final draft of the Regional Framework,

Questionnaires, and streamlined process for submission by the AMSs of fishery statistics questionnaires to SEAFDEC and FAO. The RTC also supported the improvement of the existing fishery statistics databases to have a dashboard with importation information and generate an Excel table after query. The final draft of the revised Regional Framework will be further submitted to the 56th Meeting of SEAFDEC Council for approval and subsequently to the 32nd Meeting of the ASWGFi also for approval.

Officials and staff from the SEAFDEC Secretariat and representatives from the AMSs at the Third Regional Technical Consultation on Fishery Statistics and Information in Southeast Asia on 22–24 August 2023 in Chiang Mai, Thailand

It should be also noted that this Project serves as a platform to disseminate the outputs and outcomes of the various projects implemented by SEAFDEC. In 2023, two issues of the Special Publication "Fish for the People" (Volume 21 Nos. 1 and 2) were published and disseminated to target audiences. Meanwhile, another regular publication of the SEAFDEC Secretariat, "Fishery Statistical Bulletin of Southeast Asia 2020" which includes a compilation of the fishery statistics from the respective AMSs in line with the harmonized Statistics Frameworks was published and disseminated in 2023, while the Bulletin 2021 was being prepared for publication in early 2024.

(Left–right) SEAFDEC Special Publication "Fish for the People" Volume 21 Nos. 1 and 2 and Fishery Statistical Bulletin of Southeast Asia 2020

1.4 Development and promotion of regional measures and tools for combating IUU fishing

Strengthening Regional Cooperation and Enhancing National Capacities to Eliminate IUU Fishing in Southeast Asia

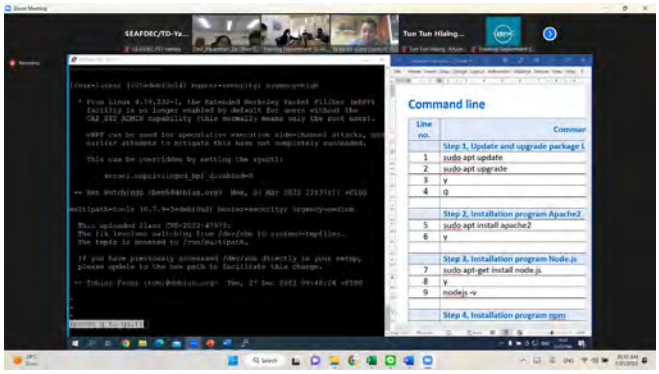
FCG/ASSP Project no. 5

In the global and regional situation where illegal, unreported and unregulated (IUU) fishing continues to be a challenge for the sustainability of the fisheries sector, SEAFDEC/TD has been implementing the project "**Strengthening a Regional Cooperation and Enhancing National Capacities to Eliminate IUU Fishing in Southeast Asia**" with the objective of achieving sustainable utilization and sound management of fisheries resources in Southeast Asia. The duration of this Project is from 2020 to 2024. The Project has four expected outputs, *i.e.* 1) enhancing the Regional Fishing Vessels Record (RFVR) database, 2) strengthening national capacities in the implementation of port State measure (PSM) and monitoring control and surveillance (MCS), 3) further promoting the electronic ASEAN Catch Documentation Scheme (eACDS), and 4) coordinating and promoting a national/regional/international network for collaborative activities to combat IUU fishing.

In 2023, TD continued to facilitate the request of the AMSs for utilization of the RFVR database and the provision of updated information on registered fishing vessels into the database by the respective countries. Moreover, as part of the initiative to enhance the understanding of the AMSs of the global framework relevant to combating IUU fishing, TD organized the "Regional Training Course on the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982) in Fisheries Perspective" during 6–9 November 2023 in Bangkok, Thailand. The Training was attended by 51 participants from the AMSs with resource persons from the Division for Ocean Affairs and the Law of the Sea (DOALOS) of the United Nations, and from FAO, among others, to deliver knowledge and information on: 1) UNCLOS and the UN Fish Stock Agreement, 2) Enforcement of International and Domestic Fisheries Laws: Case Studies, 3) Biodiversity Beyond National Jurisdiction (BBNJ) Agreement, 4) International Instruments of the Implementation of the Provision of the UNCLOS Relating to Fisheries Perspective through Prevent, Deter and Eliminate IUU Fishing, and 5) Implement of FAO and fishery bodies in the UNCLOS and other agreement.

"Regional Training Course on the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982) in Fisheries Perspective" (6–9 November 2023 in Bangkok, Thailand)

TD also continued conducting the activities to promote the application of the ASEAN Catch Documentation Scheme (ACDS) by the AMSs. For Myanmar, TD organized the "Practical Workshop on Preparation and Installation of the eACDS Application to Server" on 21–22 February 2023 via the online platform. The Training was aimed at strengthening and enhancing the understanding of the DOF Myanmar officers of the preparation and installation of the eACDS application by transferring eACDS application to the country's server as a prototype for the traceability of fish and fishery products. For Cambodia, TD organized the "Training on the Use of electronic Asian Catch Documentation Scheme (eACDS) Applications in the Part of Catch Declaration (CD)" on 21–22 June 2023 in Koh Kong Province to impart the knowledge of eACDS application in the part of CD to the FiA officers who were expected to be trainers for other relevant stakeholders in the future. Moreover, for Malaysia, technical assistance for eACDS was provided through a series of training courses as requested by the DOF Malaysia, *i.e.* training in Putrajaya on 12–14 September 2023, training in Kuala Terengganu on 24–27 September 2023, training in Kota Kinabalu on 23–26 October 2023, and training in Perlis on 20–23 November 2023. These trainings aim to impart knowledge of the use of eACDS application for the traceability of fish and fishery products to support inclusive and sustainable trade and economic growth in Malaysia.



"Practical Workshop on Preparation and Installation of the eACDS Application to Server" for Myanmar (21–22 February 2023, online meeting)

"Training on the Use of electronic Asian Catch Documentation Scheme (eACDS) Applications in the Part of Catch Declaration (CD)" in Cambodia (21–22 June 2023)

Training on eACDS for Malaysia: in Putrajaya (12–14 September 2023)

Training on eACDS for Malaysia: in Kuala Terengganu (24–27 September 2023)

Training on eACDS for Malaysia: Kota Kinabalu (23–26 October 2023)

Training on eACDS for Malaysia: in Perlis (20–23 November 2023)

ASEAN-JICA Capacity Building Project on IUU Fishing Countermeasures in Southeast Asia

FCG/ASSP Project no. 6

The Project "**ASEAN–JICA Capacity Building Project on IUU Fishing Countermeasures in Southeast Asia**" was aimed at enhancing the capacities of the AMSs to prevent and combat IUU fishing through a series of training and/or workshop activities, and of relevant staff from the concerned government agencies responsible for the implementation of activities to eliminate IUU fishing.

Although this ASEAN-JICA Project was approved by the SEAFDEC Council in 2021 to be implemented in 2022 provided that the fund could be secured, the administrative process in Japan in preparation for the Project has been delayed. Currently, the project proposal is in the finalization stage with JICA, taking into consideration the inputs from the ASEAN-SEAFDEC Member Countries. As of 2023, there has been no implementation of activities.

1.5 Promotion of innovative management tools and concepts applicable for the region

Small-scale Fisheries Management for Better Livelihood and Fisheries Resources

FCG/ASSP Project no. 7

SEAFDEC/TD has been implementing the project "**Small-scale Fisheries Management for Better Livelihood and Fisheries Resources**" which aims to obtain sustainable management of small-scale fisheries for improving the livelihood and well-being of fishers in Southeast Asia. The duration of the Project is from 2020 to 2024 with three main components, *i.e.* 1) Implementation of the EAFM in the pilot learning sites; 2) Capability development in the implementation of FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) for improving the livelihood and well-being of small-scale fishers; and 3) Further promotion of the gender integration and empowerment in sustainable fisheries management in the Southeast Asian countries.

Under the first component, TD organized the "Regional Workshop on Towards a New Era of Support for Small-scale Fisheries in Southeast Asia" on 29–31 August 2023 in Bangkok, Thailand. The resource persons of the Workshop were from the FAO/Regional Office for Asia and the Pacific (RAP), Too Big to Ignore (TBTI), Mahidol University, Asia-Pacific Rural and Agriculture Credit Association (APRACA), Sustainable Development Foundation (SDF). The Workshop served as a platform for identifying the contribution of small-scale fisheries in the region; obtaining the current concepts and approaches of small-scale fisheries management systems in the region; identifying the critical challenges/needs on small-scale fisheries management in fisheries resources, human, governance, socioeconomic contexts; and gathering recommendations and ways forward to strengthen small-scale fisheries management in the region that aligns with regional and international norms. It is envisaged that the outputs of the Workshop will help in providing the appropriate short-term and long-term support including the regional policy related to sustainable small-scale fisheries management and pave the way for better livelihood of small-scale fishers.

Regional Workshop on Towards a New Era of Support for Small-scale Fisheries in Southeast Asia (29–31 August 2023, Bangkok, Thailand)

In 2023, the Project also conducted follow-up activities on the EAFM implementation at two learning sites, *i.e.* Kawthoung District in Myanmar and Boeng Tonle Chhmar in Cambodia. In Myanmar, data collection on demographics and socioeconomics was conducted on 1–4 June 2023 at Chaung Wa Village in Kawthaung District, followed by the "Key Stakeholder Engagement Workshop on Development of the Ecosystem Approach to Fisheries Management (EAFM) Plan" on 5–6 June 2023. Attended by the DOF Myanmar fisheries officers, EAFM core team, and key stakeholders (with TD staff attending online), the EAFM plan of Chaung Wa Village was developed by the participants.

For Cambodia, as the country had successfully finalized the EAFM plan for the project learning site in Boeung Tonle Chhmar, Tonle Sap Lake in 2022, TD continued to build the capacity of community fishery on fish processing techniques as a follow-up activity on 20–21 June 2023. As a result, a fish processing group was established in Boeng Tonle Chhmar.

Data collection on demographics and socioeconomics was conducted at Chaung Wa Village in Kawthaung District, Myanmar on 1–4 June 2023

Key Stakeholder Engagement Workshop on Development of the EAFM Plan at Kawthoung District, Myanmar on 5–6 June 2023

Building the capacity of community fishery on fish processing techniques in Boeng Tonle Chhmar, Cambodia on 20–21 June 2023

Under the second component, an activity was conducted on 1–4 June 2023 to study the status of fisheries socioeconomic assistance, particularly in microfinance, microcredit, and insurance in the learning site of Kawthoung, Myanmar, and the data was analyzed during the "Data Analysis Workshop on Socio-economic Information of Small-scale Fisheries" on 13–14 July 2023 at Kasetsart University in Bangkok, Thailand The Workshop strengthened the capacity of TD staff on the data analysis and communication of the result as well as on the development of technical reports and papers. Moreover, a study on a development

plan for supporting fishing communities to enhance their product development and marketing (quality control, distribution, market access, etc.) was conducted together with the "Training on eACDS Application in Catch Documentation Part in Krabi Province, Thailand" on 24–25 May 2023 at Baan Nainang, Krabi Province. The Training familiarized the relevant fisheries officers and fishers on the use of the eACDS application, undertook a trial application of the eACDS, and gathered relevant inputs for video and promotional materials.

Data Analysis Workshop on Socio-economic Information of Small-scale Fisheries, Bangkok, Thailand (13–14 July 2023)

Training on eACDS Application in Catch Documentation Part in Krabi Province, Thailand (24–25 May 2023)

Under the third component, the "Training on Gender Mainstreaming in Fisheries Sectors" was organized in Viet Nam on 25–27 April 2023 and in Cambodia on 14–16 March 2023 to ensure the awareness of the staff of the Directorate of Fisheries (D-Fish) of Viet Nam and the Fisheries Administration of Cambodia of gender aspects as well as to mainstream gender in the countries' development of fisheries management policies and programs.

Training on Gender Mainstreaming in Fisheries Sectors in Viet Nam (25–27 April 2023)

Training on Gender Mainstreaming in Fisheries Sectors in Cambodia (14–16 March 2023)

Promoting the Blue Economy and Strengthening Fisheries Governance of the Gulf of Thailand through the Ecosystem Approach to Fisheries

FCG/ASSP Project no. 14

The project "**Promoting the Blue Economy and Strengthening Fisheries Governance of the Gulf of Thailand through the Ecosystem Approach to Fisheries**" or "GoTFish Project" is a five-year initiative funded by the Global Environmental Facility (GEF). The Project will be executed in collaboration among SEAFDEC, Sustainable Fisheries Partnership (SFP), and University of Queensland (UQ), with the Food and Agriculture Organization of the United Nations (FAO) serving as the GEF Implementing Agency.

The primary objective of the Project is to enhance natural resource governance in the Gulf of Thailand by implementing the ecosystem approach to fisheries (EAF), thereby contributing to the broader regional fisheries objectives outlined in the South China Sea Strategic Action Programme (SCS-SAP). To accomplish this goal, the GoTFish Project will focus on four main components: 1) Regional transboundary fisheries governance and management strengthened; 2) Alignment of incentive mechanisms; 3) Ecological Corridor of Critical and Important Habitat for Aquatic Resources in the Gulf of Thailand (with focus on Malaysia); and 4) Stakeholder engagement, communication, monitoring and evaluation. SEAFDEC will serve as the Executing Agency for overseeing the Project Components 1 and 4. The project involves four countries, namely: Cambodia, Malaysia, Thailand, and Viet Nam.

While the GoTFish Project received approval from the SEAFDEC Council in 2023, the final endorsement from the GEF CEO was secured in June of the same year. Following this endorsement, FAO initiated several administrative processes necessary for the Project to become operational. It is anticipated that the project activities will commence in 2024.

1.6 Development and promotion of responsible fishing technologies

Responsible Fishing Technology and Practice

FCG/ASSP Project no. 8

For over two decades, SEAFDEC/TD has continued to promote sustainable utilization of coastal and marine fishery resources and avoid adverse impacts on the ecosystems. There is however a continued pressing need for further development and promotion of environmentally friendly fishing gear and practices toward sustainable utilization of the resources, securing fish food for the people, and improving the ocean health of the region. Moreover, most of the capture fishery methods especially active fishing gear such as trawls and dredges are heavily dependent on the utilization of fossil fuels or petroleum, making fuel consumption constitute a major constraint to the economic viability of the fishing activities. Fossil fuels used in fishing activities are also a significant source of greenhouse gas emissions. Such problems therefore need to be addressed through the project "**Responsible Fishing Technology and Practice**" implemented by TD with the duration from 2020 to 2024. The Project aims to: 1) promote responsible fishing technology and practices to mitigate fishing impacts on the marine ecosystem, 2) promote marine engineering technologies and their applicability in enhancing the capability of fuel consumption efficiency and safety in fishing operations, and 3) enhance human resource capacities on fish handling techniques onboard fishing vessels.

Under the first objective, two trials of experiment on the comparative efficiency and impact of Vee type and rectangular flat otter boards for trawling were performed in the Gulf of Thailand through a trawl monitoring system (Scanmar) of M.V. PLALUNG during 11–18 March 2023 and 3–9 December 2023. A report of the experiment will be prepared in 2024.

TD staff performing experiment on the comparative efficiency and impact of Vee type and rectangular flat otter boards for trawling onboard M.V. PLALUNG

Moreover, the "Regional Technical Meeting on Responsible Fishing: The Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) and Marking of Fishing Gear" was organized by TD on 15–17 November 2023 in Bangkok, Thailand. The aims of the Meeting were to enhance human resources capacity on the ALDFG and fishing gear marking; update and share information on the national policies, research activities, and best practices on the ALDFG and fishing gear marking; and identify the challenge and way forward to combatting ALDFG and promotion on the marking of fishing gear in Southeast Asia. The Meeting came up with a technical report on international, regional, and national policies on ALDFG and marking of fishing gear; compilation of relevant best practices, research, trials, and awareness-building activities on ALDFG and marking of fishing gear; and summary of the way forward to combatting ALDFG and promoting marking of fishing gear in Southeast Asia. The information and relevant extension materials will be subsequently disseminated to the AMSs to promote the marking of fishing gear.

Regional Technical Meeting on Responsible Fishing: The Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG) and Marking of Fishing Gear on 15–17 November 2023 in Bangkok, Thailand

Under the second objective, a number of studies were undertaken in 2023. To facilitate the adoption of the concept of low impact and fuel efficient (LIFE) fishing as a responsible fishing technology, a study on trawl winches and other innovations installed onboard the fishing vessel M.V. PLALUNG was conducted during 3–9 December 2023. An automatic identification system (AIS) was installed to improve and ensure safe navigation and operation of the M.V. PLALUNG.

Under the third objective, a study on the sherbet ice system onboard the purse seiner was also conducted in 2023 to improve the freshness of fish catches from purse seiner. Sherbet ice system was installed on a purse seine fishing vessel in Pattani Province, Thailand from 3 to 12 February 2023 and tested at sea from 28 March to 2 April 2023. The system successfully cooled down 5,000 L of seawater in the fish hold from 28 °C to 0 °C within 14 h, achieving a cooling rate of 2 °C/h. Upon reaching 0 °C, sherbet ice began to form. Laboratory analysis conducted at Prince of Songkhla University, Pattani Campus confirmed that fish preserved using sherbet ice had a better freshness index by measuring the total plate count for the presence of specific coliform bacteria (*i.e. Staphylococcus aureus*, *Vibrio parahaemolyticus*, and *Escherichia coli*) and chemical spoilage indicators (*i.e.* TVB-N and TMA-N) than those preserved with traditional crushed ice.

Installation and testing of the sherbet ice system on a purse seine fishing vessel in Pattani Province, Thailand

Furthermore, TD also organized the "Regional Training Course on Energy Optimization for Fishing Vessels and Optimal Post-Harvest Fish Handling Techniques" from 27 November to 1 December 2023 in Samut Prakan, Thailand. The Training provided up-to-date information on the best practices and innovative technologies for optimizing fuel usage, enabling participants to make informed decisions regarding fuel efficiency measures, as well as technologies for optimizing post-harvest fish handling practices. The fish handing technique to preserve fish at the premium grade, ikejime method, was introduced by the resource person from the Fisheries Research and Education Agency (FRA) of Japan.

Regional Training Course on Energy Optimization for Fishing Vessels and Optimal Post-Harvest Fish Handling Techniques on 27 November–1 December 2023 in Samut Prakan, Thailand

Regional Collaborative Research and Capacity Building for Monitoring and Reduction of Marine Debris from Fisheries in Southeast Asia

FCG/ASSP Project no. 9

The project "**Regional Collaborative Research and Capacity Building for Monitoring and Reduction of Marine Debris from Fisheries in Southeast Asia**" was approved by the Japan-ASEAN Integration Fund (JAIF) in April 2022 to be implemented by SEAFDEC/TD originally from 2022 to 2023. The objectives of the Project were to enhance regional collaborative research and capacity building in the fisheries sector including application of scientific knowledge in regional policies and monitoring based on four priority areas of the "ASEAN Framework of Action on Marine Debris" for combating marine debris in Southeast Asia.

However, the original budget plan of the Project was designed in 2019, and the current costs are anticipated to be different particularly for fuel and travel costs. From May 2022 to December 2023, SEAFDEC in collaboration ASEAN Secretariat and JAIF therefore revised the budget plan. The Project period was shifted to be from 2024 to 2025, thus, no activities were implemented in 2023.

Improvement of Fisheries Technology and Reduction of the Impact from Fishing Activities

Departmental Program no. 7

TD continued to implement its ongoing Departmental Program "**Improvement of Fisheries Technology and Reduction of the Impact from Fishing Activities**." This Program comprises three scopes of activities, namely: 1) research and promotion of appropriate technologies and practices of fishing and marine engineering, 2) study on the impact on fisheries resources, marine environments, social well-being, and livelihood from fishing activities, and 3) develop a database for fisheries management.

Under the first scope, TD started in 2022 to develop the "Handbook of the Scientific Echo Sounder EK 80 for M.V. SEAFDEC 2" after the installation of the scientific echo sounder SIMRAD EK-80 onboard the M.V. SEAFDEC 2 in 2021. The Handbook was finalized in 2023 and currently under production process. It is expected that this Handbook will serve as a reference for TD technical staff and researchers who will be responsible for the EK-80 maintenance, repair, and improvement in the future.

Under the second scope, a study was conducted on the type and amount of debris in the surface layer of the Chao Phraya River that flows into the Gulf of Thailand. The 12-month data collection was completed in 2023 and the data analysis was ongoing. The model to assess the amount of floating debris runoff from Chao Phraya River was introduced by an expert from the Tokyo University of Marine Science and Technology (TUMSAT), Japan.

Under the third scope, a database under the web-based system was developed to support TD's activity on fisheries socioeconomic and small-scale fisheries in Krabi Province, Thailand. This activity is considered complete, although there is still an ongoing process of improving the database to be more user-friendly and adding more data/information to the database.

1.7 Integration of habitat and fisheries management and provision of support for the conservation of important fishery resources

Sustainable Management of Fisheries, Marine Living Resources and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities

FCG/ASSP Project no. 13

The Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) phase of the Bay of Bengal Large Marine Ecosystem (BOBLME) program identified three priority transboundary issues: 1) overexploitation of marine living resources, 2) degradation of critical habitat, *i.e.* mangroves, coral reefs and seagrasses, and 3) pollution and water quality. A BOBLME program framework was developed with countries bordering the Bay of Bengal to agree on priority issues to address and these were included in the project "**Sustainable Management of Fisheries, Marine Living Resources and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities**" or the **BOBLME** Phase II Project. The Project was designed to address the barriers, namely: i) institutional, legal, and administrative barriers; with incomplete regional policy cycles and weak national-regional as well as science-policy interfaces, leading to poor governance; ii) socio-economic barriers by improving stakeholder awareness, capacity, gender equity and participation, and introducing valuation of ecosystem services, leading to improved governance; and iii) reversing the lack of integration of climate change in planning and management to enhance the resilience of its fisheries, critical habitats, and people's livelihoods.

The objectives of the Project are to contribute to the sustainable management of fisheries, marine living resources, and their habitats in the Bay of Bengal region, to reduce environmental stress and improve environmental status for the benefit of coastal states and communities. This will be achieved through the five interlinked Project Components based on the SAP themes, and with an added component to strengthen the institutional arrangements for regional partnerships, coordination and collaboration, ecosystem-based monitoring, and assessment.

- Component 1: Sustainable Management of Fisheries
- Component 2: Restoration and conservation of critical marine habitats and conservation of biodiversity
- Component 3: Management of coastal and marine pollution to improve ecosystem health
- Component 4: Improved livelihoods and enhanced resilience of the BOBLME
- Component 5: Regional mechanism for planning, coordination and monitoring of the BOBLME

The BOBLME Phase II Project is implemented by three executing agencies, namely: International Union for Conservation of Nature (IUCN) which will perform as a Regional Coordinating Unit (RCU) and be responsible for the implementation of Components 2 and 4; Bay of Bengal Programme Inter-Governmental Organization (BOBP-IGO) which will be responsible for the implementation of Components 1, 3, and 5 in Bangladesh, India, Maldives, and Sri Lanka; and SEAFDEC which will be responsible for Components 1, 3, and 5 in the SEAFDEC Member Countries, namely Indonesia, Malaysia, and Thailand. The Components implemented by SEAFDEC received funds from GEF and Norad. The Operational Partners Agreement (OPA) between FAO and SEAFDEC for GEF International

Waters funding was signed in September 2023, while the OPA for Norad funding was signed in November 2023. The duration of the OPA will be until April 2028.

In the initial phase, the "Project Inception Meeting" was organized on 12–13 December 2023 back-to-back with the "1st Project Steering Committee Meeting" on 14 December 2023 in Bangkok, Thailand to discuss several critical elements of the Project. As a result, the Terms of Reference for the Project Steering Committee were discussed and approved, outlining the roles, responsibilities, and operating framework for the Committee. Moreover, the Year 1 Workplan and Budget were also approved, providing a clear roadmap for activities in the initial year of implementation. In addition, other recommendations from the Inception Meeting were also endorsed by the Committee, signifying a collective commitment to the proposed strategies.

Project Inception Meeting on 12–13 December 2023 in Bangkok, Thailand

1st Project Steering Committee Meeting on 14 December 2023 in Bangkok, Thailand

Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region

FCG/ASSP Project no. 10

Sharks and rays, with approximately 1,200 species worldwide and an estimated 200 species in the Southeast Asian region, play a crucial role in marine ecosystems. Globally, one-third of shark species is facing the threat of extinction, primarily due to overfishing; consequently, there is a growing emphasis on the importance of conserving these species. Recognizing the dual significance of sharks and rays as both a source of income and food for people in the Southeast Asian region, it is therefore imperative to obtain an understanding of their vital role in maintaining the balance of ecosystems, while ensuring that the resources are utilized in a sustainable manner.

In 2023, MFRDMD continued to implement the project "**Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region**" from 2020 to 2024. The Project was aimed at 1) developing capacity in taxonomy, encompassing the identification of new species/records and effective management of major shark species; 2) confirming the stock structures for at least two common species of sharks/rays and one CITES-listed species in participating countries, with a specific focus on determining whether these stocks are shared or individual; and 3) conducting socioeconomic studies in selected areas to gain valuable insights into the economic aspects related to the utilization and management of sharks and rays in these regions.

- *On-Site Training on Chondrichthyans Taxonomy, Biology, and Data Collection*

In 2023, MFRDMD continued its capacity-building activities by organizing two on-site training sessions, namely: 1) On-Site Training on Chondrichthyans Taxonomy, Biology, and Data Collection, on 14–17 February 2023 at the Marine Fisheries Research and Development Institute (MaFReDI) in Sihanoukville, Cambodia, in collaboration with the Department of Fisheries Cambodia; and 2) Regional On-site Training on Chondrichthyans Taxonomy, Biology, and Data Collection, on 3–6 October 2023, at Likas Fisheries Complex in Kota Kinabalu, Sabah, Malaysia, in collaboration with the Department of Fisheries Sabah. The objectives of the training sessions were: 1) conducting a training course on the taxonomy and biology of chondrichthyans for Department of Fisheries (DoF) staff, 2) providing participants with appropriate techniques for collecting morphometric and meristic data, and 3) training participants in the collection and preservation of specimens for DNA studies.`

On-Site Training on Chondrichthyans Taxonomy, Biology, and Data Collection, in collaboration with the Department of Fisheries Cambodia

Regional On-site Training on Chondrichthyans Taxonomy, Biology, and Data Collection conducted in Sabah, Malaysia

Renowned elasmobranch expert, *Dr. Ahmad Ali*, was invited as a lecturer to impart his knowledge of the taxonomy and biology of sharks and rays. A total of 18 and 21 participants attended in the respective training sessions. The comprehensive program included lectures covering taxonomy, biology, data management, and standard operating procedures for data collection up to the species level. Practical exercises conducted in the laboratory facilitated the identification of shark and ray species caught by trawlers and other fishing gear, as well as the SOPs for the collection of tissue samples for DNA analysis, sample selection, and measurement techniques for sharks and rays at the landing sites.

Participants undertaking practical activity on identification shark specimens

- *Data collection of sharks and rays at selected landing sites*

MFRDMD in collaboration with the DOF Malaysia also supported data collection on the landing of sharks and rays by species from January to December 2024 at landing sites in Kota Kinabalu and Tawau in Sabah, Malaysia. Data were collected at least 12 days per month, each day from 1–3 vessels randomly selected at the landing site. All sharks and rays were measured individually for length and weight if the total number was less than 50 individuals per vessel. If the total number of individuals was more than 50, a 10–50 % sub-sample was measured. In Kota Kinabalu, 17 shark species with a catch percentage of 0.25 % (5,066.8 kg) and 19 ray species with a catch percentage of 0.72 % (14,886.8 kg) were recorded. The dominant shark species in Kota Kinabalu were *Chiloscyllium punctatum*, *Carcharhinus sorrah*, and *Chiloscyllium plagiosum*; while the dominant ray species were *Neotrygon orientalis*, *Maculabatis gerrardi*, and *Telatrygon zugei*. In Tawau, there were only two shark species with a catch percentage of 0.14 % (233.5 kg) and eight ray species with a catch percentage of 0.77 % (1,352.7 kg). The dominant shark species in Tawau were *Sphyrna lewini* and *Carcharhinus sorrah*; while the dominant ray species were *Maculabatis gerrardi*, *Neotrygon orientalis*, and *Gymnura zonura*.

- *Regional Training for Stock Assessment of Sharks and Rays Using the Yield Per Recruit Model*

MFRDMD organized the “Regional Training on Stock Assessment of Sharks and Rays using the Yield Per Recruit (YPR) Model” from 4 to 7 December 2023 in Selangor, Malaysia. There are several models developed using different types of data. However, considering that the data collected for sharks and rays in the Southeast Asian region is limited, the yield per recruit or YPR model is the most appropriate method for stock assessment. YPR analysis focuses on predicting the potential yield resulting from individual recruitment (if the sharks are let to grow) at a given age and fishing mortality. The YPR stock assessment model can

provide an important reference point as a target or a limited reference point for fisheries management.

The Training was attended by researchers from the AMSs and relevant MFRDMD staff. The resource persons of the Training included the oceanographer and fish stock assessment researcher from SEAFDEC/TD, *Dr. Supapong Parapongpang*, and experts from Fisheries Research and Education Agency (FRA) of Japan, *Dr. Misawa Ryo* and *Dr. Yano Toshikazu*. During the Training, the participants deepened their knowledge of shark and ray stock assessment using the YPR model in order to maintain the sustainable utilization of shark and ray resources. It is envisioned that after the training, a network of researchers on shark and ray stock assessment in the Southeast Asian region will be established and the availability of information on shark and ray stock assessment by species in the region will be improved.

Participants of the Regional Training on Stock Assessment of Sharks and Rays using the Yield Per Recruit (YPR) Model

- *Study of stock structure of selected shark and ray species using genetic marker*

The study on the stock structure of selected shark and ray species, which was initiated in 2020, continued its investigation of two CITES-listed shark species (*Carcharhinus sorrah* and *Sphyrna lewini*) and one ray species (*Maculabatis gerrardi*). The four sampling sites across Malaysia (*i.e.* Kuantan, Pahang; Bagan Panchor & Hutan Melintang, Perak; Kota Kinabalu; and Sandakan, Sabah) covered the Andaman Sea, South China Sea, and Sulu Sea.

A total of 378 specimens was collected with 20–35 specimens per species at each site. The breakdown of specimens collected at each location is as follows:

Sampling site	Species	Number of samples collected
Kuantan, Pahang	*C. sorrah*	35
	S. lewini	35
	M. gerrardi	35
Bagan Panchor & Hutan Melintang, Perak	*C. sorrah*	35
	S. lewini	20
	M. gerrardi	35

Sampling site	Species	Number of samples collected
Kota Kinabalu, Sabah	*C. sorrah*	31
	S. lewini	30
	M. gerrardi	35
Sandakan, Sabah	*C. sorrah*	22
	S. lewini	35
	M. gerrardi	30
Total		**378**

The study employed the mitochondrial DNA D-loop region as a DNA marker, and the DNA sequencing analysis of all collected specimens was nearly completed in 2023. The DNA sequences would be continued to determine genetic diversity and structure that will pave the way for proposed management measures.

Additionally, in collaboration with the Department of Fisheries Malaysia, MFRDMD conducted a survey and DNA barcoding of freshwater stingrays in Peninsular Malaysia. Out of 40 samples from four states (*i.e.* Johor, Pahang, Kelantan, and Perak), three species were identfied, *i.e. Urogymnus polylepis*, *Fluvitrygon signifer*, and *F. kittipongi*. All findings have been submitted to BOLDSYSTEM and GenBank for further documentation.

Preparation of individual specimen for photograph procedure

- *Survey on fishermen's dependencies, commercialization, and trade of sharks and rays in Sabah, Malaysia*

Under the study "Fishermen's Dependency, Marketing, and Trade of Sharks and Rays in Sabah," MFRDMD conducted a survey from 5 to 12 October 2023 in Kota Kinabalu and Sandakan in Sabah, Malaysia. The survey aimed to delve into the economic impact of shark and ray resources on traditional fishers who often rely on these species to enhance their modest income derived from fishing activities. The survey focused on gathering comprehensive information regarding the dependence of both fishers and traders on sharks and rays, assessing the socio-cultural and economic implications of various shark and ray species listed in CITES Appendix II, and evaluating the quantity and value of shark and ray species landed. Respondents of the survey included fishers, boat owners, and local middlepersons/collectors who possess firsthand knowledge of fishing activities, fishing grounds, species, quantity, value, and destinations of the landed fish in the study areas.

This collaborative effort was led by MFRDMD, with support from the DoF Sabah, and featured the expertise of *Dr. Nakano Makibi* from Toyo University, Japan.

MFRDMD staff visiting a landing jetty

Grilled stingray

- *Other Activities*

A study conducted in 2019 and 2020 at selected artificial reef sites in Peninsular Malaysia through underwater video census revealed the presence of two ray species, *Pateobatis jenkinsii* and *Neotrygon* sp., along with one species of bamboo shark, *Chiloscyllium hasseltii*. These findings underscored the potential of artificial reefs to serve as new habitats for bamboo sharks and rays, a conclusion supported by monitoring data from the same period. Bamboo sharks and Jenkins whiprays emerged as commonly spotted chondrichthyes in artificial reefs in Malaysia, a fact well-recognized among the diving community. The result led to a subsequent study utilizing an underwater video to survey the sunken confiscated vessel as an artificial reef site in Pulau Perhentian, Terengganu conducted from 21 to 23 August 2023 to monitor the presence of sharks and rays. Regrettably, despite diligent efforts, this study yielded no sightings of sharks or rays. This outcome prompts consideration for potential future repetitions of the study.

Number and species of sharks and rays spotted at artificial reef sites

Species	No. of individuals	Type of Artificial reef	Location	Year
Chiloscyllium hasseltii	72	Concrete	Merchong, Pahang	2019
	36	Vessel	Kuala Kemasin, Kelantan	2019
	6	Oil rigs	Pulau Kapas, Terengganu	2019
	26	Concrete	Bachok, Kelantan	2020
	162	Concrete	Kuala Nerus, Terengganu	2020
	20	Vessel	Pulau Kapas, Terengganu	2020
	6	Oil rigs	Pulau Kapas, Terengganu	2020
	75	Concrete	Nenasi, Pahang	2020

Species	No. of individuals	Type of Artificial reef	Location	Year
Pateobatis jenkinsii	18	Vessel	Kuala Kemasin, Kelantan	2019
	1	Vessel	Pulau Kapas, Terengganu	2019
	4	Oil rigs	Pulau Kapas, Terengganu	2020
	6	Concrete	Kuala Kemaman, Terengganu	2020
Neotrygon sp.	9	Concrete	Kuala Nerus, Terengganu	2020

Sustainable Utilization of Anguillid Eels in the Southeast Asian Region

FCG/ASSP Project no. 11

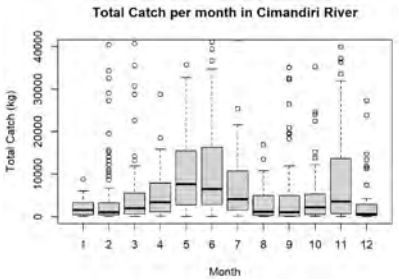
The declining temperate eels combined with the rising market value of tropical eels intensified glass eel capture fisheries in the tropical zone. To prevent the overexploitation of tropical anguillid eels in the Southeast Asian region, Indonesia and other countries prohibited the export of eel seeds and juveniles. Other conservation policies for sustainable tropical eel resources are also crucial. However, due to limited knowledge of tropical anguillid eel species, SEAFDEC carried out two regional projects, namely: "Sustainable Utilization of Anguillid Eels in the Southeast Asia Region" and "Development of Stock Assessment Methods and Strengthening of Resources Management Measures for Tropical Anguillid Eel in Southeast Asia."

The project "**Sustainable Utilization of Anguillid Eels in the Southeast Asian Region**" is being implemented by SEAFDEC/IFRDMD from 2020 to 2024 with the goals of obtaining a better understanding of the status, biology, and life cycle of anguillid eel stocks and to promote sustainable management and utilization of the eel fishery resources in the region. The Project activities were aimed at standardizing the data collection system and clarifying the Southeast Asian eel genetic population structure.

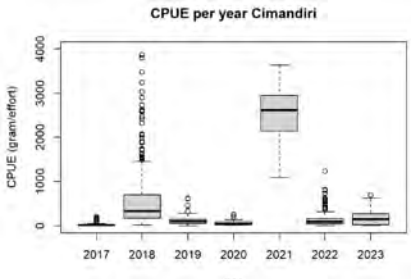
In 2023, IFRDMD continued to collect catch and catch per unit effort (CPUE) data in Palabuhan Ratu and Cilacap in Indonesia, and in Cagayan and Mindanao in the Philippines and analyzed the data using R statistical language.

Indonesia

In Indonesia, Palabuhan Ratu is a well-known location for glass eel fisheries that provide natural seeds to eel farms in the country. IFRDMD staff collected catch data from fishers using scoop nets to catch glass eels at night at the mouth of the Cimandiri River. From the data collected under this Project as well as the previous project implemented by IFRDMD since 2017, the average monthly data on the catch of glass eels and the CPUE data could be summarized as appears in the below figure. *A. bicolor bicolor* was found to be the main species caught in this area.

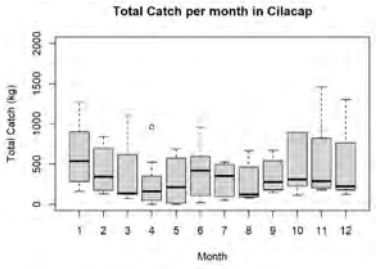


Average monthly catches of glass eels in Palabuhan Ratu during 2017–2023

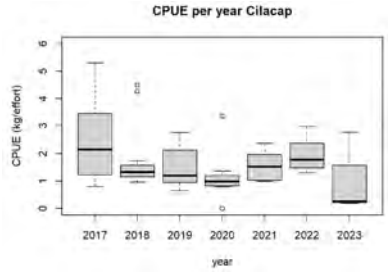


Annual of CPUE (g/effort) of eel between 2017 and 2023

In Cilacap, which is a famous fishing ground for the elvers and yellow eels, fishers collected eels at night by using a PVC trap. The yellow eel stage is very important as the natural production for the eel processing around Cilacap, while elver is a seed source for the eel farms in this area. IFRDMD collected the data on the monthly catch of elvers and yellow eels in the watershed of the Serayu River . The dominant species in this area was *A.bicolor bicolor*.



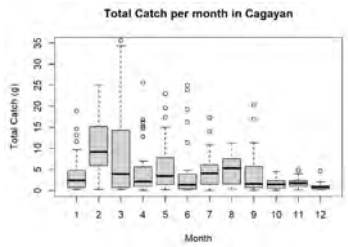
Average monthly catche of eels in Cilacap during 2017–2023



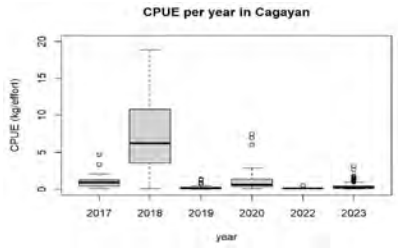
Annual CPUE (kg/day) of eels in Cilacap between 2017 and 2023

Philippines

For the Philippines, Cagayan located in the northern tip of Luzon is a famous area for glass eel fishing grounds that provide a natural seed source for eel farms in the country. IFRDMD collected the monthly catch and CPUE data of glass eel in Cagayan during 2017–2023 using a big fyke net operated by 6-10 fishers at night in the mouth of the river of Cagayan. From the collected data, the average monthly data on the catch of glass eels and the CPUE data appear in the below figures. The dominant species in this area is *A. marmorata*.

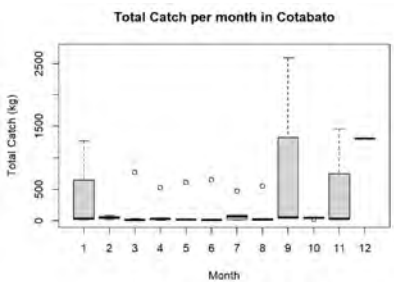


Average monthly catch and standard deviation of glass eel caught by gear in Cagayan during 2017–2023.

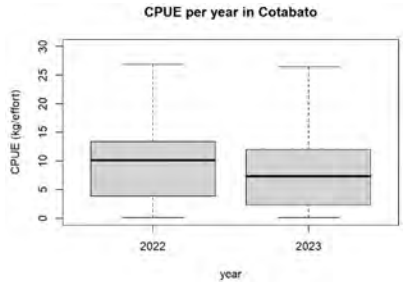


Annual CPUE (kg/day) of glass eel from gear operating between 2017 and 2023

Cotabato City in Mindanao Island is another famous area for the eel fishery in the Philippines. In 2022–2023, IFRDMD collected monthly catch data and CPUE data of adult eels from a fisher operating the bamboo trap at night in the inland waters of Cotabato. The average monthly data of the adult eel catch and the CPUE data appear in the below figures. The dominant species in this area is *A. marmorata*.

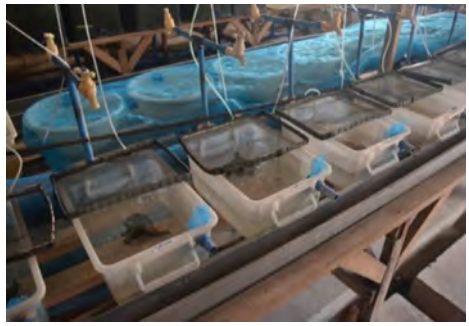


Average monthly catches and standard deviation of eel caught by gear in Cotabato during 2022–2023.



The monthly mean catch and standard deviation of eel caught by gear in Cotabato during 2022-2023.

Acknowledging the cruciality of collaboration, research, training, aquaculture promotion, market development, environmental conservation, policy advocacy, community engagement, and technology adoption for sustainable anguillid eel fisheries, a working visit was made by the IFRDMD staff to SEAFDEC/AQD in Tigbauan, Iloilo and Binangonan Station and the site for eel biological survey in Cagayan, Philippines on 4–11 December 2023. In Cagayan, a decline in anguillid eel catches was observed which could be due to the low demand and impacts of sand mining; while a notable aquaculture project in Cagayan offered a model for small-scale eel cultivation, potentially increasing income and promoting sustainability. An EAFM study was also conducted in Cagayan emphasizing environmental, technological, social, economic, and governmental aspects. Focusing on gender, the study came up with strategies for gender inclusivity including research, training, promoting aquaculture, community engagement, policy advocacy, and strengthening women's roles in the supply chain.



IFRDMD staff visiting AQD in Iloilo (left) and experimental set-up in BFS (right) in the Philippines

IFRDMD staff interviewing stakeholders using the EAFM tool

IFRDMD in collaboration with D-Fish organized a regional workshop in Viet Nam on 18–20 July 2023 with the aim of developing a field guidebook for anguillid eel identification. The workshop gathered participants from the SEAFDEC Member Countries together with representatives from academia to promote collaboration and sharing of knowledge.

Regional workshop and field study to develop a field guidebook for anguillid eel identification in Viet Nam

It is recognized that information on genetic population structure or stocks is essential for fisheries management as it can help identify the source and sink populations and the potential for replenishing the depleted stocks. Moreover, molecular genetic techniques have been widely used in marine systems and fisheries management due to the ability to identify distinct stocks, genetic health, and connectivity between stocks. Therefore, in another Project activity that aims to clarify the eel genetic population structure, mtDNA markers were used to study the genetic population structure of tropical eels (*Anguilla* spp. except *Anguilla bicolor*) in Southeast Asia.

The genetic study focused on identifying the genetic population structure of three eel species, namely: *A. marmorata*, *A. celebensis*, and *A. bengalensis bengalensis*. A total of 191 samples from Bali, Poso, Kendari, and North Kalimantan of Indonesia were collected and processed for DNA analysis, revealing species distribution across these areas. The distribution in North Kalimantan consists entirely of *A. marmorata*. In Poso, *A. celebensis* constitutes 50 %, *A. marmorata* 43 %, and 7 % were categorized as "bad sequence." In Kendari, the results showed that 77 % are *A. bicolor pacifica* while 23 % are "bad sequence." Bali displays 65 % of *A. marmorata*. In June and November 2023, additional genetic samples of yellow eels were collected from Denpasar, Bali, Indonesia. The samples with an average weight of 58.8 g and an average length of 34.5 cm were identified as *A. bicolor.* These samples were earmarked for the JAIF project aiming to develop stock assessment for anguillid eels.

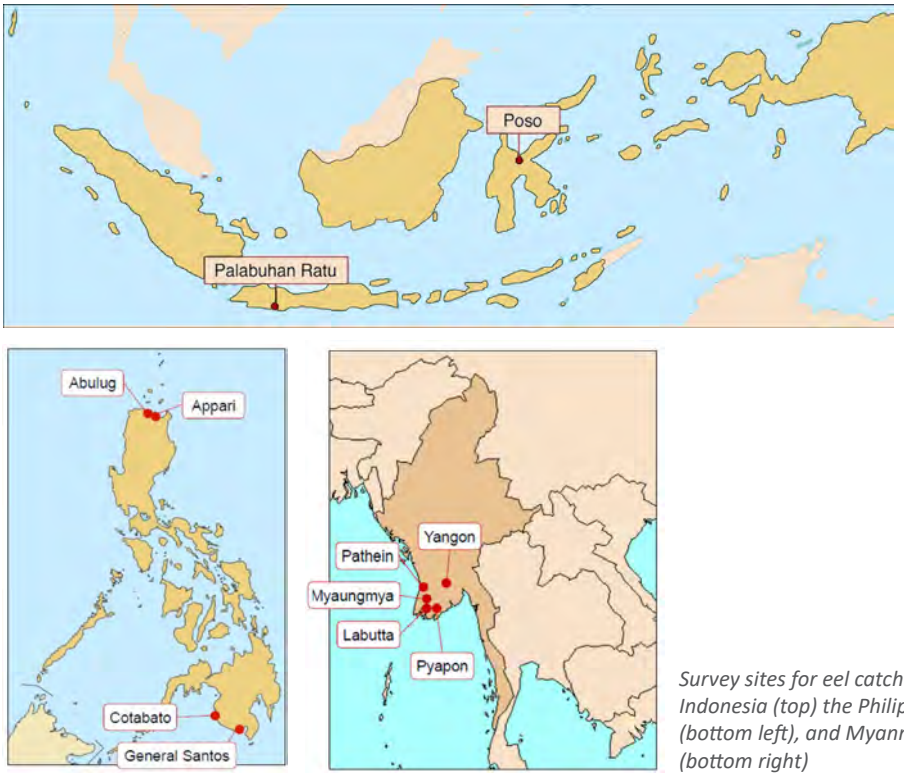
Glass eel samples were also collected from Cagayan, Philippines and would be analyzed for genetic population structure in collaboration with other AMSs.

Development of Stock Assessment Methods and Strengthening of Resources Management Measures for Tropical Anguillid Eel in Southeast Asia

FCG/ASSP Project no. 12

Another project "**Development of Stock Assessment Methods and Strengthening of Resources Management Measures for Tropical Anguillid Eel in Southeast Asia**" was implemented by the SEAFDEC Secretariat in collaboration with AQD and IFRDMD. Supported by the Japan-ASEAN Integration Fund (JAIF), the Project has the objective of developing mathematical/statistical methods for estimating tropical anguillid eel resource stocks, facilitating the formulation of effective management strategies for their sustainable use in Southeast Asia. The Project encompasses four main activities, namely: 1) eel statistics survey, 2) eel catch survey, 3) genetic study, and 4) environmental DNA study. The target species include *A. bicolor bicolor*, *A. bicolor pacifica*, and *A. marmorata*. The Project duration was originally from 2020 to 2022, however, the Project was extended until January 2026.

In Indonesia, IFRDMD completed eel catch surveys with DNA sampling collection from the Cimandiri River and Cikaso River at Palabuhan Ratu of Sukabumi Regency, and in the Poso River in Central Sulawesi, which was conducted from April 2020 until December 2023. In Myanmar, eel statistics surveys were conducted exclusively for capture fisheries in Ayeyarwady Region and Yangon City from March to December 2022. Moreover, in the Philippines, eel surveys were conducted for both capture fisheries and aquaculture in Abulug and Appari Municipalities in Luzon as well as in Cotabato City and General Santos City in Mindanao from March to December 2022.



Survey sites for eel catch in Indonesia (top) the Philippines (bottom left), and Myanmar (bottom right)

To analyze the data and information from statistical and catch surveys, SEAFDEC organized two data analysis workshops, namely: 1) Anguillid Eel Data Analysis Meeting on 2–3 August 2023, and 2) Workshop on Data Analysis for Sampling Data on 26–30 September 2023. The Workshops aimed to analyze the catch per unit effort (CPUE) to understand the trends of eel resources and support stock assessment. However, the survey results revealed monthly variability in tropical eel catch. Consequently, it was planned that the Project would continue the data collection in 2024, which was however subject to JAIF approval.

In 2023, the Project produced the publication "Manual on the Identification of Anguillid Eel Species Using DNA-Based Methods." The publication was submitted to JAIF for approval and subsequent dissemination.

Anguillid Eel Data Analysis Meeting in IFRDMD, Palembang, Indonesia on 2–3 August 2023

Workshop on Data Analysis for Sampling Data in IFRDMD, Palembang, Indonesia on 26–30 September 2023

2. Strategy 2: Supporting the sustainable growth of aquaculture to complement fisheries and contribute to food security, poverty alleviation and livelihood of people in the region

2.1 Sustainable aquaculture through cost-effective culture systems, and prompt and effective aquatic animal health management

Sustainable Aquaculture through Cost-effective Culture Systems, and Prompt and Effective Aquatic Animal Health Management

FCG/ASSP Project no. 15

In 2023, SEAFDEC/AQD continued to implement the project "**Sustainable Aquaculture through Cost-effective Culture Systems, and Prompt and Effective Aquatic Animal Health Management**" with support from the Japanese Trust Fund (JTF) covering he period from 2020 to 2024. Under this Project, the following components were initiated in 2020 and are being implemented in collaboration with several research partners in the Southeast Asian region: 1) Cost-effective culture systems, 2) Prompt and effective aquatic animal health management, and 3) Capacity enhancement on sustainable aquaculture.

- ***Cost-effective culture systems***

This component aims to: 1) establish a community-based seedlings supply system, 2) promote alternative feeds for reduction of feed cost, 3) establish a shrimp farming system using ecosystem function, and 4) develop aquaculture techniques for new aquatic species.

o *Developing community-based sustainable aquaculture livelihood strategies*

This activity aims to develop community-based aquaculture strategies on the full cycle of aquaculture technology for the giant freshwater prawn *Macrobrachium rosenbergii* to improve livelihoods in the rural area of the Philippines as one of the case studies in the region.

In 2023, the local aquaculture producer association and its local government, with technical support from AQD and JTF, started to collaborate and participate in the community-based hatchery operation, broodstock maintenance, and grow-out of the giant freshwater prawn (GFP).

It is planned that exit strategies (*e.g.*, aquaculture business management) for resilient community-based sustainable aquaculture livelihood activities will be developed in 2024 through further training on innovative hatchery operations. A final impact assessment study will also be conducted.

Harvesting of newly-hatched GFP

Start operation of GFP hatchery

Constructed GFP hatchery

- *Promoting alternative feeds for the reduction of feed cost*

This activity aims to develop sustainable feed technologies using alternative feeds and feeding strategies for the culture of freshwater species to promote small-scale aquaculture in Southeast Asia.

In 2023, tank trials were implemented to evaluate the effects of replacing fish meal and soybean meal with the black solder fly (BSF) larvae and okara meal on the survival and growth of GFP. As a result, the 25 % of protein in fishmeal and soybean meal can be replaced with protein from BSF larvae and okara meal. In addition, the feeding trials provided information on the effective feeding schedule that will promote compensatory growth and effective feed utilization, which can help lower the production costs of GFP cage culture.

Black soldier fly and okara meal

Experiment on diets and feed restriction of GFP

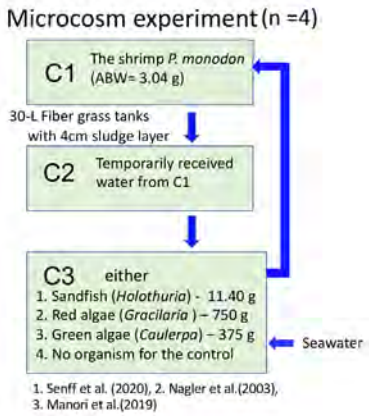
Growth trials will be conducted to evaluate the feeding value of fish silage from tilapia wastes and by-products from diets for the culture of tropical anguillid eels in 2024. Other potential feed ingredients during the study will also be identified and tested.

- *Establishment of shrimp farming system using ecosystem function*

Through laboratory tank experiments, this activity aims to verify the efficacy of purifying organisms for use in small-scale shrimp farms.

In 2023, the microcosm experiment was completed, allowing the effects of the three organisms (sandfish, green algae, and red algae) tested as purifying organisms to be analyzed regarding causative bacteria and water quality for diseases.

It is planned that potential to reduce disease occurrence in purifying organisms (sandfish, green algae, and red algae) will be evaluated in 2024 through their relationship to disease-causative bacteria and water quality.



C3 was filled with water from the sea
After two weeks, water from C3 was used to fill C1 (C3 was replenished with water from the sea)
C1 was restocked with P. monodon (ABW = 3.04 g)
Fed with commercial pellets for 9 weeks duration of the experiment.
Water change was done every 2 weeks by allowing water from C1 to flow to C2 then to C3.

Experimental design of shrimp farming system using ecosystem function

- *Development of aquaculture techniques for new aquatic species*

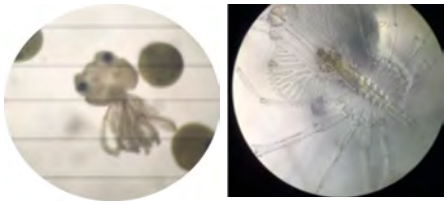
Aquaculture techniques for new aquatic species including slipper lobster, kawakawa, and shortfin scad, are being developed to create and promote a new local aquaculture industry.

a. *Slipper lobster*
   Hatched phyllosoma of a slipper lobster has been obtained stably, and their rearing activities are still ongoing.

b. *Kawakawa*
   A few individuals of kawakawa could be maintained for up to nine months, with the initial weight of 100 g growing to 1,750 g. However, they have not reached sexual maturity.

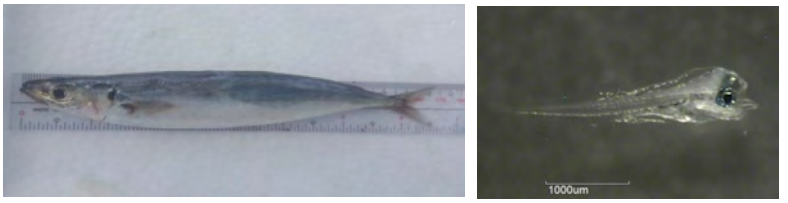
c. *Shortfin scad*
   Hatched larvae of a shortfin scad obtained from the broodstock could be reared until they develop into adults. Although a few individuals have reached sexual maturity, mating or spawning is not still observed.

The techniques of broodstock management will be improved and optimized in 2024. After that, the larval-rearing techniques will be established using fertilized eggs or hatched larvae from broodstock.



Hatched phyllosoma larvae of the slipper lobster

Kawakawa grown in a tank



Adult shortfin scad and its hatched larvae

- ***Prompt and effective aquatic animal health management***

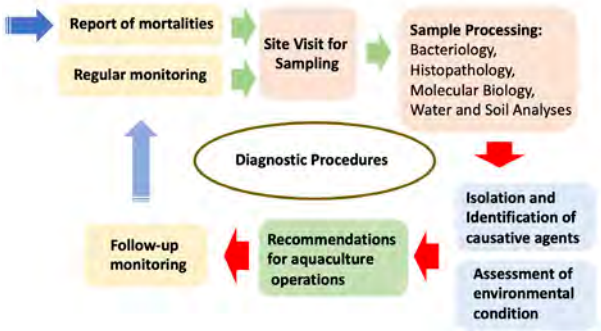
This component aims to: 1) prevent mass mortality through active monitoring, 2) formulate guidelines on EHP management, 3) explore methods to prevent shrimp diseases at the hatchery phase, and 4) establish integrated disease management methods in shrimp culture.

- *Development of diagnostic procedures against unknown and emerging crustacean diseases*

This activity aims to identify and profile unknown and emerging crustacean and fish diseases in aquaculture farms and develop diagnostic protocols for their diseases.

In 2023, the prevalent bacterial isolates from the samples of the two cases of shrimp culture monitoring were identified. These isolates will be subjected to artificial infection to respective hosts (crustaceans and fish) to identify pathogenic isolates.

It is planned that monitoring and surveillance of mass mortalities in aquaculture farms will be continued in 2024 to isolate and identify the causative agent(s) of unknown and emerging crustacean and fish diseases. This will enable the isolation and identification of the causative agent(s) and, eventually, the development of disease diagnostic protocol(s).



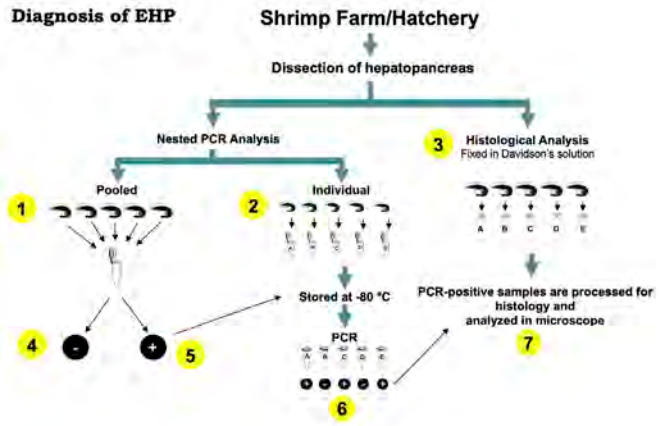
Diagnostic procedure to address crustacean and fish diseases in aquaculture farms

o *Surveillance and epidemiology of* Enterocytozoon hepatopenaei *(EHP)*

The transmission mechanism of EHP will be clarified to formulate guidelines on EHP management, and a diagnosis protocol for infecting shrimps will be developed.

In 2023, EHP surveys have already been conducted in the target areas of Luzon and Visayas. A list of EHP-positive shrimp farms has been made, providing substantial information on the number of days of culture, water quality parameters, and prevalence of EHP-positive shrimp farms.

Surveillance of EHP will be extended in Mindanao and the cohabitation experiments will be implemented to elucidate the horizontal transmission mechanism of EHP via soil and water in 2024.



Diagnosis of EHP

o *Exploration of methods to prevent shrimp diseases at the hatchery phase*

This activity aims to explore chemicals to prevent shrimp diseases at the hatchery phase and develop guidelines on shrimp disease prevention.
So far, no disinfection effect has been observed for AHPND with formalin, hydrogen peroxide, detergent, and iodine. There remains a slight possibility of disinfection efficacy for WSSV only with 200 ppm detergent.

Experiments on the disinfection effects of the chemicals on shrimp eggs will be continued in 2024 to determine if the chemicals are effective against shrimp diseases and their appropriate dosage.

Chemicals used to disinfect shrimp eggs

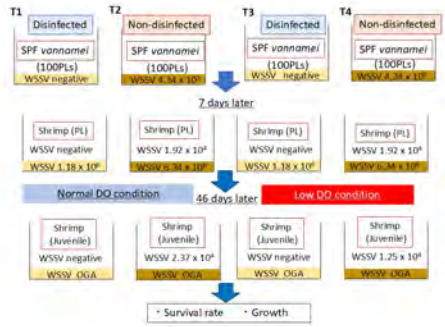
Collection of tiger shrimp eggs

Disinfection of shrimp eggs

o Establishment of integrated disease management methods in shrimp culture

This activity aims to implement disease management by combining approaches such as immunostimulants, probiotics and antivirals, biosecurity, and best management practices and formulate updated guidelines for farm-based disease management.

In 2023, results of tank experiments showed that the shrimp were infected with WSSV through the soil and that the rearing environment, such as dissolved oxygen, significantly impacted the survival and growth of the shrimp with pathogens.



Experimental design of disease management in shrimp culture

Verification trials will be conducted in shrimp ponds to confirm the results of the tank experiments in 2024. A manual on fish health management in brackishwater ponds using integrated approaches will also be developed.

- ***Capacity enhancement on sustainable aquaculture***

This component provides three training courses: 1) Training course on sustainable aquaculture, 2) Training course on fish nutrition and feed development, and 3) Training course on fish health management.

o Training course on sustainable aquaculture

a. Marine fish hatchery
The Training Course on Marine Fish Hatchery was conducted twice face-to-face at AQD Tigbauan Main Station on 8 May–12 June and on 19 June–24 July 2023 with trainees from Brunei Darussalam, Myanmar, Philippines, Malaysia, and Thailand.

b. Community-based freshwater aquaculture
The Training Course on Community-Based Freshwater Aquaculture was conducted face-to-face at AQD Binangonan Freshwater Station on 13–27 November 2023. with trainees from Myanmar, Philippines, and Thailand.

The two training courses, “Marine Fish Hatchery” and “Community-based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia,” will be held face-to-face for the participants from the SEAFDEC Member Countries in 2024.

- *Training course on fish nutrition and feed development*

The Training Course on Fish Nutrition and Feed Development was conducted online with nine modules from 25 September to 23 December 2023 with participants from Myanmar, Philippines, and Thailand.

The training courses on “Fish Nutrition and Feed Development” will be held face-to-face or online for the trainees from the SEAFDEC Member Countries in 2024.

- *Training course on fish health management*

The Training Course on Fish Health Management was conducted online with 14 modules from 6 November to 13 February 2023with participants from Myanmar; Philippines; and Thailand.

In 2024, the training courses on “Health Management in Aquaculture” will be held face-to-face or online for trainees from the SEAFDEC Member Countries.

Practical sessions of the training courses conducted by AQD in 2023

ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia (Phase 2)

FCG/ASSP Project no. 17

The project was proposed by SEAFDEC/AQD as the second phase of the "**ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia**," the first phase of which was organized in 2018. The main objective of this proposed Consultation is to reconvene the representatives of AMSs and technical experts with the addition of people from the private sector and the academe to prepare contingency plans for high-profile diseases, manuals, and other EPRS toolkits needed in the implementation of the Technical Guidelines on EPRS prepared in the first phase of the project. However, this project was postponed from 2023 to 2024-2025, with support from the Japan-ASEAN Integration Fund (JAIF).

2.2 Improvement of broodstock and seed production technologies

Quality Seed for Sustainable Aquaculture

Departmental Program no. 1

A sustainable supply of good quality seedstock is key to a successful aquaculture enterprise. Rearing quality seedstock to commercial sizes requires efficient husbandry techniques and suitable farm conditions to achieve increased yield. With the intensification of aquaculture systems in several Southeast Asian countries and the environmental challenges such as those resulting from climate change, the development and use of quality farmed broodstock and adoption of innovative, optimal culture management methods are equally important in ensuring the steady production of seeds and later, marketable aquaculture products.

In 2023, SEAFDEC/AQD continued to implement its Departmental Program "**Quality Seed for Sustainable Aquaculture**" which focused on studies and activities that determine optimal conditions and cost-effective, science-based methods for producing quality seedstock. Specifically, it addresses the 1) enhancement of breeding performance, development of potential broodstock as well as the adoption of efficient broodstock management schemes; 2) nutritional interventions, *e.g.*, formulation of broodstock diets and larval nutrition schemes; and 3) other non-genetic/environmental interventions or approaches that are being adopted. Studies conducted in 2023 focused on the verification of the breeding and seed production technologies of priority species such as shrimps, giant freshwater prawn, tilapia, oyster, abalone, sandfish, mangrove crab, and seaweeds with the end view of packaging these technologies for transfer to the target beneficiaries, the fish farmers.

Suitable hatchery and nursery protocols that have been developed are further refined depending on the level of technology for each species. These technologies are verified and shall be packaged into the most viable or cost-effective method for seed production. Once ready for dissemination, industry stakeholders, or primarily the fish farmers, shall be informed of advances in hatchery and nursery production methods through training and the production of information, education, and communication or (IEC) materials such as technical manuals.

- ***Broodstock development***

Information on the efficiency of androgenic gland ablation in giant freshwater prawn may help promote the monosex culture of this crustacean species to improve growth and production yield.

  - *Use of andrectomized males (neo-females) giant freshwater prawn (*Macrobrachium rosenbergii*) for the production of all-male progenies*

This study aims to verify the efficiency and the cost analysis of a protocol to produce all-male giant freshwater prawns by applying the modified bilateral androgenic gland ablation protocols by Aflalo *et al.* (2006) and Rungsin, *et al.* (2006). The ultimate objective is to increase yield since male prawns are noted to grow larger than female prawns.

Giant freshwater prawn subjected to Ablation (one surgery only) (left) and re-ablation (two surgeries) (right)

Partial results from 2021–2022 trials showed that the ablated PL_{45} specimens produced a higher percentage (23.5 %) of potential neo-female 90 days post-ablation. Ablated samples with successful feminization were grown until they developed gonads and later paired with normal males for progeny testing. However, most potential neo-females died due to cannibalism, and no potential neo-female had successfully hatched its eggs after several mating and spawning attempts.

In 2023, protocols were modified by subjecting PL_{45} specimens to ablation and re-ablation of the fifth walking leg. Survival rates of ablated prawns 15 days post-ablation ranged from 58 % to 96 %. Half of the surviving prawns were further subjected to re-ablation, and the rest were reared individually in hapa net cages. Some ablated prawns had deformities such as fusion of regenerated fifth walking legs. Survival rates of re-ablated prawns varied from 36 % to 62 % after 15 days.

- ***Refinement of hatchery and nursery protocols***

To increase the production of larvae and juveniles of important aquaculture species, mechanisms that: 1) enhance laboratory production of natural food organisms, *e.g.* algal paste, and alternative live food items, *e.g.* polychaetes (*Marphysa iloiloensis*), small rotifers (*Proales similis*) which serve as early stage diets; as well as 2) improved rearing conditions and interventions that allow the aquatic organisms to adapt and survive well during larval development, are evaluated.

- *Nursery and grow-out culture of snubnose pompano* Trachinotus blochii *in pond-based net cages*

This study determines the best-performing diet in pond-based nursery culture of pompano, effect of illumination on the production performance, optimum stocking density in pond grow-out culture, and economic viability of pompano nursery and grow-out culture.

Trials conducted in 2023 examined the growth effect of 1) illuminated pond net cages + 100 % day feeding, 2) illuminated pond net cages + no day feeding, and 3) non-illuminated cages + 100 % day feeding. Pompano fry reared after 63 days in illuminated cages + 100 % day feeding had significantly better growth (43 g body weight (BW), 0.65 g/day daily weight gain (DGR), and 5.4 kg total biomass than those stocked in illuminated + no feeding (5 g BW, 0.05 g/day DGR, 0.4 kg total biomass) and non-illuminated + 100% day feeding (33 g BW, 0.50 g/day DGR, 4.7 kg total biomass). However, a mean survival of 94 % was noted in non-illuminated + 100 % day feeding, which was significantly higher than those recorded from the two other groups. This time, a second trial was made, modifying Treatment 2 to illuminated + 75 % day feeding in view of improving fish performance and reducing feed cost. The highest BW was noted in both illuminated with 100 % and 75 % day feeding and lowest in the control group. Reducing the daily feed ration from 100 % to 75 % in illuminated groups resulted in the lowest feed conversion ratio (FCR) of 1.4.

Illuminated pond net cage set-up for the nursery culture of pompano

- *The use of biofloc technology on mangrove crab larval rearing and indoor nursery culture*

This study evaluates the effectiveness of biofloc technology on the growth performance, stress and disease resistance of mangrove crab (*Scylla serrata*) in hatchery and indoor nursery tanks.

To evaluate the effect of the biofloc system on the growth and survival of mangrove crab, larvae were reared on clear water (CW) serving as the control group, green water (GW), and biofloc water (BW) for 13 days from Z1 to Z5 stages and another 14 days from Z5 to C1 stages. BW provided the conditions for higher survival of 34.1 % from Z1 to Z5 stages. On the other hand, rearing Z5 stage to crab instar in GW resulted in a survival rate of 12.88 % which was higher than those reared in CW (6.19 %) and BW (1.67 %).

In another trial, the same rearing treatments used in the hatchery were tested to assess the possibility of rearing mangrove crab in biofloc-based indoor nursery culture. The rearing of crab instar was divided into two phases, which lasted 21 days each. In Phase 1, survival and growth were comparable among treatment groups, but the highest survival (60 %) and growth (0.58 g) were consistently achieved in BW. Similarly, in Phase 2, the highest number of surviving crab instars (60 %) was found in BW, which were also slightly heavier (2.91 g) compared to those reared in GW (2.86 g) and CW (2.47 g).

A challenge experiment assessed the benefits of biofloc on conferring resistance to white spot syndrome virus (WSSV). Crabs were injected intramuscularly with WSSV (104 copies/g) at the base of the third walking leg, and cumulative mortality was monitored daily for seven days. Another set of crabs was injected with PBS, as the negative control. Crabs reared in BW and GW had lower cumulative mortalities (73 %) than those reared in CW (80 %) seven-day post-challenge.

- *Nursery culture of mangrove crab* Scylla serrata *megalopae in pond-based net cage*

This study aims to determine the optimum stocking density and the ideal culture period of crab megalopae in pond-based net cages, establish a feeding management protocol for megalopae, assess the economic viability of the nursery culture operations using megalopae and produce 3–5 cm crablets for grow-out farmers.

In 2023, two subsequent trials were conducted to establish a feeding management protocol for megalopae. Hatchery-reared megalopae (DOC 17-18) were stocked in net cages at an initial density of 200 m³ and reared for three weeks. The megalopae were fed formulated diet (FD) and macerated mussel meat (M) at different combinations: 50FD:50M, 80FD:20M, 70FD:30M, and 100FD. In the first trial, crabs fed 100FD had the lowest average body weight (ABW), carapace width (CW), and carapace length (CL) but did not statistically differ from the other groups. Survival rates were highest in crabs fed 50FD:50M and 100FD but not statistically different from those fed 80FD:20M and 70FD:30M. Smaller size crabs, with 0.08–0.10 g weight and 7.5–8.5 mm CW (C4), accounted for 51–71 % of the harvested stocks in all the treatment groups. Larger size crabs, ranging from 0.21–0.26 g ABW and 10.5–12 mm CW (C5), comprised 29–62 %.

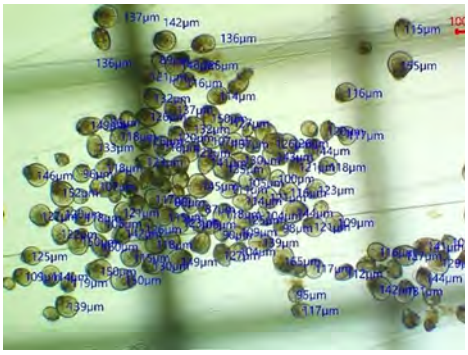
Pond experimental set-up for the nursery culture of mangrove crab at the Dumangas Brackishwater Station

In the second trial, crab megalopae reared on 70FD:30M grew faster than those fed 100FD but did not significantly differ from crab megalopae fed 50FD:50M or 80FD:20M. Similarly, the highest survival rate (69.92 %), biomass (38.75 g), and better FCR (1.25) were noted in 70FD:30M group, suggesting the ideal feeding combination for nursery culture of megalopae.

Based on 2021–2022 AQD production data, about 13,875 matchbox-sized crablets and 5 kg marketable-size crabs were disposed to support the requirements of in-house research and private sector.

- *Verification of adequate feed rations and use of algal paste for single seed spat production of slipper-shaped oyster* Magallana bilineata

This study verifies the administration of adequate food-cell density relative to the larval stage and spat age, the use of algal paste for single spat production, and compares the economic viability of using live algae and algal paste (SEAFDEC and commercial) as food source for the slipper-shaped oyster larvae. In 2023, three feed rations (low, mid, and high) were further tested for each larval stage and spat age that will result in improved survival and growth. Survival rates from D-larvae to umbonate larvae were highest in the low feed ration (74.5 %) and lowest in the high feed ration (63.6 %). From umbonate to eyed larvae, feeding high ration resulted in higher survival rates (23.7 %) than those reared on mid (19.4 %) and low rations (18.8 %). Similarly, survival rates from eyed larvae to spat were higher at mid (3.7 %) and high feed (3.6 %) rations than at low feed (0.8 %) rations. Together, growth in terms of dorso-ventral measurements and shell height, survival, and yield from D-larvae to spat were improved at high feed rations.



Changes in dorso-ventral measurements (DVM, um) of slipper-shaped oyster larvae across different rations

In addition, using live microalgae at a low ration provided a survival advantage (20.1 %) for D-larvae to umbonate larvae, while feeding algal paste at a high ration improved survival but not growth for similar stages of development. Only those reared on live microalgae at a low ration developed up to the spat stage.

Confirmatory trials are underway to further test the effectiveness of algal paste as a food source for oyster larvae and spat.

- *Sea-based nursery cage production of farmed eucheumatoids*

This study attempts to increase the production of seaweed plantlets by improving the survival rate of the propagules and expanding the area for sea-based nursery cages, decreasing the cost of producing propagules in sea-based nursery cages at the Igang Marine Station, conducting biosecurity measures to improve the survival of sea-based nursery cage-produced seaweed plantlets, providing quality plantlets as a better alternative source of seaweed seedlings, and conducting field trials of tissue-cultured plantlets in a commercial seaweed farm setting.

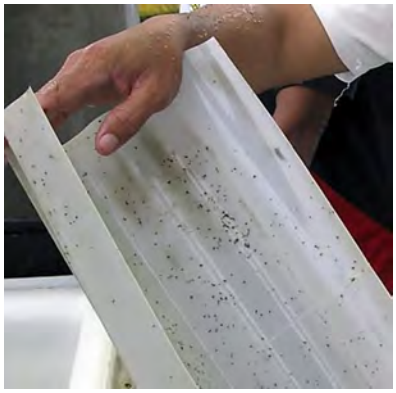
New stocks of *Kappaphycus/Eucheuma* were acquired from San Dionisio and Barotac Viejo in Iloilo and Sibunag in Guimaras for use in producing seaweed micropropagules. Monitoring of the growth and survival of seaweed plantlets in a sea-based floating cage nursery setup at the Igang Marine Station is in progress. About 12,006 plantlets were produced in September 2023, with a mean survival rate of 31.2 %. To improve the survival of sea-based nursery cage-produced seaweed plantlets, the use of commercially available chemicals, *i.e.*, the use of treatment regimen/prophylactic treatment to reduce (if not totally eliminate) the incidence of seaweed health problems is already incorporated in seaweed culture protocols.

For the field trial of tissue-cultured plantlets, an alternative site other than Culasi, Antique is being considered. A manuscript comparing the seasonal growth, carrageenan properties and resistance to disease and epiphytic pests of tissue-cultured and farm-sourced seaweeds has already been accepted for journal publication.

- *Hatchery production of early juvenile sandfish* Holothuria scabra

This study aims to maintain the survival of early sandfish juveniles (> 5 mm) to at least 2 %, produce at least 90,000 early juvenile sandfish per spawning batch, conduct at least 12 spawning and larval rearing batches in a year, and produce at least 1 million early juveniles per year.

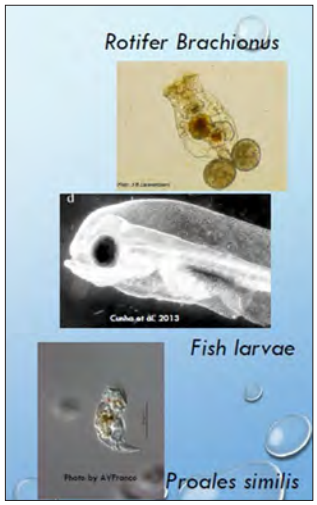
A total of 13 spawning batches were conducted from February to August 2023, four of which successfully achieved a survival rate of > 2 % and production of 20,000–50,000 early juvenile sandfish. As of August 2023, the total spat production was recorded at 203,726.



Early juvenile sandfish settled on the plates ready for harvest

- *Use of microalgal paste-fed* Proales similis *in marine fish larviculture: I. Refinement of* P. similis *mass production schemes; II. Assessment of* P. similis *as first food for marine fish larvae*

This study evaluates *Proales similis* as first food for newly-hatched small-mouth fishes in comparison to *Brachionus*, defines the optimal mass production protocols for *P. similis*-fed centrifuged *C. sorokiniana* paste and examines the effectiveness of *C. sorokiniana* paste-fed *P. similis* as first food for small-mouth marine fish larvae.



Previous trials conducted in 2022 have established the optimum conditions for mass production of *P. similis* in 100 and 500-liter capacity tanks. Mass production of *P. similis* was continued in 2023 to support a series of larval rearing trials wherein the following feeding schemes were tested: 100 % *Brachionus* (B), 75 % B + 25 % *Proales* (P), 50 % B + 50 % P, 25 % B + 75 % P and 100 % P. Results showed that survival rates of 10–11 days post-hatch rabbitfish *Siganus guttatus* larvae were consistently improved when fed 50 % B + 50 % P, ranging from 1.26 to 4.03 %.

In 2023, five larval rearing trials were conducted in 250 L fiberglass tanks. Notably, mass production of *P. similis* was achieved using bigger volume tanks. The production of Primo Alga® paste has resumed with the EVODOS dynamic settler. Problems related to ammonia buildup in rearing tanks depended on the source of green algae and fertilizers used.

Repairs in the experimental setup to address problems such as high bacterial load and poor water quality have resulted in higher survival rates (4.03 % ± 0.24 %) which were consistently obtained from those fed 50 % B+50 % P.

The results of this study are essential in increasing the production of small-mouth fish in the marine fish hatchery. In-house users may acquire a starter volume of 10–30 L from the larval food laboratory. The distribution of *P. similis* culture starters outside SEAFDEC/AQD is still prohibited.

- *Production of mud polychaete* Marphysa iloiloensis *in modular tanks*

This study aims to continue producing the polychaete *Marphysa iloiloensis* to support the in-house research projects and crustacean hatcheries at AQD, develop a disease screening protocol in the mass production of SPF *M. iloiloensis*, and assess the economic profitability of polychaete production using modular tanks.

From January to September 2023, polychaete broodstock housed in 20 tanks produced 1,134 jelly cocoons, of which 79 % were viable. An additional ten tanks and four hapa net cages installed in the pond raceway were stocked with 3,902 wild-sourced jelly cocoons for 6–12 months, until broodstock stage.

Newly stocked polychaete larvae at pond raceways intended for broodstock

About 75 % of the basins were stocked with 500 wild and hatchery-bred polychaete larvae per basin for grow-out production. Ten units of grow-out canvass tanks were also installed to increase production and cater to the demands of in-house hatcheries for polychaetes. About 4.06 kg or equivalent to 31,061 pcs of *M. iloiloensis* were produced, with survival rates varying from 20 % to 41 %. Moreover, about 1.1 kg or 110,000 pcs of *Simplisetia* spp. were also produced to support the eel study.

- ***Increase awareness of available genetically selected/improved stocks and optimize their use for improved on-farm aquaculture production***

This is done either through developing and evaluating selected commercially available breeds or otherwise. Once such stocks or strains are noted as superior, these can be promoted to farmers for use with the goal of increasing on-farm yield. In previous years, preliminary activities related to stock improvement have been done in mangrove crab, abalone, oyster, and milkfish with the genetic characterization of potential sources of quality stocks from natural habitats. Information on genetically diverse stocks of mangrove crab, oyster, abalone, milkfish, and seaweed have already been published, and some are still awaiting publication. To date, however, there are no studies and initiatives toward the use of genetically variable stocks for breeding and/or genetic improvement, but hopefully, these shall be done in the future.

- ***Promotion of technically and economically viable breeding and seed production schemes***

It is not enough to disseminate information on innovative and technically feasible breeding and seed stock production methods. One has to ensure that such methods are cost-effective, thus can generate increased profit for the hatchery/nursery farm operators. The objectives for this activity can be achieved if the technologies which are based on science are verified on farms and its economic viability demonstrated.

  - *Seed production of donkey's ear abalone* Haliotis asinina *juveniles*

This study aims to demonstrate the successful hatchery production of abalone juveniles at 25,000 pcs per cropping, verify the efficacy of different types of broodstock diets on the reproductive performance of abalone, verify the efficacy of artificial diet on the growth and survival in the early weaning of abalone juveniles, determine the growth and survival of

abalone during nursery rearing using PVC pipes and plastic drum, and conduct an economic analysis of the abalone hatchery operation based on the actual cost of hatchery production. From January to August 2023, a total of 51,034 abalone juveniles (~5 mm) were produced from veliger larvae, with an average survival rate of 1.93 %. Feeding early juveniles with a combination of *Spirulina* and *Navicula* for 90 days resulted in a higher survival of 3.3 % than when fed solely on *Spirulina* or *Navicula* (1.2 %).

Different forms of artificial diet were likewise examined as an alternative diet for abalone juveniles to reduce dependence on seaweeds. After 60 days, abalone juveniles preferred seaweeds over *Spirulina* + diatoms or different forms of artificial diets (refined flakes,

Preparation of different forms of artificial diets for abalone

unrefined flakes, refined pellets, unrefined pellets) as evidenced by the highest mean body weight and shell length of 0.58 g and 1.50 cm, respectively.

Nursery rearing of abalone juveniles stocked at 100 pcs in PVC pipes resulted in the highest shell height and body weight of 3.4 cm and 8 g, respectively. When abalone juveniles were reared at 350 pcs in plastic drums, shell height and body weight were lowest at 2.8 cm and 4.8 g.

- *Mass production of mangrove crab (*Scylla serrata*) seedstock*

This production study aims to mass-produce crab instars to support the requirements of in-house research projects and nursery and grow-out pond operators.

Of the 103 mangrove crab broodstock acquired from different sources in the first quarter of 2023, only 28 survived, and five broodstock spawned but died before their eggs hatched. Because no crablets were produced, various interventions and modifications to the existing protocols were done, such as acclimatization of broodstock upon arrival at the hatchery, disinfection with formalin at 100 ppm and 150 ppm concentrations, installation of heater in hatching tanks during cold days in February, bilateral ablation and candling of broodstock to check for gonad fullness and submission of individual samples for disease diagnosis. A complete dry-up of the hatchery was also conducted, including disinfection of all tanks, change of aeration lines, and use of new sand substrates in broodstock tanks.

In the second quarter, with the acquisition of 44 new broodstock from the provinces of Capiz, Sorsogon, and Zamboanga, 16 spawning runs and ten successful hatchings produced

viable larvae. Additional 117 broodstock were obtained in the third quarter, with 51 crabs sourced from Sorsogon testing positive for WSSV, leading to gradual mortalities.

During the last quarter of 2023, 96 additional broodstock were collected from Capiz (59 crabs), Balasan, Iloilo (19 crabs), and Kalibo, Aklan (18 crabs), bringing the total number of crab broodstock acquired for hatchery utilization to 360. A total of 77 spawning and 36 successful hatching runs were recorded, but only 18 batches reached the crab instar stage as weak batches were not stocked, and mortalities were experienced at an earlier stage for other batches and C1 survival rates ranging from 0.3 % to 3.9 %.

In total, 250,033 pcs of mangrove crab instar and 21,040 megalopae have been sold to SEAFDEC in-house projects and buyers from various provinces, including Iloilo, Capiz, Negros Oriental, Aklan, Masbate, and Zamboanga City.

- *Seed production of the giant freshwater prawn* Macrobrachium rosenbergii

This study aims to demonstrate and further refine the existing hatchery protocols developed at the SEAFDEC/AQD Binangonan Freshwater Station to improve the larval rearing of the giant freshwater prawn *Macrobrachium rosenbergii*, produce 200,000 pcs of postlarvae for use in in-house research and fish farmers, and prepare an economic analysis of giant freshwater prawn hatchery operation.

For the first quarter of 2023, an additional 30 female broodstock (28.09 ± 2.79 g) grown from the Dumangas Brackishwater Station were transported to the hatchery. A modified larval rearing protocol was tested by directly stocking the larvae from 6 ppt to 12 ppt water and rearing them until Day 15. Water salinity was gradually lowered by 2 ppt every three days until Days 30 to 35. However, due to the low water temperature (24–27 ˚C) recorded in February, some broodstock aborted their eggs, and larvae collapsed.

Another trial examined the use of *Moina* sp. to replace egg custard and *Artemia nauplii* as initial food for the larvae. *Moina* sp., in combination with *Artemia*, was only provided for a week because of the collapse of cladocerans from 2 to 4 weeks of culture. Culture trials of *Moina* sp. were discontinued because of the lack of a culture starter.

From January to September 2023, survival rates from larvae to postlarval stage ranged from 7.18 % to 31.14 %, or equivalent to producing 52,895 pcs of postlarvae. These byproducts were sold to support the requirement of in-house studies and potential buyers in the Visayas region.

- *Production of farmed eucheumatoids by micropropagation in the land-based nursery*

This study aims to increase the production of seaweed propagules through improved survival and expansion of a seaweed land-based nursery, produce micropropagules to support the needs of SEAFDEC/AQD sea-based seaweed nursery, determine the cost and return analysis of micropropagules production, and publish a brochure on seaweed micropropagule production in the laboratory.

From January to November 2023, 22 batches of propagules from the land-based nursery produced a combined total of 49,822 *K. alvarezii* and *K. striatus* propagules, which were successfully transplanted to the sea-based nursery cages facility at the Igang Marine Station (IMS). The average survival was 65.90 %.

In 2024, the production of tissue-cultured seaweeds will continue to supply the needed propagules for the sea-based seaweed nursery. Also, it is hoped to increase the production by two-fold beginning January 2024 with the tissue culture laboratory expansion, which is almost done at 90 % completion. With the expanded laboratory, an increase in initial stocking density per month from 7,200 to 14,000 is also expected.

The cost-and-return analysis of micropropagules production in the laboratory is currently being updated.

- *Mass production of all-male and mixed-sex tilapia fingerlings and promotion of saline-tolerant tilapia*

Good quality tilapia seedstocks

This production study aims to develop broodstock from the offsprings of improved founder stocks of Nile tilapia (i-Excel and iBEST) and BFS-sourced red tilapia for use in SEAFDEC/AQD Tigbauan Main Station's hatchery, produce mixed-sex and all-male tilapia fingerlings for use in brackishwater (BW) and seawater (SW) culture areas by local fish farmers in Panay island, produce a total of 100,000-120,000 tilapia fingerlings per month (or 1,200,000-1,440,00 pcs annually), and to determine the cost and benefits of using improved strains of tilapia in the hatchery.

From January to September 2023, a total of 788,703 pcs of tilapia fingerlings were produced in the hatchery, where 635,500 pcs valued at PHP 213,712 (around USD 3,795) were sold to interested Panay-based farmers. This year's production data was 241 % higher than in 2022 because of new and younger broodstock and controlled breeding lines used during pairing.

2.3 Ensuring food safety through sustainable aquaculture methods

Departmental Program no. 2

Healthy and Wholesome Aquaculture

The concept of healthy and wholesome aquaculture is integral in improving and sustaining aquaculture production to provide the protein needs of an escalating human population. Research and development efforts in aquaculture have resulted in the sector's phenomenal growth in the last four decades. However, more problems need to be studied and solved to attain significant improvements and assure sustainability for future generations in the face of many challenges posed by ecological, economic, and climatic changes, among others, happening in our world today.

In 2023, SEAFDEC/AQD continued to implement its Departmental Program "**Healthy and Wholesome Aquaculture**" comprising two components, namely: 1) fish health and 2) nutrition and feed. Fish health concentrates on disease diagnosis, control, monitoring and surveillance of aquatic animals, and environmental integrity, certification, and food safety; while the nutrition and feed component focuses on conducting studies to address some problems and need areas related to nutritional factors, which will eventually sustain the production of aquaculture products in the Southeast Asian region.

- ***Fish health component***

Fish health component aims to improve aquaculture production through innovations in fish health management and maintaining the environmental integrity of aquaculture systems.

  - *Treatment regimen on tissue culture seaweed plantlets affected by disease and epiphytic pest using commercially available chemicals*

Seaweed is the leading aquaculture commodity in the Philippines, contributing to 63 % of the 2019 total aquaculture production. The seaweed and its by-products are the second-highest contributors to the country's export receipts, amounting to USD 250 million. However, a significant decline in production was attributed to the outbreak of diseases and pests affecting farmed eucheumatoids.

A recent survey on seaweed farms in the Philippines suggested widespread diseases and pests, including ice-ice disease (IID) and epiphytic filamentous algae (EFA). Both IID and EFA outbreaks have been reported to affect biomass production and carrageenan quality extracted from affected seaweed plants. The spread of disease and pests is mainly attributed to the absence of biosecurity measures or translocation of seaweeds, especially if not properly checked. Using commercially available household chemicals to treat EFA tissue cultured plantlets showed that chlorine-based chemicals are more effective than citric acid and hydrogen peroxide. However, the latter two chemicals do not affect the epiphytes. Using sodium hypochlorite and granulated chlorine at several concentrations has resulted in a bleaching or whitening effect on EFA, eventually leading to the death of epiphytic pests. On the other hand, treatment for IID using povidone-iodine has shown varied results depending on the severity of the infection affecting the seaweed thallus.

Seaweed plantlets affected with IID and EFA

This continuing study aims to optimize the effective doses of chemicals used to treat EFA and IID without detrimental effects on the host seaweed before and after the translocation. Further, the parameters are analyzed to determine the health status of the host seaweed after treatment. The results of this study will be adopted in the sea-based nursery cage production protocols and can also be used in shallow and deep-water farms for seaweed grow-out culture.

The EFA-affected seaweeds at the Igang Marine Station (IMS) were collected and transferred to the Tigbauan Main Station for analysis and treatment. These infected plantlets have the same chlorophyll α as healthy plantlets when treated with sodium hypochlorite (400 ppm). The same higher results were observed for phycobiliproteins except in phycoerythrin. There was no adverse effect on the host plant after chemical treatment. IID-treated plantlets (chlorophyll α and phycobiliproteins) showed the same results with healthy seaweeds. These results suggested that povidone-iodine and sodium hypochlorite treatment have no detrimental effect on the seaweed plant upon recovery.

An experiment on prophylactic treatment is being conducted at IMS to determine the effect of povidone-iodine on seaweed plantlets. For comparison, two treatments with or without iodine are conducted weekly by immersion of plantlets in 100 ppm iodine and control (seawater only) for 30 min. Further, weekly monitoring for the presence of seaweed health problems, especially IID and EFA, is also done.
Statistical analysis and result writing are ongoing.

- *Epidemiology of skin ulceration disease in juvenile and adult sea cucumber*

The sandfish *Holothuria scabra* is considered the most important tropical sea cucumber among the more than 60 commercially important species. The development of aquaculture technology for this species comes with an increasing risk of diseases, particularly skin ulceration (SKUD). Such disease could spread rapidly, may be difficult to control, and may eventually lead to mortality if not eliminated from the broodstock. Hence, the primary objective of this study is to investigate the epidemiology of SKUD that has been erratically affecting the hatchery-reared and sea pen-caged cultured *H. scabra* at Tigbauan Main Station (TMS) and Igang Marine Station (IMS), respectively.

Three to five dominant colonies recovered from sandfish's water, sediment, and coelomic fluid were collected from the culture plates, purified, and stocked in 1/3-strength TSA tubes. Isolates from IMS sandfish broodstock rearing tanks were subjected to physicochemical and biochemical tests. Results showed that 60 % of the water and sediment sample isolates were sucrose fermenters and identified as *Vibrio alginolyticus*.

Bacterial isolates recovered from seawater and sediment samples collected from IMS were similarly characterized physico-chemically and biochemically. Results showed that 80 % of the selected isolates examined were *V. alginolyticus*, while the remaining isolates were identified as *V. proteolyticus* and *V. corallyticus*. Similarly, in the case of sediment samples, most of the isolates were identified as *V. alginolyticus*, while few were identified as *V. mediterranei*.

Eighty bacterial isolates recovered from sediment and seawater samples obtained from Molocaboc, Sagay in December 2022 were taxonomically identified using conventional biochemical and API 20E tests. The dominance of *A. hydrophila* (16/40; 41 %) and *V. fluvialis* (12/40; 30 %) was noted in the case of bacteria recovered from the sediment samples. Additionally, *V. proteolyticus* (9/40; 22.5 %), *V. cholerae* (9/40; 22.5 %), and *A. hydrophila* (9/40; 22.5 %) were the dominant species identified from the seawater samples examined.

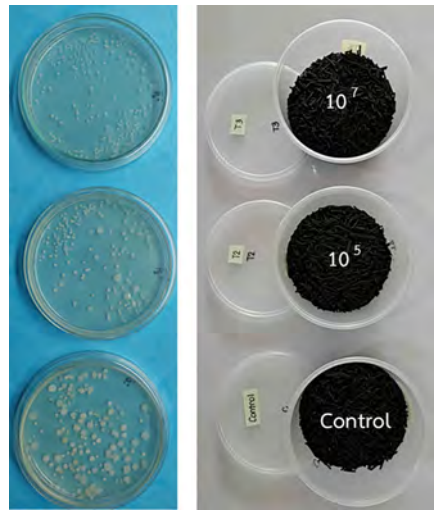
At the end of 2023, this study is expected to document the seasonal occurrences of SKUD in the hatchery and grow-out culture of sandfish and juveniles and broodstock samples from the wild. The symptoms of SKUD will be observed through macroscopic and microscopic (wet mount and histopathology) investigations. Further, using conventional methods, the bacterial taxa recovered from the coelomic fluid, rearing water, and sediment of both healthy and diseased sandfish will be characterized. The isolates that cannot be identified by conventional biochemical tests will be ascertained by 16S rRNA sequencing. *In vivo*, experimental infection assays will be conducted using crude extracts from *H. scabra* ulcerations and with bacteria isolated from these extracts.

In the future, practical disease and prevention control strategies will be proposed.

- *Verification of probiotic supplementation in enhancing survival and immune response of juvenile abalone* Haliotis asinina

The intrinsic growth rate of abalone is one of the major constraints of its culture, which is frequently associated with low digestibility and inefficient absorption of nutrients from the diets. As demonstrated in several studies, the potential use of probiotics to enhance growth is worth exploring. These studies showed that incorporating probiotics into the abalone diet through either macroalgae preconditioning or spraying improved growth rate, survival, and immune response.

AQD uses fresh *Gracilaria* sp. to feed the abalone juveniles from 5 to 10 mm shell length until three months. While this seaweed is the most preferred natural abalone feed, it contains complex polysaccharides that are difficult to digest. Feed digestibility could be enhanced through supplementation of probiotics by increasing the number of digestive enzymes and the solubility and absorption of nutrients. Further, probiotics stimulate the innate immune system of abalone, hence resulting in a significant increase in survival rate.



Probiotic supplementation into formulated diet

Specifically, the probiotic *Bacillus amyloliquefaciens* can produce various types of enzymes, such as amylase, protease, lipase, and cellulase. It is used as a probiont in *Haliotis asinina* culture, enhancing growth and survival, and promoting the antioxidant capacity and immune response in other abalone species. AQD has focused on developing formulated diets for abalone juveniles. Hence, this study aims to evaluate the effect of

the different concentrations of probiotic (*B. amyloliquefaciens*) supplementation on the growth, survival, and immune response of juvenile abalone *H. asinina*. The economic viability of using probiotics through seaweeds and formulated diet will also be evaluated.

Different concentrations of *B. amyloliquefaciens* at 10^5 and 10^7 cfu/g were incorporated in the formulated diets as treatments 1 and 2, respectively. The control group used formulated diets only. The supplementation of *Gracilaria* with probiotics was done after its preconditioning. The probiotic supplementation experiment was conducted for 90 days.

At the end of the phase 1 experiment using seaweeds with probiotics, the total weight gain, total shell length gain, SGRw, SGRL, and survival rates of the treated groups were comparable with that of the control group. The feed conversion ratio (FCR) was also calculated, showing that the treated groups had higher FCR than the control group. The survival rate was higher in treatment 2, though not statistically significant. Further, the effect of probiotics on the immune response of abalone juveniles showed that the total number of hemocytes was not significantly different between treatment 1 and treatment 2, but treatment 2 had a significantly higher total hemocyte count than the control group ($p < 0.05$). This correlated with the observed higher survival rate for the treatment 2 group. Hence, it could potentially stimulate the immune response in terms of an increased level of hemocytes.

For phase two of the study, the formulated feeds were supplemented with probiotics instead of seaweeds. Monitoring of the feeds was conducted for 14 days to check the viability of the probiotics used. The results showed that the probiotic concentrations were 1 log lower than the prepared initial concentration. A biochemical test was conducted to check whether the target probiotic was the same, and the result showed *B. amyloliquefaciens*.

Additional runs will be conducted to validate the results of the experiments. Another method of probiotic delivery will also be tested.

- *Biological control against sea lice on snubnose pompano*

Snubnose pompano, *Trachinotus blochii*, is one of the high-value finfishes that is now being cultured in the Philippines. Its meat is popular for its fair thickness and rich and tasty flavor. However, a consistent parasitic infestation of copepods belonging to the family Caligdae, commonly known as sea lice, has been observed in pompano. Specifically, the marine fish lice, *Lepeophtheirus spinifer*, is the predominant species infesting pompano in floating sea cages at the Igang Marine Station.

Snubnose pompano infested with sea lice

A study on applying various chemical treatments, such as the freshwater bath, hydrogen peroxide bath, and emamectin benzoate (EMB) as medicated feed on infected snubnose pompano was conducted from 2021 until 2022. The effect of freshwater bath and hydrogen bath treatments was a short-term reduction of the infestation, however laborious.

While the EMB treatment resulted in a long-term reduction of the infestation, but it was costly.

An alternative approach using biological control, such as cleaner fish, will be used to address these gaps. The wrasse (Labridae) has been widely used in salmon aquaculture as a control strategy for sea lice, specifically *Lepeophtheirus salmonis* and *Caligus elongatus*. As a biological control, the wrasse has greater environmental acceptability and is less laborious and more cost-efficient. No studies have used wrasse as the biological control against sea lice on the snubnose pompano. Hence, this study aims to assess potential use and efficacy of wrasse for such purposes through tank and field testing.

Based on the morphological examination and identification, the moon wrasse or green wrasse (*Thalassoma lunare*), is the most prevalent at Igang Marine station and will be used throughout the experiment. The ratios of wrasse to pompano were 1:1, 1:2, and 1:5. The control treatment had no wrasse. The initial tank trial experiment showed that the prevalence of sea lice was consistent at 100 % from pre-treatment to day 21 post-treatment. All treatment groups have a reduced but varying prevalence. The prevalence range for 1:1, 1:2 and 1:5 was 40–60 %, 55–85 %, and 60–90 %, respectively. The mean intensity of sea lice is relatively higher in the control than in the treated groups from Day 3 to Day 21. The lice intensity in the treated group from the pre-treatment count slightly decreased toward Day 21. All treated groups had less than 4.0 mean intensity of sea lice on all time points, whereas the control group had more than 4.6 mean intensity.

The mean intensities of sea lice per life stages of the treated and control groups pre- and post-treatment showed that the adult female sea lice in the treated group were absent with cohabitation of wrasse, whereas they were consistently present in the control group from pre-treatment to Day 21. The most prevalent life stages observed for the control and treated groups were adult males, pre-adult II, and pre-adult I.

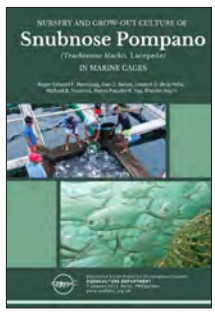
The second trial for the tank experiment is still ongoing. A field trial will be conducted after.

- ***Nutrition and Feed Component***

The nutrition and feed component aims to 1) find effective alternative protein sources to fish meal in dietary formulations, 2) determine specific nutrients that enhance growth performances, and 3) promote practices and strategies to improve production.

  - *Culture of pompano* Trachinotus blochii *in floating net cages*

AQD has completed this study by establishing an optimum stocking density at 100 fish/m³ and 45 fish/m³ for the nursery and grow-out phase of pompano cage culture, respectively. The optimum feeding rate was identified at 8–10 % of the body weight during the early nursery stages. This was gradually lowered to 2–3 % upon reaching the finishing stage of the grow-out phase. After 210 days of culture, the average harvest size of pompano was 350 g with an FCR of 2.29.



Aquaculture Extension Manual No. 73

The conduct of this study has published a manual entitled "Nursery and Grow-out Culture of Snubnose Pompano (*Trachinotus blochii*, Lacepede) in Marine Cages."

An additional study will be carried out to find an effective alternative fish meal substitute and lessen its inclusion in the feeds of pompano juveniles for the remaining duration allotted for the study.

- *Refined formulated feed for the grow-out culture of mangrove crab,* Scylla serrata *(Forsskal 1755) in brackish water ponds*

Conventional feeds for mangrove crabs depend highly on using fish-by-products (FBC) and other slaughter wastes. These feeds, however, are highly polluting and can easily cause water quality spoilage, affecting the health of mangrove crabs. They can likewise bring about problems, including the shortage of supply, unreliability in quality, and disease carriers.

This continuing study compares the efficiency of formulated refined crab feed (RCF) given alone or in combination with FBC to mangrove crabs grown in brackishwater ponds. Also, it seeks to maximize the mangrove crab's RCF consumption by developing comprehensive feeding mechanisms and feeding management techniques. This intends to improve the economic viability of mangrove crab grow-out culture in brackish water ponds by replacing conventional feed with a cost-efficient RCF formulation.

Preparation of refined crab feed (RCF)

The formulation of RCF has been done and produced at AQD's feed mill plant. The grow-out feed for *Scylla serrata* is currently being verified for its efficiency when applied in grow-out culture compared to the conventional FBC diet.

The study is being conducted in 250 m^2 ponds using three dietary treatments of RCF, FBC, and a mixture of RCF and FBC. The study utilized 160 crablets per pond at a stocking weight of 3 ± 1 g. The feeding trials for this study are ongoing, and feed is given two times a day at a rate of 10 % of body weight.

- *Evaluation of microbound diet for larval-stage mangrove crab (*Scylla serrata*)*

Larval rearing of mangrove crabs depends on the availability of live food; however, challenges to its availability, pathogen contamination, collapse of culture batches, and inconsistency in nutritional composition are encountered.

A microbound diet (MBD) is an ideal microparticulate feed over the use of live feed as it enables modification of the nutritional contents to match the larvae's requirements. However, when immersed in water, formulated diets are not stable compared to live feeds. Further, the unsuccessful use of MBDs in the early larval stages was attributed to their lack of enzymes, which are present in live feeds. These enzymes aid in larval digestion and nutrient absorption. Hence, this study aims to determine an appropriate feed binder to improve the water stability of MBDs and to determine the effect of enzyme addition on the survival of *S. serrata* larvae.

To reduce the dependence of mangrove crab larvae on live food and improve its survival, initial feeding trials of MBD using commercially available feeds were also conducted. Two feeding treatments were tested in the study: one that was fed purely with live food and another that was supplemented with a commercial shrimp diet.

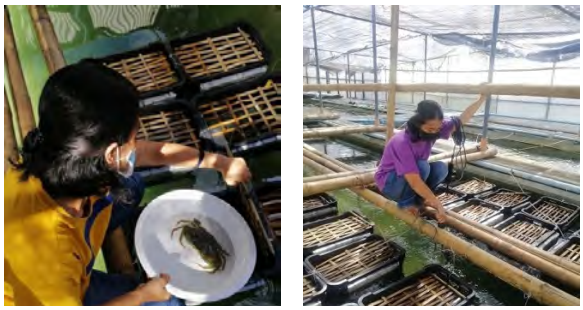
Feeding of commercial shrimp diet by S. serrata *zoea 1*

The survival from hatching to crab instar 1 was 4.8 ± 2.7 % when fed purely with live food and 5.3 ± 3.4 % when supplemented with a commercially available feed. Supplementation of feeds reduced live food needed for larval rearing and the maximum molting duration by one day for both the megalopa and the crab instar. Mortality due to molting failure was observed in the experiment, which is attributed to an imbalance of the diets' fatty acids, EPA, and DHA. Finally, feeding of commercial diets was observed under the microscope for the zoea stages 1 and 2.

The rearing parameters for a small-scale set-up have already been established and were found to be capable of producing up to the crab instar stage, thus allowing for further feeding trials to test the effect of the feeds that would be formulated under this study.

- *Refinement of* Scylla serrata *maturation diet*

Broodstock nutrition is a basic component of any hatchery production. For mangrove crab broodstock, maturity could not be met without supplementing an artificially formulated diet with a natural fresh diet. However, using a natural fresh diet is discouraging due to its unpredictable quantity and quality and highly variable prices, and it could also likely cause poor water quality and diseases. Further, the existing formulated diets contained lower average protein and lipid levels.



Stocking of crabs in plastic crates with wooden covers for acclimation to formulated diets prior to use in feeding experiments

Thus, this study aims to refine the existing maturation diets used for mangrove crab and improve its reproductive performance by optimizing protein and lipid inclusion levels.

Approximately 200 g *S. serrata* were acquired, disinfected, stocked in isolation tanks, and screened for WSSV. This study was conducted in individual 250 L sheltered indoor tanks to reduce mortality due to uncontrolled outdoor conditions.

The preparation of culture tanks, formulation of maturation feeds, and enhancement of the water stability have been completed. Subsequently, the effect of partial and full substitution of the natural fresh diet with a formulated diet on the maturation of *S. serrata* will be assessed.

- *Efficiency of polychaete phospholipid in promoting* Penaeus monodon *maturation*

Diet manipulation is the most effective intervention to increase the penaeid reproductive performance, of which polychaete is considered an indispensable component. Known to contain high protein levels, highly unsaturated fatty acids (HUFA), and reproductive hormones, a recent study reported that polychaete phospholipid extract supplemented at 0.25 % was the most efficient component and dose in promoting maturation of Indian white prawn, *Penaeus indicu*s. Optimization of polychaete inclusion in penaeid broodstock maturation diet can strongly influence reproductive performance and eventually have a long-term impact on overall seed production.

The possibility of reducing dependence on polychaete by replacing it with other cheaper alternative diets can boost the profitability of penaeid hatchery operations and ensure a more stable supply of good quality post-larvae. Hence, the main objective of this study is to verify the efficiency of supplementing phospholipid sources (polychaete and krill) using 0.25 % and 0.50 % inclusion levels in reproductive performance, vitellogenin expression, and offspring quality of *P. monodon*.

To instigate this study, only healthy and disease-free tiger shrimp broodstock were used and subjected to unilateral eyestalk ablation and eye tagging for identification. The cold-acetone precipitation method was used to obtain the polar lipid fraction from polychaetes and krill oil, which were then supplemented to the formulated diets. Hemolymph was also sampled every ten days to determine the effect of phospholipid supplementation on the reproductive hormones of *P. monodon* broodstock.

Polar lipid fractions extracted from krill (left) and polychaete (right) through cold-acetone precipitation method

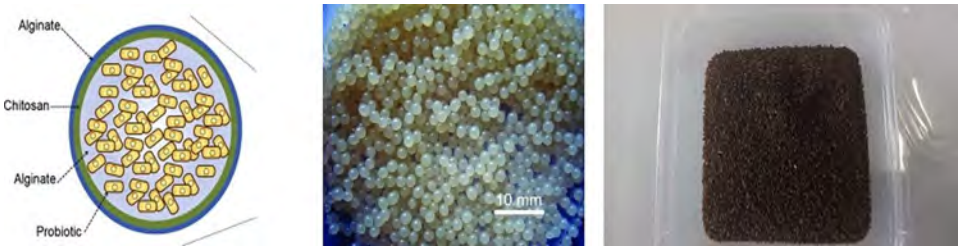
- *Microbead technology: Enhancing fish gut nutrition through efficient delivery system and functionality of microencapsulated probiotics for aquaculture*

Probiotics are known as positive promoters of growth, health, and survival of aquaculture species such as milkfish and tilapia. However, its application in aquaculture is highly affected

by adverse environmental factors, which may result in unviable probiotic cells, thereby minimizing its efficacy on the host. This limitation may be addressed through MicroBead technology by encapsulating the cells for protection from harsh external environmental factors.

This project generally aims to develop alginate-based MicroBead probiotics to enhance fish gut nutrition, efficient delivery system, and functionality in milkfish and tilapia aquaculture. Specifically, this study aims to assess the effects of probiotics on the growth of milkfish and tilapia when added to the feeds directly or as microbeads.

Initial trials were conducted with three treatments consisting of only a formulated diet to serve as control; powdered probiotics mixed with the formulated diet (1 g/kg feeds); and MicroBeads (1 g/kg BW of fish), which were directly fed before feeding the formulated diet.



Representation of the microencapsulation of probiotics (left) in chitosan-coated alginate beads (middle) and the actual alginate beads (right)

2.4 Development of responsible and sustainable aquaculture technologies

Maintaining Environmental Integrity through Responsible Aquaculture

Departmental Program no. 3

Aquaculture production has steadily increased in recent decades, significantly contributing to more than 50 percent of the total fish-food volume globally. Because of the intensification of production, there are concerns about its adverse effects on the environment, especially in the culture areas that have been used for a long time. Conversely, there are varying needs to develop new aquaculture fields and explore new species using environment-friendly approaches.

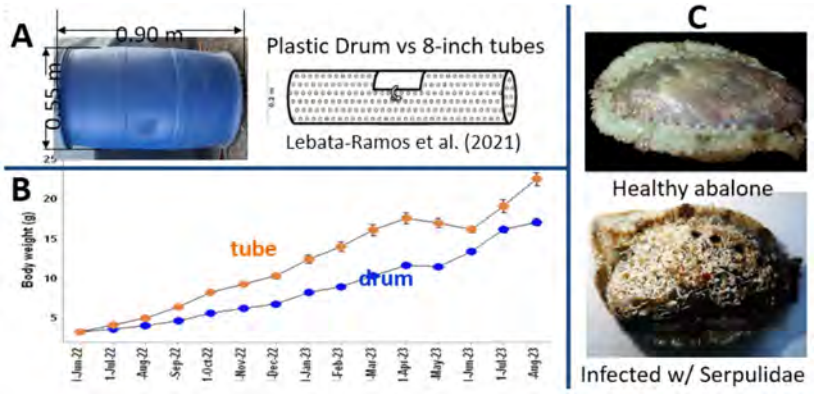
Through its Departmental program "**Maintaining Environmental Integrity through Responsible Aquaculture**" or MEITRA, SEAFDEC/AQD explored and addressed these issues and developed green aquaculture technologies. AQD has been developing aquaculture technologies for various species of finfish, crustaceans, mollusks, seaweeds, and other emerging aquaculture species to boost production in the Philippines and other countries in Southeast Asia while taking the lead in the development and promotion of eco-friendly aquaculture strategies.

- *Field verification of mixed-diet in deep water grow-out culture of abalone using PVC tubes and recycled drums*

Among the main challenges for developing aquaculture technologies for tropical abalone include the availability of good feeds and practical but efficient grow-out culture methods. Previous studies showed that flake-type feed is better than noodle-type feed.

This study on abalone grow-out culture aims to verify the use of alternate feeding of seaweed and flake feed on the growth and survival of abalone and to compare culture performance between using recycled drums and PVC tubes. Further, this study aims to explore bigger containers to increase production. Hence, the economics of producing abalone using different containers were compared.

The initial culture showed that feeding with live seaweed alternately with formulated flake feeds can support good abalone growth in a sea-based culture system. Abalone growth was significantly better in PVC tubes than in drums.



Experimental drums and PVC tubes (A), growth of abalone (B), and comparison of a healthy abalone with one that is infected with fouling tubeworm (C).

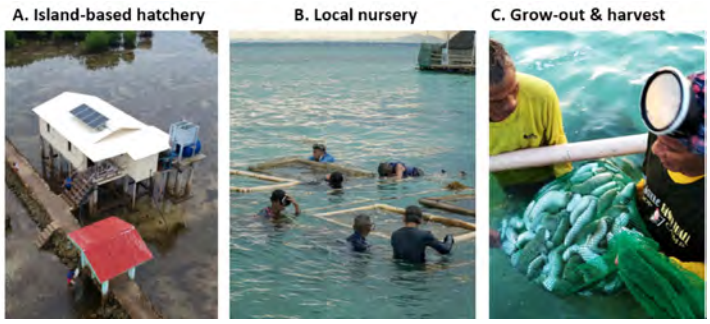
Meanwhile, abalone survival (> 90 %) was not significantly different between PVC tubes and drums, especially within the first six months. However, from April 2023, fouling organisms were observed on the abalone shells, with some blocking their respiratory pores/tremata. These were tube-building polychaetes belonging to the Family Serpulidae. This infestation caused a significant decline in abalone survival at the end of the culture trial in 2023. For treatment, the infected abalones were bathed in a 50-ppm formalin bath for 10 min and transferred to an aerated recovery tank for 30 min before being placed back into their respective culture containers. The calcareous tubes were also manually scraped off.

The infected stocks were turned over to the Fish Health Section for bioassay experiments. New containers will be designed to minimize the parasite infestation. A new culture site with better water quality will be surveyed to mitigate the infestation by Serpulids, and then another culture run will be proposed in 2024.

- *Increasing technical skills supporting community-based sea cucumber production in Viet Nam and Philippines*

This study is part of a five-year project funded by the Australian Centre for International Agricultural Research (ACIAR) on the production of sea cucumber *Holothuria scabra* that started in the last quarter of 2019. The project involves multiple sites in the Philippines and Viet Nam. The project's components, which AQD spearheads, involve various production phases for the sandfish, from optimizing hatchery and nursery production up to resource enhancement and grow-out in the sea ranch. Hence, it aims to use microalgae concentrate

or paste products in sandfish hatchery, assess sandfish production in nursery and grow-out including environmental factors and predation, check the suitability of sandfish for sea ranch, and demonstrate the technology and capacitate the local community.



The demonstration of actual sandfish hatchery production in an island-based small-scale hatchery (A), sandfish juveniles reared in floating nurseries; (B), then grown and eventually harvested and processed by the local fisher partners (C)

Many activities of the project were significantly affected by travel restrictions due to the COVID-19 pandemic. Field travels were only resumed in 2022, while activities were only fully resumed in 2023. Earlier activities focused on optimizing hatchery production using microalgal concentrates to minimize dependency on live microalgae cultures. Experiment results in 2019 showed that live *Chaetoceros calcitrans* (Cc) is still best in promoting the fastest larval development to the doliolaria stage, but commercial microalgae products of *Isochrysis* sp. and mixed diatoms can be possible alternatives. The use of locally available concentrated microalgae or pastes was also tested. One was the SEAFDEC/AQD PrimoAlga, which showed high applicability as a replacement larval feed for sandfish. Recently, an optimized feeding protocol using microalgae concentrate was developed and demonstrated in an island-based hatchery managed and operated by local community members.

For the ocean-based nursery culture of sandfish in floating hapas, results suggested that algal biofilm (*i.e.* chl-*a*) positively affects sandfish growth in hapa, while wind and rain were negative factors. Sandfish nurseries were successfully operated in two separate sites on Guimaras Island and Molocaboc Island in Sagay, Negros Occidental, which a local fishers' group is operating.

Problems with predation of sandfish in nursery pens and sea ranch were also evaluated in laboratory and field experiments. In a predation-avoidance experiment, small (3–5 g) sandfish juveniles seemed to be naive to predators, while medium (15–20 g) sandfish tended to avoid predators. Thus, > 20 g sandfish are recommended for stocking in the field.

Ultimately, the project was able to capacitate the local community and demonstrated sandfish production, from practical hatchery operation in an island-based facility, nursery rearing in sea-based floating hapa nets, grow-out culture in sea ranch and pens until harvest, and even demonstrated sea cucumber processing and drying methods. Grow-out expansion sites were also assessed and determined using both technical biophysical suitability criteria, coupled with participatory site selection utilizing local and traditional knowledge of the local residents.

For results dissemination, a regional summit on sea cucumber aquaculture is planned to be conducted in 2024.

- *Assessment and development of an intermediate culture system for tropical aquaculture species (sea cucumber)*

The aquafarming of various seafood species has been developed in the past 40 years, and more species are being promoted for aquaculture. Focusing on aquaculture development, JIRCAS and SEAFDEC/AQD have engaged in a collaborative project on a system that introduces high-value seedling production and intermediate culture of high-value aquaculture species in harmony with the environment in tropical areas. This present study is one of the three sub-studies under this project, which aims to develop and assess an appropriate intermediate culture system (ICS) for tropical aquaculture species.

As a pilot commodity, the tropical sandfish *Holothuria scabra* was the chosen species, using the sea-based nursery pen system to grow the juveniles from 2 g onwards. Specifically, the study aims to assess significant environmental parameters that may influence the culture performance of sandfish during the intermediate or nursery culture phase and to determine the optimal culture duration and size of sandfish juveniles using the system dynamics model.

In 2023, preliminary experiments were carried out in pens at Igang Marine Station of SEAFDEC/AQD to assess seasonality and test the best size at release. Two initial stocking sizes (2 g and 5 g) were tested in a culture run during the colder months of December to February. Then, another run was conducted from April to June 2023 when it was warmer. Weather and water parameters were monitored every 5 min using data loggers and an online weather station. Initial results showed that those with the initial size of 5 g had higher overall biomass, but those with the smaller sizes of 2 g promoted faster growth. Survival was better during the warmer months (> 60 %) compared to colder months (< 30 %).

Field studies in pens

Online weather station

Water quality loggers

Nursery or intermediate culture of sandfish experiments using sea pens at Panobolon Island in Guimaras using data loggers to monitor the weather and water conditions

Another culture trial will be conducted in 2024 using the same methodology but in two new sites in Panobolon Island in Guimaras which are exposed to different weather and water conditions.

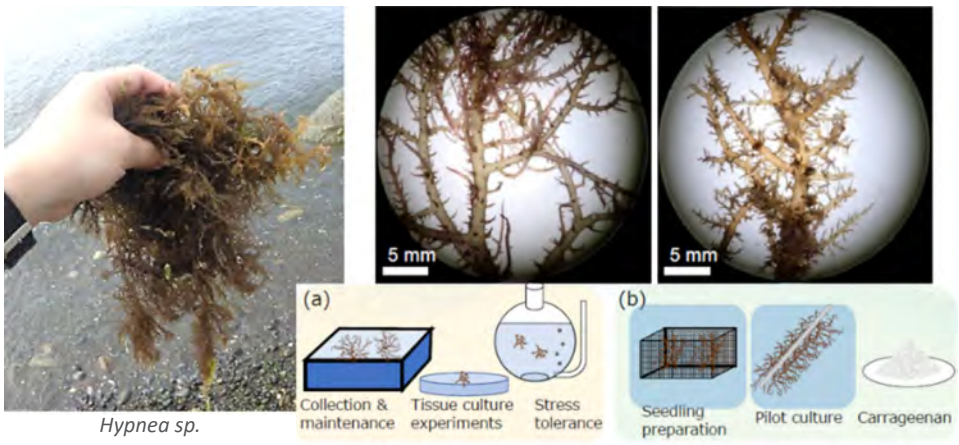
- *Assessment of growth traits of* Hypnea *sp. as a potential tropical seaweed species for aquaculture*

Red seaweeds had the largest share of the seaweed market in 2020 due to a demand for agar and carrageenan hydrocolloids in several industries. *Eucheumatoids*, which include two genera of red seaweeds *Kappaphycus* and *Eucheuma*, are major sources of raw materials for carrageenan. In Southeast Asia, seaweed is among the top aquaculture commodities in terms of gross production volume, especially in the Philippines. However, the primary problem with seaweed cultivation is the dependence on a few eucheumatoid species in the tropical regions, like *Kappaphycus* and *Eucheuma*. Both species have very similar physiological properties and are, therefore, fragile to the same environmental stresses. Hence, it is a good strategy to explore other cultivable seaweed species.

This study, which started in late 2022, will characterize the physiological traits and fundamental biological and ecological information of a possible candidate seaweed species, *Hypnea* sp., because it possesses ideal traits such as high growth rate in temperate-warm water, kappa-carrageenan content, and great tolerance to a wide range of salinity. Based on such information, seedling production for *Hypnea* will be explored and ultimately demonstrate culture in several mariculture fields in succeeding years. Specifically, this study aims to characterize the growth traits and stress tolerance of *Hypnea* and verify its growth in a pilot marine farm. The carrageenan production will also be verified, and results as to its potential as the new carrageenophyte in the Philippines will be published.

In 2023, samples of wild *Hypnea* were successfully collected around Panay Island during the warmer month of March, but none were found during the rainy months of August, which suggests that this species may have some seasonal trends in availability.

The collected samples were initially reared in indoor tanks using protocols for known seaweed species but were not sustained for long. Hence, a detailed assessment of water quality parameters will be needed. Further, the samples of the new batch will be collected and subjected to tissue culture, characterization of growth traits, and stress tolerance experiments.



Hypnea sp.

Wild Hypnea *seaweeds were collected around Panay Island with the basic morphology and physical characteristics were recorded and a series of experiments will be conducted to determine protocols for seed and grow-out production in the field*

- *Co-culture of milkfish and giant freshwater prawn in brackishwater ponds*

Polyculture is a strategy that promotes sustainable food production by minimizing ecological impacts linked to waste products from aquaculture. This system uses complementary species that are held together to encourage synergistic interactions on food availability and environmental conditions. The milkfish *Chanos chanos* is the most important aquaculture fish in the Philippines, whether in low-salinity ponds or marine cages. The milkfish has also been successfully co-cultured with other species like shrimps, crabs, and seaweeds.

Another potential species for co-culture with milkfish is the giant freshwater prawn (GFP) *Macrobrachium rosenbergii*. A previous study conducted in brackishwater ponds showed that GFP can be successfully co-cultured with fish like tilapia. Therefore, such a co-culture technique can be tested with milkfish in the same pond system. The differences between milkfish and GFP locomotory behavior and feeding habits, in addition to their conforming water quality, culture period, and nutritional requirements for growth and survival, may complement both species' success under a co-culture system. Therefore, this study will determine the efficiency of the milkfish-GFP co-culture in a brackishwater pond system that will assess the culture performance between mono and co-culture. The economic feasibility will also be compared.

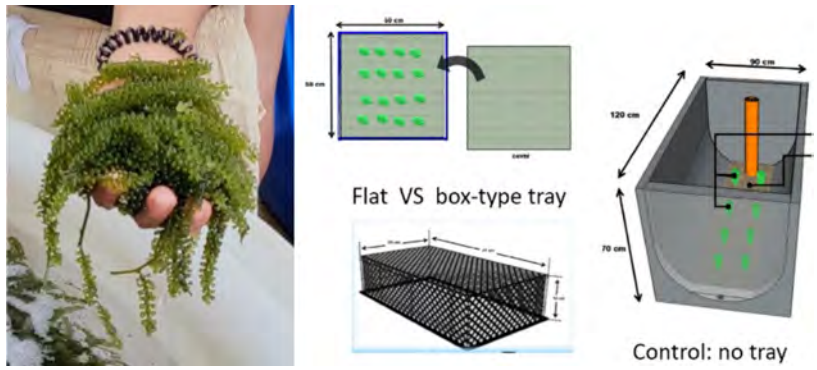
Experimental brackishwater ponds will be prepared first to test the monoculture of milkfish and GFP versus their co-culture at initial densities shown above

Started in June 2023, the study is still in the preparation stage, especially in refurbishing the needed experimental ponds at the SEAFDEC/AQD Dumangas Brackishwater Station and sourcing for experimental juvenile stocks for both milkfish and GFP. The grow-out experiment continues to assess the growth performance and survival of milkfish and GFP under a co-culture system compared to monocultures of both species and to determine the best stocking density.

- *Establishing grow-out culture techniques of sea grapes* Caulerpa *in tanks*

In the Philippines, seven species of sea grapes, *Caulerpa*, are consumed as food and for medicinal applications. *Caulerpa lentillifera* is the most favored because of its succulent texture and hypocholesterolemic and hypoglycemic effects; it lowers cholesterol and glycaemic index. Also, *C. lentillifera* has a high protein content, comparable to soybean. Even though sea grapes are commercially important, their production in the Philippines is

limited to wild harvests and a few extensive farms in marine ponds, which can be highly seasonal and prone to collapse during adverse weather fluctuations. This new study will explore options for producing sea grapes in indoor tanks, which can promote this seaweed year-long availability and increase production and stable market prices. Moreover, *Caulerpa* culture in tanks will mitigate the exposure of the seaweed to contaminants and diseases that could affect biomass yields and nutrient content. The different culture media, like a flat tray versus a box-type cage, will be compared, and the result will be directly planted onto the sediments, just like in wild or pond systems.



The sea grapes Caulerpa *will be tested to be cultured in various trays in an indoor tank experiment at SEAFDEC/AQD.*

This study started in July 2023. *Caulerpa* samples were collected from the wild and/or farms. Sourcing sea grape stock from the wild was done on 16 November and 8 December 2023 in Barangay Pandaroanan, Nueva Valencia, Guimaras. The collected samples were subjected to culture tray and stocking density experiments to determine the ideal culture vessel and optimum density, respectively.

Seminar-Workshop on Aquaculture Development in Southeast Asia (ADSEA)

Other Program no. 1

The project "**Seminar-Workshop on Aquaculture Development in Southeast Asia (ADSEA)**" was endorsed by the SEAFDEC Council Members during the Fifty-Second Meeting of the SEAFDEC Council on 19 May 2020, but it was put on hold due to the pandemic. ADSEA aims to review the recent developments in aquaculture and to provide a forum to discuss strategies to ensure further developments of responsible aquaculture in the region. This project was postponed from 2023 to 2024 in a face-to-face or hybrid setup.

Blue Horizon: Ocean Relief through Seaweed Aquaculture

FCG/ASSP Project no. 16

The project "**Blue Horizon: Ocean Relief through Seaweed Aquaculture**" is funded by the Global Environmental Facility (GEF). With the World Wildlife Fund, Inc. (WWF-US) as the GEF Implementing Agency, the Project will be executed in partnership with SEAFDEC, Bureau of Fisheries and Aquatic Resources (BFAR) of the Philippines, and Department of Fisheries of Viet Nam.

The overarching goal of the Project is to create new sustainable seaweed value chains that will deliver ecosystem services and provide socioeconomic benefits to communities, particularly those reliant on marine ecosystems for their livelihoods. To achieve the goal, the Project will implement its four key components: 1): Regional approach and capacity for seaweed value chains in Southeast Asia; 2) Enabling environment for seaweed aquaculture in Philippines and Viet Nam; 3) Seaweed value chains (production, processing, and marketing); and 4) Knowledge management, M&E, and IW Learn (regional).

While the GEF CEO endorsed the Project Document in July 2022, administrative preparations for its operation are currently underway. Project activities are anticipated to commence in 2024.

2.5 Generation of appropriate technologies for rural aquaculture to provide livelihood and alleviate poverty

Meeting Socioeconomic Challenges in Aquaculture

Departmental Program no. 4

Scientific and technological advances made and embraced by receptive business people and investors are the primary drivers of aquaculture growth in the Southeast Asian region. However, the expansion of aquaculture in the region has resulted in and contributed to several unintended problematic situations, including 1) inequitable distribution of opportunities and benefits among aquaculture adopters, 2) technological and production cost dualism among aquaculturists, 3) social conflicts and economic losses due to competing uses of resources for aquaculture and other purposes; and 4) high cost of rehabilitation of habitats affected by the misuse of natural resources for aquaculture.

Through stakeholder collaboration, the Departmental Program "**Meeting the Social and Economic Challenges in Aquaculture Program**" or MSECAP seeks to develop and implement social and economic strategies in aquaculture and resource management to secure food and income. The main goal is to respond to the specific recommendations for this Program identified and adopted during the 2011 ASEAN-SEAFDEC Fish for the People Conference. These include 1) prioritizing collaborative R&D in aquaculture in the region to have a clear regional assessment and understanding of the role of aquaculture in poverty alleviation and provide basis for policy formulation; 2) allocating R&D resources to address emerging issues on the impacts of climate change and global trade on aquaculture with emphasis on small-holder fish farmers; and 3) enhancing multi-agency collaboration and sharing of information and resources between and among SEAFDEC and its Member Countries and other organizations in addressing the common problems of alleviating the socioeconomic conditions of the poor sector of the region.

Since its inception in June 2011, the MSECAP program has conducted research to develop sustainable livelihoods that will assist marginalized households in fishing communities with food availability and income security. These anticipated results are intended to be maintained through the bottom-up development of supportive local regulations that are jointly implemented by local government institutions and equipped fisherfolk organizations.

- *Assessment and development of community-based sandfish (*Holuthuria scabra*) farming livelihoods for fishing communities*

This study concluded in 2022 and established the fishing community's profile, emphasizing their production, management, decision-making roles, and sea cucumber farming gaps. Further, the indicators of willingness to participate in a community-based sea cucumber farming supplemental livelihood opportunity were also established.

- *Developing community-based sustainable aquaculture livelihood strategies in the Laguna Lake and tributaries*

The outputs of this study last 2022 include the established collaboration among fisherfolk, local government, relevant national government agencies, seafood traders, and AQD in sustainable GFP production in the Laguna Lake and tributaries and the capacitated PAPA members who are engaged in community-based hatchery and nursery operations with income from the sale of GFP post-larvae.

Accordingly, this study in Barangay Pipindan, Binangonan, Rizal aims to provide sustainable community-based hatchery operations and family-based grow-out production for a possible source of income, conduct training in broodstock management and explore trial ranching opportunities in the Laguna Lake and tributaries.

2.6 Collaborative projects with the Philippine Government

Collaborative Projects with the Philippine Government

Departmental Program no. 5

For the past five decades, SEAFDEC/AQD has pioneered advancements in broodstock management, seed production, and grow-out of economically important finfishes, crustaceans, mollusks, and seaweeds. AQD emphasizes that for a substantial transformation in the aquaculture industry, it is crucial to effectively and strategically implement these science-based technologies in the field, starting with pilot initiatives in the Philippine context. To accelerate fish production and export revenues within the aquaculture sector, AQD is committed to expediting the transfer of matured aquaculture technologies to stakeholders. This initiative aims to offer additional and alternative livelihood opportunities to fishers by adopting sustainable aquaculture technologies that are economically viable, environment-friendly, and socially equitable.

Under its Departmental Program "**Collaborative Projects with the Philippine Government**," AQD addressed the pressing concerns of fry shortage, increasing feed prices, and insufficient training initiatives. The ultimate goal is to accelerate fish production and enhance export revenues within the aquaculture sector. This collaborative effort involves key partners such as the Department of Agriculture- Bureau of Fisheries and Aquatic Resources (DA-BFAR) and other government entities, including the National Fisheries Research and Development Institute (NFRDI).

- *Fry Sufficiency Program*

The primary objective of this project is to address the issue of seed insufficiency in the Philippines through the establishment and operation of additional hatcheries, revitalization of unproductive hatcheries, and improvement of the milkfish breeding program.

In 2023, the research team focused on two main components: developing feasibility studies for establishing legislated hatcheries and reviving abandoned hatcheries nationwide.

Approximately 48 facilities are required for this program to implement the legislated hatcheries. Each hatchery is expected to produce 25 million fry annually. These proposed hatcheries would need about 3,750 milkfish breeders, with a female-to-male ratio of 2:1. Beyond addressing the scarcity of fry supply; the program aims to challenge the perception that captive-bred fry is inferior to wild-caught fry in terms of growth and survival. DA-BFAR ensures that the fry produced will meet the highest quality standards. In addition to milkfish, these versatile hatcheries can accommodate the cultivation of other economically important aquaculture species, such as the black tiger shrimp (*Penaeus monodon*), mangrove crab (*Scylla serrata*), and emerging commodities like pompano (*Trachinotus blochii*), abalone (*Haliotis asinina*), sandfish (*Holothuria scabra*), and seaweed (*Kappaphycus* spp.), which are rapidly gaining popularity.

The Memorandum of Agreement between DA-BFAR and SEAFDEC/AQD encompassed the involvement of 15 Republic Acts (RAs). AQD completed eight feasibility studies for the legislated hatcheries. The procedural steps involved evaluating pre-identified project sites, selecting the most suitable site, and developing comprehensive feasibility study reports and other pertinent documents.

As of December 2023, the hatcheries in Bantayan, Cebu, and Sultan Naga Dimaporo, Lanao del Norte were successfully constructed and inaugurated in November and December 2023, respectively. Both hatcheries are currently operational. The hatchery in Jose Dalman, Zamboanga del Norte has been completed but is awaiting inauguration scheduled in early 2024. These hatcheries and previously inaugurated facilities in Ligao, Albay and Plaridel, Quezon are expected to contribute to the country's immediate milkfish fry production. As for the other remaining hatcheries, some are expected to be completed in 2024.

Sultan Naga Dimaporo, Lanao del Norte

Jose Dalman, Zamboanga del Norte

Bantayan, Cebu

Legislated hatcheries under MOA with DA-BFAR and SEAFDEC/AQD that were completed

An additional eight House Bills (HBs) and RAs were filed, and SEAFDEC/AQD was tapped to perform the feasibility studies for six HBs in Western Visayas by entering a MOA with DA-BFAR 6. Four feasibility studies were completed in Iloilo Province (Batad, Carles, and Concepcion) and Antique Province (Tibiao). Outside the Panay Island, two feasibility studies were completed. One is for Negros Occidental (Talisay City), and another for Dinagat Islands (Basilisa). So far, three HBs have been passed into law. The construction of the hatchery in Antique is set to start in early 2024.

In support of the Fry Sufficiency Program, AQD partnered with DA-BFAR 6 to rehabilitate abandoned hatcheries in Panay. These hatcheries are expected to produce 5–10 million milkfish fry annually. Improvements were made in two hatcheries located in Batan, Aklan, and Concepcion, Iloilo.

Improvements for the hatchery in Batan, Aklan included repairs of tanks and training of natural food personnel to maintain culture. AQD also donated larvae onsite to jumpstart the rearing process, and they were able to produce fingerlings.

For the hatchery in Concepcion, Iloilo, tanks were repaired, and natural food cultures were maintained. AQD provided the stocks; hence, the larval operation began in August 2023.

Regarding the assessment of the suitability of the pre-identified project sites by the concerned DA-BFAR Regional Office, the following will be continued:

- Complete the feasibility study for the proposed hatchery in Sagay City in Negros Occidental
- Ocular inspection for a hatchery in Cauayan, Negros Occidental
- Another ocular inspection will be conducted for the new pre-identified sites in Negros Occidental

Following this, AQD will once again create a feasibility report for submission to the aforementioned local government units and regional offices of BFAR.

As for the revival of abandoned hatcheries, monitoring the rehabilitation activities will continue in 2024 to ensure sustainable operation.

o Development of Cost-Efficient Feeds

The project's primary objectives include seeking more economical alternatives to replace fish-based feed ingredients, formulating effective feeds using these alternatives to reduce costs, and promoting utilizing locally sourced ingredients.

In collaboration with BFAR and NFRDI, AQD is actively involved in identifying cost-effective feed ingredients as substitutes for fish meal. The formulated feed, priced at PHP 31.89/kg (USD 0.62/kg) for tilapia and PHP 34.78/kg (USD 0.67/kg) for milkfish as of 2019, has undergone verification trials since 2019 in partnership with BFAR techno-farms and private fish farms. The project is transitioning towards the technology transfer phase, disseminating cost-efficient feed formulations to prospective cooperators. Tilapia farm in Sto. Tomas, Nueva Ecija; Taal, Batangas; and San Rafael, Iloilo, have participated in technology transfer, while the techno-demo farm for milkfish was located in Roxas City, Capiz. Plans involve

recommending feed formulations for high-value marine fish, conducting verification trials and transferring technology to stakeholders.

To scale up feed production, AQD has initiated collaborations with DA-BFAR and local government units (LGUs) of Bulalacao, Oriental Mindoro and Bolinao, Pangasinan, to establish aquaculture feed mill plants. The construction has commenced for three feed mill plants in Tigbauan, Iloilo (AQD main station), Bulalacao, and Bolinao. As of December 2023, progress is at 35 % in Tigbauan, 25 % in Bulalacao, and 30 % in Bolinao. Completion for all feed mill plants is anticipated in 2024.

Tigbauan, Iloilo (35 %)

Bulalacao, Oriental Mindoro (25 %)

Bolinao, Pangasinan (30 %)

The progress of the ongoing construction of various feed mill plants in different parts of the Philippines

- *Oplan Balik Sugpo*

The initiative endeavors to rejuvenate the tiger shrimp industry in the Philippines by advocating environmentally sustainable practices, implementing advanced biosecurity measures in ponds, and producing high-quality shrimp larvae in the hatchery. Two key strategies to revive the prawn industry in the Philippines are the production of high-quality *Penaeus monodon* postlarvae (PL) and enhancing the grow-out culture methods.

At the Tigbauan Main Station of AQD, the Shrimp Hatchery Complex has been established to produce black tiger shrimp fry from the wild during the hatchery phase. The hatchery utilizes a spawner/broodstock facility used as a quarantine area. The newly-spawned eggs are washed with UV-sterilized seawater, disinfected with iodine, and rinsed with UV-sterilized seawater. Harvesting of the nauplii is based on the PCR test results of the spent spawners. Pathogen-negative nauplii are stocked in larval-rearing modules in the shrimp hatchery. PCR tests are conducted at PL 5, PL 10, and PL 15 to monitor the health condition of the shrimp fry before harvest. Fry harvesting is done when they reach PL 15–20.

In 2018, around 6.67 million fry had already been harvested, with a survival rate of 19.03 %. The highest survival rate was attained in 2020 with 25.34 %. The harvested fry was primarily used for the verification study on *Penaeus monodon* grow-out culture in ponds at the Dumangas Brackishwater Station, while the excess stock was sold to interested buyers.

Several developments have been made during the implementation of Oplan Balik Sugpo. The recently constructed Shrimp Broodstock Facility at the Tigbauan Main Station was inaugurated. This facility housed four 120-ton concrete broodstock tanks holding 1,440 breeders following a 3F:1M ratio (960 females and 480 males). These breeders can produce up to 80 million PL annually given the optimum culture conditions. Subsequently, new

breeders were acquired, disinfected, and conditioned before stocking in the broodstock tanks. As of September 2023, 4,571 breeders were already contained at the Shrimp Broodstock Facility.

The events culminated in the completion and launch of a manual on black tiger shrimp hatchery operations in July 2023. The manual contained the biology, site selection, hatchery operations, diseases, and economic analysis of *P. monodon*. The enhanced biosecurity measures to serve as a guide for hatchery operators in producing disease-free shrimp fry were also incorporated in the manual.

Verification is conducted at Dumangas Brackishwater ponds for the grow-out phase using the high-quality and disease-free shrimp fry produced from the TMS hatchery. Two ponds were stocked with 18.75 pcs/m² for Pond 1 and 24 pcs/m² for Pond 3. After 120 days of culture (DOC), the average body weight gain (g) and survival rate (%) for Ponds 1 and 3 were 30.8g/92.43 % and 28g/78.65 %, respectively. The harvest in 2023 already summed up to 5.65 t.

AQD is committed to sustaining the production of high-quality PL using enhanced biosecurity measures in the hatchery, which will be improved through testing the best health practices. This will also be carried out to demonstrate and verify the *P. monodon* culture in ponds using enhanced biosecurity measures. In 2024, the field testing will continue to expand to collaborators including BFAR and private farms.

- *In-situ (on-site) training courses and accelerated technology transfer*

Recognizing a weak connection between the scientific development of aquaculture technologies and fish farmers, this project is geared towards expediting technological advancements through techno-caravans and field demonstrations.

In response to the requests of the government, an on-site training course was organized and tailored for fish farmers. The course covered various aspects, including hatchery, nursery, and grow-out operations of freshwater commodities, specifically tilapia, catfish, and giant freshwater prawns. Practical sessions involving the preparation of feeds for tilapia sex reversal and identification and sexing of giant freshwater prawn broodstocks were also conducted.

Participants of the on-site training course on freshwater aquaculture at Mina, Iloilo, Philippines

Another on-site course with an online component was designed for science research specialists, research assistants, technicians, and fish farm workers. The training comprised lectures on biology, ecology, and the grow-out culture of white-leg shrimp. Additional topics included pompano biology, ecology, hatchery management, and grow-out culture in ponds and cages. In addition, a practical session on the sampling of shrimps and pompano in ponds, including the computation of their average body weight, survival rate, etc. was conducted

Upon the request of a private farm owner in Aklan Province, a field demonstration was done to assess whether the site is suitable for the brackishwater pond grow-out culture of snubnose pompano (*Trachinotus blochii*). With the positive result, AQD provided the pompano fry for stocking and assisted in nursery rearing to the grow-out phase. Pompano stocks were sampled regularly to determine the average body weight. As of October 2023, the stocks reached 200 ABW after 91 DOC including the nursery phase.

Stocking of pompano fry in floating net cages for nursery rearing (left); sampling of pompano (middle); and pompano samples (right) in New Washington, Aklan

Another technology demonstration on snubnose pompano was facilitated for NFRDI Freshwater Fisheries Research and Development Center in Taal, Batangas. As of October 2023, the stocks reached 200 ABW after 139 DOC including the nursery phase.

AQD will continue collaborating with government agencies such as BFAR and NFRDI in 2024 to conduct training courses and techno-caravans around the country, particularly in areas where the aquaculture industry has potential.

- *Manpower Development*

This project aims to address the shortage of technical manpower in the country, particularly individuals equipped to operate the newly established government aquaculture facilities (including hatcheries, feed mills, ponds, and cage grow-out systems). The proposed solutions involve addressing this manpower gap through comprehensive, hands-on training for fisheries graduates. The training will cover diverse areas within SEAFDEC/AQD, encompassing several disciplines such as fish health and nutrition, natural food propagation, breeding, farming systems, and socioeconomics.

From 2018 to 2023, twenty-four graduates from various fisheries schools in Visayas and Mindanao underwent screening to meet the criteria for participation in the Training Course on Aquaculture Technologies for Manpower Development. The primary aim was to augment their capabilities and provide a broader perspective and experience in aquaculture.

Following an intensive 3-month training program, the participants were employed by AQD and assigned to various areas and hatcheries at Tigbauan Main Station in Iloilo. Their primary responsibility involved technical assistance in hatchery operations, leading them to be deployed to different rehabilitated hatcheries in Western Visayas.



Manpower Development staff providing technical assistance in various hatcheries

3. Strategy 3: Ensuring the food safety and quality of fish and fishery products for the Southeast Asian region

3.1 Promotion of seafood quality assurance systems for fish processing establishments in the region

Enhancing Food Safety and Competitiveness of Seafood Products

FCG/ASSP Project no. 18

Seafood is an important commodity in many AMSs and serves as an important source of foreign exchange and food supply for these countries. There is an increasing demand for seafood as consumers around the world recognize its nutritional value. However, seafood is highly perishable, and several chemical and biological changes occur immediately after capture or harvest. The deterioration process of seafood quality by microbiological metabolism, oxidative reaction, and enzymatic activity is irreversible and accelerated by poor temperature control along the supply chain. Thus, good handling practices and technologies are critical in keeping seafood products fresh and safe, extending shelf life, and maintaining their quality and economic value from catch to consumer.

In today's fast-moving world including the Southeast Asian region, consumers increasingly demand for quick and easy ready-to-cook (RTC) foods or even ready-to-eat (RTE) meals. Quick- and easy-to-prepare RTE seafood dishes include sushi and sashimi, shucked shellfish, and RTC seafood in sauce. However, the minimally processed or raw nature of these foods puts them at high microbiological risk. Therefore, it is essential that these foods are prepared under good manufacturing practices (GMP) and good handling practices (GHP), and with reputable technologies such as high-pressure processing (HPP) that would mitigate high microbiological risk while retaining high nutritional content.

To introduce such technologies for possible adoption by countries in the Southeast Asian region, MFRD embarked on the project "**Enhancing Food Safety and Competitiveness of Seafood Products.**" The duration of this Project is from 2020 to 2024 and comprises

two tracks: 1) Development of Regional Guidelines on Good Manufacturing and Handling Practices (GMP & GHP) for Ready-to-eat Raw Fish and Fishery Products, and 2) Development of HPP Handbook for Seafood. The development of these resources will allow the adoption of GMP and GHP for high-risk seafood such as sushi and sashimi and serve to strengthen regional capabilities in the safe handling of high-risk seafood products, as well as allow the AMSs to gain knowledge about new preservation technologies, enhancing the value, safety, and quality of seafood products.

Track 1: Development of Regional Guidelines on Good Manufacturing and Handling Practices (GMP & GHP) for Ready-to-eat raw fish and fishery products.

After the virtual training course on "GHP-GMP for RTE Fish & Fishery Products" organized in April 2022, the AMSs conducted pilot trials and surveys for a year till the second quarter of 2023. Subsequently, MFRD organized "Mid-term Review Meeting on Regional Guidelines on Good Manufacturing and Handling Practices (GMP & GHP) for Ready-to-eat Raw Fish and Fisheries Products" on 20 June 2023 in Singapore. The meeting was attended by representatives from the AMSs who presented their experiences and findings from the 1-year pilot trial period, addressing issues such as monitoring and enforcement of implementation, hesitancy of fishery establishments in adapting food safety measures, and difficulties in implementing guidelines in local small-scale fishery companies. The meeting also gathered inputs from the AMSs to improve the draft Regional Guidelines on GMP & GHP for Ready-to-Eat (RTE) Raw Fish and Fisheries Products, developed in collaboration with a project consultant from Nanyang Polytechnic (NYP). MFRD is currently working with the consultant on the draft Regional Guidelines of GMP & GHP with the inputs gathered from the AMSs during the Mid-term Review Meeting.

Participants from the ASEAN Member States, the SEAFDEC Deputy Secretary-General and SEAFDEC Secretariat staff during the Mid-Term Review meeting

Track 2: Development of HPP Protocols for Seafood

MFRD engaged a consultant from NYP to develop training materials on high-pressure processing (HPP) of fish and fishery products based on results gathered from R&D and product development. These materials were utilized for the "Regional Training Workshop on High Pressure Processing (HPP) Technology" organized by MFRD on 21–22 June 2023 in Singapore. Attended by representatives from the AMSs, the workshop covered the fundamentals of HPP for seafood, HPP parameters for various seafood products, and provided insights into the impact of HPP on seafood quality and shelf-life extension. Participants also had the opportunity to visit a HPP tolling facility in Singapore to observe the visual changes after the seafood was processed in HPP. MFRD is currently drafting the handbook on HPP of fish and fishery products in collaboration with the consultant. Once completed, the handbook would be translated into the national languages of the Member Countries as per requested.

Participants in the HPP training workshop learnt about the effects of HPP on seafood quality and its ability to extend shelf life

Representatives from the AMSs visiting a HPP tolling facility in Singapore to observe seafood processing in HPP

4. Strategy 4: Enhancing trade and compliance of the region's fish and fishery products with market requirements

4.1 Development and Implementation of regional standards, policies, and guidelines to enhance intra-regional/international trade

ASEAN-JICA Food Value Chain Development Project

FCG/ASSP Project no. 19

The "**ASEAN-JICA Food Value Chain Development Project**" comprises four thematic areas: 1) ASEAN Good Agriculture Practice (GAP); 2) Sanitary and Phyto-sanitary (SPS) measures; 3) Fishery value chain; and 4) Coordination and research on Public-Private Partnership (PPP)-based Food Value Chain. The activities to be implemented by SEAFDEC are under the third thematic area to support the fisheries sector in achieving the expected output, *i.e.* updates on Implementation of HACCP, GMP & GHP on Fishery Products; regional guidelines on cold chain management promoted in the AMSs; ASEAN Guidelines serves as reference for developing laboratory testing methods for the defined scope(s) for fish and fishery products; strengthening the implementation of protocols in the ASEAN GAqP; and training course on GAqP (Marine and Inland Aquaculture).

Under the third thematic area, the proposed initiatives seek to enhance the hygiene management system of fishery products, implement ASEAN Good Aquaculture Practices (ASEAN GAqP), and conduct inspections for fish and fisheries products throughout the supply chain. The Project's operational scope involves various activities such as assessing and disseminating information on hygiene management systems, including Good Manufacturing Practice (GMP) and Hazard Analysis and Critical Control Point System (HACCP) for fisheries products. It also entails the development of module-based training materials and the facilitation of training sessions dedicated to implementing the ASEAN Regional Guidelines on Cold Chain Management, GMP, and HACCP. Additionally, the Project outlines plans to develop regional guidelines for inspecting fish and fishery products at each stage of the supply chain. It aims to identify issues and propose solutions to encourage ASEAN GAqP certification, consolidating these findings into a comprehensive report. Additionally, the project envisions organizing training sessions focused on ASEAN GAqP. These initiatives collectively contribute to the overarching goals of the Project, aligning with the broader objectives of the ASEAN-JICA Food Value Chain Development Project.

Although this ASEAN-JICA Project was approved by the SEAFDEC Council in 2021 to be implemented by SEAFDEC in 2022 provided that the fund could be secured, the administrative process in Japan in preparation for the Project has been delayed. In 2022, JICA conducted a detailed study on project activity, including sub-activities and budget allocations, which were subsequently discussed and confirmed in collaboration with the ASEAN Secretariat. In July 2023, the ASEAN Secretariat and JICA reached an agreement on the Project Design Matrix (PDM), and subsequently, SEAFDEC revised the Project Workplan and Budget Plan in accordance with the PDM, submitting the updated documents to JICA. Project activities are anticipated to commence in 2024.

5. Strategy 5: Addressing cross-cutting issues, such as labor, gender and climate change, where related to international fisheries

5.1 Enhancing the awareness of Member Countries and addressing regional concerns on international fisheries-related issues

Assistance for Capacity Development in the Region to Address International Fisheries-related Issues

FCG/ASSP Project no. 20

The project "**Assistance for Capacity Development in the Region to Address International Fisheries-related Issues**" has been undertaken by the SEAFDEC Secretariat from 2020 to 2024. The primary objective of the project is to monitor emerging international fisheries-related issues and establish regional platforms for the ASEAN Member States (AMSs) to address these issues. These regional platforms facilitate awareness-raising activities regarding emerging international fisheries and trade-related issues across various international forums such as ASEAN, FAO, UN, CITES, CBD, and WTO, among others. The Project aims to enhance the understanding and capacity of the ASEAN-SEAFDEC Member Countries in effectively addressing these issues. Anticipated deliverables included the formulation of regional common/coordinated positions and recommendations for national and regional action plans to safeguard the interest of the region.

- ***Addressing CITES-related issues***

In 2023, SEAFDEC participated in events related to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) including the "Regional Meeting Focused on Implementing the Convention on International Trade in Endangered Species (CITES) for seahorses (*Hippocampus* spp.) in Asia" which took place from 14 to 17 March 2023 in Cebu City, Philippines. The Workshop was co-organized by the Project Seahorse; IUCN SSC Seahorse, Pipefish and Seadragon Specialist Group; and Zoological Society of London-Philippines in collaboration with the Philippine BFAR and the National Fisheries Research and Development Institute (NFRDI). Its purpose was to assist CITES Parties in assessing various aspects of CITES implementation for Appendix II species, including non-detriment findings (NDFs), legal acquisition findings (LAFs), monitoring in support of adaptive management, and enforcement. During the Workshop, the situation of the respective countries was analyzed based on these aspects, with discussion centered on possible actions considering that exporting seahorses is legal and sustainable. All seahorses have been listed in CITES Appendix II since 2002. At the 74th Standing Committee of CITES, particularly concerning seahorses, it was noted that Parties can fulfill their obligations to seahorses under the Convention by either "a) increasing their efforts to address illegal trade" or "b) ensuring that the seahorses being traded are sourced sustainably and apply the CITES Appendix II listing following precautionary approach."

On 7–11 June 2023, SEAFDEC participated in the 32nd Meeting of Animals Committees of CITES held in Geneva, Switzerland. The AC32 agenda encompassed various subjects, including CITES trade regulations, compliance, capacity building, and more. Additionally, discussions and reviews at AC32 addressed specific species including aquatic species listed in the CITES Appendices such as sharks and rays, eels, sea cucumbers, seahorses, and marine ornamental fishes, among others. Regarding commercially exploited aquatic

species, SEAFDEC contributed to the discussion of the working group on sharks where detailed elements of sharks and rays-related issues were deliberated. Recommendations were drafted for consideration by the AC and for submission to the Standing Committee as appropriate. During the side event organized by FAO titled "Needs and Solutions to Enable Parties to Service CITES Provisions for CoP19 Listed Commercially Exploited Aquatic Species" on 9 June 2023, SEAFDEC served as one of the panelists and shared insights and information on the current management and conservation status of sharks and rays in Southeast Asia. Additionally, SEAFDEC highlighted ongoing activities supporting the Member Countries and identified areas of the capacity building needs in the region.

Furthermore, SEAFDEC participated in the open session of the 18th Meeting of the ASEAN Working Group on CITES and Wildlife Enforcement (AWG-CITES and WE) on 31 May 2023 via the online platform. SEAFDEC was invited to be one of the international partners engaged in activities relevant to CITES, particularly in marine resources management. During the open session, SEAFDEC presented its efforts in addressing CITES-related issues, including the results of the "Regional Technical Consultation (RTC) on Development of the ASEAN-SEAFDEC Common Positions on the Proposed Listing of Commercially-exploited Aquatic Species (CEAS) into the CITES Appendices" organized on 30 August–1 September 2022. In addition, SEAFDEC provided information on the ongoing projects focused on capacity development, namely: "Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region" and "Sustainable Utilization of Anguillid Eels in the Southeast Asian Region."

32nd Meeting of the Animals Committee of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) on 7–11 June 2023 in Geneva, Switzerland

SEAFDEC staff served as one of the panelists of the FAO Side event "Needs and Solutions to Enable Parties to Service CITES Provisions for CoP19 Listed Commercially Exploited Aquatic Species"

- ***Addressing issue on aquatic genetic resources (AqGR)***

Recognizing the importance of utilizing, managing, and conserving aquatic genetic resources for food and agriculture, the SEAFDEC Secretariat, with technical support from FAO, organized the "Webinar on Aquatic Genetic Resources for Food and Agriculture" on 8 August 2023. The Webinar aimed to address the status and challenges for genetic management in global aquaculture as well as provide updates on the implementation of the FAO Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture. During the Webinar, FAO introduced the aquatic genetic resources information system (AquaGRIS) focusing on farmed types of aquatic genetic resources (AqGR) and its practical application. Moreover, the Webinar also featured insights from the Philippines regarding data collection and genetic resource registry of milkfish (*Chanos chanos*), enriching the discussion with practical experiences and case studies.

- ***Enhancing human resource capability and fostering cooperation among the AMSs***

Also under this Project, the Regional Capacity Building Network (RECAB) was initiated by SEAFDEC as per directive of the SEAFDEC Council during its 53rd Meeting in 2021. The RECAB program offers comprehensive technical training courses delivered by SEAFDEC Departments. These courses aimed to enhance the capabilities of fisheries officers from the ASEAN Member States (AMSs) while fostering regional cooperation and networking across aspects of fisheries and aquaculture.

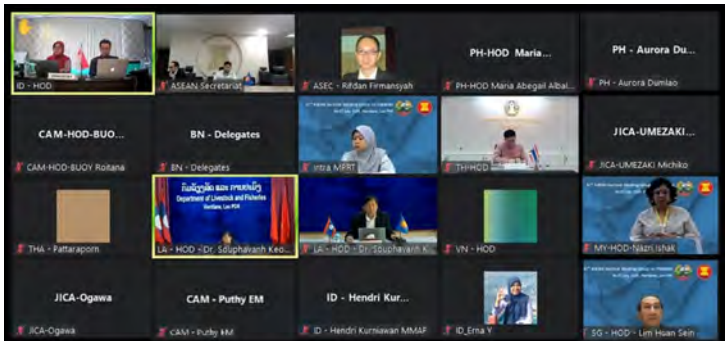
In 2023, the second year of the RECAB, the SEAFDEC Secretariat and SEAFDEC Aquaculture Department (AQD) co-organized the "Regional Training Course on Advanced Aquaculture Technologies for Commercially Important Commodities in Southeast Asia" from 9 to 26 October 2023 at AQD in Tigbauan Main Station, Iloilo, Philippines. The Training was participated by a total of 20 trainees from the ASEAN Member States (AMSs) representing Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. The objective of the Training was to enhance their knowledge and skills across various aspects of aquaculture *i.e.* biology, broodstock management, hatchery and breeding technology, nutrition, feeding, disease management, biosecurity measures and protocols, food safety of aquaculture products, and effects of climate change. The training curriculum included lectures, hands-on learning, and field visits to aquaculture operations. The trainees received learned the aquaculture technologies developed by AQD for economically important aquatic species, including marine fishes, mangrove crab, sandfish, giant freshwater prawn, and tilapia.

Regional Capacity Building Network (RECAB) 2023 on Aquaculture organized by SEAFDEC/AQD

Regional Capacity Building Network (RECAB) 2023 on Aquaculture organized by SEAFDEC/AQD

- ***Monitoring and raising awareness of international fisheries-related issues and its impacts to fisheries and aquaculture in the region***

Throughout the year, SEAFDEC actively participated in several ASEAN fisheries-related meetings, including the 15th Meeting of the ASEAN Fisheries Consultative Forum (15th AFCF) and 31st Meeting of the ASEAN Sectoral Working Group on Fisheries (31st ASWGFi). These meetings hosted by the Ministry of Agriculture and Forestry of Lao PDR, were conducted virtually on 24–25 and 26–27 July 2023, respectively. During these meetings, SEAFDEC presented updates on the progress of the implementation of the activities undertaken between 2022 and 2023 in key fisheries priority areas. These areas included fishing capacity and zoning system, securing sustainable small-scale fisheries, resource rehabilitation and enhancements, impacts of climate change on fisheries, combating IUU fishing, and traceability of fisheries and aquaculture products.



SEAFDEC participated in the virtual ASEAN meetings related to fisheries in 2023

Furthermore, SEAFDEC actively participated and contributed technical insights at numerous international events in 2023 addressing various international fisheries-related issues crucial for advancing the sustainable development of fisheries of the region. These include:

- OECD-ASEAN Workshop on Food Security: Sharing Evidence and Policy Experiences, (organized by the Organization for Economic Co-operation and Development (OECD) and the Association of Southeast Asian Nations (ASEAN), 2 February 2023)
- 10th Ocean Summit (organized by the Economist, 27 February–2 March 2023)
- Symposium on Sustaining Marine Biodiversity through Blue Economy (co-organized by SEAFDEC and the Ministry of Primary Resources and Tourism through the Department of Fisheries of Brunei Darussalam, 6–8 June 2023)

- 37th Session of the Asia-Pacific Fishery Commission (APFIC) (hosted by the Government of China and FAO/APFIC, 13–15 June 2023)
- 7th Global Fisheries Enforcement Training Workshop (GFETW) (organized by the IMCS Network, 30 July–4 August 2023)
- The Sustainable Ocean Initiative (SOI) Regional Capacity Building Workshop for East, South and South-East Asia (organized by the Convention on Biological Diversity (CBD) Secretariat and the government of South Korea, 5–8 September 2023)
- 19th Session of the Sub-Committee on Fish Trade of the Committee on Fisheries (19COFI:FT) (organized by FAO and government of Norway, September 2023)
- Global Plastics Summit 2023: Working towards a robust UN plastics treaty (Hosted by the Economist, 11–12 October 2023)
- 2nd High-Level Meeting on Aquaculture Transformation in Asia and Pacific Region (organized by FAO, NACA and the Department of Fisheries of Thailand, 8–9 November 2023)

5.2 Recognition of the importance of gender equality in the fisheries and aquaculture sector

With the adoption of the "SEAFDEC Gender Strategy" by the SEAFDEC Council in 2019 aimed at mainstreaming gender in SEAFDEC and its programs, SEAFDEC continued to enhance the knowledge of gender of its staff as well as those of the Member Countries. The gender aspects were integrated into various programs and projects of SEAFDEC as relevant and applicable.

In 2023, two gender mainstreaming training sessions were conducted by the SEAFDEC/TD, *i.e.* the "Training on Gender Mainstreaming in Fisheries Sectors in Cambodia" on 14–16 March 2023 and the "Training on Gender Mainstreaming in Fisheries Sectors in Viet Nam" on 25–27 April 2023 under the Project on "Small-scale Fisheries Management for Better Livelihood and Fisheries Resources."

To boost the visibility of SEAFDEC as a gender-sensitive and gender-responsive organization as well as to strengthen the cooperation and collaboration with other organizations on gender aspects, SEAFDEC officers participated in the activities by providing insights and delivering presentations to promote gender equality and equity under social-related programs, namely:

- International Conference on Achieving Ocean Equity: Innovative, Fair, Inclusive and Sustainable Strategies and Blue Impact Investments (27 February to 1 March 2023 in Australia)
- Consultation Workshop on Participatory Review and Selection of Adaptation Options with Inclusive, Gender-responsive Multi-Criteria Analysis (MCA) to Improve Natural Resource Management (12 May 2023 in Rayong Province, 15 May 2023 in Phetchaburi Province, and 29 and 31 May 2023 in Songkhla Province)
- Workshop Towards Creating an Enabling Environment for Securing Sustainable Small-scale Fisheries (14–16 November 2023 in Rome, Italy)
- Training Course on Fisheries MCS in Southeast Asia (21–24 November 2023 in Nha Trang University, Viet Nam)

Three articles were published in the SEAFDEC Special Publication "Fish for the People" Volume 21 No. 2 highlighting the interventions that were undertaken to promote gender equality in fisheries as well as results of gender analysis to document the roles of women and men in the fisheries sector. These articles are: 1) Striving to Mainstream and Integrate Gender in Small-scale Fisheries of Southeast Asia: SEAFDEC initiatives on gender through the years, 2) Promoting CBRM and co-management: empowering women in fish processing group in the Nam Xouang Reservoir, Lao PDR, and 3) Understanding the Gender Roles in Small-scale Fisheries and Aquaculture in Southeast Asia.

Activities were undertaken to build capacity and understanding of SEAFDEC staff of gender. A series of training on gender mainstreaming in SEAFDEC was conducted for the new SEAFDEC staff at the SEAFDEC Secretariat on 7 August 2023 and at TD on 9 and 15 August 2023. Also for staff capacity development, SEAFDEC officers participated in the "Gender Equality and Social Inclusion (GESI) Integration in Fisheries Training" from 26 to 27 September 2023 in Bangkok, Thailand. The training was organized by the CTI-CFF to pilot a "hybrid Gender Integration in Small Scale Fisheries in Southeast Asia Training Module" for future use.

Moreover, for SEAFDEC/IFRDMD, the Department organized three gender-related commemorative events organized in Palembang, Indonesia with a total of 89 participants (50 females and 39 males). The events were Kartini Day on 21 April 2023 , Mother's Day on 22 December 2023, and International Women's Day on 7 March 2023. The IFRDMD staff also participated in two events to build their capacity on gender subjects, namely: 1) Training on Artisanal Fisheries Measures and Women's Participation in Fisheries organized by Marino Forum 21 on 22 July–3 August 2023 in Japan and 2) Lecture on the gender participation in the fisheries sectors delivered by *Dr. Mina Hori* from Kochi University on 27 December 2023 in Palembang, Indonesia.

6. Strategy 6: Empowering SEAFDEC to strengthen its roles in the region and to improve its services to Member Countries

6.1 Extending support and capacity for Member Countries on fishery resource survey

Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC

FCG/ASSP Project no. 21

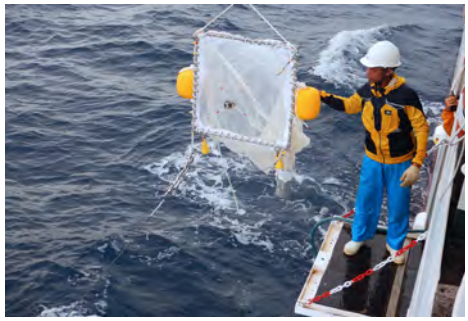
The M.V. SEAFDEC 2 has been utilized by SEAFDEC/TD since 2004 to support the AMSs in the conduct of fishery resource surveys to obtain a better understanding of the marine fishery resources in their respective waters. This had been facilitated through the ongoing project of TD "**Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2.**"

In 2023, TD carried out four cruises utilizing the M.V. SEAFDEC 2, two of which were aimed at supporting the SIMRAD EK-80 training onboard the vessel on 23–24 March 2023 and 29–31 May 2023. Through the two cruises, researchers of TD and those of the AMSs obtained skills in EK-80 calibration using tungsten sphere and data analysis using the Echoview program. Nevertheless, a concern was expressed that the use of the Echoview program for data analysis may not be suitable for the AMSs; therefore, other free software should be

considered. Another concern was on the lack of data on "target strength" for species in the region, especially the demersal species.

Another cruise was conducted on 15–22 October 2023 in the Gulf of Thailand for a marine debris survey in 13 stations. Moreover, samples were collected at each station including water using CTD device, seafloor debris and demersal biota by trawl net, microplastics in water column by Neuston net, microplastic in sediment by Smith McIntyre grab, and phytoplankton by plankton net. Additionally, floating debris was recorded by visual observation method for fourteen tracts. Through this survey cruise, the skills and experience of the researchers of TD and the AMSs on marine fisheries resources and marine environment surveys were improved.

Training on the use of SIMRAD EK-80 onboard the M.V. SEAFDEC 2



Marine debris survey in the Gulf of Thailand onboard the M.V. SEAFDEC 2

Moreover, a cruise was conducted on 2 April 2023 to train university students on trawl net operation, oceanographic instruments, and navigation. The students were from Burapha University, Kasetsart University, and Prince of Songkla University of Thailand and from Hokkaido University, Japan.

6.2 Enhancing human resources within the SEAFDEC organization

USAID DOI International Technical Assistance Program (ITAP)

Departmental Program no. 8

The "**USAID DOI International Technical Assistance Program (DOI-ITAP)**" is working in close collaboration with governmental and non-governmental partners to facilitate the exchange of the DOI technical experts with international counterparts on all aspects of natural and cultural resources management, support technical assistance and training. DOI-ITAP collaborates with State and federal U.S. agencies, foreign governments, and civil society groups to excel as an active leader in the global conservation community. Recognizing the importance of addressing IUU fishing and supporting SEAFDEC human resource development, a Memorandum of Understanding (MOU) was established between the U.S. DOI and SEAFDEC in August 2023 with the objective to enhance the capacity of SEAFDEC staff on fisheries management and resilience in the context of climate change and strengthening capacity in fisheries resources and marine environmental research survey, which focuses on implementing a holistic way to manage fisheries and marine resources. The Project duration is one year from October 2023 to September 2024. There are three scopes of activities under this Project, *i.e.* 1) Fisheries Resilience and Management, 2)

Climate Change and Fisheries Stock Assessments, and 3) Strengthening Capacity of the Marine Fisheries Resources and Marine Environmental Research Survey.

Under the first scope, the activity started with the development of prospectuses for the "Training Workshop on Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia"; and the "Training Workshop on Fisheries Resilience and Impact Assessment." Communication was made with potential resource persons for the conduct of these trainings in 2024.

For the second scope, TD also prepared a concept note and training prospectus for "Training course on the monitoring of fish stock life history parameters for observing the effect of climate change in the Southeast Asian Region" to be conducted in 2024.

For the third scope, a working group of technical officers from the TD was formed to prioritize the capacity-building topics that could be applied in SEAFDEC projects and support the policymakers from the Member Countries to develop a management plan for sustainable fisheries resources.

6.3 Promoting SEAFDEC visibility capacity building towards sustainable fisheries

Promotion on Strengthening of SEAFDEC Visibility and Enhancing Human Capacity Building

Departmental Program no. 6

In 2023, SEAFDEC/TD continued the implementation of its ongoing Departmental Program "**Promotion on Strengthening of SEAFDEC Visibility and Enhancing Humanapacity Building.**" The Program has the overall objective of strengthening the visibility and image of SEAFDEC, while also enhancing the knowledge of relevant agencies and stakeholders on fisheries-related issues. The activities were categorized into 1) Promotion and enhancement of SEAFDEC visibility and image; 2) Production of information materials, *e.g.* books, brochures, videos, and other media, to raise awareness and understanding of fishers, stakeholders, and the public; 3) Management of information system including databases, TD website, and official social media accounts; and 4) Enhancing the capacity of human resources including the conduct of tailor-made training based on the needs of partners and donors.

In 2023, TD prepared exhibitions to promoted SEAFDEC at the national events of Thailand, namely: Children's Day on 14 January 2023 and Annual Fishery Exhibition (Pramong Nomklao) from 30 June to 9 July 2023. Moreover, TD prepared and published 29 articles on fishery management, fishing technology, combating IUU fishing, and fisheries resources on TD's website and official social media account. TD also produced and uploaded two video clips on fisheries and two video clips on TD activities on TD's official YouTube channel.


TD exhibition during the Children's Day (left) and the Annual Fishery Exhibition (right)

As for the TD website which is accessible at www.seafdec.or.th, relevant information and news on activities of TD were updated on the website. Moreover, the published documents of TD were uploaded and made accessible through the TD repository at http://repository.seafdec.or.th.

7. Special Project

USAID Southeast Asia Fisheries Partnership

FCG/ASSP Project no. 22

SEAFDEC has entered into an agreement with the United States Agency for International Development (USAID) and received a Public International Organization (PIO) grant from the USAID Regional Development Mission for Asia (USAID/RDMA) under the "**USAID Southeast Asia Fisheries Partnership**" (hereafter called the Activity). The duration of this collaboration spans five years from 1 October 2023 to 30 September 2028. The Activity is under the management of the SEAFDEC Secretariat in collaboration with the SEAFDEC Departments namely: TD, AQD, MFRDMD, and IFRDMD. The overarching goal of this Activity is to enhance fisheries and aquaculture practices and ensure their sustainable management. To achieve this, the Activity is designed with three main objectives: 1) support the adoption and implementation of fishery policies, programs, and plans adopted and implemented by national fisheries agencies; 2) equip commercial and small-scale fishers with necessary financial and human resources, capacity, and good governance to adopt sustainable fishing and aquaculture practices; and 3) increase operational and technical capacity among national fisheries agencies and fisheries institutions.

Following the award date, USAID/RDMA hosted on the "Post-award Kick-off Meeting" at the USAID/RDMA office in Bangkok, Thailand on 11 October 2023. The purpose of the Meeting was to introduce the Activity; familiarize the USAID/RDMA and SEAFDEC team; and provide information on financial management, branding and marking, communication, monitoring, evaluation, and learning (MEL), and gender integration. The Meeting underscored the partnership between USAID/RDMA and SEAFDEC, a joint commitment to ensuring sustainable, secure, and resilient fisheries in Southeast Asia.

Post-award Kick-off Meeting of the project "USAID Southeast Asia Fisheries Partnership" in Bangkok, Thailand on 11 October 2023

In 2023 as the first year of the Activity, the technical activities have not yet been conducted. The majority of the efforts were dedicated to preparing for the upcoming activities and enhancing the capacities of SEAFDEC staff across various aspects to align with USAID requirements. Key milestones achieved included the establishment of the Activity implementation team which involved nominating the Departmental Focal Person; initiation of the recruitment process for key staff (Project Manager and Monitoring, Evaluation, and Learning (MEL) Specialist); and development of flow charts and working mechanisms, among other tasks. In addition, a workspace is being prepared at TD to serve as the project coordinating unit (PCU) office. During the initial year of the Activity, SEAFDEC was assigned the responsibility of developing essential documents such as the Co-branding Plan and Communications Strategy; First Annual Workplan; Monitoring, Evaluation, and Learning (MEL) plan; and Gender Equality and Social Inclusion (GESI) Analysis, among others. During the fourth quarter of 2023, three documents were submitted to the USAID/RDMA including 1) First Annual Work Plan, 2) Cobranding and Communication Strategy, and 3) MEL Plan.

With technical assistance from the Sustainable Fish Asia Technical Support (SuFiA TS) through USAID/RDMA, SEAFDEC co-hosted the "Monitoring, Evaluation, Learning, and Communications Workshop" on 20–22 December 2023 held face-to-face at SEAFDEC/TD and through the online platform for the participation of other SEAFDEC Departments. The Workshop aimed to enhance the capacity of the staff from the SEAFDEC Secretariat and Departments in implementing the Co-branding Plan and Communications Strategy as well as to introduce the MEL concepts and practical tools commonly used in USAID-funded projects. The Workshop sessions facilitated a deeper understanding of challenges and ways to mitigate them, providing a group work platform for sharing experiences among participants. After the Workshop, SEAFDEC staff gained knowledge of MEL and improved their communication skills.

Participants during the Monitoring, Evaluation, Learning, and Communications Workshop at SEAFDEC/TD on 20–22 December 2023

Group work during the Monitoring, Evaluation, Learning, and Communications Workshop at SEAFDEC/TD on 20–22 December 2023

SEAFDEC PROGRAMS FOR 2024

During the Forty-sixth Meeting of the SEAFDEC Program Committee on 20–22 November 2023 in Bali, Indonesia, the programs and projects to be implemented by SEAFDEC in 2024 were scrutinized and endorsed. These programs and projects had been categorized as 1) Projects under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) Mechanism (22 ongoing projects); 2) Departmental Programs (9 programs); and 3) Other Program (1 program). The list and description of programs and projects in 2024 appear as follows:

1) Projects under the FCG/ASSP Mechanism

Ongoing Projects

Project Title	Lead Department	Funding Source
Strategy 1: Securing the sustainability of fisheries to contribute to food security, poverty alleviation and livelihood of people in the region		
1. Sustainable Utilization of Fisheries Resources and Resources Enhancement in Southeast Asia (2020–2024) The Project aims to achieve improved technical capacities of human resources in the region in conducting marine fishery resources and oceanographic research surveys; improve technical knowledge, skills, and experiences of staff from SEAFDEC and the Member Countries through their participation in survey cruises; assist in the development of research cruise plans for the vessels of SEAFDEC and those of the Member Countries; generate scientific knowledge to support the management of transboundary fishery resources in Southeast Asia; promote the application of fisheries GIS (FGIS) and remote sensing (RS) for the monitoring of marine fishery resources and environment; and sustain resource enhancement through the establishment of artificial habitats. In 2024, the activities would continue to focus on improving the knowledge of fisheries officers/researchers through the upcoming training courses, namely: 1) Online regional training on research cruise planning for marine fisheries resources and oceanographic survey; and 2) Regional training course and seminar on Fisheries Resource Enhancement. In addition, the Project also plans to build the capacity of fisheries officers/researchers by organizing regional meetings/workshops to share knowledge and seek way forward activity for the region. Lastly, the Project will encourage the Member Countries to carry out a national fisheries and marine environmental survey and support SEAFDEC staff and researchers from the Member Countries to participate in the seminars, meetings, and workshops.	TD	JTF

Project Title	Lead Department	Funding Source
2. Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region (2020–2024) With the participating countries, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia Myanmar, Philippines, Thailand, and Viet Nam, the Project aims to support stock and risk assessment of small pelagic fisheries, especially neritic tunas in the Southeast Asian region, clarify the stock structure for neritic tuna species in the region, and carry out life history study on neritic tuna species in the region. In 2024 which is the last year of this Project, MFRDMD will organize the "Third Core Expert Meeting on Fisheries Management Strategies for Pelagic Fish Resources in the Southeast Asian Region." The Meeting aims to share the output for the stock and risk assessments of three selected small pelagic species (*i.e. Rastrelliger kanagurta*, *R. brachysoma*, *Decapterus* spp.), two neritic tuna species (*i.e. Thunnus tonggol* and *Euthynnus affinis*), and two tuna-like species (*Scomberomorus commerson* and *S.guttatus*) as well as their genetic and otolith analysis information. In addition, the Meeting will discuss the extent of the success of this Project and the necessary improvement to be included in the next JTF project. MFRDMD will also publish the report of the "Workshop on the Stock and Risk Assessments of Seerfish in the Southeast Asian Region" held in December 2023.	MFRDMD	JTF
3. Management Scheme for Inland Fisheries in the Southeast Asian Region (2020–2024) In achieving the objectives toward the sustainable management and utilization of inland fishery resources in Southeast Asia, the Project would carry out two main activities. The first is aimed at improving the fishers' livelihood program by developing guidelines for international fisheries management that will be disseminated to governments and other relevant agencies in Southeast Asia; while the second is aimed at assembling fish catch data and information by establishing a catch database and profiles of freshwater fish biodiversity and publishing a manual for swamp fisheries management model. While the study sites in 2023 focused on Lao PDR, Thailand, Indonesia, and Malaysia; Indonesia will be the site location in 2024. IFRDMD will organize a regional workshop with the participation of the representatives from the AMSs.	IFRDMD	JTF
4. Harmonization and Enhancing Utilization of Fishery Statistics and Information (2020–2024) The Project has the main objective of enhancing the utilization of fishery statistics data and information for policy planning and management of fisheries toward sustainability. Under this Project, concerned staff from SEAFDEC will continue to participate in international/regional meetings related to fishery statistics. Moreover, based on the results from discussions at the Regional Technical Consultations (RTCs) organized in 2021, 2022,	SEC	JTF

Project Title	Lead Department	Funding Source
and 2023, it is expected that the revised version of the Regional Framework on Fishery Statistics in Southeast Asia (2024 Edition) will be submitted for consideration by the SEAFDEC Council in 2024. Moreover, the 4th RTC on Fishery Statistics and Information in Southeast Asia will be organized in 2024 to discuss the tabulation for the new annual "Fishery Statistical Bulletin of Southeast Asia" as well as the development of a database based on the new Regional Framework (2024 Edition). The Regional Framework (2024 Edition) will be published and disseminated to the ASEAN Network on Fishery Statistics, Member Countries, and partner organizations. Meanwhile, the special publication "Fish for the People" Volume 22 with three issues in 2024 would be also sustained under this Project.		
5. Strengthening a Regional Cooperation and Enhancing National Capacities to Eliminate IUU Fishing in Southeast Asia (2020–2024) The Project has the objective of promoting the regional tools, *i.e.* Database on Regional Fishing Vessels Record (RFVR) and electronic ASEAN Catch Documentation Scheme (eACDS) and enhancing regional cooperation to support the implementation of Port State Measures (PSM) with a view of preventing the entry of fish and fishery products from IUU fishing into the supply chain. While the responsibility to key-in data into the RFVR Database has already been transferred to the AMSs, the capacity building activities and transfer of the eACDS application to the respective participating countries would be continued. In 2024, the Project would also continue the activities to develop the capacity of AMSs on monitoring, control and surveillance (MCS) focusing on the implementation of FAO Voluntary Guidelines for Transshipment for the Southeast Asian region.	TD	JTF
6. ASEAN-JICA Cooperation for Capacity Building on IUU Fishing Countermeasures in Southeast Asia (2023–2026) The Project was scheduled to commence in 2022 but was postponed to 2023. However, in 2023, the Project proposal was revised and submitted to the ASEAN Secretariat. The Project comprises three expected outputs, namely: 1) Responsible fishing technologies and practices to combat IUU fishing are promoted, 2) The capacity of AMSs to combat IUU fishing activities is enhanced through effective management tools of traceability for fish and fishery products, and 3) Policy measures to combat IUU Fishing are enhanced in AMSs. Upon approval of the Project, the activities to be implemented include training course on responsible fishing technologies/ practices to combat IUU fishing in Southeast Asia, training course on human resource development on traceability for fish and fishery products for eliminating IUU fishing, on-site training on traceability for fish and fishery products for relevant stakeholders in AMSs, regional capacity building workshop on enhancing policies and countermeasures against IUU fishing in Southeast Asia, and training course for fisheries inspectors in the implementation of port State measures.	TD	JICA

Project Title	Lead Department	Funding Source
7. Small-scale Fisheries Management for Better Livelihood and Fisheries Resources (2020–2024) The Project aims toward the sustainable management of small-scale fisheries (SSF) for improving the livelihood and well-being of fishers in Southeast Asia. In 2024, the Project activities in the following three components would be implemented: 1) effective and appropriate use of fisheries management concept/approach/tools for small-scale fisheries in the Southeast Asian region, 2) capacity development of the SSF team of TD and key officers of the Member Countries in the implementation of the FAO "Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication" for improving the livelihood and well-being of the small-scale fishers, and 3) further promotion of the gender integration and empowerment in sustainable fisheries management in the Member Countries. In 2024, it is expected that a regional workshop will be organized to compile the lessons learned and key successes/challenges of EAFM implementation in pilot sites in Southeast Asia. A technical write-shop will be organized for the development of the technical manual for fisheries socioeconomic assistance, particularly in microfinance, microcredit, and insurance data collection. Moreover, regional workshops on gender integration in SSF which include its current key challenges and ways forward in the Southeast Asian region will also be organized.	TD	JTF
8. Responsible Fishing Technology and Practice (2020–2024) The Project aims to promote responsible fishing technologies and practices in Southeast Asia that would minimize the impacts of fishing activities on fishery resources and marine ecosystems with an emphasis on the optimization of energy, improvement of fish handling and preservation techniques onboard, and promotion of responsible fishing technology through the training and studies. In 2024, the end-of-Project meeting on the identification and information gathering of environmental impacts of fishing gear and practices in Southeast Asia and national activities/legislation to reduce/mitigate the impact of impacts fishing gear and practices on the ecosystem will be organized back-to-back with the end-of-Project on information gathering of the fuel consumption in fishing operation and/or safety on fishing operation of major fishing operation in Southeast Asia.	TD	JTF
9. Regional Collaborative Research and Capacity Building for Monitoring and Reduction of Marine Debris from Fisheries in Southeast Asia (2024–2025) The Project is aimed toward establishing regional collaborative research and capacity building in the fisheries sector, including the application of scientific knowledge in regional policies and	TD	JAIF

Project Title	Lead Department	Funding Source
monitoring based on four priority areas of the "ASEAN Framework of Action on Marine Debris." The Project was originally scheduled to be implemented in 2023. However, the original budget plan of the Project was designed in 2019, and the current costs are anticipated to be different particularly for fuel and travel costs. From May 2022 to December 2023, SEAFDEC in collaboration ASEAN Secretariat and JAIF therefore revised the budget plan. The Project period was shifted to be from 2024 to 2025. In 2024, it is expected that the following activities will be carried out: 1) information gathering to estimate the amount of ALDFG and monitoring of the ALDFG at accumulated pilot sites and development of removal guidance of the ALDFG; 2) workshop on information exchange and the development of technical guidance on ALDFG countermeasures; 3) marine environment and fishery resources survey by using a research vessel, and evaluate the impacts of microplastics on the fisheries resources (in the Gulf of Thailand); 4) research and evaluation on the amount of marine debris collected by different types of fishing gear during fishing activities at sea; 5) marine environment and fishery resources survey by using a research vessel, and evaluate the impacts of microplastics on the fisheries resources; 6) research and evaluation on the amount of marine debris collected by different types of fishing gears during fishing activities at sea; 7) investigation and risk assessment of microplastics in freshwater fish and marine fish, and dissemination of the results on contaminant of microplastics; 8) on-the-job training on reliable research methods on marine debris and microplastics to officers and researchers in AMSs; and 9) development of Project website and communication materials and production of the technical manual for fishing gear marking.		
10. Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region (2020–2024) The Project aims toward capacity development of the participating Member Countries, namely: Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam, on taxonomy, new species/record identification, and management of major shark species; confirmation of stock structures for selected common species and CITES-listed species of sharks and rays; and conduct of socioeconomic studies in selected sites using multifactor partitioning analysis. In 2024, which is the final year of this Project, MFRDMD will conduct a core expert meeting to share the Project findings, identify issues, and discuss the way forward. All the Project participating countries will be invited to this meeting tentatively scheduled in August 2024. The new edition of the waterproof field guide on sharks, rays, and skates in the Southeast Asian region will be published with updatedinformation, including new species and new species identified that occur in this region. TD and MFRDMD will continue to support landing data collections in the selected participating countries. MFRDMD will also continue the study on stock structures of	MFRDMD	JTF

Project Title	Lead Department	Funding Source
selected species of sharks (*Carcharhinus sorrah* and *Sphyrna lewini*) and rays (*Maculabatis gerrardi*) by using genetic markers and will organize an internal workshop to verify the findings and prepare the final report. To follow up the Survey on Fishers' Dependencies, Marketing and Trade of Sharks and Rays conducted in October 2023 in Kota Kinabalu and Sandakan, Sabah, the output from this survey will be published in 2024.		
11. Sustainable Utilization of Anguillid Eels in the Southeast Asian Region (2020–2024) The Project aims to support the sustainable management and utilization of anguillid eel fishery resources in the Southeast Asian region through the strategic program on sustainable eel resources management. There are two main activities under the Project. The first one is on sustainable eel fisheries resources and standardization of data collection systems in Southeast Asia, and the second is on mapping the genetic population structure of tropical eels in Southeast Asia based on mtDNA approach. In 2024, the collection of data on the catch and CPUE of anguillid eel fisheries in Cilacap and Palabuhan Ratu in Indonesia and in Cagayan and General Santos in the Philippines would be continued. Genetic surveys will be also continued to identify the genetic population structure of tropical anguillid eels in Southeast Asia. *Anguilla marmorata* samples and tissues will be collected and analyzed in selected Member Countries (*i.e.* Indonesia, Philippines, Vietnam, and Myanmar). Meetings will be conducted twice a year to monitor and evaluate the progress of each activity. Experts will be invited to evaluate the study results by the end of 2024.	IFRDMD	JTF
12. Development of Stock Assessment Methods and Strengthening of Resources Management Measures for Tropical Anguillid Eel in Southeast Asia (2020–2024, expected to extend to 2025) The Project started in 2020 and focused on the collection of catch data and biological/ecological information for the estimation of eel stocks and the development of mathematical/statistical methods for estimating tropical anguillid eel stocks that could be used for the formulation of effective management measures for the sustainable use of tropical anguillid eels in Southeast Asia. The Project is expected to be extended to 2025. In 2024, a survey will be conducted by IFRDMD in the Philippines and Myanmar, considering that the previous survey from March to December 2022 demonstrated monthly variability. In order to assess eel stocks, catch/fishing effort and biological data on eels caught directly by fishers will be collected and analyzed at two sites in Indonesia. Genetic data on tropical anguillid eel will be collected from eel habitats in Indonesia and analyzed to clarify the genetic structure of the populations. Moreover, methods for eel stock assessment will be developed to assess eel stock by analyzing catch and fishing effort data.	SEC	JAIF

Project Title	Lead Department	Funding Source
13. Sustainable Management of Fisheries, Marine Living Resources and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities (BOBLME Phase II) (2023–2026) The Project objective is to contribute to sustainable management of fisheries, marine living resources and their habitats in the Bay of Bengal region to reduce environmental stress and improve environmental status for the benefit of coastal states and communities. This will be achieved through five interlinked Project components based on the Strategic Action Programme (SAP) themes, namely: 1) Sustainable management of fisheries; 2) Restoration and conservation of critical marine habitats and conservation of biodiversity; 3) Management of coastal and marine pollution to improve ecosystem health; 4) Improved livelihoods and enhanced resilience of the BOBLME; and 5) Regional mechanism for planning, coordination and monitoring of the BOBLME. SEAFDEC will be the Executing Agency responsible for the Project implementation in participating SEAFDEC Member Countries, namely: Indonesia, Malaysia, and Thailand; while the implementation in non-SEAFDEC members, *i.e.* Bangladesh, India, Maldives, and Sri Lanka would be under the responsibility of the BOBP-IGO. The Project was endorsed by the GEF CEO in March 2022, and the Operational Partners Agreement (OPA) between SEAFDEC and FAO was signed in 2023. The detailed plan of Project activities was agreed upon during the Inception Meeting and was approved at the back-to-back 1st Project Steering Committee Meeting in December 2023 in Bangkok, Thailand.	TD	FAO/GEF and Norad
14. Promoting the Blue Economy and Strengthening Fisheries Governance of the Gulf of Thailand through the Ecosystem Approach to Fisheries (GoTFish Project) (2024–2028) The aim of the Project is "Improved natural resource governance in the GoT through the implementation of the ecosystem approach to fisheries (EAF) contributing to the broader, regional fisheries objectives of the South China Sea Strategic Action Programme (SCS-SAP)." To achieve this, the GoTFish Project will work on four main components: 1) Regional transboundary fisheries governance and management strengthened; 2) Alignment of incentive mechanisms; 3) Ecological Corridor of Critical and Important Habitat for Aquatic Resources in the Gulf of Thailand (with focus on Malaysia); and 4) Stakeholder engagement, communication, monitoring and evaluation. SEAFDEC will be the Executing Agency responsible for Project Component 1 and Component 4 with the four Project participating countries, namely: Cambodia, Malaysia, Thailand, and Viet Nam. The Project was endorsed by the GEF CEO in June 2023. Currently, the signatory process of the participating countries is still ongoing. In the meantime, the Operational Partner Agreements (OPA) between FAO and the Executing Agencies (including SEAFDEC) are being drafted and will be ready for signature once the Project	TD	FAO/GEF

Project Title	Lead Department	Funding Source
becomes operational. The detailed plan of Project activities and indicative budget plan will be confirmed during the Project Inception Workshop.		
Strategy 2: Supporting the sustainable growth of aquaculture to complement fisheries and contribute to food security, poverty alleviation and livelihood of people in the region		
15. Sustainable Aquaculture through Cost-Effective Culture Systems, and Prompt and Effective Aquatic Animal Health Management (2020–2024) The Project aims to attain: 1) sustainable aquaculture through cost-effective culture systems, and 2) prompt and effective aquatic animal health management schemes. The activities to be undertaken in 2024 are as follows: • Development of exit strategies (*e.g.* aquaculture business management) for resilient community-based sustainable aquaculture livelihood activities through further training on innovative hatchery operations, and conduct of a final impact assessment study • Conduct of growth trials to evaluate the feeding value of fish silage from tilapia wastes and by-products in diets for culture of tropical anguillid eels. Other potential feed ingredients during the course of the study will be also identified and tested. • Evaluation of the potential to reduce disease occurrence in purifying organisms (sandfish, green algae, and red algae) through their relationship to disease causative bacteria and water quality • Improvement and optimization of the techniques of broodstock management and establishment of larval rearing techniques using the fertilized eggs or hatched larvae acquired from the brood stock • Continued monitoring and surveillance of mass mortalities in aquaculture farms to isolate and identify the causative agent(s) of unknown and emerging crustacean and fishdiseases. This will enable to isolate and identify the causative agent(s) and develop disease diagnostic protocol(s). • Extension of surveillance of EHP in Mindanao and implementation of the cohabitation experiments to elucidate horizontal transmission mechanism of EHP via soil and water • Continued experiments on the disinfection effects of the chemicals on shrimp eggs to determine if the chemicals are effective against shrimp diseases and their appropriate dosage • Verification trials in shrimp ponds to confirm the results of the tank experiments, and development of a manual on Fish Health Management in brackish water ponds using integrated approaches	AQD	JTF

Project Title	Lead Department	Funding Source
• Conduct of two face-to-face training courses, "Marine Fish Hatchery" and "Community-Based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia" • Conduct of face-to-face training courses on "Fish Nutrition and Feed Development" • Conduct of face-to-face training courses on "Health Management in Aquaculture" • Conduct of JTF international workshop "Promotion of Sustainable Aquaculture, Aquatic Animal Health, and Resource Enhancement in Southeast Asia (SARSEA)" to review, evaluate, and share the Project achievements • Coordination and encouraging research, training, and dissemination activities related to the JTF Project proper use of the budget to contribute to the achievement of the project's objectives		
16. Blue Horizon: Ocean Relief through Seaweed Aquaculture (2024–2027) The overarching goal of the Project "Blue Horizon: Ocean Relief through Seaweed Aquaculture" is to create new sustainable seaweed value chains that will deliver ecosystem services and provide socioeconomic benefits to communities, particularly to households whose livelihoods depend on marine ecosystems. To achieve the goal, the Project will be implemented through its four components, namely: 1) Regional capacity building for seaweed aquaculture; 2) Enabling environment for seaweed aquaculture in Philippines and Viet Nam; 3) Seaweed value chains (production + processing + marketing); and 4) Knowledge Management, M&E, and IW Learn (regional). The Project participating countries are Philippines and Viet Nam. The GEF CEO endorsed the Project document in July 2022, and the Project is now in the process of preparation for commencement. The detailed plan of activities will be agreed upon when the Project enters into its Inception Phase.	SEC in collaboration with AQD	WWF-US/ GEF
17. ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia (Phase 2) (2024-2025) The proposed "ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia (Phase 2)" will bring together again the same representatives attending the "RTC on AEPRS for Effective Management of Transboundary Disease Outbreaks in Southeast Asia" organized in 2018 with the added participation of people from the private sector and the academe to assess the status of the respective AMSs contingency plans regarding disease	AQD	JAIF

Project Title	Lead Department	Funding Source
control. The RTC would be the avenue to identify the gaps in the contingency plan(s) of each AMS. This RTC is intended to facilitate the further development and refinement of a regional aquatic emergency preparedness and response system that will result in the more systematic management of aquatic animal disease outbreaks in the region; while also strengthening the cooperation among the AMSs, regional/international organizations, the academe, fish farmers, and other relevant stakeholders on initiatives that support emergency preparedness and response systems for effective management of aquatic animal disease outbreaks. Currently, AQD is coordinating with the Japan-ASEAN Integration Fund Management Team (JMT) to submit the proposal and it is expected that the Project activities will commence in 2024.		
Strategy 3: Ensuring the food safety and quality of fish and fishery products for the Southeast Asian region		
18. Enhancing Food Safety and Competitiveness of Seafood Products (2020–2024) The Project is aimed at improving food safety and competitiveness of seafood products in the ASEAN region through conducting training workshops and developing guidelines, with the support of technical experts of the region. The Project comprises two tracks: 1) Development of Regional Guidelines on Good Manufacturing and Handling Practices (GMP & GHP) for Ready-to-eat Raw Fish and Fishery Products, and 2) Development of HPP Handbook for Seafood. Under the first track, MFRD is currently working with the consultant on the draft Regional Guidelines of GMP & GHP with the inputs gathered from the Member Countries during the Mid-term Review Meeting. The draft will be finalized at the End-of-Project (EOP) Meeting scheduled in 2024. For the second track, MFRD is currently in the process of drafting the handbook on HPP of fish and fishery products in collaboration with the consultant. Once completed, the handbook would be translated into the national languages of the Member Countries as requested. The EOP Meeting for the second Project track will be conducted back-to-back with the EOP for the first project track.	MFRD	JTF
Strategy 4: Enhancing trade and compliance of the region's fish and fishery products with market requirements		
19. ASEAN-JICA Food Value Chain Development Project (2024–2027) This Project was originally scheduled to commence in 2022 but was postponed to 2023. The Project is composed of four thematic areas: 1) ASEAN Good Agriculture Practice (GAP); 2) Sanitary and Phyto-sanitary (SPS) measures; 3) Fishery value chain; and 4) Coordination and Research on Public-Private Partnership (PPP)-based Food Value Chain. The proposed activities to be	SEC in collaboration with TD, AQD, and MFRD	JICA

Project Title	Lead Department	Funding Source
implemented by SEAFDEC are under the third thematic area to support the fisheries sector in achieving the expected output *i.e.* food safety in the fishery sector is improved by the promotion of GAqP and development of ASEAN guidelines and relevant principles on fisheries inspection mechanism. While waiting for the approval for the workplan and budget, SEAFDEC in consultation with JICA has been drafting the Project Cooperation Agreement (PCA). The detailed plan of Project activities and indicative budget plan for 2024 will be confirmed once the PCA is finalized.		
Strategy 5: Addressing cross-cutting issues, such as labor, gender and climate change, where related to international fisheries		
20. Assistance for Capacity Development in the Region to Address International Fisheries-related Issues (2020–2024) The Project aims to ensure the sustainable utilization and sound management of fishery resources through appropriate regional approaches in the international fish trade. In 2024, SEAFDEC will continue to support SEAFDEC staff to participate in the relevant regional/international fora e.g. those organized by the ASEAN, FAO, CITES, etc., and will update the status of the international fish trade-related issues by providing platforms for Regional Technical Consultation (RTC) for the AMSs to discuss the issues which may impact the development of fisheries and aquaculture in the Southeast Asian region. Under the Regional Capacity Building Network (RECAB Network) program, the SEAFDEC Secretariat will collaborate with MFRDMD to organize the Regional Training Course on Stock Assessment.	SEC	JTF
Strategy 6: Empowering SEAFDEC to strengthen its roles in the region and to improve its services to Member Countries		
21. Fisheries Resource Survey & Operational Plan for M.V. SEAFDEC 2 (Since 2004) The M.V. SEAFDEC 2 was granted by the Government of Japan in 2004 to support fisheries resources and marine environmental surveys of the Member Countries. Under the agreed cost-sharing scheme, technical support to the Member Countries has been sustained by TD for monitoring their respective fishery resources and marine environmental conditions and enhancing human resource development. In 2024, SEAFDEC plans to carry out four research cruises with an estimated total of 139 working days, as follows: • Cruise No. 1–2: SEAFDEC in collaboration with Brunei Darussalam will carry out two cruises of marine resources survey in the waters of Brunei Darussalam in the area that covers Zones 2, 3, and 4. The expected service days for these cruises is 50 days for each cruise.	TD	JTF, with cost sharing from the AMSs requesting to use the vessel

Project Title	Lead Department	Funding Source
• Cruise No. 3: Marine debris surveys in the Gulf of Thailand will be conducted to support the project "Formation of a Center of Excellence for Marine Plastic Pollution Studies in the Southeast Asian Sea" implemented by Chulalongkorn University in Thailand, Tokyo University of Marine Science and Technology in Japan, and Kyushu University in Japan. The surveys will be conducted during the dry season with an expected eight service days. • Cruise No. 4: SEAFDEC-JAIF Project on Regional Collaborative Research and Capacity Building for Monitoring and Reduction of Marine Debris from Fisheries in Southeast Asia plans to conduct a shipboard survey on "Marine Environment and Fishery Resources Survey by Using a Research Vessel and Evaluate the Impacts of Microplastics on the Fisheries Resources" an expected 31 service days.		
Special Project		
22. USAID Southeast Asia Fisheries Partnership Activity (2023–2028) The Project comprises four thematic areas, namely: 1) Data-driven Fisheries Management for Climate Change Mitigation and Adaptation; 2) Exploration of Seaweed Culture as Part of Blue Economy and Climate Change Mitigation; 3) Reducing Negative Impacts from Fishing on the Marine Ecosystem; and 4) Sustainable Inland Fisheries Management. The geographical areas cover the Southeast Asia region and will benefit the AMSs. The Project activities will work through regional and sub-regional approaches to be implemented. In the first quarter of 2024, SEAFDEC plans to recruit Project personnel, *i.e.* Project Manager; Monitoring, Evaluation, and Learning Specialist; and Communication Specialist. Several workshops *e.g.* on the detailed planning workshop, inception workshop, as well as the expert consultation on stock assessment for priority species in region or sub-regional areas will be conducted in 2024.	SEC, in collaboration with TD, MFRDMD, AQD, and IFRDMD	USAID

2) Departmental Programs

Program Title	Department	Funding Source
1. Quality Seed for Sustainable Aquaculture (QSSA) (*ongoing*) The QSSA Program aims to generate, verify, and promote technologies to ensure the sustainable production of quality seed stocks for aquaculture and stock enhancement. In 2024, the Program would continue to undertake the following research until the conclusion: A. Broodstock development • Use of andrectomized males (neofemales) giant freshwater prawn (*Macrobrachium rosenbergii*) for the production of all-male progenies	AQD	AQD*

Program Title	Department	Funding Source
B. Refinement of hatchery and nursery protocols • Nursery and grow-out culture of snubnose pompano *Trachinotus blochii* in pondbased net cages • The use of biofloc technology on mangrove crab larval rearing and indoor nursery culture • Nursery culture of mangrove crab *Scylla serrata* megalopae in pond-based net cage • Verification of adequate feeding rations and use of algal paste for single seed spat production of slipper-shaped oyster *Magallana bilineata* • Sea-based nursery cage production of farmed eucheumatoids • Hatchery production of early juvenile sandfish *Holothuria scabra* • Use of microalgal paste-fed *Proales similis* in marine fish larviculture: I. Refinement of *P. similis* mass production schemes II. Assessment of *P. similis* as first food for marine fish larvae • Production of mud polychaete *Marphysa iloiloensis* in modular tanks C. Increase awareness of available genetically selected/ improved stocks and optimize their use for improved on-farm aquaculture production – NO studies being conducted D. Promotion of technically and economically-viable breeding and seed production scheme • Seed production of donkey's ear abalone *Haliotis asinina* juveniles • Mass production of mangrove crab (*Scylla serrata*) seedstock • Seed production of freshwater prawn, *Macrobrachium rosenbergii* • Production of farmed eucheumatoids by micropropagation in the land-based nursery • Mass production of all-male and mixed-sex tilapia fingerlings and promotion of saline-tolerant tilapia		
2. Healthy and Wholesome Aquaculture (HWA) (*ongoing*) The HWA Program has two main components, namely: 1) Fish Health, and 2) Nutrition and Feed. The "Fish Health Component" aims to improve aquaculture production through innovations in aquaculture nutrition and feeding, and fish health management as well as maintain the environmental integrity of aquaculture systems. The activities in 2024 would include: • Treatment regimen on tissue culture seaweed plantlets affected by disease and epiphytic pest using commercially available chemicals • Epidemiology of skinulceration disease in juvenile and adult sea cucumber	AQD	AQD*

Program Title	Department	Funding Source
• Verification of probiotic supplementation in enhancing survival and immune response of juvenile abalone *Haliotis asinina* • Tank and field testing of wrasse as a biological control against sea lice on snubnose pompano (*Trachinotus blochii*) The "Nutrition and Feed Component" aims to: 1) find effective alternative protein sources to fish meal in dietary formulations; 2) determine specific nutrients that enhance growth performances; and 3) promote practices and strategies to improve production. In 2024, the following studies will continue: • Culture of pompano *Trachinotus blochii* in floating net cages • Refined formulated feed for the grow-out culture of mangrove crab, *Scylla serrata* (Forsskal) in brackish water ponds • Evaluation of microbound diet for larval-stage mangrove crab, *Scylla serrata* • Refinement of *Scylla serrata* maturation diet • Efficiency of polychaete phospholipid in promoting *Penaeus monodon* maturation • Microbead technology: Enhancing fish gut nutrition through efficient delivery system and functionality of microencapsulated probiotics for aquaculture		
3. Maintaining Environmental Integrity through Responsible Aquaculture (MEITRA) (*ongoing*) The general objective of the Program is to develop environment-based aquaculture technology by integrating environmental factors in AQD research activities and maintain environmental integrity by promoting responsible aquaculture practices. In 2024, most of the studies undertaken in 2023 will be continued including: • Field verification of mixed-diet in deep water grow-out culture of abalone using PVC tubes and recycled drums • Increasing technical supporting community-based • Assessment and development of an Intermediate Culture System for tropical aquaculture species (sea cucumber) • Assessment of growth traits of *Hypnea* sp. as a potential tropical seaweed species for aquaculture • Co-culture of milkfish and giant freshwater prawn in brackishwater ponds • Establishing grow-out culture techniques of sea grapes *Caulerpa* in tanks	AQD	AQD*

Program Title	Department	Funding Source
4. Meeting Socio-economic Challenges in Aquaculture (MSECAP) (*ongoing*) The MSECAP Program generally aims to implement socioeconomic research and development studies to promote the inclusive engagement of fishing communities and small-holder fish farmers in aquaculture and resource enhancement. Since the Program has no program-specific proposal for this year, the Program is planned to carry out a variety of feasible activities in subsequent years to address the social and economic challenges in the industry. Activities planned in 2024 include: • Engagement of AQD researchers in MSECAP activities through research, verification, extension, and capacity-building studies across multi-stakeholder engagement and collaboration • Collaborative studies/engagements in terms of AQD's matured technologies with government agencies such as DA-BFAR & DANFRDI • Review/revisit earlier projects for sustainability and post-study evaluation and assessment • Pursue of fresh proposals incorporating MSECAP activities	AQD	AQD*
5. Collaborative projects with the Philippine Government (*ongoing*) With the goal of accelerating fish production and export revenues from the aquaculture sector in the Philippines, AQD is committed to intensifying the techno-transfer of matured aquaculture technologies to stakeholders which will provide additional and alternative livelihood to fishers through sustainable aquaculture technologies that are economically viable, environment-friendly, and socially equitable. In 2024, AQD in collaboration with the DA-BFAR, NFRDI, and other government agencies, would continue strategizing to harmonize relevant research and development studies with the priorities of the Philippine Government. The projects/activities include: • Fry Sufficiency Program • Development of cost-efficient feeds • Oplan Balik Sugpo (Operation Black Tiger Shrimp Revival) • In-situ (onsite) training courses and accelerated technology transfer • Manpower Development	AQD	AQD*
6. Improvement of Fisheries Technology and Reduction of the Impact from Fishing Activities (*ongoing*) The Program has the overall objective of improving fishing technologies and marine engineering to support the sustainable utilization of marine fishery resources. In 2024, the following activities will be continued:	TD	TD*

Program Title	Department	Funding Source
• Research and promotion of appropriate fishing and marine engineering technologies and practices o Production of a handbook on the Scientific Echo Sounder EK-80 installation for M.V. SEAFDEC 2 • Study on the impact of fisheries resources, marine environment, social well-being, and livelihood from fishing activities and climate change o Preliminary study on end-of-life fishing (EOLFG) o Mainstreaming climate change into TD projects		
7. Promotion on Strengthening of SEAFDEC Visibility and Enhancing Human Capacity Building (*ongoing*) The Program has the overall objective of strengthening the visibility and image of SEAFDEC, while also enhancing the knowledge of relevant agencies and stakeholders on fisheries-related issues. In 2024, the activities are categorized into: • Promotion and enhancement of SEAFDEC visibility and image • Production of information materials, *e.g.* books, brochures, videos, and other media, to raise awareness and understanding of fishers, stakeholders, and the public • Management of information systems including databases, TD website, and social media • Enhancing human capacity building including the conduct of tailor-made training based on the needs of partners and donors	TD	TD*
8. USAID DOI International Technical Assistance Program (ITAP) (2023–2024) The objective of the Project is to enhance the capacity development of SEAFDEC staff on fisheries management and resilience in the context of climate change and strengthening capacity in fisheries resources and marine environmental research survey, which focuses on implementing a holistic way to manage fisheries and marine resources. Activities to be undertaken are categorized into three scopes that include: • Fisheries Resilience and Management o Training and field practice on Socioeconomic Monitoring (SOCMON) for coastal and small-scale fisheries management in Southeast Asia o Training on Fisheries Resilience and workshop on the development of fisheries management plan in small-scale fisheries • Climate Change and Fisheries Stock Assessments o Training course on the monitoring of fish stock life history parameters for observing the effect of climate change in the Southeast Asian region o Core expert meeting to improve the draft work plan and way forward on the project implementation plan	TD	USAID and U.S. DOI

Program Title	Department	Funding Source
• Strengthening Capacity of the Marine Fisheries Resources and Marine Environmental Research Survey o Human resources capacity building program to improve skill and experience of SEAFDEC/TD researchers and navigators for fisheries resources and marine environment research survey		
9. Implementing the Lower Mekong Fish Passage Initiative in Cambodia, Thailand, and Viet Nam (2023–2024) This Project is a continuation of the project for construction of fish passages in Cambodia, Thailand, and Viet Nam which was successfully completed in 2022. In 2023 and 2024, the follow-up activities were continued to support the participating countries to monitor and evaluate the fish passage efficiency and disseminate the result of the follow-up activities.	TD	U.S. DOI

*Funding from the regular contributions of the respective Host Governments

3) Other Program

Program Title	Department	Funding Source
1. Seminar-Workshop on Aquaculture Development in Southeast Asia (ADSEA) (2024) The Seminar-Workshop on Aquaculture Development in Southeast Asia (ADSEA) was proposed to be conducted by AQD in 2021 but was postponed until 2024. The objectives of the ADSEA are to review recent developments in aquaculture and provide a forum to discuss strategies to ensure further developments of responsible aquaculture in the region. It is expected that the ADSEA will collect valuable inputs from aquaculture officers from the SEAFDEC Member Countries in terms of research areas. The training opportunities through closer collaboration and partnership can be strengthened as well. Further, the participants will be updated on the recent activities on sustainable and responsible aquaculture technologies including the gaps and possible research areas. Subsequently, they may be able to provide recommendations to address these gaps and issues identified during the Workshop. Following the re-approval of the proposed activity, AQD will proceed with the creation of a committee to oversee the conduct of the ADSEA.	AQD	To be confirmed

In addition to the above projects and programs, there were also five **pipeline projects** of which the proposals are being prepared in consultation with the respective donor agencies and SEAFDEC Member Countries.

Project Title	Department	Funding Source
1. Implementation and Assessment of the ASEAN Regional Plan of Action for the Management of Fishing Capacity * The overall objective of this proposed Project is to assess the implementation of the "ASEAN Regional Plan of Action for the Management of Fishing Capacity" and regional fishery information systems/mechanisms to facilitate sharing, exchange, and compilation of fishery data and information that are required at the sub-regional and regional levels for the improvement of transboundary fisheries management. The proposed activities include: • Management and assessment of fishing capacity • Compilation and enhancement of relevant existing fisheries information systems/mechanisms • Standardization of simple and practical fisheries indicators • Compilation and assessment of management strategies of transboundary species • Compilation and publication of the terminal report • Project monitoring and evaluation The final proposal has been submitted to the JAIF Management Team (JMT) for consideration.	MFRDMD	JAIF

* To be implemented under the FCG/ASSP mechanism once funding could be secured.

COOPERATION WITH DONORS AND OTHER ORGANIZATIONS IN 2023

1. Collaboration with International/Regional Organizations, Non-member Governments, and Donors

- **Association of Southeast Asian Nations (ASEAN)**

The cooperation between the Association of Southeast Asian Nations (ASEAN) and SEAFDEC has been sustained since 1998 with the establishment of the Fisheries Consultative Group (FCG) Mechanism. The cooperation was formalized in 2007 with the signing of the Letter of Understanding on the ASEAN-SEAFDEC Strategic Partnership (ASSP), where SEAFDEC serves as a technical arm to implement fisheries programs/projects for the benefit of the ASEAN Member States (AMSs). In 2022, SEAFDEC continued to support the AMSs in the implementation of activities in line with the "Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 (RES&POA-2030)" which was adopted by the ASEAN-SEAFDEC Ministers and Senior Officials in 2020. In 2023, twenty-two (22) projects were implemented by SEAFDEC under the FCG/ASSP Mechanism. The progress and achievements of these projects were reported to the Twenty-sixth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) on 23–24 November 2023 in Bali, Indonesia.

In 2023, SEAFDEC was also represented in several events organized by the ASEAN, namely:

- Workshop on the Development of the ASEAN Declaration of the Protection of Migrant Fisher (Ministry of Manpower, Indonesia on 16–17 March 2023 in Bali, Indonesia)
- Inter-Sectoral Workshop on the Implementation and Monitoring of the ASEAN Roadmap on Elimination of the Worst Forms of Child Labour by 2025 (15–16 May 2023 in Bangkok, Thailand)
- 18th ASEAN Working Group on CITES and WE Meeting (AWG-CITES and WE) (30–31 May 2023, online)
- 13th Meeting of ASEAN Shrimp Alliance (ASA) (24 July 2023, online)
- 15th Meeting of the ASEAN Fisheries Consultative Forum (AFCF) (25 July 2023, online)
- 31st Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi) (26–27 July 2023, online)

- **Food and Agriculture Organization of the United Nations (FAO)**

SEAFDEC is collaborating with the Food and Agriculture Organization of the United Nations (FAO) in the implementation of several fisheries projects in Southeast Asia.

In 2023, SEAFDEC signed two **Operational Partner Agreements (OPAs) between SEAFDEC and the Food and Agriculture Organization of the United Nations (FAO) for the implementation of the Project "Sustainable Management of Fisheries, Marine Living Resources and Their Habitats in the Bay of Bengal Region for the Benefit of Coastal States and Communities."** The first OPA was signed on 1 September 2023 for funding from Global

Environment Facility's International Waters (GEFIW); while the second OPA was signed on 10 November 2023 for Norway Co-financing. The duration of the two OPAs would be from the date of signature until 30 April 2028 The Project aims to promote sustainable management of fisheries, marine living resources, and their habitats in the Bay of Bengal region for the benefit of coastal states and communities. The participating countries are Indonesia, Malaysia, and Thailand. The Project comprises five (5) Components, *i.e.* 1) Sustainable management of fisheries; 2) Restoration and conservation of critical marine habitats and conservation of biodiversity; 3) Management of coastal and marine pollution to improve ecosystem health; 4) Improved livelihoods and enhanced resilience of the BOBLME; and 5) Regional mechanism for planning, coordination, and monitoring of BOBLME. SEAFDEC will serve as an Operational Partner and will be responsible for the activities under Component 1, and some part of activities under Components 3 and 5.

On 11 December 2023, SEAFDEC signed a **Letter of Agreement (LOA) between FAO and SEAFDEC for provision of Information collection and capacity building to support FAO Members implement novel listings of aquatic species on CITES Appendix II.** The duration of the LOA is from the date of signature until 31 July 2024. Under this LOA, FAO will provide SEAFDEC with a fund for the purpose of helping FAO Members speed the implementation of CITES CoP19 shark and ray listings. Specifically, SEAFDEC will undertake the activities as follows: 1) Read supplied background material on implementation requirements for fisheries authorities in implementing CITES provisions for sharks and rays (termed shark); 2) Collate contacts of fisheries authority persons with responsibility for shark (fisheries address book) from countries in their region; 3) Interview fisheries authority persons with responsibility for shark from at least 5 countries on the success and challenges of implementing CITES provisions for shark, including their needs to strengthen management and delivery of information needed for legal and sustainable trade in shark and related commodities; 4) Produce a summary document of the findings in collaboration with researchers from other regions, as the raw material to be used in more extensive and wide ranging reporting to follow; 5) Assist in the production and delivery of a presentation at CITES meetings; and 6) Assist in the production of a wide ranging overview report that explains fisheries authorities needs for information, capacity support and funding for their work in implementing CITES provisions for commercially exploited aquatic species, especially shark listing made at CITES CoP19.

On 26 December 2023, SEAFDEC signed another **LOA between FAO and SEAFDEC for provision of "Support for strengthening regional capacity to monitor the status of management of aquatic genetic resources."** The duration of the LOA is from the date of signature until 30 September 2024. Under this LOA, FAO will provide SEAFDEC with a fund for the purpose to support for strengthening of regional capacity to monitor the status of management of aquatic genetic resources (AqGR) used in the aquaculture sector. SEAFDEC will host a two-day workshop on "The Application of AquaGRIS: the FAO global information system, to build national registries of aquatic genetic resources" which will be attended by participants from the SEAFDEC Member Countries including the AqGR Focal Person of the respective countries; and, through expert to be recruited under the LOA, provide interim post-workshop technical support to participants from a group of countries identified during the Workshop to upload national data on AqGR into AquaGRIS.

In 2023, SEAFDEC was also involved in regional and international events organized by FAO with the view of ensuring that the activities and initiatives promoted by SEAFDEC are harmonized with relevant international instruments and initiatives. These include:

- FAO Regional Workshop for a Network of Practitioners on Fishery Stock Assessment (23–25 January 2023 in Bangkok, Thailand)
- 4th Session of the Intergovernmental Technical Working Group on Aquatic Resources for Food and Aquaculture (21–23 February 2023 in Rome, Italy)
- 13th FIRMS Steering Committee meeting (FSC13) and the CWP Intersessional Meetings of Aquaculture and Fisheries Subject Groups (26–30 June 2023 in London, UK)
- 19th Session of FAO Sub-Committee on Fish Trade (11–15 September 2023 in Bergen, Norway)
- 2023 ASFA Advisory Board Meeting (3–6 October 2023 in Bangkok, Thailand)
- Regional Workshop for Asia on the 2022 FAO Voluntary Guidelines for Transshipment (23–27 October 2023 in Bangkok, Thailand)

In 2023, FAO also extended its experts as resource persons in several events organized by the SEAFDEC Secretariat, including:

- *Dr. Graham Mair* during the Webinar on Aquatic Genetic Resources for Food and Agriculture (8 August 2023, online)
- *Dr. Daniela Lucente*, during the Webinar on Aquatic Genetic Resources for Food and Agriculture (8 August 2023, online)
- *Mr. James Geehan* during the 3rd Regional Technical Consultation on Fishery Statistics and Information in Southeast Asia (22–24 August 2023 in Chiang Mai, Thailand)

- **United States Agency for International Development/Regional Development Mission for Asia**

On 8 September 2023, SEAFDEC signed with the United States Agency for International Development/Regional Development Mission for Asia (USAID/RDMA) the **Public International Organization (PIO) Grant Agreement.** The duration of the Agreement is from 1 October 2023 to 30 September 2028. The purpose of this Agreement is to provide support for USAID Southeast Asia Fisheries Partnership. The USAID Southeast Asia Fisheries Partnership Activity is a part of the larger Sustainable Fish Asia (SuFiA) project funded by the USAID/RDMA. This Activity has the overarching goal for "fisheries and aquaculture practices and productions improved and managed sustainably" with three objectives, namely: 1) Fishery policies, programs, and plans supported by SEAFDEC are adopted and implemented by national fisheries agencies; 2) Commercial and small-scale fishers have appropriate financial and human resources, capacity, and good governance to adopt sustainable fishing and aquaculture practices, and 3) Increase operational and technical capacity among national fisheries agencies and fisheries institutions. Four thematic areas of the Activity are: 1) Data-driven Fisheries Management and Conservation, including for Climate Change Mitigation and Adaptation; 2) Exploration of Integrated Multi-Trophic Aquaculture for Biodiversity Conservation, Blue Economy, and Climate Change Mitigation; 3) Reducing Negative Impacts From Fishing On The Marine Ecosystem; and 4) Sustainable Inland Fisheries Management.

- **United States Department of the Interior (US-DOI)**

On 31 August 2023, SEAFDEC signed an "**Extension 2 to the Memorandum of Understanding between the United States Department of the Interior and SEAFDEC Concerning Supporting Participation in Sustainable Fish Asia (SuFiA)**" to extend the MOU until 30 September 2024. On the same day, SEAFDEC also signed the "**Amendment 1 to Annex 1 of the MOU between the U.S. Department of the Interior and SEAFDEC Concerning Supporting Participation in Sustainable Fish Asia (SuFiA).**" The terms of the Annex are from the date of signature until 30 September 2024 with the objective to enhance the capacity development of SEAFDEC staff on fisheries management and resilience in the context of climate change and strengthening capacity in fisheries resources and marine environmental research survey. Activities to be undertaken by SEAFDEC are: 1) Fisheries Resilience & Management; 2) Climate Change and Fisheries Stock Assessments; and 3) Strengthening Capacity of the Marine Fisheries Resources and Marine Environmental Research Survey.

2. Cooperation with Agencies of SEAFDEC Member Countries

- **Japan Fisheries Research and Education Agency (FRA)**

The Fisheries Research Agency of Japan (formerly FRA) and SEAFDEC signed the "Arrangement for Scientific and Technical Cooperation between FRA and SEAFDEC" (hereafter referred to as "the Arrangement with former FRA") in January 2004, with an extension of the Arrangement with former FRA signed in February 2009 and January 2014; while the National Fisheries University (NFU) and SEAFDEC signed the "Arrangement for Academic and Educational Cooperation between SEAFDEC and NFU" (hereafter referred to as "the Arrangement with NFU") in May 2005, with an extension signed in November 2009 and November 2014. In 2016, the Japan Fisheries Research and Education Agency (FRA) was established through a merger of the former FRA and the NFU. Consonant with the establishment of FRA, SEAFDEC and FRA agreed to unify the Arrangement with former FRA and the Arrangement with NFU, and signed the "Arrangement for Scientific and Educational Cooperation between FRA and SEAFDEC" (hereafter called "the Arrangement with FRA") on 22 January 2019, covering the period of five years.

Considering that the Arrangement for Scientific and Educational Cooperation between Japan Fisheries Research and Education Agency (FRA) and SEAFDEC which was signed in January 2019 would soon expire in January 2024, SEAFDEC and FRA signed the "**Extension of Arrangement for Scientific and Educational Cooperation between Japan Fisheries Research and Education Agency and SEAFDEC**" on 7 July 2023. This Arrangement has the objectives of: 1) The Development of Scientific and Technical Cooperation in various fields that are of interest to the two relevant organizations under the mutual understanding and interrelationship; 2) The Development of Academic and Educational Cooperation in various fields that are of interest to the two relevant organizations under the mutual understanding and interrelationship; and 3) Detailed discussions between FRA and SEAFDEC if required in the case of each practical matter. The period of the Arrangement is five years from the date of signature.

Under the framework of the Cooperation Arrangement between SEAFDEC and FRA, FRA sent experts to support SEAFDEC activities in 2023, namely:

- *Dr. Sayaka Ito* as the Deputy Chief of AQD
- *Dr. Masahito Hirota* as the Deputy Chief of MFRDMD
- *Mr. Tomohito Shimizu* as the Deputy Chief of IFRDMD
- *Dr. Koki Abe* as the Senior Expert on Fisheries Acoustics in TD
- *Dr. Jun Miyoshi* and *Dr. Ryuzo Takahashi* to support the Regional Training Course on Energy Optimization for Fishing Vessel and Optimal Post-Harvest Fish Handling Techniques (27 November–1 December 2023 in Samut Prakan, Thailand)
- *Dr. Koichi Sawada*, *Dr. Satoshi Imaizumi*, and *Dr. Tomohiko Matsuura* to support the Training Course on the scientific echo sounder EK80 installed in the M.V. SEAFDEC 2 (May 2023 in Samut Prakan, Thailand)

- **Hokkaido University, Japan**

Under the framework of the "**Extension of Arrangement for Scientific, Educational, and Technical Cooperation between SEAFDEC and Faculty of Fisheries Sciences, Hokkaido University, Japan,**" which was signed on 3 February 2021, SEAFDEC has continued the cooperation with FRA, especially through Prof. *Dr. Matsuishi Takashi Fritz* in capacity building on stock assessment and development of management schemes for multispecies fisheries of Southeast Asia. Moreover, Hokkaido University also sent five undergraduate students with *Prof. Onishi Hiroji* to attend the Short-term Training Course for University Students on Eco-friendly Fisheries for Sustainable Fisheries Resources Management on 19–26 April 2023 at the Training Department in Samut Prakan, Thailand.

- **Tokyo University of Marine Sciences and Technology (TUMSAT), Japan**

Under the framework of the "**Extension of Arrangement for Academic and Educational Cooperation between SEAFDEC and Tokyo University of Marine Science and Fisheries**" signed on 23 March 2020, SEAFDEC had several cooperations with TUMSAT in 2023. On 6–10 December, the Umitaka-maru made a port call at TD, where an international symposium "The Frontier of Ocean Observation" was organized for TUMSAT students and SEAFDEC researchers to share information, *i.e.* on microplastic of marine organisms research in Japan, current status of ocean observation using acoustic methods, and oceanographic research and acoustic surveys to be carried out by M.V. SEAFDEC 2. A sightseeing program was also arranged for TUMSAT students to learn about intercultural communication in Thailand. During the subsequent cruise of the Umitaka-maru from TD to Australia, TUMSAT also accepted one TD researcher to join the cruise to enhance the experience of the researcher in undertaking research and other activities onboard the cruise.

TUMSAT also sent an expert to support SEAFDEC activities in 2023, namely:

- *Dr. Toshihide Kitakado* for the activities on tropical anguillid eels and marine debris data analysis.

- **West Visayas State University (WVSU), Philippines**

On 2 February 2023, SEAFDEC/AQD signed a "**Memorandum of Agreement (MOA) between the West Visayas State University (WVSU) and SEAFDEC/AQD**." Visayas State University offers degree programs that require on-the-job training (OJT) in order to adequately expose its students to actual work situations and enable them to enhance their knowledge, skills, work attitudes, and values; while AQD has the facilities and/or expertise to provide occupational experience to student-trainees to enhance their competence in their chosen field or endeavor. Under this MOA, WVSU will identify, recommend, and endorse the names of the students who are qualified to undergo the OJT in AQD and undertake the required preparatory procedures. AQD will allow qualified students, as recommended by the WVSU, to enter its premises and provide and/or expose the students to various work experiences and/or activities. The duration of the MOA is two years from January 2023 to February 2025.

- **Iloilo Doctors' College (IDC), Philippines.**

On 27 February 2023, SEAFDEC/AQD signed with the Iloilo Doctors' College, Philippines the "**Memorandum of Agreement (MOA) between Iloilo Doctors' College, Philippines and SEAFDEC/AQD.**" IDC offers programs that require students to undergo on-the-job training (OJT) as a requirement for graduation in order to expose them to actual work situations relevant to the field of specialization. Upon request of IDC, the SEAFDEC/AQD has expressed its willingness to assist the student-trainees in OJT-related activities. Under the MOA, IDC shall be responsible for the selection process of the student-trainees as well as the required preparatory procedures; while AQD shall accept the qualified student-trainees recommended by the IDC to undergo the required total hours for OJT with personnel assigned to supervise the student-trainees. The MOA was effective from June 2022 to June 2024.

- **Igbaras National High School, Philippines**

On 17 March 2023, SEAFDEC/AQD signed with Igbaras National High School the "**Memorandum of Agreement (MOA) between the Igbaras National High School and SEAFDEC/AQD.**" Igbaras National High School offers programs that require students to undergo on-the-job training (OJT) as a requirement for graduation in order to expose them to actual work situations relevant to the field of specialization; while AQD has expressed its willingness to assist the student-trainees in their OJT related activities. Under this MOA, Igbaras National High School shall be responsible for the selection of the student-trainees and the required preparatory procedures, while AQD shall accept the qualified student-trainees as recommended by the School to undergo the required total hours of the on-the-job training with personnel assigned to supervise the students. The duration of the MOA is from January 2023 to January 2024.

- **Mindanao State University – Marawi, Philippines (MSU-Marawi)**

On 19 June 2023, SEAFDEC/AQD signed with the Mindanao State University – Marawi, Philippines the "**Memorandum of Agreement (MOA) between the Mindanao State University – Marawi (MSU-Marawi), Philippines and SEAFDEC/AQD.**" MSU-Marawi is offering degree programs that require on-the-job training (OJT) as a requirement for graduation, in order to adequately expose its students to actual work situations relevant to their field of specialization and enable them to enhance their knowledge, skills, work attitudes, and values; while AQD has a pool of resources, activities, and technical experts to provide adequate supervision and to assist the needs of MSU-Marawi. Under this MOA, MSU-Marawi shall submit to AQD the OJT request and shall screen and identify the student-trainees to undergo OJT at AQD, and undertake other required preparatory procedures, while AQD shall coordinate with MSU-Marawi regarding the OJT and accept qualified student-trainees recommended by MSU-Marawi upon approval of the concerned commodity/program leaders and the AQD management. The duration of the MOA is two years after the signing date.

- **PTT Exploration and Production (PTTEP) Public Company Limited, Department of Fisheries (DOF) of Thailand, Faculty of Fisheries of Kasetsart University, and Prince of Songkla University, Thailand**

Under the Memorandum of Agreement (MOA) signed in 2022 among the PTT Exploration and Production (PTTEP) Public Company Limited, Department of Fisheries (DOF) of Thailand, Faculty of Fisheries of Kasetsart University, Prince of Songkla University, and TD for the implementation of the project on the rehabilitation of fisheries habitats in the oil rig platform in the Gulf of Thailand, TD was involved in the 8th component of the project "Investigating on Impacts of Artificial Reef Structure from Retired Wellhead Platform Jacket (RWPJ) to Water Level, Flow Velocity, and Water Circulation using Physical Modeling to Investigate Changes in Hydraulic Properties of the Offshore Waters (including water levels, current flow velocities and circulation patterns) affected by submerged PTTEP's oil rig or a group of the PTTEP's oil rigs using physical modeling technique." In 2023, the physical model experiment was conducted to measure the effects of a submerged oil rig on the hydraulic properties under ten configurations of Rig to Reef arrangement at TD's flume tank and experimental basin at the Asian Institute of Technology (AIT). The draft report on the experiment results was submitted to PTTEP, and the final report will be submitted in the 2nd quarter of 2024.

PROGRESS IN THE IMPLEMENTATION OF INFORMATION STRATEGIES FOR ENHANCING SEAFDEC VISIBILITY AND COMMUNICATION IN 2023

Since its establishment, SEAFDEC has been implementing fisheries-related programs/projects that cover wide aspects of research, training and information. Starting in 2007, the SEAFDEC Secretariat and Departments made full use of the Information Strategies as guiding principles in formulating and implementing information-related activities that aim to enhance the Center's image and visibility. The Information Strategies have been developed to enhance the effectiveness of the implementation, monitoring, and reporting of the progress of SEAFDEC information-related activities.

In 2023, the progress and achievements made by SEAFDEC in the implementation of the Information Strategies were monitored and discussed during the 24th Meeting of the Information Staff Program (ISP) from 17 to 19 October 2023 in Bali, Indonesia, and were subsequently updated to cover the period from 1 January to 31 December 2023. Summary of the progress corresponding to the five Information Strategies are as follows

Strategy 1. Production of relevant, timely, and useful information material to meet the requirements of the target audience

- Technical/scientific publications: 64 titles/issues produced: 4,788 copies published, with 1,551 hard-copies and 14,449 e-copy distributed
- Technical videos: 4 titles produced, with 562 online views
- Technical/scientific articles: 37 titles produced: 13 titles published in SEAFDEC publications and 24 titles published in non-SEAFDEC publications
- Inquiries for information through the SEAFDEC libraries recorded and replied: 4,163 queries recorded (including 147 from e-mail, 1,115 from social media, 540 from website, 2,085 from repository, and 276 from library), and 1,890 materials sold
- Number of citations: 27,517 citations (including 26,280 citations from Scopus, and 1,237 citations from Google Scholar)

Strategy 2. Raising SEAFDEC image at national, regional, and international levels

- Promotional publications: 20 titles/issues produced: 11,555 copies published, with 10,799 hard-copies and 13,222 e-copies distributed
- Promotional SEAFDEC eNews: 18 number of SEAFDEC eNews disseminated
- Promotional souvenirs: 12,515 items produced, and 11,879 items distributed
- Promotion videos: 15 titles produced, and 2,437 online views
- SEAFDEC websites established: SEAFDEC Departmental websites had a total of 140,094 unique visitors, and 3,492 links from other websites
- Project websites: 2,404 unique visitors, and 96 links from other websites
- Social media administered by SEAFDEC: 57,407 followers, 146,107 engagements, and 1,616,988 reaches
- Participation in exhibitions and related events: joined 10 exhibitions with 116,820 visitors recorded at SEAFDEC exhibition booths and displays

- Official press statements released: 9 press statements released and recorded 88 appearances of SEAFDEC in public media and websites.

Strategy 3. Enhancing communication and information sharing both within SEAFDEC and with Member and non-Member Countries, other international/ regional organizations, and public

- Management of libraries of SEAFDEC Secretariat and Departments: SEAFDEC Secretariat and Departments libraries continued to provide library services
- Additional acquisitions of SEAFDEC libraries: total of 258 issues of newsletters/serial publications, 124 titles of technical publications, and 1 audio-visual materials were acquired
- Cooperation and exchange of materials: sustained cooperation with 437 network libraries within and outside the region
- Dissemination of technical and promotional materials: 84 titles (with 12,279 copies) of technical materials, and 48 titles (with 18,700 copies) of promotional materials disseminated to target groups
- Accessibility of information materials: 6,133 downloadable materials, 1,049,411 downloads during reporting year 2023, and 5 databases made accessible in SEAFDEC websites
- Institutional Repository: 5,292,470 access, 5,104,004 unique visitors; 680 titles of materials uploaded during the reporting year, 9,197 accumulated titles, and 1,028,655 downloads during the reporting year
- Usage of e-mail systems (including e-groups) to facilitate communications both among SEAFDEC staff and with other concerned personalities had been enhanced
- Direct visitors to SEAFDEC Secretariat and Departments: recorded a total number of 8,364 visitors
- Participation of SEAFDEC officials in events organized by other organizations: 374 SEAFDEC officials participated in 158 events: 141 officials at regional/international levels (*88 in physical events and 53 in virtual events*), and 233 officials at national/local levels (*217 in physical events and 16 in virtual events*)
- Number of presentations made by SEAFDEC Staff at non-SEAFDEC events: 16 oral presentations in events at regional/international levels; 15 oral presentations in events at national/local levels; and 1 poster presentation at national/local levels
- SEAFDEC events organized:
  - International/regional meetings, seminars, workshops: 19 meetings with 690 participants (*18 physical events with 633 participants, and 1 virtual events with 57 participants*)
  - National/local meetings, seminars, workshops, consultations: 13 meetings with 178 participants (*11 physical events with 155 participants, and 2 virtual events with 23 participants*)
  - International/regional training courses: 21 courses with 238 trainees (*19 physical training courses with 222 trainees, and 2 online training courses with 16 trainees*)
  - National, on-site training courses: 21 physical training courses with 420 trainees
  - Internships: 1 group with 9 interns
  - On-the-job training: 4 colleges with 144 students
  - Internal meetings: 9 physical meetings with 305 participants

- Participants in events organized by SEAFDEC:
  - o International/regional meetings, seminars, workshops (690 participants)
  - o National/local meetings, seminars, workshops, consultations (178 participants)
  - o International/regional training courses (238 trainees)
  - o National on-site training courses (420 trainees)
  - o Internships (9 persons)
  - o On-the-job trainings (144 students)

  (The number of participants from Member Countries in SEAFDEC events appears in **Table 1**)
- Network and cooperation mechanisms established (now with 56 fisheries-related organizations) for the implementation of collaborative activities at national, regional and international levels
- Support from other organizations and donor agencies for relevant activities solicited: total support received in 2023: US$ 6,577,015 representing non-regular sources of funds for the activities of SEAFDEC (*2,578,169 from agencies/institutions in the region and 3,998,846 from agencies/institutions outside the region*)

Strategy 4. Strengthening SEAFDEC capability in information-related activities

- SEAFDEC staff enhanced their information and communication knowledge (through Training on Network Security, social media, and Repository Management)
- SEAFDEC staff enhanced their knowledge of Monitoring, Evaluation, Learning, and communication (through the Monitoring, Evaluation, Learning, and Communication Workshop)
- Financial sustainability of SEAFDEC institutional publications and information activities boosted (through intensified sale of technical publications and souvenir items on a cost-recovery basis)

Strategy 5. Regular monitoring and evaluation of information activities

- Feedback on materials produced by SEAFDEC obtained (developed for the training, research, and information transfer through communication channels, *e.g.* dedicated e-mail, etc.)
- Twenty-fourth Meeting of the SEAFDEC Information Staff Program (ISP) organized to monitor the implementation of information-related activities, in accordance with the Information Strategies for Enhance SEAFDEC Visibility and Communication (convened on 17–19 October 2023 in Melaka, Malaysia)

Table 1. Participation of Member Countries in SEAFDEC Events in 2023

Category	Participants from Member Countries (persons)										
	Brunei Darussalam	Cambodia	Indonesia	Japan	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam
SEAFDEC regional/international meetings, seminars, workshops	22	36	58	16	21	53	29	23	13	30	23
SEAFDEC national/local meetings, seminars, workshops, consultations	0	0	27	1	0	3	7	0	0	21	0
International/regional training courses	14	13	15	0	12	20	17	37	4	23	13
National, on-site training courses	0	24	39	5	0	102	0	40	0	166	25
Study tours	0	0	0	0	0	0	0	0	0	0	0
Internships	0	0	0	0	0	0	0	9	0	0	0
On-the-job trainings	0	0	0	0	0	0	0	138	0	6	0
SEAFDEC internal events	0	0	1	0	0	0	0	0	0	6	0
TOTAL	**36**	**73**	**140**	**22**	**33**	**178**	**53**	**247**	**17**	**252**	**61**

PROGRESS IN THE IMPLEMENTATION OF SEAFDEC GENDER STRATEGY IN 2023

The SEAFDEC Gender Strategy was approved by the 51st Meeting of the SEAFDEC Council in 2019 for implementation by the SEAFDEC Secretariat and Departments with the goal for "SEAFDEC as gender-responsive and gender-sensitive in pursuing sustainable development and management of fisheries and aquaculture in Southeast Asia." The Progress in the implementation of the Gender Strategy by SEAFDEC during the year 2023 could be summarized as follows:

Strategy 1. Mainstreaming gender at all levels of the organization

- Policies and regulations for the staff: generally applied equally to male and female, with some specific gender-related policy, *e.g.* maternity/paternity leave, special leave benefits for women
- Gender-related facilities: provided as and when necessary, *e.g.* breastfeeding areas, child care facilities, muslim prayer room for men/women, and women's parking area.
- Number of staff in HR system: a total of 412 staff (202 female and 210 males) at the SEAFDEC Secretariat and five Departments
- Four (4) training courses on program and activity results reporting and communication including gender-sensitive was organized
- SEAFDEC staff participated in five (5) events of gender-related trainings organized by other organizations

Strategy 2. Integrating gender in SEAFDEC programs and projects

- Gender sensitive[1] programs/projects: 6 regional projects (out of 22) are gender sensitive
- Stakeholders and participants involved in programs/projects of SEAFDEC: 1,349 stakeholders/ participants (629 females and 820 males) involved
- Gender-related events organized by SEAFDEC: 3 events, with a total of 88 participants (58 females and 30 males) attended

Strategy 3. Incorporating gender perspectives in all events organized by SEAFDEC

- Equal opportunities given for the participation of male and female representatives in all events organized by SEAFDEC
- Sex disaggregated number of participants in events organized by SEAFDEC:
  - Regional/international meetings, seminars, workshops: 19 events, with 690 participants (286 female and 404 male)
  - SEAFDEC national/local meetings, seminars, workshops, consultations, etc.: 13 events, with 178 participants (81 female and 97 male)
  - International/ regional training courses: 21 courses, with 238 trainees (102 female and 136 male)
  - National, on-site training courses: 21 courses, with 420 participants (175 female and 245 male)

[1] Gender sensitive refers to the programs and projects where gender norms, roles and inequalities have been considered and awareness of these issues has been raised.

- Internships (group/persons): 1 group, with 9 interns (3 female and 6 male)
- On-the-job trainings (students): 4 colleges, with 144 students (105 female and 39 male)
- SEAFDEC Internal Events: 9 events, with 305 participants (139 female and 166 male)

Strategy 4. Boosting the visibility of SEAFDEC as a gender-responsive and gender-sensitive organization

- Articles/papers/reports published and distributed: 5 titles, with 3,902 hard-copies produced, 3,600 hard-copies distributed, and 136 e-copy downloaded.
- Presentation on gender-related subject at events organized by other organizations: five (5) oral presentations
- Three (3) events organized for gender-related commemorative

Strategy 5. Strengthening further the cooperation and collaboration with Member Countries and other organizations on gender aspects

- Collaboration with five (5) organizations by participating at the events and providing inputs during the session.

SEAFDEC REVENUES AND EXPENDITURES IN 2023

Un-audited Abridged Consolidated Financial Statements As at December 31, 2023 and 2022 (in US$)

	2023 (Un-audited)		2022 (Audited)	
REVENUES				
Contributions from:				
Member governments	10,356,832		10,254,872	
Other sources	80,658		504,454	
Other income	631,752		783,878	
TOTAL REVENUES	**11,069,242**		**11,543,204**	
EXPENDITURES				
Operating and Capital Expenditures				
Research	3,347,052		3,770,179	
Training	725,263		1,101,305	
Information	434,792		469,163	
Collaborative	241,699		134,575	
Others	17,130		198,296	
Administrative	5,448,520		4,202,561	
TOTAL EXPENDITURES	**10,214,456**		**9,876,079**	
SURPLUS (DEFICIT), For the year	854,786		1,667,125	
FUND BALANCE, Beginning of year	19,324,075	1/	17,500,847	
FUND ADJUSTMENT	1,211		4,325	
FUND BALANCE, End of year	**20,180,072**		**19,172,297**	1/
REPRESENTED BY:				
ASSETS				
Current assets				
Cash and cash equivalents	20,614,872		19,886,351	
Receivables and other receivables	200,905		196,141	
Advance and deposits	18,244		13,280	
Materials and supplies inventory	41,360		31,323	
Fuel oil for vessels	147,576		179,183	
Prepayments	10,041		9,069	
Other Current assets			20,082	
Total Current assets	**21,032,998**		**20,335,429**	
Noncurrent assets				
Reserved budget for vessel periodic maintenance	314,708		262,962	
Restricted bank deposit	5,441		5,395	
Termination indemnity fund	2,190,382		2,108,939	
Long-term investments	281,299		279,356	
Other noncurrent assets	252,377		220,798	
Total Noncurrent Assets	**3,044,207**		**2,877,450**	
TOTAL ASSETS	**24,077,205**		**23,212,879**	
Less: Liabilities				
Accrued payable	529,096		697,144	
Contribution received in advance	711,368		759,166	
Fund held in trust	241,292		209,940	
Reserved budget for vessel periodic maintenance for M.V. SEAFDEC 2	224,995		265,393	
Total Current Liabilities	**1,706,751**		**1,931,643**	
Provision for termination indemnity	2,190,382		2,108,939	
Total Liabilities	**3,897,133**		**4,040,582**	
NET ASSETS	**20,180,072**		**19,172,297**	

Remark: 1/ The Difference of US$ 151,778 (US$ 19,324,075 – US$ 19,172,297) is a resulted of change of rate in US$ translation.

Un-audited Contribution Received by SEAFDEC from Member Countries and Other Sources for the Year 2023 (in US$)

Sources	SEC	TD	MFRD	AQD	MFRDMD	IFRDMD	Total	%
Brunei Darussalam	7,000	-	-	-	-	-	7,000	0.06
Cambodia	12,000	-	-	-	-	-	12,000	0.11
Indonesia	52,000	-	-	-	-	705,829	757,829	6.85
Japan	280,000	-	-	-	-	-	280,000	2.53
Lao PDR	6,500	-	-	-	-	-	6,500	0.06
Malaysia	21,500	-	-	-	635,796	-	657,296	5.94
Myanmar	22,500	-	-	-	-	-	22,500	0.20
Philippines	25,000	-	-	5,869,604	-	-	5,894,604	53.25
Singapore	13,500	-	-	-	-	-	13,500	0.12
Thailand	33,000	2,646,603	-	-	-	-	2,679,603	24.21
Viet Nam	26,000	-	-	-	-	-	26,000	0.23
Sub-total	**499,000**	**2,646,603**	**-**	**5,869,604**	**635,796**	**705,829**	**10,356,832**	**93.56**
Other Sources /grant [2/]	-	-	-	80,658	-	-	80,658	0.73
Other income	(478)	105,260	-	526,970	-	-	631,752	5.71
Total	**498,522**	**2,751,863**	**-**	**6,477,232**	**635,796**	**705,829**	**11,069,242[3/]**	**100%**

Remarks:

[2/] Including contributions from non-member governments, international organizations/agencies, and miscellaneous receipts.

[3/] Excluded contribution received for the year 2023 which was supported from Fisheries Agency-Japan for the Japanese Trust Fund for the amount US$ 1,510,518 (Excluded Japan-MRC = US$ 280,000)

Un-audited Other Contributions Received by SEAFDEC in 2023 (in US$)

Other Contributions	Amount in US$ [4/]
Japanese Trust Fund (excluded: Japan MRC = US$ 280,000)	1,510,518
USAID Southeast Asia Fisheries Partnership	143,269
Total	**1,653,787**

Remark:

[4/] Other sources of contribution which are not reported in the SEAFDEC Financial Statements.