



Fisheries and Environment Research and Development in the Mekong Region

Volume 29, No 1

ISSN 0859-290X

April 2023



INSIDE

- Plastic 'interceptor' deployed in Mekong Delta in Viet Nam
- Nineteen fishes affected by plastic entanglement or ingestion
- Protecting and restoring fish habitats in Lower Mekong Basin
- ASEAN Inter-Parliamentary Assembly promotes ESG action
- Implications of COP27 and COP15 for developing countries
- Endangered fishes released near Cambodia Royal Palace



Catch and Culture - Environment is published three times a year by the office of the Mekong River Commission Secretariat in Vientiane, Lao PDR. The preparation of the newsletter is facilitated by the Environmental Management Division of the MRC Secretariat. Free email subscriptions are available through the MRC website, www.mrcmekong.org. Contributions to **Catch and Culture - Environment** should be sent to peterstarr@mac.com and copied to mrcs@mrcmekong.org.

Editorial Panel:

Phetsamone Khanophet, Director of Environmental Management Division

So Nam, Chief Environmental Management Officer

Lai Tung Quan, Fisheries Management Specialist

Ly Kongmeng, Ecosystem and Wetland Specialist

Panpan Worranut, Fisheries and Aquatic Ecology Officer

Editor: Peter Starr

Designer: Chhut Chheana

The MRC is funded by contributions from its Member Countries and development partners of Australia, Belgium (Flanders), the European Union, Finland, France, Germany, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United States of America and the World Bank.

Copyright © Mekong River Commission 2023. First published (1995)

This work is an approved product of the Mekong River Commission Secretariat and reflects the collective views of the Commission and its Member Countries. While all efforts are made to present accurate information, the Mekong River Commission does not guarantee the accuracy of the data included in this work. The boundaries, colors, denomination, and other information shown on any map in this work do not imply any judgement on the part of the Mekong River Commission concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of the Mekong River Commission, all of which are specifically reserved.

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made and notification is sent to MRC. The Mekong River Commission Secretariat would appreciate receiving a copy of any publication that uses this publication as a source. This publication cannot be used for sale or for any other commercial purpose whatsoever without permission in writing from the Mekong River Commission Secretariat.

Catch and Culture - Environment

Mekong River Commission Secretariat
ISSN 0859-290X

Keywords: fisheries, environment

Citation

Mekong River Commission. (2023). Fisheries and environment research and development in the Mekong region. *Catch and Culture – Environment*, 29 (1), 1–48. DOI: 10.52107/mrc.b193w4

Information on MRC publications and digital products can be found at <http://www.mrcmekong.org/publications/>.




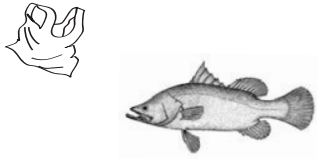













All queries on rights and licenses should be addressed to:

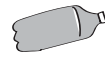
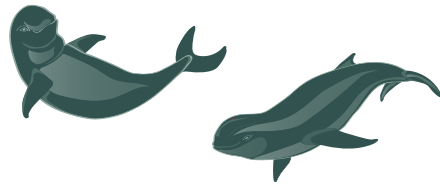
Mekong River Commission Secretariat
Documentation and Learning Centre
184 Fa Ngoum Road, Unit 18, Ban Sithane Neua, Sikhottabong District, Vientiane 01000, Lao PDR
Telephone: +856-21 263 263 E-mail: mrcs@mrcmekong.org

Cover: A solar-powered automated vessel for removing plastic from rivers in Can Tho, the main city in the Mekong Delta. Known as "Interceptor 003", the vessel is among a handful of similar systems deployed by Dutch group Ocean Cleanup (others are in Costa Rica, Indonesia and Malaysia). After trials and several months of operation, the vessel was recently handed over to the Municipal Department of Natural Resources and Environment (see page 8).

PHOTO: THE OCEAN CLEANUP

Contents

- 4  **Riverine plastic (1)**
Report identifies 19 fish species affected by plastic entanglement or ingestion 
- 8  **Riverine plastic (2)**
Cleanup group wins growing support as plastic ‘interceptor’ deployed in Can Tho 
- 12  **Capture fisheries**
Protecting and restoring fish habitats in the Lower Mekong Basin 
- 20  **Cetaceans**
Three Irrawaddy dolphins found dead over seven-day period 
- 26  **Green finance (1)**
ASEAN lawmakers promote ESG action including performance indicators 
- 30  **Green finance (2)**
Green borrowing forecast to drive rebound in sustainable bonds this year 
- 34  **Climate change and biodiversity**
Implications of the latest UN conferences on climate change and biodiversity 
- 40  **Conservation**
Endangered fishes among thousands released near Cambodia Royal Palace 
- 46  **Prices**



Regional prices
This issue contains minor changes to the presentation of regional prices for fish and other aquatic animals on page 47. The most noticeable are with Vietnamese prices which now separate seed (fry, fingerlings and post-larvae) from the items being marketed (fish, frogs and crustaceans) in weekly reports from Dong Thap and Danang. For Thai prices, the order of species has been revised to comply with the current sequence used in daily reports from the Talaad Thai Wholesale Market.





Report identifies **19 fish species** affected by **plastic entanglement** or **ingestion**

Interviews with fishers and fish vendors in Cambodia, Lao PDR, Thailand and Viet Nam shed first light on regional challenges ahead

The first-ever report on riverine plastic pollution in the Lower Mekong Basin (LMB) has identified 19 fish species affected by entanglement or ingestion. Published by the MRC Secretariat in December last year, the report (MRC, 2022) notes that six of the 19 species account for one percent of the basin's overall fish catch. In terms of conservation, most of the fishes are of least concern as they are widespread and abundant. But two are threatened – the striped catfish (*Pangasianodon hypophthalmus*) and the wallago (*Wallago attu*). The International Union for the Conservation of Nature (IUCN) in Switzerland assesses the striped catfish

as “endangered” (facing a very high risk of extinction in the wild in the near future). The wallago is “vulnerable” (at high risk of extinction in the wild in the medium-term future). A third species known as the goonch (*Bagarius*) is “near threatened” (close to qualifying or likely to qualify for a threatened category in the near future).

Interviews with fishers and fish vendors in Cambodia identified seven species as getting entangled in plastic. Similar interviews in Thailand identified three species ingesting plastics including the wallago and the goonch along with the silver barb (*Barbonymus gonionotus*). The Vietnamese interviews identified eight species getting entangled and another two species ingesting plastic including the striped catfish which was



Plastic food wrappers and other detritus from a commercial fish catch in the Lower Mekong in January this year. The fishing operation employs women to remove the plastic before the fish are sent for processing.

PHOTO: LEM SAMEAN

found with styrofoam in its digestive system. No incidences of entanglement or ingestion were reported in Lao PDR (see table below).

'Most of the research put an emphasis on analysing the marine rather than on freshwater ecosystems'

According to the report, a fish vendor in Chiang Saen in northern Thailand said she frequently opened up fish stomachs to clean them before selling. Cambodian fishers meanwhile complained that for the past five years they often catch more plastic than fish.

The report found "serious gaps" in the analysis of the impact of plastic debris on freshwater fauna in the LMB.

"Four countries reported that there was no published report on the effect of plastic pollution on freshwater ecosystems in the LMB nor in specific (Member Countries). Some of the consultants pointed out that most of the research put an emphasis on analysing the marine rather than on freshwater ecosystems. Considering that the Mekong River ecosystem provides food and is home to various species including humans, it is necessary to clarify both the distribution and significance of the risk of plastic pollution."

'The lives of species that play a critical role in the environmental hierarchy and in human daily lives are at risk'

In addition to the exposure to plastic of threatened or

Impact from plastic pollution on freshwater fauna observed in interviews

Species	English common name	Conservation status		Effect from plastic debris E: Entanglement, I: Ingestion								CR ^{*1}	
				KH		LA		TH		VN			
		IUCN	CITES	E	I	E	I	E	I	E	I		
<i>Bagarius</i>	Goonch	NT	N/A							X			30
<i>Barbonymus gonionotus</i>	Silver barb	LC	N/A							X			14
<i>Channa striata</i>	Snakehead murrel	LC	N/A										33
<i>Cirrhinus siamensis</i>	Siamese mud carp	LC	N/A										-
<i>Clarias batrachus</i>	Walking catfish	LC	N/A								X		-
<i>Clarias gariepinus</i>	African catfish	LC	N/A								X		-
<i>Cyclocheilichthys enoplos</i>	Soldier river barb	LC	N/A								X		-
<i>Cynoglossus microlepis</i>	Smallscale tonguesole	LC	N/A										-
<i>Datnioides microlepis</i>	Finescale tigerfish	LC	N/A										-
<i>Glossogobius biocellatus</i>	Sleepy goby	LC	N/A	X									-
<i>Hemibagrus nemurus</i>	Asian redtail catfish/yellow catfish	LC	N/A	X									8
<i>Hemibagrus wyckioides</i>	Asian redtail catfish	LC	N/A								X		23
<i>Kryptopterus micronema</i>		LC	N/A	X									-
<i>Oxyeleotris marmorata</i>	Marbled goby	LC	N/A	X									-
<i>Pangasius hypophthalmus</i>	Striped catfish	EN	N/A								X	X	-
<i>Pangasius larnaudii</i>	Spot pangasius	LC	N/A									X	-
<i>Rasbora borapetensis</i>	Blackline rasbora	LC	N/A								X		-
<i>Rasbora hobelmani</i>	Kottelat rasbora	N/A	N/A	X									-
<i>Wallago attu</i>	Wallago	N/A	N/A								X		14

*1 Contribution Rank based on the contributions to the total fish catch weight (average of four countries). Unnumbered species contribute less than 1%. (Modified from MRC, 2013)

*2 IUCN Red List of Threatened Species (International NT: Near Threatened, VU: Vulnerable, EN: Endangered, LC: Least Concern)

*3 Convention on International Trade in Endangered Species of Wild Fauna and Flora (N/A: The species does not appear on the list).



Plastic bags dominate this commercial catch of mud carps in the Lower Mekong in January this year. Fishers at this location said high levels of plastic were "normal" in the early part of the fishing season and usually declined as the season progressed in February. After sorting the plastic from the fish, the fishers threw the plastic back into the water.

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



Plastic and other household waste on an island in the Mekong as waters recede in the early dry season in 2021. Villagers expected the garbage to be flushed downstream as waters rose during the next wet season.

PHOTO: CHHUT CHHEANA/WONDERS OF THE MEKKONG

near-threatened species, the report noted that “species that significantly contribute to the fish catch in the Mekong River are also affected by both entanglement and ingestion, hence the lives of species that play a critical role in the environmental hierarchy and in human daily lives are at risk.

“Also, since the table shows the results from interviews with several fishers from each country, closer scientific observation of the ecosystem may reveal further adverse impacts. For example, the case of frequent ingestion of plastic debris seen in Chiang Saen, Thailand could be taking place anywhere in the basin. In this context, continuously monitoring the impacts of plas-

tic pollution on freshwater fauna and comparing the results by locations and over time will allow to take effective action towards the more sustainable use of freshwater resources.” A summary of the MRC’s new monitoring protocol for riverine plastics is scheduled to be published in our next issue in August.

Further reading

MRC (2013). Integrated analysis of data from MRC fisheries monitoring programmes in the Lower Mekong Basin. Vientiane: MRC Secretariat.

MRC (2022). The status and trends of riverine plastic pollution in the Lower Mekong River Basin. Vientiane: MRC Secretariat. [10.52107/mrc.aqrsb2](https://doi.org/10.52107/mrc.aqrsb2)



Cleanup group wins growing support as plastic ‘interceptor’ deployed in Can Tho

Vietnamese city has a new resident

A Dutch group founded to rid the world’s oceans of plastic is now operating in the Mekong Delta in Viet Nam after deciding to extend its focus to rivers. In announcing its plan to tackle rivers as the “main source of ocean plastic pollution” in 2019, Rotterdam-based Ocean Cleanup also unveiled its “Interceptor” solution for riverine plastic – a semi-automated solar vessel that can be anchored to a riverbed. The vessel uses a floating barrier to collect garbage from a river, with a capacity of 50,000 kg a day or even 100,000 kg in optimal conditions.

By the end of 2021, “Interceptor 003” was deployed for trials in Can Tho City, the biggest metropolis in the Mekong Delta in Viet Nam. In making its first deployment in a river on the Southeast Asian mainland, Ocean Cleanup worked with People’s Committee of Can Tho and the Can Tho Department of Natural Resources and Environment (DoNRE).

‘Ecological and modern city’

DoNRE Vice Director Nguyen Chí Kien said in January last year that the project was expected to help the city improve waste collection, segregation and treatment while preventing waste – especially plastic – floating on some major river routes in the city. “At the same time, this project will greatly contribute to Can Tho City’s goal towards an ecological and modern city, imbued with the identity of rivers and the Mekong Delta,” Kien said. “We are looking forward to joining hands of non-profit organizations, the private sector and Can Tho citizens in such environmental protection projects, maintaining our position as an ‘ASEAN Environmentally Sustainable City’ – one of the most remarkable titles that was honorably given to Can Tho City.”



Can Tho People’s Committee Vice Chairman Duong Tan Hien addressing the inauguration ceremony

PHOTO: TUOI TRE

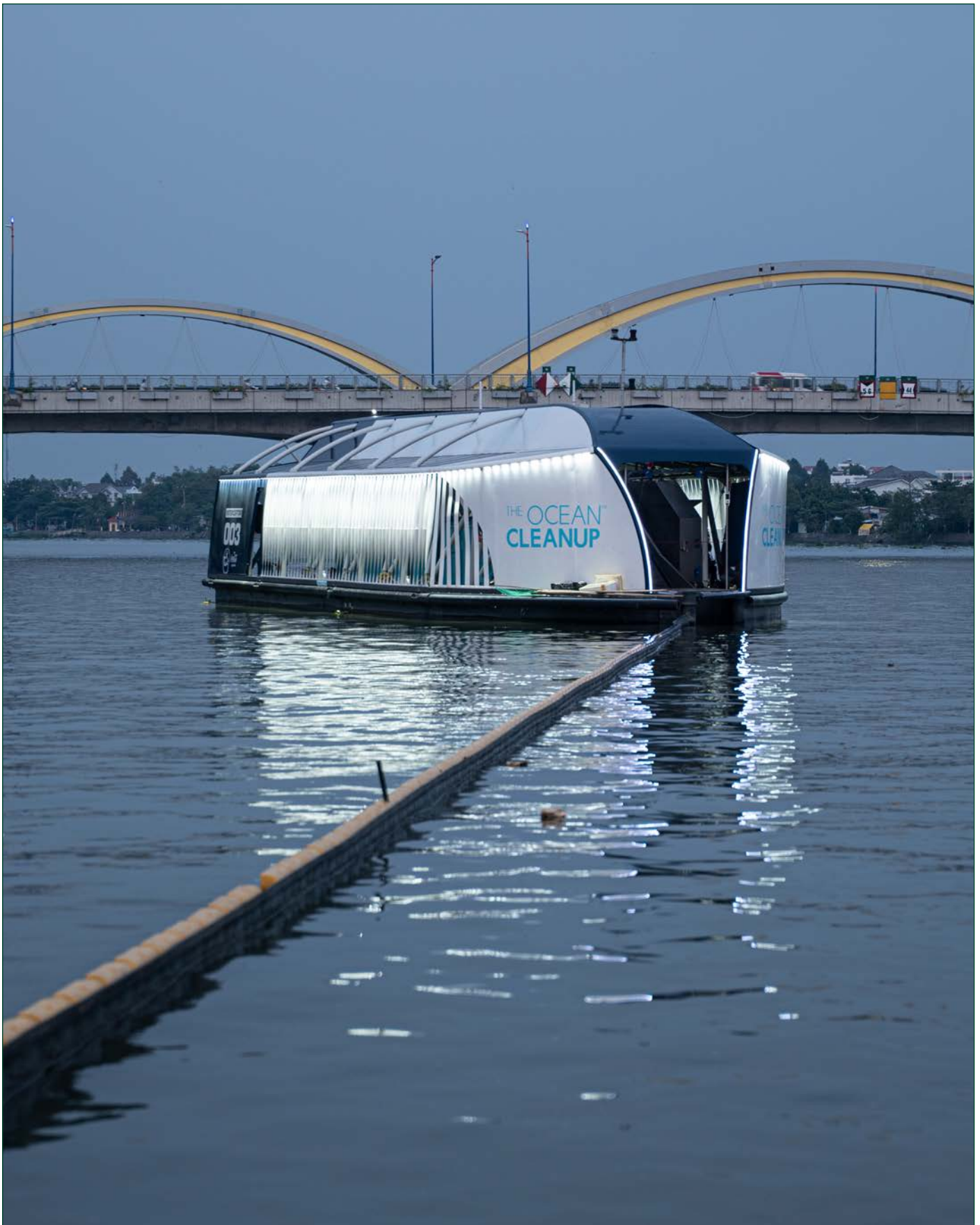
At an inauguration ceremony for “Interceptor 003” on 8 April last year, Ocean Cleanup handed the project over to DoNRE. “I am happy to see the first impact of our work in an area as iconic as the Mekong Delta,” Ocean Cleanup Founder and CEO Boyan Slat said. He described the Can Tho vessel as an “important milestone” for the group, given that it was the fourth such project (after those in Indonesia, Malaysia and a third in Costa Rica) and also part of the group’s 15-river global plan. “We will continue the roll-out to the remaining locations at full speed,” Slat said.

Is Thailand next?

Among the other rivers are the Chao Phraya in Thailand. In 2021, Ocean Cleanup signed a memorandum of understanding with Thai Ministry of Environment and Natural Resources. “We look forward to deploying Interceptors in Thailand’s rivers,” said the Dutch group, which had already forged a partnership with Siam Cement Group (SCG) in 2019. “This partnership will give Thailand precise and accurate data on the waste in the Chao Phraya River that flows to the oceans,” SCG said at the time. In its sustainability report for 2021, SCG said it expected to an Interceptor to be “piloted” in the Chao Phraya and “installed in major rivers” in Thailand.

In the cases of both Viet Nam and Thailand, Ocean Cleanup has been assisted by America’s Coca-Cola Company which became the group’s first global partner” in mid-2021 with the aim of jointly tackling the priority 15 rivers. As “Interceptor 003” was completing its trials in Can Tho in early 2022, Leonardo Garcia, General Manager of Coca-Cola Vietnam and Cambodia, admitted that his company’s packaging was among the waste targeted by Ocean Cleanup “This is unacceptable to us,” he said. “We want to support partners and technologies that help to clean up our oceans and rivers, especially the Mekong river system.”

Since the deployment of “Interceptor 003”, Ocean Cleanup has forged two more global partnership. The first, announced in April last year, is with South Korea’s Kia Corp, one of the world’s leading automakers. Under the seven-year deal, Kia has agreed to make financial and in-kind contributions to support ocean operations and the construction of various river-cleaning devices including Interceptors. In return, Ocean Clean will sup-



"Interceptor 3" at home in Can Tho. The semi-automated solar vessel is the fourth to be deployed as part of a global plan targeting 15 rivers worldwide

PHOTO: THE OCEAN CLEANUP



The floating barrier (left) of "Interceptor 003" leverages tides and currents in the Mekong Delta to direct plastic and other river detritus to the vessel's conveyor belt. Inside are six 8 m³ containers. Once full, a barge collects the trash and transfers it to a treatment facility.

PHOTO: THE OCEAN CLEANUP



Kia President Ho Sung Song and Ocean Cleanup CEO Boyan Slat with agreement in Seoul last year

PHOTO: KIA

ply Kia with some of the plastic it harvests for recycling. The Dutch group has also agreed to share its research results and data with Kia.

The second new partnership is with the United Nations Development Programme (UNDP) in New York. Announced on 8 February this year, it includes “accelerating the deployment of interception technologies in rivers to

end marine plastic pollution,” the UN agency said. UNDP Administrator Achim Steiner described the partnership as an “important step to curb the flow of plastic pollution into oceans and rivers but also to raise awareness, support sound policy making, and trigger behavioral change along the entire plastic value chain.”

Ocean Cleanup’s ability to attract such high-level partners in a relatively short period of time comes as little surprise to its CEO. “There is a market need for what we’re doing,” Slat told BBC radio in November last year, estimating that the Dutch group would need billions of dollars over the coming decade. To achieve that, turnover will have to increase from tens of millions to hundreds of millions of dollars a year. “When you think about the rivers, there is a clear market need there because it’s a lot cheaper to intercept plastic in rivers than let it go out of the river mouths (and) pollute the coastlines which damages tourism. We already see more and more governments that we engage with willing to actually pay for these Interceptors,” he said.

Reputational risk

As for the consumer companies that generate plastic waste, “there’s a reputational risk for them,” Slat said. “These are brands that are worth billions of dollars. They spend billions a year on their marketing budgets. But they also see that having their names on products in wrong places – rivers, oceans – is a real liability.”

According to Slat, rivers account for about 60 percent of the group’s activities and oceans the remaining 40 percent. “On rivers, it’s actually more difficult because you don’t just have the system, you have the systems around the system,” he said, referring to the different authorities and stakeholders in areas such as waste management, operations, funding, maintenance and manufacturing.

“Also, every river is different in terms of plastic composition,” he said. “For rivers, I would say it’s easier to get from zero to one – to just have one thing that works. But going from one to a thousand is actually extremely difficult. It’s not copy-paste. There’s always this element of customization involved in every river.”

Instead of removing plastics from rivers, Slat concedes that prevention would be a better option – by reducing plastic consumption or improving waste management, for example. “The problem is that these things take a lot of money, take a lot of time,” he said. “So hopefully what we can do with these rivers is a sort of stop-gap solution to buy ourselves time to figure out these other solutions that are required further upstream,” he said. But “one day, we want the Interceptors to not be necessary anymore.”

Further reading

Bangkok Post. 2022. Plastic fantastic in reverse. 20 April, 2022. Bangkok: Bangkok Post Public Company Ltd.

BBC. 2022. Business Daily meets; Boyan Slat. 11 November, 2022. <https://www.bbc.co.uk/sounds/play/w3ct30sk>

Minh. H. 2022. Ung dung cong nghe lam sach rac thi tren song Can Tho. Can Tho Online, 9 May, 2022. Can Tho, Viet Nam; Bao Can Tho. <https://baocantho.com.vn/ung-dung-cong-nghe-lam-sach-rac-thai-tren-song-can-tho-a146637.html>

Coca-Cola. 2022. About our partnership with the Ocean Cleanup in Vietnam. 10 April, 2022. Ho Chi Minh City: Coca-Cola Beverages Vietnam Ltd.

Kia. 2022. Kia partners with The Ocean Cleanup. 28 April, 2022. Seoul: Kia Corp.

Juez, F. 2023. UNDP and The Ocean Cleanup team up to tackle plastic pollution. 9 February, 2023. New York: United Nations Development Programme.

Ocean Cleanup. 2019. The Ocean Cleanup unveils plans to address the main source of ocean plastic pollution: rivers. 26 October, 2019. Rotterdam: The Ocean Cleanup.

Ocean Cleanup. 2021. Thailand interceptor project kicks off with signing of MOU. 3 February, 2021. Rotterdam: The Ocean Cleanup.

SCG. 2021. SCG and The Ocean Cleanup Strike up R&D Partnership to Make Use of Waste Collected by The Interceptor. 11 November, 2019. Bangkok: Siam Cement Public Company Ltd.

SCG. 2021. Sustainability Report 2021. Bangkok: Siam Cement Public Company Ltd.

Slat, B. 2012. How the oceans can clean themselves: Boyan Slat at TEDxDelft. <https://www.youtube.com/watch?v=ROW9F-c0kIQ>.

Tuoi Tre News. 2021. The Ocean Cleanup, Coca-Cola hand over automatic river cleanup solution to Can Tho City. 15 April, 2021. Ho Chi Minh City: Tuoi Tre News.



Protecting and restoring fish habitats in the Lower Mekong Basin

National report summaries from Cambodia, Lao PDR, Thailand and Viet Nam

BACKGROUND

Fish production from inland capture fisheries and aquaculture in Southeast Asia – and the Mekong in particular – is progressively increasing. But it is under threat from multiple pressures. Fisheries in the Lower Mekong Basin are under considerable stress from both fishing activities (legal and illegal) and external pressures (hydropower, aggregate extraction, pollution, agricultural development, urbanization) and the predicted impact of climate change.

Overall catches are stable. But declines in landings of large, late-maturing species and smaller average-size species are being observed. While aquaculture can produce fish to help meet demand, wild capture fisheries are crucial for food security to support the rural poor.

Fisheries management and enhancement in the region are achieved through traditional law enforcement, fish stock enhancement (stocking), habitat protection and – to a limited extent – restoration. Stocking is the most widely used approach and the MRC has developed stocking guidelines with the FAO (FAO, 2015). It is now widely recognized, however, that guidance is needed for other aspects of protecting and restoring fisheries beyond stocking.

To support the development of these new guidelines (MRC, forthcoming), MRC Member Countries carried out national reviews of fisheries protection and restoration activities. Each recognized the importance of protecting key habitats that ensure the fisheries are maintained and improved – especially for the important migratory species that contribute to a major part of the fish catches.

The key messages from these reviews are used to identify common issues and recommendations for protecting, restoring and improving key fish habitats of regional importance.

Cambodia

Cambodian fisheries play a very important role in contributing to national food and nutritional security, the national economy and people’s livelihoods. Inland fisheries are threatened by habitat degradation and overexploitation. The fisheries are very dependent on migratory species. Migrations occur between deep pools of the Mekong mainstream in the Kratie-Stung Treng reach (also known as dry-season refuges and spawning habitats, especially for white fishes) and the floodplains of the Tonle Sap Lake and areas south of Phnom Penh (known as flood-season rearing and feeding habitats).

The IUCN has recognized key areas of biodiversity, mainly in the Tonle Sap river and lake, and the Sekong,

Cambodia: prioritised environmental assets of regional importance and additional key fish habitats

Name of Site	Status
Prioritised environmental assets of regional importance in Cambodia	
Tonle Sap Multiple Use Area	Fish sanctuaries (conservation areas), Ramsar wetlands (Prek Tuol and Boeung Chmar), IUCN’s KBA, CFi conservation zones.
Virachey National Park	There is likely no existing/reliable data on key critical fish habitats studied. New survey may be necessary.
Sre Pok Wildlife Sanctuary	There is likely no existing/reliable data on key critical fish habitats studied. New survey may be necessary.
Additional key fish habitats recommended in the Cambodia national report	
Prek Toal Ramsar Site	Prek Toal Ramsar site, fish sanctuaries (former fishing lot areas), CFi conservation zones.
Mekong River and its tributaries in Stung Treng province	Deep pools in those river reaches (also known as dry-season refuge and spawning ground especially for white fishes).

Sesan and Srepok rivers, known as the 3-S system (see table opposite). In addition, fish sanctuaries or conservation areas have been established – particularly in the lower floodplain (the Tonle Sap Lake and areas south of Phnom Penh) and the Cambodian upper Mekong (such as dolphin conservation areas and wetlands of global ecological significance in Stung Treng). These areas are known to be critical habitats for fish rearing/feeding and dry-season refuge/spawning. In the lower floodplain, fish sanctuaries mostly cover parts of the productive fishing areas previously under commercial fishing concessions, known as fishing lots. Some of these conservation areas were established after the abolition of the fishing lots in the first and second waves of inland fisheries reforms in 2000 and 2012.

There are some 167 deep pools in the Mekong River in Cambodia, particularly south of the Khone Falls. These are recognized as critical habitats for fisheries conservation. As a result, some community fisheries along the Mekong have established fish conservation zones to protect fishes and/or set specific internal rules for fishing practices.

The current policy focus also includes Community Fish Refuge Ponds (CFRs), defined as “a form of stock enhancement or a fish conservation measure that is intended to improve the productivity of rice field fisheries”. The idea is to create dry-season refuges or sanctuaries for brood fish in seasonally inundated rice fields.

The biggest challenges to enhance fisheries are the impacts of hydropower dam development on hydrological cycles and intensity. This is compounded by water infrastructure development – such as irrigation dams and flood prevention dykes – and widespread degradation of flooded forest to support agriculture, causing irreversible changes to lower floodplain habitats. In addition, disruption of flood cycles is profoundly affecting migration patterns that play pivotal roles to sustain fish life cycles between spawning-refuge habitats and feeding-rearing habitats, seriously affecting fisheries production and biodiversity. Intensive fishing pressure is also likely to represent a key challenge to fisheries enhancement in Cambodia.

RECOMMENDATIONS FOR FUTURE ACTIVITIES

Critical habitats, connectivity among them and fish fauna using the habitats should be effectively protected and conserved. Priority should be given to habitats where fishes breed, feed and seek refuge.

Robust environmental impact assessments and trans-

parency are needed during all stages of hydropower and other infrastructure development in the floodplain to ensure sustainability of critical habitats. Proper sub-national, national and regional management plans need to be prepared and effectively implemented to conserve these habitats and fish resources.

Formal institutions – such as fisheries sector administrations, fisheries communities or fisheries associations as well as the LMB transboundary fisheries management bodies, which have been established in the form of community-based fisheries management, and joint mechanisms for transboundary fisheries management under LMB national governments and the Mekong River Commission – should be strengthened.

Lao PDR

People living within the Mekong basin in Lao PDR are dependent on fisheries for food security and livelihoods, often as a source of secondary or supplemental employment. Lao fisheries are, however, under considerable pressure from population growth and high demand for fish. Fishers have increased their fishing effort – sometimes illegally – and compete to catch larger fish for brood stock. As a result, stocks of larger species are declining and being replaced by smaller species. The development of hydropower and irrigated agriculture is expected to have a negative impact on fisheries productivity. But the main threat to fisheries yields is agriculture and land use, especially in rain-fed habitats. Nevertheless, it may be possible to maintain or even increase yields by maintaining water depths, improving connectivity, developing refuge ponds and promoting integrated pest management. There is, thus, a need to conserve and use fisheries resources sustainably. Stock enhancement through formal stocking programmes is generally recognized as an important tool to compensate for loss of productivity and diversity. Further actions include rehabilitation and conservation of key important habitats. Fisheries management should be incorporated into Integrated Water Resource Management and focus on Regional Transboundary Fisheries Management Frameworks.

There are a number of key fish habitats in the Mekong in Lao PDR, including national parks (see table next page), fish conservation zones, fish protected areas and fish refuges. Of particular importance are the many deep pools (of 337 identified, 172 were more than 20 m deep), which rural people rely on heavily for subsistence and income generation. Although deep pools are important habitats for many fish species, especially during the dry season, little is known



about their functioning or how they contribute to overall fisheries production. Numerous FCZs (more than 1,000) exist not only in the Mekong River but also in the important tributaries, including the San, Kading and Theun rivers. These FCZs prohibit fishing all year round or during the fish breeding seasons.

Some efforts to rehabilitate fish habitats have been undertaken in Lao PDR, most notably the reconnection of rice production areas in the central region via the Pak Peung fishway and fishways on the Xe Bang Fei river. Over the last three decades, there have been increasing numbers of reports from local people suggesting a decline in available aquatic resources in Lao PDR. The reasons for these declines are complex, perhaps interrelated, and as yet poorly understood. To address this, the 2009 Fishery Law provides a framework for implementing, managing, monitoring and inspecting capture fisheries and aquaculture. It aims to promote aquaculture, conserve and protect fisheries resources for sustainable development, and ensure the availability of fish and other aquatic animals for food security, contributing to the socio-economic development of the nation. The law provides for community fisheries management and control measures, indicating the right of local communities to manage and use their resources. In addition, the law empowers communities to establish village or community fisheries management committees (FMCs) for specific water bodies.

The key challenges facing fisheries include:

- Rural people are poor and heavily dependent on fisheries resources for food security;
- Declining catch rates and changes to species composition in the main fishing ground, including deep pools;

- Rural people fishing in deep pools all year round, in particular in the dry season when fish aggregate in the deep pools;
- Increasing (excessive) fishing effort to meet commercial demand;
- Illegal fishing such as electrofishing, poisoning and dynamite in deep pools in remote areas;
- Many deep pools have been altered due to development projects (navigation, sand mining, hydro-power) and climate change;
- Weak or ineffective enforcement of fisheries laws leading to declining fish catches and yields;
- Limited funds to support local communities to implement fishery management plans.

Lao PDR is in a strong position to promote fisheries enhancement. Fisheries regulations and laws are already in place; FCZs have been established throughout the country, mostly in deep pools, with many more planned; local people recognize the importance of deep pools and FCZs as refuge habitats for fish; transboundary fisheries management projects have been implemented (Bokeo-Chiang Rai; Champassak-Stung Treng) and can be used as starting point for deep pool management.

RECOMMENDATIONS FOR FUTURE ACTIVITIES

Prioritizing significant deep pools in the mainstream zones to ensure migration patterns and refuge areas are not disrupted. This can be done within the framework of existing transboundary fisheries management projects (Bokeo-Chiang Rai and Champassak-Stung Treng).

Lao PDR: prioritised environmental assets of regional importance and additional key fish habitats

Name of Site	Status
Prioritised environmental assets of regional importance in Lao PDR	
Nam Et Phoulei National Park	Important for biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, and global importance
Bueng Kiat Ngong Wetland	Ramsar site with an area of 2,360 ha and consists of lakes, swamps, marshes with established Fishery Conservation Areas
Xe Chanphone Wetland	Ramsar site important for the conservation of the Siamese crocodile, occurrence of specific wetland habitats and the support it brings to local livelihoods
Additional key fish habitats recommended in the Lao PDR national report	
Nong Nga Wetland	Important wetlands for fisheries
Nong Fah	Volcanic crater lake



Fish Conservation Zone on the Nam Et River in Mueng Et District in the northeastern Lao province of Houaphan. Lao PDR has prioritised the Nam Et Phoulei National Park as an environmental asset of regional importance (see table on opposite page).

PHOTO: SINSAMOUT OUNBOUNDISANE/FISHBIO



The confluence of the Mun River (left) and the Chi River (top) in northeastern Thailand, looking upstream. Together, the two rivers form one of the Mekong's most important tributaries. Thailand has identified the confluence as a key fish habitat of regional importance (see table on opposite page).

PHOTO: CHHUT CHHEANA

As local communities depend on fisheries resources to support their livelihoods, there is a need to explore options to diversify livelihoods such as aquaculture and eco-tourism to supplement the food and incomes of local people who may be affected by restrictions in significant deep pools.

Education and awareness campaigns are needed on laws for the sustainable use of fisheries resources and biodiversity including fisheries regulations.

Further assessment of significant deep pools in Cham-passak province is recommended. As different deep pools are inhabited locally or during migrations by different fish species, it is important to map those pools, link them with the species, fishing gear used and management arrangements. This information is important baseline data for management and decision making about fisheries enhancement actions.

Thailand

The Mekong basin in northern Thailand includes 98 km of the main river from Chiang Saen to Wiang Kaen in Chiang Rai, which has many small rapids and deep pools – important spawning grounds and dry-season refuges. In northeast provinces including Chiang Khan, Loei, Khong Chiam and Ubon Ratchathani, the basin includes 860 km of main river. The northeast includes many large tributaries that have been disconnected by hydropower and irrigation infrastructure, the exception being the Lower Songkhram River and its floodplains.

Intense use of wetlands has had serious negative impacts on ecosystems. Such threats – whether from adjacent or surrounding areas or within the wetlands – have resulted in pollution, eutrophication, siltation and reduction of water quantity, declining numbers of aquatic animals, reduction of wetland size, and destruction of vegetation. Affected wetlands need to be conserved and protected. There are also threats from encroachment of agriculture and settlement, illegal fishing, inappropriate water allocation – causing lack of water in the dry season and flooding in the rainy season – proliferation of aquatic plants, such as water hyacinth, and invasion of non-indigenous species such as the golden apple snail and giant mimosa. As a result, a large number of wetlands in Thailand have been either lost or degraded.

There are 39 important wetland sites covering an area of 1,601,082 ha in the Mekong Basin of Thailand, of which at least 15 are internationally important (see table below) and 5 nationally important.

Fisheries management practices in inland waters have been implemented through various institutions, notably government agencies (some with overlapping jurisdictions). The Royal Ordinance on Fisheries B.E. 2558 (2015)* regulates fishing activities.

Fisheries enhancement in Thailand includes:

- Establishing fish conservation zones (FCZs)

Thailand: prioritised environmental assets of regional importance and additional key fish habitats

Name of Site	Status
Prioritised environmental assets of regional importance in Thailand	
Chiang Saen Basin including Nong Bong Khai Wildlife Non-Hunting Area	RAMSAR
Lower Songkhram River and its floodplains	RAMSAR site for a wide range of Mekong mainstream and Lower Songkhram resident fish species
Dong Phrayayen-Khao Yai Forest Complex	World Heritage Site for the conservation of globally threatened and endangered mammal, bird and reptile species
Additional key fish habitats recommended in the Thai national report	
Bung Khong Long Wildlife Non-Hunting Area	RAMSAR – birds and some fish
Koot Ting	RAMSAR - birds and some fish
Confluence of the Mun and Chi Rivers	Important wetlands for fisheries
Mun River flooded forest alongside Kaeng Tana National Park	
Lower Nam Mong Basin (Mekong River Tributaries)	Important wetlands

* amended in 2017



- Managing dry-season refuges
- Diagnosing and restoring stocks
- Diagnosing restoring habitats
- Rehabilitating habitats and installing fish shelters

Fish conservation zones (FCZs) are a primary activity, established by many local communities to manage their own fisheries resources. Critical habitats are selected based on generations of local knowledge. Most local people believe that the impact of fish harvesting can be reduced by banning or significantly limiting fishing activities in key areas that serve as dry-season refuges and sometimes spawning grounds.

RECOMMENDATIONS FOR FUTURE ACTIVITIES

The key challenges in restoring and enhancing fish stocks in important habitats along transboundary areas include habitat rehabilitation, human resources and institutional capacities in co-management approaches.

Effective implementation of a restoration and enhancement programme requires integrated fisheries and habitat management plans. The plans should involve many parties, such as fishers, government (local and/or sometimes central), non-governmental institutions, academics and other fisheries user groups (traders, cage culture farmers). Co-management is an appropriate approach that encourages links between parties and between humans and natural ecosystems.

Human and institutional capacity development require a substantial investment in the form of time, resource capacities and also clear understanding of the responsibilities of government and local people. Both parties can play crucial roles to:

- avoid further damage to the key habitats by limiting development activities in the areas;
- diminish the impacts of development activity on the ecosystem by retaining some of the natural diversity (physical and biological aspects) by limiting certain activities in transboundary areas;
- restore habitats re-establishing the ecosystem structure and functions that existed prior to the initiation of development activities.

Viet Nam

The Mekong delta ecosystem in Viet Nam is driven by both seasonally flooded wetlands and daily tidal cycles. These wetlands provide important habitats for indigenous flora and fauna, including many fish species that seasonally migrate into wetlands for spawning, feeding or refuge or occupying permanent habitats. Wetlands are therefore very important for conserving biodiversity and abundance of fisheries resources and other aquatic organisms. The wetlands have been heavily degraded through pollution (agrochemicals, industrial and urban wastes), loss of mangroves, channelization for flood control and dyke building, particularly to up-scale rice production. The fisheries are also vulnerable to the accidental introduction of non-native species that have become invasive, including the freshwater golden snail (*Pomacea canaliculata*), suckermouth catfish (*Pterygoplichthys disjunctivus*), the red-eared turtle (*Trachemys scripta*). These are a serious threat to many fish habitats in the Mekong Delta.

The most important fish habitats identified in the Mekong Delta are hotspot wetlands, some of which have been designated as Ramsar sites because of their ecological values and biodiversity (see table opposite). There are 23 deep pools in the Mekong and Bassac of the delta in Viet Nam. Maximum depths range from 13 to 44 m and areas from 4 to 95 ha. Most of the deep pools are common fishing grounds during the dry season. Protected areas in the delta region are subjected to considerable pressures from an increasing human population.

The fish habitats of these protected areas are composed of seasonally inundated Melaleuca forest and grassland, swamp and floodplains affected by Mekong river flows. These habitats provide breeding, nursery and feeding grounds for floodplain grey fish in the wet season and primary habitats for black fish all year round. They are replenished during the wet season. Therefore, most key habitats are strongly affected by the hydrological regime, as well as other local and basin-wide development. The Mui Ca Mau National Park, Thanh Phu Nature Reserve and Bac Lieu Bird Sanctuary provide favourable habitats for marine and estuarine fish guilds and some anadromous Mekong catfishes. The area of the Sesan river basin in the Central Highlands of Viet Nam has mostly been impacted by hydropower development and these water bodies are under hydropower management authorities.

The Government of Viet Nam has promulgated le-

Viet Nam: prioritised environmental assets of regional importance and additional key fish habitats

Name of Site	Status
Prioritised environmental assets of regional importance in Viet Nam	
U Minh Thuong National Park	Ramsar Wetland site Conservation of primitive Melaleuca forest Core zones of UNESCO Kien Giang Biosphere Reserve by Recognized as ASEAN Heritage Park
U Minh Ha National Park and Mui Ca Mau National Park	Mui Ca Mau NP designated Ramsar Wetland site
Yok Don National Park	Focused on the conservation of biodiversity of the terrestrial landscape, no fisheries related action
Additional key fish habitats recommended in the Viet Nam national report	
Tram Chim National Park	Ramsar Wetland site Conservation of the biodiversity of primitive Plain of Reeds; Conservation of water birds, especially the Sarus Crane
Lang Sen Wetland Reserve	Ramsar Wetland site Wetlands reserve to protect remains of the primitive Plain of Reeds
Lung Ngoc Hoang Nature Reserve	Action plan mainly targets conservation of Melaleuca ecosystem and its wetland landscapes
Tra Su Nature Reserve	Management and protection of mangrove forest ecosystem for conservation of biodiversity and natural habitats of wild animals such as water birds for ecotourism, No fisheries related actions
Bac Lieu Bird Sanctuary Nature Reserve	Bird sanctuary
Bung Binh Thien Lagoon	Open access area for local communities and fishers
Yok Don National Park	Focused on the conservation of biodiversity of the terrestrial landscape, no fisheries related action.

gal frameworks related to fish habitat management through the Law on Fisheries (2017), the Law on Biodiversity (2008) and the Law on Environmental Protection (2014). Presently these protected areas, including fish habitats, are under the management of governmental institutions. They focus on the conservation of natural landscapes, biodiversity of wild animals (Sarus crane and other water birds), protection of Melaleuca forest and development of ecotourism, but not much on fish biodiversity and fisheries.

There has been limited investment on research into fish habitats, assessment of biodiversity or abundance management measures. Most information is out of date and needs to be updated for further planning and effective management, as well as for habitat and environmental rehabilitation and enhancement.

RECOMMENDATIONS FOR FUTURE ACTIVITIES

- Inventory of key fish habitats in the Mekong Delta in Viet Nam with updates of information on biodiversity and abundance of fisheries resources;
- Research on measures to improve fish habitat func-

tionality, linked with other sectors such as agriculture, irrigation, aquaculture, navigation and hydro-power;

- Training, research, monitoring and assessment of fish habitat management;
- Review and improve regulations for management of freshwater protected areas to ensure fish habitats are integrated into management plans;
- Setting up basin-wide cooperation in development of technical guidelines for effective management of fish habitats and enhancement of their biodiversity and abundance as well as sharing information and experience.

Further reading

Mekong River Commission (forthcoming). Technical Guidance for Protection and Restoration of Key Fish Habitats, with Regional Importance. Vientiane: Mekong River Commission Secretariat.

FAO (2015). Responsible stocking and enhancement of inland waters in Asia. FAO Regional Office for Asia and the Pacific, Bangkok. RAP Publication 2015/11, 142 pp.



Three Irrawaddy dolphins found dead over seven-day period

Cambodian Prime Minister announces crackdown after illegal fishing in conservation zone blamed for unprecedented dolphin mortalities

Three Irrawaddy dolphins (*Orcaella brevirostris*) were found dead in the Mekong River in Cambodia in the space of a week in December last year, prompting Prime Minister Samdech Techo Hun Sen to order provincial authorities to do more to protect the critically endangered sub-population. “The Ministry of Agriculture must jointly protect this area,” he said during a groundbreaking ceremony for a new bridge over the Mekong in Kratie Province on 2 January this year. “The issue falls within the jurisdiction of the Ministry of Agriculture, but the one who is in charge directly is the provincial governor, for which the authority must work out ways to ensure that these dolphins are not trapped or disturbed.”

‘If fishing is allowed, only a number of fishermen will benefit, but it will damage the conservation area’

The Prime Minister said a “permanent” off-limits core area “must be marked to ensure that it is reserved as a tourist area” in Kratie, where dolphin watching is promoted by the Ministry of Tourism – especially at Kampi Pool, about 15 km upstream from the provincial capital. “If fishing is allowed, only a number of fishermen will benefit, but it will damage the conservation area,” he said. “We must take measures and pay close attention to protection.”

In a statement welcoming the announcement, the Cambodian branch of the Swiss-based Worldwide Fund for Nature (WWF) highlighted the need for “full and strict protection” of conservation areas along the Mekong River to ensure remaining dolphins and mega fish are protected from illegal fishing.

“WWF applauds Samdech Techo Prime Minister’s recommendations on the establishment of the permanent core conservation zones and seasonal core conservation areas within a 180 km stretch of Cambodia’s Mekong river, where all kinds of fishing activities are prohibited to protect the dolphins and mega fish,” Country Director Seng Teak said.



Prime Minister Samdech Techo Hun Sen speaking in Kratie on 2 January

PHOTO: AKP

“WWF stands ready to collaborate with relevant authorities including the Dolphins Commission, Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries and Provincial Administrations of Kratie and Stung Treng provinces, to support the effective management of this critically endangered species and to implement the Prime Minister’s recommendations.”

First mortality

On 19 December last year, WWF announced that an adult male Irrawaddy dolphin of 15-20 years had been found floating around Koh Dambang deep pool near the border between Kratie and Stung Treng provinces the previous day. The individual was 230 cm long and weighed 162 kg. Examination of the carcass suggested the dolphin died due to gill net entanglement “with signs of monofilament on the flipper, body and fluke, and bruising areas of neck lesion,” a statement said.

“It is extremely terrifying every time a dead dolphin is discovered,” Seng Teak said. “The death of a healthy adult dolphin like this one is sad given its currently tiny

Continued on page 24 ...



Dead male (230 cm long weighing 162 kg) found on 20 December (top), dead female (193 cm long weighing about 85 kg) found on 22 December (middle) and another dead female (196 cm long weighing 93 kg found on 24 December (bottom).

PHOTOS: COMMUNITY/FIA-WWF (TOP), EAM SAM UN/FIA-WWF (MIDDLE AND BOTTOM)



Mekong population largest of seven known in fresh and brackish waters

The Irrawaddy dolphin is one of only three whale and dolphin species to inhabit both fresh and marine waters. Those found in the Mekong river are the largest of seven known freshwater populations of this species in the world. IUCN has assessed sub-populations in three rivers – the Mekong, the Ayeyarwady River in Myanmar and the Mahakam River in Indonesia – as critically endangered – facing an extremely high risk of extinction in the wild in the immediate future. Apart from the three rivers, the species also

occurs in shallow coastal waters across South and Southeast Asia as well as four brackish water bodies in Bangladesh, India, the Philippines and Thailand.

The IUCN assessment in 2017 identified 12 sub-populations overall, with the largest of more than 5,000 individuals in estuarine waters of Bangladesh. Smaller populations of several hundred individuals each were estimated for Sundarbans mangrove area in Bangladesh (contiguous with the dolphins in

Distribution of Irrawaddy dolphin



SOURCE: IUCN

estuarine waters), coastal waters off Trat Province in southern Thailand, Kuching Bay and along the coast of the eastern Malaysian state of Sarawak. The smallest populations of some 100 individuals or less were estimated for Chilika Lake in India and the Mahakam, Ayeyarwady and Mekong rivers along with Malampaya Sound in the Philippines, Balikpapan Bay in Indonesia and Koh Kong Province in Cambodia (contiguous with the coastal population in Thailand).

'If dolphin populations decline to unrecoverable levels, other species and surrounding ecosystems are thrown out of balance too'

Irrawaddy dolphins are shy mammals of dark grey colour, with a small rounded dorsal fin and a bluntly rounded head. Adults weigh between 90 and 150 kg, and measure 2.10-2.75 m in length. Their diet includes fish, crustaceans, and squid. The dolphins often live in deep pool river areas and are generally found in small groups of up to ten. Freshwater populations are at the top of the food chain. With no natural predators in rivers, they control populations of other species below. So if dolphin populations decline to unrecoverable levels, other species and surrounding ecosystems are thrown out of balance too. At the the same time, the livelihoods of communities that rely on the Mekong River are also directly linked to healthy dolphin populations.

The Cambodian government has identified the Irrawaddy dolphin as being among 58 endangered aquatic species. The dolphin is also subject to a sub-decree in 2012, which bans and restricts the use of gill nets either entirely or during certain times of the year. Several dozen river guards trained by the Fisheries Administration and WWF are responsible for enforcing the regulations. Between 2012 and 2014 alone, more than 60,000 m of gill nets were confiscated and burnt.

"The Mekong dolphin plays an important role in Cambodia's heritage, ecology and economy," then Fisheries Administration Director-General Dr Nao Thuok said in 2014. "Local and international tourists come to Kratie to see the dolphins, contributing to tourism growth and poverty reduction. Protection of this species also means protection of deep pools, enabling local communities to fish for sustainable

daily consumption and income."

'Seeking refuge from the dry season in deep pools makes the dolphins vulnerable to fishermen'

Once found throughout much of the southern part of the Lower Mekong – from the Lao-Cambodia border to the Tonle Sap Lake and the Mekong Delta in Viet Nam – the dolphins have become increasingly rare in recent decades. Dry-season congregations in nine deep pools – along a 190 km stretch of the Mekong upstream from the town of Kratie – may provide safe habitats for the animals to rest and forage. But seeking refuge from the dry season in deep pools leaves the dolphins vulnerable to fishermen.

'In addition to fishing gear, mortalities across Asia have been attributed to hydropower development and deforestation ... as well as gold, gravel and sand mining'

Irrawaddy dolphins spend most of their time foraging. They are neither particularly active nor acrobatic, but they do make low leaps on occasion. The dolphins typically dive for less than 2 minutes – but dive times are longer when the animals are frightened. Some individuals reach adult size at the age of four to six. But the specific age of sexual maturity is not clear. Newborns are about 1 m and weigh around 12 kg. In their first seven months, calves grow by more than 50 cm and 33 kg. Females give birth every 2-3 years. But in stressed populations, mating may take place at an earlier age and calving at shorter intervals.

In addition to fishing gear, mortalities across Asia have been attributed to hydropower development and deforestation – which increases sedimentation and makes water bodies more shallow – as well as gold, gravel and sand mining.

Sources

Minton, G., Smith, B.D., Braulik, G.T., Krebs, D., Sutaria, D. & Reeves, R. 2017. *Orcaella brevirostris* (errata version published in 2018). The IUCN Red List of Threatened Species 2017: e.T15419A123790805. <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15419A50367860.en>

WWF. 2017. Conservation of Mekong Irrawaddy Dolphins. WWF Fact Sheet, November 2017. Gland, Switzerland: World-wide Fund for Nature.



... continued from page 20

population, as this directly affects the breeding potential of the Mekong dolphins.

'If the current illegal fishing practice continues the Mekong dolphins may go extinct in the near future'

"We urge relevant authorities to step up law enforcement effort to completely halt all illegal fishing activities in dolphin conservation areas – by doing so, we will not only protect our living heritage but we also will manage our wild fish stock for a long lasting food security for millions. If the current illegal fishing practice continues the Mekong dolphins may go extinct in the near future."

Second and third mortalities

A second dolphin was found dead on 22 December – a female aged between 7 and 10 years old. It was 193 cm long and weighed about 85 kg. Researchers from WWF and the Kratie Fisheries Cantonment suggested that it too died after gill net entanglement. Seng Teak said the discovery of two dead dolphins over a five-day period was a "very serious and worrying sign" for the species. "This death rate has not been seen in the last ten years," he said. "If this situation is not immediately addressed, this species will go extinct on our watch."

Two days later, a third dolphin was found dead, another female. She was estimated to be 7 to 10 years old, about 196 cm long and weighing about 93 kg. The carcass was found at Koh Trung, about 10 km downstream from Kampi Pool. Researchers suggested this dolphin died after getting caught in longline fishing hook. "This was the third healthy dolphin that died within just a 7-day period, indicating an increasingly alarming situation and the need for intensive law enforcement to be urgently conducted in the dolphin habitats," WWF said.

Three-year death toll 'unprecedented'

For the whole of last year, WWF said, 11 dolphins died, bringing mortalities to 29 over three years. "In renewing its call-to-action in the face of this unprecedented mortality, WWF strongly urges a mobilization of law enforcement forces to be urgently organized to increase both day and night patrols in order to protect the remaining dolphins from being killed by illegal fishing in the conservation areas," the Swiss group said. According to WWF, about 70 percent of the dolphin's population is beyond the breeding age limit of 20 years. Life expectancy of the species is between 27 and 30

years old. Moreover, a mortality rate of 63 percent over three years has been accompanied by a low survival rate of calves into adulthood. It called for measures to urgently address mortalities caused by gill nets and electro-fishing in conservation areas. "The only solution to this man-made crisis is for all responsible authorities to implement strict law enforcement actions against these illegal fishing activities in the dolphin habitat," it said.

"The recent increase in illegal fishing activities in the dolphin conservation areas will cause the extirpation of the Mekong River dolphin in Cambodia if actions to stop these activities are not taken immediately," Seng Teak said. "There are no other options except to immediately implement strict law enforcement to crackdown on all types of illegal activities in the areas where dolphins live," the country director added.

"To stop these activities, river-guards and law enforcement officers need to be active 24/7, conducting both day and night patrols in the dolphin zones," WWF also called for "severe penalties" for those found fishing illegally in the conservation zones.

The dry season from December to May is a critical period – as Mekong water levels recede, dolphins and fish retreat to the deep pools, making them vulnerable to illegal fishing. According to WWF, about 70 percent of the dolphin's population is older than 20 years, beyond the breeding age limit. Life expectancy of the species is between 27 and 30 years old.

Death of last dolphin along Cambodia-Lao border

The last Irrawaddy dolphin inhabiting the Anlong Chheuteal transboundary pool along the Cambodia-Lao border died in early 2022, according to official Cambodian news agency Agence Kampuchea Presse (AKP) and the WWF office in Vientiane. In a 17 February report last year, AKP quoted a Cambodian Fisheries Administration as saying that the dolphin died two days earlier and was found by a local fisherman.

Stung Treng Provincial Fisheries Cantonment Acting Director Srey Sam Vichet said the animal weighed 110 kg and was 2.34 m long. AKP said the Fisheries Administration and WWF planned to erect a memorial dolphin statue at the site, which borders Stung Treng and the southern Lao province of Champassak.

Likely extinction in Laos

The Vientiane office of WWF said the death probably meant the species was now extinct in Laos. "This death most likely represents a national-level extinction for



Last known photo dated 19 May, 2021 (top), carcass found on 15 February, 2022 (middle) and final resting place in Anlong Chheuteal Commune in Thala Borivath District in Stung Treng Province (bottom).

PHOTOS: WWF (TOP), AKP (MIDDLE) AND THALA BORIVATH COMMUNITY FISHERY (BOTTOM)

Laos," it said. "The population was publicly declared functionally extinct in 2016 when only three dolphins were left."

WWF Asia-Pacific Director Lan Mercado said the Swiss group was "saddened" by the death. "The numbers in the pool have plummeted over the last few years, due to multiple threats including hydro-power dam construction causing disruptions to river flow and reduced fish abundance, drowning in gill-nets, and the use of damaging fishing practices such as electrofishing and overfishing."

Although collaboration and conservation action with partners in Cambodia had helped to reduce bycatch and strengthen habitats, dolphins in the Cambodian stretch of the Mekong were "still facing serious challenges," Mercado said.

"WWF remains committed to working with governments, local authorities from both Cambodia and Laos, and communities along the river to secure a sustainable future for these iconic river dolphins and other important species," he added. "With due attention, resources and sustained conservation effort, the recovery of these and other iconic species is still possible."

Further reading

AKP. 2022. The Last Irrawaddy Dolphin in Anlong Chheuteal Died. 17 February, 2022. Phnom Penh: Agence Kampuchea Presse (AKP).

FiA and WWF. 2017. Report on the International Workshop on the Conservation of Irrawaddy Dolphins in the Mekong River. 16-18 January, 2017. Phnom Penh: Fisheries Administration and World Wide Fund for Nature.

Hun Sen. 2023. 2 January, 2023; Excerpts from Samdech Techo Hun Sen's Off-the-Cuff Speech at the Groundbreaking Ceremony for the Construction of a Bridge across the Mekong River from Chet Borey District to Prek Prosop District, Kratie Province. Phnom Penh: Cambodia New Vision.

KPL. 2022. WWF-Laos saddened by the loss of the Mekong dolphin. 21 February, 2022. Vientiane: Kaosan Pathet Lao.

WWF. 2021. Time is running out for saving the transboundary dolphins of the Mekong. Joint press release, 24 October, 2021.

WWF. 2022. Increase of strict and regular law enforcement urgently needed to save the Mekong dolphins from extinction. Statement, 23 December, 2022. Phnom Penh: World Wide Fund for Nature.

WWF. 2022. WWF-Laos is saddened by the death of the last known river dolphin in the transboundary pool in the Mekong between Laos and Cambodia. 17 February, 2022. Vientiane: World Wide Found for Nature.



ASEAN parliaments promote ESG including performance indicators

Compliance with environmental, social and governance standards aimed at sustainable and inclusive economic development

The ASEAN Inter-Parliamentary Assembly (AIPA) has resolved to promote environmental, social and governance (ESG) practices for sustainable and inclusive economic growth. In their first face-to-face gathering since 2019, AIPA members of parliament meeting in Phnom Penh in November last year also urged governments in the region to develop ESG performance indicators.

Jointly sponsored by Cambodia and Viet Nam, the ESG resolution adopted on 23 November acknowledged the “increasingly important roles of national parliaments” in passing laws and adopting budgets for sustainable development and post-pandemic recovery. ASEAN governments should address challenges to-

gether “by developing relevant ESG performance indicators and indexes that promote the safeguarding of environmental, labour and social protection,” the resolution said. It also asked governments to “recommend priority principles encouraging businesses and producers to comply with ESG standards for sustainable and inclusive development”.

‘Lawmakers urged the international community to deepen cooperation and partnerships with ASEAN to invest in clean and renewable energy’

To review and assess progress, the resolution called on governments to develop a regional action plan, roadmap or implementation framework for compliance. In addition, it called for a “regional approach that incentivizes the activities of the private sector and investment in areas that contribute to the promotion of the ESG



Cambodian National Assembly President Samdech Heng Samrin, who chaired the AIPA General Assembly from 20 to 25 November. After two years of virtual meetings amid the Covid pandemic, the six-day meeting was the first face-to-face annual assembly of ASEAN lawmakers since 2019.

PHOTO: LEM SAMEAN



Other Parliamentary Speakers from Lower Mekong countries – Lao National Assembly President Saysomphone Phomvihane (top), Thai National Assembly President Chuan Leekpai (middle) and Vietnamese National Assembly President Vuong Dinh Hue (bottom)

PHOTOS: LEM SAMEAN

practices in businesses and corporate transactions, including financial instruments such as sustainable loans or green bonds”.

Standards related to privacy, security and intellectual property, environmental protection and risk management should be included in commercial agreements with “wider application” in the future. At the same time, corporate governance should be strengthened – especially in the areas of human rights, information security and environmental protection – and domestic mechanisms, policies and laws should be in line with international agreements and commitments, the resolution said.

To embrace the energy transition and circular economy, reduce carbon footprints and manage climate change adaptation towards low-carbon societies, lawmakers urged the international community to deepen cooperation and partnerships with ASEAN to invest in clean and renewable energy while sharing expertise and resources, and making technology transfers.

ASEAN parliaments and governments were encouraged to take “active and proactive roles” to boost the visibility and awareness of ESG approaches and policies. These should act in unison to promote green growth, recoveries and tourism through green technologies and practices in corporate governance, environmental governance and sustainable management of scarce natural resources used in both industrial and non-industrial sectors.

Governments and the private sector were meanwhile urged to strengthen access to sustainable and green finance and access to markets – and the “internationalization of goods and services produced under strict compliance with green growth and green recovery frameworks”. The resolution said environmental policies should be in line with the interests of micro, small and medium-sized enterprises that “promote sustainable use and effective governance of natural resources as well as legislation, regulation and taxation and improvement in institutional framework arrangements”. It also called



Elder statesmen Samdech Heng Samrin, President of the Cambodian National Assembly (left), and Chuan Leekpai, President of the Thai National Assembly (right). Samdech Heng Samrin, 88, was president of Khmer People's Revolutionary Council and the People's Republic of Kampuchea between 1979 and 1989 while Chuan Leekpai, 84, served two terms as Thai prime minister between 1992 and 1995, and again from 1997 to 2001. In his opening remarks to the AIPA General Assembly in Phnom Penh on 21 November, Samdech Heng Samrin stressed the importance of promoting climate resilience, clean and renewable energy transition, green investment, and green and fair finance to be about economic recovery. "These can be achieved through an environment, social, and governance focus that further attracts foreign direct investment to our region," the incumbent AIPA president said. In a statement to the assembly's first plenary session, Chuan Leekpai noted Thailand's "green parliament" initiative. "Thailand has centered our recovery on the bio-circular-green economic model to ensure no one is left behind," he said.

PHOTO: LEM SAMEAN

Credit profiles and ESG credit impact scores of Lower Mekong countries

	Cambodia	Lao PDR	Thailand	Viet Nam
Overall Credit Profile	B2 negative	Caa3 stable	Baa1 stable	Ba2 stable
ESG Credit Impact Score	Highly Negative	Very Highly Negative	Moderately Negative	Highly Negative
Environmental Exposure	Moderately Negative	Moderately Negative	Moderately Negative	Highly Negative
Social Exposure	Highly Negative	Highly Negative	Highly Negative	Moderately Negative
Governance Exposure	Highly Negative	Very Highly Negative	Neutral-to-Low	Moderately Negative

SOURCE: MOODY'S INVESTORS SERVICE

for government measures such as publicity campaigns to “encourage applications of ESG criteria in corporate governance” in various sectors – especially smaller enterprises – and to combine such measures with e-commerce and digital media activities.

In wrapping up the annual gathering of ASEAN lawmakers, Cambodian National Assembly President Samdech Heng Samrin said the AIPA General Assembly proved that “the principles of consultation and consensus-based decision making remain fundamental to ASEAN’s unity and centrality. We have also observed that the four principles of mutual respect, understanding, trust, and interest for peace and prosperity are vital to regional integration and community building.”

ESG risks in Lower Mekong countries

In a global outlook on 9 January this year, Moody’s Investors Service said macroeconomic, financial geopolitical fallout from the Covid pandemic and the Russia-Ukraine conflict would exacerbate ESG credit risks in 2023. The New York-based credit rating agency said four ESG trends would shape credit quality. “Access and affordability risks will remain elevated, corporate decarbonization pledges will face greater scrutiny, companies will face a complex regulatory landscape and the credit cycle will test issuers’ governance capabilities,” it said.

For the four countries of the Lower Mekong Basin, ESG factors are expected to have negative impacts on current credit ratings. According to rating updates released by Moody’s in December, overall ESG credit impact scores were “highly negative” for Cambodia and Viet Nam, “very highly negative” for Lao PDR and “moderately negative” for Thailand. For environmental risks alone, the exposures were found to be moder-

ately negative for Cambodia, Lao PDR and Thailand but highly negative for Viet Nam (see table above).

Moody’s said the Vietnamese exposures included coastal flooding and water-management risks. “Over time, rising sea levels and increasing frequency of severe climate change-related weather shocks pose risks of adaption and reconstruction costs, while potentially requiring resettlement of some urban populations,” the rating agency said. “A highly negative exposure to water-management risk also reflects the impacts of upstream hydropower development and pollution of agricultural production in the Mekong River Delta.”

Further reading

AIPA. 2022. Report of the 43rd General Assembly of the ASEAN Inter-Parliamentary Assembly. Jakarta: AIPA Secretariat.

Moody’s. 2022. Government of Thailand – Ba2 stable. Update following methodology update. 2 December, 2022. New York: Moody’s Investors Service.

Moody’s. 2022. Government of Laos – Caa3 stable. Update following methodology update. 16 December, 2022. New York: Moody’s Investors Service.

Moody’s. 2022. Government of Vietnam – Baa1 stable. Update following methodology update. 16 December, 2022. New York: Moody’s Investors Service.

Moody’s. 2022. Government of Cambodia – B2 negative=. Update following methodology update. 21 December, 2022. New York: Moody’s Investors Service.

Moody’s. 2023. 2023 Outlook – Macroeconomic. Halves to exacerbate ESG credit risks. 9 January, 2023. New York: Moody’s Investors Service.

Starr, P. 2022. Asean parliaments issue clarion call for ESG action. 24 Nov, 2022. Hong Kong: The Asset.



Green borrowing forecast to drive rebound in sustainable bonds this year

Proceeds are increasingly used for water, adaptation, nature and biodiversity

Issues of green¹, social², sustainable³ and sustainability-linked⁴ bonds are expected to rebound 10 percent from a year earlier to USD 950 billion in 2023 but fall short of the record USD 1.05 trillion in 2021, according to Moody's Investors Service. In its annual outlook released on 1 February, the New York-based credit rating agency forecast that the recovery would be fueled by green bond issues, expected to climb 14 percent to USD 550 billion with a sharper focus on decarbonization commitments. Social bond volumes are expected to decline 8 percent to USD 150 billion as big borrowers reduce Covid-related financing. With increased interplays between green and social objectives, sustainability bond volumes are projected to leap 21 percent to USD 175 billion. But issues of sustainability-linked bonds are likely to remain subdued amid "credibility challenges", falling 4 percent to USD 72 billion (see

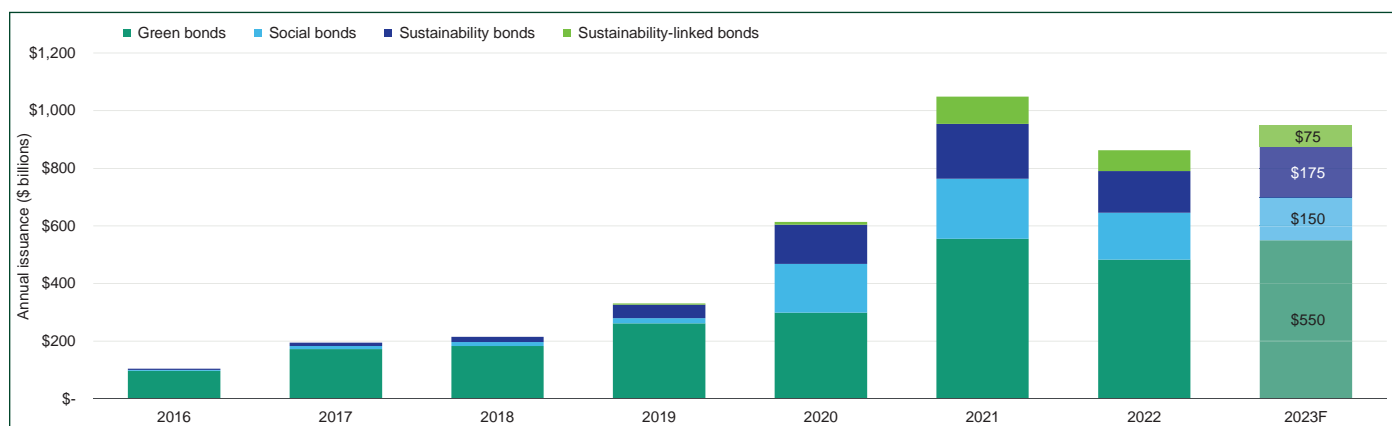
chart below).

Moody's said companies exposed to transition risks "will face growing pressure this year to follow through with credible implementation plans." At the same time, borrowers are expected to explore "increasingly diverse uses of proceeds, including water, adaptation, nature and biodiversity projects in addition to climate mitigation."

'Scrutiny over perceived greenwashing'

But "challenging macroeconomic and market conditions and greater scrutiny over perceived greenwashing will temper the overall pace of recovery," the rating agency said. "Scrutiny from investors, regulators and other market participants is heightening reputational risks for issuers claiming sustainability benefits associated with their activities. This scrutiny has intensified in recent years as the labeled bond market continues to account for a growing share of the overall capital mar-

Annual global sustainable bond issues by label



SOURCES: MOODY'S INVESTORS SERVICE AND ENVIRONMENTAL FINANCE DATA

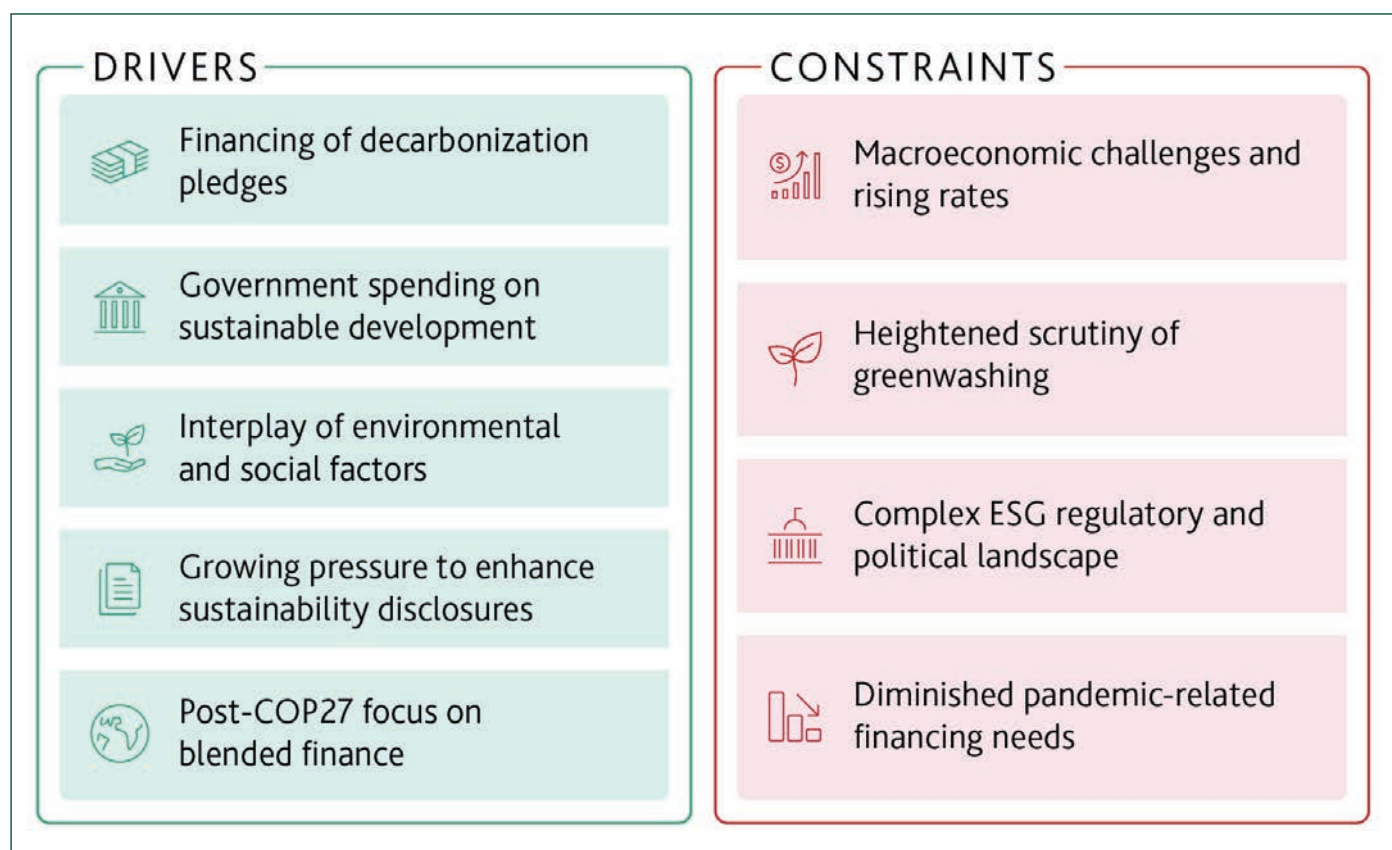
¹ Green bonds are where the proceeds will be exclusively applied to finance or refinance new and/or existing eligible green projects, such as renewable energy, energy efficiency, clean transportation, sustainable water management and green buildings.

² Social bonds are where the proceeds will be exclusively applied to finance or refinance new and/or existing eligible social projects, such as affordable basic infrastructure, access to essential services, affordable housing and food security.

³ Sustainability bonds are where the proceeds will be exclusively applied to finance or refinance a combination of new and/or existing eligible green and social projects.

⁴ Sustainability-linked bonds incentivize the issuer's achievement of material, quantitative, predetermined, ambitious, regularly monitored and externally verified sustainability objectives through knowledge performance indicators and sustainability performance targets.

Market drivers and constraints in 2023



SOURCES: MOODY'S INVESTORS SERVICE

kets. While greater attention on greenwashing risks has not derailed growth, some issuers have paused plans to bring sustainable bonds to market as concerns around quality have increased."

Moody's said more jurisdictions were expected to propose or enforce disclosure requirements on environmental, social and governance (ESG) investments in 2023. "Legal, regulatory and reputational risks stemming from ESG positioning and potential misrepresentation will rise," it said. "Prospective issuers of sustainable bonds may be reluctant to enter a market where heightened scrutiny could expose them to reputational damage, potentially constraining growth in the market over the next year."

Despite such challenges, Moody's expects greater standardization of best practices, pointing to the publication of China Green Bond Principles in July last year (see box on page 33) and the possible implementation of an EU Green Bond Standard this year. "In addition, expansion of ESG-related disclosure practices may encourage more companies to heighten their focus on incorporating sustainability into their corporate strategies," it said. "This could gradually expand the

pipeline of green and social projects, which will subsequently lead to a growing number of issuers making their sustainable bond market debuts."

'Expansion of ESG-related disclosure practices may encourage more companies to heighten their focus on incorporating sustainability into their corporate strategies'

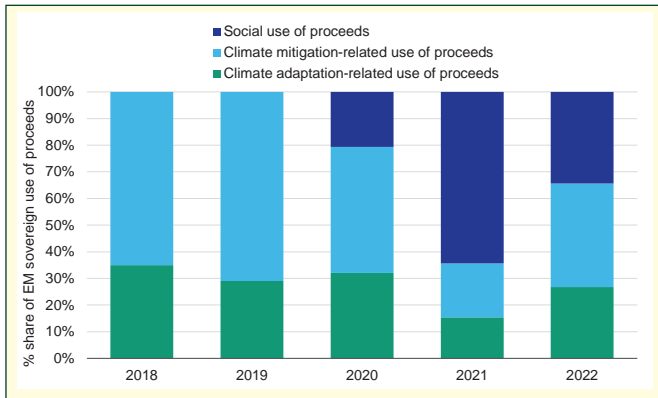
Growing scrutiny of sustainability credentials and potential greenwashing is a "largely global trend" but with differences in how regulation and sentiment are evolving in different regions. On the one hand, more jurisdictions will propose or start to enforce ESG-related disclosure requirements, raising regulatory and market scrutiny of companies' practices. On the other hand, companies in the US in particular will face growing pressure to exclude or minimize the integration of ESG considerations in business and investment decisions if they are perceived to come at the expense of shareholder returns.

Climate change and biodiversity

Moody's expects public sector issuers to "remain of



Emerging market sovereign borrowings



Mitigation-related use of proceeds includes clean transportation, eco-efficient products, energy efficiency, green buildings and renewable energy. Adaptation-related use of proceeds includes climate change adaptation, pollution prevention and control, sustainable management of living natural resources, sustainable water management and terrestrial and aquatic biodiversity conservation.

SOURCES: MOODY'S INVESTORS SERVICE AND ENVIRONMENTAL FINANCE DATA

critical importance to the sustainable bond markets in 2023 and beyond. Cross-border collaboration took center stage at the 2022 United Nations Climate Change Conference (COP27) as energy security, climate adaptation, blended finance and just transition rose up the agenda. These themes have potential to continue expansion of sustainable bond issuance from

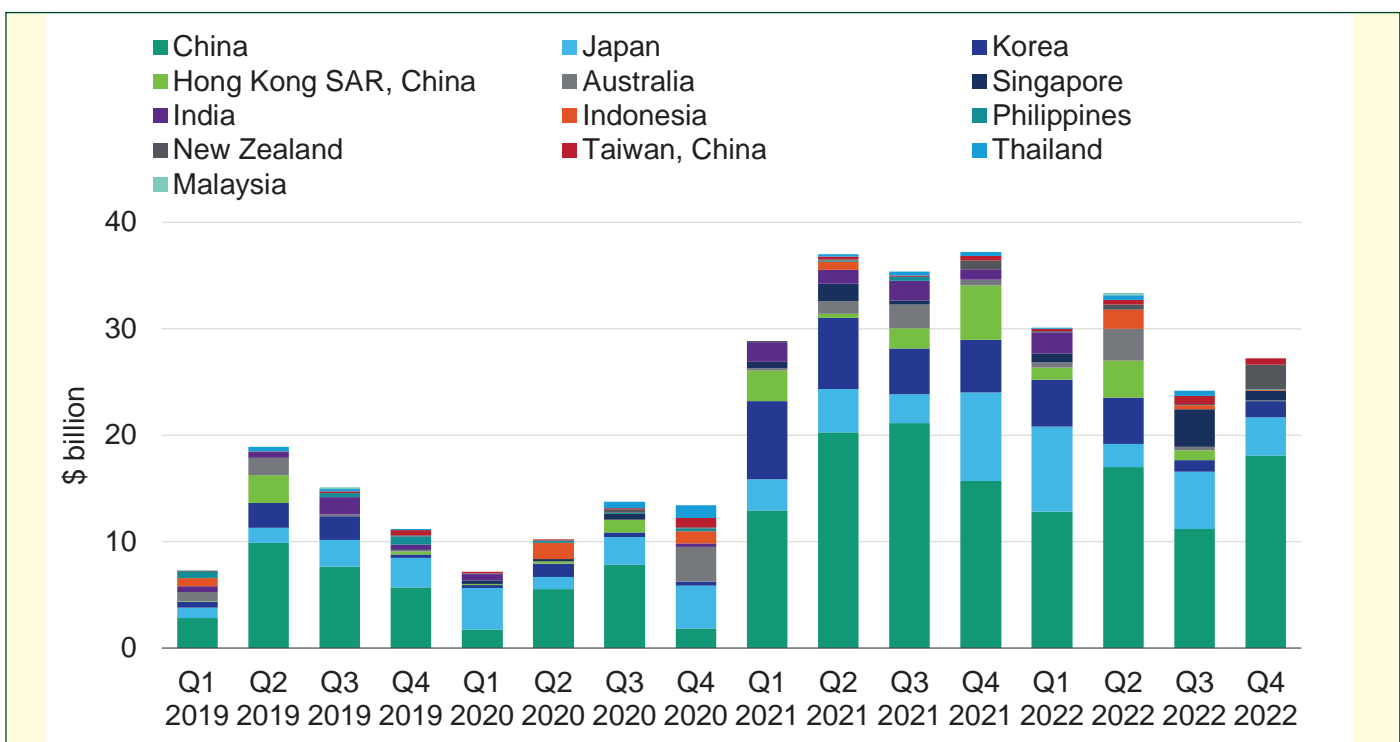
sovereign and sub-sovereign issuers, not only supporting growth in volumes but also diversifying the use of proceeds of labeled bonds."

For emerging market borrowers, climate-related use of proceeds rose 56 percent in 2022 (see chart at left). Adaptation-related financing has been of particular importance in recent years, averaging about 28 percent of share of proceeds since 2018. "We expect this continued focus on climate financing in emerging markets, and adaptation financing in particular, to grow as risks evolve and governments increasingly focus on financing resilience projects," Moody's said.

'Across Asia, governments have continued to focus efforts on developing policies and regulatory frameworks to support national carbon reduction ambitions'

Moody's also expects public sector issuers to be will 'at the forefront' of financing nature and biodiversity. "Nature has come to the fore as an emerging risk for governments to consider in their adaptation and conservation strategies, thus expanding the potential pipeline of projects for use-of-proceeds sustainable bonds," it said

Quarterly Asian-Pacific green bond issues by region



SOURCES: ENVIRONMENTAL FINANCE DATA, KOREA EXCHANGE (KRX), AND MOODY'S INVESTORS SERVICE

China's new green bond principles

On 29 July last year, the China Green Bond Standards Committee published the China Green Bond Principles with the consent of the People's Bank of China (PBOC) and the China Securities Regulatory Commission. The principles are expected to help advance the sustainable finance market in China by setting a nationally unified standard while adhering to the green bond principles of the Zurich-based International Capital Market Association.

The green bond market in China was previously governed by several different guidelines or notices issued by the PBOC, National Development and Reform Commission, and National Association of Financial Market Institutional Investors. The new principles aim to unify and clarify these guidelines by covering four types of green bonds – Standard Green Use of Proceeds Bonds, Green Project Revenue Bonds, Carbon Yield Green Bonds, and Green Asset-Backed Securities.

Further reading

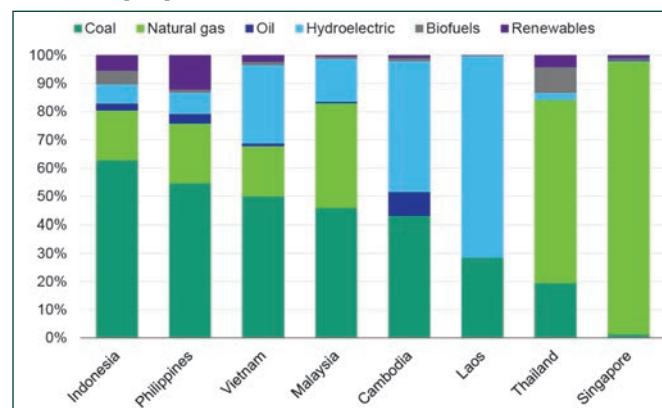
Tong, D. and A. Goto. 2022. China Green Bond Principles will support the domestic sustainable finance market's development and align with international standards. April 30, 2022. New York: Moody's ESG Solutions.

At the 2022 UN Biodiversity Conference (COP 15), over 190 countries agreed to a global biodiversity framework that aims to put biodiversity on a path to recovery by 2030. Signatories agreed to protect and restore at least 30% of the Earth's land and water, and halt human-caused extinctions of species as well as promote their recovery (see page 37).

For the Asia-Pacific region alone, Moody's expects policy and regulatory focus on green and transition finance to boost sustainable bond issues to about USD 230 billion this year, below the peak of USD 260 billion in 2021 but above USD 205 billion last year. Asia-Pacific sustainable bond issues accounted for about one-quarter of the global total last year (\$115 billion of green bonds, \$54 billion of social bonds, \$29 billion of sustainability bonds, and \$7 billion of sustainability-linked bonds).

"Across Asia, governments have continued to focus efforts on developing policies and regulatory frame-

Electricity by source in selected ASEAN economies



Renewables include geothermal, solar and wind power

SOURCE: INTERNATIONAL ENERGY AGENCY

works to support national carbon reduction ambitions. This is most notable in the areas of sustainable finance taxonomies, mandatory environmental, social and governance (ESG) disclosure requirements, decarbonization road maps, environmental regulations and green bond support schemes and guidelines."

'ESG and green regulations are at different stages of advancement across the region'

Moody's noted that ESG and green regulations are at different stages of advancement across the region. Singapore and Australia, for example, have already released centralized frameworks to boost cooperation on regional climate investment through their Green Economy Agreement in October last year. In Malaysia, Thailand and Vietnam, regulations are still taking shape. "Overall, we expect developments in this area to add momentum to sustainable bond markets in the year ahead," the rating agency said.

Further reading

ASEAN Taxonomy Board. 2021. ASEAN Taxonomy For Sustainable Finance, November, 2021: Jakarta: Association of Southeast Asian Nations.

DFAT. Singapore-Australia Green Economy Agreement. 18 October, 2022. Canberra: Department of Foreign Affairs and Trade.

Moody's. 2023. Sustainable bond issuance to rebound 10% in 2023 to \$950 billion, short of record high. 31 January, 2023. New York: Moody's investors Service.

Moody's. 2023. Policy and regulatory focus on transition to support sustainable bond issuance in 2023. 6 February, 2023. New York: Moody's investors Service.



Implications of the latest UN conferences on climate change and biodiversity

BY DENISE YOUNG *

Egypt hosted the Twenty-Seventh Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27) in Sharm el-Sheikh over two weeks in November last year. A month later, the Canadian city of Montreal hosted another two-week diplomatic marathon, the Fifteenth Conference of the Parties to the United Nations Convention on Biological Diversity (COP15). A COP veteran looks at what the outcomes imply for developing countries.

COP27 ON CLIMATE CHANGE

The Twenty-Seventh Conference of the Parties wrapped up on 20 November, and the outcome was immediately dubbed a historic win for developing countries thanks to a decision to set up a fund for those on the frontlines of the climate emergency. The significance of this cannot be understated: it has transformed the developing country narrative in this process, conferring agency, leadership and the ability to drive change.

The meeting had been billed as an “African COP” which would deliver for developing countries, and seen as underwhelming on ambition for emissions reductions, the 1.5° C target¹ and coal phase-downs. Almost 200 countries agreed to set up a fund to cover the “loss and damage” that “particularly vulnerable” nations are suffering from climate change. The new structure will be set up by the time COP28 convenes in Dubai in 2023 and the recipients will be decided by a committee of countries.

Responding to loss and damage

In the final agreement, known as the Sharm el-Sheikh Implementation Plan, parties said they welcomed “for the first time” considering matters relating to “funding

¹ Global warming scenario of 1.5° C above pre-industrial levels

² Established by 77 developing countries at the end of the UN’s First Conference on Trade and Development in Geneva in 1974, the Group of 77 is the largest intergovernmental organization of developing countries within the United Nations. The G77 now has 134 members including all ten members of the Association of Southeast Asian Nations (ASEAN).

arrangements responding to loss and damage associated with the adverse effects of climate change.” In another first, the parties recognized the “right to a clean, healthy and sustainable environment” when taking action to address climate change. The agreement “downgraded” the 1.5° C target, to the “science” section compared to COP26 in Glasgow in 2021 where it appeared in the “mitigation” section dealing with solutions to climate change.



Tensions among delegates

PHOTO: KLARA WORTH/UNFCCC

Was it the most chaotic, badly organized COP that history has ever seen? Quite possibly. But more importantly, it transformed the developing country dynamic in the UN climate change process from one of victim to one of agency and empowerment.

Pakistan unites developing world including China

Bringing developing countries together was Pakistan as president of the G77² plus China negotiating bloc and victim of unprecedented floods which put one-third of the country under water in 2022. Pakistan made a



Senator Sherry Rehman, Pakistan's Minister for Climate Change, addresses the conference. Pakistan chaired the Group of 77 in 2022. Cuba assumed the chairmanship on 12 January this year.

PHOTO: KLARA WORTH/UNFCCC

powerful case for compensation as climate justice, not as charity.

The significance of the loss and damage decision is that developing countries came together in support of a common cause, despite efforts by the EU and others to divide the group, and push the poorest of the 77 to accept a smaller fund. This fundamentally changes the dynamic of the process, what the stakes are, what constitutes a "win" and a "loss", for whom and how.

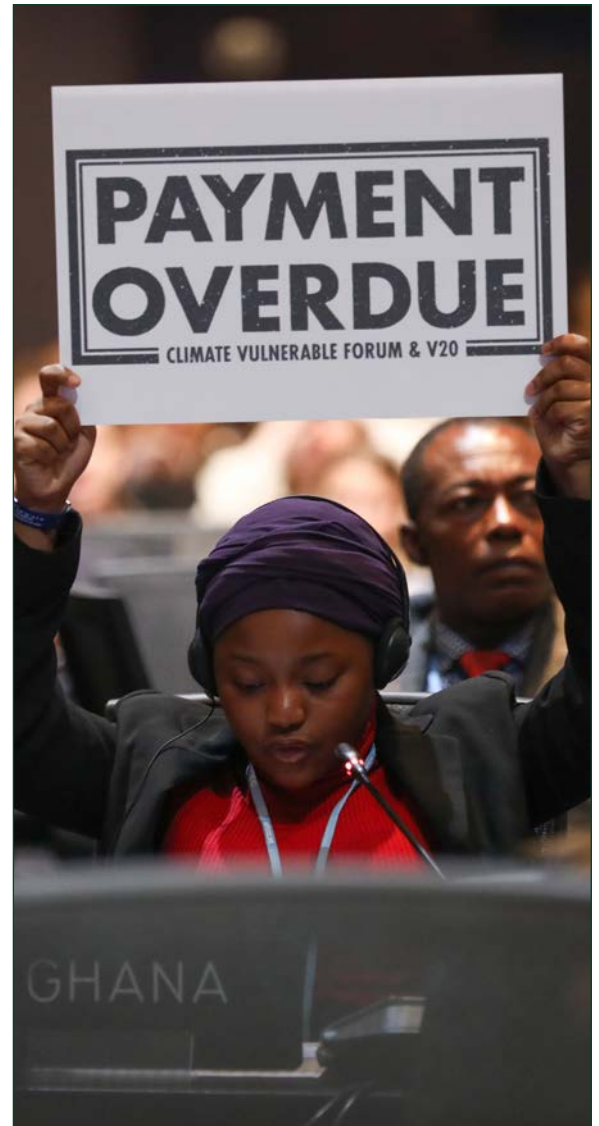
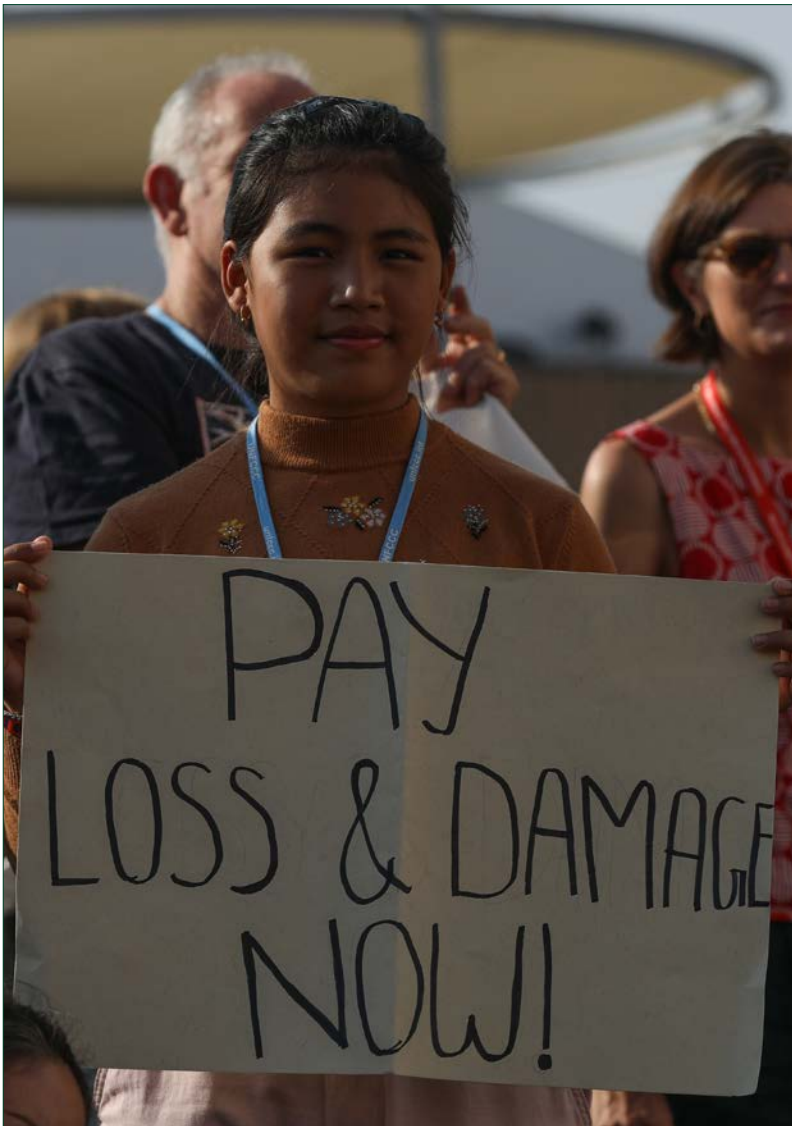
Bridgetown Agenda

Another hopeful outcome for the most vulnerable countries was an initiative led by Barbados Prime Minister Mia Mottley, who emerged as a climate champion at COP26 in Glasgow with a memorable speech.



China's Special Climate Envoy Xie Zhenhua addresses the conference

PHOTO: KLARA WORTH/UNFCCC



Protests demanding compensation for especially vulnerable developing countries extended from outside the venue (left) to inside the conference (right)

PHOTO: KLARA WORTH/UNFCCC

Known as the Bridgetown Agenda to Reform International Finance, the Barbados initiative was a rallying point for many at COP27. Its next steps are a concrete proposal to present to the spring meetings of the World Bank and International Monetary Fund (IMF) followed by a summit hosted by France in June. The Bridgetown Agenda is based on a three-pronged approach that seeks to:

- extend emergency IMF relief and long-term concessional funding for development, lent over at least 30 years, to prepare for the future.
- expand lending capacity of multilateral development banks to developing nations by USD 1 trillion to be invested in climate resilience.

- develop long-term instruments that can mobilise USD 3 to 4 trillion in finance for carbon-cutting projects and a mechanism for raising reconstruction grants to help nations rebuild after climate disasters.

‘Developing countries need revenue to finance their way to net zero emissions’

Prime Minister Mottley’s status as a climate champion is viewed with ambivalence by some in advanced countries because she defends fossil fuel exploration off the coast of Barbados, saying that developing countries need revenue to finance their way to net zero emissions. This is not uncommon

among many developing countries, who argue that they need both green energy and fossil fuels to ensure a smooth energy transition.

COP15 ON BIODIVERSITY

“This is a great moment for the world but not the final step. Our relationship with the living world is in serious danger that endangers all life on this planet. There is a lot more work to do.” Those powerful words from the Namibian delegate summed up the challenge that lies ahead after the gruelling COP15 meeting in Montreal was gavelled to a close in the pre-dawn hours of December 19.

Countries agreed to a new global deal on nature with 4 goals, 23 targets, including making 30 percent of land and ocean a protected area to save wildlife and

ecosystems, and to cut food waste in half by 2030. This Global Biodiversity Framework adopted by 196 countries to halt and reverse nature loss is a big deal. It commits to conserving nearly a third of Earth for nature by 2030 and highlights the importance of effective conservation management to protect wetlands, rainforests, grasslands and coral reefs. As ever, finance was a thorny point throughout – even after the adoption of the historic deal, the Democratic Republic of the Congo and Uganda protested that their concerns over the financial mechanism and resource mobilization were ignored.

Highlights

Target 15 on corporate accountability in the end dropped the original “mandatory” requirement, and compromised on asking large national and transna-



Prime Minister Mottley – a climate champion from COP26 in Glasgow in 2021 - addresses the conference. Her Bridgetown Agenda to Reform International Finance became a rallying point for many at COP27 meeting in Sharm el-Sheikh.

PHOTO: KLARA WORTH/UNFCCC



China's Ecology and Environment Minister Huang Runqiu – the chair of COP15 – gaveling the conference to a close after delegates adopt the Kunming-Montreal Global Biodiversity Framework on 22 December. The conference was initially scheduled to be held in the Chinese city of Kunming. Given China's stringent Covid restrictions, the venue was changed to Montreal, where the Secretariat of the Convention of Biological Diversity is based.

PHOTO: CBD SECRETARIAT

tional companies and financial institutions to:

- regularly monitor, assess and transparently disclose their risks, dependencies and impacts on biodiversity
- provide information needed to consumers to promote sustainable consumption patterns

There are promises of money (as opposed to money on the table). Countries aim to ensure USD 200 billion per annum goes to conservation initiatives, from public and private sources. Developed countries should contribute at least USD 20 billion of this every year by 2025, and at least USD 30 billion a year by 2030.

Target 19 addresses the need to leverage private finance by promoting blended finance, implementing strategies for raising new and additional resources, and encouraging the private sector to invest in biodiversity, including through impact funds and other instruments.

‘The new global framework has a concrete plan for implementation’

Unlike the Aichi Targets – a set of 20 biodiversity-related goals adopted by the Conference of the Parties to the Convention on Biological Diversity (CBD) in Japan in 2010 – the new global framework has a concrete plan for implementation whereby all countries translate global goals into national goals. Negotiations were fraught and complex. Reflecting how hard it is to land agreement with 196 countries in a room, Mexican delegates offered fellow delegates bottles of tequila for every bracket in the text they could delete (bracketed text had not yet been agreed with entire sections sometimes in brackets).

‘The idea that nature can no longer be taken for granted – and that everything in the economy is dependent on nature – has been mainstreamed’

The Global Biodiversity Framework replaces the Aichi Targets. None of these were achieved, for reasons ranging from no financial resources to no mechanism for accountability. Yet 2022 was a very different story from 2010. The idea that nature can no longer be taken for granted – and that everything in the economy is dependent on nature – has been mainstreamed. This

is partly thanks to recent reports such as those by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services in 2019 and the Dasgupta report on the economics of biodiversity by the British Treasury in 2021.

** Ms Young is the Paris-based publisher of The Zeroist, a monthly finance newsletter aimed at those seeking new economic narratives that go beyond the orthodox assumptions of mainstream media or with no time to dig through the latest research on green finance (<https://thezeroist.substack.com>). She is also the director of Climate Narratives which broadcasts New Climate Capitalism, a podcast featuring interviews with change-makers working at the intersection of finance, climate and activism (<https://climatenarratives.co/New-Climate-Capitalism/>). Originally from Hong Kong, Ms Young has advised world leading climate scientists on communications and was an active participant in the UN Climate Change Conference that brokered the Paris Agreement in 2015.*

Further reading

CBD. 2022. COP15: Nations adopt four goals, 23 targets for 2030 in landmark UN biodiversity agreement. 19 December, 2022. Montreal: Convention on Biological Biodiversity.

Dasgupta, P. 2021. The Economics of Biodiversity: The Dasgupta Review. London: HM Treasury.

Farand, C. 2022. Mia Mottley builds global coalition to make financial system fit for climate action. 23 September, 2022. Broadstairs, United Kingdom: Climate Home News.

Group of 77. 2023. Statement by H.E. Mr. Bruno Rodríguez Parrilla, Minister Of Foreign Affairs of the Republic Of Cuba, at the Handover Ceremony of the Chairmanship of the Group Of 77 and China. 12 January, 2023. New York: G 77 Executive Secretariat.

Hodgson, C. 2022. Barbados PM defends fossil fuel exploration off coast of island nation. 8 March, 2022. London: Financial Times.

IPBES. 2019. Global assessment report on biodiversity and ecosystem services. Bonn, Germany: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

Lakhini, N. 2022. ‘We couldn’t fail them’: how Pakistan’s floods spurred fight at Cop for loss and damage fund. 21 November, 2022. London: The Guardian.

MFA. The 2022 Bridgetown Initiative. 23 September 2022. Bridgetown: Ministry of Foreign Affairs and Foreign Trade.

Peel, J. 2022. It’s the big issue of COP27 climate summit: poor nations face a \$1 trillion ‘loss and damage’ bill, but rich nations won’t pay up. 10 November, 2022. Melbourne, Australia: The Conversation.

Reuters. 2009. G77 condemns Danish text as dangerous, insult to COP15 president. 10 December, 2009. London: Reuters <https://reuters.screenocean.com/record/568660>.

UNFCCC. 2022. Sharm el-Sheikh Implementation Plan. Revised draft decision-/CMA.4. 20 November, 2022. Bonn, Germany: United Nations Framework Convention on Climate Change.



Endangered fishes among thousands released near Cambodian Royal Palace

Event highlights plight of three Mekong species facing high risks of extinction in the wild

Cambodia's Ministry of Agriculture, Forestry and Fisheries (MAFF) celebrated the New Year by joining the United States Agency of International Development (USAID) and the University of Nevada in releasing an estimated 5,000 fish in front of the Royal Palace in Phnom Penh. The event took place on 13 January at Chaktomuk where the upper Cambodian stretch of the Mekong and the Tonle Sap Rivers join the lower stretch and the Bassac River (Chaktomuk means "four

mouths" in Khmer, translated as Quatre Bras or "four branches" during French colonial rule).

The release focussed on the critically endangered Mekong giant catfish (*Pangasianodon gigas*) and giant barb (*Catlocarpio siamensis*, also recognized as Cambodia's national fish) and the endangered striped catfish (*Pangasianodon hypophthalmus*). According to the Red List of Threatened Species assessed by the International Union for the Conservation of Nature (IUCN) in Switzerland, the former two fishes face an "extremely high risk of extinction in the wild in the immediate future." The latter – a highly migratory fish that was once



One of two critically endangered Mekong giant catfish released in Phnom Penh on 13 January. Both individuals were about 1.6 m long and weighed around 50 kg.

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



Fisheries Administration Director-General Phum Sotha (left) and Ministry of Environment Secretary of State Neth Pheaktra (third from left) release the Mekong giant catfish pictured opposite as USAID Acting Mission Director Hanh Nguyen (second from left) and MAFF Secretary of State Has Sareth (fourth from left) look on

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



University of Nevada strengthens fisheries cooperation with Cambodia

The University of Nevada has inaugurated a limnology laboratory at a government research institute in Phnom Penh and signed a memorandum of understanding on natural resource conservation with Cambodia's Royal University of Agriculture. The latest strengthening of ties between the American university and Cambodia came during a visit to the country by University of Nevada President Brian Sandoval in January this year.

'The lab contains state-of-the-art equipment for understanding water chemistry'

Aimed at studying freshwater ecosystems, the new limnology lab is located at the Inland Fisheries Research and Development Institute (IFReDi) of the Cambodian Fisheries Administration, part of the Ministry of Agriculture, Forestry and Fisheries (MAFF). Mr Sandoval inaugurated the new lab on 12 January with United States Ambassador Patrick Murphy, MAFF Secretary of State Has Sareth and Fisheries Administration Director-General Phoum Sotha (see photo).

According to the American university, the lab contains state-of-the-art equipment for understanding water chemistry. "Over 200 water samples from around the country have already been collected and analyzed," it said, describing the facility as "another step towards establishing long-term monitoring of Cambodia's lakes and rivers. This lab will provide critical data to help protect the health of fish, wildlife,

and people who depend on Cambodia's aquatic resources daily."

Mr Sandoval signed the MOU with Royal University of Agriculture Rector Ngo Bunthan on 13 January (see photo opposite below). "This event formalizes a partnership between students and researchers in Cambodia and the United States dedicated to preserving Cambodia's wildlife and natural resources," the American university said. "In addition, the document outlines goals and highlights future opportunities for collaborative research, education, and cultural exchanges."

During his visit to the university, Mr Sandoval also inaugurated a fish collection room at the Faculty of



Mr Sandoval inaugurates the new lab as MAFF Secretary of State Has Sareth (left), Ambassador Patrick Murphy (second from left) and MAFF Undersecretary of State Khun Savoeun (right) look on

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG

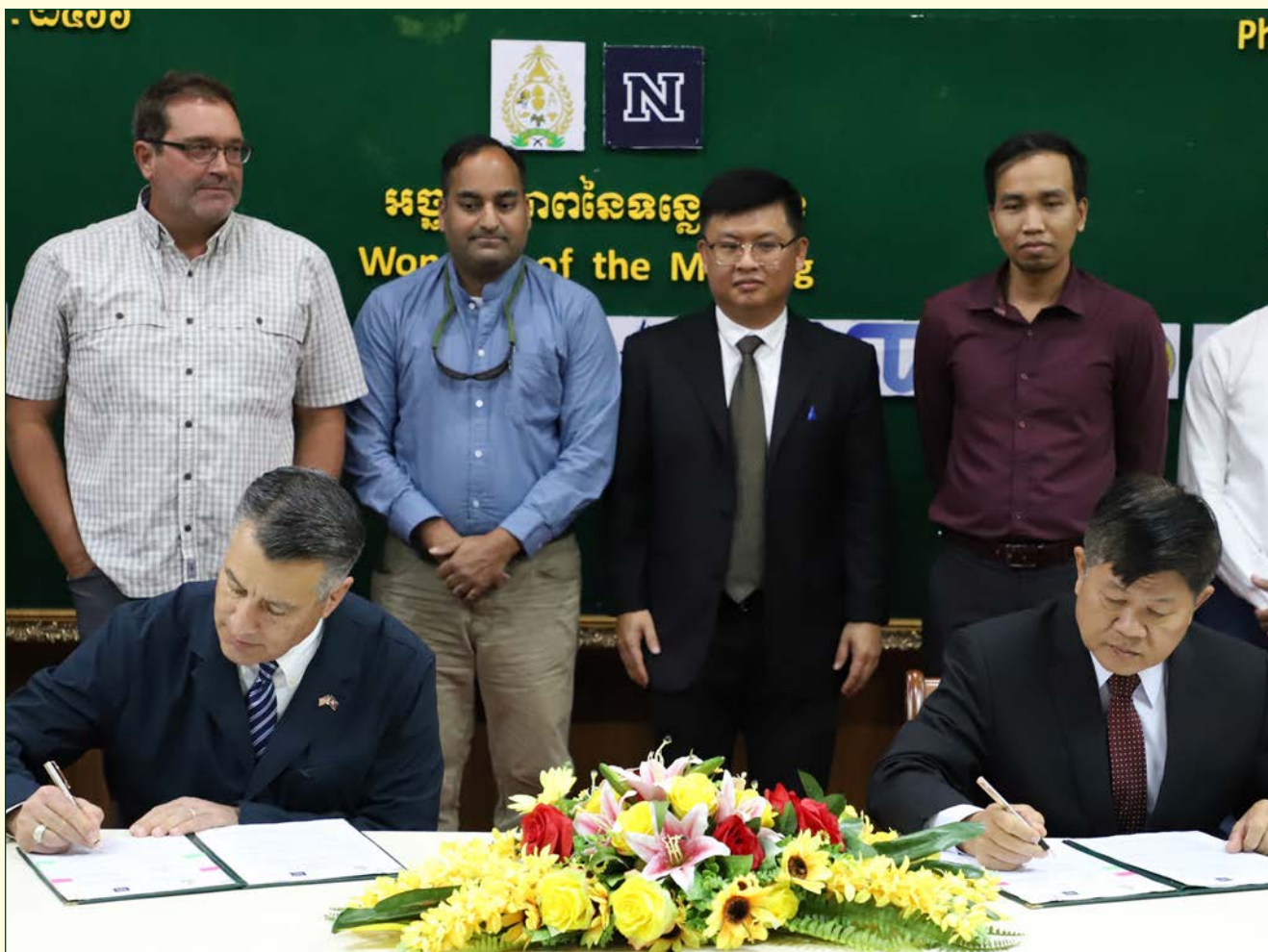
Fisheries where by Dr Ngor Peng Bun – a former capture fisheries specialist at the Mekong River Commission - has been serving as dean since 2022.

University of Nevada cooperation with the Cambodian fisheries sector dates back to 2017 when its Global Water Center in Reno launched a project with the Fisheries Administration (see *Catch and Culture - Environment*, Vol 23, No. 1). Known as Wonders of the Mekong, the project is funded by the United States Agency for International Development (USAID).



Monks bless the new fish collection room at the Royal University of Agriculture's Faculty of Fisheries

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



Mr Sandoval (left) signs the memorandum of understanding with Royal University of Agriculture Rector Ngo Bunthan (right) as faculty members of the two universities look on

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



a staple food in the region – faces a “very high risk of extinction in the wild in the near future.”

Highlighting the release were two giant catfish individuals raised by fish farmer Cheng Mouychhen. Each weighed about 50 kg and measured more than 1.6 m. “I am happy that my family can contribute to endangered fish conservation,” Mrs Mouychhen said. “This is what my husband wished before he passed away, to release these fishes back into the Mekong River.”

MAFF Secretary of State Has Sareth highlighted the importance of conserving such fish. “We want to encourage policies that enable this important resource to thrive in the wild,” he said. USAID Acting Mission Director Hanh Nguyen made similar remarks. “It is essential that we work together to save and conserve ecologically important and critically endangered fish species, like the Mekong giant catfish, in order to keep

the Mekong River healthy,” she said. “This will conserve natural ecosystems to support communities, wildlife, and economic activity across Cambodia.”

Under a USAID-funded project known as Wonders of the Mekong, the University of Nevada has collaborated with MAFF in tagging and releasing endangered fish through its Inland Fisheries Research and Development Institute (IFReDI), part of the Cambodian Fisheries Administration. Referring to the release on 13 January, Project Leader Zeb Hogan said: “The addition of these fish, together with parallel efforts to protect wild fish and their habitats, represent a significant contribution to the persistence of these species in the wild.” Dr Hogan – a research associate professor at the university – has been working to conserve giant species such as the Mekong giant catfish for two decades.

In a joint statement, USAID, University of Nevada and



Students from the Faculty of Fisheries at the Royal University of Agriculture hold one of the giant barb among the estimated 5,000 fish released in Phnom Penh on 13 January. Now critically endangered, the giant barb is recognized as the national fish of Cambodia.

PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG



Students from the Faculty of Fisheries at the Royal University of Agriculture releasing striped catfish on 19 January. Once a staple food in the region, the species is now assessed as endangered. In Cambodia, wild individuals are increasingly rare in markets and most consumers have to rely on farmed striped catfish instead.

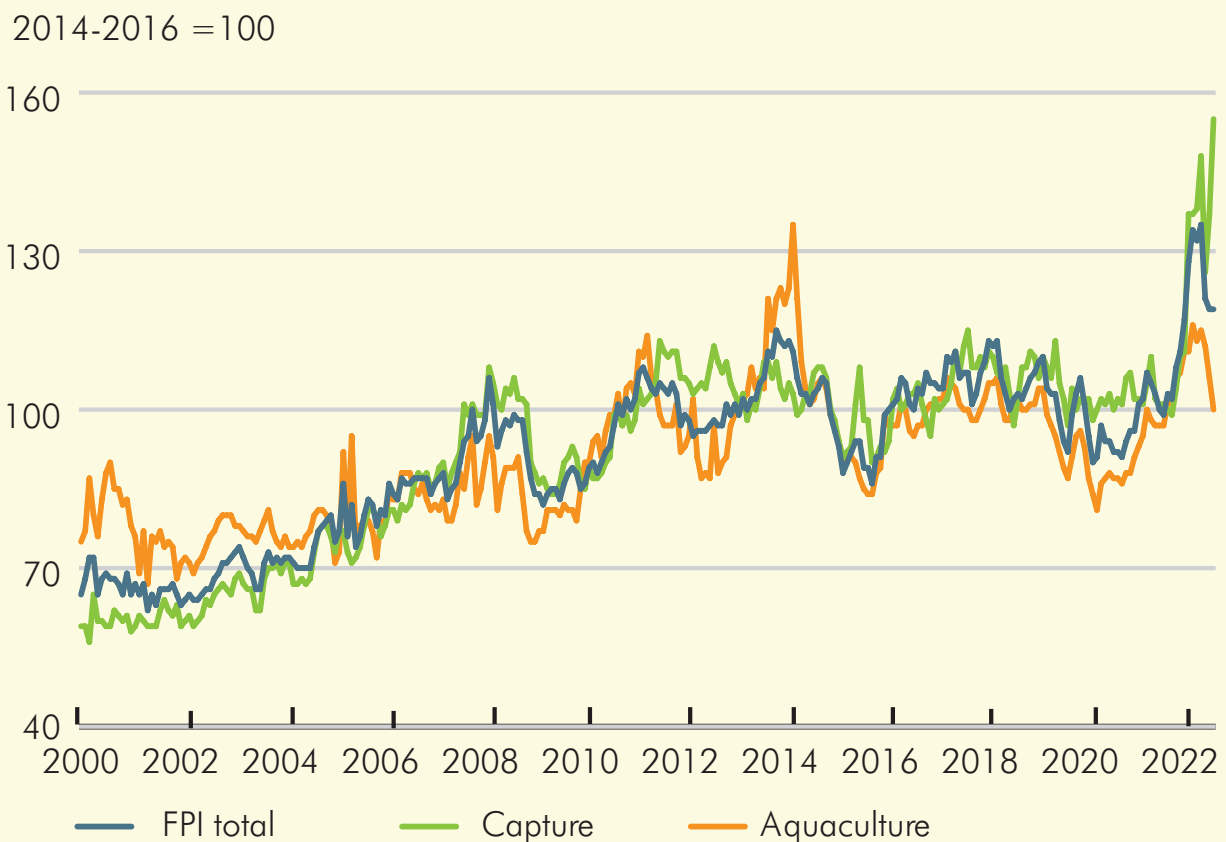
PHOTO: CHHUT CHHEANA / WONDERS OF THE MEKONG

the Fisheries Administration noted that the populations of some of the endangered species had plunged by as much as 99 percent in recent decades. Scientists hope the fish release "will lead to more concerted and coordinated conservation action, including greater outreach to communities living along the Tonle Sap and Mekong rivers," it said "The giant catfish have all but disappeared from rivers outside Cambodia. Today, the Southeast Asian country is widely recognized as being the best hope for the persistence and recovery of the species."

The statement said Cambodia was recognized as "the last stronghold of the Mekong River's freshwater giants. In addition to the giant catfish, it highlighted the importance of conserving the giant barb along with other giant endangered fish species including Jullien's carp (*Probarbus jullieni*) and the giant freshwater whipray (*Urogymnus polylepis*). A 300 kg specimen of the latter caught in northern Cambodia in 2022 has been confirmed as the world's biggest freshwater fish, surpassing the 293-kg record for a Mekong giant catfish caught in Thailand in 2005 (see *Catch and Culture - Environment*, Vol 28. No 2).



FAO Fish Price Index



Source of the raw data for the FAO Fish Price Index: EUMOFA, INFOFISH, INFOPESCA, INFOYU, Statistics Norway.

Production, trade, utilisation and consumption FAO Food Outlook, November, 2022	2020	2021 Estimate	2022 Forecast	Change 2022/2021
	Million tonnes			%
Production	177.8	182.0	184.1	+1.2
Capture fisheries	90.3	92.3	92.1	- 0.2
Aquaculture	87.5	89.7	92.0	+2.6
Trade value (exports USD billion)	150.9	174.8	193.5	+10.7
Trade volume (live weight)	64.3	68.3	68.9	+ 0.8
Total utilisation	177.8	182.0	184.1	+1.2
Food	157.4	161.1	163.7	+1.6
Feed	16.4	16.9	16.4	- 2.8
Other uses	4.0	4.0	4.0	+ 1.1
Consumption per person				
Food fish (kg/year)	20.1	20.4	20.5	+0.8
From capture fisheries (kg/year)	8.9	9.0	9.0	+0.5
From aquaculture (kg/year)	11.2	11.3	11.5	+1.8
FAO Fish Price Index (2014 – 2016 = 100)	2020	2021	2022 Jan-Apr	Change Sep 2022/Sep 2021
	94.9	101.7	124.0	+22.8

Thailand Talaad Thai Wholesale Market, Pathum Thani Province		THB per kg	
		Nov, 2022	Feb, 2023
Item		Price	
Chinese edible frog (<i>Haplobatrachus rugulosus</i>) (small)	กบนา (เล็ก)	90 - 95	110
Asian redbtail catfish (<i>Hemibagrus wyckioides</i>)	ปลากดคัง	140 - 250	190 - 220
Yellow mystus (<i>Hemibagrus filamentus</i>)	ปลากดเหลือง	125 - 150	125 - 150
Tire track eel (<i>Mastacembelus favus</i>)	ปลากะรัง	145 - 260	260 - 280
Clown featherback (<i>Chitala ornata</i>)	ปลากราย	190 - 300	190 - 300
Great white sheatfish (<i>Wallago attu</i>) (small)	ปลาเค็มขาว (เล็ก)	120	150 - 170
Great white sheatfish (<i>Wallago attu</i>) (large)	ปลาเค็มขาว (ใหญ่)	180 - 200	200 - 220
Farmed North African walking catfish hybrid (<i>Clarias</i> spp.) (small)	ปลาดุก เลียง (เล็ก)	42 - 45	38
Farmed North African walking catfish hybrid (<i>Clarias</i> spp.) (large)	ปลาดุก เลียง (ใหญ่)	43 - 47	40
Bronze featherback (<i>Notopterus notopterus</i>)	ปลาสร้อย หรือ ปลาสร้อย	90	90
Farmed giant snakehead (<i>Channa micropeltes</i>) (small)	ปลาชะโด เลียง (เล็ก)	60 - 80	80 - 110
Farmed giant snakehead (<i>Channa micropeltes</i>) (large)	ปลาชะโด เลียง (ใหญ่)	95 - 100	80 - 110
Silver barb (<i>Barbonymus gonionotus</i>) (small)	ปลาดตะเพียนขาว หรือ ปลาดตะเพียนเงิน (เล็ก)	30 - 35	38 - 40
Silver barb (<i>Barbonymus gonionotus</i>) (large)	ปลาดตะเพียนขาว หรือ ปลาดตะเพียนเงิน (ใหญ่)	48 - 50	45 - 50
Red tilapia hybrid (<i>Oreochromis</i> spp.) (small)	ปลานิลแดง (เล็ก)	60 - 65	75 - 79
Red tilapia hybrid (<i>Oreochromis</i> spp.) (large)	ปลานิลแดง (ใหญ่)	70 - 78	84 - 87
Nile tilapia (<i>Oreochromis niloticus</i>) (small)	ปลานิล (เล็ก)	30 - 38	42 - 45
Nile tilapia (<i>Oreochromis niloticus</i>) (large)	ปลานิล (ใหญ่)	48 - 55	52 - 55
Mekong giant catfish (<i>Pangasianodon gigas</i>)	ปลาบึก	60 - 65	60 - 65
Boeseman croaker (<i>Boesemania microlepis</i>)	ปลาบ้า	220 - 350	220 - 350
Horse-face loach (<i>Acantopsis choirorhynchus</i>)	ปลารากกล้วย	140 - 150	190 - 220
Giant gourami (<i>Osphronemus goramy</i>) (large)	ปลาแรด (ใหญ่)	-	80 - 85
Siamese mud carp (<i>Henicorhynchus siamensis</i>)	ปลาสร้อยขาว	32 - 35	50 - 60
Snakeskin gourami (<i>Trichopodus pectoralis</i>)	ปลาสร้อย	100 - 190	100 - 190
Striped catfish (<i>Pangasianodon hypophthalmus</i>)	ปลาสวาย	30 - 33	28 - 33
Spot-fin spiny eel (<i>Macrogathus siamensis</i>) (small)	ปลาหลดจุด (เล็ก)	150	180
Spot-fin spiny eel (<i>Macrogathus siamensis</i>) (large)	ปลาหลดจุด (ใหญ่)	200	220
Whisker sheatfish (<i>Kryptopterus</i> spp.) (small)	ปลาช่อน (เล็ก)	120 - 140	100 - 130
Whisker sheatfish (<i>Kryptopterus</i> spp.) (large)	ปลาช่อน (ใหญ่)	350 - 400	150 - 160
Iridescent mystus (<i>Mystus multiradiatus</i>) (small)	ปลาแขยง (เล็ก)	100 - 130	100 - 130
Iridescent mystus (<i>Mystus multiradiatus</i>) (large)	ปลาแขยง (ใหญ่)	150 - 160	150 - 160
Siamese red catfish (<i>Phalacroglanis bleekeri</i>) (small)	ปลาแดง (เล็ก)	140 - 170	140 - 170
Siamese red catfish (<i>Phalacroglanis bleekeri</i>) (large)	ปลาแดง (ใหญ่)	300 - 350	300 - 350
Common carp (<i>Cyprinus carpio</i>) (large)	ปลานิล (ใหญ่)	35 - 40	35 - 40
Rice-field eel (<i>Monopterus javanensis</i>) (small)	ปลาไหลนา หรือ ปลาไหลบึง นาข้าว (เล็ก)	300 - 320	300 - 320
Rice-field eel (<i>Monopterus javanensis</i>) (large)	ปลาไหลนา หรือ ปลาไหลบึง นาข้าว (ใหญ่)	250 - 270	250 - 270
Pond snail (<i>Filopaludina martsensi</i>)	หอยขม	45 - 130	45 - 130

Viet Nam Vietnam Association of Seafood Exporters and Producers (VASEP) Dong Thap in the Mekong Delta except black tiger shrimp (Da Nang)			VND per kg unless otherwise stated	
			Nov, 2022	Feb, 2023
Marketable-size item				
Pangasius (<i>Pangasianodon hypophthalmus</i>) (white flesh)	Cá tra thịt trắng	0.7 – 0.8 kg	29,000 – 30,000	28,000 – 29,000
Red tilapia (<i>Oreochromis</i> spp.)	Cá điêu hồng	> 300 g – 1,000 g	39,000 – 40,000	38,500 – 40,000
Snakehead (<i>Channa</i> spp.)	Cá lóc nuôi	1.0 – 1.2 kg	38,000 – 40,000	43,000 – 44,000
Snakeskin gourami (<i>Trichopodus pectoralis</i>)	Cá sặc rần	8 con/kg	52,000 – 55,000	37,000 – 40,000
Climbing perch (<i>Anabas testudineus</i>)	Cá rô đầu vuông	4 – 5 con/kg	37,000 – 39,000	31,000 – 34,000
Japanese wrinkled frog (Thai strain) (<i>Glandirana rugosa</i>)	Éch Thái	3 – 5 con/kg	39,000 – 41,000	53,000 – 55,000
Giant freshwater prawn (<i>Macrobrachium rosenbergii</i>)	Tôm càng xanh	15 – 25 con/kg	200,000 – 220,000	200,000 – 220,000
Black tiger shrimp (<i>Penaeus monodon</i>)	Tôm sú	15 con/kg	480,000	470,000
Black tiger shrimp (<i>Penaeus monodon</i>)	Tôm sú	25 – 30 con/kg	280,000	260,000
Black tiger shrimp (<i>Penaeus monodon</i>)	Tôm sú	40 con/kg	240,000	160,000
Seed				
Pangasius fry (<i>Pangasianodon hypophthalmus</i>)	Cá tra bột	Per fry (bột)	1.6 – 2.0	1.6 – 2.0
Pangasius fingerlings (<i>Pangasianodon hypophthalmus</i>)	Cá tra giống	28 – 35 con/kg	32,000 – 33,000	38,000 – 42,000
Red tilapia fingerlings (<i>Oreochromis</i> spp.)	Cá điêu hồng giống	35 con/kg	31,000 – 33,000	31,000 – 35,000
Japanese wrinkled frog fry (Thai strain) (<i>Glandirana rugosa</i>)	Éch Thái giống	500 con/kg	600 – 700	500 – 600
Giant freshwater prawn (<i>Macrobrachium rosenbergii</i>) P/L*	Tôm càng xanh post*	100,000 con/kg	100 – 120	100 – 120

* all male



Cambodian National Assembly President Samdech Heng Samrin (top left), Lao National Assembly President Saysomphone Phomvihane (top right), Thai National Assembly President Chuan Leekpai (bottom left) and Vietnamese National Assembly President Vuong Dinh Hue (bottom right) at the annual ASEAN Inter-Parliamentary Assembly (AIPA) meeting in Phnom Penh in November last year. Held in person for the first time in three years, the AIPA General Assembly adopted a resolution to promote environmental, social and governance (ESG) practices including performance indicators (see page 26).

PHOTOS: LEM SAMEAN



184 Fa Ngoum Road,
PO Box 6101, Vientiane, Lao PDR
Tel: (856-21) 263 263 Fax: (856-21) 263 264

Solar aquaculture farm emerges on mudflats of Pearl River Delta in China

Company says modules installed above water reduce mortalities

China's Trina Solar Co Ltd has announced the completion of 100 MW photovoltaic system for fish ponds in Taishan in the Pearl River Delta in southern Guangdong Province. In a statement released on 14 February this year, Singapore subsidiary Trina Solar Energy Development Pte Ltd said the system could "withstand harsh maritime environments" and was being used for fish and shrimp breeding after being connected to the grid.

"The climate in the marine mudflat location places particularly tough demands for modules' safety and reliability, such as potential induced degradation, corrosion of electrical equipment, tougher installation, construction," it said.

Trina Solar said the benefits of solar modules installed above water included providing shade to ponds, reducing water temperature, cutting evaporation and effectively blocking strong sunlight "which significantly reduces the incidence of fish dying."

The company said its previous involvements with the aquaculture sector included a 60 MW floating system in Singapore and a 70 MW fishery project in China's central Hebei Province.

Owned by energy and urban development company Sembcorp Industries Ltd, the Sembcorp Tengeh Floating Solar Farm at Singapore's Tengeh Reservoir is one of the largest inland floating solar farms in the world, covering 45 ha. Equipped with 122,000 Trina Solar modules, it opened in July 2021 after a construction period of 12 months.



Photovoltaic system for ponds in Taishan in the Pearl River Delta

PHOTO: TRINA SOLAR



Trina Solar says the benefits of modules above water include providing shade to ponds which – along with other benefits – can significantly reduce mortalities

PHOTO: TRINA SOLAR

“With this project, the Tengeh Reservoir doubles up as a source for renewable energy, in addition to being an area for water catchment,” the Singapore company said in its annual report for 2021. “We will look at opportunities to implement similar projects in other countries where there are large water bodies or land scarcity constraints.”

Based in Changzhou in the eastern Chinese province of Jiangsu, Trina Solar is one of the world’s top manufacturers of photovoltaic modules, delivering more than 100 GW of modules since being founded in 1997. In 2020, it was listed on the STAR market, the

science and technology board of the Shanghai Stock Exchange.

Further reading

Semcorp. 2021. Transforming from Brown to Green. Semcorp Industries Annual Report 2021. Singapore: Semcorp Industries Ltd.

Trina Solar. 2021. Trina Solar 210 Vertex Modules Provides Backbone for 60MW Solar Farm in Singapore, One of World’s Largest Inland Floating Solar PV Systems. 24 August, 2021. Changzhou, China: Trina Solar Co Ltd.

Trina Solar. 2023. Trina Solar's modules powered 100MW fishery PV project with high-performance. 14 February, 2023. Singapore: Trina Solar Energy Development Pte. Ltd.