



SYNTHESIS REPORT ON CRITICAL FISH HABITATS IN THE LOWER MEKONG RIVER BASIN

Possible options for updating the Strategy for Basin-wide
Environmental Management for Environmental Assets of
Regional Importance

July 2025



**Synthesis report on critical fish habitats in the
Lower Mekong River Basin:
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The MRC is funded by contributions from its Member Countries and Development Partners, including Australia, Canada, the European Union, Flanders/Belgium, France, Germany, Japan, Republic of Korea, Luxembourg, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, and the United States of America.

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First published (2025)

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Title: Synthesis report on critical fish habitats in the Lower Mekong River Basin: Possible options for updating the Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance

DOI: 10.52107/mrc.d1d01cf3bac08796

Keywords: capture fisheries/ governance/ fisheries management/ sustainability/ communities/ co-management/ community-based management/ habitat restoration/ ecosystem restoration.

For bibliographic purposes, this volume may be cited as:

Mekong River Commission. (2025). *Synthesis report on critical fish habitats in the Lower Mekong River Basin: Possible options for updating the Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance*. Vientiane: MRC Secretariat.

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CITATION

Mekong River Commission. (2025). *Synthesis report on critical fish habitats in the Lower Mekong River Basin: Possible options for updating the Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance*. Vientiane: MRC Secretariat. DOI: 10.52107/mrc.d1d01cf3bac08796

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FOREWORD

To help deliver Strategic Priority 1 of the Basin Development Strategy 2021–2030, i.e. to maintain the ecological function of the Mekong River Basin, the four Member Countries developed the *Mekong Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance 2021–2025* (SBEM). National and regional consultations have narrowed an initial list of potential Regional Environmental Assets (REAs) into 12 priority REAs. The selection criteria used to establish the shortlist led to potential gaps regarding fish and fisheries. A review of critical fish habitats in each country was commissioned. The Concept Note, ‘Updated list of key regional environmental assets relevant to critical fish habitats and national management plans incorporating measures for conserving fish habitats’, was approved by the Member Countries in 2024. This report provides a summary of the information available on critical fish habits and possible options for updating the SBEM regarding fish and fisheries criteria for future consideration by Member Countries.

EXECUTIVE SUMMARY

This report reviews available information on critical fish habitats in the Lower Mekong Basin (LMB). It also assesses the degree to which this is covered in the Mekong's *Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance for 2021–2025 (SBEM)* and considers possible options for updating the SBEM. Criteria can differ for the prioritization of sites based on fish species diversity and fisheries. Fish diversity is a measure of biodiversity, whereas fisheries reflect a measure of production or ecosystem services. Although fish diversity and fisheries can be related, they are not necessarily the same. For example, a site with high fish diversity but where there is a limited or no fishery productivity differs from a site with low fish diversity but high fisheries productivity.

Twelve Regional Environmental Assets (REAs) were prioritized by the four Member Countries for the SBEM in 2020. However, Thailand officially requested to removed Khao Yai and Thap Lan National Park from the list of 12 REAs that make the current list of 11 REAs. Although all 11 REAs support fish and fisheries, only four were prioritized in the list of REAs in 2019 based explicitly on fisheries criteria and the same four plus another one on fish biodiversity criteria. However, additional national reviews undertaken in 2020 identified 30 sites in the LMB ranked either first, second or third priority for fish and fisheries including 11 prioritized REAs. In addition to the criteria used to prioritize the 12 REAs, four additional criteria were considered relevant to a potential future composition of the group of REAs as a whole: (i) total number of sites bearing in mind resource and capacity constraints; (ii) diversity of management and institutional settings of the sites to support the upscaling of management planning experiences beyond individual sites; (iii) ecological representativeness across the LMB; and (iv) connectivity among the sites.

In the short term, the current list of REAs can be maintained for fish diversity and fisheries purposes. The current stage of the REAs focuses on a shortlist of priority sites and on developing a tool, methodology and approach for developing management plans. The 11 sites already include a good range of sites covering fish and fisheries criteria for this purpose. The sites are:

Cambodia: Tonle Sap Multiple Use Area, Virachey National Park, and Sre Pok Wildlife Sanctuary.

Lao PDR: Beung Kiat Ngong Wetland, Nam Et Phoulei National Park, and Xe Champhone Wetland.

Thailand: Lower Songkhram River and Nong Bong Kai Non-Hunting Area.

Viet Nam: U Minh Thuong, Yok Don, and Mui Ca Mau National Park.

If capacities and resources for the sustainable management of REAs are increased, and if lessons learned from the current implementation justify expansion, up to 16 additional REAs could be considered for inclusion in the SBEM in the future. This would enhance its relevance to critical fish habitats across the region. These REAs would include:

- the existing 11 REAs currently prioritized by the Member Countries for the SBEM;
- additional REAs of critical fish habitats as identified by this synthesis report:
 - expanding the REAs in Viet Nam by adding one site: Tram Chim National Park, which is ranked first priority for key fish habitats for Viet Nam;
 - expanding the REAs in Thailand by adding two sites: i.e. Kaeng Tana National Park (included flooded forest alongside Mun River) and Kut Ting Wetland, based on their fish species richness, habitat diversity and flooded forest extent (now rare in the LMB, particularly in Thailand);
 - expanding the REAs in Cambodia by adding one site: Strung Treng Ramsar Wetland;
 - expanding the REAs in Lao PDR by adding one site: Siphandon Wetlands.

This would create a list of four REAs each in Member Country.

The report contains the assessment results, which identified options for the longer-term development and expansion of the REAs, which would include: a more explicit emphasis on supporting national protected area (PA) systems; the development of a network of PAs; improved systematic science-based methods for addressing representativeness based on regional considerations; the development of connectivity; and a basin-wide strategy for addressing the requirements for deep pools.

1 BACKGROUND AND PURPOSE

Strategic Priority 1 of the Basin Development Strategy 2021–2030 (BDS) is to maintain the ecological function of the Mekong River Basin (MRC, 2021a). To help deliver this outcome, in 2019, the four Member Countries agreed on the Mekong Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance in the Lower Mekong Basin 2021–2025 (MRC, 2021b) and later on the Project-based Action Plan (MRC, 2021d) to implement it (MRC, 2021c). National and regional consultations previously considered a long list of national sites as potential Regional Environmental Assets (REAs) and agreed on the current shortlist of **11 priority REAs** (Figure1; Table 1). It was deemed that the selection criteria used to establish the shortlist could lead to gaps regarding fish and fisheries.

Table 1. The current Regional Environmental Assets, by area and country

Country	Area (ha)	Percentage (%)
Cambodia	2,193,450.00	51.2
Lao PDR	610,660	14.2
Thailand	1,316,600	30.7
Viet Nam	165,445	3.9
Total	4,286,155	100

Reviews of key fish habitats in each country were commissioned by the following authors: Ngor (2020) for Cambodia; Pouthavong (2020) for Lao PDR; Ratanachamnong (2020) for Thailand; and Trong (2020) for Viet Nam. Subsequently, the Concept Note, ‘Updated list of key regional environmental assets relevant to critical fish habitats and national management plans incorporating measures for conserving fish habitats’, was approved by the Member Countries in 2024 (MRC, 2024a).

This report provides a synthesis of the background information available on key and critical fish habitats in the LMB. This is used to assess gaps in the current list of REAs for fish and fisheries, and to identify possible options for updating the SBEM accordingly.

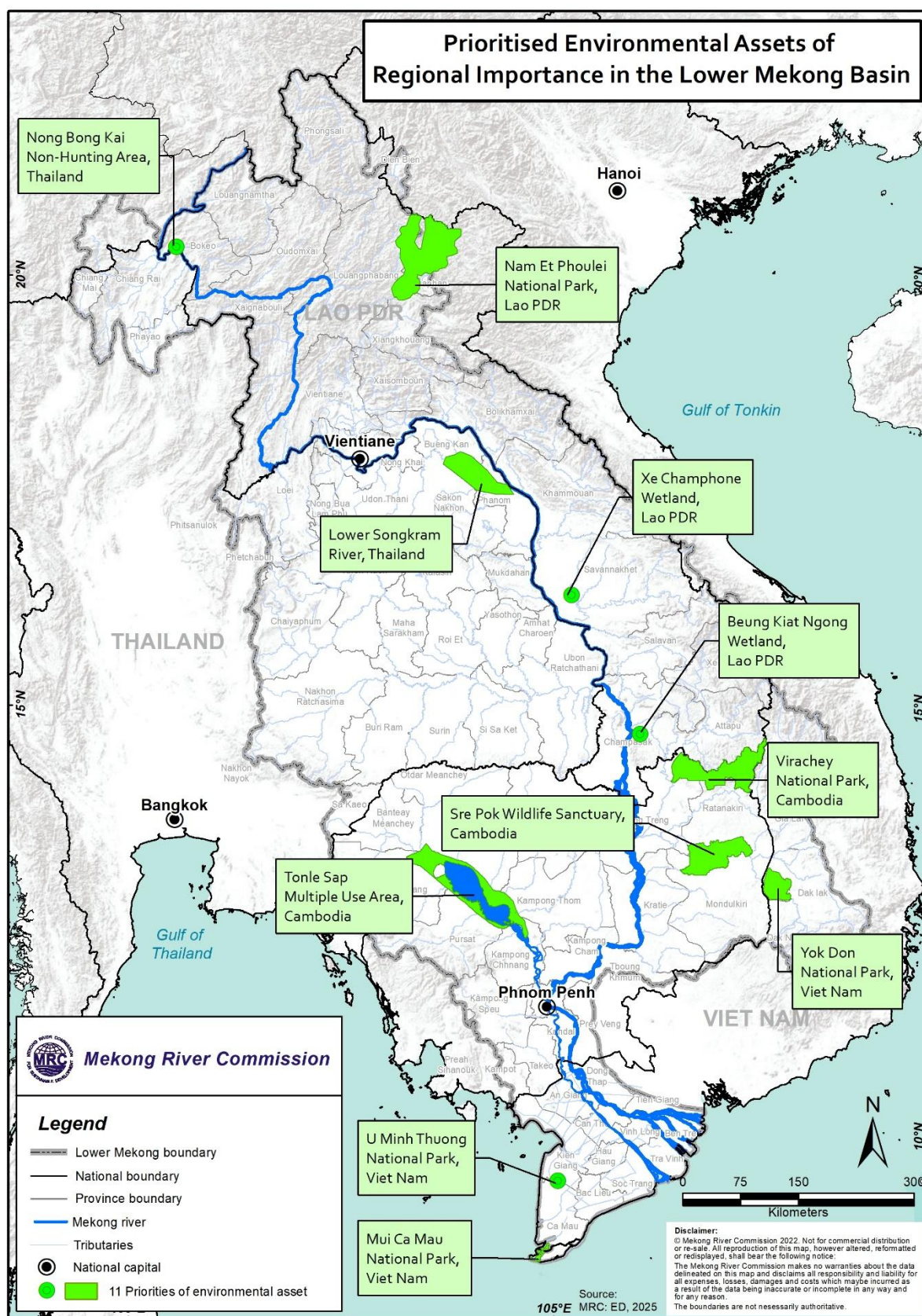


Figure 1. The 11 prioritized REAs in the LMB, as of May 2025

2 SYNTHESIS OF INFORMATION ON FISH, FISHERIES AND KEY OR CRITICAL HABITATS

2.1 Basic concepts, terms and considerations

2.1.1 Relevant factors of fish and fisheries ecology

Specific ecosystem types or categories (e.g. flooded forest, wetlands, river, rapids) tend to be associated with specific fish species compositions, although much overlap occurs. The relationships between terrestrial and aquatic ecosystem and species diversity are not well understood. Although terrestrial areas with high levels of biodiversity can be associated with diverse aquatic biodiversity, this is not always the case. Therefore, indicators on terrestrial biodiversity are not necessarily reliable for assessing aquatic biodiversity. Hydrological diversity (i.e. natural variations in the timing and quantities of flows) is an important factor in maintaining fish species diversity. Because of the dynamic hydrological nature of the ecosystem (including terrestrial influences on hydrology), almost all river and related wetland fish species move seasonally and over short distances, for example, from floodplain to adjacent dry season refuges, or over longer distances, sometimes over 1,000 km and beyond. Major movements usually occur between feeding, breeding and dry season refuge areas, which can be located over short or long distances.

In the LMB, most fish production comes from species with more limited movements, but some major fisheries are based on long-distance migrations. An important requirement for maintaining fish diversity, populations and productivity is to maintain connectivity, which enables fish to move between the different areas that the fish depend on. It is important to maintain this connectivity within any REA, but for long distance migrations, it is necessary to maintain connectivity among networked sites. The result is a very complex requirement for maintaining current fish species diversity and production. In addition, in common with most rivers of this kind, there are significant information gaps in the LMB; for example, the critical spawning areas and environmental requirements for the young life stages of the fish are not known for many species. This requires management to proceed in a general rather than precise manner. For fisheries, although some critical areas can be identified and prioritized, the overwhelming need is to maintain the ecological character, functioning and health of the basin as a whole.

There are important differences between establishing and managing terrestrial and aquatic PAs, as follows:

- It is very common for rivers to be used as boundaries for terrestrial PAs, which only protects one bank of the river, whereas for aquatic systems, catchment boundaries that protect both banks can be more appropriate;
- The objectives of managing hydrology (water regimes) for terrestrial and aquatic needs can differ; for example, the Viet Nam national report (Trong, 2020) states that the water management regime for Tram Chim National Park is dominated by the needs for the sarus crane to the detriment of fish and fisheries;

- Connectivity, which enables wildlife to move (migrate), is equally important in terrestrial areas, but the current ‘biodiversity corridors’ established in the PA system in the LMB extend laterally across rivers, whereas for aquatic fauna, the key need is longitudinal connectivity. In addition, connectivity needs in aquatic systems can apply at very short distances, for example, a few metres between river or irrigation channels and floodplain or rice fields.

To date, these factors have not been considered in assessing the suitability of the shortlisted REAs related to fisheries. But this topic is more relevant to the next stage of this work, which addresses the management plans for the REAs and needs to integrate fish and fisheries into them.

2.1.2 Differences between the objectives of fish species conservation and sustainable fisheries in identifying and prioritizing sites

There are differences between the objectives of fish species conservation and sustainable fisheries in identifying and prioritizing REAs:

- **Fish species conservation** concerns sustaining the continued existence of species (biodiversity), which requires maintenance of a minimal extent of necessary habitat; and
- **Sustainable fisheries** concerns sustaining the benefits of fisheries to people (ecosystem services), where total habitat extent and overall ecological health of the LMB are key determining factors.

Prioritizing fish biodiversity conservation does not always align with the goal of achieving sustainable fisheries production. For example, the Giant Mekong Catfish (*Pangasianodon gigas*) is an iconic species and a high priority for species conservation efforts (mentioned particularly in the Lao PDR and Thailand national reports), but it has never made a significant contribution to overall fisheries production. Similarly, the REAs in the LMB Delta in Viet Nam are purported to protect the last remnants of natural areas, including local fisheries in the Delta, but in fact, their contribution to total fisheries production there is negligible. In contrast, a significant proportion of the total LMB fisheries production now comes from modified areas; for example, community fish refuges associated with rice fields in Cambodia have been identified as important fish habitats and over 40% of fisheries production in Lao PDR comes from reservoirs and rice fields (MRC, 2024b).

Fish diversity and sustainable fisheries objectives can be inter-related; for example, unsustainable fishing practices are a threat to many fish species; hence, sustainable fisheries management needs to be central to any REA management plans, irrespective of whether the site is prioritized for fisheries.

2.1.3 Terminology: ‘habitat’, ‘important’, ‘key’ and ‘critical’

There is an inconsistent, and sometimes confusing, use of various terms in the documents and literature on this subject; the following aims to clarify this.

Three aspects of ‘importance’ regarding habitat are:

- its role in sustaining the life-cycle of the fish in question. In this regard, all habitats are equally important; for example, maintaining breeding areas requires simultaneous maintenance of feeding areas and dry season refuges, and connectivity between them, as well as any other areas used;
- its role in supporting relatively high fish biodiversity or that are important to individual fish species or assemblages; and
- its role in sustaining fisheries productivity, such as ensuring access for local communities, and reliance on these resources for livelihoods and food security.

Fish **‘habitat’** can be defined as ‘the place where fish live’, which for most fish means multiple places, at different times, which must be connected. Habitat not only concerns location, but also ecological characteristics and conditions. ‘Habitat’ is scale-dependent. It can refer to very local areas (even a few square metres) where a fish lives for part of its life, or a broad range (even hundreds of km²) within which the species occurs and depends on.

National reports use the term ‘habitat’ in various ways, both within and among individual reports. In most cases, it is used to refer to a specific area that might be alternatively called a ‘site’. These habitats can differ in area from less than one to several thousand hectares. In some cases, the term refers to a particular ecosystem type (e.g. flooded forest, river riffle, pool), and in others, to a location (e.g. the Lower Songkhram River). Aquatic habitats can also be described and categorized by referring to discrete physical and biological characteristics such as: natural materials that comprise the habitat (e.g. rocks, sand and mud); type of vegetation present (e.g. macrophytes); the shape and nature of the habitat (e.g. pools and riffles); or the freshwater aquatic ecosystem (e.g. wetlands, floodplains, streams, lakes). The national report of Thailand (Ratanachamnong, 2020) provides a more extensive list of such descriptors. The bigger the area, the more complex the mosaic of different habitat or ecosystem types that will likely be present.

Using a standardized approach to habitat descriptions would help. For example, the typology the Ramsar Classification System for Wetland Types, as approved by the Conference of the Contracting Parties in Recommendation 4.7 and amended by Resolutions VI.5 and VII.11, could be used for wetland classification; however, this does not necessarily help identifying which types of wetlands in which areas are key or critical. None of the national reports have used a standardized approach to habitat classification.

‘Key’ (habitats) are main habitats that sustain the fish species or fishery (which is all of them). **‘Critical’** (habitat) is a descriptor of an immediate and extreme level of ‘importance’. In the current context, the most useful criterion for ‘critical’ is level of vulnerability and threat to fish and sustainable fisheries. For example, deep pools are widely regarded as critical habitat not because fish might breed there. but because fish congregate there and are susceptible to overfishing and environmental shocks (e.g. engineering works). Floodplain forest is considered critical not just because it supports high fish diversity and production, but also because it is now a highly threatened ecosystem type.

There is a high degree scientific uncertainty in the use of these terms, and significant data and information gaps, much of which can be addressed through use of local knowledge and expert opinion, but a certain level of subjectivity remains.

Recommended use of terminology with regard to the SBEM

The SBEM uses the term ‘habitat’ generally to refer to larger-scale areas.

The SBEM does not use the terms ‘key’ or ‘critical’. Introducing these terms regarding habitat in the SBEM can be unhelpful; it can create unnecessary and confusing debate about what these terms mean regarding REAs. The better, more science-based, and less subjective approach is to use agreed criteria for prioritizing a REA, as has already been the case when establishing the SBEM and its list of REAs. The REA criteria (MRC, 2021b) do not use the terms ‘habitat’, ‘key’ or ‘critical’, except for a minor reference to critical mammal habitat.

2.2 Fish, fisheries and the SBEM

2.2.1 The current SBEM

The objective of the SBEM is to: *identify strategic priorities and related priority actions for the protection and management of REAs for implementation at national, transboundary, and regional levels*. The SBEM complements other relevant regional and national strategies, legislation, policies and projects, and its strategic priorities and actions have been included in the BDS 2021–2030. The SBEM will be reviewed and updated every five years, and expanded to include additional REAs over time and will carry out further work towards managing environmental assets within the LMB (MRC, 2021b).

A core purpose of the BDS and the SBEM is to contribute to a wider adaptive planning process linking regional and national plans. All the current REAs prioritized are nationally established PAs. Therefore, in effect, the efforts under the SBEM, such as those towards achieving the national PA targets, support national PA systems. Therefore, linkages to national PA systems (and national wetland policies) will be an important aspect of REA management plans developed in the next stage of this work.

The SBEM is implemented through its Project-based Action Plan (MRC, 2021c), which applies to all 12 REAs and presumably to any that might be added to the list in the future. The SBEM also has several linkages with the Mekong Basin-wide Fisheries Management Strategy 2018–2022 (MRC, 2017), such as: updating and ranking key habitats; cataloguing the efficiency of existing protection and conservation measures of key species and developing and implementing guidelines for their long-term conservation; promoting co-management and transboundary fisheries arrangements; and investigating fish-stock and habitat-enhancement activities in all four Member Countries. Specifically, these commonalities are also directly related to the Strategic Priority 4.2.3 of the Strategic Plan 2021–2025, i.e. to strengthen the protection of mutually agreed environmental assets.

2.2.2 Criteria for the identification and prioritization of REAs

Criteria used to establish the current list of REAs and suitability for fish conservation and sustaining capture fisheries

The most consequential criterion used for identifying an REA regarding sustainable fisheries is that the site must be a 'natural' area. However, it is unclear what 'natural' means in a now significantly altered LMB, although it can be agreed that some areas are more natural than others. In practice, almost any larger aquatic REA that could be identified will be a mosaic of areas in a 'good' to 'poor' ecological state and in a 'relatively undisturbed' to 'highly modified' condition. For example, most of the larger REAs include expanses of rice fields. Consequently, management plans for most REAs will need to include measures to both conserve the better condition areas and rehabilitate (restore) the more degraded areas.

An initial short list of REAs in the LMB was developed using international criteria (MRC, 2019). A weighting system was developed to emphasize the importance of ecosystem services provided by these assets and where environmental assets demonstrated having regional (basin-wide) or transboundary importance. It is not necessary for a site to meet all the criteria; meeting just one is enough for prioritization. Obviously, sites that meet multiple criteria might optionally be prioritized higher. The selection criteria used have different relevance to fish conservation (biodiversity) and sustainable fisheries (Table 2).

Table 2. The relevance of the selection criteria for the current list of REAs to fish conservation and sustainable fisheries

REA Selection Criteria (from MRC 2021b)	Relevance to fish conservation (biodiversity)	Relevance to sustainable fisheries
1. Biodiversity/Ecological Importance	High	It is unclear what 'ecological importance' means
2. Hydrological Importance (wetland and river ecosystem health)	High	High
3. Rareness and Uniqueness (irreplaceability)	High (for threatened fish species/assemblages)	Low. The LMB fishery is not unique; it is arguably replaceable, but at high cost.
4. Ecosystem Services Importance	Low	Very high. Fisheries are one of the most valuable ecosystem services in the LMB.
5. Global Importance	High. The aquatic biodiversity, including fish, of the LMB is globally significant.	Low. Even though the LMB fishery is not globally important (i.e. there are limited exports beyond the region), it has very high regional, national and local importance.
6. Regional (basin-wide) or Transboundary Importance	High	High

Initially, a shortlist of over 120 potential REAs was proposed by the four Member Countries, which was already a significant reduction in sites considered important at the national and local levels. For example, in Thailand, nearly 20,000 sites in the whole country are noted as wetlands of local importance and/or wetlands in need of protection and rehabilitation (Thailand Environment Institute, 2019). Similarly large numbers of important areas could probably be identified in Cambodia, Lao PDR and Viet Nam.

The initial list that was agreed on was narrowed down to the top three sites in each country, resulting in a practical and workable, reasonably well distributed, and diverse selection of 12 REAs, or about 10% of the total number of REAs initially identified. All of the REAs are nationally designated PAs, which differ in size, social settings and management challenges. Later, Thailand officially requested to removed Khao Yai and Thap Lan National Park from the list of 12 REAs that make the current list of 11 REAs. Nevertheless, there were concerns that the SBEM was too ambitious. In total, the 11 prioritized REAs cover 42,861 km², or around 6.9% of the total area (620,000 km²) of the LMB, 51.2% of the LMB of Cambodia, 14.2% of the LMB of Lao PDR, 30.7% of the LMB of Thailand, and only 3.9% of the LMB of Viet Nam. The discrepancies in the relative distribution of the REAs by area among the Member Countries are accounted for by the prioritization of a large site in Cambodia (Tonle Sap Multiple Use Area), in Lao PDR (Nam Et Phoulei National Park) and in Thailand (Lower Songkhram River), and relatively small sites in Viet Nam.

The current list of REAs is summarized in Table 3, which also indicates where fish conservation and sustainable fisheries criteria were referenced as explicit criteria for prioritizing each REA. This can be difficult to assess because fisheries can be included as an ecosystem service but not mentioned explicitly. Table 3 includes only where fish or fisheries were referenced explicitly as priority criteria. Only four of the 11 sites were explicitly prioritized based on referenced importance for sustainable fisheries, one each in Cambodia and Lao PDR, two in Thailand, none in Viet Nam. All of these were also prioritized based on their fish diversity, and another REA was added (Sre Pok) also using this criterion. Terrestrial biodiversity considerations dominated the key criteria referenced to prioritize the other seven. However, subsequent national reports on key fish habitat clarified that six of the seven sites where fish or sustainable fisheries were not the main criteria for initial prioritization in the SBEM (Table 3) are also considered important for sustainable fisheries (further details are provided in Section 2.3 below).

Forest-based criteria are used to identify the 'eco-regions' that each site represents (Table 3), which, in turn, are used to confirm that the list is representative. However, 'freshwater-relevant eco-regions' would be a more appropriate term for fish and fisheries.

Table 3. The current prioritized Regional Environmental Assets and their representative eco-regions, and references to prioritization based on importance for fish species conservation and fisheries

Regional Environmental Assets	Total area (km ²)	Eco-region	Main criteria used for prioritization	Reference to relevance to fish species conservation	Reference to relevance to fisheries prioritization
Cambodia					
Virachey National Park,	3,380	1. Central Indochina Dry Forest 2. Southern Eastern Indochina Evergreen Forest	Biodiversity/ecology, rareness and uniqueness, global, and regional or transboundary (basin-wide processes) importance. This refers mainly to terrestrial fauna	Not used as a reference specifically in prioritization.	Not used as a reference specifically in prioritization. (indirectly important through watershed services maintaining flows)
Sre Pok Wildlife Sanctuary	3,720	1. Central Indochina Dry Forest	Biodiversity/ecology, ecosystem services, and regional or transboundary (basin-wide processes) importance	Very high fish diversity	Not mentioned as a basis of prioritization (indirectly important through watershed services maintaining flows)
Tonle Sap Multiple Use Area	14,833	1. Tonle Sap Freshwater Swamp Forest	All six: biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, and global, and regional or transboundary (basin-wide processes) importance	Very diverse fish species including several on the International Union for Conservation of Nature (IUCN) Red List.	Very important, accounting for a significant proportion of LMB production including beyond the Regional Environmental Asset
Lao PDR					
Nam Et Phoulei National Park	5,959	1. Northern Indochina Subtropical Forest 2. Luang Prabang Mountain Rainforest	Biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, and global importance. This refers mainly to terrestrial species.	Not used as a reference specifically in prioritization.	Not used as a reference specifically in prioritization. (indirectly important through watershed services maintaining flows)
Xe Champhone Ramsar Wetland	124	1. Central Indochina Dry Forest	Biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, and global importance.	Not used as a reference specifically in prioritization.	Used to prioritize

Regional Environmental Assets	Total area (km ²)	Eco-region	Main criteria used for prioritization	Reference to relevance to fish species conservation	Reference to relevance to fisheries prioritization
		2. Southern Eastern Indochina Evergreen Forest			
Beung Kiat Ngong Ramsar Wetland	23.6	1. Central Indochina Dry Forest	All six: Biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, global, and regional or transboundary (basin-wide processes) importance	Not used as a reference specifically in prioritization.	Not used as a reference specifically in prioritization.
Thailand					
Nong Bong Kai, Wiang Nong Lhom and Mainstream Mekong	38.0	1. Northern Indochina Subtropical Forest 2. Northern Thailand/ Lao PDR Moist Deciduous Forest	All six: biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, global, and regional or transboundary (basin-wide processes) importance	High diversity. The site provides critical fish habitat of over 1% of the population the Mekong giant catfish, <i>Pangasianodon gigas</i> , (possibly the entire population more recently) and the Chao Phraya giant catfish, <i>Pangasius sanitwongsei</i> , during the breeding season.	Included in prioritization
Lower Songkhram River	13,128	1. Northern Khorat Plateau Moist Deciduous Forests 2. Northern Annamites Rainforest	All six: biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, global, and regional or transboundary (basin-wide processes) importance.	High fish diversity. One of Thailand's freshwater biodiversity hotspots. Last remaining stretch of the free-flowing main Mekong tributary.	High local importance and livelihoods dependency.
Viet Nam					
Yok Don National Park, central highlands	1,140	1. Central Indochina Dry Forest	All six: biodiversity/ecology, hydrology, rareness and uniqueness, ecosystem services, global, and	Not used as a reference specifically in prioritization.	Not used as a reference specifically in prioritization.

Regional Environmental Assets	Total area (km ²)	Eco-region	Main criteria used for prioritization	Reference to relevance to fish species conservation	Reference to relevance to fisheries prioritization
		2. Southern Eastern Indochina Evergreen Forest	regional or transboundary (basin-wide processes) importance.	(Used elephants as the key criterion).	
U Minh Thuong National Park, Mekong delta	80	1. Indochina Mangroves 2. Tonle Sap Mekong Peat Swamp Forest	Biodiversity/ecological, rareness and uniqueness, ecosystem services, global, and regional or transboundary (basin-wide processes) importance.	Not used as a reference specifically in prioritization. Although since it is one of the last peat swamp forest areas in the delta, it may be highly relevant.	Not used as a reference specifically in prioritization.
Mui Ca Mau National Park, Mekong Delta	418	1. Indochina Mangroves	Rareness and uniqueness, ecosystem services, global and regional or transboundary (basin-wide processes) importance	Not used as a reference specifically in prioritization.	Not used as a reference specifically in prioritization.

Source: Based on information provided in Table 2 of the SBEM (MRC, 2021b).

Considerations for determining the number of REAs and the composition of the group of REAs

Beyond determining the relative importance of individual REAs, there is a need to consider criteria for the composition of the group of REAs as a whole:

- a) *Number of sites*: The need to focus the next stage of work on the development of management plans for the REAs requires that the initial total list of sites remains within a practical and feasible number, bearing in mind resource and capacity constraints. To date, the Member Countries have agreed on an initial shortlist of 11 sites. In the short term, this number is to be maintained.
- b) *Diversity of management settings*: In the longer term, the aim is that the SBEM will expand. Therefore, it is a priority that experiences in developing management plans are transferable across the broadest range of possible additional REAs in the future. This requires a diverse set of trial sites from the perspective of size, habitat types, management challenges, threats, and geographic, social and institutional setting, among other characteristics.
- c) *Ecological representativeness*: is a key need for any effective national or regional PA system. Here, 'representative' means that the sites collectively represent the diversity of areas that exist to ensure that all ecosystem types are covered. These differ nationally and regionally; for example, brackish water ecosystem types would be one category but only occur in Viet Nam. Similarly, the Member Countries differ in the proportion of different ecosystem types that occur within their boundaries. Although expert opinion may have factored this into site prioritization, the methodology and criteria are not stated. The only reference to representativeness regarding 'eco-regions' refers to a forest-based classification system (Table 3), whereas an aquatic-based approach would be much more consistent in the context of a river basin and the MRC. However, achieving effective, science-based representativeness requires much additional work, and it is unlikely that it would be achieved with only 11 sites. Therefore, since the current list does represent a diversity of areas, even if not quantified, this subject is more relevant to future work regarding potentially expanding the list of REAs.
- d) *Connectivity*: All of the Member Countries and national reports fully recognize that ecosystem and habitat connectivity, both within and between sites, is a high priority for PA effectiveness in river basins. There are also significant differences between 'connectivity' for terrestrial and for aquatic systems. The criteria used to prioritize the REAs (Table 2) do not include consideration of connectivity, nor is it mentioned in the description of the criterion 'hydrological importance' in the SBEM (MRC, 2021b). A key requirement is to maintain 'free flowing' rivers, or at least the effective movement of migratory species over both long and short distances. The extent to which the current suite of REAs is vulnerable to the loss of connectivity (habitat fragmentation) has not been systematically assessed. This aspect would be an important consideration to elaborate further when management plans for individual REAs are developed and with respect to possibly further developing and expanding the SBEM.

2.3 Key habitats for fish and fisheries identified in national reports

2.3.1 Criteria for identifying and prioritizing sites for fish conservation and fisheries

National reports did not clearly state the criteria on which their prioritization of key habitats were based; they used expert opinion for the prioritization. It is assumed that this opinion would broadly follow criteria used for other biodiversity and/or ecosystem services as applied to fish and fisheries.

The criteria used to prioritize the initial list of REAs (as discussed immediately above) can be used to guide the identification and prioritization of the most important potential areas for REAs based on fish and fisheries criteria, as follow:

- a) *Biodiversity/Ecological Importance*: It must support highly diverse assemblages (communities) of fish species, or important for the conservation of critically endangered priority species (particularly iconic species in the fishery);
- b) *Hydrological Importance* for fisheries, particularly connectivity to the mainstream to enable fish migrations;
- c) *Rareness and Uniqueness* (irreplaceability) of the fish community or fish species within the basin;
- d) *Ecosystem Services Importance*: The site must be important for delivering benefits from fisheries, including productivity (total catch), economic value (monetary value of the catch), and socio-economic importance (including livelihood dependency and food and nutrition security);
- e) *Global Importance* applies to fish conservation only and is an added dimension of criterion (i) above;
- f) *Regional (basin-wide) or Transboundary Importance*, as applied to the above criteria based on fish conservation and/or sustainable fisheries considerations.

2.3.2 Summary of key sites for fish and fisheries identified in national reports

The national reports identify many key sites from the perspective of fish and fisheries. There are widespread references to 'fish conservation zones', 'community fishery areas', 'fish sanctuaries' and 'community fish refuge ponds'. Technically, these refer to a management system but are usually established in areas considered at least locally important.

Deep pools emerge as a priority habitat type with many identified but often widely dispersed. Some of these occur in larger priority areas identified, including all those that contain main Mekong River or tributary river channels, and requirements for their management would be expected to be included in plans for those sites. However, their national and regional importance justifies the development of an additional strategy for their basin-wide management beyond the current site-based SBEM REA approach.

Flooded forest emerges as one of the most important habitat types for both fish diversity and fisheries productivity and is a component (or habitat type) of some of the priority sites listed.

Cambodia

It was concluded that 'critical' fish habitats were those situated in the Mekong River system in Kratie, Stung Treng and part of the Sekong, Sesan, and Sre Pok (3S) river system (e.g. the Mekong-3S confluence), the lower floodplains in the Tonle Sap ecosystem, and the area south of Phnom Penh (i.e. Prey Veng and Takeo Provinces). These are all large areas (as is Tonle Sap Multiple Use Area already selected as an REA). In addition, the connectivity of free-flowing rivers (e.g. the river section in Kampong Cham and Kandal Provinces) as the seasonal fish migration corridor that connects the upper Mekong system and lower Mekong floodplain habitats is equally imperative in order to sustain fish life cycles and thus their seasonal productivity. These areas are indeed already in the 10-year Strategic Planning Framework on fisheries of the Cambodian Government as well as in the implementation plans of various fisheries-related development agencies operating in the country. All also have strong transboundary significance being important to support migratory species.

Many fish conservation areas and sanctuaries totalling more than 95,215 ha are identified (Figure 2) and distributed throughout seven provinces (Figure 3), each of which is a locally important area. Many are located within larger areas identified as current or potential additional REAs.

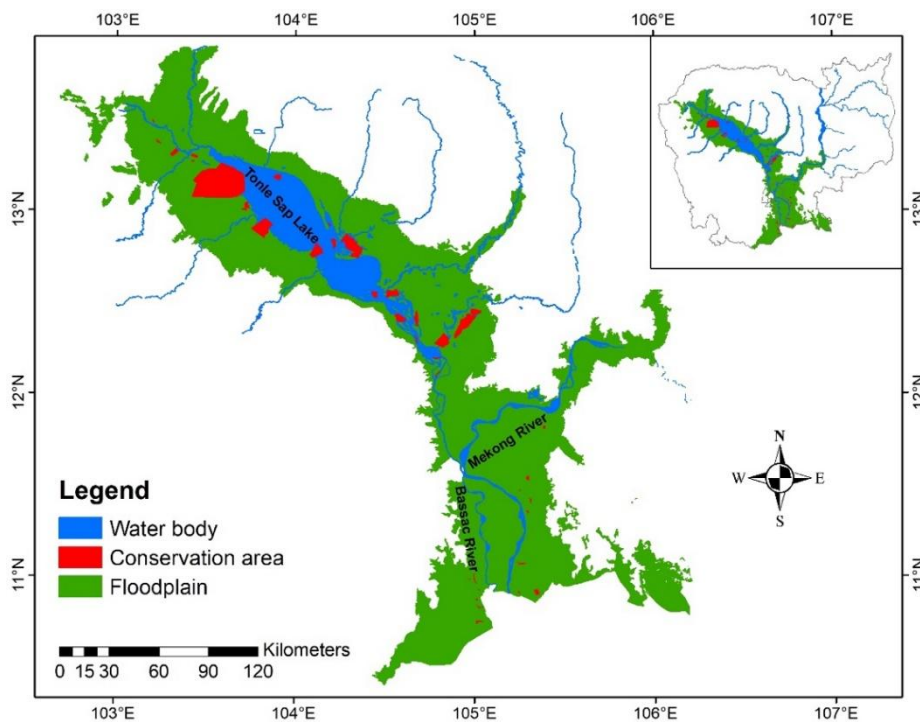


Figure 2. Major fish conservation areas in Cambodia

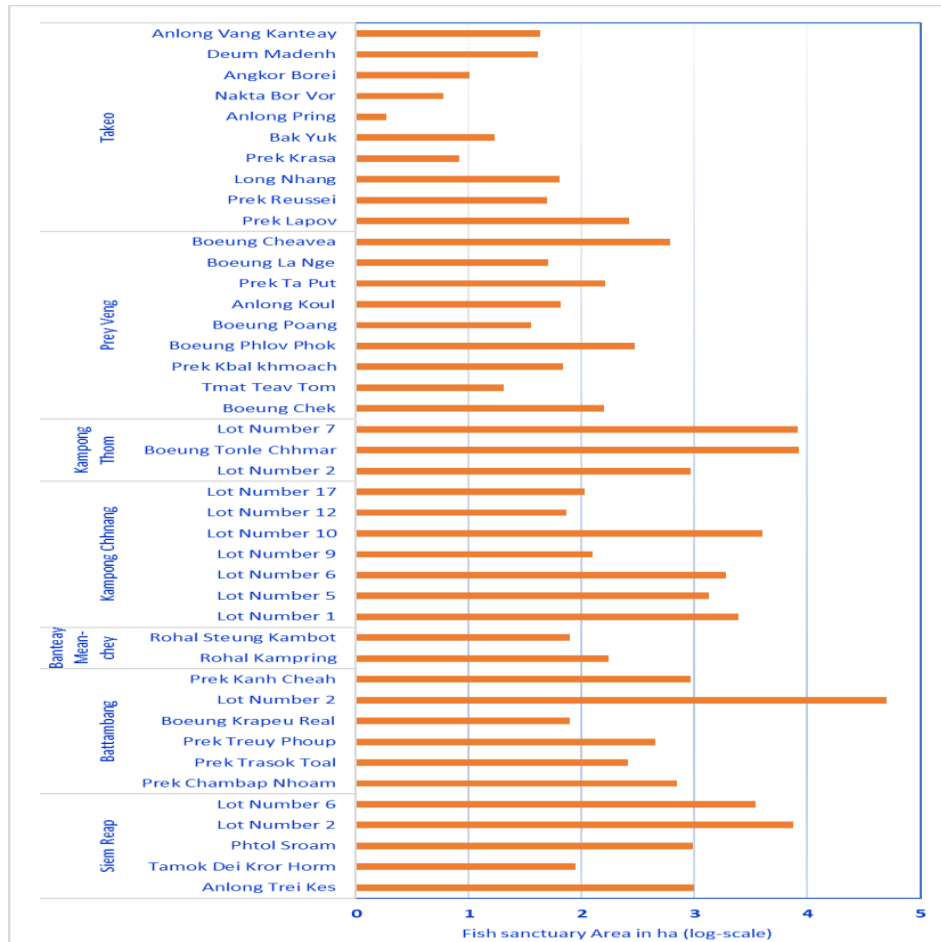


Figure 3. Major fish sanctuaries in Cambodia, by province and area

As of 2020, there were 516 community fisheries (Cfi) in Cambodia with a total area of 182,673,222 ha (Figure 4) and 820 community fish refuge ponds (Figure 5).

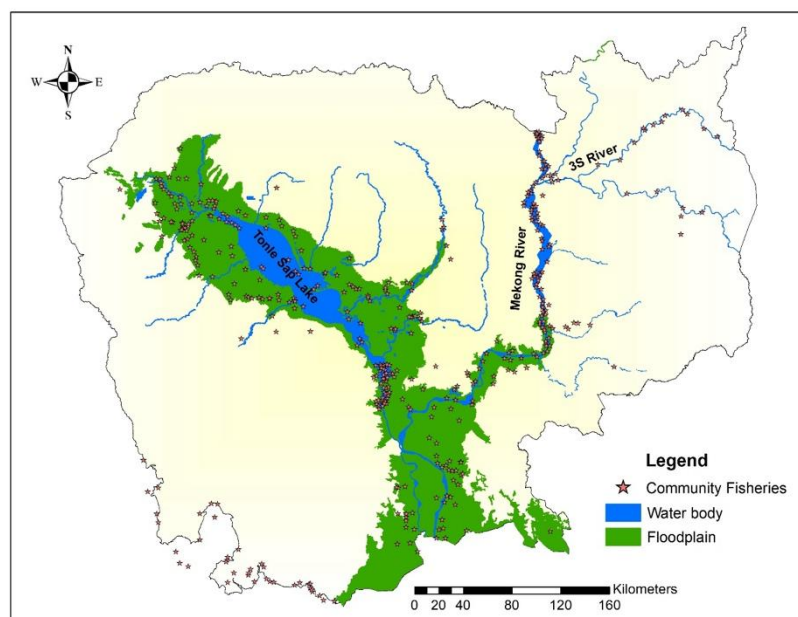


Figure 4. Community fisheries in Cambodia, as of 2020

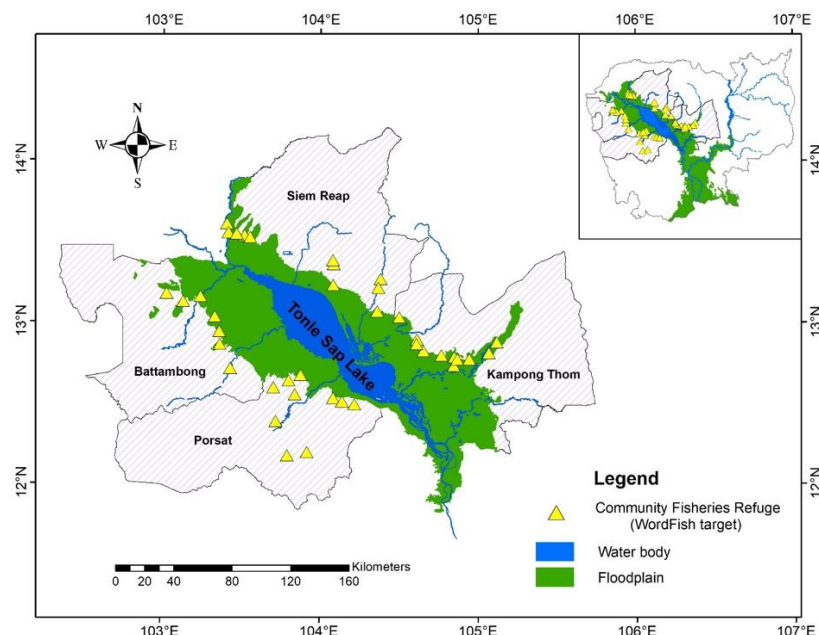


Figure 5. Community fish refuge ponds in Cambodia, as of 2020

Deep pools in the Mekong River, particularly north and south of the Khone Falls, are highlighted as important critical habitats for the fish conservation and fisheries in the Mekong. The deep pool data are available for the Mekong mainstream river section in Kratie and Stung Treng and in the Tonle Sap River and the Tonle Lake tributaries. At least 97 deep pools are identified in the Mekong river mainstream, particularly in the Kratie-Stung Treng reach, with 81 deep pools extending to 1,282 ha with depths ranging between 7 m and 80 m (Figure 6).

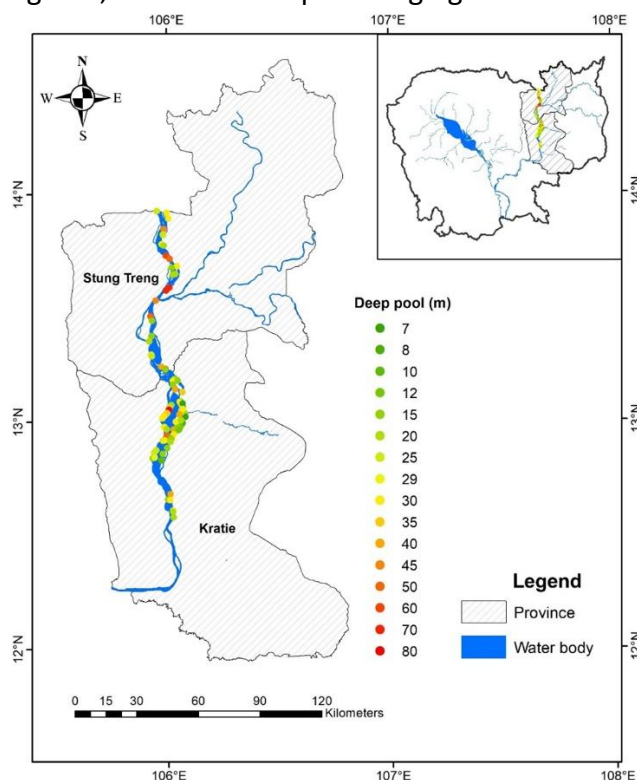


Figure 6. Major deep pools in Cambodia

International Union for Conservation of Nature (IUCN) 'Key Biodiversity Areas' are mainly situated in the Tonle Sap River and Lake and the Cambodia Mekong-Sekong, Sesan, and Sre Pok (3S) rivers system.

Four 'assemblage clusters' are identified based on fish species composition associated with: the northern Tonle Sap Lake in Battambang and Siem Reap; southern Tonle Sap Lake (Pursat, Kampong Thom, Kampong Chhnang, Kandal); the middle Mekong in Cambodia (Kratie-Kandal Provinces); and Stung Treng Provinces and the 3S Rivers. Each of these has its distinctive fish species composition, probably reflecting differences in ecological characteristics. This confirms that fish species diversity is not necessarily uniform across current or potential REAs.

Prioritized REAs based on fisheries criteria for Cambodia are shown in Table 4.

Table 4. Prioritized REAs in Cambodia based on fisheries criteria

Province	Names of sites	Legal status	Area (ha)	No. of fish species	Habitat	Connectivity	Ranking	List of 11 REAs
KT, KC,PU, BA, SR*	Tonle Sap Multiple Use Area	Ramsar and Biosphere Reserve	1,483,339	350	Floodplain	High	1	Yes
Stung Treng	Strung Treng Ramsar Wetland	Ramsar	14,600	96	Floodplain, Deep pools	High	2	No
Mondulkiri	Sre Pok Wildlife Sanctuary	Wildlife sanctuary	372,054	81	Floodplain	High	3	Yes

Note: * KT: Kampong Thom, KC: Kampong Cham, PU: Kampong Thom, BA: Battambang, SR: Siem Reap.

Lao PDR

The Lao PDR national report noted significant information gaps regarding several major tributaries and catchments still not studied; however, information for some tributaries and catchments has since improved. The report highlights the importance of deep pools in the Mekong River as seasonal feeding, spawning and refuge habitats. More than 460 deep pools have been mapped, including their distribution, depths, shape and substrates (Figure 7). A total of 416 pools was identified along the Lower Mekong River between the Lao PDR-Myanmar border and the Cambodia-Viet Nam border (Viravong et al., 2006). Some of the pools are known to be associated with specific fish species, with their local names reflecting the key species they support. Importantly, although some pools are likely relatively permanently located, studies show that the natural dynamics of the river system creates many pools that, in time, silt up before new ones are created, hence they move. Therefore, the management of this aspect of REAs must be based on spatially and temporally dynamic habitats, and not on static fixed geo-referenced locations.

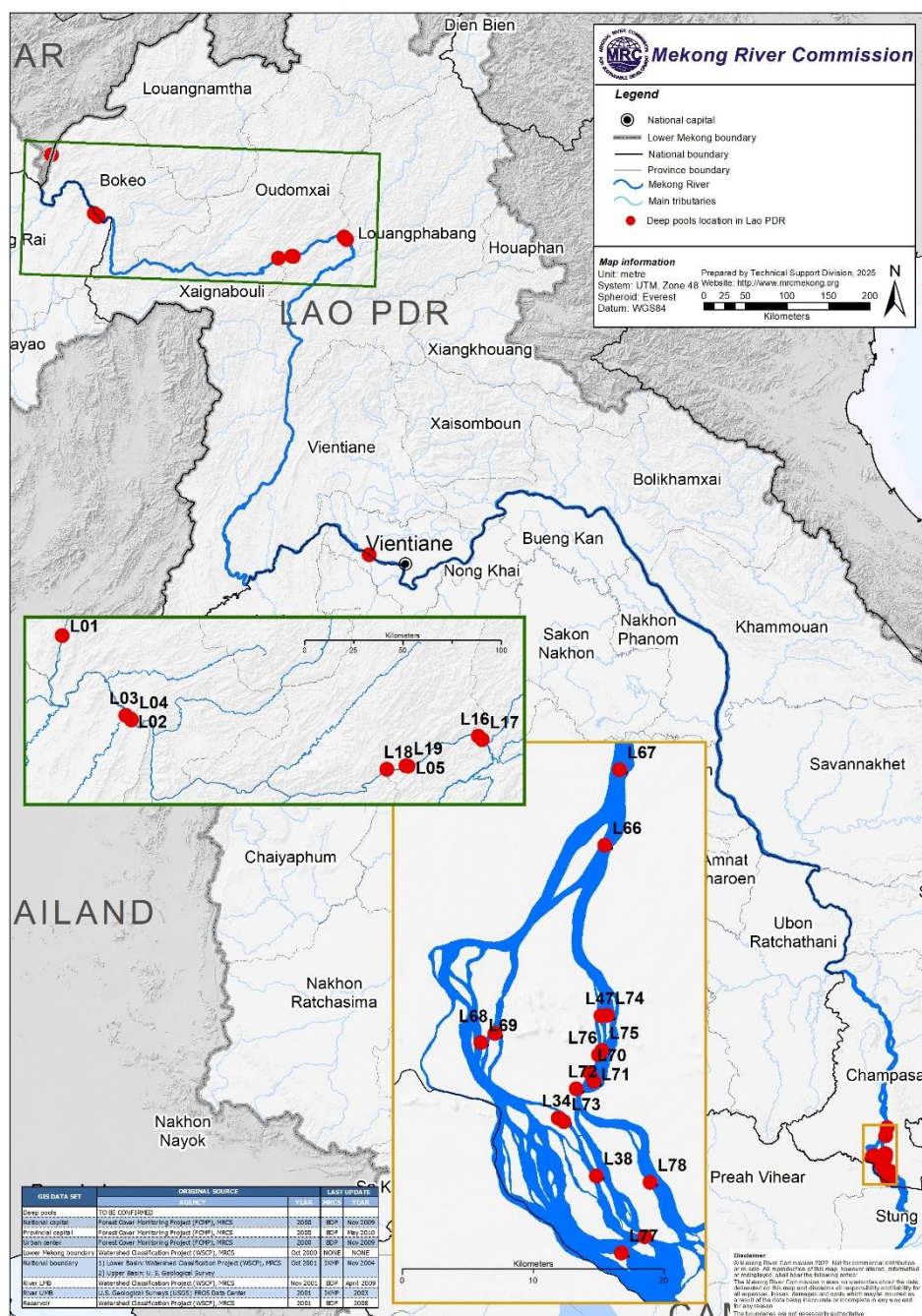


Figure 7. Deep pools in Lao PDR

In terms of regional and transboundary importance, deep pools in Lao PDR and in the LMB were further prioritized by zones (Figure 8):

- Zone 1. Deep pools in the Khong District, Champasak province, especially the pools close to the border Lao PDR (Champasak province) and Cambodia (Stung Treng province).
- Zone 2. Deep pools in upper Pakse between Savannakhet province (Lao PDR) and Mukdahan province (Thailand).
- Zone 3. Deep pools in Vientiane (Lao PDR) and Nongkai (Thailand).
- Zone 4. Deep pools in Bokeo province (Lao PDR) and Chiang Rai province (Thailand).

These prioritized areas are significant spawning and refuge habitats for important Mekong fish species. Zones 1 and 4 previously had a transboundary fisheries management plan. Zone 2 has many deep pools (more than 70 m depth) that connect to the tributaries and floodplain. These tributaries serve as wet season migration routes where fish migrate from the Mekong deep pool to tributaries and floodplain for spawning in the early wet season and return to the deep pools in the Mekong River at the end of the wet season. The deep pools in Vientiane and Nongkai (Zone 3) were historically important for traditional fishing, which need to be preserved and protected.

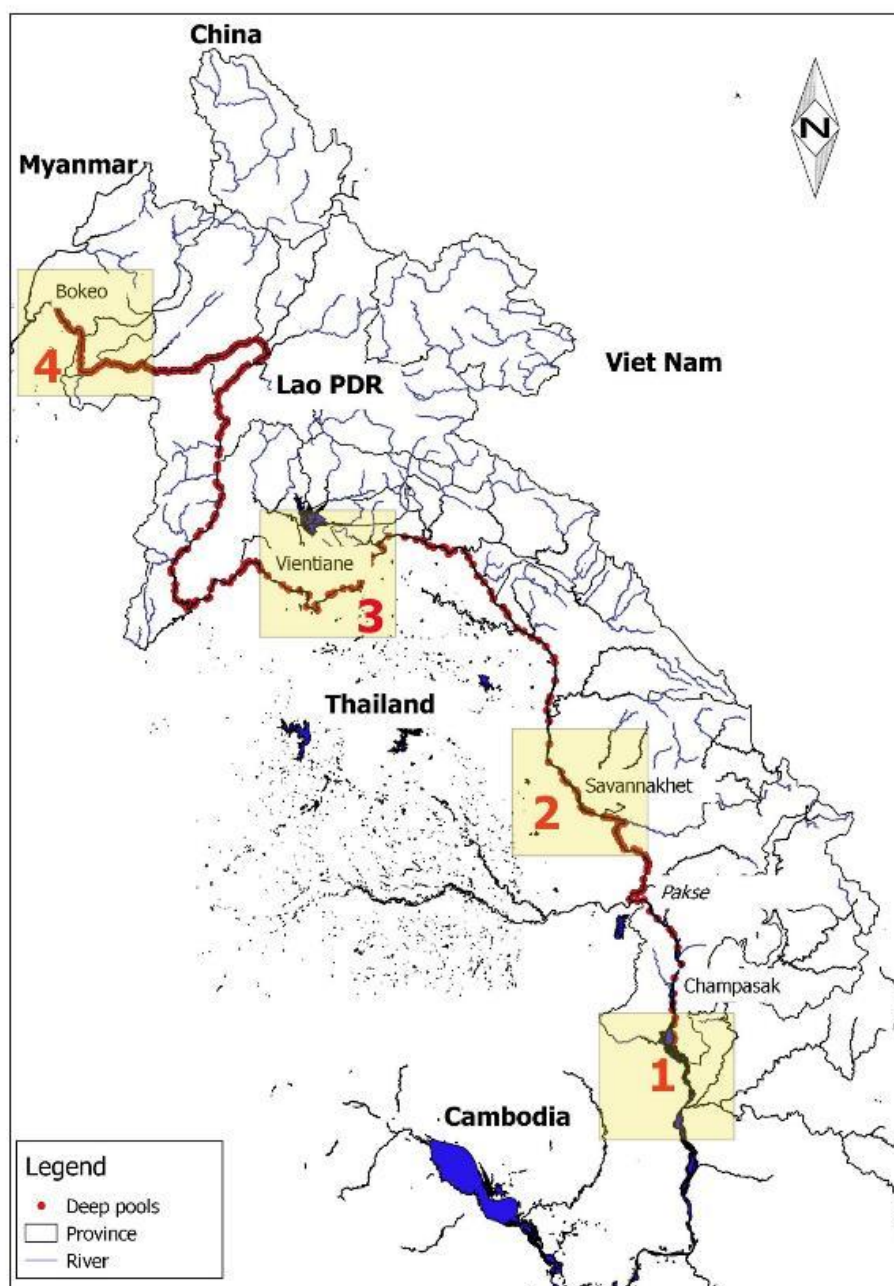


Figure 8. Zones of deep pools in the Lower Mekong River

Source: Phouthavong (2020).

Fisheries conservation zones are widespread in Lao PDR, where there are 78 registered zones between Bokeo and Champasak alone (Figure 9).



Figure 9. Fish conservation zones in Lao PDR, from Bokeo to Champasak

The prioritized REAs based on fisheries criteria for Lao PDR are shown in Table 5.

Table 5. Prioritized REAs based on fisheries criteria in Lao PDR

Province	Names of sites	Legal status	Area (ha)	No. of fish species	Habitat	Connectivity	Ranking	List of 11 REAs
Champassak	Siphandone	No conservation status	50,000	200	Floodplain	High	1	No
Champassak	Beung Kiat Ngong Wetland	Ramsar	2,360	130	Waterbody	Medium	2	Yes
Savannakhet	Xe Champhone Wetland	Ramsar	12,400	51	Waterbody	Medium	3	Yes

Thailand

Thailand's national report includes descriptions of nine major aquatic habitat types based on ecological characteristics (e.g. morphology, hydrology, vegetation etc.) and on ecological importance, and on the relationship of aquatic habitats to hydrological processes. Each of these could be further sub-divided. Multiple habitat types can be in any site identified. The information is useful for identifying what management plans need to address regarding

maintaining the ecological character of a REA once prioritized – a key character being diversity of sub-habitats.

Wetlands in Thailand are grouped in three categories of international, national and local importance. Ten important wetlands are listed; most are large areas (up to over 13,000 km²) and located along 954 km of the Mekong River. Many important sites are identified by region in the Thailand LMB. Thirty-seven important transboundary (with Lao PDR) fish conservation zones are identified along the Mekong River mainstream and 33 registered aquatic sanctuaries across the Thailand LMB, with very many more locally or community designated.

Thailand's national report explicitly draws attention to additional criteria used to prioritize sites:

- The degree of fragmentation/connectivity of the river basin, highlighting the importance of the Lower Songkhram River as the last remaining 'free flowing' major tributary in the Thailand LMB; and
- the existence of rare or highly vulnerable important fishery habitat, i.e. the existence of flooded forest' as a criterion for prioritizing several sites.

Fish conservation zones are widespread in Thailand, with 72 in Chiang Rai, Ubon Ratchathani and Nakhon Phanom (as of 2020). In addition, there are 31 Fish Sanctuaries under Emergency Decree on Fisheries B.E. 2558 (2015). Koot Ting Wetland is among the most important sites for fish conservation (Figure 10), while the Lower Songkhram River Ramsar site is critical for maintaining sustainable fisheries in the LMB (Figure 11).

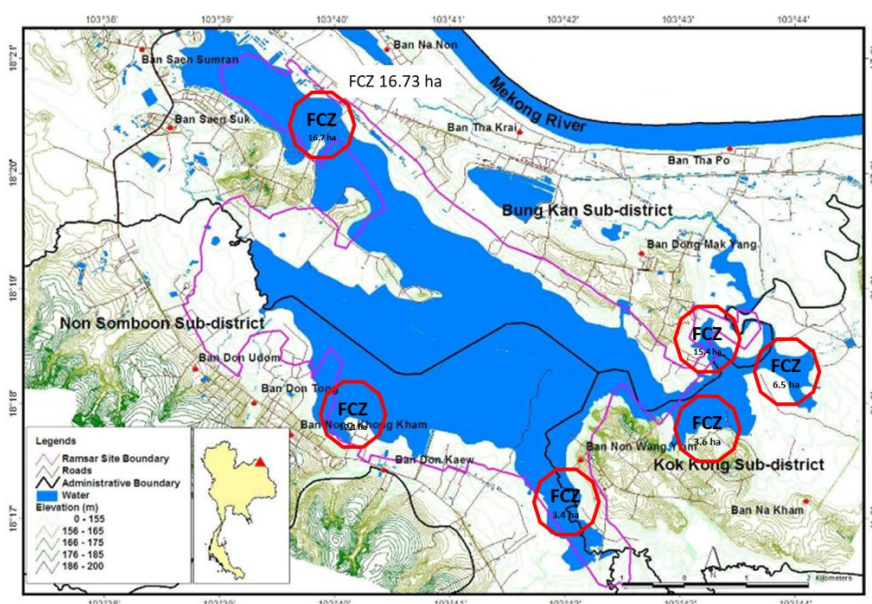


Figure 10. Koot Ting wetland in Thailand and its fish conservation zones

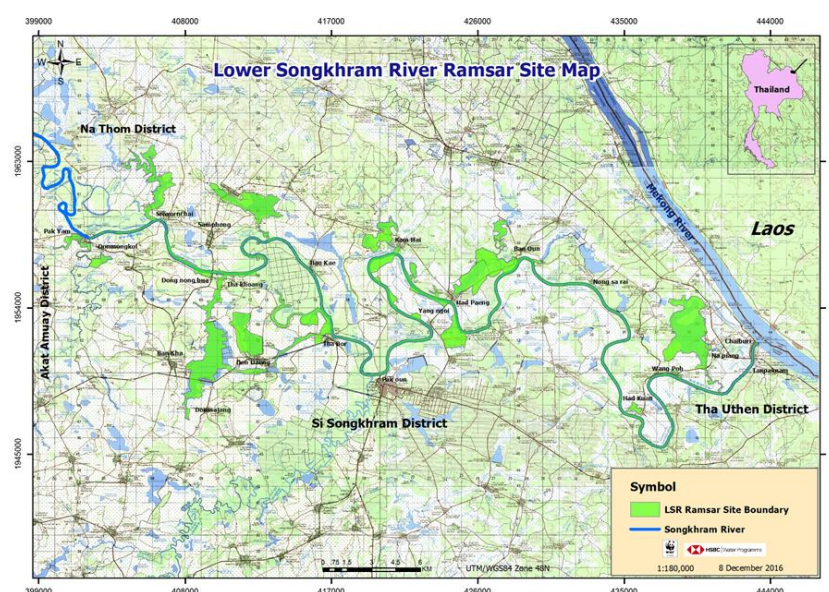


Figure 11. The Lower Songkhram River Ramsar Site, Thailand

The prioritized REAs in Thailand, which are based on fisheries criteria, are listed in Table 6.

Table 6. Prioritized REAs in Thailand based on fisheries criteria

Province	Names of sites	Legal status	Area (ha)	No. of fish species	Habitat	Connectivity	Ranking	List of 11 REAs
Nakhon Phanom	Lower Songkhram River	Ramsar	1,312,800	220	Floodplain	High	1	Yes
Ubon Ratchathani	Kaeng Tana National Park	National Park	8,000	184	Floodplain	High	2	No
Bung Kan	Kut Ting	Ramsar	2,200	113	Floodplain	High	3	No

Viet Nam

Important areas in Viet Nam are located in two distinct regions – the Mekong Delta and the Central Highlands. The upper Sesan River and its catchment are now highly modified and fragmented. There are extensive wetland areas in the Mekong Delta in Viet Nam (Figure 12). The types and extent of the wetland types are listed in Table 7.

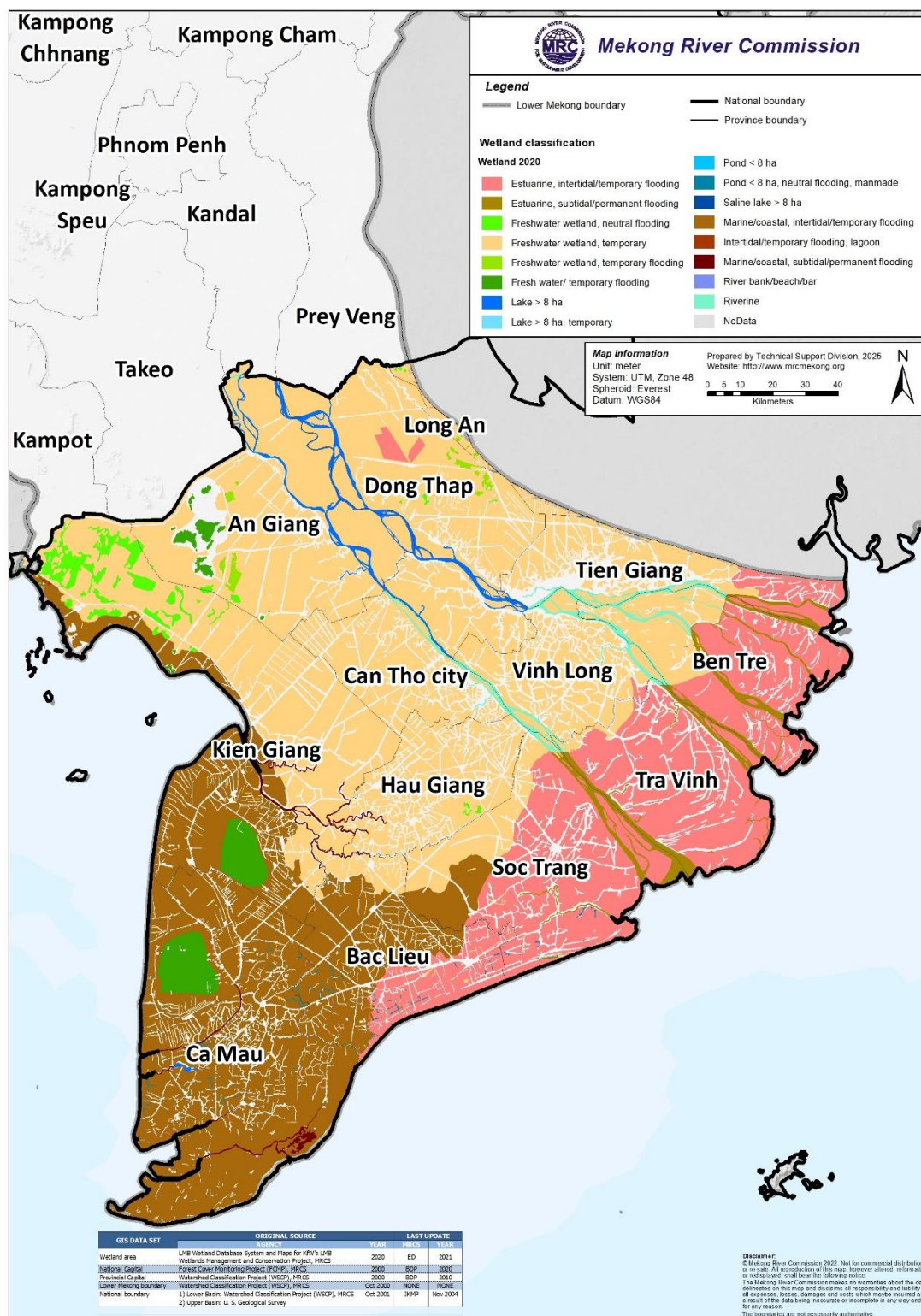


Figure 12. Wetland areas in the Mekong Delta in Viet Nam (MRC, 2024c)

Table 7. Types and extent of wetlands in the Mekong Delta in Viet Nam

Type of wetland	Area (km ²)
Estuarine, intertidal/temporary flooding	5,736.52
Estuarine, subtidal/permanent flooding	584.27
Fresh water/temporary flooding	583.36
Freshwater wetland, neutral flooding	341.18
Freshwater wetland, temporary	14,703.39
Freshwater wetland, temporary flooding	80.43
Intertidal/temporary flooding,lagoon	3.41
lake > 8 ha	327.59
Marine/coastal, intertidal/temporary flooding	7,225.74
Marine/coastal, subtidal/permanent flooding	151.93
pond < 8 ha, neutral flooding, manmade	40.98
Riverine	450.14
Grand Total	30,228.93

At least 23 deep pools are identified in Mekong and Bassac reaches in the Mekong Delta of Viet Nam ranging from 13-m to 44-m deep and 4 ha to 95 ha (Figure 13). Among these deep pools, Vam Nao site is reported as the most important fishing ground with common catches of large fish species such as *Pangasius krempfi*, *Catlocarpio siamensis* and *Boesemania microlepis*. However, to date, no Fish Conservation Zones or PAs have been designated to any deep pools in the Mekong Delta of Viet Nam. Eleven wetland ‘hotspots’ important to fisheries are identified in the Mekong Delta of Viet Nam. Seven additional key areas are identified in the national. It has been suggested that Bung Binh Thien Lagoon should be added. Among these hotspots, the Viet Nam national report lists Tram Chim National Park as the top priority (Table 8).

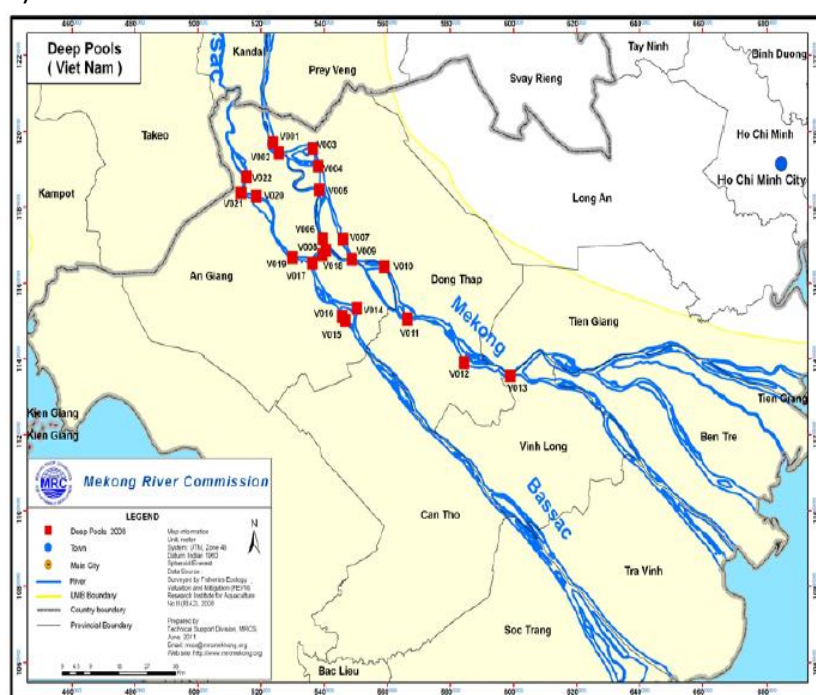


Figure 13. Deep pools in the Mekong Delta, in Viet Nam

Prioritized sites in Viet Nam based on fisheries criteria are listed in Table 8 with prioritized REAs based on fisheries criteria shown in Table 9.

Table 8. Sites prioritized for fisheries, and current REAs in Viet Nam

Province	Names of sites	Legal status	Area (ha)	Prioritized REAs relevant to fisheries	Included in current 11 REAs?
Dong Thap	Tram Chim National Park	Natural Reserve, Ramsar	4,802	1	No
Long An	Lang Sen Wetland National Park	National Park and Ramsar	7,313	2	No
Kien Giang	U Minh Thuong National Park	Natural Park, Ramsar	8,038	3	Yes
Ca Mau	U Minh Ha National Park	Natural Park	8,527	4	No
Ca Mau	Mui Ca Mau National Park	National Park	41,862	5	Yes

Table 9. Prioritized REAs in Viet Nam based on fisheries criteria

Province	Names of sites	Legal status	Area (ha)	No. of fish species	Habitat	Connectivity	Ranking	List of 11 REAs
Dong Thap	Tram Chim National Park	Natural Reserve, Ramsar	7,313	165	Floodplain	High	1	No
Long An	Lang Sen Wetland Reserve	National Reserve and Ramsar	4,802	131	Floodplain	High	2	No
Kien Giang	U Minh Thuong National Park	Natural Park, Ramsar	8,038	64	Rainfed	Medium	3	Yes

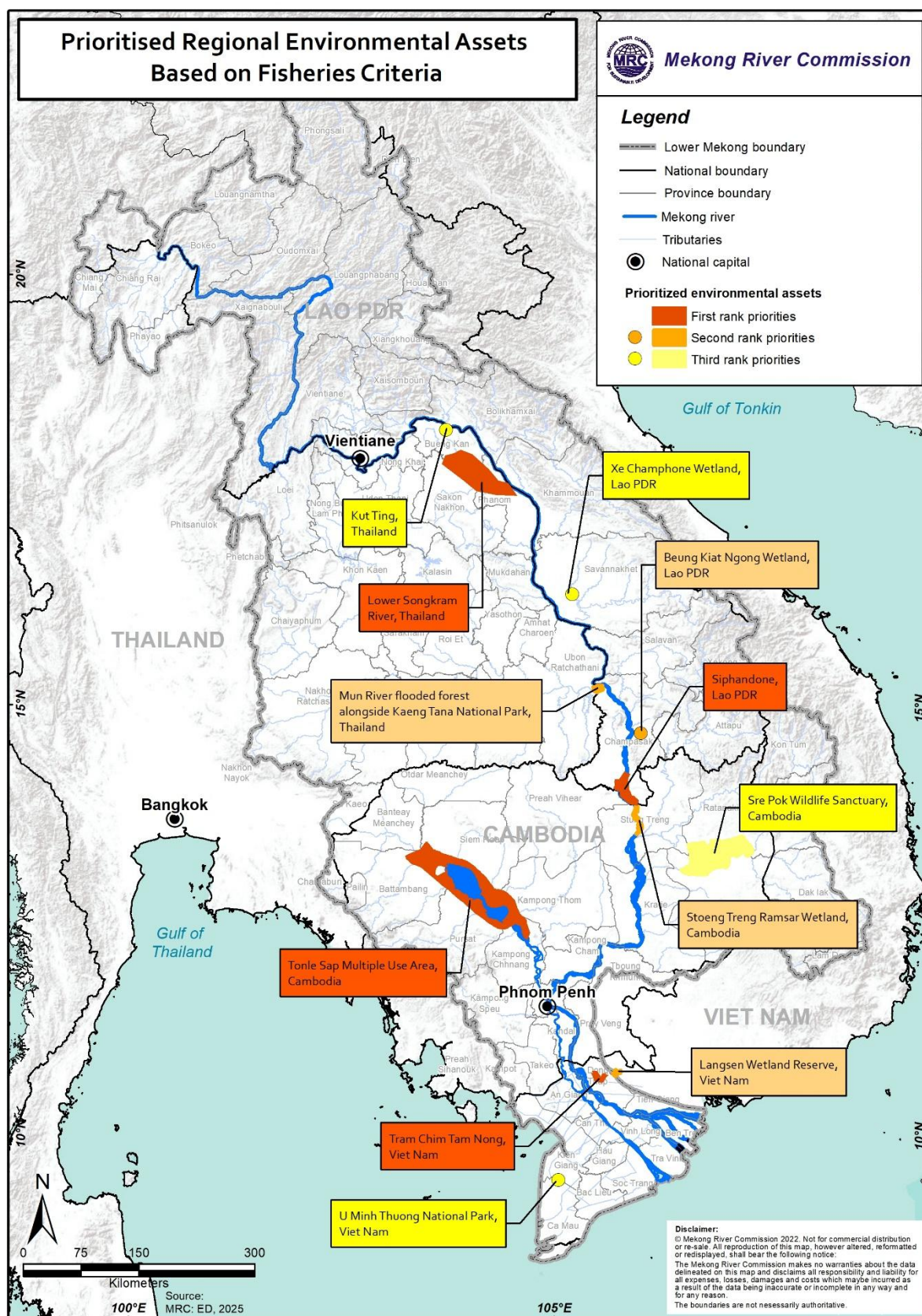


Figure 14. Prioritized Regional Environmental Assets based on fisheries criteria

2.3.3 Other relevant sources of information

Meynell (2012) considered the ecological and fisheries significance of the tributaries of the Mekong to fill gaps in knowledge that previously applied to the Mekong mainstream. Basin-wide geographic and other data sets, generally held by the MRC, underpinned GIS analysis to develop proxy indicators of ecological and fisheries significance of 104 catchments making up the LMB. The presence of PAs or Key Biodiversity Area (KBA) within a catchment can be used as a proxy indicator of significance of a tributary; although these are not usually designated based on aquatic biodiversity, fish or fisheries criteria. The report includes a list of 'ecological zones' in the LMB based on earlier work by World Wildlife Fund (WWF) using multiple criteria such as elevation, hydrology, vegetation, network characteristics, among others. For aquatic species diversity, fish was the only taxon assessed, and species lists were only available for 22 of the tributaries. The report includes useful information on ecological zone uniqueness and diversity, wetlands, ecosystem connectivity, productivity of tributaries, extent of modification, and a river habitat type classification system.

3 OPTIONS FOR POSSIBLY UPDATING THE ENVIRONMENTAL STRATEGY TO BETTER INCLUDE FISH AND FISHERIES

The list of 30 key fish and fisheries areas includes 11 REAs under the SBEM 2020–2025 (MRC, 2021b), only six of which are deemed the highest priorities for fish and fisheries (ranked 1 to 3 in Table 4 to Table 9).

In addition to criteria for prioritization of individual sites, consideration might be given to the composition of the group of REAs collectively. Criteria for this include:

- the optimal number of REAs based on capacity and resources requirements;
- a diversity of sites representing, as far as practical, the diversity and extent of important fish habitats across the LMB; and
- a diversity of sizes and ecological, socio-economic and management/institutional characteristics that enables the management plans (to be developed in the next phases of work) to be relevant and upscaled to areas beyond the current REAs.

3.1 Possible options for updating the SBEM

3.1.1 Short term: maintain the current 11 REAs

It is not possible to comprehensively cover requirements for fish biodiversity with a small number of sites and even less so for fisheries. Although the sites selected are all important, and their improved management will be a significant outcome, the impact of the work beyond the sites will be as, if not more, important. The 11 sites already include a good range of areas based on fish and fisheries criteria for the preliminary stage of the SBEM. The 11 REAs are (Table 3):

Cambodia: the three existing REAs (Tonle Sap Multiple Use Area, Virachey National Park, Sre Pok Wildlife Sanctuary)

Lao PDR: the three existing REAs (Beung Kiat Ngong Wetland, Nam Et Phoulei National Park, Xe Champhone Wetland)

Thailand: the two existing REAs (Lower Songkhram River, Nong Bong Kai Non-Hunting Area)

Viet Nam: the three existing REAs (U Minh Thuong, Yok Don, Mui Ca Mau National Park).

The above results in a group of REAs that maintains the original list of REAs given the sites may not be ranked first priority for fish and fisheries in each MC. This recommendation still meets the criteria for fish, fisheries and diversity of sites while keeping the number within previously agreed limits. Member Countries agreed with this recommendation in the regional meeting on 27 June 2025 in Ho Chi Minh city.

3.1.2 Long term: possibly expanding the list to 16 REAs

Based on the Concept Note endorsed by the Expert Group of Environmental Management in December 2024, related to updating the SBEM with relevance to critical fish habitats and the above analysis, an updated/expanded SBEM with greater relevance to critical fish habitats could include the existing 11 REAs currently prioritized by the Member Countries for the SBEM in addition to the following REAs based on fish and fisheries criteria:

- additional REAs of critical fish habitats as identified by this synthesis report:
 - expanding the REAs in Viet Nam by adding one site: Tram Chim National Park, which is ranked first priority for key fish habitats for Viet Nam;
 - expanding the REAs in Thailand by adding two sites: i.e. Kaeng Tana National Park (included flooded forest alongside Mun River) and Kut Ting Wetland, based on their fish species richness, habitat diversity and flooded forest extent (now rare in the LMB, particularly in Thailand);
 - expanding the REAs in Cambodia by adding one site: Strung Treng Ramsar Wetland;
 - expanding the REAs in Lao PDR by adding one site: Siphandon Wetlands.

This would create four REAs each in each country, as summarized in Table 10.

Table 10. Summary of possible long-term options for expanding the REAs to 16

Member Country	Name of sites	Area (ha)	In the current list of 11 REAs?
CA	Tonle Sap Multiple Use Area	1,483,339	Yes
CA	Sre Pok Wildlife Sanctuary	372,054	Yes
CA	Virachey National Park	338,057	Yes
CA	Strung Treng Wetland	14,600	No
LA	Xe Champhone Wetland	12,400	Yes
LA	Beung Kiat Ngong Wetland	2,360	Yes
LA	Nam Et Phoulei National Park	595,900	Yes
LA	Siphandone	50,000	No
TH	Lower Songkhram River	1,312,800	Yes
TH	Nong Bong Kai Non-Hunting Area	3,800	Yes
TH	Kaeng Tana National Park	8,000	No

TH	Kut Ting wetland	2,200	No
VN	Yok Don National Park	115,545	Yes
VN	Mui Ca Mau NP	41,862	Yes
VN	Tram Chim National Park	7,313	No
VN	U Minh Thuong NP	8,083	Yes

Note: CA=Cambodia; TH=Thailand; LA=Lao PDR; VN= Viet Nam

3.2 Conclusions relevant to future work on the list of REAs

In the longer term, the list of REAs in the SBEM should be expanded to provide a greater coverage of critical fish habitats. The following are some conclusions relevant to this longer-term effort.

3.2.1 Supporting national protected areas systems

A key objective of the BDS and MRC is to support national plans. Clearly, a key purpose of the SBEM is to support national PA systems. This includes supporting national efforts towards achieving relevant national targets for protected areas. This might have been central to Member Country inputs into the SBEM REA process but is invisible in the documentation. Neither the SBEM (MRC, 2021b) nor the national reports explicitly reference national PA strategies, needs or targets. More explicit linkages between the SBEM REAs and national PA systems would help increase the visibility of, and therefore support for, the MRC's efforts. It is also very common for national PA systems, tools and approaches to be influenced by international bias towards terrestrial needs; this was not assessed for the Member Countries. The SBEM, therefore, may be useful to assist countries integrate aquatic considerations into their national PA systems, where needed.

3.2.2 Supporting 'networks' of protected areas

Supporting PA 'networks' has consistently been identified as a key need, as referred to in the Aichi Biodiversity Target 11 (referenced in the SBEM). A PA 'network' refers to a system of interconnected PAs that are managed in a coordinated manner to increase overall progress towards PA objectives. To this end, ecological connectivity between sites must be ensured as well as the sharing of experience and knowledge. In addition, a group of sites also must be representative (as discussed below), and collectively managed, nationally and internationally. The current work of the SBEM REAs is an important initiative in this regard that can be built on further.

3.2.3 Improved methods for addressing representativeness

To some extent, 'representativeness' has been factored into the current SBEM process, for example, using the criterion 'rarity/uniqueness'. Future efforts can strengthen the focus on ensuring representativeness across the group of REAs. 'Representativeness', in the current sense, indicates that the group of areas selected is a reasonable representation of the diversity and area of habitats in question. It is based on knowledge of habitat types, their extent and distribution throughout the basin, with prioritization often based on rarity, uniqueness and threats. This will likely have been factored into REA selection at the national level: national experts will have factored this into their identification and prioritization of sites, and most REAs are already declared national protected areas. However, the method used to include representativeness in the prioritization of the 12 REAs based on regional criteria is not mentioned. The only reference to this is with regard to ecological zones, which refers to forest criteria.

Freshwater and/or wetlands-based classification and tools would be appropriate for the prioritization of sites for MRC purposes. Various models are available although not as well developed as for terrestrial ecosystems. Freshwater 'eco-regions' would be a more relevant framework to assess representativeness for fish and fisheries (and other aquatic biota) than forest eco-regions. An example developed by the MRC, and using MRC databases, is provided in Meynell (2012), which ranked the importance of 104 sub-catchments in the LMB based on various criteria, such as fish biodiversity and fisheries (although with significant data gaps). As noted earlier, Ramsar's wetland classification system would be useful in organizing data to assess representativeness; indeed, the previous and ongoing work of the MRC on wetlands inventory and assessment has used it.

Different categories of habitats are not evenly distributed across the LMB. Hence, different Member Countries can contribute in different ways to the overall needs for representativeness on a regional basis. There is a clear role for MRC here recognizing its regional scope.

3.2.4 Addressing needs for deep pools

There is opportunity for an initiative to specifically address the conservation and management of deep pools basin-wide. All four Member Countries recognize the significance of deep pools, and their management, to fish biodiversity and fisheries. Some are included in some of the REAs and will therefore be included in management plans. Community-based management of pools is widespread except in Viet Nam. Connectivity between deep pools is important, including nationally and regionally. Currently, there is no coordinated approach for deep pools nationally or regionally.

3.2.5 Addressing connectivity

The need to maintain connectivity is well recognized by the Member Countries. This can apply at small local scales (e.g. between irrigation canals and rice fields) or at a larger scale (e.g. between breeding sites in the upper Mekong and feeding sites in the lower Mekong). Sustaining or restoring connectivity will be an important aspect of management plans. However, there has been limited attention among the REAs to connectivity among them as a group.

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