



Regional Flyway Initiative · Site Study

May 2026

RFI Priority Site · Bangrin Marine Protected Area

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General Site Information

Country	Philippines			
RFI Site Name	Bangrin Marine Protected Area	ID117		
City/ Municipality, Province, Region	Bani Municipality, Pangasinan			
Geographical coordinates	16.25°N, 119.93°E	Area (has)	82 has	
Key species	Breeding/roosting populations of several egret and heron species (e.g. Great Egret), especially the Intermediate Egret, while the intertidal flats are used by smaller numbers of shorebirds			
Key habitats (biomes)	Coastal mangroves, intertidal flats			
Key ecosystem services	Provisioning services and regulating services (flood hazard protection)			
Key drivers of change	Aquaculture activities and upstream dam construction			
Conservation status (mark all that applies)	<input type="checkbox"/>	Protected Area	<input type="checkbox"/>	Flyway Network Site
	<input type="checkbox"/>	Ramsar Site	<input type="checkbox"/>	Others _____
IBA/ KBA name (and number) and other designations	NA			
Management Stakeholders	Bani Municipal Government, local community groups			
With management plan?				
Project concept themes	Ecotourism, site management and restoration, microfinance			
Length of project	5 years			
Sector/s	Fishery, tourism			
No. of potential beneficiaries				
Indigenous Peoples	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	Yes _____
Anticipated Implementation Risks	Some disturbance expected as a result of infrastructure expansion for the site, and buy-in from the local communities			
Estimated Project Budget (US\$)	2,850,000			
Potential Source/s of Financing	<input checked="" type="checkbox"/>	Loan (to be identified)	<input type="checkbox"/>	Private Sector
	<input type="checkbox"/>	Grant (to be identified)	<input type="checkbox"/>	Public-Private Partnership

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Abbreviations

ADB	Asian Development Bank
AFA	Aporao Fisherfolks Association
AWC	Asian Waterbird Census
BFAR	Bureau of Fisheries and Aquatic Resources
CSR	Conservation Status Review
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
ECA	Ecologically Critical Area
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
LGU	Local Government Unit
MPA	Marine Protected Area
NAGKASAMA	Nagkakaisang Samahan ng San Miguel Association
NGO	Non-governmental Organisation
PCSD	Palawan Council for Sustainable Development
RFI	Regional Flyway Initiative
SLR	Sea Level Rise
TESSA	Toolkit for Ecosystem Services Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USD	United States Dollars

Executive Summary

The Bangrin Marine Protected Area (MPA) is located in Tambac Bay, in Pangasinan Province and covers a relatively compact area of 82 ha, although it is surrounded by a wider landscape of fishponds and strips of remnant mangroves and is bordered on the coast by intertidal flats and shallow marine waters. The mangrove forests in Bangrin MPA support large congregations of egrets and other waterbirds. Waterbird count data from the 2019, 2020, and 2021 Asian Waterbird Censuses demonstrate the importance of the site for some of the largest congregations of roosting and breeding egrets in Luzon, especially for the Intermediate Egret, while the intertidal flats are used by smaller numbers of shorebirds. The site is locally administered and is co-managed by the Nagkakaisang Samahan ng San Miguel Association (NAGKASAMA), Aporao Fisherfolks Association (AFA) and the Municipal Government of Bani.

Bangrin's key ecosystem services include provisioning services through its coastal fisheries, given that many small-scale fishers operate in the inland waters surrounding the site. Regulating services, such as local climate regulation were also identified as essential and positively impact local communities living around Bangrin MPA. Cultural services such as recreation, ecotourism, and knowledge systems provide another source of benefits and livelihoods for site-level stakeholders. In monetary terms, Bangrin is below the average of all RFI coastal sites in the Philippines for its total annual benefits, but the site ranks above both the national RFI and overall country averages in terms of total annual benefits per ha of mangroves (15,294 vs. 14,895 or 11,160 USD/ha). Important drivers of change for Bangrin include aquacultural activities for fish and prawns, which drive water pollution, and the construction of dams upstream of the site that can alter the wetlands' hydrological regime, which can lead to habitat degradation and loss of biodiversity.

As a result of its accessibility and strong local management structures already in place, led by the Bani Municipal Government and local groups, there is strong potential for implementing wetland restoration activities, especially in disused areas of aquaculture, to expand existing mangrove cover and improve the quality of existing wetland habitat. There is scope to improve access to the site for visitors, including expansion of existing boardwalks, and the construction of shelters, access signages and a wetland interpretation centre (for wetland education). Other proposed interventions should include initiatives to strengthen the livelihoods of fishers and local communities, while advancing a plan of work to improve management of the wetland site.

1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South, and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia, and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortium of international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site prioritisation analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water-based ecosystem services and stored carbon.

In the Philippines, a total of 20 wetland sites, including many Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which twelve (12) were defined and identified to be RFI priority sites on the basis that they support more than 1% the flyway population of at least one EAAF migratory waterbird species. The majority of the RFI wetlands prioritised for the Philippines are coastal wetlands, a consequence of the country's long coastline, with the largest cluster of priority sites being North Manila Bay, which constitutes three sites across the provincial jurisdictions of Bataan, Pampanga and Bulacan. 28 EAAF species exceeded the 1% threshold at the site level, with species such as Chinese Crested Tern, Chinese Egret and the Tufted Duck.

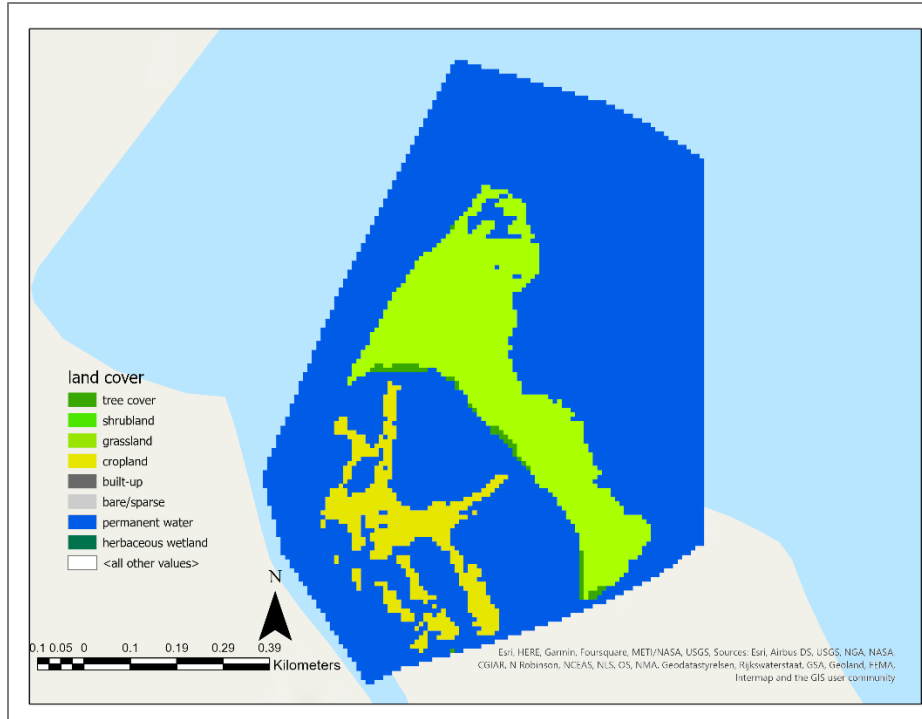


Figure 1 Map showing the extent of the Bangrin Marine Protected Area, in the Lingayen Gulf (Map: Radhika Bhargava).

2. Site profile of Bangrin Marine Protected Area

Location: The Bangrin Marine Protected Area (MPA) is located in Tambac Bay, in Barangays Aporao and San Miguel, Bani Municipality, Pangasinan Province.

Area: The Bangrin MPA RFI site covers an area of 82 ha.

Altitude: Sea-level.

Geographical coordinates: 16.25°N, 119.93°E

Description of site: Bangrin MPA comprises a 42.25 ha coastal mangrove forest, bordered by tidal flats and shallow marine waters. A 450-meter boardwalk has been constructed through the mangroves, which is popular with tourists and birdwatchers.

Site administration, management and land tenure: Bangrin Marine Protected Area is co-managed by the Nagkakaisang Samahan ng San Miguel Association (NAGKASAMA), Aporao Fisherfolks Association (AFA) and the Municipal Government of Bani.

Social and economic values: Bangrin Marine Protected Area is one of 13 birdwatching sites in the Philippines which have been identified and promoted by the Department of Tourism. Activities available for local and foreign visitors include birdwatching, boat trips, the board walk, forest adventure walks, fishing, and the gathering of shells.

3. Biodiversity value of the Bangrin Marine Protected Area

3.1 Key habitats

The Bangrin Marine Protected Area (MPA) covers a relatively compact area of 82 ha, surrounded by a wider landscape of fishponds and strips of remnant mangroves, and bordered on the coast by intertidal flats and shallow marine waters.

3.2 Importance of Bangrin Marine Protected Area for migratory waterbirds

The mangrove forests in Bangrin MPA support large congregations of egrets and other waterbirds. Waterbird count data from the 2019, 2020 and 2021 Asian Waterbird Census was used in the RFI priority sites analysis for this site. The counts from these three years were averaged and then compared to the CSR1 1% population estimates to calculate a score for each species. Two egret species were found to exceed the 1% population estimates, and the scores for these species were summed to produce the overall site score for Bangrin MPA (Table 1).

Table 1 List of migratory species (based on the EAAFP list of species) with globally significant congregations in the Bangrin Marine Protected Area.

Scientific name	IUCN	Average count	CSR1	CSR1 score
Intermediate Egret <i>Ardea intermedia</i>	LC	16,023	1,000	16.0
Great White Egret <i>Ardea alba</i>	LC	5,085	1,000	5.1

3.3. Other notable biodiversity

4. Ecosystem services

4.1. Ecosystem services provided by Bangrin Marine Protected Area

The Bangrin Marine Protected Area overlaps with diverse coastal wetland habitats, which in turn provide valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop¹ in the Philippines highlight the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, such as food and genetic resources, are crucial, with food provision benefiting both within and adjacent communities, while genetic resources extend their benefits to distant communities as well. Regulating services, such as local climate regulation, are also essential and positively impact communities within and adjacent to the site. Cultural services, including recreation ecotourism and knowledge systems, provide key benefits to adjacent communities.

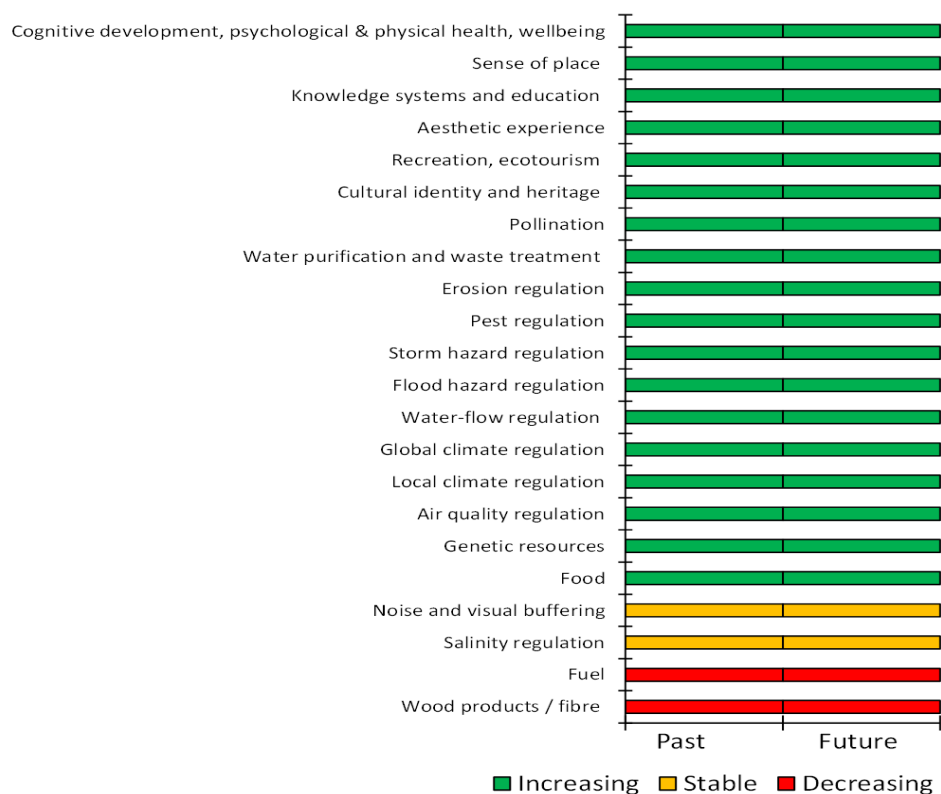


Figure 2 List of ecosystem services provided by Bangrin Marine Protected Area, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

¹ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

Table 2 List of top ecosystem services provided by the Bangrin Marine Protected Area.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
<i>Provisioning services</i>						
Food	Yes	✓	✓		Increase	Increase
Genetic resources	Yes	✓	✓	✓	Increase	Increase
<i>Regulating services</i>						
Local climate regulation	Yes	✓	✓		Increase	Increase
<i>Cultural services</i>						
Recreation, ecotourism		✓			Increase	Increase
Knowledge systems and education		✓			Increase	Increase

4.2. Global climate regulating services

Based on systematic reviews (Chen and Lee, 2022; Stankovic et al., 2023), the amount of carbon stored in Bangrin MPA is estimated to range from 3,020 to 88,600 tonnes, while the annual carbon sequestration rate is estimated to be between 60 and 541 tonnes per year.

4.3. Coastal protection services

The coastal protection services provided by Bangrin MPA were assessed using both biophysical indices and monetary values (see Tables A1 and A2, and Annex 1 for details). Unfortunately, Bangrin MPA cannot be compared to the average risk levels of either the nine RFI coastal sites or of all other coastal areas in the Philippines because no biophysical data were available for this site due to its relatively small size (Table A3 in Annex 1).

In monetary terms (Table A4 in Annex 1), Bangrin MPA is well below the average of all RFI coastal sites in the Philippines regarding both total annual benefits (1.0 million vs. 16.4 million USD) and total benefits against 100-year return period storms (0.3 vs. 2.4 million USD). However, Bangrin MPA ranks above both the national RFI and overall country averages in terms of total annual benefits per ha of mangroves (15,294 vs. 14,895 or 11,160 USD/ha).

5. Drivers of change and their potential impacts on Bangrin Marine Protected Area

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop² identified 21 drivers of change impacting the Bangrin Wetland. Table 3 highlights these key drivers of change and their corresponding level of impact on the site. High-impact drivers include dams within or upstream of the wetland site that alter the hydrological regime, significantly affecting water flow and the overall health of the wetland ecosystem. This alteration can lead to habitat degradation and loss of biodiversity. Medium-impact drivers include marine and freshwater aquaculture, which affects water quality and habitat conditions. Agricultural and forestry effluents contribute to nutrient loading and pollution in the wetland. Erosion and siltation/deposition further impact habitat stability, affecting species that rely on these areas. Fishing, killing, and harvesting of aquatic resources also pose medium-level threats to the wetland's biodiversity. Additionally, vandalism, destructive activities, and water extraction/diversion within the wetland site or catchment have been identified as medium-impact concerns.

Table 3 Drivers of change and their potential impact on the integrity of Bangrin Marine Protected Area based on consultations with stakeholders.

Driver of change	Impact
Dams within or upstream of the wetland site, which alter the hydrological regime	High
Dams, hydrological modification and water management/use	
Habitat shifting and alteration	
Household sewage and urban waste water from outside the wetland site	
Other 'edge effects' that degrade the wetland site values	
Recreational activities and tourism	
Restoration for conservation	
Shipping lanes and canals	
Tourism and recreation infrastructure	
Marine and freshwater aquaculture	
Agricultural and forestry effluents	
Erosion and siltation/deposition	
Fishing, killing and harvesting of aquatic resources	
Vandalism, destructive activities or threats to staff and visitors	
Water extraction/diversion within the wetland site or catchment	
Air-borne pollutants	Low
Garbage and solid waste	
Hunting, killing and collecting of terrestrial animals	
Invasive animal species	
Livestock farming and grazing	
Research, education and other work-related activities	

² Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

5.2. Potential alternative state of Bangrin Marine Protected Area under current drivers of change

Stakeholders at the RFI workshop³ defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site (current habitat cover vs future alternative cover; Figure 3). The alternative state of the site assumes there will be no changes in the current drivers of change impacting the site, and the current management regime.

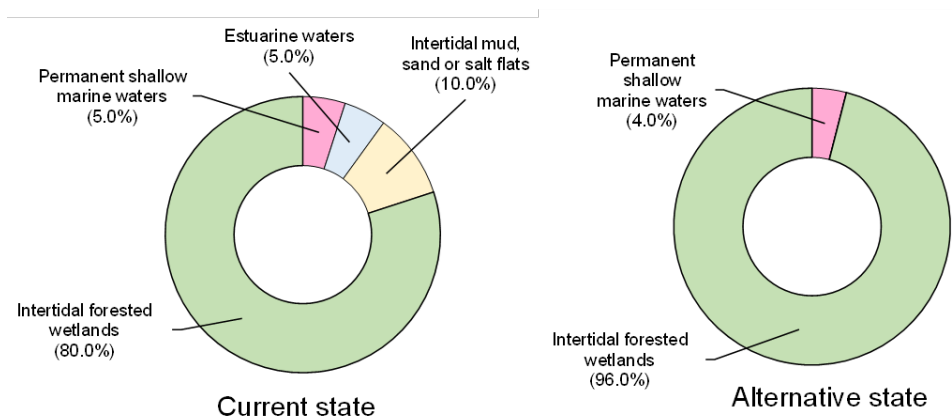


Figure 3 The proportional change in the extent of different habitat types between the current and alternative states of Bangrin Marine Protected Area.

5.3. Expected changes in the ecosystem services of Bangrin Marine Protected Area

Stakeholders at the RFI workshop⁴ documented the future trends in the provision of ecosystem services in Bangrin Marine Protected Area, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable, assuming that the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Figure 2 and Table 2 highlight that provisioning services, such as food and genetic resources are projected to increase in the future. Regulating services, such as local climate regulation, may increase in the long term. The importance of cultural services, including recreation ecotourism and knowledge systems, are expected to increase over time.

³ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

⁴ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

In the alternative state, an increase of 20% of mangrove and a total loss of intertidal mudflat are expected to result in a gain of stored carbon by 8,030 tonnes and an increase of carbon sequestration (carbon accumulation) rate by approximately 47 tonnes per year.

A gain of 13.1 ha of mangroves as presented in Table A5 is equivalent to 16% of the total land use for the site, which is expected to result in roughly a 19% increase in coastal protection. This may amount to over US\$200,000 in gained total benefits per year (based on USD15,294 per hectare of mangroves) and USD63,000 in gained total benefits per 100-year return period storm (based on the same 19% increase in coastal protection).

6. Capacity needs in Bangrin Marine Protected Area

Table 4 summarizes the identified capacity gaps and needs for the management of the Bangrin MPA by the participating stakeholders at the RFI workshop⁵.

Table 4 Key stakeholders involved in the management of Bangrin MPA and the capacity gaps and needs, as identified at the RFI stakeholder workshop.

Stakeholder	Current Role in wetland management	Future role (alt state)	Future capacity (alt state)	Form of capacity development
BANI Municipality Government Agriculture Office Tourism Office	Monitoring, patrolling and promoting of the site	Increased role and leadership in community management, sustainable ecotourism and citizen science (oversight on monitoring)	Community engagement Transfer of management	Workshops and targeted training programmes MPA month celebrations Experiential learning and exchange visits to other wetland sites.
Fisherfolk	Livelihood subsistence	Increased role in site protection and management.	Monitoring techniques and approaches for wetlands.	Tools for monitoring, develop goals and objectives, and workplans.

⁵ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

Stakeholder	Current Role in wetland management	Future role (alt state)	Future capacity (alt state)	Form of capacity development
DENR BFAR	Provide technical assistance	Bottom-up dialogue and consultation to improve regulations and enforcement. Networking with other municipalities and wetland sites.	-	-
		Manage data and support knowledge transfer.	-	-
PNP Maritime Police	Security and law enforcement (including on environmental violations)	Partners in strengthening education and awareness for wetland protection.	-	-
Fishpond owners	Feeding ground resource user livelihood	Increased education and stronger advocacy for Bangrin.	-	-

7. Opportunities for RFI interventions

7.1 Recommended Interventions

The Bangrin Marine Protected Area is a relatively compact wetland site (and among the smallest in the RFI sites prioritised for the Philippines) but there are in fact extensive landscapes of fishponds and mangroves in and around the site (under Bani Municipality), which offers potential for wetland restoration, especially in disused areas of aquaculture. Its size and accessibility, like Bataan's Balanga wetlands, makes it very attractive for domestic tourism, and there is scope to improve access to the site for visitors, including expansion of existing boardwalks, and the construction of shelters, access signages and a wetland interpretation centre (for wetland education). Other proposed interventions (see Table 5) should include initiatives to strengthen the livelihoods of fishers and local communities, while advancing a plan of work to improve management of the wetland site, through the creation of management plans and active management activities to enhance habitat heterogeneity. Restorative work to increase mangrove cover can be implemented at disused areas of aquaculture around the MPA, increasing the amount of habitat available for nesting and roosting waterbirds.

Table 5 Key interventions recommended for the sustainable management of the Bangrin Marine Protected Area.

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1. Enhancement of wetland-based ecotourism</i>					
Improve and expand ecotourism infrastructure, including boardwalks, signages and viewing structures at Bangrin MPA.	Infrastructure repaired and improved, with extended boardwalks and new observation hides constructed.	Number of established ecotourism infrastructure (i.e., expanded boardwalk of at least 0.3 km, two new observation decks)	300,000	2 years	Bani Municipality Government Department of Environment and Natural Resources Department of Tourism
Improve capacity of local tourism stakeholders to adopt nature-based tourism and more sustainable wetland tourism practices.	Training and capacity needs for nature-based tourism assessed Relevant training modules developed and implemented with key stakeholders (e.g., DENR, LGU Bani, provincial government, DoT) Improved capacity of key stakeholders about nature-based tourism and sustainable wetland tourism practices	Training Needs Assessment on nature-based tourism completed and disseminated to concerned stakeholders Number of training modules developed based on the results of training needs assessment Number of capacity-building activities administered with concerned stakeholders Number of people benefitting from the capacity-building activities, especially those	110,000	5 years	Provincial Government of Pangasinan NAGKASAMA AFA Local ecotourism operators Conservation organisations (including bird and community-focused NGOs)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		from the vulnerable groups			
<i>Component 2. Improvement of wetland protection and management</i>					
Establish a local-led biodiversity and wetland monitoring scheme.	<p>Biodiversity and wetlands monitoring framework and mechanism for the site established.</p> <p>Improved local biodiversity and wetland information for better site management.</p> <p>Formation of a locally led conservation monitoring group led by LGU Bani</p>	<p>Biodiversity and wetlands monitoring framework identified and used for site monitoring</p> <p>Number of monitoring reports on the biodiversity and wetland status generated, especially during the migration season</p> <p>A locally led conservation monitoring group organized</p>	50,000	3 years	<p>DENR</p> <p>Bani Municipality Government</p> <p>Universities</p> <p>Conservation organisations</p>
Update and expand existing site management plan of Bangrin MPA.	<p>Legal status of the Bangrin MPA as a protected area under national and provincial legislation approved.</p> <p>Management framework in place and actively implemented.</p> <p>Formation of a locally led conservation group to implement the</p>	<p>One management plan established for the site.</p> <p>One local conservation group, with participation of LGUs established.</p>	50,000	5 years	<p>Provincial Government of Pangasinan</p> <p>DENR</p> <p>Bani Municipality Government</p> <p>Conservation organisations</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	updated site management plan				
Expand mangrove restoration plots at degraded areas of mangroves and disused fishponds around the Bangrin MPA. Enhance habitat heterogeneity through targeted plantings.	Degraded mangrove areas, including fishponds restored and more resilient to coastal erosion.	Up to 15 ha of degraded mangroves restored at identified plots in fishponds adjacent to the MPA	100,000	3 years	
<i>Component 3. Strengthening local resilience through microfinance and capacity building mechanisms</i>					
Develop financing instruments to generate financing for local communities, including small loans and grants for fishers, and capacity building.	Improved capacity for financial management of local communities Financial mechanism and management board established to manage disbursement of small loans and grants relevant to site management	Microfinancing mechanism for small grants/loans to fishers established in at least two barangays. Number of capacity-building activities administered with concerned stakeholders	100,000	5 years	DENR BFAR Provincial Government of Pangasinan Bani Municipal Government AFA Existing cooperatives

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	Better fishing practices documented in the areas covered by the capacity-building activities	Number of participating households (targeting 50-100 households) in the target communities			Researchers
Build institutional capacity for small-scale fishers and ecotourism operators through cooperatives.	Improved capacity for sustainable fishing practices of local communities	Training Needs Assessment on sustainable fishing practices completed and disseminated to concerned stakeholders	100,000	5 years	
	Training and capacity needs for small-scale fishers and ecotourism operators assessed	Number of training modules developed based on the results of training needs assessment			
	Relevant training modules developed and implemented with key stakeholders (e.g., DENR, LGU Bani, provincial government, DoT)	Number of capacity-building activities administered with concerned stakeholders			
	Improved capacity of key stakeholders about sustainable fishing practices	Number of people benefitting from the capacity-building activities, especially those from the vulnerable groups			
Total investment over a five-year period				2,850,000	

7.2 Potential Financing

The estimated project cost is USD 2,850,000 over a five-year period. This project budget supports the assessment and improvement of local capacity in wetland-based tourism, wetland monitoring, and sustainable fishing, as well as the expansion of local infrastructure, restoration of degraded areas, and institutionalization of a biodiversity monitoring system.

If the proposed USD 100,000 investment over three years is directed toward mangrove restoration around the Bangrin Marine Protected Area, it could enable the rehabilitation of up to 15 hectares of degraded mangroves and disused fishponds. With estimated coastal protection benefits of USD 15,294 per hectare annually (see Section 5.3), this intervention could generate approximately USD 229,410 in annual ecosystem service benefits—equivalent to nearly USD 688,000 over three years. This reflects a strong benefit–cost ratio of nearly 7:1, demonstrating the cost-effectiveness of targeted restoration in enhancing natural coastal defenses. In addition to improving resilience to coastal erosion, the intervention would enhance habitat heterogeneity and support the ecological integrity of the broader MPA. Leaving these degraded areas unrestored would represent a lost opportunity to recover high-value natural protection and increase the long-term sustainability of coastal ecosystems and livelihoods.

7.3 Proposed Institutional Arrangements

Proposed interventions are expected to involve the leadership of Bani LGU and stakeholder groups from the local communities such as AFA around Bangrin MPA, with strong representative of women and disadvantaged groups. This includes fisherfolk, small businesses (in production of seafood-based food products) and tour operators. There are no indigenous or minority peoples in this landscape.

7.4 Project Beneficiaries

The Municipal Government of Bani and the local groups, NAGKASAWA and AFA are expected to be key implementing partners.

The Provincial Environment and Resources Office (PENRO) for Pangasinan has played a major role in promoting wetland conservation at Bangrin and will be a critical partner for the development and implementation of this project, together with the Department of Tourism (DOT).

7.5 Anticipated Implementation Risks

Environment: Poorly planned establishment of mangrove plantings may lead to loss of foraging habitat for some waterbirds and is a known issue in many parts of the Philippines where coastal restoration is being implemented. Evidence-based scoping needs to be carried out to identify key restoration plots. Construction of new visitor infrastructure may result in short-term disturbance to wildlife.

Stakeholder: Establishing a locally managed approach for the wetland requires engaging local communities adjacent to the Bangrin MPA. Stakeholder mapping and discussions with local communities will help determine their interests and perceived benefits from co-managing the wetland. Engaging women, indigenous people, and marginalized fishing communities whose livelihoods are directly affected can provide an inclusive conservation approach.

References

Asenso Pangasinan: Bangrin Mangrove Farm (Marine Protected Area). Available at: <https://asensopangasinan.com/2019/06/23/bangrin-mangrove-farm-marine-protected-area/>

Asian Waterbird Census (AWC): Philippines data for 2019-2021. See <https://eaaflyway.net/asian-waterbird-census>

IUCN Red List of Threatened Species. Available at: www.iucnredlist.org

Mundkur, T. & Langendoen, T. (2022) Report on the Conservation Status of Migratory Waterbirds of the East Asian – Australasian Flyway Partnership. First Edition. Draft Report to the East Asian – Australasian Flyway Partnership. Wetlands International, Ede, The Netherlands. Available at: <https://www.wetlands.org/publication/eaaf-conservation-status-review1/>

See Pangasinan: Bangrin Marine Protected Area. Available at: <https://seepangasinan.com/places/bangrin-marine-protected-area/>

Wikimapia: Bangrin Marine Protected Area. Available at: <https://wikimapia.org/9303035/Bangrin-Marine-Protected-Area>

Annex 1. Supplementary information on coastal protection services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co\$tingNature (Mulligan, 2022). Estimates for coastal protection by mangroves (after the effects of coral reefs) were spatially inferred in QGIS from a selection of metrics expressing different biophysical and monetary values modelled by Chaplin-Kramer et al. (2023) and Menéndez et al. (2020), respectively.

The key metrics selected for biophysical values (Table A1) were current maximum potential exposure to coastal hazards, which is a vulnerability risk index calculated in InVEST^[1] for several hazard variables (i.e., wind, waves, sea level rise, geomorphology, and bathymetry) in the hypothetical absence of current mangrove extent, and nature’s (i.e., the mangroves’) contribution to reducing this coastal risk, both as an absolute value multiplied by the local population affected and a percentage of the maximum potential exposure.

Table A1. Contribution of mangroves to coastal protection as a critical natural asset in Bangrin MPA based on site-level (biophysical) values inferred from Chaplin-Kramer et al. (2023) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Critical contribution of mangroves to coastal protection (metrics)	Risk levels
Current population density within 2.5 km of the coast (number of people per hectare)	No Data
<i>Current maximum coastal risk to be mitigated, or potential exposure to coastal hazards (unitless index)</i>	<i>No Data</i>
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #1 ‘Sustainability’ (unitless index)	No Data
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #3 ‘Regional Rivalry’ (unitless index)	No Data
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC’s Shared Socioeconomic Pathway #5 ‘Fossil-fueled Development’ (unitless index)	No Data
Current proportional risk reduction, nature’s contribution to reducing coastal risk as a proportion of maximum coastal risk (unitless index)	No Data
<i>Nature’s contribution to reducing coastal risk as a proportion of population density within 2.5 km of the coast (# of people per hectare)</i>	<i>No Data</i>
<i>Nature’s contribution to reducing coastal risk as a percentage of the maximum potential exposure (%)</i>	<i>No Data</i>

The key metrics selected for economic values (Table A2) were the annual expected flood protection benefits to total stock, which is the monetary value of the averted damages to the industrial and residential stocks (i.e., property) in 2015 US\$, the same total annual benefits expressed per hectare of mangroves, and the total benefits in the event of a 100-year return period storm, which are the rarest of cyclonic conditions but cause the most flood damages to property (i.e., maximum level of coastal protection by mangroves).

Table A2. Coastal protection benefits offered by mangroves in Bangrin MPA based on site-level (monetary) values inferred from Menéndez et al. (2020) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Benefits of mangroves in terms of coastal protection (metrics)	Avoided costs (US\$)
Mangrove extent (hectares) ^[2]	1 – 54
Annual expected flood protection benefits to people (number of people)	933 – 1,128
Annual expected flood protection benefits to Industrial Stock (US\$)	428,847 – 518,458
Annual expected flood protection benefits to Residential Stock (US\$)	535,389 – 647,263
<i>Annual expected flood protection benefits to Total Stock (US\$)</i>	946,410 – 1,144,170
<i>Annual expected flood protection benefits to Industrial Stock per hectare of mangroves (US\$ per hectare)</i>	13,847 – 16,741
1-in-100-year return period damage in terms of area flooded (number of hectares)	10 – 12
<i>Total expected flood protection benefits of mangroves per 100-year return period storms (US\$)</i>	299,985 – 362,669

Table A3. Biophysical benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Max pot exp (index)	Risk reduction (index * pop)	Risk reduction (% max pot exp)
Bangrin Marine Protected Area	No Data	No Data	No Data
Kabasaran-Siay Wetland Area	2.24 (±0.03)	50 (±13)	8.2 (±0.2)
Negros Occidental Coastal Wetlands Conservation Area (NOCWCA)	2.55 (±0.04)	187 (±37)	4.8 (±0.3)
North Manila Bay (Balanga Wetlands Park)	No Data	No Data	No Data
North Manila Bay (Pampanga River East Bank)	3.16 (±0.03)	296 (±451)	3.3 (±0.6)
North Manila Bay (Sasmuan Pampanga Coastal Wetland)	2.99 (±0.06)	18 (±28)	5.3 (±1.3)
Olango Island Wildlife Sanctuary	2.77 (±0.09)	496 (±87)	7.7 (±0.2)
Panabo Coast	2.40 (±0.05)	1,537 (±617)	8.1 (±0.5)
Tubbataha Reef Natural Park	2.82 (±0.04)	Not Applicable	0.8 (±2.1)
Philippines RFI average	2.70	306	5.28
Philippines national average	2.36	122	6.60

Table A4. Monetary benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Total annual benefits (US\$)	Per mangrove area (US\$/ha)	For 100-yr return period storms (US\$)
Bangrin Marine Protected Area	1,045,290 (±98,880)	15,294 (±1,447)	331,327 (±31,342)
Kabasaran-Siay Wetland Area	86,324,218 (±160,880,759)	12,182 (±22,704)	1,571,774 (±3,587,626)
Negros Occidental Coastal Wetlands Conservation Area (NOCWCA)	2,511,290 (±2,318,575)	1,687 (±1,557)	5,477,498 (±5,654,072)
North Manila Bay (Balanga Wetlands Park)	1,207,200 (±572,108)	28,002 (±13,270)	202,433 (±6,784)
North Manila Bay (Pampanga River East Bank)	3,621,601 (±33,678,493)	4,200 (±39,060)	6,609,485 (±106,458,484)
North Manila Bay (Sasmuan Pampanga Coastal Wetland)	3,621,601 (±102,747)	28,002 (±794)	607,298 (±17,229)
Olango Island Wildlife Sanctuary	No Data	No Data	No Data
Panabo Coast	No Data	No Data	No Data
Tubbataha Reef Natural Park	No Data	No Data	No Data
Philippines RFI average	16,388,533	14,895	2,466,636
Philippines RFI total	98,331,201	Not Applicable	14,799,814
Philippines national average	1,849,798	11,160	4,933,082
Philippines national total	789,863,793	Not Applicable	2,136,024,319

Table A5. Key habitat types in Bangrin Marine Protected Area based on stakeholder-based assessment at the Regional Flyway Initiative workshop in June 2023.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Permanent shallow marine waters	4.1	5.0	3.3	4.0
Estuarine waters	4.1	5.0	0.0	0.0
Intertidal mud, sand or salt flats	8.2	10.0	0.0	0.0
Intertidal forested wetlands	65.5	80.0	78.6	96.0
Total	81.9	100.0	81.9	100.0

[1] <https://naturalcapitalproject.stanford.edu/invest/coastal-vulnerability>

[2] The reference value used by Menéndez et al. (2020) for their modelling is c. 565 ha, remote sensing data from ESA World Cover 2020 map at 10m resolution.