

Hanifaru Marine Protected Area, Maldives: Research and Monitoring Plan 2025 – 2030



**Ministry of Environment,
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Hanifaru Marine Protected Area Research and Monitoring Plan 2025-2030

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EXECUTIVE SUMMARY

Protected and Conserved Areas (PCAs) are crucial for preserving biodiversity and promoting sustainable use of marine resources. When effectively managed, these areas contribute to healthier ecosystems by protecting habitats and endangered species, which in turn supports more robust fisheries. These improved environmental conditions provide numerous benefits to local communities, including enhanced food security through sustainable fishing practices and increased income opportunities from eco-tourism. By attracting visitors who are interested in exploring pristine marine environments, well-managed PCAs can also boost local economies and encourage conservation efforts. Monitoring and research programmes are essential for effective management of PCAs, providing evidence for the occurrence and magnitude of changes through time and space, and enabling assessment of these changes against known impacts or management actions.

A Research and Monitoring Plan (RMP) is a document which provides a standardised framework to aid environmental managers and scientists in developing these programmes. RMPs are developed alongside PCA-specific management plans, thus establishing clear links between PCA visions, the implementation of management actions, and the subsequent influence of management on the 'health' or 'condition' of protected species, habitats and human communities. A well-designed RMP will act as a 'blueprint' for the scientific activities needed to collect targeted scientific data and evidence for PCA effectiveness evaluations, allowing managers to responsively adapt management and maximise conservation benefits to both the environment and stakeholders.

The key function of an RMP is to collate and structure all relevant information on monitoring requirements for PCAs in a clear and central repository. This ensures that monitoring activities are closely linked to management actions and that responsibility for each element of the monitoring is understood by all participants. A well-designed RMP will also streamline the acquisition of 'research relevant' data through monitoring objectives, whilst identifying knowledge gaps where additional research projects could feed into long-term management.

This report represents the first edition of an RMP for the Hanifaru MPA. Designated as a MPA in 2009, the Hanifaru MPA (known as Vandhoomaafaru Adi by the local community) forms the core area of the Baa Atoll UNESCO Biosphere Reserve. The local topographical, hydrodynamic, and seasonal climatic conditions of the MPA between May and October each year support phytoplankton and subsequently zooplankton blooms which attract large numbers of reef manta rays (*Mobula alfredi*) and whale sharks (*Rhincodon typus*). Hanifaru

is an internationally significant area for seasonal feeding aggregations of these species, which are the primary reason for designation of the MPA.

Since its designation, Hanifaru has seen a marked increase in eco-tourism, focused principally on the manta ray and whale shark aggregations. This significant increase, and the associated disturbance to the animals through human interactions, has the capacity to negatively impact the health of their populations through disturbance of feeding behaviours, resulting in reduced fitness and potentially breeding capacity. Since the establishment of the Baa Atoll Biosphere Reserve and the Hanifaru MPA, regulations have been enacted to ensure that such damaging activities are either prohibited or heavily controlled, but despite this, some threats to the marine environment and its biodiversity remain.

This RMP outlines the roles of the relevant stakeholders with respect to governance of the Hanifaru RMP and presents a list of indicators/parameters that should be used to address the various monitoring objectives for the site. The report outlines the target trends or thresholds for each parameter/indicator, what type of data (both ecological and socio-economic) is required to address them, how these data are to be collected and how often (e.g., seasonally, annually) and the key responsible stakeholder. The report then outlines how these data should be reported. Finally, this RMP identifies the key knowledge gaps regarding the understanding of the Hanifaru MPA and presents a number of potential research ideas and opportunities for the future.

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Acronyms

Baa BRO	Baa Atoll Biosphere Reserve Office
EPA	Environmental Protection Agency
ISRA	Important Shark and Ray Areas
IUCN	International Union for Conservation of Nature
MoCCEE	Ministry of Climate Change, Environment and Energy
MoTE	Ministry of Tourism and Environment
METT-4	Management Effectiveness Tracking Tool (version 4)
MMCP	Manta Trust Maldives Manta Conservation Programme
MMRI	Maldives Marine Research Institute
MNU	Maldives National University
MPA	Marine Protected Area
MWSRP	Maldives Whale Shark Research Programme
NGO	Non-Governmental Organisation
OCP	Ocean Country Partnership Programme
ORP	Olive Ridley Project
PAME	Protected Area Management Effectiveness
RMP	Research and Monitoring Plan
UNESCO	United Nations Educational, Scientific and Cultural Organisation

1 Introduction

This Research and Monitoring Plan (RMP) provides a framework for the delivery of research and monitoring activities for the Hanifaru Marine Protected Area (MPA) (and beyond, where relevant to its protected features), in accordance with the Maldives National Research and Monitoring Plan Guidance for Protected and Conserved Areas (MoTE, 2025a).

This RMP is a partner document to the Hanifaru MPA Management Action Plan (MoTE, 2025b) and aims to establish clear links between the MPA vision, management objectives, the implementation of management actions and subsequent impacts on ecological features and communities. The RMP acts as a ‘blueprint’ for the scientific activities required to collect targeted scientific evidence for MPA condition assessments and Protected Area Management Effectiveness (PAME) evaluations. It should be noted that this document focuses on the ecological, environmental and socio-economic monitoring requirements for the Hanifaru MPA, as opposed to monitoring of compliance with regulations. Its key function is to collate and structure all relevant information on monitoring requirements for the site in a clear and central repository, to ensure that monitoring activities are closely linked to management actions and that responsibility for each element of the monitoring is understood by all participants. The RMP will also streamline the acquisition of ‘research relevant’ data through monitoring objectives, whilst collating existing research outputs and identifying knowledge gaps where additional research projects could feed into long-term management of the MPA.

The RMP provides a framework to enable the collection of evidence to fulfil the following objectives:

- 1) Assess the overall condition of species and habitat ‘features’ for which the MPA has been designated;
- 2) Assess the types, distribution and intensity of threats to the features of the MPA;
- 3) Assess whether ecological and socio-economic management objectives have been achieved;
- 4) Assess the nature, magnitude and direction of changes in response to implementation of MPA-specific management actions;
- 5) Inform the adaptive development and enhancement of management objectives and actions where required;
- 6) Improve understanding of the species and habitat features and their wider supporting environmental conditions and processes;
- 7) Provide evidence to demonstrate that the MPA meets the inclusion criteria for UNESCO Biosphere Reserve and IUCN Green List accreditation.

Figure 1 highlights the scope of this RMP and associated activities (bordered in red), stemming from the management objectives and actions detailed in the Hanifaru MPA Management Action Plan (MoTE, 2025b), in the wider cycle of adaptive management.

This RMP should be considered a ‘living document’ to be updated as and when changes are required. A ‘light-touch’ review of the plan will be conducted annually alongside the pre-season review of the management plan, code of conduct and regulations. A full review of the plan and formal condition assessment will be conducted every five years, in line with the PAME evaluation cycle.

This document has been informed by feedback from stakeholders attending the Ocean Country Partnership Programme (OCP) biodiversity workshops held in May 2022, January 2023 and January 2024.

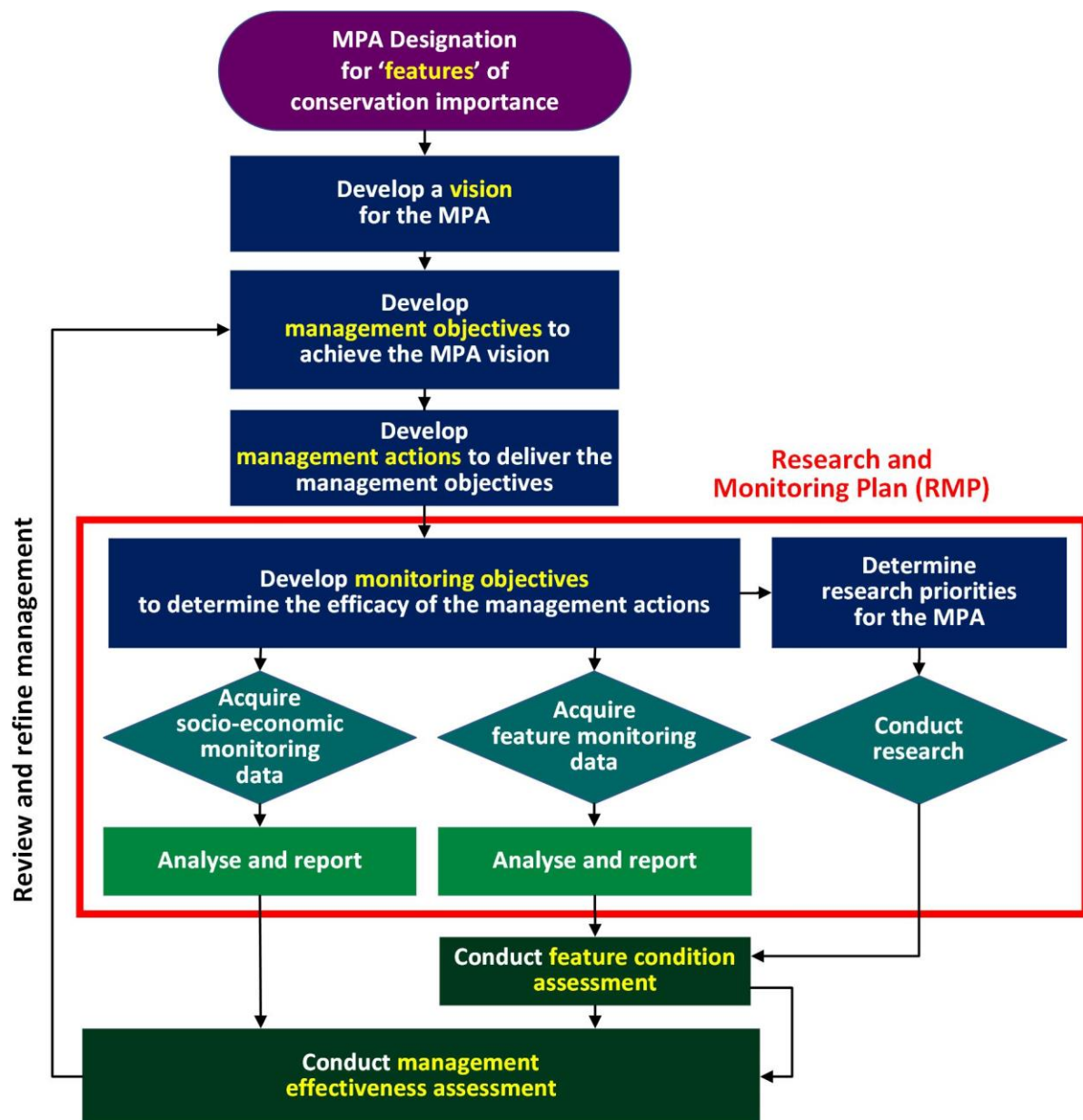


Figure 1. A hierarchical framework of objectives, actions, and processes for the adaptive management of Hanifaru MPA, with the scope of the Research and Monitoring Plan (RMP) highlighted by the red box.

2 Hanifaru MPA context

2.1 Hanifaru MPA overview

Designated as a MPA in 2009, the Hanifaru MPA (known as Vandhoomaafaru Adi by the local community) forms the core area of the Baa Atoll UNESCO Biosphere Reserve. The local topographical, hydrodynamic, and seasonal climatic conditions of the MPA between May and October each year support phytoplankton and subsequently zooplankton blooms which attract large numbers of reef manta rays (*Mobula alfredi*) and whale sharks (*Rhincodon typus*). Hanifaru is an internationally significant area for seasonal feeding aggregations of these species, which are the primary reason for designation of the MPA.

Since its designation, Hanifaru has seen a marked increase in eco-tourism, focused principally on the manta ray and whale shark aggregations. This significant increase, and the associated disturbance to the animals through human interactions, has the capacity to negatively impact the health of their populations through disturbance of feeding behaviours, resulting in reduced fitness and potentially breeding capacity (Murray, 2020).

Since the establishment of the Baa Atoll Biosphere Reserve and the Hanifaru MPA, regulations have been enacted to ensure that such damaging activities are either prohibited or heavily controlled, but despite this, some threats to the marine environment and its biodiversity remain. These threats can be further mitigated via the management objectives and actions provided in the Hanifaru MPA Management Action Plan (MoTE, 2025b) which provides further details on the ecological and environmental context of the MPA, its key values, threats, and overarching vision.

2.2 Legislative and policy drivers

The following sections cover the various obligations and drivers which underpin the requirement for research and monitoring at Hanifaru MPA (and beyond its boundary where relevant to specific features of the MPA).

2.2.1 Formal designation, features and sub-features

As stated in the 2012 Regulation for the Protection and Preservation of Baa Atoll Hanifaru Marine Protected Area (Regulation 2012/R-23; EPA 2012), this MPA has been designated **to preserve the environment and to protect the frequently visiting whale sharks and manta rays**. In this regulation, the term ‘Hanifaru’ constitutes the Hanifaru Island, the sandbanks in the area, the reefs and lagoons connected to the area, Vandhoomaafaru Adi, the sea, and lagoon.

The ‘features’ for which the MPA is designated (environmental elements of conservation importance which have been formally highlighted) and its associated sub-features, which have been defined by the Baa Atoll Biosphere Reserve Office (Baa BRO) and the Environmental Protection Agency (EPA), are listed in Table 1.

Table 1. Formally designated features and sub-features of Hanifaru MPA, as defined by Baa BRO and EPA.

Feature	Sub-features	
Whale sharks	n/a	
Manta rays	n/a	
The environment	Hanifaru island	Terrestrial vegetation
		Beaches
		Turtle nesting sites
		Seabirds and shorebirds
	Coral reefs	
	Seasonal sandbanks	
	Benthic sediments	
	Water column (including zooplankton communities)	

2.2.2 UNESCO Biosphere Reserve status

The Hanifaru MPA is part of the wider Baa Atoll UNESCO Biosphere Reserve, designated in 2011. UNESCO Biosphere Reserves have specific monitoring and evaluation requirements (reflecting high-level best practice), which must be built into the RMP to ensure that UNESCO designation is retained following the decadal Periodic Review. The UNESCO Technical Guidelines for Biosphere Reserves (UNESCO, 2021) state that monitoring must be sufficient to answer questions posed in the [Periodic Review Form](#). This form does not cover all possible monitoring topics however, therefore monitoring should also reflect the specific needs of each site. High-level UNESCO monitoring and evaluation requirements are summarised in Annex 1.

2.2.3 IUCN Green List

The Hanifaru MPA is not yet included on the IUCN Green List, however its inclusion is a stated ambition of the Government of Maldives. The IUCN monitoring and evaluation requirements are also summarised in Annex 1.

This RMP and the outcomes of its delivery will provide evidence to support inclusion on the IUCN Green List, by demonstrating a systematic and co-ordinated approach to monitoring and research planning, resulting in the required evidence to evaluate the success of the MPA.

2.2.4 Important Shark and Ray Areas (ISRA)

Hanifaru Bay and Anga Faru are recognised as Important Shark and Ray Areas (ISRA) by the IUCN Shark Specialist Group, following nomination by the Manta Trust and based on scientific criteria that describe the importance of the area for the survival and wellbeing of the shark and ray species found there (IUCN SSC Shark Specialist Group, 2023). Retention of ISRA status is dependent on a decadal re-assessment, which will incorporate monitoring evidence.

2.3 National monitoring requirements and standards

The national requirements and standard protocols in Table 2 apply to research and monitoring data collection activities within Hanifaru MPA (as per MoTE, 2025b).

Table 2. Examples of national guidelines, requirements, and protocols applicable to research and monitoring at Hanifaru MPA.

Habitat / Species	Source
Manta rays	National protocols will be developed as part of the National Ray Management Framework • Manta ray mooring line entanglement protocol (Manta Mooring Line Entanglements — Manta Trust) • How to swim with manta rays (How to Swim with Manta Rays) • Maldives Conservation Research Programme (Maldives Manta Conservation Programme)
Whale sharks	Big Fish Network - Maldives Whale Shark Research Programme
Coral reefs	The Coral Database Protocols
Mangroves, wetlands and island vegetation	Guidelines for Coral Reef and Small Island Vegetation Surveys in the Maldives
Sea turtles	Photo ID and nesting monitoring protocols (available on request from the Olive Ridley Project (ORP Maldives Olive Ridley Project))

2.4 Governance and stakeholders

This section contains information on the roles and responsibilities pertaining to research, monitoring and subsequent assessments and evaluations for the Hanifaru MPA.

2.4.1 Government bodies

The mandates and remits of Government bodies relating to research and monitoring of Hanifaru MPA are as follows:

The **Environmental Protection Agency (EPA)** are the statutory body responsible for oversight of research and monitoring of MPAs, under the Environmental Protection and Preservation Act 4/93.

The **Baa Atoll Biosphere Reserve Office (Baa BRO)** are the on-site management team with direct responsibility for management and monitoring of the MPA (as part of the wider Biosphere Reserve, overseen by the **Ministry of Tourism and Environment; MoTE**). They oversee and record human activity within the MPA, facilitate research activities, liaise with, and collate ecological information from scientific stakeholders, and collect socio-economic data as part of their community engagement programme. They are required to report on the performance of the MPA to the EPA and UNESCO and disseminate information on the MPA to local communities.

The **Maldives Marine Research Institute (MMRI)** do not directly conduct monitoring or research activities at Hanifaru but are embarking on the delivery of a major training initiative to upskill NGOs, volunteers and citizen scientists in marine survey protocols, which could benefit the Hanifaru Research and Monitoring Programme.

2.4.2 Key scientific stakeholders

The **Manta Trust** (hosted and supported by the Four Seasons Resort at Landaa Giraavaru, Baa Atoll) have operated at Hanifaru since 2005, collecting regular ecological and human pressure monitoring data and conducting research, as part of the wider **Maldives Manta Conservation Programme (MMCP)**. The primary research aims of the MMCP within Hanifaru Bay focus on monitoring and understanding the reef manta rays, including their population dynamics, behaviour, and on assessing the impacts associated with environmental fluctuations and/or human pressures. The Manta Trust also works in academic partnership with international universities to deliver research projects specific to populations of manta rays visiting Hanifaru, and those elsewhere in the Maldives. Additionally, the MMCP aims to expand marine education programmes to encourage and enable local communities, especially the youth, to become stewards of marine conservation, jointly facilitating activities such as snorkelling visits for local schools and the annual Manta Festival. The team also provides Code of Conduct briefings and presentations to Hanifaru stakeholders and tourism groups throughout the manta season. The MMCP team also has strong links with local and resort-based tour operators (e.g., dive, snorkel and marine guides) who regularly provide photo ID, environmental and tourism data.

The **Maldives Whale Shark Research Programme (MWSRP)** conducts research and ecological monitoring of whale sharks at Hanifaru, in addition to gathering sighting data from citizen scientists. Since 2022, the MWSRP has been based in Baa seasonally and typically operates within a resort or guesthouse collaboration setting. Survey effort is a mix of independent surveys led by MWSRP (consisting of MWSRP staff members alone) and joined excursion surveys which take place with guides and guests present. MWSRP also partners with Maldives National University (MNU) and international universities to conduct whale shark research. Since 2013, MWSRP has hosted the citizen science platform 'Big Fish Network', where contributors (tour operators, community members and tourists) can upload their whale shark encounters and check with the profiles of different individual whale sharks in the database. The platform has significantly enhanced the capacity for data collection and has provided valuable insights into whale shark populations and their movements, with over 8,000 whale shark encounters having been logged so far. MWSRP also provides training sessions related to whale shark conservation and research activities to guides and delivers presentations to tourists to promote responsible wildlife viewing practices.

The **Olive Ridley Project** (hosted by Coco Palm Dhuni Kolhu) works with Baa BRO to provide standardised data collection protocols and training on beach surveys and turtle nest monitoring, in addition to offering photo ID processing.

A number of dive centres provide information and data regarding tourists, tourists in the water (and their behaviour) and boat numbers in the area via social media: these are logged onto a database by the Baa BRO. Incidents are also reported and logged.

2.4.3 Responsibilities regarding the RMP

The responsibilities of the governing bodies and key scientific stakeholders in relation to the development and delivery of the RMP are provided in Table 3.

Table 3. Responsibilities regarding the development and delivery of the Hanifaru MPA Research and Monitoring Plan and the subsequent condition assessments.

Role	Responsibility / Ownership
Development and updating the RMP	Baa BRO (lead), EPA (support & sign-off)
Monitoring of RMP delivery	EPA (lead), Baa BRO (input)
Annual 'light touch' condition assessment	Baa BRO, Manta Trust and MWSRP
Five-yearly detailed condition assessment	Baa BRO, Manta Trust and MWSRP
Review of five-yearly condition assessments	EPA
Prioritise scientific research	Baa BRO with input from EPA and key stakeholders (not limited to those detailed in Section 2.4.2)
Grant permissions for scientific research	EPA, with consent from Baa BRO
Facilitate scientific research	Baa BRO

3 Monitoring plan

3.1 Monitoring objectives and activities

3.1.1 Types of monitoring

The following 'types' of monitoring are needed to demonstrate whether the Hanifaru MPA SMART (Specific, Measurable, Achievable, Relevant, Time-bound) management objectives are being achieved, as detailed in the Hanifaru MPA Management Action Plan (MoTE, 2025);

- **Feature monitoring** of the designated MPA features (i.e., the direct 'condition' of visiting manta ray and whale shark populations, and the terrestrial, benthic, and pelagic environments of the MPA).
- **Environmental monitoring** of parameters that are likely to influence the condition of the above MPA features. It should be noted that wherever possible (particularly if requiring little additional effort or resource), collection of environmental monitoring data should be aligned to the requirements of future or ongoing research projects.
- **Pressure monitoring** of human activities and anthropogenic impacts to the MPA features (at Hanifaru this is primarily focused on interactions between tourists and megafauna, but should also include boat strikes, pollution, and climate change).
- **Socio-economic monitoring** of both positive and negative impacts of MPA management on the economy and society. Socio-economic monitoring should acquire data on the local socio-cultural context to ensure that social and economic impacts of the MPA do not undermine its long-term goals.

3.1.2 Defining monitoring objectives

Monitoring objectives have been defined based on the management objectives and actions presented in the Hanifaru MPA Management Action Plan (MoTE, 2025b) that directly require

ongoing monitoring actions (management objectives 1, 2, 3 and 5). The monitoring objectives are operational statements of intent, which direct subsequent monitoring activities. They link directly to the management actions, providing evidence to determine whether the actions have succeeded in achieving the desired outcomes of the MPA.

Ecological and environmental monitoring objectives for Hanifaru are provided in Table 4, with socio-economic objectives in Table 5. The objectives are accompanied by details on the indicator metrics and parameters to be measured to understand management effectiveness, alongside target trend directions, monitoring methods, status, timeframes, and task ownership.

It must be noted that, as a developing monitoring programme, some aspects of the monitoring objectives are currently being delivered, whilst others are subject to further scoping and – critically – securing of additional resources. It is clearly stated in the tables whether activities are already ‘ongoing’ or are ‘aspiration’ to enhance the effectiveness of the ongoing activities.

3.1.3 Indicator metrics, target trends and supporting parameters

Indicator metrics have been selected for their capacity to ‘respond’ to the implementation of management actions, providing a clear ‘signal’ against a background of natural variation. In this way indicator metrics are distinct from other supporting parameters (e.g., temperature, plankton) which do not provide direct information about the condition of the MPA features being monitored but are important to understand trends and patterns in the indicator metrics themselves and what might be affecting them.

Indicator metrics and supporting parameters have been collaboratively selected by Baa BRO, Manta Trust and the MWSRP, based on local knowledge and available scientific literature, and are detailed against each monitoring objective in Table 4 and Table 5. Given the current limited understanding of manta ray and whale shark population dynamics, longevity, and movements outside Hanifaru, it is not yet possible to set specific benchmarks and thresholds for the overall condition of the populations. Each indicator metric has instead been assigned a directional target trend (where appropriate; see Table 4 footnote). It should be noted that the management regulations primarily relate to visitor interactions with marine megafauna. Most habitat features are not directly managed and are therefore not assigned a target trend.

3.1.4 Ongoing monitoring activities within Hanifaru MPA

The majority of current monitoring activities within the MPA are conducted by Baa BRO, Manta Trust and MWSRP.

Baa BRO

Baa BRO primarily acquire data on tourism activity and pressures within the MPA, alongside socio-economic information on its use and community perception, as follows:

- Daily vessel-based ranger operations and drone operations, providing data on numbers of boats and tourists, infractions of the regulations and safety incidents.
- Regular socio-economic data collection using various methods, e.g., community workshops, questionnaires, school visits.
- Monitor commercial photographic and video operations (e.g., documentary makers) via a permit system. This is undertaken in collaboration with the EPA.

Manta Trust

The Manta Trust team within Baa Atoll comprises a core permanent staff and seasonal interns and apprentices during the manta season. As the principal collectors of manta ray data within the MPA, the Manta Trust has access to a dedicated research monitoring vessel and boat crew to facilitate their project work and regular monitoring.

Regular scientific activities are as follows:

- Daily research trips within Hanifaru to collect:
 - Megafaunal observation data.
 - Photo ID's.
 - Basic environmental data.
 - Tourism data (including numbers of snorkellers, boat and code of conduct breaches).
- Maintenance / deployment / retrieval of equipment used in university research projects:
 - Remote Underwater Video systems (RUVS).
 - conductivity/temperature/depth (CTD) sensors.
 - hydrophones.
- *Ad hoc* aerial surveys using drones (in collaboration with Baa BRO).
- MantaBase – an artificial intelligence (AI) manta matching tool whereby visitors match their manta sightings themselves online. Manta Trust data are also available on the tool. This is also a fully interactive tool for citizen scientists.

MWSRP

In addition to a wide range of monitoring and R&D work around the Maldives, the MWSRP collect data pertaining to whale shark numbers and behaviour within Hanifaru, their life cycle stages (e.g., adult, juvenile) and gender (male, female) using photographs taken in the field.

Regular survey activities include boat-based surveys to capture data on the following:

- Photo ID's and observational data - this includes anthropogenic impacts such as injury and disturbance from tourism activities.
- Vessel data - this includes vessel name, type (resort excursion, guesthouse or liveaboard vessel etc), number of users and any other relevant observations.
- Megafauna data - includes species, number of individuals and behaviour observed.
- Basic environmental variables (e.g., visibility, temperature, wind strength and direction and basic surface current measurement taken after encounters are observed).
- Plankton sampling for ecotoxicological studies. This is part of a collaborative study with the University of Insubria, Italy. In 2024, this was conducted outside Hanifaru Bay only and is yet to be trialled inside the Bay.
- Drone surveys (for search purposes) - behavioural observations and length measurement purposes. To date, this has been conducted outside of the Bay only, and drone data is quite limited for the last two seasons (2023 and 2024).
- Stereo video measurements - conducted in collaboration with MARECO and currently (at the time of writing) in the trailing and troubleshooting period. No data from previous years.

Table 4. Ecological and environmental monitoring plan for Hanifaru MPA, linked to management objectives and actions (as presented in MoTE, 2025b). Note: this table only contains management objectives and actions which have direct monitoring requirements.

Monitoring type and objective	Indicator / parameter	Target trend ¹	Method	Status & frequency	Task owner
Management Objective 1. By 2028, the population size and distribution of manta rays and whale sharks is maintained at current levels or has increased					
Management Action 1.1: Develop and implement a long-term monitoring programme that ensures a collaborative approach with stakeholders and external scientists to understand the protected features of the MPA in the context of environmental parameters and human pressures.					
Feature monitoring Collect data to determine the condition of the manta ray population through time.	No. of sightings (Adult/Juvenile/Male/Female)	Stable or increasing	Photo ID	Ongoing (Daily in season; Aspiration for year-round)	Manta Trust (Baa BRO would be task owner for year-round monitoring)
	No. of individuals (A/J/M/F)	Stable or increasing			
	No. of new individuals (A/J/M/F)	Stable or increasing			
	Male : female ratios	Stable or increasing			
	Residency Index (RI)	Stable or increasing			
	No. of observed courtships	Stable or increasing			
	Natural pressure: shark bites	n/a [◇]			
	Natural pressure: deformities	n/a [◇]			
	Other pressures: ectoparasites	n/a [◇]			
	Patterns of movement	n/a*	Drone imagery	Ongoing (Daily in season)	Baa BRO
Feature monitoring Collect data to determine the condition of the whale Shark population	No. of sightings (A/J/M/F)	Stable or increasing	Photo ID	Ongoing when possible (Aspiration for daily in season)	MWSRP
	No. of individuals (A/J/M/F)	Stable or increasing			
	No. of new individuals (A/J/M/F)	Stable or increasing			
	Male : female ratios	Stable			

¹ Where a target trend cannot be set, the following symbols are used to indicate why: * = a qualitative observation; [◇] = indicators or parameters where the outcome cannot currently be directly influenced by the management actions applied; [‡] = activities which have been limited by the Hanifaru regulation (e.g. number of boats and snorkellers in the water at any given time). Activities that are aspirational rather than currently ongoing or in active planning are coloured light blue.

Monitoring type and objective	Indicator / parameter	Target trend ¹	Method	Status & frequency	Task owner
Management Objective 1. By 2028, the population size and distribution of manta rays and whale sharks is maintained at current levels or has increased					
Management Action 1.1: Develop and implement a long-term monitoring programme that ensures a collaborative approach with stakeholders and external scientists to understand the protected features of the MPA in the context of environmental parameters and human pressures.					
through time.	Residency Index (RI)	Stable	Photo ID and drone footage	Weekly / monthly / seasonal	
	Natural pressure: shark bites	n/a [◇]			
	Patterns of movement	n/a*			
Feature monitoring Collect data to determine the condition of environment features and sub-features through time	Area and shape of Hanifaru island (including beach and terrestrial vegetation cover) and seasonal sandbanks	n/a [◇]	Drone aerial photography, satellite imagery	Aspiration (Annual): time-series data currently being collated	Baa BRO
	Diversity of native terrestrial vegetation	Increasing	Transects / quadrats (where feasible)	Aspiration (Annual)	Baa BRO
	Invasive vegetation (e.g. vines)	Decreasing			
	Turtle nesting	Stable or increasing	On-foot survey	Aspiration (Weekly TBC)	Baa BRO / ORP
	Seabird abundance and diversity	n/a [◇]	On-foot survey	Aspiration	Baa BRO
	Coral reef health (coral diversity, live % cover, rugosity, bleaching, disease) ²	n/a [◇]	Snorkelling /diving transects / quadrats	Aspiration	Baa BRO
Pressure monitoring Collect data on anthropogenic pressures with the potential to impact the	Number of snorkellers	n/a [‡]	Observation from patrol vessels, drone footage (plus potentially camera approaches)	Ongoing (daily during the season)	Baa BRO
	No. of boats	n/a [‡]			

² In accordance with the [Maldives Marine Research Institute \(MMRI\) protocols](#)

Monitoring type and objective	Indicator / parameter	Target trend ¹	Method	Status & frequency	Task owner
Management Objective 1. By 2028, the population size and distribution of manta rays and whale sharks is maintained at current levels or has increased					
Management Action 1.1: Develop and implement a long-term monitoring programme that ensures a collaborative approach with stakeholders and external scientists to understand the protected features of the MPA in the context of environmental parameters and human pressures.					
Status of the manta ray and whale shark populations, and their supporting environments	No. of observed distance infractions	Decreasing	Observations in water and potentially drone footage	Ongoing (daily during the season)	Manta Trust and potentially Baa BRO
	No. of observed touch infractions	Decreasing			
	No. of observed anthropogenic sub-lethal injuries	Decreasing			
	Noise	n/a ³	Hydrophones	Ongoing (preliminary study with a view to longer term deployment)	Manta Trust
	Microplastics (benthic and pelagic)	n/a ³	Water and sediment sampling	Aspiration	n/a
	Hydrocarbons (benthic and pelagic)	n/a ³			
	Sewage indicative bacteria (benthic and pelagic)	n/a ³			
Environmental monitoring Collect environmental data to support manta ray and whale shark and their supporting environments (and feed into wider assessments and research requirements)	Temperature	n/a	Samplers and sensors	Data are available from standalone University of Plymouth oceanographic study. Aspiration for ongoing monitoring	n/a
	Hydrodynamics	n/a			
	Dissolved O ₂	n/a			
	Salinity	n/a			
	pH	n/a			
	Turbidity	n/a			
	Nutrients	n/a			
	Zooplankton	n/a			
	Phytoplankton	n/a			

³ The Hanifaru regulations do not currently specify management measures to reduce noise, however the Manta Trust and the University of Bristol are currently conducting a preliminary study to monitor this pressure.

Monitoring type and objective	Indicator / parameter	Target trend ¹	Method	Status & frequency	Task owner
Management Objective 1. <i>By 2028, the population size and distribution of manta rays and whale sharks is maintained at current levels or has increased</i> Management Action 1.1: Develop and implement a long-term monitoring programme that ensures a collaborative approach with stakeholders and external scientists to understand the protected features of the MPA in the context of environmental parameters and human pressures.					
	Sediment deposition	n/a			
	Other oceanographic parameters (EPA)	n/a			

Table 5. Socio-economic monitoring plan for Hanifaru MPA, linked to management objectives and actions (as presented in MoTE, 2025b). Note: this table only contains Hanifaru management objectives and actions which have direct monitoring requirements.

Monitoring type and objective	Indicator / parameter / observation	Target trend	Method	Status & frequency	Task owner
Management Objective 2. <i>By 2028, visitor awareness and understanding of manta rays and whale sharks has improved as a result of the education programme.</i>					
Management Action 2.1: Improve the dissemination of awareness raising materials for visitors about the purpose and rules of the MPA					
Socio-economic monitoring Collect data to monitor trends in visitor understanding of the values of the MPA, the rules and why they are important	% of visitors with a good understanding of the MPA natural values	Increasing	Via application form completed by visitors	Aspiration	Baa BRO and Manta Trust
	% of visitors with a good understanding of the MPA rules and why they are necessary	Increasing			
	% of visitors willing to pay a higher permit fee to enable enhanced management, monitoring, and research	Increasing			
Management Objective 3. <i>By 2028, Baa Atoll communities have increased understanding and ownership through equitable participation in management decision-making</i>					
Management Actions 3.7: Undertake community surveys to understand social, cultural, and economic benefits for the local community, perceptions of the MPA and how benefits are shared.					
Socio-economic monitoring Collect data to monitor trends in local population of the values of the MPA and why its management is important	Total days of public engagement	Increasing	Summary statistic collation	Ongoing (Annual)	Baa BRO and Manta Trust
	No. of islands visited	Increasing			
	No. of households visited	Increasing			
	No. schools visited	Increasing			
	No. of students engaged (by age and gender)	Increasing			
	No. of snorkelling / diving students	Increasing			
	No. of Manta festival attendees	Increasing			
	No. of visitor permits issued to residents of Baa Atoll	Increasing			
	No. of questionnaires completed (by age, gender, occupation)	Increasing			

Monitoring type and objective	Indicator / parameter / observation	Target trend	Method	Status & frequency	Task owner
	% aware of the MPA values, vision and regulation	Increasing	Questionnaire	Ongoing	Baa BRO
	% with a good understanding of MPA rules and regulations	Increasing			
	% with a good understanding of MPA values and threats	Increasing			
	% with a positive general perception of the MPA	Increasing			
	% feeling a sense of pride in relation to the MPA	Increasing			
	% positive perception of economic benefits of the MPA	Increasing			
	% perceiving equitable distribution of economic benefits	Increasing			
	% with a high level of satisfaction with stakeholder engagement	Increasing			
	% aware of the management and monitoring plans	Increasing			
	% with a high level of satisfaction with MPA management	Increasing			
	Value of local income generated by tourism related to the MPA	Increasing	Summary statistic collation	Ongoing	Baa Atoll
	No. of local jobs provided by tourism related to the MPA	Increasing			
Objective 5. By 2028, all visitor interactions with protected features in Hanifaru will be high quality, safe, and sustainable.					
Management Action 5.2: Establish an online visitor feedback form to capture data on quality, safety, and sustainability of visitor interactions					
Socio-economic monitoring Collect data to understand quality, safety and sustainability of visitor experiences	% of visitors satisfied with the quality, safety, and sustainability of their experience	Increasing	Feedback form, managed through visitor guides	Aspiration	Baa BRO
	No. of visitors reporting potential safety incidents due to natural factors (e.g. jellyfish stings, strong currents)	Decreasing			
	No. of incidents requiring assistance to visitors by rangers (e.g., snorkellers drifting towards the mouth of the bay)	Decreasing	Summary statistic collation	Ongoing (Annual)	Baa BRO
	No. of safety incidents related to boat traffic (e.g., collisions, human injuries, near misses)	Decreasing			

3.1.5 Additional resources required

To achieve the integration of the 'Aspirational' activities into a long-term monitoring programme (as detailed in Table 4), the following additional equipment and resources would be required (note, this list is not intended to be exhaustive):

Baa BRO

- Increased number of rangers.
- Additional drone and GoPro cameras.

Manta Trust

- Oceanographic sensors and water samplers.
- Acoustic monitoring equipment (including hydrophone arrays).
- Hydromoths (*in situ* microphone) to detect vessel noise (augmented with 360 degree cameras to improve interpretation of noise data impacts on manta ray behaviour).
- Additional human resources to continue surveys through year.
- Drone.

MWSRP

- Long term plankton collection and plankton analysis equipment (could be purchased under a collaborative or 'shared' facility with other stakeholders within Baa).
- Long term environmental data collection equipment (as above, could represent a shared asset across practitioners within Baa).
- Satellite tagging equipment for whale sharks (would provide important insight to whale shark movements across large regions).

3.1.6 Wider monitoring in Baa Atoll

Monitoring activities are currently focused on Hanifaru MPA, yet the wider Baa Atoll Biosphere Reserve includes areas which influence the condition of the manta and whale shark populations, including migration pathways and manta cleaning stations. To fully contextualise manta ray and whale shark patterns at Hanifaru through time, and to better understand their ecology and life histories, monitoring would be required within the wider Biosphere Reserve (and potentially outside of it). The 'Aspiration' activities listed in Table 4 and Table 5 pertain specifically to monitoring within Hanifaru, but the wider aspiration for a more interconnected Baa Atoll monitoring plan will be investigated as part of a future study.

3.2 Monitoring data and reporting

The MMCP team has a close working relationship with the Baa BRO team, contributing manta ray data to annual reviews of management and regulations. There is currently no routine sharing of raw data as there are a large volume of it and not really of much interest until it has been analysed and published into reports which are shared annually and freely downloaded from the website. If requested, the MMCP team openly shares data records with the EPA and

BRO teams. Anyone with access to these data is required to sign a proprietary information agreement and data sharing agreement and, depending on the need for the data sharing, MoU's are usually prepared.

The MWSRP has only been present for a short period of time (during 2023 and 2024) and all the previous data they hold have been sent by citizen science contributors (including the Manta Trust and the BRO).

Visitor and socio-economic data are collected by Baa BRO are collated and summarised at the end of each season (<https://www.environment.gov.mv/v2/en/category/biosphere-reserve>).

4 Research Plan

This section collates details of past and current research projects and programmes within the Hanifaru MPA, alongside presenting future research needs and ideas to fill gaps in understanding on the features and values of the MPA.

4.1 Bibliography

An assessment of the research already conducted is essential to identify research gaps. A significant body of research has already been conducted for Hanifaru and its features (particularly the megafauna). A scientific bibliography for Hanifaru is provided in Annex 2 (with DOI links where available) and will be used as a foundation upon which to base the development of future research requirements.

4.2 Ongoing research programmes and projects

In addition to regular monitoring, the Manta Trust runs a long-established manta ray research programme (both within and beyond Hanifaru MPA) and works with various international universities to investigate manta ray ecology, oceanography and socio-economics. Their previous publications can be found in Annex 2, whilst ongoing projects are detailed in Table 6.

MWSRP also have active whale shark research partnerships with the Maldives National University (MNU), international universities, and the research NGO MARECO ([Marine Research and Conservation Foundation - MARECO | Sharks | UK](#)).

Table 6. Ongoing research programmes and projects relating to Hanifaru MPA and its features. This list pertains to information acquired during previous stakeholder engagement meetings so some entries may no longer be current.

Topic	Lead Organisation	Partners
The reproductive ecology of the manta ray: life history factors limiting population growth (PhD student Niv Froman)	Manta Trust	University of Cambridge (UK)
Oceanographic drivers of manta ray feeding ecology and behaviour in Hanifaru Bay (PhD student Hannah Moloney, supervised by Dr. Phil Hosegood)	Manta Trust	Project Manta, University of the Sunshine Coast (Australia), Plymouth University (UK)
Identification of manta nurse areas in Raa Atoll, where individuals visiting Hanifaru are known to frequent (PhD student Jess Haines)	Manta Trust	University of Exeter (UK)
“Ears on the reef”: The first acoustic study of manta feeding & cleaning stations in Baa Atoll & Hanifaru Bay (MSc Students Mischa Andon and Samuel Johns, supervised by Steve Simpson).	Manta Trust	University of Bristol (UK)
Assessing boat traffic overlaps with manta ray sites in Baa Atoll to help inform future conservation planning. Study yet to commence but will include; mapping of boat access routes using GPS tracking technology; analysis of boat speeds in different areas of the atoll, (particularly in proximity to manta ray aggregation sites); identification of high-traffic areas and potential collision zones; development of data-driven recommendations for sustainable boat navigation practices within Baa Atoll	Manta Trust	
General baseline data collection and assessment of whale shark movements, size, sex, threats and the influence of environmental factors.	MWSRP	n/a
Research relating to citizen science data uploaded to the ‘Big Fish Network’ platform. Over 8,000 whale shark encounters have been logged through this platform, providing valuable insights into whale shark populations and their movements.	MWSRP	Citizen scientists
Assessing the ecotoxicology of planktonic whale shark prey items. Opportunistic fecal samples will be collected and analysed together with plankton samples. All samples will be analysed for persistent organic pollutants, trace elements and emerging contaminants (PhD student Ginevra Boldrocchi)	MWSRP	University of Insubria (Italy)

4.3 Future research projects

Table 7 provides suggestions for research projects, incorporating the research requirements of the Management Plan (MoTE, 2025a) and suggestions from the wider Baa Atoll community. This list of research projects and ideas should be periodically reviewed and revised accordingly as the interests and knowledge gaps change over time.

Table 7. Research gaps to be addressed to support the attainment and assessment of Hanifaru MPA objectives.

Theme	Research Topics	Proposed by
Manta ray and whale shark ecology	Investigate how manta rays and whale sharks move and migrate around Baa Atoll and other atolls: - Where do they move to in the evenings and overnight during the season? - Where do they migrate in the Hanifaru 'off-season'? - Can migration corridors within and beyond Baa Atoll be identified to enable assessment of MPA connectivity within the wider network? - Which cleaning stations are most important?	OCPD stakeholder workshop (May 2022)
Oceanographic processes and climate change	Identify the potential risks of current and predicted impacts of climate change on whale sharks, manta rays and their supporting environment. - Regional, high-resolution projections of sea level rise - Sea surface temperature, pH, DO, wind and wave trends and future projections - Incorporate results of oceanographic processes and feeding studies at Hanifaru to project future conditions and potential impacts to mantas and whale sharks	Management objective 1, (MoTE, 2025a)
	The size and shape of Hanifaru Island has changed notably since weather conditions have become less stable and storms have begun earlier in the season; What are the future projections for the island and what impact will this have on the MPA and its features?	Baa BRO
	Investigate observed changes in coral communities within the MPA; are these related to climate change / increasingly stormy weather?	Baa BRO
Improving monitoring efficiency	Development of a machine learning algorithm to count manta rays from drone footage (and perhaps estimate distance of approach by snorkellers?)	OCPD biodiversity specialists
Anthropogenic pressures	Undertake an assessment of underwater noise and investigate impacts on marine megafauna	OCPD stakeholder workshop (May 2022)

Theme	Research Topics	Proposed by
	Investigate the prevalence of microplastics and other items of marine litter (e.g. paint flakes from boat hulls), hydrocarbons and nutrients in the water column and sediments. Compare to morphologically similar but less visited lagoons.	OCPD pollution specialists & OCPD stakeholder workshop (May 2022)
Tourism and infrastructure	Investigate the impacts of tourism and infrastructure development on the features of Hanifaru MPA; • How would nearby planned reclamation processes impact the mantas, whale sharks and environmental features of Hanifaru MPA? • Investigate impacts of increasing numbers of visitors to the manta and whale shark behaviour and population dynamics. • Is there a carrying capacity for boats in Baa Atoll, with regard to the safe migration of megafauna?	Baa BRO
Socio-economic	‘Willingness to pay’ study for tourists, dive centres and resorts. • Could the Biosphere Reserve increase the entry fee to increase the Conservation Fund and expand monitoring and research activities?	MoCCEE & OCPD stakeholder workshop (May 2022)
	Investigate the scale of economic benefits to local communities as a direct result of the MPA.	OCPD

5 Assessment and evaluation

This section details how the research and monitoring will feed into the cycle of adaptive management, bringing together all sources of evidence to inform assessment and evaluation against the MPA management objectives.

5.1 Condition assessment

Condition assessments draw together all available evidence from environmental monitoring and research activities to investigate whether and/or how the MPA features have changed, and whether they are considered to be in 'good condition' (or equivalent terminology, such as 'healthy' or 'favourable status') following implementation of management actions. This is the point at which indicator metrics are evaluated against the target trend directions, in the context of supporting parameters and anthropogenic pressure data.

A formal condition assessment will be conducted and published every five years, within a timeframe designed to feed into the Protected Area Management Effectiveness (PAME) evaluation cycle. This assessment will combine all available monitoring data and research evidence, being co-ordinated by Baa BRO, with input from the Manta Trust and MWSRP, and reviewed by the EPA. As no thresholds or benchmarks have been specified for the features of Hanifaru, expert judgement will be used to evaluate condition and determine whether the observed changes reflect the success or failure of management actions in achieving the management objectives.

A 'light-touch' condition assessment will be conducted annually by Baa BRO, Manta Trust and MWSRP (and included in the annual report) to allow any changes to management to be implemented the following season.

5.2 PAME Evaluation

The results of the formal condition assessment will ultimately be combined with socio-economic monitoring and research evidence, together with a wide range of information on various aspects of the MPA, to conduct a five-yearly PAME evaluation (see MoTE, 2025b).

5.3 UNESCO decadal assessment

The UNESCO Statutory Framework of the World Network of Biosphere Reserves stipulates the obligation to provide a periodic review of the status of each Biosphere Reserve every ten years, based on a report prepared by Baa BRO, which will include evidence derived from the monitoring and research activities on the status of the protected features of the MPA. The report is examined by UNESCO to assess if and how each Biosphere Reserve fulfils the criteria of the Statutory Framework to make a final assessment on the compliance of the Biosphere Reserve with UNESCO standards.

6 References

Environmental Protection Agency (EPA) (2012). Regulation on the Protection and Preservation of Baa Atoll Hanifaru Marine Protected Area (Regulation 2012/R-23). Available in Dhivehi at <https://files.epa.gov.mv/file/74>, in English at http://broffice.gov.mv/en/files/unofficial_translation_HMP.pdf

IUCN SSC Shark Specialist Group (2023). Hanifaru Bay & Anga Faru ISRA Factsheet. Dubai: IUCN SSC Shark Specialist Group. <https://sharkrayareas.org/portfolio-item/hanifaru-bay-anga-faru-isra/>

IUCN and World Commission on Protected Areas (WCPA) (2017). IUCN Green List of Protected and Conserved Areas: Standard, Version 1.1. Gland, Switzerland: IUCN.

MoTE (2025a). Maldives National Research and Monitoring Plan Guidance for Protected and Conserved Areas. Update with correct title once finalised. Add publication details when available.

MoTE (2025b). Hanifaru MPA Management Action Plan. Update with correct title once finalised. Add publication details when available.

Murray, A., Garrud, E., Ender, I., Lee-Brooks, K., Atkins, R., Lynam, R., Arnold, K., Roberts, C., Hawkins, J. and Stevens, G. (2020). Protecting the million-dollar mantas; creating an evidence-based code of conduct for manta ray tourism interactions. *Journal of Ecotourism* 19, 132-147. <https://doi.org/10.1080/14724049.2019.1659802>.

UNESCO (2021). Technical guidelines for Biosphere Reserves. Available at: https://en.unesco.org/sites/default/files/tgbr_en.pdf

Annex 1. UNESCO Biosphere Reserve and IUCN Green List monitoring and evaluation requirements

Designation	Requirement	Source
UNESCO Biosphere Reserve	Management is based on a continuous cycle of planning, implementation, monitoring, and evaluation. Monitoring and evaluation should form an integral part of the management plan and should be adequately resourced. Section 199 .	UNESCO (2021) Technical Guidelines for Biosphere Reserves
	Indicators (data collected as part of monitoring) should be quantified and accompanied by benchmarks . The indicators need to be linked to the goals and objectives to give an indication of whether the medium and long-term goals of the biosphere reserve are likely to be achieved. Section 199 .	
	According to the attributes and specificities of a biosphere reserve, it is necessary for managers to choose, from the time of nomination, a set of data for progressive monitoring . Section 271 .	
	Monitoring should be sufficient to answer the questions in the UNESCO Periodic Review Form . Section 265 .	
IUCN Green List	Procedures are in place to ensure that results from monitoring, evaluation and consultation are used to inform management and planning processes including the establishment of goals and objectives. Good Governance, Criterion 1.3 .	IUCN & WCPA (2017) IUCN Green List of Protected and Conserved Areas (V1.1)
	For each of the major site values identified (<i>under Criterion 2.1</i>), a monitoring system is in place and a set of performance measures has been defined and documented , which provides an objective basis for determining whether the associated value is being successfully protected. Effective Management, Criterion 3.7 .	
	A threshold level has been specified and assessed in relation to each set of performance measures that relate to natural values, that if achieved, is considered to demonstrate objectively that the associated major site value is being successfully conserved . Effective Management, Criterion 3.7 .	

Annex 2. Hanifaru scientific bibliography

Table 8. Peer-reviewed scientific literature, reports and theses pertaining to Hanifaru Bay and/or its protected features.

Author/s	Year	Title	Publication / Platform	DOI / weblink
PEER-REVIEWED PUBLICATIONS				
Humble <i>et al.</i>	2023	Comparative population genomics of manta rays has global implications for management	Molecular Ecology	https://doi.org/10.1111/mec.17220
Pelletier <i>et al.</i>	2023	Insight into manta ray behaviour using animal-borne Crittercams	Behaviour	https://doi.org/10.1163/1568539X-bja10242
Strike <i>et al.</i>	2022	Sublethal injuries and physical abnormalities in Maldives manta rays, <i>Mobula alfredi</i> and <i>Mobula birostris</i>	Frontiers in Marine Science	https://doi.org/10.3389/fmars.2022.773897
Allen <i>et al.</i>	2021	Anthropogenic injury and site fidelity in Maldivian whale sharks (<i>Rhincodon typus</i>)	Aquatic Conservation: Marine and Freshwater Ecosystems	https://doi.org/10.1002/aqc.3524
Anderson <i>et al.</i>	2021	Reef manta rays forage on tidally driven, high density zooplankton patches in Hanifaru Bay, Maldives	Peer J	https://doi.org/10.7717/peerj.11992
Harris and Stevens	2021	Environmental drivers of reef manta ray (<i>Mobula alfredi</i>) visitation patterns to key aggregation habitats in the Maldives	PLOS One	https://doi.org/10.1371/journal.pone.0252470
Harvey-Carroll <i>et al.</i>	2021	The impact of injury on apparent survival of whale sharks (<i>Rhincodon typus</i>) in South Ari Atoll Marine Protected Area, Maldives	Scientific Reports	https://doi.org/10.1038/s41598-020-79101-8
Nicholson-Jack <i>et al.</i>	2021	A hitchhiker guide to manta rays: Patterns of association between <i>Mobula alfredi</i> , <i>M. birostris</i> , their symbionts, and other fishes in the Maldives	PLOS One	https://doi.org/10.1371/journal.pone.0253704
Valsecchi <i>et al.</i>	2021	Analysis of the temporal and spatial variability of whale shark (<i>Rhincodon typus</i>) aggregation in the South Ari Marine Protected Area, Maldives, Indian Ocean	The European Zoological Journal	https://doi.org/10.1080/24750263.2021.1922523
Womersley <i>et al.</i>	2021	Wound-healing capabilities of whale sharks (<i>Rhincodon typus</i>) and implications for conservation management	Conservation Physiology	https://doi.org/10.1093/conphys/coaa120

Author/s	Year	Title	Publication / Platform	DOI / weblink
Murray <i>et al.</i>	2020	Protecting the million-dollar mantas; creating an evidence-based code of conduct for manta ray tourism interactions	Journal of Ecotourism	https://doi.org/10.1080/14724049.2019.1659802
Harris <i>et al.</i>	2019	Gone with the wind: Seasonal distribution and habitat use by the reef manta ray (<i>Mobula alfredi</i>) in the Maldives, implications for conservation	Aquatic Conservation: Marine and Freshwater Ecosystems	https://doi.org/10.1002/aqc.3350
Copping <i>et al.</i>	2018	Does bathymetry drive coastal whale shark (<i>Rhincodon typus</i>) aggregations?	Aquatic Biology	10.7717/peerj.4904
Stevens <i>et al.</i>	2018	Courtship and mating behaviour of manta rays <i>Mobula alfredi</i> and <i>M. birostris</i> in the Maldives	Journal of Fish Biology	https://doi.org/10.1111/jfb.13768
Perry <i>et al.</i>	2017	Comparing length-measurement methods and estimating growth parameters of free-swimming whale sharks (<i>Rhincodon typus</i>) near the South Ari Atoll, Maldives	Marine and Freshwater Research	https://doi.org/10.1071/MF17393
Andrzejaczek <i>et al.</i>	2016	The ecological connectivity of whale shark aggregations in the Indian Ocean: a photo-identification approach	Royal Society Open Science	https://doi.org/10.1098/rsos.160455
Cagua <i>et al.</i>	2014	Whale shark economics: a valuation of wildlife tourism in South Ari Atoll, Maldives	Peer J	https://doi.org/10.7717/peerj.515
Davies <i>et al.</i>	2012	Can citizen science monitor whale-shark aggregations? Investigating bias in mark–recapture modelling using identification photographs sourced from the public	Wildlife Research	https://doi.org/10.1071/WR12092
Anderson <i>et al.</i>	2011	From monsoons to mantas: seasonal distribution of <i>Manta alfredi</i> in the Maldives	Fisheries Oceanography	https://doi.org/10.1111/j.1365-2419.2011.00571.x
Anderson <i>et al.</i>	2011	Extent and economic value of manta ray watching in Maldives	Tourism in Marine Environments	https://doi.org/10.3727/154427310X12826772784793
Riley <i>et al.</i>	2010	Analysis of whale shark <i>Rhincodon typus</i> aggregations near South Ari Atoll, Maldives Archipelago	Aquatic Biology	https://doi.org/10.3354/ab00215
Rowat	2007	Occurrence of whale shark (<i>Rhincodon typus</i>) in the Indian Ocean: A case for regional conservation	Fisheries Research	https://doi.org/10.1016/j.fishres.2006.11.016
Carroll and Harvey-Carroll	2023	The influence of light on elasmobranch behaviour and physiology: a review.	Frontiers in Marine Science	http://dx.doi.org/10.3389/fmars.2023.1225067

Author/s	Year	Title	Publication / Platform	DOI / weblink
REPORTS AND THESES				
Manta Trust	2010 - 2021	Maldivian Manta Ray Project (MMRP) Baa Atoll Annual Reports	Manta Trust website	https://www.mantatrust.org/resources
Manta Trust	2008 - 2022	Various MSc theses focused on manta ray ecology and conservation in Hanifaru Bay, Baa Atoll and Maldives	Manta Trust website	https://www.mantatrust.org/resources
MWSRP	-	Various theses focused on whale shark ecology and conservation in South Ari Atoll	MWSRP website (on request)	https://maldiveswhalesharkresearch.org/research/publications-index/
Armstrong	2021	The spatial ecology of Manta Rays: movement, habitat use and connectivity	PhD Thesis, University of Queensland	https://espace.library.uq.edu.au/view/UQ:4fcdc0f
Murray	2019	A study of the behaviour and conservation of manta rays in the Maldives	PhD Thesis, University of York	https://etheses.whiterose.ac.uk/24813/
Eady	2017	Whale shark movements between atolls in the Maldives	MSc Thesis, University of York	http://saruna.mnu.edu.mv/jspui/handle/123456789/3668
Dixon	2016	Motivations behind the 'Site Fidelity' of whale sharks (<i>Rhincodon typus</i>) in South Ari Atoll and Baa Atoll, Maldives	MSc Thesis, University of York	http://saruna.mnu.edu.mv/jspui/handle/123456789/3672
Stevens	2016	Conservation and population ecology of manta rays in the Maldives	PhD Thesis, University of York	https://etheses.whiterose.ac.uk/16981/

