



**STATUS REPORT ON THE
MARINE ENVIRONMENT
OF THE MERSING MARINE PARK ISLANDS
AND INDICATIVE PROPOSAL FOR A MARINE
PROTECTED AREA NETWORK**

JABATAN TAMAN LAUT MALAYSIA

**STATUS REPORT ON THE MARINE
ENVIRONMENT OF THE MERSING
MARINE PARK ISLANDS,
AND INDICATIVE PROPOSAL FOR A
MARINE PROTECTED AREA NETWORK**



STATUS REPORT ON THE MARINE ENVIRONMENT

OF THE MERSING MARINE PARK ISLANDS,
AND INDICATIVE PROPOSAL FOR A MARINE
PROTECTED AREA NETWORK

- Copyright: 2017 Department of Marine Park Malaysia
Reproduction of this publication for educational or other non-commercial purposes is authorised without prior written permission from the copyright holder provided the source is fully acknowledged.
Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission of the copyright holder.
- First Printing: 2017
- Citation: Ooi, J.L.S., Goh, H.C., Then, A.H.Y, Affendi, Y.A., Izarenah, M.R., Abu Muntalib, J. 2017. Status Report on the Marine Environment of the Mersing Marine Park Island, and Indicative Proposal for a Marine Protected Area Network. Department of Marine Park Malaysia.
- Available from: Division of Research and Resource Inventory
Department of Marine Park Malaysia
Ministry of Natural Resources and Environment
Level 11, Wisma Sumber Asli
Precint 4
62574 Putrajaya
Tel: 03-88861379 Fax: 03-88880489
www.dmpm.nre.gov.my

STATUS REPORT ON THE MARINE ENVIRONMENT OF THE MERSING MARINE PARK ISLANDS, AND INDICATIVE PROPOSAL FOR A MARINE PROTECTED AREA NETWORK

Authors:

1. Jillian Ooi Lean Sim,
Department of Geography, Faculty of Arts and Social Sciences, University of Malaya
2. Goh Hong Ching,
Department of Urban & Regional Planning, Faculty of Built Environment, University of
Malaya
3. Amy Then Yee Hui,
Institute of Biological Sciences, Faculty of Science, University of Malaya
4. Affendi Yang Amri,
Institute of Ocean and Earth Sciences, University of Malaya
5. Izarenah Md Repin,
Department of Marine Park Malaysia
6. Abd Muntalib bin Juli,
Department of Marine Park Malaysia



STATUS REPORT ON THE MARINE ENVIRONMENT

OF THE MERSING MARINE PARK ISLANDS,
AND INDICATIVE PROPOSAL FOR A MARINE
PROTECTED AREA NETWORK

TABLE OF CONTENTS

| | |
|--|----|
| Contents | |
| 1.0 EXECUTIVE SUMMARY | 7 |
| 2.0 MAPS | 10 |
| 2.1 Study Area | 10 |
| 2.2 Marine Habitats | 11 |
| 2.2.1 Coral Reefs | 11 |
| 2.2.2 Seagrass | 12 |
| 2.2.3 Swamps | 15 |
| 2.2 Marine Fauna of Special Interest | 15 |
| 2.2.1 Dugong (<i>Dugong dugon</i>) | 15 |
| 2.2.2 Marine Turtles | 16 |
| 2.4 Marine Environment | 17 |
| 2.4.1 Water Quality | 17 |
| 2.5 Areas of Biological Significance | 17 |
| 2.5.2 Charismatic Megafauna | 17 |
| 2.5.3 Other Fauna | 18 |
| 3.0 INTRODUCTION | 19 |
| 3.1 Study Aims | 19 |
| 3.2 Objectives | 19 |
| 4.0 METHODOLOGY | 19 |
| 4.1 Desktop Study | 19 |
| 4.2 Social Survey | 20 |
| 4.3 Indicative Proposal | 20 |
| PART 1A: STATUS OF MARINE ENVIRONMENT | 21 |
| 5.0 MARINE HABITATS | 21 |
| 5.1 Coral reef ecosystems | 21 |
| 5.1.1 Distribution | 22 |
| 5.1.2 Biodiversity | 22 |
| 5.1.3 Habitat condition | 30 |
| 5.1.4 Key associated species | 32 |
| 5.2 Seagrass ecosystems | 41 |
| 5.2.1 Distribution | 41 |
| 5.2.2 Biodiversity | 41 |
| 5.2.3 Habitat condition | 41 |
| 5.2.4 Key associated species | 43 |
| 5.3 Swamp ecosystems | 45 |



| | |
|---|-----------|
| 5.3.1 Distribution | 45 |
| 5.3.2 Biodiversity | 45 |
| 5.3.3 Habitat condition | 47 |
| 5.3.4 Key associated species | 47 |
| 6.0 MARINE FAUNA OF SPECIAL INTEREST | 48 |
| 6.1 Marine Mammals | 48 |
| 6.1.1 Distribution | 48 |
| 6.1.2 Potential threats | 50 |
| 6.2 Marine Turtles | 50 |
| 6.2.1 Distribution | 50 |
| 6.2.2 Potential threats | 50 |
| 7.0 FISHERIES | 52 |
| 7.1 Status and distribution | 52 |
| 7.2 Biodiversity and seasonality | 53 |
| 7.3 Potential threats | 58 |
| 8.0 MARINE ENVIRONMENT | 58 |
| 8.1 Overview | 58 |
| 8.2 Areas of high impacts and threats | 59 |
| 9.0 AREAS OF BIOLOGICAL SIGNIFICANCE | 61 |
| 9.2 Dugongs and turtles | 61 |
| 9.3 Other charismatic fauna | 62 |
| <u>PART 1B: SOCIO-ECONOMIC BACKGROUND</u> | <u>62</u> |
| 10.0 DEMOGRAPHY AND SOCIOECONOMY | 62 |
| 11.0 AWARENESS/PERCEPTIONS OF LOCAL COMMUNITIES TOWARDS MARINE ECOSYSTEMS AND THE MARINE PARK | 63 |
| 11.1 Survey results: perception of local communities towards the existing marine park ... | 65 |
| 11.2 Survey results: perception of tour operators towards the existing marine park | 68 |
| 12.0 GOVERNANCE | 69 |
| <u>PART 2: AN INDICATIVE PROPOSAL FOR THE ESTABLISHMENT OF A MARINE PROTECTED AREA NETWORK IN THE MERSING MARINE PARK ISLANDS</u> | <u>73</u> |
| 13.0 INDICATIVE PROPOSAL | 73 |
| 13.1 Ecological Considerations | 73 |
| Objective 1.0: Ensure full representation of marine biodiversity in the MPA network | 73 |
| Objective 2.0: Ensure ecologically significant areas are represented | 75 |

STATUS REPORT ON THE MARINE ENVIRONMENT

OF THE MERSING MARINE PARK ISLANDS, AND INDICATIVE PROPOSAL FOR A MARINE PROTECTED AREA NETWORK

| | |
|--|-----------|
| Objective 3.0: Protect connectivity pathways | 76 |
| Objective 4.0: Ensure maximum contribution of individual MPAs to the MPA network..... | 77 |
| 13.2 Socioeconomic Considerations | 77 |
| Objective 5.0: Ensure full understanding of the socioeconomic costs and benefits of establishing an MPA network | 77 |
| Objective 6.0: Maximize positive socioeconomic benefits | 78 |
| 13.3 Governance and Management Considerations..... | 79 |
| Objective 7.0: Review the current governance of the Mersing Marine Park Islands..... | 79 |
| Objective 8.0: Review the existing legislation for Marine Protected Areas | 80 |
| Objective 9.0: Examine MPA network objectives and management capacity | 80 |
| Objective 10.0: Review enforcement within the MPA network..... | 81 |
| 13.4 MPA Network Design Considerations | 82 |
| Objective 11.0: Explore designs based on multiple uses | 82 |
| Objective 12.0: Develop a marine spatial (management) plan for the proposed MPA network | 82 |
| 13.5 Monitoring, Research, and Education Considerations..... | 83 |
| Objective 13.0: Align monitoring with priority areas..... | 83 |
| Objective 14.0: Align research with priority areas | 83 |
| Objective 15.0: Align education with priority areas..... | 83 |
| 14.0 CONSIDERATION FOR THE FUTURE: SCALING UP BEYOND THE MERSING MARINE PARK ISLANDS..... | 86 |
| 15.0 REFERENCES | 87 |
| Section 5.1 Coral Reef Ecosystems..... | 87 |
| Section 5.2 Seagrass Ecosystems..... | 88 |
| Section 5.3 Swamp Ecosystems..... | 90 |
| Section 6.0 Marine Fauna of Special Interest | 90 |
| Section 7.0 Fisheries | 90 |
| Section 8.0 Marine Environment | 91 |
| Section 9.0 Areas of Biological Significance..... | 91 |
| Section 10.0 Demography and Socioeconomy..... | 91 |
| Section 11.0 Awareness/Perceptions of Local Communities towards Marine Ecosystems and the Marine Park..... | 92 |
| Section 12.0 Governance..... | 92 |
| Section 13.0 Indicative Proposal for MPA Network | 93 |

STATUS REPORT ON THE MARINE ENVIRONMENT OF THE MERSING MARINE PARK ISLANDS, AND INDICATIVE PROPOSAL FOR THE ESTABLISHMENT OF A MARINE PROTECTED AREA (MPA) NETWORK

1.0 EXECUTIVE SUMMARY

Marine Parks in Peninsular Malaysia were established to arrest the decline in marine fish catch that first became evident in the early 1980s. Based on the understanding that coral reefs provide habitat for fish and can lead to spill-over fishery benefits, Marine Protected Areas (MPA) here were gazetted around islands with coral reefs. The Department of Marine Park Malaysia (DMPM) is now considering scaling up from individual island-based MPAs into an MPA network, with the Mersing Marine Park Islands selected as a pilot study in the establishment of the first MPA network in Malaysia. This report serves as a starting point for considering the prospects of such a network.

Section 2.0 shows all maps related to the study area. Section 3.0 states the objectives of this study which are to report on the status of the marine environment in the study area by drawing from the published literature, and to develop an indicative proposal for the establishment of an MPA network. One social survey was conducted on the islands and mainland to collect primary data on stakeholder perceptions towards the existing MPA. Section 4.0 explains the methodology used, which consisted of (1) a desktop literature survey, and (2) a social survey conducted on the islands and mainland in August and September 2016 to collect primary data on stakeholder perceptions towards the existing MPA. Where possible, locational information in the literature was used to construct distribution maps.

We begin Part 1 of this report by synthesizing information on the status of the marine environment in the study area. Section 5.0 addresses the current status of coral reefs, seagrass meadows and swamps. It begins with Section 5.1 on coral reefs, which in Johor waters, consist mainly of fringing reefs around offshore islands. However, the coral reefs of only 6 out of the 13 gazetted islands in the study area were documented scientifically between 2011 and 2016. The most recent survey by the Department of Marine Park Malaysia in 2013 reported 229 species in Pulau Aur, Pulau Pemanggil, Pulau Babi Besar, Pulau Tinggi and Pulau Sibiu. When revised to reflect the recent coral taxonomical changes, there is now an estimated 249 hard coral species in 70 genera, 14 families, and 7 *incertae sedis* (of uncertain placement) in the study area. The main monitoring reports for habitat condition came from Reef Check Malaysia. However, there were no habitat condition reports for 7 of the gazetted marine park islands of Pulau Harimau, Pulau Mensirip, Pulau Guam, Pulau Rawa, Pulau Babi Hujung, Pulau Mentigi and Pulau Sibiu Hujung in this timeframe.

In Section 5.2, we show that seagrass meadows occur on the leeward side of many of the islands in the study area, but published maps of meadows exist only for Pulau Tinggi and Pulau Sibiu. These mapped references estimate the combined size of meadows around Pulau Tinggi and Pulau Sibiu to be 7.06 km². The study area has 12 seagrass species, compared to the total 15 species recorded for Malaysia. Pulau Tinggi has the greatest number of species (11). Meadows in Pulau Tinggi were dominated by *Halophila ovalis* (1,870±937 shoots m⁻²) and *Halodule uninervis* (1,455±795 shoots m⁻²). In Pulau Sibiu, the large *Enhalus acoroides* and *Cymodocea serrulata* dominated the community biomass wherever they occurred. However, meadow trends were unavailable because all studies were based on single season sampling events.

Section 5.3 addresses the status of swamps, which were less well-represented in the literature in comparison to coral reefs and seagrass meadows. Within the Mersing Marine Park Islands, mangrove swamps can be found on Pulau Sibul (Teluk Bakau) and Pulau Tinggi. One species of mangrove tree, *Rhizophora stylosa*, uncommon to Malaysian mangrove forests, has been recorded on both Pulau Sibul and Pulau Tinggi. It is hardly reported elsewhere, where muddy substrate is more common than on these islands.

Section 6.0 is dedicated to marine fauna of special interest such as dugongs and turtles that were relatively well-represented in the literature. When the distribution points of these two fauna were geocoded, a hotspot of sightings was identified in the west and southwest waters of the Sibul group of islands. Other charismatic fauna such as seahorses did not have fine-scale locational information, while giant clams, bumphead parrotfish and groupers were observed only intermittently and opportunistically in dive surveys. Thus, estimates of their population size and potential distribution patterns could not be made.

Section 7.0 addresses the issue of fisheries in the study area. No-take zones in MPAs are expected to bring spill-over benefits to the surrounding waters but because the condition of fishery resources in the study area prior to gazettelement was unknown, it wasn't possible to assume spill-over benefits. A 2009 survey of catch composition in bottom trawlers yielded a total of 155 species, with trash fish comprising almost 50% (338.7 kg) of the total catch; while commercially important species contributed the other half (348.4 kg). Major families of fish recorded were Carangidae, Leiognathidae, Psettodidae, Dasyatidae, Clupeidae, Chirocentridae, Gerridae, Serranidae, Cynoglossidae, Bothidae, Sphyraenidae, Tetraodontidae, Mullidae, Carcharhinidae and Trichiuridae.

The marine environment of the study area is characterised in Section 8.0. Water quality in the study area appeared to be influenced by tourist loads on islands in the vicinity. This is reflected in the differentiation/clustering of islands based on water quality, whereby islands with higher tourist loads (Pulau Babi Besar, Pulau Tinggi, Pulau Rawa, Pulau Sibul Tengah and Pulau Sibul Besar) share similar water quality properties. In contrast, uninhabited islands or those with low populations such as Pulau Mensirip, Pulau Babi Tengah, Pulau Babi Hujung, Pulau Nanga Besar, Pulau Sibul Hujung, Pulau Pemanggil and Pulau Aur, are grouped together. This pattern indicates that tourist and local population size appear to have had an impact on water quality.

Section 9.0 highlights areas of biological significance, where threatened or endangered species occur. One such area was the hotspot in the west and southwest waters of the Sibul group of islands (for dugongs and turtles).

Section 10.0 provides information on the demography and socioeconomy in the study area. The most current data by the Mersing District Office in 2015 showed that Pulau Sibul is the most highly populated island, followed by Pulau Aur, and that the dominant socioeconomic sectors are fisheries and tourism, while agricultural activities are practiced at small local scales. Park gazettelement appeared to be a major cause of depopulation in these islands, attributed to the lack of livelihood options because of MPA restrictions on extractive activities. However, data that was specific to the perceptions of communities on each island was lacking in the literature survey, leading the project team to conduct questionnaire surveys in Pulau Tinggi, Pulau Besar, Pulau Sibul, Mersing, Sedili and Endau. In Section 11.0, we explain the findings of this survey. A total of 416 samples were collected and analysed in August and September 2016. Out of the 368 local villagers sampled, 60% agreed with and supported the gazettelement of the existing MPA. Those who disagreed were more likely to be fishermen, with a higher proportion of disagreement expressed by respondents in Pulau Tinggi. A perceived lack of MPA enforcement of the no-take ruling was the main source of dissatisfaction. Respondents were particularly worried about the encroachment of trawlers in park waters. Tour operators displayed a slightly different response: a higher percentage of this group expressed support

for the MPA in comparison to local communities, with tour operators on the mainland (Sedili and Endau) being more inclined to be supportive of the current MPA system. This group of respondents expressed concern over the existing implementation, monitoring, and control of the marine park.

In Part 2 of this report, an Indicative Proposal for an MPA network is presented to serve as a scoping guide to the key issues that should be considered when setting up an MPA network in the study area. Five focal areas are addressed in Sections 13.1 to 13.5, i.e. Ecological Considerations, Socioeconomic Considerations, Governance and Management Considerations, MPA Network Design Considerations and Monitoring, Research, and Education Considerations are presented, encompassing 15 proposed objectives and 30 strategies that are relevant to the idea of establishing an MPA network in the study area.

Finally, the idea of scaling up the proposed MPA network beyond that of the Mersing islands is introduced in Section 14.0. Should this idea be considered for the future, we suggest that the existing Marine Ecoregions of the World (MEOW) be used as a reference point for classifying bioregions, but that finer-level classification than that in the MEOW scheme be devised to develop regional MPA networks. Potentially, these are broad-scale MPA networks that extend beyond the immediate study area in Johor, to encompass all existing MPAs on the east coast of Peninsular Malaysia.