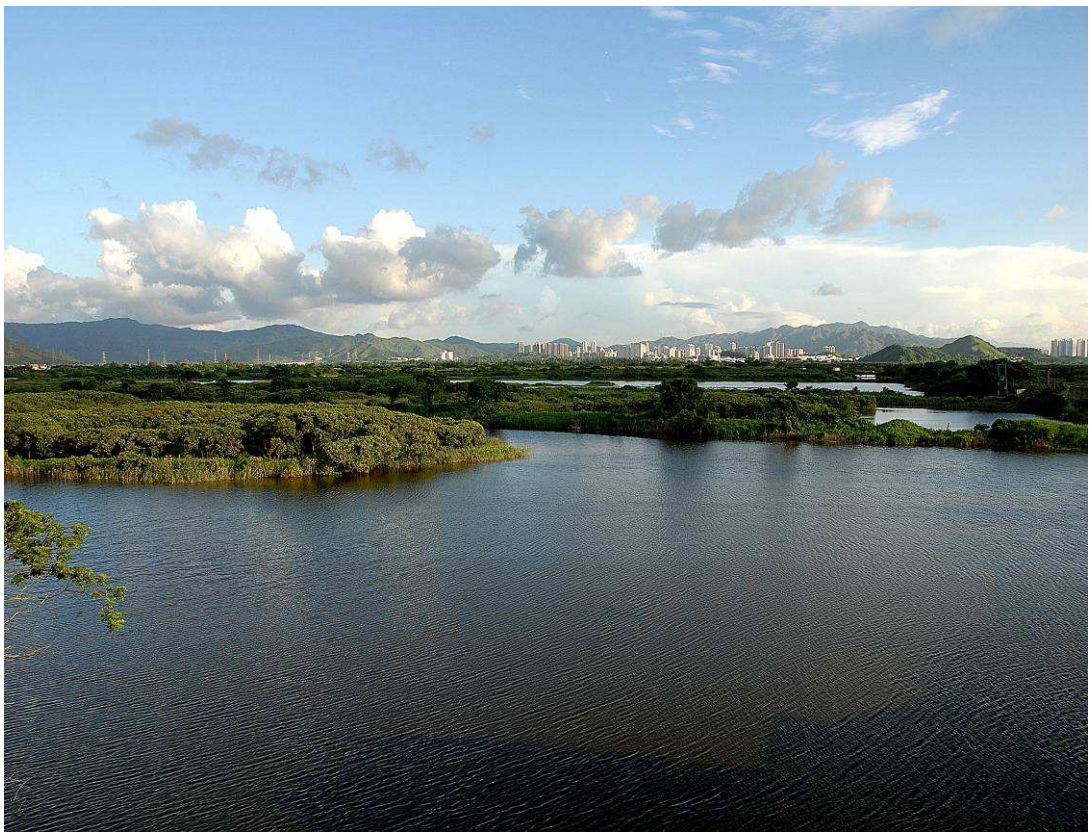
WWF for a living planet®

Research & Monitoring Programme Plan for Mai Po Nature Reserve 2007 – 2011



CONTENTS

[Cover photo: View over the Mai Po *gei wai*. Photo by: Bena Smith]

ACKNOWLEDGEMENTS

Special thanks to the members of the Research Sub-committee Working Group for their valuable advice and comments throughout the drafting of this plan; Mr. M. Kilburn, Dr. M.W.N. Lau, Mr. P.J. Leader, Dr. M.R. Leven, Mr. G.T. Reels, Dr. P.K.S. Shin, Prof. N.F.Y Tam and various AFCD working groups.

Several Mai Po staff, in particular Dr. L. Young (Mai Po Reserve Manager) and Ms K. Leung (Assistant Reserve Officer) also contributed to the plan through their knowledge and experience of Mai Po.

This publication should be cited as:

WWF-HK, 2007. **Research and Monitoring Programme Plan for the Mai Po Nature Reserve : 2007 - 2011**. The World Wide Fund For Nature Hong Kong, Hong Kong.

Report author: Mr Bena Smith, Reserve Officer (Research and Monitoring), Mai Po Nature Reserve, WWF Hong Kong.

EXECUTIVE SUMMARY

i In 2003 WWF Hong Kong established a Research and Monitoring Section at the Mai Po Nature Reserve (MPNR) to ensure the research and monitoring requirements of the Mai Po Management Plan are realised. The section operates a programme of research works according to the following goals:

GOAL 1. To assess the success of habitat intervention by WWF at the Mai Po Nature Reserve.

GOAL 2. To expand the ecological and management needs knowledge base for conservation important wetland biodiversity.

ii Over the last 4 years, the section's overall work load and its operational responsibilities within MPNR have both increased. This is mainly due to the more extensive research and monitoring requirements of the current Management Plan (WWF-HK, 2006) and an internal demand for environmental administration data to report to HKSAR government departments and meet legal obligations. Other changes in need of attention are an outdated ecological baseline monitoring plan and a decline in the number of academic research studies linked to Deep Bay.

iii The 2007 - 2011 Research and Monitoring Programme Plan is the first 5-year plan for the MPNR. It attempts to accommodate the various demands being placed upon the section and address the identified issues through strategic direction and planning. The plan was compiled with advice of many HK-based experts and the experience gained by WWF from its management of the Nature Reserve since 1984.

iv The overall Research and Monitoring Programme Objectives for MPNR, which are to be delivered through a new programme structure, are:

PO1. To carry out long-term monitoring and baseline surveys of:-
(a) priority wildlife species/groups,
(b) key habitats, and
(c) significant threats to Deep Bay wetland biodiversity.

PO2. To carry out research studies, through joint partnership projects where possible, that could enhance the quality of key habitat types or conditions for priority wildlife species.

PO3. To collect environmental data to assess the species/habitat targets set in the Mai Po Management Plan.

PO4. To fulfill the environmental monitoring/data requirements of the Mai Po Management administration.

PO5. To encourage external research relating to the Deep Bay wetland environment through advocacy work and providing appropriate assistance to education institutions, consultants, government departments and environmental NGO's.

v To achieve the Programme Objectives, a total of 24 Component Objectives are set. The main action points and areas of focus being :

- To produce and implement an Ecological Baseline Monitoring Plan for the period 2007-2011 and produce annual Research and Monitoring Work Reports.
- Within the plan period, to undertake baseline surveys on two species of high conservation concern and two project-based surveys upon priority habitat types.
- Collect environmental data (1) to assess management plan indicators and (2) for habitat management administration purposes.
- Specific measures to promote the work of the WWF Research and Monitoring Programme, and encourage external environmental-based research in identified priority topic areas.

SECTION A

A1. INTRODUCTION

A1.1 The Work of the WWF Research and Monitoring Section

A1.1.1 Established in 2003 and based at the Mai Po Nature Reserve (MPNR), the Research and Monitoring Section operates a programme of research works to ensure the scientific research requirements of the Nature Reserve, particularly those detailed in the Mai Po Management Plan, are realised. Key functions of the programme are to facilitate assessment of WWF's habitat intervention at the MPNR, and better understand the needs of priority wetland biodiversity.

A1.1.2 The section currently employs two staff members; a Reserve Officer and an Assistant Reserve Officer. Their main activities under the programme are to implement the MPNR Ecological Baseline Monitoring Plan (WWF-HK, 2003), undertake of species and habitat related research studies, and to facilitate external scientific research relevant to the Deep Bay wetland environment. Other duties include training participants of the WWF Wetland Management Training Programme in related topics; monitoring rationale, research methods, survey design and data interpretation.

A1.1.3 Over the last 4-year period the demand for research and monitoring data/information from the section increased; the two main sources being:

(1) The 2006 - 2010 Mai Po Management Plan (WWF-HK, 2006) listed 16 research related objectives which require a number of project-based studies/habitat management trials, baseline ecological surveys on important wildlife species and habitats at MPNR, and the assessment of species indicator targets.
(2) Environmental administration data for service contracts, management agreements and legal applications between WWF and a number of HKSAR government departments.

A1.1.4 Action is also required to address two issues:

(1) The MPNR Ecological Baseline Monitoring Plan (WWF-HK, 2003) does not satisfy the contemporary monitoring needs of the Nature Reserve; monitoring elements need revising; existing methodologies need to be more robust and where feasible, standardised.
(2) A gradual decline in the number of academic research projects with links to the Deep Bay wetlands (particularly to habitat/species management) and an associated reduction in use of the WWF wet laboratory facilities housed within the Education Centre.

A1.1.5 The overall work load of the Research and Monitoring section is steadily increasing and reached a point where some degree of strategic direction and planning is necessary. Therefore to coordinate its work effectively and fulfil its roles, a Programme Plan to consolidate and rationalise the section's work is needed.

A1.2 Relationship to the Mai Po Management Plan

A1.2.1 The Mai Po Management Plan is the guiding document for the Research and Monitoring Programme and accordingly high priority is assigned to the needs of each plan. These management plan requirements are intended to generate specific information upon a variety of species/groups, habitats, management operations and targets to directly inform habitat management decision making processes with the purpose to improve conditions for priority wetland biodiversity. Requirements of the current 5-year Management Plan are listed in Appendix I and cross-referenced to the Management Plan document where detailed information and rationale can be found.

A1.3 Scope of the Research and Monitoring Programme

A1.3.1 The programme's geographical scope follows the remit imposed by the Management Plan and is therefore land managed by WWF-HK within the MPNR. However flexibility is required because some threats to the site's biodiversity originate outside the MPNR boundary, and also the Reserve's wetland biodiversity is in part dependant upon the more extensive Deep Bay wetland system.

A1.4 A Review of the Research Needs for the Deep Bay Wetland Biodiversity

A1.4.1 To identify and prioritise important research and monitoring work for WWF-HK to include in the programme, a review of existing work within the Deep Bay wetlands is necessary. This serves to avoid unnecessary duplication of research effort and to provide greater focus for external based scientific research topics/areas.

A1.4.2 The review (Appendices II, III and IV) identifies all conservation important wetland flora, fauna and habitats, significant threats facing them, and level of research attention (past and present) given to each. Under guidance from regional experts, an assessment is then made of individual "Research Needs" for further consideration.

SECTION B

B1. PROGRAMME GOALS

B1.0.1 The goals of the Research and Monitoring Programme are:

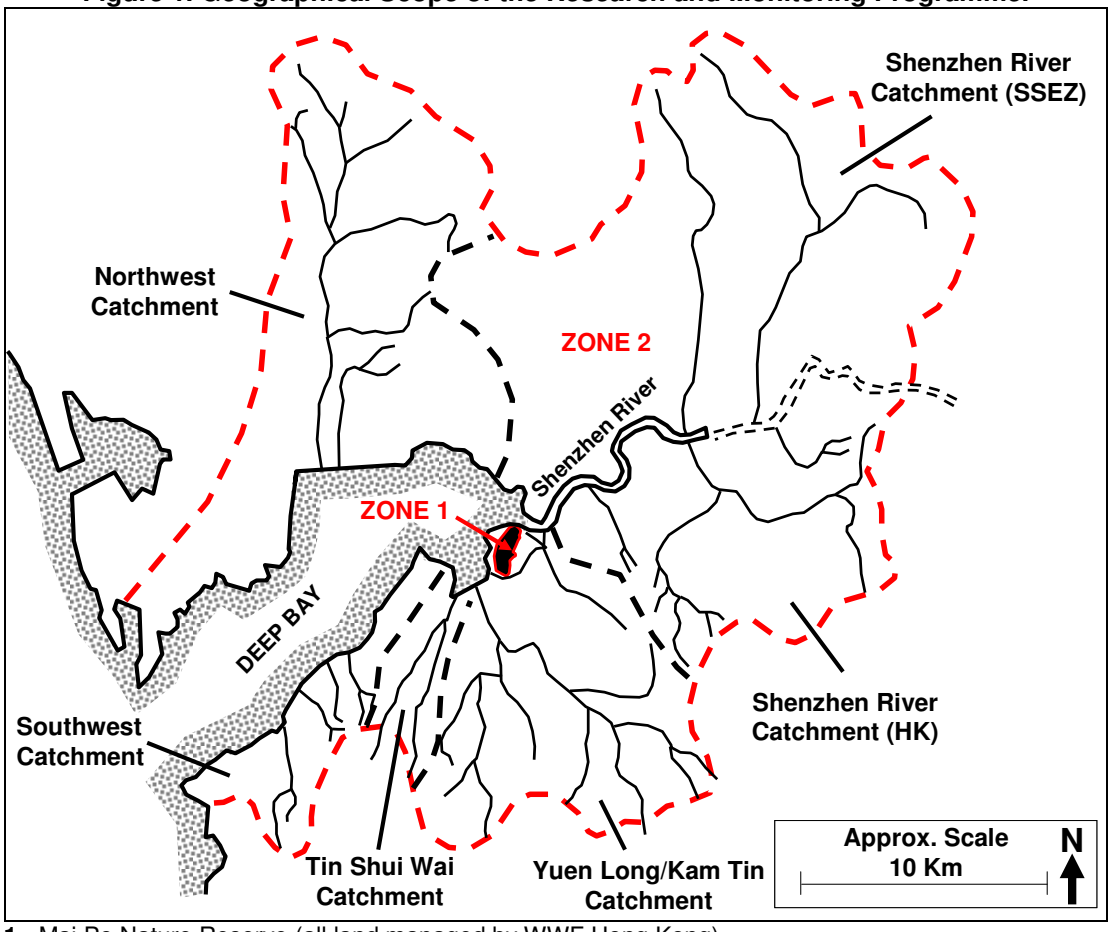
(1) To assess the success of habitat intervention by WWF at the Mai Po Nature Reserve.
(2) To expand the ecological and management needs knowledge base for conservation important wetland biodiversity.

B2. GEOGRAPHICAL SCOPE

B2.0.1 The geographical scope of the Research and Monitoring Programme is defined as:

"The Mai Po Nature Reserve with particular relevance to land managed by WWF-HK (zone 1), although occasionally extending to any wetland area in the Deep Bay catchment (zone 2) with environmental relevance to or influence upon the Reserve" [Figure 1].

Figure 1. Geographical Scope of the Research and Monitoring Programme.



ZONE 1 - Mai Po Nature Reserve (all land managed by WWF Hong Kong).
ZONE 2 - Area with environmental relevance to Zone 1 (Deep Bay catchment boundary shown for guidance).
(Adapted from Young and Melville, 1993)

B3. PLANNING PERIOD

B3.0.1 This 5-year Research and Monitoring Programme Plan is the first for MPNR and will operate between 01 October 2007 and 30 September 2011. The planning period is synchronised into the Mai Po Management Plan renewal cycle whereby subsequent Programme Plans are compiled in the first operating year of each Management Plan. This is necessary because the Programme Plan assigns high priority to the research and monitoring requirements of each Mai Po Management Plan (para. A1.2.1).

B4. PROGRAMME OBJECTIVES

B4.0.1 The five Programme Objectives (PO) in order of importance are:

PO 1. To carry out long-term monitoring and baseline surveys of:-
- **(a) priority wildlife species/groups,**
- **(b) key habitats, and**
- **(c) significant threats to Deep Bay wetland biodiversity**

PO 2. To carry out research studies, through joint partnership projects possible, that could enhance the quality of key habitat types or conditions priority wildlife species.

PO 3. To collect environmental data to assess the species/habitat targets set in Mai Po Management Plan.

PO 4. To fulfil the environmental monitoring/data requirements of the Mai Management administration.

PO 5. To encourage external research relating to the Deep Bay wetland environment through advocacy work and providing appropriate assistance to education institutions, consultants, government departments and environmental NGO's.

B5. INFORMATION RELEVANT TO THE PROGRAMME OBJECTIVES

B5.1 General

B5.1.1 The Mai Po Management Plan (WWF-HK, 2006) provides an extensive list of the 'priority wildlife species/groups' and 'key habitats' for the MPNR, as well as 'significant threats' to these. This list (presented in Appendices II, III & IV) forms a basis to identify research work items under POs 1, 2 and 5.

B5.1.2 The Research and Monitoring Programme generates a plethora of useful information for conservationists and scientists. Therefore data summary sheets and reports are to be made available through the WWF website and other potential dissemination methods employed where possible i.e. submitting papers to scientific journals or local publications, symposium presentations and workshops or guest lectures.

B5.2 Programme Objective 1

B5.2.1 Long-term baseline monitoring of important ecological/environmental features, parameters or their attributes is vital to understand temporal patterns within the Deep Bay wetlands whether natural or human induced. The primary function of this data is to act as an early warning system for possible intervention to minimise or prevent adverse impacts to wetland biodiversity, but long-term data sets relating to key features can also facilitate interpretation of other ecological results.

B5.2.2 Baseline surveys upon important ecological/environmental features, parameters or their attributes allow for current condition or status to be assessed. These surveys are essential prerequisites to the planning and design of longer-term monitoring works.

B5.3 Programme Objective 2

B5.3.1 Project-based/individual research study is necessary to understand the ecological requirements of important species, inter and intra specific relationships between species, improve management techniques for species/habitats, and identify ways to address threats

to wetland biodiversity and health. Appropriate works include habitat management trials and ecological focal studies.

B5.4 Programme Objective 3

B5.4.1 The Mai Po Management Plan (WWF-HK, 2006) identifies four species related targets to be assessed (Appendix I : Rows 01-04). These targets indicate the general success of WWF's habitat management operations and area zonation policy at MPNR for key species/groups and are to be assessed annually. Presently, no habitat targets are set by the management plan.

B5.5 Programme Objective 4

B5.5.1 There is an internal need to provide environmental administration data to the Mai Po Habitat and Infrastructure Management section in order to report to government departments or meet legal requirements. This includes data to; assess government contract performance indicators, provide reviews to government departments for certain habitat works (i.e. mangrove seedling clearance), and meet EIAO application and EM&A requirements of larger-scale development projects (i.e. 2007 boardwalk and hide project).

B5.6 Programme Objective 5

B5.6.1 External-based scientific research with relevance to the Deep Bay wildlife or environments can provide valuable information to help conserve biodiversity and improve knowledge of the wetland ecosystem and its functions. Such research is to be actively encouraged by raising awareness of the need for research (i.e. through seminars and advocacy work at universities) and the provision of field-based research facilities at MPNR. On-site logistical support and advice is to be offered when possible.

B5.6.2 In 2003 and 2004, the work of the Research and Monitoring Programme was presented at several Mai Po public seminars. These seminars provided an outlet and information channel to the public. In light of the current quantity and diversity of scientific research connected to the Deep Bay wetlands - NGOs (HKBWS), government departments (AFCD and EPD), and academic institutions - a regular research seminar should be set up.

B5.6.3 In the 1990s, a WWF-HK administered research fund supported two academic dissertations relating to the management of MPNR. A similar "Scholarship Fund", possibly with corporate sponsorship or backing, should be established to encourage academic research in priority areas/topics.

B6. DELIVERY STRUCTURE

B6.0.1 The research and monitoring works required to achieve the Programme Objectives are to be delivered through the programme structure shown in Figure 2. The five component headings reflect the original objective statement text.

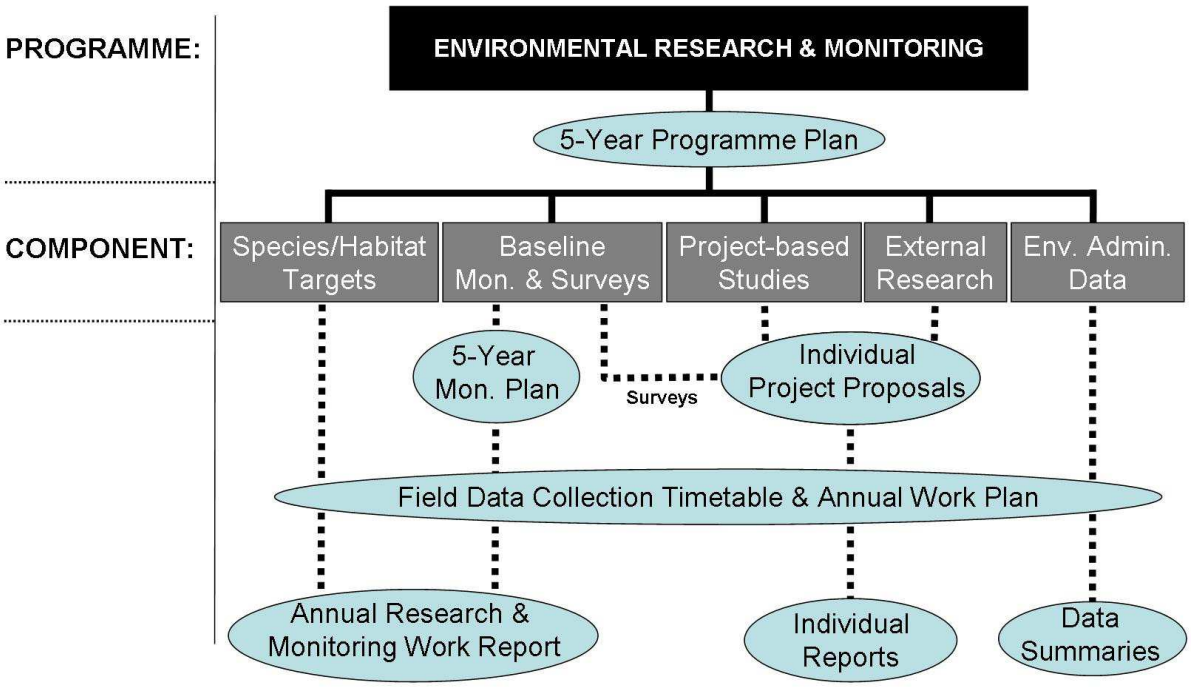
B6.0.2 The 'Baseline Monitoring and Survey' component is to operate in sequence with each Mai Po Management Plan cycle. A 5-year plan is to be produced in the year following each new Management Plan (similar to the Programme Plan renewal).

B6.0.3 All WWF baseline studies and project-based surveys require individual project proposals prior to their undertaking and final reports upon completion. Proposals are to be commented upon (and approved if necessary) by the Mai Po Management Committee, and interim/final reports presented. For external research studies, WWF should provide comment and advice where possible. 'Environmental Administration Data' is to be reported directly to the Mai Po Habitat and Infrastructure Management section.

B6.0.4 A 'Research and Monitoring Work Report' is required in October each year. It is to include data summaries from the 'Baseline Monitoring and Survey' component, data sets and an assessment of the 'Species/Habitat Targets', and a brief overview of research studies relevant to the 'Project-based Studies' and 'External Research' components from within the reporting period.

B6.0.5 In September of each year, a Field Data Collection Timetable is needed to coordinate field activities under all of the programme components and ensure timely collection of data (discussed further in para. B9.1.2). In January of each year, an Annual Work Plan to outline the coming 12-month programme activities is to be prepared.

Figure 2. Research and Monitoring Programme Structure.



B7. CONSIDERATIONS

B7.0.1 In setting Component Objectives and selecting research work items for inclusion in the Programme Plan, a number of factors and constraints need to be considered.

B7.1 General

B7.1.1
- High priority is given to the research and monitoring requirements of the Mai Po Management Plan (WWF-HK, 2006) (Appendix I). Refer to section A1.2.
- Mai Po currently employs two staff members to oversee and implement the Programme Plan. Eighty percent of their time is assigned to the section's work, the other 20% on Mai Po related works.
- Funding for the section comes from WWF's unrestricted funds and the level of annual funding allocated may vary depending on the finances of the whole organisation.
- The section operates within a small annual budget and specialist equipment purchase and maintenance can be expensive.
- Other factors include; capability and skill level of current section staff, possibility of joint partnerships, and availability of resources.

B7.1.2 Sensitive data relating to rare or threatened features of MPNR, particularly species, should not be released if it could be used inappropriately.

B7.2 Specific

B7.2.1 *PO 1*

- The completion of research studies for several priority species/groups, key habitats or significant threats under the POs, may generate the need for further baseline monitoring works within the 5-year plan period. These are listed in Table 1 under Component Objective 1.1.
- The need for new baseline monitoring works may arise from the adaptive management nature of the Mai Po Management Plan.

B7.2.2 *PO 3*

- The completion of research studies for several of the priority species/groups or key habitats under the POs may result in new targets being set for assessment within the 5-year plan period.

B7.2.3 *PO 4*

- Environmental administration data intended only for WWF internal use may not need to be disseminated outside WWF.
- The demand for environmental administration data varies annually, but is fairly predictable and easy to forecast.

B8. COMPONENT OBJECTIVES

B8.1.1 Component Objectives are set under each of the 5 POs together with a selection of general objectives to help achieve the Programme Goals. Where possible, research needs of a similar nature are amalgamated under a single objective heading. Where appropriate, each objective is referenced to other parts/sections of this plan. The number and type of objectives set are realistically achievable by the Research and Monitoring section within the 5-year period of this plan.

Table 1. Component Objectives for the MPNR Research and Monitoring Programme.

No.	Description	Ref. to Review of Research Needs	Ref. to Mai Po Man. Plan (Man. Obj.) [section]	Ref. to Mai Po Man. Plan (Table) [Text Ref.]
	PO 1 (Baseline Monitoring and Surveys)			
1.1	**Produce and Implement an Ecological Baseline Monitoring Plan for the period 2007 - 2011.** Elements to include:			
	• *Monitor the general abundance and distribution of all bird species occurring inside MPNR.	App II : 01-57		
	• *Annually monitor the number of roosting Ardeids at the Tam Kon Chau Egretry.	App II : 29, 38, 43, 56		
	• *Annually monitor the distribution and roosting population of Collared Crow.	App II : 53		
	• Carry out biennial waterbird breeding or nest surveys inside MPNR.	App II : 28		
	• *Annually monitor the number and distribution of roosting Anatidae inside MPNR each winter period.	App II : 57		
	• Monitor the abundance and species diversity of adult and breeding odonates in freshwater ponds.	App II : 70	(1.6) [3.1.6]	(Table 4, Table 5)
	• Regularly monitor the distribution and number of Red Fire Ant lairs inside MPNR.	App IV : 05		
	• *Monitor the water quality of *gei wai* and fresh water ponds inside MPNR.	App IV : 01		
	• *Monitor the key habitat types inside MPNR using fixed point photography.	App III : 01, 02, 05		
	• Monitor the size and distribution of key habitat types inside the Ramsar Site every 5 years.	App IV : 01-05	(1.4, 1.5) [3.1.4, 3.15]	(Table 4, Table 5)
	• Record all important wildlife sightings from the Deep Bay wetlands in appropriate computerised databases.	App II : 01-93		
	Additional elements may be needed within the plan period. Identified works include the monitoring of:			
	• the distribution and abundance of the damselfly *Mortonagrion hirosei*,	App II : 62	(1.8) [3.1.8] [2.4.6]	(Table 4) [3.4.1]
	• the distribution and abundance of Eurasian Otter *Lutra lutra*,	App II : 72		(Table 4) [3.4.2]
	• the distribution of invasive climbers inside the Ramsar Site,	App IV : 04		(Table 5) [3.1.10]
	• the distribution and 'health' of the 6 naturally occurring mangrove species in the Deep Bay wetlands,	App II : 76-82		(Table 5)
	• the MPNR reedbed stands for the presence of *Dimorphopterus spinolae*.	App IV : 06		
1.2	**Carry out a baseline survey of the distribution and habitat use by the damselfly *Mortonagrion hirosei*.**	App II : 62	(1.8) [3.1.8] [2.4.6]	(Table 4) [3.4.1]
1.3	**Carry out a baseline survey of the distribution and habitat use by the Eurasian Otter *Lutra lutra*.**	App II : 72		(Table 4) [3.4.2]

* - Included in the 2003 WWF Baseline Monitoring Plan.

Table 1. Component Objectives for the MPNR Research and Monitoring Programme. (cont.)

No.	Description	Ref. to Review of Research Needs	Ref. to Mai Po Man. Plan (Man. Obj.) [section]	Ref. to Mai Po Man. Plan (Table) [Text Ref.]
	PO 2 (Species/Habitat Targets)			
2.1	**Collect data to assess the target 'to provide roosting habitat in BMZ4 for an average of 50% or more of the Black-faced Spoonbill wintering in Deep Bay'.**		(1.1) [3.1.1]	(Table 4)
2.2	**Collect data to assess the target 'to provide feeding habitat for 20% or more of the Black-faced Spoonbill wintering in Deep Bay in the *gei wai* during winter drain down'.**		(1.1) [3.1.1]	(Table 4)
2.3	**Collect data to assess the target 'to provide roosting habitat in BMZ9 and *gei wai* #6, #8 and #11 for an average of 60% of the shorebirds in Deep Bay during spring and autumn passage'.**		(1.2) [3.1.2]	(Table 4)
2.4	**Collect data to assess the target 'to provide roosting habitat in *gei wai* #16/17 and Ponds #15a-b, #20 and #24 for an average of 20% of the waterfowl wintering in Deep Bay'.**		(1.3) [3.1.3]	(Table 4)
	PO 3 (Project-based Studies)			
3.1	**Carry out surveys to assess the ecological impact of all large-scale WWF Hong Kong habitat management operations or actions at MPNR.**			[3.1.10]
3.2	**Instigate at least 2 scientific investigations into new or existing management techniques for the key habitat types inside MPNR within the plan period.**	App III : 03-05		[3.1.10]
	PO 4 (Environmental Administration Data)			
4.1	**Collect environmental data to assess performance indicators relevant to contractual obligations.**			
4.2	**Collect environmental data on a needs basis to assist the Mai Po management administration section and meet legal obligations.**			
	PO 5 (External Research)			
5.1	**Compile a list of priority research topics within Deep Bay to send to Universities at the beginning of each academic year (October).**			
5.2	**Set up an information area on the WWF website for use by external researchers.**			
5.3	**Re-establish regular Deep Bay related wetland research seminars.**			
5.4	**Explore with senior management the possibility of setting up a 'Mai Po Scholarship Fund' in collaboration with local universities to fund priority academic research projects.**			
5.5	**Maintain a computerised database of all academic research projects that relate directly to the Deep Bay wildlife or environments.**			
5.6	**Offer rudimentary logistical support and advice to researchers undertaking environmental projects relating to Deep Bay.**			

Table 1. Component Objectives for the MPNR Research and Monitoring Programme. (cont.)

No.	Description
	General
6.1	Disseminate all reports and data summary sheets produced from the Research and Monitoring Programme.
6.2	Submit research papers to appropriate publishers for all major research reports produced or studies undertaken.
6.3	Present the work of the research and monitoring section through guest lectures to at least 2 different HK academic institutions each year.
6.4	Produce an Annual Research and Monitoring Work Report in October of each year.
6.5	Prepare a 12-month 'Field Data Collection' timetable to coordinate field data works in September of each year.
6.6	Produce an Annual Work Plan in January of each year.
6.7	Provide adequate wet laboratory facilities and research equipment to achieve the goals of the Research and Monitoring Programme Plan.

B9. TIMETABLE

B9.1.1 A timetable to implement the main action points of the Programme Plan is shown in Table 2.

B9.1.2 Component Objective 6.5 states the requirement for a 12-month 'Field Data Collection' timetable to be prepared each year. This timetable is to cover the period 01 October to 30 September and is necessary to ensure the timely collection of all field data relating to the Programme. An example is presented in Appendix V.

Table 2. Timetable for the Main Action Points Required to Implement the Programme Plan.

Comp. Obj.	Action	2007	2008	2009	2010	2011
1.1	Produce and Implement an Ecological Baseline Monitoring Plan for the period 2007-2011.	Produce				
1.2	Carry out a baseline survey of the distribution and habitat use by the damselfly *Mortonagrion hirosei*.					
1.3	Carry out a baseline survey on the distribution and habitat use by the Eurasian Otter *Lutra lutra.*					
2.1-2.4	Collect data to assess the 2006 – 2010 Management Plan species targets.					
3.2	Investigate management techniques for the key habitat types inside MPNR.		1*		2*	
4.1-4.2	Collect environmental administration data.					
5.1	Compile and maintain an updated list of priority research topics relevant to the Deep Bay wetlands.		Compile		Update	
5.2	Set up an information area on the WWF website for use by external researchers.					
5.3	Re-establish regular Deep Bay related wetland research academic seminars.					
5.4	Investigate setting up a 'Mai Po Scholarship Fund' in collaboration with local universities to fund priority academic research projects.					
6.4	Produce an Annual Research and Monitoring Work Report.		Oct	Oct	Oct	Oct
6.5	Prepare a 12-month 'Field Data Collection' timetable to coordinate field data works in each year.	Sep	Sep	Sep	Sep	Sep
6.6	Produce an Annual Work Plan.		Jan	Jan	Jan	Jan

* 1 – Avian value of wet reed stands.
* 2 – Waterbird changes in *gei wai* #21.

B10. REFERENCES

BirdLife International. 2006. **Threatened Birds of the World**. Lynx Editions and BirdLife International, Barcelona and Cambridge.

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Young, L. 2001. **The Avifauna of Hong Kong**. Hong Kong Birdwatching Society, Hong Kong.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. 2002. **Wild Animals to Watch: Terrestrial and Freshwater Fauna of Conservation Concern in Hong Kong**. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

IUCN, 2007. **IUCN Red List of Threatened Species – A Global Species Assessment**. The IUCN Species Survival Commission.

CSIS, 2007. **China Species Red List**. China Species Information Service.

WWF-HK, 2003. **Baseline Ecological Monitoring Plan for Mai Po Nature Reserve**. Unpublished. WWF Hong Kong, Hong Kong.

WWF-HK, 2006. **Management Plan for the Mai Po Nature Reserve : 2006 - 2010**. WWF Hong Kong, Hong Kong.

Young, L. & Melville, D.S. 1993. **Conservation of the Deep Bay Environment.** *The Marine Biology of the South China Sea*. Proceedings of the First International Conference on the Marine Biology of Hong Kong and the South China Sea, 28 October – 3 November 1990. Hong Kong University Press.

APPENDIX I - Environmental Monitoring and Research Requirements of the 2006 – 2010 Mai Po Management Plan.

Ref. No.	Description	Mai Po Man. Plan Ref. (Man. Obj.) [section]	Mai Po Man. Plan Ref. (Table) [Text Ref.]
01	Assess the target 'to provide roosting habitat in BMZ4 for an average of 50% or more of the Black-faced Spoonbill wintering in Deep Bay'.	(MO 1.1) [3.1.1]	(Table 4)
02	Assess the target 'to provide feeding habitat for 20% or more of the Black-faced Spoonbill wintering in Deep Bay in the *gei wai* during winter drain down'.	(MO 1.1) [3.1.1]	(Table 4)
03	Assess the target 'to provide roosting habitat in BMZ9 and *gei wai* #6, #8 and #11 for an average of 60% of the shorebirds in Deep Bay during spring and autumn passage'.	(MO 1.2) [3.1.2]	(Table 4)
04	Assess the target 'to provide roosting habitat in *gei wai* #16/17 and Ponds #15a-b, #20 and #24 for an average of 20% of the waterfowl wintering in Deep Bay'.	(MO 1.3) [3.1.3]	(Table 4)
05	Monitor the area of mangroves and reedbed inside MPNR.	(MO 1.4, 1.5) [3.1.4, 3.15]	(Table 4) (Table 5)
06	Monitor the distribution and 'health' of key mangrove species, e.g *Avicennia marina* and *Bruguiera conjugate*.		(Table 5)
07	Monitor the distribution of invasive climbers inside the Ramsar Site.		(Table 5) [3.1.10]
08	Monitor the abundance and diversity of odonates in the freshwater habitats.	(MO 1.6) [3.1.6]	(Table 4) (Table 5)
09	*Carry out ecological surveys to assess the impact of all large-scale WWF Hong Kong habitat management operations or actions at MPNR.		[3.1.10]
10	Investigate the distribution and habitat use by the damselfly *Mortonagrion hirosei*.	(MO 1.8) [3.1.8] [2.4.6]	(Table 4) [3.4.1]
11	Investigate the distribution and habitat use by the Eurasian Otter *Lutra lutra.*		(Table 4) [3.4.2]
12	*Investigate shorebird use of high-tide roosting sites inside MPNR.		(Table 5) [3.1.10]
13	*Investigate Black-faced Spoonbill use of feeding and roosting sites inside the Ramsar Site.		(Table 5) [3.1.10]
14	Investigate waterfowl use of habitats inside MPNR.		(Table 5) [3.1.10]
15	*Investigate effective ways of removing invasive climbers from affected mangrove areas inside MPNR.		(Table 4)
16	Investigate wildlife recolonization into newly created freshwater habitats.		(Table 5) [3.1.10]
17	Investigate *Gei wai* shrimp production.	(MO 1.7) [3.1.7]	(Table 5) [3.1.10]
18	Carry out baseline studies on the ecological requirements of the key habitats and species.	(MO All) [3.1.1 – 3.1.10]	(2.2.4)

* - To provide clarification, some text within the objective descriptions is reworded and may differ slightly from that stated in the Management Plan.

APPENDIX II – Priority Species/Groups for the Deep Bay Wetlands.

(footnote on page 21)

Ref. No.	Species/Group	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
	BIRDS				
01	Christmas Island Frigatebird (*Fregata andrewsi*)	1i	X	Mon ✓.	
02	Dalmatian Pelican (*Pelecanus crispus*)	1i	A,X	Mon ✓. Deep Bay wintering population declining rapidly and the reasons are unknown (may include habitat loss in the breeding sites, new wintering sites discovered in S. China, disturbance in Deep Bay, climate change).	• Investigate possible factors responsible for the recent decline. Priority to: - Migration routes in East Asia. - Assess the effects of disturbance from fishermen and mudskipper collectors in Deep Bay.
03	Siberian Crane (*Grus leucogeranus*)	1i	X	Mon ✓.	
04	Black-faced Spoonbill (*Platalea minor*)	1ii	A,C,D	Mon ✓.	• Investigate Black-faced Spoonbill use of feeding and roosting sites.
05	Nordmann's Greenshank (*Tringa guttifer*)	1ii	A,B,H,X	Mon ✓.	
06	Oriental Stork (*Ciconia boyciana*)	1ii	A,X	Mon ✓.	
07	Spoon-billed Sandpiper (*Eurynorhynchus pygmaeus*)	1ii	A,B,H,X	Mon ✓.	
08	Asian Dowitcher (*Limnodromus semipalmatus*)	1iii	A,B,H,X	Mon ✓.	
09	Baer's Pochard (*Aythya baeri*)	1iii	A,X	Mon ✓.	
10	Baikal Teal (*Anas Formosa*)	1iii	A,X	Mon ✓.	
11	Black Vulture (*Aegypius monachus*)	1iii	X	Mon ✓.	
12	Black-headed Ibis (*Threskiornis melanocephalus*)	1iii	A,X	Mon ✓.	
13	Black-tailed Godwit (*Limosa limosa*)	1iii	A,B,H	Mon ✓.	
14	Brown-chested Jungle Flycatcher (*Rhinomyias brunneata*)	1iii	X	Mon ✓.	
15	Falcated Duck (*Anas falcata*)	1iii	A,X	Mon ✓.	
16	Ferruginous Duck (*Aythya nyroca*)	1iii	A,X	Mon ✓.	
17	Greater Spotted Eagle (*Aquila clanga*)	1iii	A,X	Mon ✓.	• Survey of number of individuals occurring each winter using photo ID.
18	Imperial Eagle (*Aquila heliaca*)	1iii	A,X	Mon ✓.	• Survey of number of individuals occurring each winter using photo ID.
19	Japanese Paradise Flycatcher (*Tersiphone atrocaudata*)	1iii	X	Mon ✓.	
20	Japanese Yellow Bunting (*Emberiza sulphurata*)	1iii	X		
21	Lesser-white fronted Goose (*Anser erythropus*)	1iii	A,X	Mon ✓.	
22	Relic Gull (*Larus relictus*)	1iii	A,X	Mon ✓.	
23	Saunders' Gull (*Larus saundersi*)	1iii	A	Mon ✓.	• Foraging ecology and how it might relate to decline in numbers in Deep Bay.
24	Styan's Grasshopper Warbler (*Locustella pleskei*)	1iii	E		• Distribution and densities across different habitats using playback.
25	Swinhoe's Egret (*Egretta eulophotes*)	1iii	A,X	Mon ✓.	• Review of foraging ecology of migrants in Deep Bay.
26	Yellow-breasted Bunting (*Emberiza aureola*)	1iii	X		
27	Black-headed Gull (*Larus ridibundus*)	2i	A	Mon ✓.	
28	Black-winged Stilt (*Himantopus himantopus*)	2i	A,B,H	Mon ✓. BW Stilt first bred inside MPNR in 2003. The breeding population inside MPNR is important in a regional and HK context.	• Monitor the number and distribution of nests inside MPNR. • Investigate factors which influence use of breeding sites and microhabitats throughout the year.

APPENDIX II – Priority Species/Groups for the Deep Bay Wetlands. (Cont.)

(footnote on page 21)

Ref. No.	Species/Group	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
	BIRDS				
29	Chinese Pond Heron (*Ardeola bacchus*)	2i	A,G	Mon ✓. The summer roosting population at the Tam Kon Chau Egretry is important in a HK context.	• Investigate factors which influence use of microhabitats throughout the year. • Summer usage of the Egretry for roosting.
30	Common Greenshank (*Tringa nebularia*)	2i	A,B,H	Mon ✓.	
31	Common Shelduck (*Tadorna tadorna*)	2i	A	Mon ✓. The Deep Bay population has declined dramatically in the last 10 years.	• Review of feeding ecology (literature based) to try and determine massive decline in numbers. • Desktop review on the regional population.
32	Common Teal (*Anas crecca*)	2i	A	Mon ✓.	
33	Curlew Sandpiper (*Calidris ferruginea*)	2i	A,B,H	Mon ✓.	
34	Dunlin (*Calidris alpine*)	2i	A,B,H	Mon ✓.	
35	Eurasian Coot (*Fulica atra*)	2i	A	Mon ✓.	
36	Eurasian Curlew (*Numenius arquata*)	2i	A,B,H	Mon ✓.	
37	Great Cormorant (*Phalacrocorax carbo*)	2i	A,F	Mon ✓. A government review on pond-wiring to reduce Cormorant predation in commercial fishponds will be finalised in late 2007.	• Investigate feeding habitat use and feeding ecology, in order to assess their impact on the commercial fisheries in and around Deep Bay
38	Great Egret (*Egretta alba*)	2i	A,G	Mon ✓. Over 850 individuals are known to intermittently roost in wintertime at the Tam Kon Chau Egretry (Feb 2007 data).	• Winter usage of the Egretry for roosting.
39	Greater Sand Plover (*Charadrius leschenaultia*)	2i	A,B,H	Mon ✓.	
40	Grey Heron (*Ardea cinerea*)	2i	A,G	Mon ✓.	
41	Grey Plover (*Pluvialis squatarola*	2i	A,B,H	Mon ✓.	
42	Kentish Plover (*Charadrius alexandrinus*)	2i	A,B,H	Mon ✓.	
43	Little Egret (*Egretta garzetta*)	2i	A,G	Mon ✓. Over 900 individuals (up to 50% of the Deep Bay total, Feb 2007) are known to intermittently roost in wintertime at the Tam Kon Chau Egretry.	• Investigate factors which influence use of microhabitats throughout the year. • Winter usage of the Egretry for roosting.
44	Marsh Sandpiper (*Tringa stagnatilis*)	2i	A,B,H	Mon ✓.	
45	Northern Pintail (*Anas acuta*)	2i	A	Mon ✓.	
46	Northern Shoveler (*Anas clypeata*)	2i	A	Mon ✓.	
47	Pied Avocet (*Recurvirostra avosetta*	2i	A,B,H	Mon ✓. Species may breed at MPNR within the next 10 years.	
48	Spotted Redshank (*Tringa erythropus*)	2i	A,B,H	Mon ✓.	
49	Terek Sandpiper (*Xenus cinereus*)	2i	A,B,H	Mon ✓.	
50	Eurasian Wigeon (*Anas penelope*)	2ii	A	Mon ✓.	
51	Far Eastern Curlew (*Numenius madagascariensis*)	2ii	A,B,H,X	Mon ✓.	
52	Japanese Night Heron (*Gorsachius goisagi)*	2ii	A,X	Mon ✓.	
53	Collared Crow *(Corvus torquatus)*	3	A	Monitoring is adequate to record daytime numbers in Deep Bay. The roosting population inside MPNR is much higher and important in a HK context.	• Roosting numbers, behaviour and roost areas at MPNR.
54	Spot-billed Duck – (Anas poecilorhyncha haringtoni)	3	A	Mon ✓. Breeding population has declined in Hong Kong.	• Investigate potential factors behind the decline in no. of breeding pairs.
55	Shorebirds	-	A,B,H	Mon ✓.	• Investigate usage of different high tide roosts by shorebirds.

APPENDIX II – Priority Species/Groups for the Deep Bay Wetlands. (Cont.)

(footnote on page 21)

Ref. No.	Species/Group	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
	BIRDS (Cont.)				
56	Ardeidae	-	A,G	Mon ✓. Roosting population at the Tam Kon Chau Egretry is important in a Deep Bay context.	• Usage of the Egretry for roosting.
57	Anatidae	-	A	Mon ✓.	• Investigate Anatidae usage of different habitats and vegetation types.
	INVERTEBRATES (* - Benthic infauna)				
58	*Perisesarma maipoensis* - [Crab]	1i		The crab has not been recorded in HK within the last 10 years.	• An understanding of the current distribution, habitats of use, and ecological requirements.
59	*Procephalothrix orientalis* - [Ribbon worm]* *Limnodriloides fraternus* - [Oligochaeta]* *Limnodriloides biforis* - [Oligochaeta]* *Rhizodrilus russus* - [Oligochaeta]* *Pseudopythina maipoensis* - [Bivalvia]* *Discapseudes* sp. nov. - [Tanaidacea]* *Melita* sp. nov. - [Amphipoda]* *Talorchestia* sp. Nov. - [Amphipoda]* *Grandidierella* sp. nov. - [Amphipoda]* *Victoriopisa* sp. nov. - [Amphipoda]* *Kamaka* sp. nov. - [Amphipoda]*	1i	J	AFCD monitoring is only adequate to assess the overall abundance and biomass of benthic infauna. Methods employed do not identify to species level.	• For each species a better understanding of their current distribution, habitats of use, and ecological requirements.
60	*Schrankia bilineata* - [Moth]	1i		*S. bilineata* has no apparent habitat association although larvae of congeners are thought to live as detritivores in damp grasslands or reedbeds.	• Investigate distribution and habitat use.
61	*Thalassodes maipoensis* - [Moth]	1i		Little is known about *T. maipoensis*. It appears to be a mangrove associate - now known with certainty from Mai Po and HK Wetland Park.	• Investigate distribution and habitat use.
62	Four-spot Midget (*Mortonagrion hirosei*) – [Damselfly]	1ii			• Investigate distribution and habitat use. • Monitor relative abundance. • Investigate if there are any impacts from present reed management by WWF.
63	Tawny Hooktail (*Paragomphus capricornis*) – [Dragonfly]	2i		The single record of this riverine species at Mai Po is probably either a misidentification or a freak occurrence. There is no suitable habitat at Mai Po for this species. Therefore it is not a priority species for research at Mai Po.	
64	Blue Sprite (*Pseudagrion microcephalum*) – [Damselfly]	3i			• Investigate distribution and monitor abundance
65	Blue-spotted Dusk-hawker (*Gynacantha japonica*) – [Dragonfly]	3ii			• Investigate whether breeding occurs at Mai Po (exuviae survey)
66	Common Awl (Hasora badra) – [Butterfly]	3ii		Larval foodplants include *Derris*, *Millettia*, and *Pongamia* spp.	• Investigate distribution at food plant locations
67	Danaid Egg-fly (Hypolimnas misippus) – [Butterfly]	3ii		Larval foodplants include *Abelmoschus*, *Abutilon*, *Plantago* and *Portulaca* spp.	• Investigate distribution at food plant locations

APPENDIX II – Priority Species/Groups for the Deep Bay Wetlands. (Cont.) (footnote on page 21)

Ref. No.	Species/Group	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
	INVERTEBRATES (* - Benthic infauna) **(Cont.)**				
68	Dingy Dusk-hawker (Gynacantha subinterrupta) – [Dragonfly]	3ii			• Investigate whether breeding occurs at Mai Po (exuviae survey)
69	Benthic infauna	-	J	More information is needed on the diversity of benthic infauna in Deep Bay.	• Surveys to catalogue species. • Compare present species diversity and abundance with historical data.
70	Odonata	-			• Monitor the abundance and species diversity of adult and breeding odonates in fresh water ponds and compare with historical data.
	FISH				
71	Fish	-		There has been no recent survey of the types or abundance of fish in Deep Bay.	• Investigate species diversity and abundance in MPNR and Deep Bay.
	MAMMALS				
72	Eurasian Otter (*Lutra lutra*)	1i	I,X	AFCD's methodology and infrared camera network may not be suitable to assess population.	• Investigate distribution and habitat use (radio-telemetry or infrared camera) • Monitor relative abundance.
73	Crab-eating Mongoose (*Herpestes urva*)	2ii	I,X	AFCD's camera network may not be suitable to assess population. The presence of the Crab-eating Mongoose in Mai Po Nature Reserve is in doubt. No record of this species was found by AFCD Camera Trap Survey from 2002 to 2007. During the same period, this species was only recorded in Northeast parts of Hong Kong.	• Investigate distribution and habitat use • Monitor relative abundance.
74	Lesser Yellow House Bat (*Scotophilus khull*)	3ii	I	AFCD's mist net survey showed that few individuals of the Lesser Yellow Bat were captured inside the MPNR. However, no diurnal sites (usually inside buildings) were identified within the area.	• Study of bat hut or bat boxes as diurnal roost of the Lesser Yellow Bat (and also the Japanese Pipistrelle) in Mai Po.
75	Large Bandicoot Rat (*Bandicota indica*)	3ii			• Monitor distribution and abundance by trapping.
	PLANTS				
76	Many-petaled Mangrove (*Bruguiera gymnorrhiza*)	2ii			• Monitor distribution and health.
77	Milky Mangrove (*Excoecaria agallocha*)	2ii			• Monitor distribution and health.
78	Coastal Heritiera (*Heritiera littoralis*)	2ii		*H. littoralis* does not grown naturally in Mai Po.	
79	Kandelia obovata	2ii	P	AFCD remote sensing study forms a suitable baseline for the current distribution at the canopy layer.	• Monitor distribution and health.
80	Aegiceras corniculatum	2ii	P	AFCD remote sensing study forms a suitable baseline for the current distribution at the canopy layer.	• Monitor distribution and health.
81	Black Mangrove (Avicennia marina)	2ii	P	AFCD remote sensing study forms a suitable baseline for the current distribution at the canopy layer.	• Monitor distribution and health.

APPENDIX II – Priority Species/Groups for the Deep Bay Wetlands. (Cont.)

(footnote on page 21)

Ref. No.	Species/Group	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
	PLANTS (Cont.)				
82	Spiny Bears Breech (Acanthus ilicifolius)	2ii	P	AFCD remote sensing study forms a suitable baseline for the current distribution at the canopy layer.	• Monitor distribution and health.
83	Wigeon Grass (*Ruppia maritima*)	2ii			• Monitor distribution and health.
84	Common Reedgrass (*Phragmites australis*)	2ii			• Monitor distribution and health.
	HERPTOFAUNA				
85	Chinese Softshell Turtle (*Pelodiscus sinesnsis*)	1iii		Deep Bay is believed to be the only natural breeding population established in Hong Kong.	• Investigate distribution and monitor abundance in Deep Day.
86	Reeve's Turtle (*Chinemys reevesi*)	1iii		Little is known about the Mai Po population or its viability, but Mai Po only offers marginal habitat. A radio-tracking study of habitat use was recently undertaken (by Cheung Sze-man from HKU)	• Investigate distribution and monitor abundance.
87	Burmese Python (*Python molurus bivittatus*)	2i	X	Mai Po offers only marginal habitat.	• Investigate distribution and monitor abundance.
88	Common Rat Snake (*Ptyas mucosus*)	2ii		Locally common and widespread and occurs in many other habitat types.	
89	Copperhead Racer (*Elaphe radiata*)	2ii		Mai Po only offers marginal habitats.	
90	Chinese Cobra (*Naja atra*)	2iii	X	Locally common and widespread and occurs in many other habitat types.	
91	King Cobra (*Ophiophagus hannah*)	2iii	X	Mai Po only offers marginal habitats.	
92	Many-banded Krait (*Bungarus multicinctus*)	2iii		Locally common and widespread and occurs in many other habitat types.	
93	Mangrove Water Snake (*Enhydris bennettii*)	3i		This species is only recorded in Deep Bay, Tung Chung and Tai O so far. No detailed information is available on its distribution, abundance and habitat use in MPNR at present.	• Investigate distribution and habitat use • Monitor relative abundance.

APPENDIX III – Priority Habitat Types for the Deep Bay Wetlands.

(footnote on page 21)

Ref. No.	Habitat Type	Conservation Status[1]	Current Non-WWF Research[2]	Comments[3]	Research Needs
01	Intertidal mudflat	1i	J	Monitoring includes; sediment quality, sedimentation rate, water quality, and benthic fauna (abundance and biomass only).	• Monitor area of intertidal mudflat.
02	Mangroves	1ii	J, P	AFCD's work involves monitoring the rate of mangrove encroachment onto the intertidal mudflat areas, and mangrove mapping using remote sensing techniques. A Ph.D. project is using satellite imagery to monitor changes in the area and extent of the Deep Bay mangroves.	• Monitor distribution, health and area of mangrove.
03	*Gei wai*	2i	J	Monitoring at *gei wai* #12 and #13 includes; sediment quality, water quality, and benthic fauna (abundance and biomass only).	• Aquatic and benthic fauna of *gei wai* under different management regimes. • Investigate existing and new management techniques to enhance wildlife i.e. usage of draining *gei wai* by winter waterbirds (particularly BF Spoonbill). • Investigate *Gei wai* shrimp production.
04	Fish ponds (freshwater)	2ii			• Anatidae usage of freshwater ponds at Mai Po. • Investigate wildlife recolonisation into newly created freshwater ponds. • Investigate existing and new management techniques to enhance wildlife.
05	Reedbeds	2ii			• Understand bird preference of reedbed stand types. • Monitor distribution, health and area of reedbed. • Investigate existing and new management techniques to enhance wildlife.

APPENDIX IV – Significant Threats to the Biodiversity of the Deep Bay Wetlands. (footnote on page 21)

Ref. No.	Threat	Threat Level	Current Non-WWF Research[2]	Comments[3]	Research Needs
01	Water and sediment quality	High	J,K	Current monitoring considered adequate for Deep Bay, but not for MPNR.	• Monitor freshwater pond and *gei wai* water/sediment quality.
02	Siltation	High	J	AFCD's work has monitored the height of the mudflat since 2001.	• A better understanding of siltation in Deep Bay - Rate, sources, processes, and impact upon priority habitats and species. - Compare present rate of sedimentation with historical estimates.
03	Alien/invasive/destructive spp. – *Sonneratia*	High	L	Mapping work undertaken by AFCD forms a suitable baseline. Their work also included investigations into control methods.	• Impact on native flora and fauna (e.g. crabs)
04	Alien/invasive/destructive spp. – Invasive climbers	Medium			• Monitor the distribution of invasive climbers. • Study the ecological impact of invasive climbers upon key habitat types. • Investigate the ecology of invasive climber species and possible control methods.
05	Alien/invasive/destructive spp. – Red Fire Ant	Medium		Red Fire Ant was first reported in Hong Kong in 2005. Its impact upon native Hong Kong wildlife is unknown.	• Trial and identify appropriate techniques to eradicate Red Fire Ant from MP. • Understand the threats posed by Red Fire Ant to native wildlife. - Monitor distribution and abundance - Investigate (and monitor) possible impacts
06	Alien/invasive/destructive spp. – *Dimorphopterus spinolae*	Medium		The insect pest has caused serious die-off within newly established reedbeds elsewhere in Hong Kong. A few individuals resembling the pest have also been found in the MPNR reedbeds recently, but little is known about the insect's ecology or preference of reedbed types.	• Monitor the presence and potential threat of *D. spinolae* in the Mai Po reedbeds. • Investigate management techniques to control or eradicate *D. spinolae* from reedbed stands.
07	Climate change - Long-term effects to flora/fauna	Medium	O	Meteorological data from the nearby Lau Fau Shan and Wetland Park stations is of high quality and suitable for climate based studies.	• Under present predicted scenarios of sea level rise and other impacts from climate change, forecast the impact on MP and Deep Bay and make recommendations on how the reserve should respond.
08	Wildlife diseases - Avian Influenza	Medium	M,N	Current monitoring considered adequate.	
09	Wildlife diseases - Avian Botulism	Medium		Causes and vectors are well known.	• Monitor the level of clostridium in pond and *gei wai* sediments.
10	Habitat destruction – Loss of wetland habitat	Low			
11	Urban development – Loss of wetland habitat	Low			
12	Acid precipitation	Low			

Footnote to Appendices II, III and IV.

[1] - **Conservation Status**	[2] - **Research**	[3] – **Comments**
1 – Internationally Important (IUCN Redlist) i = Critically Endangered ii = Endangered iii = Vulnerable or Near Threatened 2 – Regionally Important i – High ii – Moderate iii – Low 3 – Locally Important _____ Fellowes, *et al*. 2002 WWF-HK, 2006 CSIS, 2007 IUCN, 2007	A = Monthly Waterbird Count - Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme* B = Shorebird Monitoring - Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme* C = International Black-faced Spoonbill Census D = Black-faced Spoonbill Counts - Asia Ecological Consultants E = Reedbed Bird Ringing Programme - Hong Kong Bird Ringing Group F = Cormorant Roost Counts - Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme* G = Summer Egret Counts - Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme* H = Shorebird Ringing - Hong Kong Bird Ringing Group I = Camera Trap Study - Agriculture, Fisheries and Conservation Department Mammal Working Group J = Mai Po Inner Deep Bay Ramsar Site Ecological Baseline Monitoring Programme K = Marine Water Quality Monitoring Programme - Environmental Protection Department L = Sonneratia study (2007) - Agriculture, Fisheries and Conservation Department M = Avian Influenza Surveillance - The University of Hong Kong N = Avian Influenza Surveillance - Agriculture, Fisheries and Conservation Department O = Hong Kong Observatory - Wetland Park & Lau Fau Shan Meteorological Stations P = Distribution of Mangrove Species of Inner Deep Bay Using Remote Sensing Technology (2007) - Agriculture, Fisheries and Conservation Department Q = Annual Monitoring - Agriculture, Fisheries and Conservation Department Herpetofauna Working Group X = Species likely to be reported by site users (i.e. birdwatchers) * - Waterbird Monitoring Programme works undertaken by HKBWS under AFCD's service tender.	Mon ✓ = Current monitoring considered adequate to assess changes in population from year-to-year.

APPENDIX V – Example of the Field Data Collection Timetable

WWF *for a living planet*®

Field Data Collection Timetable - Mai Po Nature Reserve : 01 Oct 2006 – 30 Sep 2007

COMPONENT Monitoring/Project Activity [No. of recorders required]	Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep	
	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time	Date	Start time
BASELINE MONITORING																								
Morning Bird Count **[1]**	**06***	06:05	**03**	06:15	**01**	06:30	**15***	06:50	**12***	06:42	**12***	06:20	**03**	06:00	**15**	05:29	**12**	05:24	**13***	05:32	**10***	05:43	**07***	05:53
	17	06:10	**17***	06:22	**18***	06:45	**29**	06:48	**27**	06:32	**26**	06:07	**23***	05:43	**23***	05:26	**19***	05:25	**27**	05:37	**24**	05:48	**24**	05:57
Anatidae Count **[5]**	**09***	17:19	**06**	16:59	**04**	16:54	**08**	17:10	**14***	17:35	**12**	17:45	**12**	17:55	-		-		-		-		-	
	23	17:07	**20***	16:54	**18***	16:58	**15***	17:15	**26**	17:40	**27**	17:50	**23***	18:00										
					29	17:04	**29**	17:25																
Ardeidae Count : Tam Kon Chau **[1]**	**10***	17:03	**07**	16:43	**05**	16:39	**05**	16:53	**08**	17:16	**13**	17:32	**11**	17:42	**09**	17:53	**07**	18:06	**04**	18:12	**13**	17:57	**12**	17:30
	25	16:51	**22**	16:39	**19**	16:43	**23**	17:06	**23**	17:24	**26**	17:36	**24**	17:47	**22**	17:59	**21**	18:10	**16**	18:10	**23**	17:49	**27**	17:15
Corvidae Count **[1]**	**<(11)>**	17:02	**<(08)>**	16:43	**<(06)>**	16:39	**<(04)>**	16:52	**(08)**	17:16	-		-		-		**<7>**	18:06	**<(12)>**	18:11	**(7)**	18:01	-	
(Collared Crow)&<Common Magpie>	**<(25)>**	16:51	**<(23)>**	16:39	**<(20)>**	16:44	**<(22)>**	17:05									**<20>**	18:10	**<(26)>**	18:07	**(21)**	17:51		
Water Quality (Pond #15) **[1]**	**04**	09:30	**04**	09:30	**06**	09:30	**04**	09:30	**02**	09:30	**01**	09:30	**04**	09:30	-		-		-		-		-	
	20	09:30	**20**	09:30	**21**	09:30	**18**	09:30	**16**	09:30	**15**	09:30	**18**	09:30										
PROJECT-BASED STUDIES																								
Buffalo : Vegetation Survey **[1]**	-		**21-23**		-		**15 – 19**		-		**19-24**		-		**14-19**		-		**16 – 20**		-		**12-14**	
Buffalo : Photographic Survey **[1]**	-		**13-17**		-		**15-16**		-		**19-20**		-		**14-15**		-		**11-13**		-		**17-21**	
Buffalo : Bird Survey **[1]**	**04 & 20**	am & pm	**07 & 21**	am & pm	**05 & 19**	am & pm	**04 & 18**	am & pm	**06 & 20**	am & pm	**05 & 19**	am & pm	**04 & 18**	am & pm	**02 & 16**	am & pm	**05 & 19**	am & pm	**04 & 18**	am & pm	**02 & 16**	am & pm	**05 & 19**	am & pm
Drained *Gei Wai* Waterbird Counts **[2]**	-		**18-30 (#11)**		-		-		-		**06-18 (#7)**	06:27 (6th) 06:16 (12th)	-		-		-		-		-		-	
Roosting Wagtail (*Gei wai* #8/#14) **[1]**	-		-		-		**04(#8)**	16:52	**05(#8)**	17:14	**05(#8)**	17:28	**03(#8)**	17:39	**03(#8)**	17:50	-		-		-		**05(#8)**	17:36
(No survey June, July or August)							**05(#14)**	16:53	**06(#14)**	17:15	**06(#14)**	17:29	**04(#14)**	17:39	**04(#14)**	17:51							**05(#14)**	17:36
							18(#14)	17:02	**21(#14)**	17:23	**19(#14)**	17:34	**17(#14)**	17:44	**17(#14)**	17:57							**20(#14)**	17:22
							19(#8)	17:03	**22(#8)**	17:24	**20(#8)**	17:34	**18(#8)**	17:44	**18(#14)**	17:57							**20(#8)**	17:22
Roosting Barn Swallow **[1]**	-		-		-		**04**	17:22	**05**	17:44	**05**	17:58	**03**	18:09	**03**	18:20	**04**	18:34	**05**	18:42	**02**	18:34	**04**	18:08
							18	17:32	**21**	17:52	**19**	18:04	**17**	18:14	**17**	18:27	**18**	18:39	**18**	18:40	**15**	18:25	**18**	17:54
SPECIES/HABITAT TARGETS																								
Gei wai Draining BFS Count **[1]**	-		-		**04**	08:00	**11**	08:00	-		-		-		-		-		-		-		-	
(#12, #13, #14)					(#12)		(#14)																	
					15	08:00																		
					(#13)																			
Daytime BFS Roosting (#3, #4, #6, #7) **[1]**	[1]**AEC**		**07**	12:00	**05**	12:00	**AEC**		**AEC**		**AEC**		-		-		-		-		-		-	
			22	12:00	**12**	12:00																		
Shorebird Count (#16/17, #8, #11) **[1]**	[2]**HKBWS**		**HKBWS**		-		-		-		**HKBWS**		**HKBWS**		-		-		-		-		**HKBWS**	
ENV. ADMIN. DATA																								
Water Quality **[1]** (AFCD Contract)	**10**	09:30	**8**	09:30	**6**	09:30	**03**	09:30	**07**	09:30	**07**	09:30	**04**	09:30	**02**	09:30	**06**	09:30	**04**	09:30	**01**	09:30	-	
Salinity (#16b, #15c, #24g, #10, #13, #14)	**18**	09:30	**28**	09:30	**21**	09:30	**17**	09:30	**21**	09:30	**21**	09:30	**18**	09:30	**16**	09:30	**20**	09:30						
pH & DO – (#15a, #15b, #10, #14)																								
Odonata **[1]** (AFCD Contract)	**13**	**12:00**	-		-		-		-		-		**04**	12:00	**02**	12:00	**06**	12:00	-		-		-	
#16b, #24g, #10, #14													**18**	12:00	**16**	12:00	**20**	12:00						

* = Date selected for assessment against the Hong Kong Bird Watching Society monthly waterbird count. [1] = Asia Ecological Consultants [2] = Hong Kong Bird Watching Society shorebird monitoring programme