

Priority Research Areas and Suggested Topics for Deep Bay

2009

Explanation Note

To identify and prioritise important research and monitoring work for the Deep Bay wetlands, WWF-HK carried out a review and assessment of existing environmental research work within the area under guidance from members of the Mai Po Management Committee (a group of wildlife experts, conservationists and academic professionals). The review and assessment, which can be found in Appendix II-IV of the Research & Monitoring Programme Plan 2007-2011, identifies all conservation important wetland flora, fauna and habitats, significant threats facing them, and level of research attention (past and present) given to each.

This process led to the identification of “Research Needs” for Deep Bay, allowing a greater focus in research work areas considered important to help conserve and protect Deep Bay's wetland biodiversity.

The topics listed within this document have been extracted from the full list of “Research Needs” (found in the Programme Plan) and are deemed suitable for either undergraduate or post-graduate study level in respect of the scale and duration of work required.

Researchers interested in any of the suggested topics should visit WWF-HK's “Information for Researchers” web page (<http://www.wwf.org.hk/eng/maipo/randm/info.php>) for background information and then contact Reserve staff (as shown on the main research and monitoring web page <http://www.wwf.org.hk/eng/maipo/randm>) for further discussion.

Priority Species/Group for the Deep Bay Wetlands

Ref. No.	Species/Group	Level of Study	Topic and Required Study
BIRDS			
02	Dalmatian Pelican (<i>Pelecanus crispus</i>)	Ug to Pg	<p><u>Decline in Wintering Dalmatian Pelican <i>Pelecanus crispus</i> in Deep Bay</u></p> <p>The wintering population of Dalmatian Pelican in Deep Bay has declined rapidly in the past decade from 24 individuals recorded in 1998 to a few individuals since 2006. The species is globally-threatened listed as Vulnerable on the IUCN Redlist. Factors believed to have contributed to the decline include:</p> <ul style="list-style-type: none"> - habitat loss in their breeding grounds in Mongolia; - usage of new wintering sites in Southern China (Fujian and Guangdong Province); - disturbance from fishermen and mudskipper collectors in Deep Bay; and - climate change. <p>A literature-based study to investigate and quantify the possible factors contributing to the decline, particularly along their migration route and at wintering sites in East Asia, is necessary in order to formulate a long-term conservation strategy for the species. This study would need to recognise that similar work is being done elsewhere in the flyway.</p>
04	Black-faced Spoonbill (<i>Platalea minor</i>)	Ug to Pg	<p><u>Ecology and Habitat use of Black-faced Spoonbill <i>Platalea minor</i></u></p> <p>The Black-faced Spoonbill is a globally-threatened species listed as Endangered on the IUCN Redlist and with ~20% of the global population wintering in Deep Bay. Despite a number of relevant studies in recent years, further information is still needed on their use of feeding and roosting habitats during the day and at night to inform conservation management decisions for the species.</p>
23	Saunders's Gull (<i>Larus saundersi</i>)	Pg	<p><u>Foraging Ecology of Wintering Saunders's Gull <i>Larus saundersi</i></u></p> <p>Saunders's Gull is a globally-threatened species listed as Vulnerable on the IUCN Redlist. In the 1990's the Deep Bay mudflat supported 70-100 wintering individuals (>1% of the flyway population), however, this has dropped to less than 60 in the past 10 years with a significantly low number of 15 individuals in winter 2003/04.</p> <p>A study to investigate their foraging ecology is required to determine whether the decline in number is related to food availability in the Bay. The study would involve:</p> <ul style="list-style-type: none"> - observation of the foraging behaviour of the species (including inter-relationships with other species); - investigating the food availability for the species at the Deep Bay mudflat; - analysing the relationship between the changes in food availability and the declining wintering population using past data; and - investigating other possible factors which might contribute to the decline of the wintering population.

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
BIRDS (Cont')			
28	Black-winged Stilt (<i>Himantopus himantopus</i>)	Pg	<p>Habitat Use of Black-winged Stilt <i>Himantopus himantopus</i> Black-winged Stilt first bred in Hong Kong at the Mai Po Nature Reserve in 2003. Thereafter, breeding was recorded annually on islands in <i>gei wai</i> and freshwater ponds in the Reserve. The breeding population in the Reserve is important in a regional and Hong Kong context. However, little is known about the factors affecting their preference of breeding site. The species is also present during passage and winter periods.</p> <p>A study into the factors which influence their selection and use of breeding sites and microhabitat throughout the year (especially intertidal mudflat areas and drained fish ponds) is needed to inform habitat management decisions at Mai Po.</p>
29	Chinese Pond Heron (<i>Ardeola bacchus</i>)	Pg	<p>Habitat Use of Chinese Pond Heron <i>Ardeola bacchus</i> The population of Chinese Pond Heron in Deep Bay has declined dramatically in the past two decades from a peak of more than 500 in the late 1980's to around 200 individuals in recent years. The reduction in total fish pond area in Deep Bay, and thus feeding habitat, is believed to be a significant factor behind this decline. WWF's research work shows that the species utilise different roosting sites in breeding and non-breeding season and do not respond positively, unlike other ardeids, to key management actions such as <i>gei wai</i> drain-down.</p> <p>A study to investigate factors affecting their use of microhabitats throughout the year is important to plan habitat management action at Mai Po/Deep Bay for the long-term viability of the species in the region. The study would involve investigating:</p> <ul style="list-style-type: none"> - factors affecting the use of different roosting sites in breeding and non-breeding seasons; - factors affecting the selection of nesting site; - comparative use of fish ponds and <i>gei wai</i> as feeding site of the species; and - the roosting and feeding habitat requirements of the species.
31	Common Shelduck (<i>Tadorna tadorna</i>)	Ug to Pg	<p>Decline in Wintering Population of Common Shelduck <i>Tadorna tadorna</i> in Deep Bay In 1988 the wintering population of Common Shelduck peaked at 4,000 individuals but has dramatically dropped to no more than 100 individuals in recent winters. In view of the increasing total number of wintering duck in the Deep Bay, it is hypothesised that food availability in the Bay and population fluctuations - both within the flyway and breeding grounds - are responsible.</p> <p>A literature-based study to review their feeding ecology and an analysis of information related to the species (e.g. population change, breeding success) within the breeding and stop-over sites along the flyway is needed to determine the reason for the massive decline.</p>

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
BIRDS (Cont')			
37	Great Cormorant (<i>Phalacrocorax carbo</i>)	Pg	<p><u>Ecology of Wintering Great Cormorant <i>Phalacrocorax carbo</i></u></p> <p>The regionally important numbers of Cormorants wintering around Deep Bay have been accused of causing significant damage to fish stocks in the commercially operated fish ponds in and around the Mai Po and Inner Deep Bay Ramsar Site.</p> <p>Whilst AFCD have conducted a number of studies on the feeding behaviour of these birds (especially in relationship to fishponds), a detailed study is required covering the whole winter period when birds are present around Deep Bay and gathering together information from previous studies. Activities involve:</p> <ul style="list-style-type: none"> - surveying the feeding habitat used by Cormorant in and around the Ramsar Site; - conducting time budget surveys on Cormorants around fish ponds, - investigating factors affecting the selection of feeding habitat; - collecting regurgitates from under the Cormorant roosts for diet analysis, and - base on data collected from previous survey, assessing the usefulness of setting up alternative feeding sites for Cormorants at Mai Po by stocking selected <i>gei wai</i> with trash fish.
43	Little Egret (<i>Egretta garzetta</i>)	Ug to Pg	<p><u>Habitat Use of Little Egret <i>Egretta garzetta</i></u></p> <p>Little Egret is a common resident species in Hong Kong with evidence of partial migration. The species utilises a variety of wetland habitats around the Deep Bay area, in particularly, fish pond, <i>gei wai</i> and intertidal mudflat to feed. Little is known about the factors affecting their selection of habitat (roosting and feeding).</p> <p>A study into the factors which influence their selection and use of microhabitats throughout the year is needed to inform habitat management decisions at conservation managed wetlands.</p>
54	Spot-billed Duck (<i>Anas poecilorhyncha haringtoni</i> and <i>A. zonorhycha</i>)	Ug to Pg	<p><u>Decline of Spot-billed Duck <i>Anas poecilorhyncha haringtoni</i> and <i>A. zonorhycha</i> in Deep Bay</u></p> <p>In the past decade, both taxa of Spot-billed Duck were considered as resident species with an influx of <i>A. zonorhycha</i> in winter. Both taxa bred almost annually in the Deep Bay area. However in recent years, the population in Deep Bay has declined with few breeding pairs. The reasons for which are unclear.</p> <p>A literature-based study to investigate the potential factors behind the decline is needed in order to develop possible habitat management action for the species.</p>

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
BIRDS (Cont')			
55, 56 & 57	Shorebirds, Ardeidae & Anatidae	Pg	<p><u>Deep Bay Waterbird Trend Analysis</u></p> <p>Waterbirds are one of the most important wildlife groups in Deep Bay. Over the past three decades, a regular waterbird census has been carried out within Deep Bay and a massive data set collected.</p> <p>A desktop-based analysis of the existing waterbird census data is important to understand changes in waterbird species composition and abundance so that they can be correlated with the changes in other environmental attributes. This analysis would also serve as a model to predict future changes in the Deep Bay waterbird community.</p>
INVERTEBRATES			
58	[Crab] <i>Perisesarma maipoensis</i>	Ug to Pg	<p><u>Ecology of the Crab <i>Perisesarma maipoensis</i></u></p> <p><i>Perisesarma maipoensis</i> is an endemic species to Hong Kong and along with other Sesarmine crabs are well-known for their association with mangrove habitats. This species has a narrow habitat range - on the raised levees of drainage channels and drier bunds near the tidal limit of the mangrove areas of Mai Po - and are not found on the landward side of the border fence road (Lee & Leung, 1999). Its distribution in Hong Kong is also limited, apart from Mai Po, one other record is from Tung Chung. The species has not been recorded within the last 10 years.</p> <p>Detailed ecological and up-to-date status/distribution information is required to ensure appropriate action is taken to prevent extinction. Study activities include:</p> <ul style="list-style-type: none"> - surveying the current distribution of the species in Hong Kong; - investigating the habitats of use and ecological requirements of the species; and - studying the inter-relationship of the species with mangrove habitats, including time energy budgets and gut content analysis etc.
59	[Benthic infauna] <i>Procephalothrix orientalis</i> , <i>Limnodriloides fraternus</i> , <i>Limnodriloides biforis</i> , <i>Rhizodrilus russus</i> , <i>Pseudopythina maipoensis</i> , <i>Discapseudes</i> sp. nov., <i>Melita</i> sp. nov., <i>Talorchestia</i> sp. nov., <i>Grandidierella</i> sp. nov., <i>Victoriopisa</i> sp. nov., <i>Kamaka</i> sp. nov.	Ug to Pg	<p><u>Ecology and Biology of Selected Benthic Infauna Species</u></p> <p>Most of these species are new to science or unique to Mai Po. There is limited information on their distribution, ecology and biology, hence no direct action is being implemented to conserve the species.</p> <p>Study activities include:</p> <ul style="list-style-type: none"> - surveying the distribution of the selected species in mudflat and/or mangrove areas, - determining the habitat characteristics (e.g., sediment particle size distribution, nutrient content, etc.) where abundant numbers of the selected species are found, - studying life cycle (e.g., reproduction, mortality) and population changes over time, and - assessing tolerance of the selected species to environmental parameters (e.g., low DO, change in salinity etc.)

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
INVERTEBRATES (Cont')			
60	[Moth] <i>Schranksia bilineata</i>	Ug to Pg	<p><u>Ecology and Distribution of <i>Schranksia bilineata</i></u> <i>S. bilineata</i> is known from seven localities throughout HK (including NW New Territories, Sai Kung Peninsula, Central New Territories, and HK Island), with no apparent habitat association. There are ten records to date, with Mai Po holding the largest population, based upon the number of individuals seen. This genus is not well known ecologically, and larvae of congeners (species of the same genus) are thought to live as detritivores in damp grasslands or reedbeds - this is possible for <i>S. bilineata</i> based on the sites known. The species meets "vulnerable" status on the IUCN Red List, based on restricted distribution and population size.</p> <p>A study on their use of habitat is needed to determine if and how, appropriate management action can be carried out at Mai Po for the species.</p>
61	[Moth] <i>Thalassodes maipoensis</i>	Ug to Pg	<p><u>Ecology and Distribution of <i>Thalassodes maipoensis</i></u> <i>T. maipoensis</i> appears to be a mangrove associate - now known with certainty from Mai Po and HK Wetland Park. Other species in the genus and allied genera are known to use woody plants (shrubs and trees) of quite a few families as larval hosts. Its distribution is restricted and therefore currently meets several IUCN Red List criteria for "endangered" status, including habitat loss / change (reduced areas of mangrove due to land use changes).</p> <p>A study on their use of habitat is needed to determine if and how, appropriate management action can be carried out at Mai Po for the species.</p>
62	[Damsselfly] Four-spot Midget <i>Mortonagrion hirosei</i>	Ug to Pg	<p><u>Ecology and Distribution of Four-spot Midget <i>Mortonagrion hirosei</i> in Mai Po Nature Reserve</u> Mai Po is one of only a few sites in Hong Kong where the globally-Vulnerable Four-spot Midget is recorded. Though the species has been recorded at various locations (including brackish water reedbed and intertidal mangroves) in the Reserve, its habitat requirements (e.g. vegetation types, water quality) are still relatively unknown.</p> <p>A baseline study to investigate the species distribution, population and habitat use in the Reserve is needed to determine appropriate habitat management action for long-term conservation of the species at Mai Po.</p>
		Pg	<p><u>Four-spot Midget <i>Mortonagrion hirosei</i> and Reed Management at Mai Po</u> Studies in Japan confirm reedbed to be an important habitat type for Four-spot Midget. Mai Po Nature Reserve contains extensive areas of reedbed yet the species preference of reedbed type (wet, dry, young, mature, etc.) is unclear. The impact of WWF's management work on reedbed areas is therefore unknown.</p> <p>A study on Four-spot Midget is needed to inform conservation management decisions for the species. Study activities include:</p> <ul style="list-style-type: none"> - surveying the distribution of the species in Mai Po reedbeds, and - investigating the impact of WWF's reed management work on the species.

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
INVERTEBRATES (Cont')			
69	[Benthic infauna]	Pg	<p><u>Benthic Infaunal Communities in Mai Po Ecosystem</u></p> <p>As benthic infauna serves as a main food source especially for wading birds on open mudflat and mangrove edge, it is important to obtain a better picture on the distribution and abundance of benthic infauna, including spatial and temporal patterns. In comparing present with past data, it would be possible to assess changes of the infaunal communities over time, which reflects the changes in carrying capacity of the intertidal mudflat especially in terms of the food sources to support the wintering bird populations.</p> <p>Study activities include:</p> <ul style="list-style-type: none"> - surveying the distribution and abundance (and biomass) of macro- and/or meio-infauna on mudflat, - determining sediment characteristics, - cataloguing species classification and preparing specimens for display and reference collection, - estimating the energy content of the infauna as food source of wading birds and the secondary production of the mudflat ecosystem, - correlating benthic distribution patterns with sediment characteristics, water quality parameters, feeding pattern of wading birds and/or the energy requirements for their food intake, and - identifying major benthic assemblages and assessing spatial and/or temporal changes.
FISH			
71	Fish	Ug to Pg	<p><u>Pelagic Fisheries in Deep Bay</u></p> <p>No detailed survey has been made in recent years of the species diversity, seasonal abundance and distribution of fish in Deep Bay. This data would not only be important for gaining a broader understanding of the food that piscivorous birds may be taking in the Bay, but would also serve as a baseline to assess future changes in the water/sediment quality status of Deep Bay.</p> <p>Study activities include:</p> <ul style="list-style-type: none"> - surveying the species diversity, abundance and distribution of fish in intertidal mangrove, <i>gei wai</i> and freshwater pond; and - literature-based survey to gather historical information and data.

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
MAMMALS			
72	Eurasian Otter (<i>Lutra lutra</i>)	Pg	<p><u>Distribution and Habitat Use of Eurasian Otter <i>Lutra lutra</i> in Deep Bay</u></p> <p>Eurasian Otter is listed as “Near Threatened” on the IUCN Redlist and in Hong Kong has only been recorded from the Deep Bay area. Recent infrared camera trap surveys (by AFCD) shed some light on their general distribution in Deep Bay, but information on population status and habitat use is urgently needed to aid local conservation efforts.</p> <p>A long-term study to determine relative abundance of the species with systematic network of infrared camera trap and investigate their habitat requirements is required.</p> <p>Note: Due to research similarities, this project could be combined with project No.73.</p>
73	Crab-eating Mongoose (<i>Herpestes urva</i>)	Pg	<p><u>Distribution and Habitat Use of Crab-eating Mongoose <i>Herpestes urva</i></u></p> <p>The presence of Crab-eating Mongoose in Mai Po and nearby wetlands is doubtful; the last record was in 2001. Recent AFCD infrared camera trap surveys show the species is only regularly recorded in Northeast parts of Hong Kong.</p> <p>A study to confirm their existence in or in proximity to Mai Po Nature Reserve and their habitat requirement is needed to inform whether habitat management action is required to assist conservation of the species.</p> <p>Note: Due to research similarities, this project could be combined with project No.72 or the Deep Bay area could be considered as part of the survey area.</p>
PLANTS			
83	Wigeon Grass (<i>Ruppia maritima</i>)	Ug to Pg	<p><u>Ecology and Distribution of Wigeon Grass <i>Ruppia maritima</i> at Mai Po</u></p> <p>Being one of the four species of seagrasses in Hong Kong, Wigeon Grass is only known from three locations in Hong Kong, including <i>gei wai</i> at Mai Po Nature Reserve. Since the discovery of the species at Mai Po in the early 1990s, no recent survey has been carried out to determine its presence and distribution at the Reserve. Also, little is known about its ecology and habitat requirements.</p> <p>A study to determine the grass’s current distribution and health status in the Reserve is essential to inform habitat management decisions to conserve the species.</p>

Priority Species/Group for the Deep Bay Wetlands (Cont')

Ref. No.	Species/Group	Level of Study	Topic and Required Study
HERPTOFAUNA			
85	Chinese Softshell Turtle (<i>Pelodiscus sinensis</i>)	Pg	<p><u>Ecology and Distribution of Chinese Softshell Turtle <i>Pelodiscus sinensis</i> in Deep Bay</u></p> <p>Chinese Softshell Turtle is listed as “Vulnerable” in both IUCN Redlist and the China Red Data Book. About a decade ago, the Deep Bay fishponds supported the only known natural breeding population in Hong Kong. In view of the change in fishpond management techniques in the past decade and the gradual loss of suitable habitat, the survival of the species is in doubt.</p> <p>A study to investigate the species distribution and abundance in Deep Bay is required to contribute to a long-term species conservation policy/action plan.</p>
93	Mangrove Water Snake (<i>Enhydris bennettii</i>)	Pg	<p><u>Ecology of Mangrove Water Snake <i>Enhydris bennettii</i> in Deep Bay</u></p> <p>In Hong Kong, Mangrove Water Snake has only been recorded from Deep Bay and two other locations. The Hong Kong population is estimated to be relatively larger than those in Fujian and Hainan and is therefore of local and regional importance. Intertidal mangrove, mudflat and <i>gei wai</i> are the main habitats used by the species. However, no detailed information is available on its present distribution and habitat requirements in Deep Bay.</p> <p>A study to investigate the distribution, abundance and habitat use of the species in Deep Bay is essential for developing a long-term conservation plan for the species.</p>

Priority Habitat Types for the Deep Bay Wetlands

Ref. No.	Habitat Type	Level of Study	Topic and Required Study
01	Inter-tidal mudflat	Ug to Pg	<p><u>Temporal and Spatial Changes in the Deep Bay Inter-tidal Mudflat</u></p> <p>The inter-tidal mudflat is one of the most biologically diverse habitats in Deep Bay and vitally important to the large numbers of migratory waterbirds. The area of open inter-tidal mudflat is changing rapidly due to encroachment of mangrove, silt accretion and land reclamation (on the Shenzhen side of the Bay). Whilst former areas of mudflat are being lost and some new areas developing, the rate, extent and predicted scenarios of change have not been assessed.</p> <p>A desktop study is required to quantify the changes in the area of intertidal mudflat through comparing historical and recent aerial photos and satellite images.</p>
02	Mangroves	Pg	<p><u>Health of the Mangrove at Mai Po</u></p> <p>Mangrove is one of the key wetland habitat types in Deep Bay with six naturally growing mangrove plant species (<i>Bruguiera gymnorrhiza</i>, <i>Excoecaria agallocha</i>, <i>Kandelia obovata</i>, <i>Aegiceras corniculatum</i>, <i>Avicennia marina</i> and <i>Acanthus ilicifolius</i>). The distribution and area of mangrove are being monitored by AFCD and through a Ph.D. project but the health status of the mangrove trees is not surveyed.</p> <p>A study to assess the health status of mangrove at Mai Po is essential to inform management decisions and to aid formulation of an effective management strategy.</p>
03	<i>Gei wai</i>	Ug to Pg	<p><u>Aquatic and Benthic Faunal Communities in <i>gei wai</i></u></p> <p>In view of the implementation of different management regimes in <i>gei wai</i> within the Mai Po Nature Reserve, it is important to assess the effectiveness of such management regimes so that future actions are well informed.</p> <p>Study activities include:</p> <ul style="list-style-type: none"> - surveying the distribution and abundance of aquatic and benthic fauna in <i>gei wai</i>, - determining environmental characteristics of <i>gei wai</i> (e.g., water quality and sediment parameters), - correlating faunal diversity and/or community structure with environmental characteristics and management practices of <i>gei wai</i>.

Priority Habitat Types for the Deep Bay Wetlands (Cont')

Ref. No.	Habitat Type	Level of Study	Topic and Required Study
03	<i>Gei wai</i> (Cont')	Pg	<p><u>Gei wai Shrimp at Mai Po Nature Reserve</u></p> <p><i>Gei wai</i> shrimp have been cultivated and harvested from the Mai Po tidal ponds for over half a century. Although the shrimp at Mai Po are no longer produced for commercial sale, traditional management techniques are still practiced on several <i>gei wai</i> to rear shrimp as an example of wise-use and for cultural preservation reasons. When the <i>gei wai</i> are drained, the shrimp become valuable prey for waterbirds. These management techniques are mainly based on traditional wisdom and experience which is yet to be supported by scientific field study.</p> <p>A field-based study to investigate the process of <i>gei wai</i> shrimp rearing at Mai Po is required so that management action optimises the benefits to waterbirds. Study activities include:</p> <ul style="list-style-type: none"> - investigating the ecology of different <i>gei wai</i> shrimp species; - investigating seasonal changes in the diversity and abundance of shrimp species in the Bay (i.e. intertidal mangrove) and in <i>gei wai</i>; - investigating the ecological processes upon which traditional <i>gei wai</i> shrimp rearing management techniques are based; and - studying physical (e.g. water and sediment quality, temperature) and biological (e.g. predatory fish, algal bloom) factors which might affect the production of <i>gei wai</i> shrimp.
05	Reedbeds	Pg	<p><u>Distribution and Health of Reedbeds at Mai Po Nature Reserve</u></p> <p>Reedbed (stands of <i>Phragmites australis</i>) support high fauna diversity. In Mai Po Nature Reserve there is currently ~46ha of reedbed, most of which (~70%) established within the last 30 years. There is concern that the older mature reedbeds are now losing their wildlife value as they become colonised by terrestrial vegetation.</p> <p>A detailed study is required on the distribution, area and health of reedbed areas within the Reserve. Such a study would contribute to the formulation of a long-term strategy to manage reedbeds.</p>

Significant Threats to the Biodiversity of the Deep Bay Wetlands

Ref. No.	Threat	Level of Study	Topic and Required Study
01	Water and sediment quality	Ug to Pg	<p><u>Water and Sediment Quality of Freshwater Ponds and <i>Gei Wai</i> in Mai Po Nature Reserve</u></p> <p>Extensive water and sediment monitoring in outer Deep Bay and inter-tidal mudflat areas is carried out by HKSAR government departments - this includes two Mai Po <i>gei wai</i>. For the remaining <i>gei wai</i> and freshwater ponds within the Mai Po Nature Reserve similar monitoring is required to assess water and sediment parameters to provide a more comprehensive understanding of the situation and potential impact to wildlife. As a minimum, data from a 12-month cycle is needed to form a baseline for future reference.</p> <p>Study activities include:</p> <ul style="list-style-type: none"> - surveying the water and sediment quality of freshwater ponds and <i>gei wai</i> in MPNR in different seasons; - investigating if WWF management regime have any impact on the water and sediment quality; and - comparing data between years to determine the possible factors affecting water and sediment quality.
02	Siltation	Pg	<p><u>Siltation in the Deep Bay Wetlands</u></p> <p>Siltation is a significant threat to the biodiversity of the Deep Bay wetlands. Recent data suggests siltation rates are increasing and thus likely to accelerate drying out of inter-tidal wetland habitats. It is hypothesised that changing hydrodynamics within the Bay and increased sediment loads from the Pearl River Delta and Shenzhen River are responsible.</p> <p>A study to understand the source and process of siltation, and its impact upon priority habitats and species is essential to predict changes to the Deep Bay wetland habitats.</p>
03	Alien/invasive/destructive spp. – <i>Sonneratia</i>	Pg	<p><u>Impact of the Exotic Mangrove <i>Sonneratia</i> on Native Species</u></p> <p>Two species of exotic mangrove genus <i>Sonneratia</i> were first recorded in Deep Bay in 2000. Both species are fast growing and can readily colonise outer shore areas of the mudflat, hence AFCD carries out a programme of removal works to minimise the potential impacts of the two species on native mangrove. Most years AFCD surveys the distribution of the two species and after carrying out field-based control trials, produced a management strategy in 2006. However, little is know about the impact of <i>Sonneratia</i> on native species.</p> <p>A study to investigate the impacts of <i>Sonneratia</i> on native species is essential to produce a management strategy. Study activities include:</p> <ul style="list-style-type: none"> - studying the process of competition between <i>Sonneratia</i> and native mangrove plants; - determining the impact of <i>Sonneratia</i> on mangrove associated fauna; and - predicting the long-term ecological impact of <i>Sonneratia</i> colonisation on the intertidal mudflat and mangrove areas in Deep Bay.

Significant Threats to the Biodiversity of the Deep Bay Wetlands (Cont')

Ref. No.	Threat	Level of Study	Topic and Required Study
04	Alien/invasive/destructive spp. – Invasive climbers	Pg	<p><u>Ecology of Invasive Climbers and their Impact to Wildlife</u> Several species of climber (both native and alien) found at Mai Po are particularly invasive; <i>Mikania micrantha</i>, <i>Derris</i> spp., <i>Paederia scandens</i> and <i>Gymnanthera oblonga</i>. They are known to compete heavily with other flora on bund areas and reduce the health of shrubs such as mangrove in intertidal areas. Reserve staff annually clear climbers from accessible areas using manual methods.</p> <p>A study on the distribution and ecological impact of these invasive climbers to other wildlife is required to aid formulation of a long-term management strategy. Study activities include:</p> <ul style="list-style-type: none"> - determining the ecology of different invasive climber species at Mai Po; - monitoring the distribution of invasive climbers at Mai Po; - surveying the ecological impact of invasive climbers upon key habitat types; and - investigating possible control methods to manage invasive climbers in the Reserve.
05	Alien/invasive/destructive spp. – Red Fire Ant <i>Solenopsis invicta</i>	Ug to Pg	<p><u>Impact of Red Fire Ant <i>Solenopsis invicta</i> on Native Species</u> Red Fire Ant was first reported in Hong Kong in 2005. So far the impact of this aggressive ant species upon Hong Kong native wildlife is unknown. Within Mai Po Nature Reserve, the species is found on earth bunds and islands in <i>gei wai</i>/freshwater ponds. Insecticide is applied regularly to lairs, which has a controlling effect, not eradication.</p> <p>A study to investigate the possible impacts of Red Fire Ant on native wildlife at Mai Po and to identify the appropriate techniques to eradicate the species from Mai Po is required. This would have implications for other conservation managed wetlands in Hong Kong.</p>
06	Alien/invasive/destructive spp. – <i>Dimorphopterus spinolae</i>	Pg	<p><u>Impact of the Insect <i>Dimorphopterus spinolae</i> on Mai Po Reedbeds</u> <i>Dimorphopterus spinolae</i> is a common insect pest on grass species of the Poaceae family. In 2007, the species caused serious die-off within a newly established reedbed in Yuen Long. The species was also recorded in mature reedbed at Mai Po (source AFCD). However, little is known about the species ecology or preference of reedbed types.</p> <p>A detailed study on the species distribution at Mai Po and impact to stands of reed in Deep Bay is required. Study activities include:</p> <ul style="list-style-type: none"> - surveying the distribution and abundance of the species in the Mai Po reedbed areas; - investigating the ecology of the species in reedbeds; - investigating the potential threat of the species to reedbeds in Deep Bay; and - investigating management techniques to control or eradicate the species from reedbeds.

Significant Threats to the Biodiversity of the Deep Bay Wetlands (Cont')

Ref. No.	Threat	Level of Study	Topic and Required Study
07	Climate change - Long-term effects to flora/fauna	Pg	<p data-bbox="721 256 1346 284"><u>Impact of Climate Change on Deep Bay Wetlands</u></p> <p data-bbox="721 288 2085 376">The potential impact of climate change upon the world's ecosystem continues to be of great concern to many conservationists. Climate change will affect wetlands in and around Mai Po, the extent and magnitude of which is uncertain.</p> <p data-bbox="721 411 2085 499">A study to forecast potential impacts of climate change on Mai Po and Deep Bay under present predicted scenarios of sea level rise and other impacts from climate change is needed to inform how the Reserve should respond i.e. introduce mitigate measures.</p>