

HONG KONG

INTRODUCTION

by David S. Melville

Area: 1,067 sq.km.

Population: 5,583,000.

Hong Kong is situated at approximately 22°20' North and 114°10' East, on the southeast coast of China. It comprises two main islands (Hong Kong and Lantau), over 200 smaller islands and an area of mainland (Kowloon and the New Territories). Hong Kong is mountainous with deeply incised submerged coastal features. Approximately 80% of the Territory is over 100 metres above sea level. Urban development and agriculture are concentrated in the lowlands and extensive coastal reclamations have been carried out to provide land for development (c.3,250 ha by 1985). Hong Kong's climate is subtropical with marked seasonality. The summer is typically hot and humid with the heaviest rainfall between April and September. The winters are mild and relatively dry. The average total annual rainfall is 2,224.7 mm. The mean daily minimum temperature is 13.2°C (January) and the maximum 31.6°C (July). Hong Kong lies on the boundary of the Palearctic and Indomalayan biogeographical regions.

Summary of Wetland Situation

Hong Kong was formerly covered by an oak-laurel forest (*Fagaceae/Lauraceae*). Small areas of freshwater marshland would have been present in poorly drained valley bottoms and much of the sheltered coasts would have been backed by mangroves. It seems likely that the first human settlers arrived in Hong Kong in about 4,000 B.C. These people would have been hunter-gatherers, living mostly along the sheltered coasts. Although rice cultivation is known to have started in China about 5,000 B.C. the timing of its arrival in Hong Kong is uncertain. It is likely that lowland paddy was grown first with subsequent terracing of hillsides.

Reclamation of the marshlands began with the early human settlers taking areas for paddy, salt pans and (probably more recently) gei wais (shallow shrimp ponds). Land tax records suggest that reclamation first took place around Yuen Long (on the shore of Deep Bay) some one thousand years ago. Since the Man clan settled at San Tin (New Field) in 1279, over 400 ha have been reclaimed for paddy. The first large-scale reclamation project in Deep Bay was at Ping Shan where over 325 ha of paddy land were won in the early 1920s. Following the success of this project, further reclamation was started north of Yuen Long. In the early 1940s, over 200 ha of mangrove to the west of Mai Po village were impounded for shrimp farming. Similar reclamations, but probably on a smaller scale, took place in other sheltered areas, around Tolo Harbour and Starling Inlet for example.

The spread of paddy farming must have resulted in an increase in the amount of freshwater habitat in Hong Kong even if reclamation of coastal marshes reduced intertidal habitat diversity. However, the reclamation of coastal swamps may have been in part beneficial by

providing suitable high tide roost sites for those shorebirds, e.g. *Charadrius spp*, which are unable to perch in mangroves.

In the days before the use of pesticides became widespread, paddies would have provided suitable breeding grounds for various frogs, dragonflies etc., and were used extensively by migrant water birds. Thus the spread of paddy cultivation could have been beneficial overall. In 1954, when the first comprehensive survey of agriculture in Hong Kong was undertaken, there were 9,450 ha of paddy (70.3% of the total area under cultivation). By 1969, this had been reduced to 5,870 ha (43.3%); in 1980 there were only 10 ha, and in 1986 none. The initial decline of paddy came about as a result of a change of farming practices with refugees arriving in Hong Kong bringing skills in market gardening, there also being a need to meet the requirements for fresh vegetables from a rapidly expanding human population. Hill paddy was abandoned when remote villages were deserted as people moved to the urban areas. Due to lack of maintenance, feeder channels became broken and the former paddies, now dry, are reverting to grassland and scrub.

In the early 1970s, many remaining lowland wetlands and paddy areas were dug up for freshwater fish ponds, such ponds being highly productive for carp (Cyprinidae) and mullet (*Mugil cephalus*) but of virtually no value to wildlife due to the lack of vegetation and steep banks. More recently, the value of freshwater fish production has dropped due to cheap imports from China and Taiwan. In 1986, local ponds produced 5,710 tonnes, or only 12% of the local consumption of freshwater fish. Many ponds around Deep Bay have now been filled in for urban development. Small areas are used for breeding freshwater aquarium fish; in 1986 domestic exports of such fish were valued at over HK65 million.

The intertidal flats of Deep Bay are used for the culture of the oyster *Crassostrea gigas*.

In 1983, estimates of the harvest varied between 60 tonnes valued at HK1.89 million, and 235 tonnes valued at HK7.38 million, the lower figure being the Hong Kong Government estimates, the higher figure that of the local fishermen. The situation is complicated as oysters are frequently brought to Deep Bay from China for fattening for up to one year before being sold in Hong Kong and this may account for some of the discrepancy. The wholesale price of shrimps, *Metapenaeus ensis*, from the Mai Po gei wais varied between about HK40 and HK150 per 600 gm during 1986. Production of the gei wais varies considerably depending largely on water quality; it is estimated that an "average" gei wai of nine hectares could yield shrimps of value HK100,000 per annum.

In 1986, of the Territory's 1,070 sq.km, there were 21 sq.km of fish ponds and one sq.km of coastal brackish swamp and mangrove, both mostly around Deep Bay. The largest remaining wetland was the Mai Po Marshes (a little over 300 ha) and the associated tidal flats of Deep Bay. Freshwater marshland has all but disappeared with only a few lotus *Nelumbo nucifera* fields, and "red worm" culture ponds (for *Chironomus spp* and *Tubificidae* to provide food for aquarium fish) remaining.

Hong Kong's running water habitats comprise the remnants of diverse and fascinating environments which once could have supported a rich array of organisms. This statement is reflected in the disappearance of the White Cloud Mountain Minnow *Tanichthys albonubes*

from the Territory, as well as the caddisfly genera *Dipseudopsis* and *Ascalophomerus* which were previously recorded in Hong Kong. Further declines in species diversity are associated with the degradation of habitat quality in the middle and lower courses of Hong Kong rivers, the lower reaches of which are heavily polluted and are often dominated by water hyacinth *Eichhornia crassipes*.

There are some twenty freshwater reservoirs, two of which have been created by blocking off arms of the sea and pumping out the sea water. The reservoirs have a total area of 2,375 ha, and range from a few hectares to Plover Cove which is the largest at 1,215 ha. Some of the smaller reservoirs are now disused and with no draw down have emergent aquatic vegetation and are of some value as wildlife habitat. The larger reservoirs, e.g. Plover Cove and High Island, have a great draw down, no aquatic macrophytes, and offer very little attraction to waterfowl but have benefitted certain invertebrates by providing a lentic habitat (lake) not formerly occurring in Hong Kong. The reservoirs are fed through an extensive network of tunnels, pipes and channels linking the various catchment areas, including pipes from the People's Republic of China, and this has allowed the spread of several molluscs, e.g. *Limnoperna fortunei*, between reservoirs.

Further reclamation of wetland areas for development is certain. For example 488 ha of former fishpond will be taken for the "Mighty City" development at Tin Shui Wai.

Hong Kong's coastal waters are heavily polluted, this being especially severe in Tolo Harbour and Deep Bay where eutrophication due to human sewage and the waste from domestic animals especially pigs and chickens is becoming critical. The Hong Kong Government intends to phase out livestock rearing in certain critical catchment areas and this should lead to improved water quality. There has been very little monitoring of trace elements, pesticides, PCBs and other contaminants in wetlands and their fauna, but with increasing industrialization taking place for example on both shores of Deep Bay, the situation is likely to deteriorate. Oil pollution is not severe in coastal wetlands at present, but the development of oil storage facilities at Shekou on the southwestern shore of Deep Bay (in the People's Republic of China) could cause problems in the future.

Watercourse entrainment programmes for the Shenzhen River and Yuen Long Creek, both of which flow into Deep Bay, could have considerable impacts on the hydrology of the Bay. Investigations of the southern Chinese freshwater fauna are too fragmentary to allow assessment of the uniqueness of the Hong Kong element, and those species which have been described locally, e.g. caddis-fly *Melanotrichia serica*, may be widespread in Guangdong Province. It is likely that this is also the case with several locally described marine Tubificidae (e.g. *Ryacodrilus lutulentus* and *Doliodrillus tener*) and possibly the Grapsid crab *Chiromanthes maipoensis*. However, hillstream species such as the fishes *Liniparhomaloptera dispar*, *Pseudogastromyzon myersi* (Homalopteridae), the cascade frog *Amolops hongkongensis*, the newt *Paramesotriton hongkongensis*, as well as the lowland tree frog *Philautus romeri* are, to date, known from no other region.

Of the approximately 134 species of waterbirds recorded from Hong Kong, the following are considered to be endangered, threatened or with limited distributions which are poorly known:

Pelecanus crispus, *Egretta eulophotes*, *Ciconia (ciconia) boyciana*, *Platalea minor*, *Limnodromus semipalmatus*, *Tringa guttifer*, *Eurynorhynchus pygmaeus* and *Larus saundersi*. In recent years, up to about 35 *Pelecanus crispus* have wintered in Deep Bay, i.e. about 1% of the world population (Crivelli & Vizi, 1981). Deep Bay also holds one of the largest known wintering populations of *Larus saundersi* in the world (Melville, 1984a); about 50 to 60 birds.

Mid-January waterfowl counts have been conducted annually in the Deep Bay area since 1979.

The maximum figures are as follows:

Cormorants 1,445

Hérons, egrets, storks, ibises, spoonbills 3,958

Ducks 11,248

Rails, coots, moorhens 2,481

Shorebirds 7,745

Gulls, terns 18,956

Total - all groups	12,830 in 1979
	38,770 in 1986
	37,800 in 1987
	38,900 in 1988

The reason or reasons for the increase in numbers of birds wintering in Deep Bay are unknown, but may be related to destruction of wetlands in adjacent areas of China (Melville, 1984b & in press).

Wetland Research

Relatively little research has been conducted on wetlands in Hong Kong. Most research by the Hong Kong Government and the two local universities has concentrated on marine systems and organisms, but some work has been done on mangroves (e.g. Hu, 1974; Thrower & Cheng, 1975; Soh, 1978; Cheng & Hill, 1982; Yipp, 1982; Li & Gao, 1985; Wells, 1985; Hodgkiss, 1986). Information on coastal wetlands is summarized by Morton & Morton (1983) and problems of coastal conservation by Morton (1979).

Freshwater systems have also received attention (e.g. Lai, 1972; Lai & Ng, 1972; Morton, 1977a & 1977b; Hodgkiss, 1978; Romer, 1978 & 1979; Brandt, 1980; Hodgkiss, 1980; Hodgkiss *et al.*, 1981; Man & Hodgkiss, 1981; Dudgeon, 1982a, 1982b, 1982c & 1983; Griffiths, 1983; Morton, 1983; Dudgeon & Yipp, 1985; Morton, 1985; Karsen *et al.*, 1986).

The avifauna of Hong Kong is comparatively well known and the status of all species has been summarised by Chalmers (1986), but little quantitative information is available (Melville, 1980a; Chalmers, 1984). A small amount of shorebird ringing has been carried out (Melville, 1981a & 1981b; Xu & Purchase, 1983). Very little is known of the breeding habits of local waterbirds (Murton, 1972).

Wetland Area Legislation

There is no legislation relating specifically to wetland conservation although land use and effluent discharges are covered under relevant legislation.

The Country Parks Ordinance 1976 and associated Regulations allow for the establishment and management of Country Parks, but of the approximately 413 sq.km so designated, most is upland. The Forests and Countryside Ordinance covers the general protection of vegetation and prohibits the destruction of mangrove.

The first wildlife legislation was 'An Ordinance for the Preservation of Birds' enacted in 1870, but this excluded "woodcocks, snipes, ... wild ducks, teals, widgeons ...". The Ordinance was replaced by "The Preservation of Wild Birds and Game Ordinance" in 1885, wherein "woodcock, snipe, ... wild-duck, and widgeon" were listed as game. As such they could only be hunted under licence (such licences being issued for a period not exceeding ten years). In subsequent years, the legislation was revised and expanded, e.g. in 1936, the otter *Lutra lutra* was protected.

"The Wild Birds and Wild Mammals Protection Ordinance 1954" allowed the shooting (under licence) of "Snipe including Painted Snipe, Woodcock, Grey Plover, Golden Plover, Teal, Wild Duck, Wild Goose ...", from the first of September to the first of April inclusive. "The Wild Animals Protection Ordinance" of 1978 greatly restricted the areas where shooting was allowed and in 1981 was amended so that all hunting of wild birds became totally prohibited throughout the Territory. All Chelonians have been protected since 1978 but at present no Amphibians are protected although three species are endemic (Karsen *et al.*, 1986). All Cetaceans have been protected since 1978, and some since 1976; the Chinese White Dolphin *Sotalia (Sousa) chinensis* occurs in Deep Bay.

The Hong Kong Government established a register of Sites of Special Scientific Interest (SSSI) in 1975. Listing of an area as an SSSI does not confer any legal protection but does mean that its value should be considered in the Government planning process; nonetheless a number of developments have taken place regardless, and some sites have been lost or damaged.

The United Kingdom extended its ratification of the Ramsar Convention to Hong Kong on 10 September 1979. No wetlands have been listed, although the Deep Bay/Mai Po area qualifies. The Hong Kong Government has not taken any special steps to conserve wetlands or promote wetland research since becoming a party to the Ramsar Convention. However, as noted below, prior to becoming a party to the Convention, steps had been taken to give legal protection to the Mai Po Marshes and to warden the area.

Hong Kong, through the United Kingdom, is also a party to the Bonn Convention on the Conservation of Migratory Species of Wild Animals and to the Convention on International Trade in Endangered Species (CITES), both of which list several wetland birds which occur in Hong Kong. No action has been taken with regard to the Bonn Convention but there is strict enforcement of trade controls under CITES. The former extensive trade in cranes (*Grus* spp) (Melville, 1980b) seems to have been stopped, and the only wetland species listed under CITES which is known to have been traded illegally within the past two years is *Numenius minutus* (one frozen carcass) (Anon, 1986).

Wetland Area Administration

The first "restricted access" area designated under the then Wild Birds and Wild Mammals Protection Ordinance was the egretty at Yim Tso Ha (in 1970). Entry into the nesting wood was prohibited during the breeding season, though the surrounding wetlands were not protected. Entry is currently restricted (in practice prohibited) between 1st April and 30th September each year, and the Agriculture and Fisheries Department has a Nature Warden on duty there during the daytime.

The Mai Po Marshes were declared a no hunting area in 1973 and entry was restricted to residents and permit holders in 1975. The actions of the Hong Kong Government have been limited to enforcement of the provisions of the relevant wildlife legislation and enforcement of Crown Land Licence conditions, apart from some tree planting in recent years. No active management for conservation purposes was carried out until WWF-HK initiated its Mai Po project in 1983. The aims of the project are to manage the Mai Po Marshes so as to maintain and if possible increase the diversity of native wildlife in the area, and to promote the use of the area for educational purposes both by school pupils and the general public. This includes the provision of special facilities for the disabled (Anon, 1987).

At the present time, WWF-HK has control over about 70 ha of the Mai Po Marshes and is able to manage the area for the benefit of wildlife. Management of the reserve is under the control of the Mai Po Marshes Management and Development Committee of WWF-HK, and representatives of the relevant Government Departments sit on this Committee.

The only other wetlands under direct management are Hong Kong's reservoirs, which are controlled by the Water Supplies Department. Large portions of the catchments of these reservoirs are within the Country Parks.

Organizations involved with Wetlands

a) Hong Kong Government

- Agriculture and Fisheries Department

Responsible for the administration of the Wild Animals Protection Ordinance, Country Parks Ordinance, and Forests and Countryside Ordinance. The contact Department for the Ramsar, Bonn and CITES conventions, although international conventions are handled through the Government Secretariat.

b) Non-governmental Organizations

- World Wide Fund for Nature Hong Kong Has established and now manages the Mai Po Marshes Wildlife Education Centre and Nature Reserve.

- Department of Zoology, University of Hong Kong

Four post-graduate students currently undertaking research at Mai Po.

- Biology Department, The Chinese University of Hong Kong

Has conducted a shrimp culture project at Mai Po.

- Hong Kong Bird Watching Society

Conducts mid-winter waterfowl counts and acts as repository for all bird records for the Territory. Publishes annual "Hong Kong Bird Report" and occasional checklists (latest 1986).

- Hong Kong Natural History Society
Collects information on natural history other than birds. Publishes occasional "Memoirs".
- Marine Biology Association of Hong Kong
Promotes marine biological research and publishes "Asian Marine Biology".

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WETLANDS

Site descriptions compiled by David S. Melville.

Wetland name: Mai Po Marshes and Inner Deep Bay

Country: Hong Kong

Coordinates: 22°30'N, 114°00'E;

Location: in the northwest of the New Territories, on the border with the People's Republic of China.

Area: Mai Po Marshes 300 ha; Deep Bay 11,500 ha.

Altitude: Sea level.

Biogeographical Province: 4.6.1.

Wetland type: 02, 06, 07 & 10.

Description of site: A large shallow estuary with extensive intertidal mudflats, fringed with dwarf mangrove and backed by shallow shrimp ponds and deeper fish ponds. The hinterland becomes increasingly industrialized. An estuarine system, with salinities ranging from 2.5 to 30 p.p.t. The water depth in Deep Bay averages three metres, with a maximum of six metres at high tide; the maximum tidal range is approximately 2.8 metres. The maximum depth of water in Mai Po Marshes is two metres.

Climatic conditions: Subtropical, with hot and humid summers and mild, relatively dry, winters. The average annual rainfall is 2,225 mm, most falling between April and September. The mean daily minimum temperature is 13.2°C (January), and the mean daily maximum 31.6°C (July).

Principal vegetation: Dwarf mangrove forest with *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Kandelia candel*, *Avicennia marina*, *Excoecaria agallocha*, *Bruguiera gymnorhiza* and associated *Derris trifoliata*. There is a small area of *Halophila becarii* on the mudflats, and there are extensive reed-beds of *Phragmites communis/australis* in the shrimp ponds (gei wais). *Acrostichum aureum* and *Clerodendrum inerme* grow on the banks of the ponds.

Land tenure: Deep Bay and the marshes are Crown (Government) Land. Adjacent areas are under Crown (Government) and private ownership.

Conservation measures taken: Mai Po Marshes were declared a "No Hunting Area" in 1973, and access was restricted in 1975 to residents and permit holders. Mai Po Marshes were declared a Site of Special Scientific Interest in 1976, and the whole of Inner Deep Bay was declared an SSSI in 1986. WWF Hong Kong has recently established the Mai Po Marshes Wildlife Education Centre and Nature Reserve.

Conservation measures proposed: Existing proposals include the acquisition of additional land by WWF Hong Kong to obtain all of the remaining marsh, and the establishment of a residential centre. WWF Hong Kong has recently proposed to the Government of Hong Kong that Inner Deep Bay and Mai Po Marshes be included in the Ramsar Convention List of Wetlands of International Importance.

Land use: Fishing for shrimps (*Metapenaeus ensis*) in the gei wais, and some fin fishing (for *Sarotherodon*, *Mugil*, *Liza*); the harvesting of oysters (*Crassostrea gigas*) and some fishing for *Lateolabrax japonicus* and Mugil fry in Deep Bay. Urban development, market gardening, fish ponds (with Cyprinidae and *Mugil* spp), and livestock raising in adjacent areas.

Possible changes in land use: Some gei wais have been converted to fish ponds but land use legislation and current market trends make it unlikely that further areas will be alienated. In former times, areas of mangrove have been impounded illegally, but this is no longer a serious threat. The Hong Kong Government proposes to phase out livestock farming in the northwest New Territories, and this should lead to improved water quality. The in-filling of Tin Shui Wai, creation of a refuse tip at Nim Wan, creation of PFA dump lagoons, expansion of the Yeun Long industrial estate, and expansion of Shenzhen City are all likely to have an impact on the wetland in the future.

Disturbances and threats: Increasing urban development and associated "flood control" programmes are likely to lead to changed water movement patterns and increased pollution, but agricultural waste input should decrease. Although the human population is expected to increase by 138% between 1984 and 2000, pollution loadings from domestic sewage are expected to increase by only 25%, as a result of improved sewage treatment. A 65 million ton capacity rubbish dump is planned for the edge of Deep Bay, principally to take domestic waste, although it is expected to take hazardous waste in the future. "Training" of the Shenzhen River, Yuen Long Creek and Tai Shang Wai Creek is likely to affect the hydrology of the wetland. The Chinese authorities plan to dredge and straighten the Shenzhen River to assist in flood control and to improve navigability. This is likely to have an adverse effect on the water quality of Deep Bay, as industrial and agricultural wastes that have settled on the river bed would be stirred up and flushed into the Bay.

In May 1987, the Chinese announced plans to build an airport on reclaimed land on the north shore of Deep Bay. The construction of the airport would have destroyed about 23% of the tidal mudflats, and the runway would have come within seven km of Mai Po Marshes. However, in early 1988, the Chinese Government announced that an alternative site for the airport had been chosen in Bo An County, some distance to the northwest of Deep Bay on the edge of the Pearl River.

Economic and social values: Each gei wai (shrimp pond) of about nine hectares gives a return of about HK100,000 per annum. Prices of live *Metapenaeus ensis* vary from HK40 to HK150 per 600 gm. The value of the fish catch is unknown but in recent years fish prices have dropped as a result of cheap imports from the People's Republic of China. The value of the Deep Bay oyster fishery was variously determined at HK1.8 million to HK 7.3 million in 1983. The WWF Hong Kong Education Centre and Reserve was visited by over 22,000 people in 1987.

Faunas Mai Pa Marshes and Inner Deep Bay are particularly important for the large numbers and great diversity of waterfowl which occur there as winter visitors and passage migrants, although a number of species also breed in appreciable numbers. Several threatened species of waterfowl occur in significant numbers. There is a regular wintering population of the Dalmatian Pelican *Pelecanus crispus*, which has been gradually declining in recent years from a maximum of 84 in 1971 to only 33 in 1987. The Chinese Egret *Egretta eulophotes* is a spring migrant in small numbers, and up to 30 Black-faced Spoonbills *Platalea minor* have been recorded during winter. The Asian Dowitcher *Limnodromus semipalmatus* is a regular migrant in fairly large numbers, with a maximum in recent years of over 340. Two other rare shorebirds, Nordmann's Greenshank *Tringa guttifer* and Spoon-billed Sandpiper *Eurynorhynchus pygmeus*, are regular spring migrants in small numbers. Up to 27 *T. guttifer* and five *E. pygmeus* have been recorded at one time, and many more individuals are thought to use the area. For example, during the spring migration of 1987, at least 33 *T. guttifer* and 16 *E. pygmeus* were recorded at Mai P0. Deep Bay is particularly important for the rare Saunders'

Gull *Larus saundersi*, as it supports one of the largest wintering populations hitherto discovered (up to 50 or 60 individuals each winter).

Mid-winter waterfowl counts in recent years have revealed up to 1,445 *Phalacrocorax carbo*, 3,950 herons and egrets, 11,250 ducks, 2,480 rails, coots and moorhens, 7,745 shorebirds, and almost 20,000 gulls and terns. Furthermore, the total number of birds wintering in the area has increased dramatically during recent years from about 13,000 birds in 1979 to around 38,000 in 1986 and 1987. The Bay and marshes are also very important as a staging area for migratory shorebirds, particularly during the spring migration, when over 10,000 individuals of thirty-five species may be present at one time. In April 1987, the concentrations of roosting shorebirds on the main scrape at Mai Po Marshes reached a maximum of 7,000 birds, and included no less than 43 species.

Other notable fauna includes the Small Indian Civet *Viverricula indica* (resident in small numbers), Common Otter *Lutra lutra* (one present in the winter of 1985/86 after an absence of about 30 years), and Chinese White Dolphin *Sotalia (Sousa) chinensis* (in Deep Bay). There is an interesting population of the House Shrew *Suncus murinus* at Mai Po not associated with human dwellings. The varied snake fauna includes *Enhydryis bennetti* which is restricted to south and southeast China. Several Testudinata (*Chinemys reevesi*, *Cuora trifasciata* and *Trionyx sinensis*) have been recorded at Mai Po, but it is likely that most of these have been released from captivity. Deep Bay is the type locality for the crab *Chiromanthes maipoensis* and the tubificid worm *Rhyacodrilus lutulentus*.

A variety of commercially important fish species occur, but no rare or unusual species have been recorded.

Special floral values: The wetland supports the largest remaining mangrove area in Hong Kong, albeit a truncated community, the landward series being converted to shrimp and fish ponds. Deep Bay is the only known locality for *Halophila beccarii* in Hong Kong.

Research and facilities: Most of the research carried out to date has been cataloguing the flora and fauna. There has been a limited amount of bird ringing since 1966, and annual mid-winter waterfowl censuses have been made since 1979. Melville *et al.* (in press) have recently summarized some aspects of the management of Mai Po Marshes. Students from Hong Kong University are currently working on nutrient cycling in a traditional gei wai, the shrimps in a gei wai, fiddler crabs and mudskippers. The WWF Hong Kong Education Centre was opened in October 1986, and provides simple laboratory facilities.

References: Anon (1987); Agriculture and Fisheries Department (1975); Chalmers (1986); Hodgkiss & Morton (1978a); Irving & Morton (1988); Melville (1987); Melville *et al.* (in press); Melville & Morton (1983); Soh (1978).

Criteria for inclusion: 123.

Source: David S. Melville.

Wetland name: Yim Tso ha, Starling Inlet and A Chau Island

Country: Hong Kong

Coordinates: 22 °35'N, 114 °11'E;

Location: in the northeast of the New Territories, on the border with the People's Republic of China.

Area: 5.4 ha.

Altitude: Sea level.

Biogeographical Province: 4.6.1.

Wetland type: 01, 03, 06, 07 & 08.

Description of site: A shallow inlet of the sea off Mirs Bay, with a small wooded island, intertidal mud and sand flats, a narrow shoreline of pebbles, and a narrow belt of mangroves. The water is up to two metres deep, and the maximum tidal range is approximately 1.3 metres.

Climatic conditions: Subtropical, with hot and humid summers and mild, relatively dry, winters. The average annual rainfall is 2,225 mm, most of which falls between April and September. The mean daily minimum temperature is 13.2°C (January), and the mean daily maximum 31.6°C (July).

Principal vegetation: Some coastal mangroves. There is a well mixed "fung shui" wood at Yim Tso ha village which is used as a nesting site for herons and egrets, and also some woodland on A Chau Island.

Land tenure: The wetland and surrounding areas are Crown (Government) Land.

Conservation measures taken: Yim Tso ha wood is protected; access has been restricted during the breeding season (April to September) since 1971, and the site has been patrolled by a Nature Warden since 1967. Both Yim Tso ha wood and A Chau Island are listed as Sites of Special Scientific Interest (1975 and 1985 respectively). A Chau Island is within the Frontier Closed Area (access restricted by the police).

Land use: Occasional fishing and the collection of shellfish. Former paddy areas nearby have been abandoned or are now used for market gardening. Former gei wais (shrimp ponds) at Nam Chong have been abandoned or converted to fishponds.

Disturbances and threats: A proposal was made in 1979 to widen and realign the road along the coast. The proposal was eventually shelved, but in recent years it has again come up for review. The original plan would have involved considerable destruction of foreshore and both egret-nesting sites. Details of the current plan were still being awaited at the end of 1987. A cottage industry, which involved burning the insulation off old electrical appliances to reclaim the copper, and then washing this out on the shore beside Yim Tso ha, was stopped in the late 1970s. Nestling herons and egrets are occasionally taken for food but since the birds bring "good luck" to the villagers this is not a serious problem. Most of the nestlings taken are probably birds, which have fallen from their nests. Many people visit the site to photograph the nesting birds but in general there is little disturbance.

Economic and social values: Valuable as a recreation and education resource. There is an information notice beside the Nature Warden Post at Yim Tso ha egretty.

Fauna: An important nesting site for:

Ardeola bacchus (100-150 pairs)

Nycticorax nycticorax (20-50 pairs)

Egretta garzetta (100+ pairs)

Bubulcus ibis (c.150 pairs)

Egretta alba (up to 10 pairs)

Egretta eulophotes (1-3 pairs)

The Chinese Egret *E. eulophotes* is listed as "vulnerable" in the IUCN Red Data Book (Ayes, 2nd edition). This is the only known nesting site of this species in Hong Kong, although there are currently two other flourishing egrettries, both in the Deep Bay area. Murton (1972) has suggested that *E. eulophotes* may find difficulty in competition with *E. garzetta*. Many *E. garzetta* from the Yim Tso ha egretty fly inland to feed at fish ponds, while *E. eulophotes* feeds

on the shore, whereas at Deep Bay, large numbers of *E. garzetta* feed on the shore and thus may exclude *E. eulophotes*.

Special floral values: The "fung shui" wood at Yim Tso ha has a mixed flora and is representative of this type of woodland which is slowly disappearing in Hong Kong.

Research and facilities: A study of the nesting egrets, especially *E. eulophotes*, was undertaken by Murton in 1969.

References: Murton (1972).

Criteria for inclusion: 2a.

Source: David S. Melville.

Wetland name: Lai Chi Wo Beach

Country: Hong Kong

Coordinates: 22°32'N, 114°15'E;

Location: on the southwestern shore of Crooked Harbour, eastern New Territories.

Area: 108 ha.

Altitude: Sea level.

Biogeographical Province: 4.6.1.

Wetland type: 06.

Description of site: A tidal sand flat. The maximum depth of water at high tide is 10 metres, and the maximum tidal range approximately 1.3 metres.

Climatic conditions: Subtropical, with hot and humid summers and mild, relatively dry, winters. The average annual rainfall is 2,225 mm, most falling between April and September. The mean daily minimum temperature is 13.2°C (January), and the mean daily maximum 31.6°C (July).

Principal vegetation: Beds of *Zostera nana*.

Land tenure: The beach and adjacent areas are Crown (Government) Land.

Conservation measures taken: Lai Chi Wo Beach was listed as a Site of Special Scientific Interest in 1978.

Land use: None. There is a village and abandoned farmland nearby.

Disturbances and threats: None known. The absence of *Z. nana* from other inlets in the area is possibly because they have been dammed to form fishponds.

Economic and social values: None known.

Fauna: No information.

Special floral values: The only known site for *Zostera nana* in Hong Kong, and considerably farther south than other known sites in China (in Shandong and Hebei Provinces, about 1,500 km to the north).

References: Agricultural and Fisheries Department (1975); Hodgkiss & Morton (1978b).

Criteria for inclusion: 1a.

Source: David S. Melville.

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