

INTRODUCTION

by Patrick W. Fairbairn and Ann Haynes

Jamaica, with an area of 10,962 km², is the third largest island in the Caribbean. It lies 140 km south of Cuba and 730 km west of Haiti, and has a population of about 2.1 million (1977). The island is crossed by a range of mountains reaching 2,256m in the east and descending gradually towards the west, with a series of spurs and forested valleys running north and south. The climate is tropical, with a fairly high humidity; temperatures on the coast average 27°C and there is a rainy season during the summer months (May to September). Much of the native vegetation, particularly in the lowlands, has been cleared for agriculture, mainly sugar, tobacco, bananas, coffee and palm products. Most of Jamaica's wetlands are coastal, and these include shallow sea bays, tidal creeks and brackish to saline lagoons with mangrove swamps. There are large freshwater swamps and peat marsh systems along the Black River and at Negril, but otherwise there are few freshwater wetlands of any significance.

Institutional Base for Wetland Conservation and Research

Governmental

The Natural Resource Conservation Department (NRCD) is the only agency with an explicit concern for the management of wetland areas. Its present activities are scientific, legal (through the Wild Life Protection Act), advisory (through the development control process of the Town and Country Planning Department), and coordinative, with the ultimate prospect of managing selected wetlands as National Parks or wildlife reserves.

The Petroleum Corporation of Jamaica (PCJ), a quasi-governmental body devoted to development of indigenous energy resources, has a current interest in mining peat from the island's two largest wetlands. It also plans to manage a smaller coastal wetland area as a crocodile sanctuary and semi-private beach resort. So far its activities have concentrated on scientific research.

The Fisheries Division has the legal power, through the Fishing Industry Act, to designate Fish Sanctuaries which may include mangrove swamps and other coastal wetlands. One such area is currently protected in this way.

Non-governmental

The University of the West Indies (Mona Campus) periodically conducts research on specific wetlands and wetland problems. The other non-governmental organizations with a record of concern for wetland conservation are all small groups each with fewer than one hundred active members. These are: The Natural History Society of Jamaica, Gosse Bird Club, and the Jamaican Society of Scientists and Technologists. Activities include excursions, lectures, seminars and public education through the mass media.

Progress in Wetland Conservation and Research

In the first National Physical Plan in 1971, the island's major wetlands were delineated as areas for special attention and care. However, conservation of wetlands as wetlands is still not a concept widely accepted by Government itself, and various wetland drainage or reclamation schemes in progress in 1971 have continued to the present day,

Legal protection for wetlands and their wildlife in Jamaica has its basis in several laws. Under the Town and Country Planning Act, Development Orders have been promulgated for each of the thirteen parishes. In each Development Order, there is a map delineating among other things areas of special conservation value, a definition which includes all wetlands regardless of size. However, the degree of real protection afforded by this designation is highly problematic, since to date no major development has been successfully challenged under the provisions of this Act. An inherent weakness in the Act is the fact that the definition of

development is so worded as to exclude agriculture from the development control process.

Under the Wild Life Protection Act, wetland animals may be protected by the listing of individual species and the designation of sanctuaries. Thus the American Crocodile *Crocodylus acutus* and the West Indian Manatee *Trichechus manatus* are totally protected in law as Protected Animals, as are almost all birds except some pests and certain game species for which an open season may be declared. Although extensive upland areas have been designated as sanctuaries under this Act, no wetlands have as yet been accorded such status except in those few cases where they lie within the bounds of Crown Lands, which are by definition closed to hunting. Administration and enforcement of the Wild Life Protection Act are inadequate despite the efforts of the Natural Resource Conservation Department to educate the general public and promote observance by means of four full-time Conservation Wardens appointed primarily for this purpose.

Coastal habitats including wetlands may be protected under the Fishing Industry Act as Fish Sanctuaries. One small example of this is a mangrove lagoon in the vicinity of Montego Bay; a much larger mangrove ecosystem at Portland Bight is awaiting enactment.

Much of the wetland research conducted in Jamaica to date has focussed on the Negril and Black River Lower Morasses, mainly because of the great size of these wetlands and their potential for multiple use. During the late 1970s, both were studied by the NRCD as part of a training programme sponsored by the Canadian International Development Agency (CIDA). Particular attention was given to the potential of Negril Morass as a National Park, and a proposal was made for the captive rearing and release of several duck species in artificially reflooded areas.

The NRCD also strongly favoured the establishment of a National Park at the Black River Lower Morass, but this concept was put in abeyance in 1979 by the onset of research on the mining of peat for fuel. Studies conducted by both the NRCD and the Petroleum Corporation of Jamaica predict that peat mining would result in the destruction of about 50% of the Jamaican habitat of several species of Rallidae and the shallow-water environments preferred by juvenile *Crocodylus acutus* and many other wetland animals. The open water pools created by the mining activities would, however, undoubtedly favour some species of waterfowl, notably Podicipedidae and wintering Anatidae.

The Portland Bight coastal ecosystem is currently being studied by the NRCD to describe the area's major ecological components and functions. Results of the study are expected to make a useful contribution to the biophysical inventory of Portland Bight and its environs, which comprise a designated National Park area in the National Physical Plan.

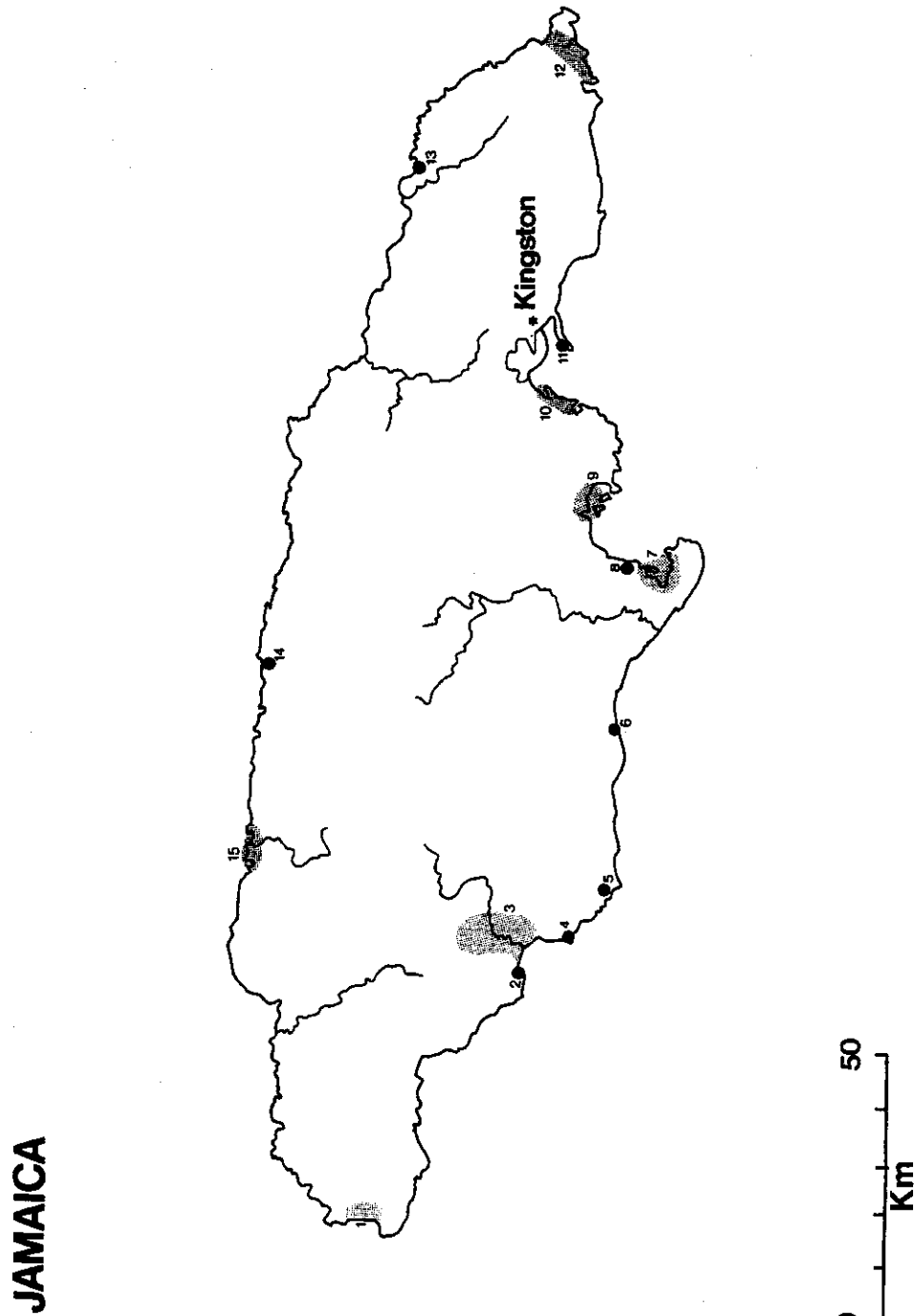
Another designated National Park area, centred on the coast of the Manchester Parish, contains a wetland that serves as the focus of a manatee management project and concurrent interpretative programme, sponsored jointly by the NRCD and the Organization of American States with additional technical assistance from the Florida State Museum. A visitor centre is being constructed to house collections of biota from the area and other educational material for display. Submerged macrophytes are being monitored in the Alligator Hole River, the habitat of the manatees.

A major scientific study of the Hellshire coast southwest of Kingston is expected to start in 1985. Arising from the collaboration of the University of Dalhousie, Nova Scotia, and the Mona Campus of the University of the West Indies, and under the sponsorship of CIDA, this research will include investigations of a large mangrove and saline ecosystem that lies between low limestone hills and a shallow offshore shelf of patch reef and turtle grass *Thalassia* sp. This wetland study is of special urgency because of plans to build the so-called Hellshire New Town in the hills nearby, and to develop the recreational potential of the area's beaches.

Major Threats to Wetlands

Despite recognition in the National Physical Plan and Parish Development Orders as areas of special conservation value, Jamaica's wetlands remain under threat, particularly from drainage for agriculture and reclamation for housing and industrial development. The mangroves of Kingston Harbour continue to be destroyed for housing, and drainage for agriculture has now almost completely destroyed the once extensive marshes of the Black River Upper Morass. The mangrove swamp at the mouth of the Martha Brae River near Falmouth was unsuccessfully drained in the 1960s and 1970s for rice cultivation, and is being gradually removed by urban encroachment and recreational development, with the resultant degradation of a famous

phosphorescent lagoon. The Cabarita Swamp in Westmoreland suffers from the continuing stress of canalization and pollution with waste products from a sugar factory and rum distillery. Elsewhere, other wetlands are at risk from smaller-scale developments with similar effects. A new possible source of disturbance that would drastically change wetland habitats in the Negril and Black River Lower Morasses is embodied in the current proposal to mine peat desoposits for fuel. In the process, herbaceous swamps would be converted into deep open-water lakes.



WETLANDS

Site descriptions based on data sheets provided by the Aquatic Resources Division of the Natural Resource Conservation Department, and Robert L. Sutton.

Negril Morass (1)

Location: 18°19'N, 78°20'W; northeast of Negril, Westmoreland and Hanover Parishes.

Area: 2,300 ha.

Altitude: 0m.

Province and type: 8.40.13; 05, 07, 08, 13, 18 & 19.

Site description: A coastal fringe of mangrove swamps and tidal marshes behind a sand bar, and extensive fresh to brackish marshes with peat formations 5-6m deep inland. Salinities range from 1-20 p.p.t., and there are slight tidal fluctuations in water level near the coast. The marshes have been greatly modified by various attempts at drainage in the past. The water level was lowered in 1959, and this led to a spread of sawgrass and invasion by shrubs and trees. **Principal vegetation:** Coastal mangrove swamps, principally *Rhizophora mangle*; extensive stands of sawgrass *Cladium jamaicensis*; swamp forest dominated by *Rystonea princeps*; and scattered shrubs and trees. The vegetation, which includes endemic species, has been described in detail by Bjork (1983).

Land tenure: Owned partly by the state and partly by the Petroleum Corporation of Jamaica.

Protection: No legal protection; a designated Conservation Area in Parish Development Orders, and proposed National Park in the National Physical Plan.

Land use: Fishing, crab hunting and illegal cultivation of marijuana; 200 ha of marsh have been drained for agriculture in the east.

Waterfowl: Resident species include *Podilymbus podiceps*, *Ixobrychus exilis*, *Butorides virescens*, *Egretta caerulea*, *E. alba*, *Rallus longirostris*, *Porzana flaviventer* and *Gallinula chloropus*; winter visitors include *Ardea herodias*, *Anas discors*, *Porzana carolina* and *Gallinago gallinago*. West Indian Tree Ducks *Dendrocygna arborea* occur regularly.

Other fauna: No information.

Threats: Sections of the wetland have already been drained for agriculture. A proposal by the Petroleum Corporation of Jamaica to mine the high quality peat deposits for fuel is likely to be given the go-ahead, and this will involve the physical removal of sections of the wetland and creation of deep-water lakes.

Research and conservation: A number of studies have been conducted on the feasibility of peat mining and its environmental impact, particularly by the Petroleum Corporation of Jamaica and University of Lund, Sweden. Several workers have concluded that the peat mining activities would in fact enhance the wildlife values of the area by "rejuvenating" the marsh and increasing habitat diversity.

References: Adelatec (1969); Natural Resource Conservation Department (1975); Natural Resource Conservation Department & Traverse Group, Inc. (1981); Bjork (1982, 1983 & 1984); Coke *et al* (1982); Handy (1982); Cronberg (1983); Fritzon (1983); Svensson (1983); Digerfeldt & Enell (1984); Enell (1984).

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2b & 3a.

Luana Swamp (2)

Location: 18°07'N, 77°59'W; west of Black River, St. Elizabeth Parish.

Area: Unknown.

Altitude: 0m.

Province and type: 8.40.13; 05, 06, 07 & 08.

Site description: An area of tidal mudflats, mangrove swamps and brackish marshes behind a sand bar.

Principal vegetation: Mangrove swamps with *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus* and *Rhizophora mangle*; some *Typha domingensis*.

Land tenure: Owned by the Petroleum Corporation of Jamaica.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing, harvesting of crabs and hunting of Columbidae; agriculture nearby.

Waterfowl: *Pelecanus occidentalis* and *Egretta alba* occur.

Other fauna: The wetland supports a significant population of the American Crocodile *Crocodylus acutus*.

Threats: Fishermen kill crocodiles as competitors for fish stocks, and some crocodiles are drowned in fishing nets. There is some hunting of sea turtles and collection of their eggs.

Research and conservation: The wetland and adjacent coastline have been delineated by the Natural Resource Conservation Department for protection by the Petroleum Corporation of Jamaica as a sanctuary for crocodiles and other fauna. A crocodile tagging project is in operation at Luana, Black River and Parottee.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2a & 3a.

Black River Lower Morass (3)

Location: 18°03'N, 77°48'W; northeast of Black River town, St. Elizabeth Parish.

Area: 5,700 ha.

Altitude: 0m.

Province and type: 8.40.13; 06, 07, 08, 13, 16, 18 & 19.

Site description: A complex of shallow brackish lagoons, tidal marshes, mudflats and mangroves near the coast; and extensive freshwater marshes with peat formations 3-7m deep, seasonally flooded grassland and swamp forest along the lower Black River. Salinities range from 1-20 p.p.t., and there are slight tidal fluctuations in water level near the coast. The morass comprises an interesting estuarine system in which salt water underlies fresh water for some kilometres inland.

Principal vegetation: Coastal and riverine mangrove swamps, principally *Rhizophora mangle*; extensive marshes with *Typha domingensis*, *Cladium jamaicensis* and, in drier parts, *Sabal jamaicensis*; and swamp forest. The vegetation has been described in detail by Bjork (1983).

Land tenure: Owned partly by the state and partly by the Petroleum Corporation of Jamaica.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order, and a proposed inland conservation area in the National Physical Plan.

Land use: Fishing, harvesting of shrimps, exploitation of mangroves for the production of tannin, and reed-cutting for basket-making. Agriculture in surrounding areas. Approximately 1,000 people use the wetland for fishing and shrimping, and for many, this is their only means of livelihood.

Waterfowl: A very important breeding area for many waterfowl, and the last stronghold of several species in Jamaica, notably *Dendrocygna arborea* (hundreds), *Aramus guarana* (tens), and *Laterallus jamaicensis* (rare). Other breeding species include *Podilymbus podiceps*, *Ixobrychus exilis*, *Nycticorax nycticorax*, *Bubulcus ibis* (thousands), *Butorides virescens*, *Oxyura dominica*, *Rallus longirostris*, *R. maculatus*, *Porzana flaviventer*, *Gallinula chloropus*, *Porphyryula martinica*, *Jacana spinosa* and *Charadrius vociferus*. Common non-breeding visitors include a variety of Ardeidae, *Plegadis falcinellus*, *Anas discors*, *Porzana carolina*, *Fulica americana*, *Actitis macularia*, *Gallinago gallinago* and *Himantopus himantopus*.

Other fauna: *Pandion haliaetus*, *Circus cyaneus* and *Falco peregrinus* are winter visitors, and *Crocodylus acutus* occurs. The wetland is an important breeding ground and nursery for commercially important fishes such as *Lutjanus apodus*, *Megalops atlantica* and *Caranx latus*, and the shrimps *Macrobrachium acanthurus* and *M. faustinum*.

Threats: Large-scale drainage of the Black River Upper Morass has had some detrimental effects on the Lower Morass, and there is some pollution from industrial waste. There is also a project to plant rice in extensive areas of shallower peat. The most serious threat, however, is a proposal of the Petroleum Corporation of Jamaica to mine the peat resources for fuel. Although it has been argued that mining activities could enhance the value of the wetland for some wildlife species, e.g. Anatidae, the unique and as yet relatively undisturbed natural ecosystems would be seriously disrupted.

Research and conservation: A number of studies on the feasibility and environmental impact of peat mining have been carried out by the Petroleum Corporation of Jamaica, the Natural Resource Conservation Department and the University of Lund, Sweden. Whether or not the area will be mined is still under debate. The peat resources are inferior to those of Negril Morass (site 1), and the wetland is much more important, both in terms of its native fauna and flora and its commercially important fisheries. If properly managed as a Wildlife Park, the wetland could support a wide range of recreational activities with minimum disturbance to the ecosystems. In 1984, it was proposed that parts of the Morass not suitable for peat mining or rice production should be managed by NRCD as a Conservation Area.

References: Crontmij (1964); Natural Resource Conservation Department & Traverse Group, Inc. (1981); Bjork (1982, 1983 & 1984); Coke *et al* (1982); Cronberg (1983); Fritzson (1983); Svensson (1983); Digerfeldt & Enell (1984); Enell (1984).

Source: Robert L. Sutton and Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 123.

Parottee Salt Pond (4)

Location: 17°58'N, 77°50'W; 7 km southeast of Black River, St. Elizabeth Parish.

Area: 190 ha.

Altitude: 0m.

Province and type: 8.40.13; 06, 07 & 08.

Site description: A complex of shallow saline lagoons, up to 3m deep, surrounded by mudflats and patches of mangrove swamp; formerly connected to the sea but recently cut off by road construction. Salinities range from 29-48 p.p.t. As much as two-thirds of the wetland dries out during the dry season.

Principal vegetation: Mangrove swamps.

Land tenure: A mixture of state and private ownership.

Protection: None.

Land use: Fishing, cutting of mangroves for fuel, and livestock grazing.

Waterfowl: One of the richest wetlands in Jamaica for waterfowl, with a great diversity of breeding, passage and wintering species (62 species recorded). Breeding birds include *Pelecanus occidentalis*, *Ixobrychus exilis*, *Nyctanassa violacea*, *Egretta caerulea*, *E. tricolor*, *E. thula*, *E. alba*, *Dendrocygna arborea*, *Rallus longirostris*, *Porphyryla martinica*, *Charadrius wilsonius*, *Himantopus himantopus* and *Sterna albifrons*. Passage migrants and winter visitors include *Anas discors* (hundreds), *A. crecca*, *A. americana*, *A. clypeata* and *Oxyura jamaicensis* in small numbers, *Porzana carolina*, *Fulica americana* (hundreds), many shorebirds, notably *Charadrius semipalmatus*, *Tringa melanoleuca*, *T. flavipes*, *Calidris minutilla* and *Micropalama himantopus*, and a variety of Laridae.

Other fauna: *Pandion haliaetus*, *Falco peregrinus* and *F. columbarius* are winter visitors. The area is excellent habitat for the American Crocodile *Crocodylus acutus*.

Threats: The main threat is a plan by private developers to drain large portions of the wetland for housing development.

Research and conservation: The avifauna of the area is relatively well known. The wetland has great potential for nature tourism and could make an excellent wildlife reserve. However, the lagoon must be reconnected to the sea to ensure the survival of the mangrove swamps. It has recently been proposed that the lagoon be allocated to NRCD and managed as part of a Black River Conservation Area.

References: Svensson (1983).

Source: Robert L. Sutton.

Criteria for inclusion: 2a, 2b & 3a.

Great Pedro Pond (5)

Location: 17°52'N, 77°45'W; near Treasure Bay, St. Elizabeth Parish.

Area: 20 ha.

Altitude: 0m.

Province and type: 8.40.13; 07.

Site description: A shallow saline coastal lagoon with fringing mudflats. The salinity ranges from 15-35 p.p.t., and the water level fluctuates widely, the lagoon drying out completely in some years.

Principal vegetation: Almost no vegetation.

Land tenure: Privately owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing and illegal duck hunting; livestock grazing in surrounding areas.

Waterfowl: An important feeding area for resident species, particularly Ardeidae, and passage and wintering area for Nearctic Anatidae, shorebirds and Laridae. Over 40 species of waterfowl have been recorded. The commoner species include *Podilymbus podiceps* (hundreds), *Podiceps dominicus*, *Pelecanus occidentalis*, *Egretta caerulea*, *E. tricolor*, *E. thula*, *E. alba*, *Ardea herodias*, *Anas discors* (hundreds), *Oxyura dominica*, *Fulica americana* (hundreds), *Pluvialis squatarola*, *Charadrius semipalmatus*, *C. vociferus*, *Tringa melanoleuca*, *T. flavipes*, *Arenaria interpres* and *Calidris minutilla*. *Sterna albifrons* breeds, and *Egretta rufescens*

is a regular winter visitor in small numbers.

Other fauna: *Pandion haliaetus*, *Falco peregrinus* and *F. columbarius* occur in winter. Up to three American Crocodiles *Crocodylus acutus* have been seen in the lagoon, but they are not resident.

Threats: The lagoon is under no immediate threat, but housing development nearby may eventually have a serious effect on the wetland.

Research and conservation: The Natural Resource Conservation Department has proposed that the area be protected, and this has met with opposition from only one of the adjoining land owners.

References: Svensson (1983).

Source: Robert L. Sutton and Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 3a.

 Canoe Valley (6)

Location: 17°52'N, 77°25'W; east of Alligator Pond, Manchester County.

Area: 625 ha.

Altitude: 0m.

Province and type: 8.40.13; 05, 07 & 08.

Site description: A chain of shallow brackish marshes and mangrove swamps behind a coastal sand bar; fed by a series of springs upwelling from the base of a limestone hill to the north. Salinities range from 1-10 p.p.t.

Principal vegetation: Mangrove swamps with *Avicennia germinans* and *Conocarpus erectus*; brackish marshes with *Typha domingensis* and *Cladium jamaicensis*.

Land tenure: State owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order, and a proposed National Park in the National Physical Plan.

Land use: Fishing and reed-cutting for basket-making.

Waterfowl: No detailed information is available. The commoner species include *Podilymbus podiceps*, *Pelecanus occidentalis* (breeding colony), *Bubulcus ibis* (breeding colony), *Egretta caerulea*, *E. tricolor*, *E. thula*, *Ardea herodias*, *Gallinula chloropus*, *Jacana spinosa* and a variety of shorebirds.

Other fauna: A few manatees *Trichechus manatus* and American Crocodiles *Crocodylus acutus* occur in the marshes, and sea turtles occur along the beach.

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Threats: The wetland is under no immediate threat, but road development and charcoal production are causing some problems.

Research and conservation: The Natural Resource Conservation Department carried out an ecological study of the wetland in 1975, and is currently conducting a manatee research and management project (Operation Sea Cow). A Government proposal exists for the protection and development of the site as a National Park, and it is already being developed as an educational and recreational facility, with some funding from the O.A.S.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2a & 3a.

Portland Bight Swamp (West Harbour) (7)

Location: 17°47'N, 77°11'W; southeast of Lionel Town, Clarendon Parish.

Area: 2,083 ha.

Altitude: 0m.

Province and type: 8.40.13; 01, 03, 07 & 08.

Site description: A shallow sea bay with mangrove covered islands and mangrove fringe; a large saline lagoon, up to 4m deep, behind the mangrove fringe; and some brackish marshes in the north. Salinities range from 34-40 p.p.t., and tidal variation in the bay ranges from 36-40 cm. The wetland contains the best mangrove development in Jamaica.

Principal vegetation: Mangrove swamps with *Avicennia germinans*, *Laguncularia racemosa* and *Rhizophora mangle*; brackish marshes with *Typha* sp and *Phragmites* sp.

Land tenure: State owned.

Protection: No legal protection. A designated Conservation Area in the Parish Development Order, and a proposed National Park in the National Physical Plan; the local Gun Club closes off the wetland to public access during the bird hunting season.

Land use: Sport and commercial fishing, crab fishing, sport hunting (mainly for Columbidae), cutting of mangroves for timber and to produce tannin for curing hides, and scientific research.

Waterfowl: Known to be an important area for waterfowl, but few data are available. Species recorded include *Nycticorax nycticorax*, *Egretta caerulea*, *E. rufescens*, *Ardea herodias*, *Eudocimus albus*, *Aramus guarauna*, many Nearctic shorebirds, *Himantopus himantopus* and *Sterna albifrons*.

Other fauna: *Pandion haliaetus* occurs in winter. There is an extremely rich marine fauna associated with the mangrove swamps.

Threats: The main threats are reclamation of land for industry and indiscriminate felling of mangroves. There is some oil pollution from passing shipping, and excessive hunting may be affecting some waterfowl populations.

Research and conservation: A considerable amount of research has been conducted in the wetland, particularly by students from the University of the West Indies in Kingston. B.A. Wade has studied oil pollution in the bay, and B. Chow has recently completed an evaluation of the importance of the wetlands to the economy of the region. The Natural Resource Conservation Department is developing a management plan, and the wetland has been included in a proposed "Portland Ridge and Bight National Park (Marine Park)".

References: Wade (1974); Chow (in prep).

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2b & 3a.

Cockpit - Salt River Swamp (8)

Location: 17°50'N, 77°10'W; east of Salt River, Clarendon Parish.

Area: 166 ha.

Altitude: 0m.

Province and type: 8.40.13; 07, 08 & 13.

Site description: A freshwater swamp fed by numerous springs, flowing into a salt water creek with mangrove swamps behind a sea beach. Salinities range from fresh to 35 p.p.t.; and there is some tidal influence near the coast. An irrigation canal originates in the north of the swamp and flows the full length of it.

Principal vegetation: Mangrove swamps with *Avicennia germinans* and *Rhizophora mangle*; freshwater marshes with *Typha domingensis* and *Nasturtium officinale*.

Land tenure: State owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing.

Waterfowl: No information.

Other fauna: The American Crocodile *Crocodylus acutus* occurs.

Threats: A proposal has been made to drain the swamp for real estate development.

Research and conservation: The coastal fringe of mangroves should be preserved for coastal protection, and the entire area could be developed as a small National Park offering a variety of forms of outdoor recreation.

References: Wade *et al* (1972).

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2a & 3a.

Hellshire - Cabarita Swamp (9)

Location: 17°53'N, 77°04'W; southeast of Old Harbour, St. Catherine Parish.

Area: 666 ha.

Altitude: 0m.

Province and type: 8.40.13; 05, 06, 07 & 08.

Site description: A group of permanent shallow brackish lagoons behind a sand bar, with tidal mudflats and mangrove swamps. Some of the lagoons are connected to the sea by narrow channels and are subject to tidal influence. Salinities range from 25-30 p.p.t.

Principal vegetation: Mangrove swamps, mainly *Rhizophora mangle* with some *Avicennia germinans*, *Conocarpus erectus* and *Thespesia populnea*.

Land tenure: State owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing.

Waterfowl: Known to be an important area for waterfowl, particularly migrant shorebirds, but no details are available.

Other fauna: An important spawning ground for the Bone Fish *Albula vulpes*. The adjacent coastal waters are important for *Trichechus manatus* and sea turtles.

Threats: None known.

Research and conservation: The wetland remains poorly known despite its proximity to Kingston. However, the Zoology Department of the University of the West Indies is beginning an ecological study of the wetland in January 1985. The area would be suitable for the establishment of a National Park.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 0.

Great Salt Pond and Flashes (10)

Location: 17°58'N, 76°52'W; southeast of Spanish Town, St. Catherine Parish.

Area: 186 ha.

Altitude: 0m.

Province and type: 8.40.13; 05, 07 & 08.

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Site description: A saline coastal lagoon, up to 3m deep, behind a sand bar, with brackish marshes (flashes) and mangrove swamps. The lagoon has now been permanently opened to the sea. Salinities range from 16-74 p.p.t.

Principal vegetation: Mangrove swamps, mainly *Rhizophora mangle* with some *Conocarpus erectus*; brackish marshes with *Typha domingensis* and *Cladium jamaicensis*.

Land tenure: State owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing and recreation. There is a proposal to use the lagoon for shrimp farming.

Waterfowl: No information.

Other fauna: The American Crocodile *Crocodylus acutus* occurs.

Threats: There is some pollution in the lagoon, and the Urban Development Corporation has proposed a scheme to take water from the aquifer supplying the wetland to Hellshire New Town.

Research and conservation: The ecology of the wetland has been studied by an MSc student of the University of the West Indies. The site would be ideal for a small park as it has the nearest white sand beach to Kingston and is a popular recreation area.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2a & 3a.

Port Royal Swamps (11)

Location: 17°57'N, 76°49'W; east of Port Royal, Kingston.

Area: 20 ha.

Altitude: 0m.

Province and type: 8.40.13; 05 & 08.

Site description: A mangrove swamp subject to tidal influence, behind a sea beach. Salinities range from 25-35 p.p.t.

Principal vegetation: Mangrove swamps with *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus* and *Rhizophora mangle*.

Land tenure: State owned.

Protection: No legal protection, but protected to some extent by the Marine Laboratory of the University of the West Indies. A designated Conservation Area in the Parish Development Order.

Land use: Fishing.

Waterfowl: An important area for waterfowl, but few data are available. *Eudocimus albus* is reported to have nested.

Other fauna: No information.

Threats: There is a considerable amount of pollution from oil spills in Kingston Harbour, and there are plans to use the area for extensions to the nearby airport and marina. Proposals for the expansion of Port Royal also pose a threat.

Research and conservation: The mangrove swamp lies very close to the Marine Laboratory of the University of the West Indies and is used for teaching purposes. It is also part of a proposed National Park.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 3a.

The Great Morass (12)

Location: 17°55'N, 76°14'W; east of Port Morant, St. Thomas Parish.

Area: 1,660 ha.

Altitude: 0m.

Province and type: 8.40.13; 05 & 08.

Site description: A mangrove swamp subject to tidal influence, behind a sea beach. Salinities range from 25-35 p.p.t.

Principal vegetation: Mangrove swamps with *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus* and *Rhizophora mangle*.

Land tenure: A mixture of state and private ownership.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing; agriculture in surrounding areas.

Waterfowl: No information.

Other fauna: The American Crocodile *Crocodylus acutus* occurs in the area; sea turtles are known to use the beaches for nesting; and the swamp is an important nursery ground for marine fishes.

Threats: A part of the swamp has already be drained for agriculture, and further drainage is likely to occur.

Research and conservation: The area is a proposed National Park, and has potential value for aquaculture.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2a, 2c & 3a.

Turtle Crawle Swamp (13)

Location: 18°11'N, 76°25'W; east of Port Antonio, Portland Parish.

Area: 25 ha.

Altitude: 0m.

Province and type: 8.40.13; 05, 07, 08 & 13.

Site description: A mangrove swamp and tidal marshes behind a sea beach, and adjacent fresh to brackish marshes.

Principal vegetation: Mangrove swamps with *Avicennia germinans*, *Laguncularia racemosa* and *Rhizophora mangle*; marshes with *Typha domingensis*, sedges and grasses.

Land tenure: Privately owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing and harvesting of shrimps.

Waterfowl: No information.

Other fauna: The swamp constitutes a small nursery ground for shrimps and 17 species of commercially important fishes.

Threats: There is a proposal to reclaim the swamp for housing development, and some landfill has already been established at the western extremity.

Source: Aquatic Resources Division, Natural Resource Conservation Department.

Criteria for inclusion: 2c & 3a.

Pear Tree Swamp (14)

Location: 18°27'N, 77°21'W; east of Runaway Bay, St. Ann Parish.

Area: 16 ha.

Altitude: 0m.

Province and type: 8.40.13; 05 & 13.

Site description: A small spring-fed freshwater marsh with clear pools (blue holes) up to 2m deep; behind a sea beach. The last remaining freshwater swamp of its kind in Jamaica.

Principal vegetation: *Typha domingensis* and *Acrostichum aureum*.

Land tenure: State owned.

Protection: No legal protection; a designated Conservation Area in the Parish Development Order.

Land use: Fishing and harvesting of shrimps.

Waterfowl: No information.

Other fauna: No information.