Part 1. Introduction

1.1. Background

The Turks & Caicos Islands are rich in environmental and historic treasures on which a thriving tourism business is being built. They contain significant areas of unspoilt marine and terrestrial habitats, and many sites of historic interest from the Lucayan and plantation periods. The great conundrum for countries which use their natural resources to bring income from tourism is how to build the industry without destroying the resources on which it is based. Only careful planning can enable a country to do this, and planning requires information. The natural resources of these Islands have not, until now, been well-documented, and this has hindered the development of appropriate policy planning and activities. This management plan, which covers a large area of unspoilt marine and terrestrial ecosystems centred on the Ramsar site in North, Middle and East Caicos is based on extensive scientific study of the resources in the area. Building on this scientific research and on extensive consultation with the people who live there, this plan lays out the means to develop an appropriate-scale eco-tourism industry which will preserve both the environmental resources and the human communities which have lived there for the last two centuries.

The Ramsar Convention on Wetlands of International Importance, signed by 133 contracting states by July 2002 since its adoption in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Under this convention, a large area centred on Middle Caicos has been declared a Wetland of International Importance, and both the UK and TCI Governments are committed to manage the site in a way that ensures its conservation and wise use. This is one of the largest (58,617 ha) and most natural of UK Ramsar sites, and one of the few which includes the high-priority coral reef, mangrove and sea-grass bed ecosystems. As part of its commitment to conservation, the TCI Government has designated the entire site as a Nature Reserve under the National Parks Ordinance, and has worked cooperatively with the Turks and Caicos National Trust ("the Trust") and the UK Overseas Territories Conservation Forum ("the Forum") in the development of this management plan.

This plan results from a joint project between the local communities, the Trust, the Forum, and another of the Forum's member organisations, CABI Bioscience. The work was carried out under a Memorandum of Understanding with the Turks and Caicos Islands Government, and with financial support from UK Government (including the Darwin Initiative) and others. The intention is that the collaborative venture should continue with the Trust leading the implementation of this plan, the Forum continuing to contribute extensive technical support, both working in close and active collaboration with the local community. The TCI Government is continuing to support this, for example by provision of a building and land for an eco-centre on Middle Caicos and a vehicle, as well as other support. Through a project managed by the Forum, the UK Government (Foreign & Commonwealth Office Environmental Fund for Overseas Territories) continues to contribute towards the cost of this work. The work is complementary to the development of management of marine national parks by the DFID-supported Coastal Resources Management Programme (CRMP), now part of the Department of Environmental & Coastal Resources (DECR).

The purpose of the present plan is to provide means by which the internationally important biodiversity and cultural heritage of the Caicos Islands can be treasured by local people and experienced by visitors without damage. The plan works through wide-ranging co-operative action with the local people, local Government and other institutional stakeholders, and deploys biodiversity and other heritage information for the long-term benefit of the Islands and their inhabitants. This will enable the local people to protect the area by generating sustainable usage involving eco-tourism-based activities, as well as education. This will be accomplished through (1) this shared, regularly reviewed management plan; (2) trained local personnel working as wardens, guides and educators; and (3) integrated programmes to develop tourism resources such as trails, hides, an eco- centre, displays, courses, booklets etc.

1.2. Meeting international responsibilities

Implementation of this plan would help in a major way to fulfil the UK & TCI Government commitments under the Ramsar Convention. Implementation would also address all four key elements of the Convention on Biological Diversity by providing skills enabling local people to use environmental resources, share these with visitors and receive incomes, by biodiversity conservation and sustainable development.

The Convention on Biological Diversity underlines the need to integrate conservation of biodiversity into all sectoral plans and policies. The TCI Government recognises this in its tourism slogan "Beautiful by Nature." However, much work needs to be done to implement this. One crucial element is the long awaited National Physical Plan (now within the Sustainable Development Planning Initiative, SDPI). The TCI Department of Physical Planning has made clear to the project partners that it would welcome major input to the new SDPI with regard to the Ramsar site and adjacent areas in North, Middle and East Caicos, which form such a high proportion of the country's area. The TCI Tourism Department has similarly proposed collaboration for work on Middle and North Caicos.

Further, implementation of this management plan will be a critical step in fulfilling the Environmental Charter. On 26th September 2001, in common with other UK Overseas Territories, the TCI Government signed an Environmental Charter with the UK Government. This is reproduced at Appendix 2. The Charter involves wide-ranging undertakings by both the UK and TCI Governments, including a commitment by the TCIG to "ensure the protection and restoration of key habitats, species and landscape features through legislation and appropriate management structures and mechanisms…" The implementation of this management plan is potentially one of the major ways by which the TCIG's commitments in this Charter are implemented.

1.3. The views of the local community

The wishes of the local community have been sought and integrated throughout the development of this plan; this will continue in the implementation phase. Some of these consultations are summarised in Appendix 7. The central theme which came out in every community meeting was sustainable management and the conservation of environmental resources in a way that enhances the lives of the people living there.

This is a special situation in which a small group of people had, until a few years ago, been living at near subsistence levels for two centuries, closely integrated in a sustainable way with their environment. However, a rapidly changing socio-economic environment is causing both a loss of these skills and of the local communities. Local residents regret this loss of the quality of life but are powerless to reverse it without jobs for their young people. The presence of an internationally important biodiversity site (and historical and cultural heritage features) provides both a further need and an opportunity for reversing this trend. Without the continued presence of people, there can be no local culture and little chance of effective biodiversity conservation; the people and the heritage depend on each other.

Timing is critical. Development is at a stage which could either follow a sustainable model or could intensify to lose the local cultural and biodiversity heritage. If left without planned intervention now, two main threats are imminent: (1) externally driven intensive development with irreversible changes; and (2) loss through death of elderly persons of the detailed and extensive knowledge of traditional ways of life and sustainable practice. The pace of externally driven development is likely to accelerate when the European Union-funded dock and ferry link between Providenciales and North Caicos, and the causeway which will link North and Middle Caicos, come on line. It is of vital concern to the local communities that environmental protections be in place before that time.

1.4. Formula for success

The situation in the subject area of this plan gives one of the best opportunities anywhere to provide a conservation model which will have wide applicability, because of the following features which are present in rare combination:

- a local community which wishes to maintain its way of life;
- the presence of an internationally important site for biodiversity in an area of historic and cultural important which has the potential to attract significant numbers of paying visitors;

- a local membership-based statutorily established NGO which can provide the focus for management;
- a sympathetic government set in a stable framework and which is supportive;
- local people who have seen the rapid development on adjacent islands and therefore have a clear idea of the alternative routes, and would prefer a sustainable one if that can be facilitated;
- the presence of senior citizens with first-hand knowledge of sustainable practices and willingness to pass this on;
- a mechanism for ongoing funding for management of protected areas through the recently implemented visitor tax earmarked in the Conservation Fund;
- a small country, which will be prepared to flag up the success of this major project to very wide international audiences, which may wish to use the model;
- a constitutionally linked partner country within the same nation-state (UK) with very limited involvement in government locally but with a supportive approach.

1.5. Objectives

To provide a practicable means to conserve the rich biodiversity and cultural integrity of the Caicos Islands, including the Ramsar wetland of international importance, through enabling the local people to protect the area by generating sustainable usage involving eco-tourism-based activities, as well as educating both visitors and the next generation of citizens.

More specifically:

1. To provide a means by which the rich biodiversity and cultural heritage of the area can be treasured by local people and experienced by visitors without damage to these internationally important ecosystems

2. To facilitate the development of the capacity of local people to establish small businesses based on eco-tourism and traditional crafts, so as to provide both the economic incentive for item 1 above, and employment for local people so that they no longer need to leave the islands to find work, thereby maintaining the communities and cultural integrity.

3. To provide means of coordinating the work, educating local children (and where appropriate adults) and visitors and integrating the work into the National Physical Plan [now the Sustainable Development Planning Initiative] and the implementation of the Environmental Charter.

4. To use this experimental approach to provide an example to the widely spread small island communities which are searching for ways of maintaining biodiversity and local culture while generating an income, so that these can be maintained rather than surrendering to intensive development models imposed and driven by external investment replacing local culture and control by North American/European systems.

1.6. Plan approach

The Plan addresses these objectives by integrating the various elements in an approach which is potentially sustainable in environmental, social and economic terms. This is by linking conservation of biodiversity, historic and cultural heritage with means of gaining income for local people from this, and hence increasing the value of maintaining it. This builds on the wish of local people to maintain their communities by facilitating development on an appropriate scale to provide enough local jobs while not so many that the local social framework is overwhelmed and sustainability lost. Importantly, control is restored largely to local hands. This project is innovative because it will provide an alternative to foreign-driven intensive built development in the country. Instead, it will empower and involve the local people to utilise and extend their undervalued skills and knowledge to create a product unique to their islands. This will involve multisectoral cooperation, and will result in both the maintenance and regeneration of their communities and their natural, historical and cultural heritage.

The methodology does this by making maximum use of local involvement, supplementing this where necessary (e.g. in technical surveys and evaluation) but in a way which facilitates capacity-building so that further tasks can become locally undertaken. The approach is multi-sectoral, integrated and firmly rooted in unique local culture, rather than focussing on just one element as happens in some development projects (which might, e.g. relate just to craft work or to nature protection or to tourism development).

The operational plan assists the local people of TCI to establish "ownership" of local biodiversity, by facilitating the implementation of a management plan for local habitats. It facilitates the development of sustainable, low-impact eco-tourism, and thereby provides a model for the integration of biodiversity conservation into local planning and action. Key elements will include:

- Provide local people with the means to influence the development of tourism, integrating the conservation of biodiversity, using a sustainable model – consistent with the Ramsar Convention, the Convention on Biological Diversity, the Environmental Charter and the wishes of the local community.
- Arrange local conservation management control over key areas of biodiversity and historic value.
- Regular community meetings and with other stakeholders
- Develop the initial management plan into final plan as shared working tool, with regular revision.
- Design and construct nature trails, hides etc in phased programmes; integrated leaflets, signs & displays matched to the opening of different trails etc.
- Produce other interpretative and awareness-raising materials.
- Train local tour guides.
- Develop means of access control, fees and system of enforcement, feedback and revision as necessary.
- Establish plan for longer term maintenance, including using resources generated by the activities.
- Develop further modules of successful environmental education course, and use resource centres, trails etc as "living classrooms".
- Facilitate local small businesses based e.g. on local crafts and services.
- Establish management systems and regular reporting.

1.7. Geographical coverage

This plan is centred on the Ramsar site of North, Middle and East Caicos (see Fig. 1). However, it is not restricted to this area but includes much of the surrounding area of North, Middle and East Caicos. This is for two main reasons.

First, site boundaries are to some extent artificial, and sites need to be managed in conjunction with the surroundings, which are parts of the same ecological, hydrological and geomorphological systems. Attempts to manage parts of such systems in isolation are likely to be both inefficient and ineffective. Moreover, the work of the Darwin Initiative project demonstrates high biodiversity and other interest outside the site boundaries. In a few cases, this interest occurs in other protected sites, but in most cases in areas not so protected.

Second, if the local community is to benefit from the development of eco-tourism as outlined in the plan, it is essential that these surrounding areas are included in the plan.

Information gathered to date is not, of course, uniform across the whole area. During the Darwin Initiative project work, some emphasis was placed initially on Middle Caicos, although other areas were not neglected. It is planned progressively to fill major gaps in coverage. Already, work on North Caicos has been increased considerably.

1.8. Structure of this plan

Following the Introductory material in Part 1 of this Plan, Part 2 describes the important features of the area in the light of the best available information. This results from the scientific surveys in the Darwin Initiative project, together with collation of local knowledge and other sources.

Part 3 briefly evaluates overall objectives in the light of this material, serving as the basis for Part 4, which is the operational part of the Plan.

Several Appendices contain supporting information, to which reference is made in the main parts of the Plan.

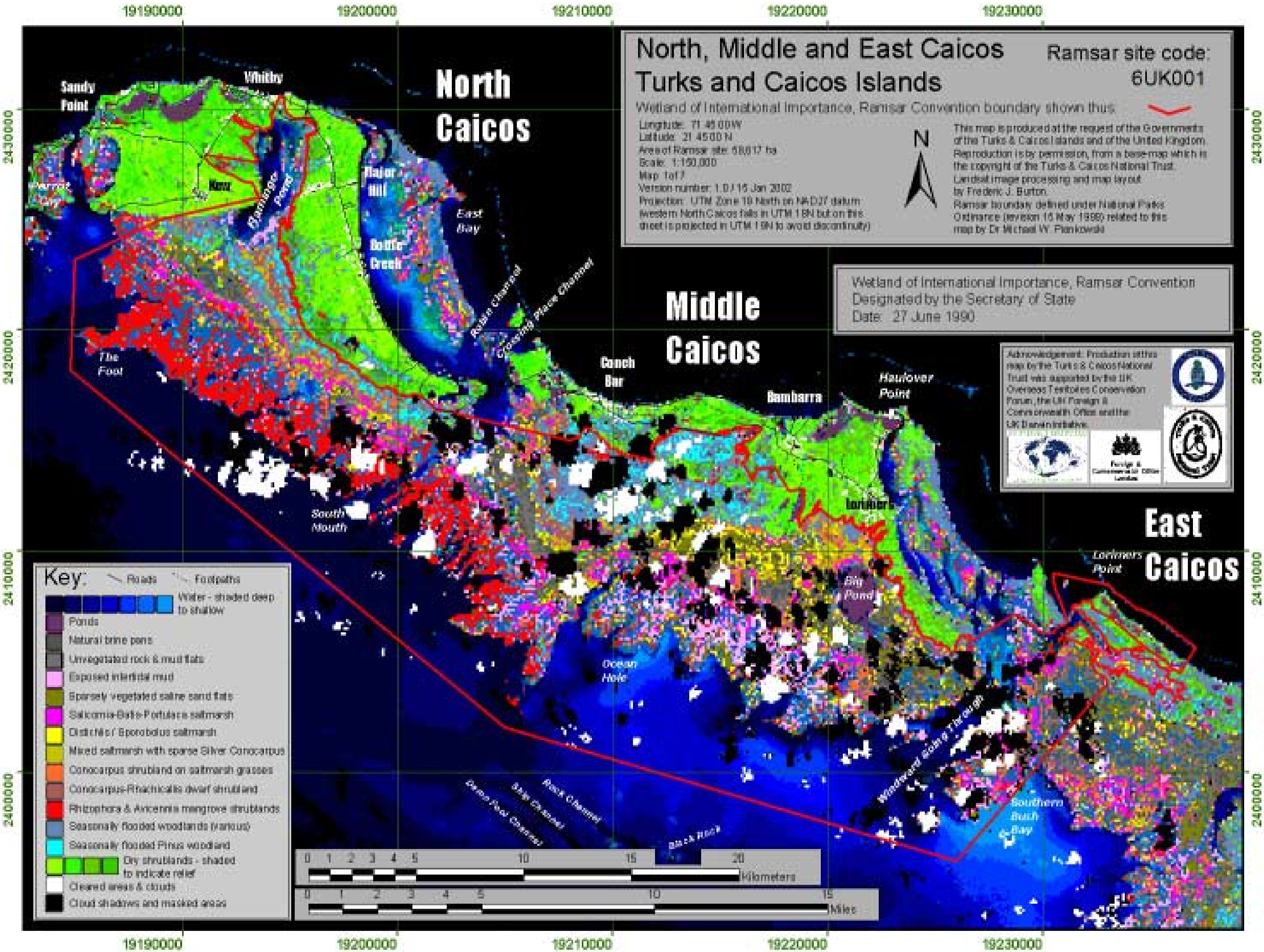
North, Middle and East Caicos
Turks and Caicos Islands
Ramsar site code:
6UK001
Wetland of International Importance, Ramsar Convention boundary shown thus
Longitude: 71 45 00W
Latitude: 21 45 00 N
Area of Ramsar site: 58,617 ha
Scale: 1:150,000
Map: 1of 7
Version number: 1.0 / 15 Jan 2002
Projection: UTM Zone 19 North on NAD27 datum (western North Caicos falls in UTM 18N but on this sheet is projected in UTM 19N to avoid discontinuity)
N
This map is produced at the request of the Governments of the Turks & Caicos Islands and of the United Kingdom. Reproduction is by permission, from a base-map which is the copyright of the Turks & Caicos National Trust. Landsat image processing and map layout by Frederic J. Burton. Ramsar boundary defined under National Parks Ordinance (revision 15 May 1998) related to this map by Dr Michael W. Pienkowski
Wetland of International Importance, Ramsar Convention
Designated by the Secretary of State
Date: 27 June 1990
Acknowledgement: Production of this map by the Turks & Caicos National Trust was supported by the UK Overseas Territories Conservation Forum, the UK Foreign & Commonwealth Office and the UK Darwin Initiative.
Foreign & Commonwealth Office London
North Caicos
Middle Caicos
East Caicos
Sandy Point
Whitby
Kew
Flamingo Pond
Major Hill
East Bay
Bottle Creek
Parrot Cay
Juba Channel
Crossing Place Channel
Conch Bar
Bambarra
Haulover Point
Lorimers
Lorimers Point
Big Pond
The Foot
South Mouth
Ocean Hole
Windward going Through
Southern Bush Bay
Rock Channel
Ship Channel
Drum Pool Channel
Black Rock
Key:
Roads
Footpaths
Water - shaded deep to shallow
Ponds
Natural brine pans
Unvegetated rock & mud flats
Exposed intertidal mud
Sparsely vegetated saline sand flats
Salicornia-Batis-Portulaca saltmarsh
Distichlis / Sporobolus saltmarsh
Mixed saltmarsh with sparse Silver Conocarpus
Conocarpus shrubland on saltmarsh grasses
Conocarpus-Rhachicallis dwarf shrubland
Rhizophora & Avicennia mangrove shrublands
Seasonally flooded woodlands (various)
Seasonally flooded Pinus woodland
Dry shrublands - shaded to indicate relief
Cleared areas & clouds
Cloud shadows and masked areas
0 1 2 3 4 5 10 15 20 Kilometers
0 1 2 3 4 5 10 15 Miles
19190000
19200000
19210000
19220000
19230000
2430000
2420000
2410000
2400000

Figure 1 (on previous page). North, Middle and part of East Caicos, showing the boundary of the Ramsar site. (Note that this is a reduced version of the map, so that the actual scale is about 1:200,000, as reflected by the scale bars.) The key is amplified in section 2.2.1.

Part 2. Description

This part brings summarises the main results of the Darwin Initiative project studies, together with a collation of relevant material from other sources. This serves to describe the main features of the area, as a basis for later parts, which analyse the work needed. Analysis of much of the Darwin Initiative material continues, and future editions of the Plan will incorporate this and other material as it becomes available.

2.1. Geography

2.1.1. Geology

The Bahamas Platform (also including Florida, Turks and Caicos and nearby areas) was formed about 150 million years ago. Sealey (1994) gives a convenient summary of the geological history of the region, and this is summarised below.

From about 200 million years ago, the North Atlantic Ocean was created when North America drifted away from Africa and Europe. By about 150 million years ago, fault lines in the opening rift created a triangular projection off the south-east coast of North America, the Bahamas Platform. The areas that became southern Florida and the Turks and Caicos Islands were all part of the Platform. The Caribbean Sea and West Indian Islands had not yet been formed. (Dietz *et al.* 1970). At the boundary of North America and the Atlantic Ocean the continental crust was stretched and thinned as Africa pulled away from it. This thinning crust began to be flooded by the new ocean, and sediments were laid down in the shallow seas so formed. As the stretching went on, the crust got thinner and weaker. As the sediments got heavier they weighed down on the weakened crust, forcing it to sink. (The widening of the Atlantic is still going on today, although at a slower rate believed to be about 2.7 cm (1.1 inch) a year. The stretching of the crust has probably now stopped altogether.)

Boreholes have shown that a very unusual origin for the rocks of this platform. Despite drilling as deep as 6 000 metres (20 000 feet), volcanic material has never been encountered. The rocks are all of the same type, shallow water carbonates, and these can only have formed near the surface. Virtually all the rock (possibly except the deepest from one borehole, which may illustrate the basal layer) is no older than the Cretaceous Period, that is 135 million years old. Virtually all these rocks are of marine origin, except some fossil soils and sand-dune rock (aeolian limestone). This suggests that the region has always had a marine environment from the time of its formation until the recent Ice Ages.

The great thicknesses of limestones of consistent type, down to at least 6 000 m (20 000 ft – as deep as the ocean is today), and total absence of any other rocks is both remarkable and unique. To produce this, two processes had to be occurring: the production of sediment at a fairly rapid rate in a shallow marine environment; and subsidence of the crust on which the region stands. The rate of subsidence had to be fairly slow so that the water did not get too deep for the processes to continue, but not so slow that sediments appeared for prolonged periods above sea-level. Furthermore, geographical conditions at the surface must have been fairly similar throughout this period, an area of shallow seas and banks.

The Turks & Caicos are geologically related to their neighbours – the Bahamas and the Blake Plateau to the north, Florida, and Northern Cuba. Throughout this region similar conditions existed. The Blake Plateau which lies to the north can be considered to be a submarine extension of the Bahamas that was drowned about 80 million years ago, but carried on sinking so that it is now under 900 metres (3 000 feet) of water. Cuba is rather different from the other islands because it has been subjected to mountain building at its extremities, but virtually all of northern Cuba has had the same history as the Bahamas and Turks & Caicos – shallow water carbonate deposition for 200 million years. Much of mainland Cuba is a flat limestone plain, and numerous islands fringe the northern shores.

All this time the region was nearly at sea-level, and probably formed a single vast marine plain dotted with islands. This situation changed only when, in some areas, the rate of adding sediment became less than the rate at which the crust below it was sinking.

About 80 million years ago there must have been a major change in the environment. Perhaps it was the creation of the Gulf of Mexico which led to the flooding of the region by the waters of the Gulf Stream. If so, this strong current may have carried the sediments away, or the changing conditions may have stopped the production of sediment. In either case, the absence of a build-up of sediment in some parts of the sinking platform would have led to flooding and submergence. Perhaps there was an excess of sediment which smothered and killed the coral reefs. Whatever happened, the result was:

- the drowning of the Blake Plateau;
- the separation of The Bahamas from Cuba and Florida;
- the disintegration of the south-eastern Bahamas and the Turks and Caicos Islands into a series of small banks (with low islands on them), surrounded by a complex system of troughs and basins over 1800 metres (6 000 feet) deep;
- the creation of troughs and channels within and between the Little and Great Bahama Banks.

The banks have been evolving since Cretaceous times, even if there was a single event that disrupted the original platform. Mullins & Hine (1989) suggests that several processes are at work:

- step-faulting or rifting which creates troughs or channels; this lowers the sea-bed below the depth at which shallow water sedimentation can occur.
- in-filling of these troughs by lateral accretion: sediment is swept into the channels from the adjacent banks to windward.
- scalloping of the bank margins which creates crescentic embayments; as this continues the bank is progressively destroyed. It has been suggested that this is what produced the fragmentation of the southeastern Bahamas and Turks & Caicos, perhaps because scalloping was more active in this area.

Observation of the bank margins from research submarines suggests that this kind of erosion is most active on the windward sides. Erosion takes the form of collapse of portions of the bank edge, in much the same way that a cliff face collapses. The collapsing leaves crescentic embayments in the platform edge. Successive collapses over millions of years create a progressive destruction of the bank, like the headward erosion of river valleys, and this may account for the large semicircular embayments found in the Columbus Basin, and at the head of the Tongue of the Ocean, today.

In the case of the Tongue of the Ocean it, should be noted that its general alignment follows subterranean faults in NNW/SSE direction, but that the southern extension of the 'tongue' is a huge embayment oriented to the east. Even bigger is the Columbus Basin to the south-east of the Tongue of the Ocean, and it can be conjectured that if scalloping and headward erosion continue the Tongue and the Columbus Basin will join, and the Great Bahama Bank will be split in two. In the case of the Turks & Caicos Islands and the south-eastern Bahamas it has been suggested that this has already happened. This area is much closer to the North American Plate margin than the northern Bahamas, and it is therefore more likely to be affected by plate movements. Earthquakes along the plate margin (in the vicinity of Cuba and Hispaniola), would provide just the right kind of shock-waves to trigger the collapse of unstable masses along the edge of the bank. As the Bahamas platform is much narrower in this region anyway, channels could have been cut through it more quickly than in the north, such as the Crooked Island Passage, the

Mayaguana Passage and the Caicos Passage.

However they were formed, the deep-water troughs and channels receive much less sediment than the shallow-water areas. Some sediment undoubtedly enters them from catastrophic collapses along the bank edge, and these avalanches have been identified as turbidity currents as they continue across the sea floor. In addition there is a continuous fine ‘rain’ of minute particles from the banks. This settles over the deepwater sea-bed as an *ooze*, which is the only sediment found in areas far from land. During the current geological era, known as the Quaternary Era, some 120 metres (400 feet) of sediments have been laid down over Andros, but only a metre-thick layer of ooze has been deposited in the adjacent Tongue of the Ocean and Providence Channel. Consequently, sedimentation in these areas did not keep up with the subsidence of their floors, which now lie well below the level of the banks.

On the banks themselves, sedimentation continued, accumulating at a rate of about 2 cm (0.8 inches) per 1 000 years. Each bank is a self-contained system, usually referred to as an atoll. In it a variety of sediments are produced, but these would simply be washed away and lost were it not for the retaining walls of the atolls the coral reefs. In many ways the atolls, whatever their shape, can be likened to a bucket of sand (the loose sediments) with the sides of the bucket (the coral reefs) holding it in. (The term ‘atoll’ is not meant to imply the volcanic origin so common in Pacific atolls. Atolls are marine sedimentary structures whatever they are built on.)

The sculpting of these rocks depended largely on actions in the Pleistocene Ice Ages, which began approximately two million years ago, and may not have ended yet. Four main periods of glaciation are known, separated by three interglacials. These interglacials were periods when the climate was probably fairly similar to the present time.

When snow fell in the higher latitudes, it did not melt in summer and return to the oceans. Instead, it accumulated in great ice caps and glaciers on the land, so the level of the oceans dropped. The best evidence suggests that, in the third glacial, sea-level in the region fell by well over 120 metres (400 feet), and, in the last one, by just under 120 metres. Glaciation was not a simple process and the effect on sea-level was quite varied, with a minimum of about -120 metres (-400 feet) and a maximum of about +6 metres (+20 feet).

As sea-level fell, the oolite was blown up from the beach to form dunes. When sea-level fell farther no more oolite was formed, and the land was covered with vegetation. When sea-level rose enough to flood the banks, new sediment was formed and was washed up on new beaches. Eventually, a new line of dunes was formed. In the next glacial period sea-level fell again and the cycle was repeated. As the winds blew across the new land, the oolitic sand was piled into great sand-dunes at right angles to the wind. The ridges are complex, being comprised of many dunes, some of which were eroded and all of which were superimposed on others, and in turn often buried. The dunes harden as rock ridges.

It was not, of course, necessary for the sea to drop hundreds of metres for the sand to be piled into dunes – it only needed to be left a few metres above sea-level. Over the whole period of the Ice Ages, sea-level fell sufficiently to expose the banks at least four times. Periods of drowning in-between created fresh oolite, and so a fresh line of dunes, later to become ridges, could be formed.

Of great importance to the later development of the ridge is the cave and its related features. Caves occur in all the other landscapes as well, but usually these are so low-lying that the caves are flooded. Those associated with the blue holes are good examples of this. It is only when a cave is found on relatively high ground, well above the water table, that it is dry and accessible.

Limestone is a rock which dissolves easily in rainwater, which is why there are no rivers. Instead, the water finds its way underground, eventually to the water table. Caves are the result of this downward movement, and usually a cave consists of two sets of characteristics as a result. It will have vertical sections, where the water is falling downwards, and horizontal sections where the water, now an underground stream, is flowing, probably towards the sea.

The reason for having several levels may be explained, by each one representing a different water table level. Water-table levels are related to sea-level, and as the sea-level changed so did the water-table, with underground streams moving to different depths or levels. The base of the fresh-water lens, where fresh water meets salt water in the mixing zone, has chemical conditions which cause increased rock dissolution. As a result, whilst both the top and the bottom of the fresh water lens are the zones for cave formation, where these layers meet, at the edge of the lens, is likely to be most favourable for dissolution and cave formation.

Blue holes and underground caves are features which can be formed only above sea-level. In addition, some of the features connected with them, such as stalactites, are further evidence of an atmospheric origin. Consequently any, depth recorded for a blue hole will also be an indication of how low sea-level was at that time. Several blue holes reach 130 metres (400 feet) or more. This is why some blue holes are in the sea. (when they may also be called ocean holes). During the periods of glaciation, both the entire Caicos Bank (as well as the entire Turks and other Bahaman banks) were dry land, and would have been subject to erosion and solution. Blue holes would have formed in many areas, but most of them would have been filled in by marine sediments once the rising sea covered them up. In some areas they have stayed open. This could well be due to the passage of water through them as the tides rise and fall, particularly if there is an outlet into deep water.

2.1.2. Tides and Currents

The following notes are based on direct observations, reports by local people and information in Pavlidis (1998).

The islands of the Turks and Caicos are affected by the west setting North Equatorial Current on both their northern and southern extremities. After entering the Caribbean the North Equatorial Current splits into two branches, the northern branch flowing northeast of the Turks and Caicos and the Bahamas as the Antilles Current, with an average velocity of approximately 0.5 knot. To a lesser extent the Antilles Current also flows through the Old Bahama Channel along the northern coast of Cuba and through the islands of the Turks and Caicos themselves. The more southern branch of the North Equatorial Current makes its way around the Caribbean and the Gulf of Mexico and enters the Straits of Florida as the Gulf Stream, with an average velocity of approximately 2.5 knots in a northward direction. Once north of the Bahamas, the stronger Gulf Stream merges with the weaker Antilles Current and bears off north and northeastward across the North Atlantic.

Where the shallow banks drop off to deeper ocean waters, the tidal currents flow in and out of the passes and cuts, sometimes reaching 2-4 knots in strength, and even more in a few of the more narrow passes. Some cuts may be impassable in adverse wind conditions or in heavy swells that may exist with or without any wind.

Tidal amplitude varies from less than 1 m (about 2 ft) at neap tides to a little more than 1 m (about 4 ft) at spring tides (at new and full moon). In the complex system of channels, tidal delays may occur, and the regular sine-curve of water-levels may become very distorted, often with the flow (rise) occurring in a much shorter time than the ebb (fall). Tides on the Caicos Banks are generally northwest on the flood and southwest on the ebb with an average strength of approximately 1 knot. However, in the more complex channels, the current may often appear in places as a swift flowing river, and currents may flow from 2.5 to over 4 knots.

Tides depend more on wind and pressure than regular tidal cycle proper. In the Lorimers vicinity (and generally in the shallows on the Caicos Bank on the south side of the islands), strong and persistent northerly winds may keep water down. Strong southerly winds will give the southern shore higher tides than normal. (However, this sort of feature normally varies locally depending highly on local topography. Caution needs to be observed, not least because strong winds can markedly affect both tidal range and flow velocity.)

Senior local residents report that one can walk between islands (crossing creeks in correct tidal conditions), and that this was formerly the main means of travel, and of moving livestock. Again, local knowledge would be required to use this method safely, and – even in the most favourable tidal conditions – is likely to require at least very deep wading, if not swimming, across channels. It is not advised.

2.1.3. Climate

(Modified from Pavlidis 1998) The climate is generally warm and dry, with occasional heavy rain. The Turks and Caicos Islands lie in the path of the northeast trade winds. Temperatures usually stay in the neighbourhood of 70º-85ºF (21º-29ºC). Winter temperatures in the Turks and Caicos rarely fall below 60ºF (16ºC) and generally are above 75ºF (24ºC) in the daytime. The average year-round temperature in the Turks and Caicos is 83º F (28ºC). During the summer months the lows are around 75º-78ºF (24º-26ºC) while the highs seldom rise above 90ºF (32ºC) except in the hottest months of September and October when they can reach 95ºF (35ºC). Seawater temperatures normally vary between 74ºF (23ºC) in February and 84ºF (29ºC) in August. The trade winds also bring rain to these islands, although there can be prolonged droughts. Grand Turk averages 20" (50 cm) per year while the Caicos group averages around 40" (100 cm) per year. The rainiest month is May; the summer months may see a lot of rain depending on the actions of tropical waves and hurricanes. In the winter, rainfall is dependent upon frontal passages.

Humidity is fairly high all year long, especially during the summer months, but breezes can lessen the effect. In the summer, winds tend to be light, 10 knots or less from the southeast with more calms, especially at night. In the winter, the prevailing winds are east-southeast and stronger. It is not unusual to get a week of strong winds, 20 knots or more, during the winter months as fronts move through. These fronts tend to move through with regularity during the winter months and become more infrequent as spring approaches. The wind will usually be from the southeast or south before a front and will often be very light to calm. As the front approaches with its telltale bank of dark clouds on the western and northwestern horizon, the winds will steadily pick up and move into the south-west, west, and northwest. Strongest winds are usually from the west and northwest. After the front passes the winds will move into the north and northeast for a day or two before finally settling back into an east/southeast pattern until the next front. Winds just after the front tend to be strong and the temperature a little cooler.

In the summer the weather pattern is typically scattered showers with the occasional line squall. Although the main concern during June through November is hurricanes, the Turks and Caicos are more often visited by a tropical wave with its strong winds and drenching rains. Tropical waves, sometimes called easterly waves, are low pressure systems that can strengthen and turn into a tropical depression or hurricane.

2.1.4. Wetlands background

The early report on the potential Ramsar sites in the Turks & Caicos (Clarke & Norton 1987) provides a useful background to the wetlands, and parts of its background are summarised below.

The total exposed flat limestone formations of the Bahama and Turks & Caicos islands (11,406 km^2) is comparable to the size of Jamaica, while the submerged banks cover ten times that area. The Turks and Caicos are structurally part of the southern Bahamas group, receiving only about half the rainfall of the northern islands (Grand Turk has a mean annual precipitation of 729.7 mm/28.73"). The Turks and Caicos Islands are therefore examples of small dry islands, and lack large watershed systems such as rivers and estuaries. Instead there are relatively large areas of shallow marine banks and intertidal creeks, lagoons and flats. Inland water bodies are made up of salinas and salt ponds, with relatively few freshwater formations such as marshes and sinkholes.

The shallow submerged banks (delimited by the 100 fathom depth contour) are made up of the Turk Island Bank (254 sq km) and the Caicos Bank (5,334 sq km), of which a substantial proportion is less than 1 fathom deep. There are an additional 38,000 ha of intertidal sand banks and mud flats. Of the 500 sq km (50,000 ha) total dry land area of the Turks and Caicos Islands, 26,669 ha (over half the land area) are wetlands (Directory of Neotropical Wetlands, Scott & Carbonell1986).

Clarke & Norton (1987) note the following main wetland types.

Submerged Sand Bank – this habitat covers vast areas on the southern side of the island group. Of these shallow water banks, approximately 15% is less than 1 fathom in depth. The banks are part of the Bahama oolite formation laid down by the action of abundant bacteria. The substrate is generally silty sand worked by tidal currents which vary with the topography. There are scattered clumps of sponges, algae and sea grasses; callionassid shrimp mounds are common and shallow water corals and reef fish occur. Whilst not great in diversity, the extent of this habitat makes it very significant in terms of the productivity and nutrient cycling of the island ecosystem. It forms important feeding grounds for juvenile green turtles (endangered species), bonefish, tarpon, and mullet (commercial species).

Intertidal Sand and Mud Flats – Intertidal and occasionally flooded flats make up another large habitat type comprising 38,000 ha. Bare sand and mud is interspersed with salt marsh plants such as glasswort *Salicornia* spp., marsh grass *Distichlis* and stunted mangroves. These flats form important feeding areas for birds during low tides and fish during high tides.

Lagoon – Protected inlets which are tidal and open to the sea at least at very high tides. Together with Mangrove Swamp, this habitat type forms 25% of all wetlands. Typified by a thick border of red mangroves *Rhizophora mangle* around open water, with other marine elements such as algae, coelenterates, nereid worms, tunicates and ophuroids. The lagoon is a productive system with thick soft mud substrate and abundant invertebrates, forming important feeding areas for birds and commercial fish species during juvenile stages.

Mangrove Swamp – This can intergrade with Lagoon habitat but generally Mangrove Swamp is more or less enclosed and has less marine influence. Salinity is variable but conditions are generally hyposaline. Vegetation is patchy with clumps of red, black and button mangrove interspersed with pools and mud. Drier areas support marsh plants and this can intergrade with marshland. The larger more isolated swamps provide feeding and breeding sites for a variety of waterbirds including the threatened West Indian whistling duck *Dendrocygna arborea*.

Salt Pond – Periodically connected to the sea if only during storms, salt ponds are discrete water bodies bordered by a narrow zone of mangrove species. Underlying the open water, soft mud supports limited submerged vegetation. Marsh plants grow along the edges including *Marsilea nashii* which is endemic to the Southern Bahamas. The shallow water provides ideal feeding areas for resident and migrant waders, herons, terns and gulls. Salt Ponds make up about 20% of wetland types.

Salina – [Note that this is the technical usage. Locally, "salinas" can refer also to the flats.] Salinas are inland ponds which are generally hypersaline. The shallow open water often dries out and salt crystalises along the edges. When recently inundated, brine shrimp *Artemia maritima*, a favoured food of the flamingo, can become abundant. The pond is bordered by buttonwood, usually the silver variety *Conocarpus erectus* var. *griseus* and salt marsh plants. If large and isolated, salinas provide feeding and nesting habitat for flamingos. Salinas make up about 45% of wetland types.

Sinkhole – These are usually circular holes in the limestone rock holding fresh to hyposaline water. Often fairly deep, they provide important permanent freshwater habitat which supports submerged vegetation and a wide variety of invertebrates. Where connected to underground cave systems, some unusual crustacea may occur. This is important feeding and nesting habitat for water birds such as the Least Grebe.

Marshland – This includes the range of freshwater to saline formations with fluctuating water levels and marly type soils which makes up about 10% of wetland types. Vegetation is dominated by grasses, sedges, spikerush and reedmace (*Cladium, Cyperus, Echinodorus, Eleocharis* and *Typha*) and can intergrade with more marine elements (e.g. *Distichlis* and *Batis*). Marshlands provide rich feeding grounds for resident and migrant waders, herons and ducks including the threatened West Indian whistling duck *Dendrocygna arborea*.

2.1.5. Map features and place names

There is good general agreement between the published 1:25,000 maps and the Darwin Initiative maps, based on satellite imagery and ground survey. With the capabilities of the more modern technique, more precision on vegetation types and other habitat features was possible. The new satellite-based maps also take the opportunity to update the information on new roads. Geographical Positioning System information collected on ground surveys was also deployed to add information on trails through tall vegetation, which are otherwise not detectable either by the aerial photography on which the early published maps were based or by the satellite imagery.

It should be noted that (as is not infrequent in maps anywhere), there is some local variation in place names. In some cases, different local people may attribute a place name to different features, in some cases overlapping. Attempts have been made with the recent map to avoid this as much as possible. However, it is desirable to avoid ambiguity by using grid references in support of records as much as possible.

2.1.6. General topography and walking conditions

The general structure of the main Caicos Bank islands is:

- on the northward side, a reef between the reef-edge to deep water and the shore;
- the shore, in some areas backed by dunes;

- a dry scrub area, grading in places to taller woodland and forest, with a fairly sharp break to the flats;
- the flats progressively grade to deeper water over the bank.

Generally speaking, the dry area forms the largest proportion in the west (Providenciales) and least in the east (East Caicos), where the wet flats dominate, with intermediates on islands between.

This basic pattern is complicated by ponds, creeks and lagoons in any of the zones.

The shore is generally easily walkable, albeit sometimes laborious if the sand is soft (or the wind blowing) or slippery on some of the rocky areas.

Some parts of low maritime scrub on the northern edges of Middle and East Caicos are slightly less dense than the standard scrub (see below), and consequently rather more crossable.

The main dry scrub areas provide a major challenge to access. Most of the old tracks (marked as red lines on the 1:25,000 map) as well as some of the old roads are now overgrown with scrub, and are impassable without a cutlass. The scrub generally is solid and impenetrable off the track, unless new tracks are cut. This has implications for surveying in the scrub (a network of paths would be necessary, and sound-based methods desirable where practicable); for reaching the ponds; and for reaching the open flats habitat (beyond the scrub).

The ponds, generally within this scrub zone, are extremely varied in appearance and nature, even adjacent ones (see also Clarke & Norton 1987).

Once reached, the flats ("salinas") generally provide easy walking, although the surface may be slippery mud, and sometimes covered with shallow water. Care needs to be taken to avoid quicksand areas. These seem to be particularly the case in some lagoons with permanent water, such as Big Pond, although the dry beach there is firm.

Much of the flats have open, low mangrove savannah vegetation. In addition, dense mangrove strips occur along channels, giving an amazingly patterned landscape appearance from the air. Quite a number of distinct ponds exist, even within the flats.

There are many complex habitat gradations throughout the area, these essentially natural transition features being one of the major scientific and conservation interests of the area.

Particularly after rains, the area is remarkable for its densities of mosquitoes. These show considerable variations in density and activity in different habitat zones. By some of the ponds and particularly on wet areas of the flats, at such seasons, chemical repellent is largely ineffective. Locally made whisks are slightly more so. Head netting, thick clothing and gloves are strongly recommended in such situations.

2.2. Biodiversity description

2.2.1. Mapping and vegetation classification

An accurate map showing the distribution of different habitats and ecosystems within a site is fundamental to effective management planning. Fred Burton, of the Cayman Islands and formerly Programme Director of the Cayman Islands National Trust, led for the Darwin Initiative project on the production of such a map for the Turks & Caicos Islands Darwin Project. The starting point was a satellite image, which was classified and ground-truthed. Roads, trails and boundaries were added subsequently. The resulting map is shown at Figure 1. Further work is in hand to refine the dry-ground classification.

The final classifications are noted below, and related also to Ramsar Convention classifications, and the occurences of these within the designated Ramsar site.

Ramsar class A: Shallow marine waters

Water

Open seawater over sand banks south of the Caicos Islands, and in channels between them. Bottom vegetation not described or mapped.

Ramsar class B: Marine beds

Water
Open seawater over sand banks south of the Caicos Islands, and in channels between them. Bottom vegetation not described or mapped

Ramsar class C: Coral reefs

Water
Typical Caribbean barrier reef communities, including a reef crest and a back-reef lagoon off the north shore of East Caicos.

Ramsar class D: Rocky shores

Ramsar class E: Sand / shingle shores (including dune systems)

Ramsar class G: Tidal flats

Water
Low tidal flats which were flooded at the time of satellite image acquisition, showing as shallow water on the map, are unvegetated sand and silt substrates.

Exposed intertidal mud
Unvegetated sand and silt substrates exposed at the time of satellite image acquisition.

Ramsar class H: Salt marshes

Salicornia-Batis-Portulaca saltmarsh
A succulent herbaceous salt marsh community, on a flat calcareous silt substrate. Dominated by *Salicornia virginica, Salicornia bigelovii, Batis maritima*, and *Portulaca rubricaulis. Lycium tweedianum, Chamaesyce vaginulatum, Sporobolus virginicus*, and scattered *Avicennia germinans* shrubs may be present.

Distichlis / Sporobolus saltmarsh
A grass-dominated salt marsh community, on a flat calcareous silt substrate. Dominated by *Sporobolus virginicus* and *Distichlis spicata* in varying proportions. *Borrichia frutescens, Salicornia virginica, Salicornia bigelovii, Lycium tweedianum, Portulaca rubricaulis*, with *Conocarpus erectus* as isolated shrubs or trees, may be present.

Mixed saltmarsh with sparse silver Conocarpus
Scattered *Conocarpus erectus* var. *seriacea* shrubs and trees forming up to 20% cover on a calcareous silt substrate with emergent limestone bedrock. *Sporobolus virginicus, Salicornia virginica, Rhachicallis americana, Borrichia frutescens, Portulaca rubricaulis, Salicornia bigelovii, Fimbristylis ferruginea*, and *Batis maritima* form a partial ground cover in varying combinations. *Avicennia germinans* may be present as a rare emergent shrub or tree.

Ramsar class I: Mangrove / tidal forest

Rhizophora & Avicennia mangrove shrublands
Mangrove shrubland communities 1 metre tall, forming 40% - 60% cover on soft calcareous mud covered with a thick algal turf, and a network of tidal creeks. Ranging from monospecific *Avicennia germinans* at the landward extreme of the community, through mixed *Avicennia germinans – Rhizophora mangle*, to monospecific *Rhizophora mangle* towards the seaward edge.

Rhizophora, Avicennia and *Laguncularia racemosa* shrublands also occur in more inland sites, associated with *Conocarpus erectus* and succulent halophytes on pond fringes and in seasonal floodwater channels.

Ramsar class Q: Saline / brackish lakes – permanent

Ponds
Shallow brackish to hypersaline ponds, usually narrowly fringed by mangroves and succulent halophytes and otherwise unvegetated. Water levels fluctuate seasonally and many ponds may dry out periodically or seasonally, grading to class R below.

Ramsar class R: Saline / brackish lakes – seasonal / intermittent

Ponds
See Q above.

Ramsar class Ss: Saline / brackish marshes – seasonal / intermittent

Unvegetated rock & mud flats
Rock pavements and dark calcareous silt flooded by seasonal/intermittent expansion of natural brine pans. Virtually devoid of higher plants due to extremely high salinity. Slightly raised rock areas may rarely support a few prostrate *Conocarpus erectus*, severely stunted *Avicennia germinans*, *Salicornia virginica* or *Rhachicallis americana*.

Sparsely vegetated saline sand flats
Approximately 75% unvegetated sand with a thin algal crust, supporting local aggregations of *Avicennia germinans* shrubs, and the succulent halophytes *Portulaca rubricaulis, Salicornia virginica* and *Suaeda conferta.* Intermittently flooded by rain and/or tide. Old flamingo nests were observed in this habitat.

Ramsar class Sp: Saline / brackish marshes - permanent

Natural brine pans
Depressed rock pavement areas, intermittently filled by high tides, becoming extremely hypersaline due to evaporation, forming crystalline salt at the margins. No vegetation.

Ramsar class W: Shrub-dominated wetlands

Conocarpus shrubland on saltmarsh grasses
Conocarpus erectus, usually var. *seriacea*, forming a 1-3 metre seasonally flooded shrubland over a herbaceous community dominated by *Sporobolus virginicus* or occasionally *Distichlis spicata*. *Conocarpus erectus* var. *erectus* is often present as a prostrate shrub, with *Salicornia virginica, Portulaca rubricaulis, Borrichia frutescens, Rhachicallis americana, Jacquinia keyensis, Rhynchospora colorata, Fimbristylis ferruginea, Agalinis maritima,* and occasionally *Rhizophora mangle* and/or *Avicennia germinans* as shrubs.

Conocarpus-Rhachicallis dwarf shrubland
A seasonally flooded, shrubland with most woody vegetation dwarfed, on calcareous silt with emergent limestone bedrock. Dominated by prostrate *Conocarpus erectus*, with *Rhachicallis americana, Rhizophora mangle, Jacquinia keyensis, Manilkara bahamensis, Thrinax morrisii, Borrichia frutescens, Coccoloba uvifera, Cladium jamaicense, Swietenia mahagoni, Gundlachia corymbosa*, *Strumpfia maritima, Crossopetalum rhacoma*, *Sophora tomentosa, Fimbristylis ferruginea,* and *Distichlis spicata.*

Ramsar class X: Tree-dominated wetlands

Seasonally flooded woodlands (various)
1). *Conocarpus erectus*, including var. *seriacea*, forms seasonally / intermittently flooded woodland communities on very slightly raised sand banks amid tidal flats. The tree layer may be monospecific, or may variously include *Pithecellobium keyense, Dodonea viscosa, Guapira discolor, Swietenia mahagoni, Maytenus phyllanthoides* and *Metopium toxiferum*. The shrub layer may include the endemic *Eupatorium lucayanum*, *Crossopetalum rhacoma*, *Borrichia frutescens, Thrinax morrisii, Coccoloba uvifera*, and *Erithalis fruticosa*, while the herbaceous layer typically includes *Sporobolus virginicus, Chamaesyce vaginulatum and Lycium tweedianum.*

2). *Sabal palmetto* palms form seasonally flooded woodlands in association with *Gundlachia corymbosa* where fresh to brackish floodwater accumulates during the rainy season. The two species are strongly co-dominant, with *Distichlis spicata* often also abundant.

Seasonally flooded Pinus woodland
Pinus caribaea woodland occurs in extensive stands intermingled with other seasonally flooded habitats. The limestone bedrock has very thin soils, and many seasonally flooded sinkholes: the entire habitat floods with fresh water during periods of intense rain. *Sabal palmetto* and *Cladium jamaicense* grow in the sinkholes. The shrub layer is usually sparse, with *Coccoloba uvifera, Thrinax morrisii, Randia aculeata, Tabebuia bahamensis, Cassia inaguensis, Byrsinomia lucida, Lysiloma latisiliquum, Savia erythroxyloides, Conocarpus erectus, Metopium toxiferum, Acacia*

choriophylla, Swietenia mahagoni, Ernodea serratifolia and *Erithalis fruticosa*. Herbaceous species include *Rhynchospora colorata, Jacquemontia havanensis, Cassytha filiformis*, and the ground orchid *Spiranthes vernalis*.

Ramsar class Other

Dry shrublands, woodland and forest
Diverse xerophytic mixed evergreen–deciduous shrublands, merging to higher woodland and forest, on limestone bedrock and thin soils. Species composition varies with elevation above ground water, and exposure to salt spray. Abundant tree species include *Lysiloma latisiliquum, Coccoloba diversifolia, Tabebuia bahamensis, Coccothrinax argentata, Thouinia discolor, Metopium toxiferum, Acacia choriophylla, Cephalocereus millspaughii, Guaicum sanctum and Thrinax morrisii.* Several orchid species in the genus *Encyclia* are also widespread and conspicuous in these habitats. As noted above, further work is in hand to refine the dry-ground classification.

2.2.2. Plants

Plants represent some of the most important species in terrestrial ecosystems, "feeding" on sunlight by photosynthesis, and providing sustenance to the many organisms that feed on their leaves, roots, seeds and flowers. They also provide the structures in which many animals nest, hide from predators, or wait in ambush for their prey. Botanical survey work under the Darwin Initiative project was undertaken by Dr Gerald "Stinger" Guala and Jimi Sadle of the Fairchild Tropical Garden in Miami (*e.g.* see Guala, 2001), with valuable input from Fred Burton (Cayman Islands), Bryan Naqqi Manco and Kathleen Wood (Providenciales). The Turks & Caicos flora has attracted some previous study, principally during the compilation of the standard work on the plants of the Bahamas (Correll & Correll 1982). Indeed, the Turks & Caicos flora is essentially a subset of the Bahamian flora, reflecting the biogeographic, geological and climatic similarity of the Turks & Caicos to adjacent Bahamian islands. However, the Turks & Caicos flora contains a number of interesting and distinctive features, and the fieldwork conducted under the Darwin Initiative has produced a number of new plant records for the Islands, for example, *Malaxis spicata, Oldenlandia callitrichioides, Ponthieva racemosa* and *Psychotria nervosa*. Further new records are anticipated, as the plant specimens are processed. The material processed to date is summarised in the species list that follows:

Abrus precatorius L. Guala 2318
Acacia acuifera Benth. Guala 2311
Acrostichum aureum L. Guala 2358
Agalinis maritima (Raf.) Raf. JS070
Ambrosia sp. Guala 2343
Anthenophora sp. Guala 2291
Argusia gnaphalodes Guala 2337
Aristida ternipes Guala 2295
Asteraceae Guala 2300
Asteraceae Guala 2365
Boerhavia sp. Guala 2327
Boerhavia sp. Guala 2330
Borrichia sp. Guala 2288
Borrichia sp. Guala 2366
Bourreria ovata Micrs. Guala 2306
Bumelia americana (Mill.) Stearn. JS056
Byrsonima lucida (Mill.) DC. JS050
Caesalpinia sp. Guala 2316
Calliandra haematomma (Bert.) Benth. JS034
Canavalia sp. Guala 2342
Capparis sp. Guala 2335
Cassia sp. Guala 2348
Cassytha c.f. *bahamense* Guala 2302

Cassytha filiformis L. Guala 2305
Casuarina equisetifolia L. Guala 2338
Centrosema virginianum (L.) Benth. Guala 2281
Chaemasyce sp. JS036
Chamaecrista sp. JS033
Chamaesyce articulata (Aubl.) Britt. JS039
Chamaesyce blodegetii (Engelm. ex Hitchc.) Small. JS022
Chloris petraea Sw. Guala 2293
Cissus intermedia A. Rich. JS041
Clusia rosea Jacq. Guala 2321
Coccoloba sp. JS052
Coccoloba sp. JS057
Coccoloba sp. JS058
Coccothrinax sp. Guala 2315
Corchorus hirsutus L. JS024
Croton discolor Willd. JS037
Cuscuta cf. *americana* L. Guala 2280
Cynachum angustifolium Pers. JS072
Cynachum eggersi (Schlctr.) Alain. JS059
Cyperus fuligineus Chapm. JS027
Dactyloctenium aegypticum (L.) Beauv. JS020
Dodonea sp. Guala 2334
Eleusine indica (L.) Gaertn. Guala 2304
Encyclia hodgeana (Hawkes) Becker. JS060
Encyclia rufa (Lindl.) Britt. & Millsp. JS043
Eragrostis bahamensis Hitchc. Guala 2312
Eragrostis bahamensis Hitchc. JS031
Erithalis sp. Guala 2309
Ernodea sp. Guala 2349
Eugenia sp. Guala 2362
Eupatorium lucayanum Britt. JS038
Eupatorium odoratum L. JS044
Eupatorium sp. Guala 2283
Evolvulus arbuscula Poir. Guala 2282
Evolvulus bracei House. JS068
Fabaceae Guala 2355
Gochnatia paucifloscula (Wr. ex Hitchc.) Jervis ex Cabrera. JS053
Helichtris sp. Guala 2298
Heliotropium nanum Northrop. JS032
Hibiscus brittonianus Kearney. BM sn
indet JS035
indet JS047
indet JS051
indet. Guala 2310
indet. Guala 2332
indet. Guala 2339
indet. Guala 2340
indet. Guala 2352
indet. Guala 2364
Ipomoea triloba L. JS021
Jacquemontia cayensis Britt. JS062
Jacquemontia havanensis (Jacq.) Urb. Guala 2284

Jacquemontia havanensis (Jacq.) Urb. JS028
Jacquemontia havanensis (Jacq.) Urb. JS054
Launaea intybacea (Jacq.) Beauv. JS069
Leucaena leucocephala (Lam.) DeWit. Guala 2317
Limonium bahamense (Griseb.) Britton. JS073
Lithophila muscoides Sw. JS064
Lobelia lucayana Britt. & Millsp. JS063
Lysiloma sp. Guala 2356
Macroptilium lathyroides (L.) Urb. BM sn
Malaxis spicata Sw. BM sn new for TCI
Manilkara sp. Guala 2307
Melochia sp. Guala 2354
Melochia tomentosa L. Guala 2319
Melochia tomentosa L. JS023
Mimosa sp. Guala 2357
Oldenlandia callitrichioides Griseb. JS026 new for TCI
Oleaceae Guala 2285
Panicum sp. Guala 2353
Paspalum c.f. *blodgetii* Guala 2290
Paspalum millegrana Schrad. Guala 2363
Paspalum sp. Guala 2292
Passiflora sp. Guala 2301
Pavonia bahamensis A.S. Hitchc. JS061
Pectis linifolia L. JS030
Petiveria alliacea L. Guala 2324
Phyllanthus amarus Schum. JS066
Pinus caribea Morelet var. *bahamensis* (Griseb.) Barrett & Golfari. Guala 2347
Plumeria sp. Guala 2336
Poinsettia sp. Guala 2329
Ponthieva racemosa JS049 new for TCI
Psidium sp. Guala 2308
Psychotria nervosa Sw. JS046 new for TCI
Rhynchosia minima (L.) DC. JS040
Rhynchospora sp. Guala 2351
Rhynchospora sp. Guala 2360
Rivina humilis L. Guala 2322
Sabal palmetto (Walt.) Lodd. ex. Roem & Schult. Guala 2344
Salvia serotina L. JS025
Schizachyrium sp. Guala 2346
Setaria sp. Guala 2296
Sida acuta Burm. f. Guala 2326
Sida ciliaris L. JS067
Sideroxylon salicifolia JS045
Sideroxylon sp. Guala 2303
Smilax sp. Guala 2333
Solanum sp. Guala 2325
Spermacoce sp. JS029
Spigelia anthelmia L. JS065
Spigelia sp. Guala 2361
Spiranthes polyantha Reichb. f. JS048
Sporobolus sp. Guala 2289

Sporobolus virginicus (L.) Kunth. JS055
Sporobolus virginicus (L.) Kunth. JS071
Stachytarpheta jamaicensis (L.) Vahl. JS042
Stachytarpheta sp. Guala 2359
Stenandrium carolinae Leonard & Proctor ex. Leonard. BM sn
Stenotaphrum secundatum (Walt.) O. Ktze. Guala 2341
Stylosanthes sp. Guala 2320
Sueda conferta (Small) I.M. Johnst. JS074
Swietenia mahogani (L.) Jacq. Guala 2350
Tabebuia bahamense (Northrop) Britt. Guala 2297
Teramnus sp. Guala 2287
Thouinea discolor Griseb. Guala 2286
Tillandsia utriculata L. Guala 2331
Uniola paniculata L. Guala 2345
Verbena sp. Guala 2328
Xanthoxylum sp. Guala 2299
Paspalum fimbriatum Kunth. Guala 2294
Sterculiaceae Guala 2313
Conocarpus erectus L. Guala 2314
Cissus sp. Guala 2323

As well as leading the botanical fieldwork under the Darwin Initiative project, the Fairchild Tropical Garden is providing further support and facilities relevant to the on-going study of the plants of the Turks & Caicos. In particular, Fairchild administers an impressive “virtual herbarium”, where images of (and information on) individual plant species can be viewed through the internet. As well as the main Fairchild herbarium collection, other specimens (including the herbarium of the Cayman Islands National Trust) can be accessed here. It is anticipated that, as the specimens from Turks & Caicos develop towards a formal collection, these will also be made available electronically, courtesy of Fairchild. An initial set of Turks & Caicos specimen images is already accessible, and can be viewed at www.virtualherbarium.org/lf/tci/tci.html.

Amongst the plants recorded so far are tree species such as the Bahama Pine *Pinus caribea* var. *bahamensis* and Strong Back *Bourreria ovata*, and climbing plants including *Jacquemontia havanensis* and *Centrosema virginianum*. Amongst the ground flora are species such as Yellow Flower *Turnera ulmifolia* and Freda Bush *Rivina humilis*, both of which are said to have medicinal properties that make them useful components of a tonic, with particular value in the treatment of stomach ailments.

In parallel with plant survey work, Turks & Caicos National Trust staff are working on the Native Plant Nursery initiative. This centres on the propagation of native plants, and plants of traditional usage, for sale and distribution throughout TCI. Fundraising events were held on Providenciales and Grand Turk on Earth Day weekend, and the Grand Turk plant sale was particularly successful. The construction of a small temporary shade (made of local materials) was completed, and a large supply of used pots has been located. Plants are doing very well and more species are being propagated every week. Native plants of interest amongst those being cultivated are Frangipani *Plumeria*, Gumbo Limbo *Bursera*, Mahogany *Swietenia*, Necklace Pod *Sophora* and Geiger Tree *Cordia*. Plants of important cultural usage which are being grown include Burn Plant *Aloe*, Indian Almond *Termenalia*, Seville Orange *Citrus*, and Guinep *Melicoccus*. The National Trust plans to present trees to all schools throughout the islands for schoolyard plantings, and future sales will help to support the on-going propagation work.

2.2.3. Insects

Insects account for over half of the world’s biodiversity; of the approximately 1.75 million living species known to science, 950,000 are insects. The 1.75 million known species probably represent only 10% of the total number of living species, and under-studied groups of organisms like bacteria and fungi (and many marine taxa) are substantially under-represented. However, many insect species also remain to be discovered, and the dominance of insects as a component of global biodiversity is unlikely to be challenged (*e.g.* see Groombridge 1995).

Within terrestrial ecosystems, insects not only represent a massive proportion of the different species present, but often represent some of the most abundant organisms. The diversity and abundance of insects reflects their vital (but often overlooked) contribution to the functioning of healthy terrestrial ecosystems. For example, they provide a source of food for many other animals (and some plants), contribute substantially to the decomposition and "re-cycling" of organic matter, often help maintain the structure of the environment on which other species depend (including maintenance of soil condition) and provide pollination services to many plants. The ecological relationships between insects and plants within a given biological community are often particularly close.

As well as representing a significant proportion of global biodiversity in numerical and functional terms, insects can provide valuable resources available for direct exploitation by humans. As well as widely recognised products (such as honey and other bee products), services can be derived from insects. For example, their diversity and rapid response to environmental change makes insects an ideal group of organisms ("biological indicators") with which to measure the health of an ecosystem. Well-designed monitoring programmes, based on analysis of changing insect faunas, can provide valuable information on the integrity and stability of entire biological communities.

2.2.3.1. The insect fauna of the Turks & Caicos Islands

The relatively small area of the Turks & Caicos Islands, combined with relatively arid local conditions, will limit the number of insect species expected to occur here (as with other groups of animals and plants). Nonetheless, a fair representation of major insect taxa would be expected (as, for example, would be the case with the neighbouring southern Bahamian islands with which the Turks & Caicos share many biological characteristics). Around 30 taxonomic orders of insects are recognised under modern systems of classification (e.g. see Daly, Doyen & Purcell 1998; Gullan & Cranston 2000). Table 2.2.3a below summarises the likely representation of each of these insect orders in the Turks & Caicos Islands.

Table 2.2.3a. Likely representation of insect orders in the Turks & Caicos Islands.

Order	Common name	Global species no.*	Likely representation in the Turks & Caicos Islands (estimated species no.)**
Coleoptera	beetles	375000	Present (500)
Diptera	flies	250000	Present (200)
Lepidoptera	butterflies, moths	165000	Present (400)
Hymenoptera	ants, bees, wasps	120000	Present (200)
Hemiptera	bugs	82000	Present (100)
Orthoptera	grasshoppers, crickets, katydids	20000	Present (25)
Collembola	springtails	8000	Expected (15)
Trichoptera	caddisflies	7000	Unknown
Odonata	dragonflies, damselflies	5000	Present (25)
Phthiraptera	parasitic lice	5000	Expected (15)
Thysanoptera	thrips	5000	Expected (10)
Neuroptera	lacewings, antlions, owlflies	5000	Present (15)
Blattodea	cockroaches	4000	Present (10)
Ephemeroptera	mayflies	3000	Present (10)
Psocoptera	booklice, barklice	3000	Expected (10)
Phasmida (Phasmatodea)	stick insects	2500	Possible (5)
Siphonaptera	fleas	2400	Expected (10)
Isoptera	termites	2300	Present (10)

Plecoptera	stoneflies	2000	Unknown
Mantodea	mantids	2000	Present (5)
Dermaptera	earwigs	1800	Expected (5)
Diplura	diplurans	800	Unknown
Strepsiptera	strepsipterans	550	Unknown
Mecoptera	scorpionflies, hangingflies	500	Unknown
Thysanura	silverfish, firebrats	370	Unknown
Archeognatha	bristletails	350	Unknown
Megaloptera	alderflies, dobsonflies, fishflies	350	Unknown
Embioptera	webspinners	200	Not expected (0)
Raphidioptera	snakeflies	200	Unknown
Protura	proturans	175	Unknown
Zoraptera	angel insects	30	Not expected (0)
Grylloblattodea	rock crawlers	20	Not expected (0)

* approximate numbers of species known worldwide in each order (estimates derived from a number of sources).

** these estimates are gross approximations

The massive diversity and abundance of insects, and the limited taxonomic expertise available for many of the less-studied groups, makes a comprehensive characterisation of the insect fauna of even a limited area impractical under most circumstances. The resources and underlying objectives of the Darwin Initiative project Developing Biodiversity Management Capacity Around the Ramsar Site in the Turks & Caicos Islands required that a selective approach be adopted to insect biodiversity survey work. Consequently, two insect groups were selected for particular attention, the butterflies (a highly visible and attractive group, with flagship potential and likely appeal to eco-tourists) and the beetles (the single most diverse insect group, numerically and ecologically). Although limited data and observations were collected in relation to other insect groups, the most detailed work was conducted on these two.

The body of published information available on the butterflies and beetles of the Turks & Caicos Islands differs considerably. Although the butterfly fauna has not been studied in detail, some useful literature is available, including data that allow faunistic comparisons to be made with neighbouring southern Bahamian islands. The local beetle fauna, however, has attracted almost no previous attention, and useful comparative data are lacking. Consequently, the level of detail of information generated by the Darwin Initiative project for these two insect groups is quite different.

2.2.3.2. The butterflies of the Turks & Caicos Islands

The insect order Lepidoptera is made up of the butterflies and moths. In general terms, butterflies are day-flying, whilst moths are nocturnal. A small number of conspicuous, day-flying moths are present in the Turks & Caicos Islands, but the bulk of the moth fauna is active only at night. Although this group was not selected for particular attention under the Darwin Initiative project, a number of moth specimens were collected (particularly those attracted to light), and so some data will become available in due course.

Historically, work on the butterflies of the Turks & Caicos Islands has been sparce. Because of the islands' biogeographical association with the Bahamas, some ostensibly Bahamian collecting has extended into the Turks & Caicos Islands. Hence, some Turks & Caicos Islands butterfly records are given by Rindge (1955) on the basis of work conducted under the auspices of the Van Voast-American Museum of Natural History expedition to the Bahama Islands between December 1952 and May 1953.

Available literature hints at earlier collecting in the Turks & Caicos Islands, but details are not clear; Clench & Bjorndal (1980) refer to *Euphyes singularis insolata* being known "from a single old specimen in CM [Carnegie Museum] from Grand Turk", but provide no further information on the source of that material.

The original description of *Anaea* (=*Memphis*) *intermedia* is based on material collected from Grand Turk by N. Golding in the period December 1965 - January 1966 (Witt 1972). The corresponding NHM registration number BM 1966-44 [not BM 1965-44, as given by Witt] refers to 6 Lepidoptera from the Turks & Caicos Islands deposited by Golding. Three of these are listed as *intermedia* type specimens by Witt (1972), whilst the status (and identities) of the other specimens requires further research in the NHM collection. No further information on Golding's collecting in the Turks & Caicos Islands is readily available.

Harry Clench, the godfather of late twentieth century butterfly studies in the Bahamas, certainly collected in the Turks & Caicos Islands. Clench & Bjorndal (1980) record that he visited Grand Turk in 1978, and collected specimens of *Epargyreus zestos inaguarum* on Providenciales and North Caicos in the same year. Harry Clench's formal description of *Strymon acis leucosticha* (Miller et al., 1992) indicates that he collected this btterfly on Middle Caicos on 9 February 1978, and on North Caicos on 3 and 11 February 1978.

One of the most useful sources of observational data on the butterflies of the Turks & Caicos Islands (St Leger 198?) was published in the local magazine the *Turks & Caicos Current*. Robert St Leger was Development Finance Officer within the Turks & Caicos Islands Government in the early 1980s, and by the time of the publication of his article, had collected nearly 200 specimens and recorded 37 species (including 22 from Grand Turk). Although lacking some of the editorial discipline of a formal scientific publication, St Leger (198?) appears to be the first attempt to draw together any kind of checklist of the Turks & Caicos Islands' butterfly fauna.

For many years, Riley (1975) was the standard field guide to the butterflies of the West Indies, and includes a number of references to the Turks & Caicos Islands. Unfortunately, neither this book, nor the excellent regional work that has now surpassed it (Smith, Miller & Miller 1994) include a distributional summary from which the Turks & Caicos Islands list can be easily derived. Although all individual species and subspecies accounts in Smith *et al.* (1994) have been scrutinised (detailed accounts of some 600 butterflies in total), for relevant information, this is not always unambiguous. For example, it is not possible to assess whether "distributed throughout the Bahamian islands" indicates a definite record for the Turks & Caicos Islands.

2.2.3.3. A preliminary checklist of the butterflies of the Turks & Caicos Islands

The preliminary checklist below indicates that the Turks & Caicos Islands have yielded records of 47 butterflies, but not all of these would be expected to be extant at any one time (see below). The main sources of butterfly records from which this preliminary list is derived are St Leger (198?) and Smith *et al.* (1994). A small number of records are derived from other sources (Rindge 1955; Clench & Bjorndal 1980). Other publications (e.g. Miller *et al*. 1992; Simon & Miller 1980) provide very valuable contextual information on the butterflies of the southern Bahamian islands, but where these allude directly to Turks & Caicos records, these have invariably been collated by Smith *et al.* (1994). Observations made under the Darwin Initiative project have been very valuable in confirming (or shedding doubt on) more or less ambiguous records from the literature, and have also added to the list.

It should be noted that a wider range of species is recorded from the Bahamas in general (e.g. see Riley 1975; Smith *et al*. 1994). Furthermore (as noted above) given the historical tendency to include the Turks & Caicos Islands as part of the Bahamas for biological recording purposes, a number of these 'Bahamian' records *may* have been collected in the Turks & Caicos Islands. Other species records may not have been collected from the Turks & Caicos Islands, but might be expected, given particular species' distributions within the wider Bahamas. The butterfly fauna of Hispaniola, which is likely to have a lesser influence than the Bahamas on the Turks & Caicos fauna, is outlined in Schartz (1989).

Codes in square brackets after a name indicate the source of Turks & Caicos Islands records:

R = Rindge (1955)

St = St Leger (198?)

Sm = Smith *et al*. (1994)

Other sources are given in full

Codes/sources in brackets indicate that a source *strongly implies* the occurrence of a butterfly on the Turks & Caicos Islands, e.g. by recording a widespread West Indian distribution for a very common butterfly.

Common names follow Riley (1975)

Family: DANAIDAE (Monarchs and Milkweeds)
Danaus plexippus plexippus (Linnaeus, 1758) [St, (Sm)] (the Monarch)
Danaus plexippus megalippe (Hübner, 1826) [St, (Sm)] (subspecies of the Monarch)
Danaus gilippus berenice (Cramer, 1779) [St] (subspecies of the Queen)

Family: NYMPHALIDAE (Emperors, Fritillaries, etc.)
Memphis intermedia intermedia (Witt, 1972) [St, Sm] (the Turk Island Leaf Butterfly)
Eunica monima (Cramer, 1782) [St] (the Dingy Eunica)
Hypolimnas misippus (Linnaeus, 1764) [Ground, pers. obs.] (the Mimic)
Junonia evarete (Stoll, 1782) [St] (the Caribbean Buckeye)
Anartia jatrophae guantanamo Monroe, 1942 [Sm] (subspecies of the White Peacock)
Anthanassa frisia (Poey, 1832) [R] (the Cuban Crescent Spot)
Vanessa cardui (Linnaeus, 1758) [St] (the Painted Lady)
Euptoieta claudia (Cramer, 1779) [St] (the Variegated Fritillary)
Euptoieta hegesia hegesia (Cramer, 1779 [St, Sm] (the Mexican Fritillary)

Family: HELICONIIDAE (Heliconias)
Agraulis vanillae insularis Maynard, 1889 [R, St] (subspecies of the Gulf Fritillary)

Family: LYCAENIDAE (Blues and Hairstreaks)
Chlorostrymon maesites maesites (Herrich-Schäffer, 1864) [St, Sm] (Clench's Hairstreak)
Strymon martialis (Herrich-Schäffer, 1864) [St, Sm] (the Cuban Grey Hairstreak)
Strymon acis leucosticha Clench, 1992 [R (as subspecies *armouri*), Sm] (subspecies of Drury's Hairstreak)
Strymon columella cybira (Hewitson, 1874) [St, (Sm)] (subspecies of Hewitson's Hairstreak)
Electrostrymon angelia dowi (Clench, 1941) [Sm] (subspecies of the Fulvous Hairstreak)
Leptotes cassius theonus (Lucas, 1857) [R, St] (subspecies of the Cassius Blue)
Brephidium exilis isophthalma (Herrich-Schäffer, 1862) [R, St, Sm] (subspecies of the Pygmy Blue)
Hemiargus hanno filenus (Poey, 1832) [St, Sm] (the Hanno Blue)
Cyclargus ammon ammon (Lucas, 1857) [St] (Lucas's Blue)
Cyclargus thomasi clenchi (L.Miller, Simon & Harvey, 1992) [R (as subspecies *thomasi*), Sm] (subspecies of Thomas's Blue)

Family: PIERIDAE (Whites and Sulphurs)
Ascia monuste eubotea (Godart, 1819) [St] (the Great Southern White)
Eurema daira palmira (Poey, 1846) [?(Sm)] (subspecies of the Barred Sulphur)
Eurema elathea (Cramer, 1775) [St] (the False Barred Sulphur)
Eurema nicippe (Cramer, 1782) [St] (the Black-Bordered Orange)
Eurema lisa euterpe (Ménétriés, 1832) [St, (Sm)] (subspecies of the Little Sulphur)
Eurema dina (?subspecies *helios*) D.M.Bates, 1934 [St] (subspecies of the Bush Sulphur)
Eurema chamberlaini mariguanae D.M.Bates, 1934 [St, Sm] (subspecies of Chamberlain's Sulphur)
Kricogonia lyside (Godart, 1819) [St, Sm] (the Guayacan Sulphur)
Anteos maerula (Fabricius, 1775) [St] (the Giant Brimstone)
Phoebis agarithe antillia F.M.Brown, 1929 [St] (subspecies of the Large Orange Sulphur)
Phoebis sennae sennae (Linnaeus, 1758) [St, (Sm)] (the Cloudless Sulphur)
Aphrissa neleis (Boisduval, 1836) [St] (the Pink-Spot Sulphur)

Family: PAPILIONIDAE (Swallowtails)
Battus polydamas lucayas (Rothschild & Jordan, 1906) [St, Sm specifically records absence from TCI] (subspecies of the Polydamus Swallowtail)
Heraclides andraemon bonhotei (Sharpe, 1900) [St, Sm] (subspecies of the Bahaman Swallowtail)
Heraclides aristodemus bjorndalae (Clench, 1979) [St, Sm] (subspecies of the Dusky Swallowtail)

Family: HESPERIIDAE (Skippers)
Epargyreus zestos inaguarum Clench & Bjorndal, 1980 [St, Sm] (subspecies of the Zestos Skipper)
Urbanus proteus domingo (Scudder, 1872) [R, St, (Sm)] (subspecies of the Common Long-Tail Skipper)
Urbanus dorantes cramptoni W.P.Comstock, 1944 [(Sm)] (subspecies of the Dorantes Skipper)
Ephyriades brunnea brunnea (Herrich-Schäffer, 1862) [R, St, ?(Sm)] (the Jamaican Dusky Wing)
Hylephila phyleus (Drury, 1774) [R, St, (Sm)] (the Fiery Skipper)
Wallengrenia (?species *drury*) (Latreille, 1824) [St, Sm, but Clench & Bjorndal (1980) and Miller et al. (1992) shed doubt on species determination]
Euphyes singularis insolata (Butler, 1878) [Clench & Bjorndal (1980)] (subspecies of Butler's Branded Skipper)
Lerodea eufala (W.H.Edwards, 1869) [St ?questionable] (the Eufala Skipper)
Panoquina panoquinoides panoquinoides (Skinner, 1892) [St, (Sm)] (the Obscure Skipper)

In summary, then, the butterfly fauna of the Turks & Caicos Islands appears to consist of the following:
Family: DANAIDAE (Monarchs and Milkweeds) – 3 (sub)species
Family: NYMPHALIDAE (Emperors, Fritillaries, etc.) – 9 species
Family: HELICONIIDAE (Heliconias) – 1 species
Family: LYCAENIDAE (Blues and Hairstreaks) – 10 species
Family: PIERIDAE (Whites and Sulphurs) – 12 species
Family: PAPILIONIDAE (Swallowtails) – 3 species
Family: HESPERIIDAE (Skippers) – 9 species

This gives a total of 47 butterflies.

This total is broadly consistent with that given by Miller *et al.* (1992) for neighbouring islands in the southern Bahamas: Crooked (33); Acklins (26); Mayaguana (22); Great Inagua (37). In each of these cases (as with the analysis given above for the Turks & Caicos Islands), it is likely that additional collecting effort would accumulate further species records. However, a proportion of the fauna in each case would be expected to consist of vagrants, or highly mobile species that establish only short-term local populations but regularly re-colonise. In weighing under-recording against the occasional presence of such ephemeral species, Simon & Miller (1986) conclude that the "butterfly fauna of [Great Inagua] might be composed of no more than 40 species at any one time, even though the total number of species recorded from there might be significantly higher."

2.2.3.4. Ecological groupings of Turks & Caicos butterflies

Published accounts of the ecology of each butterfly on the preliminary checklist (generally based on observations made outside the Turks & Caicos Islands), and observations made under the Darwin Initiative project, will allow these insects to be grouped into broad ecological categories. Part 3 of this Plan includes a brief consideration of the Turks & Caicos butterflies that show most restricted distributions (ie. highest degrees of endemicity), and therefore have disproportionate conservation value and potential interest to visitors.

2.2.3.5. The beetles (Coleoptera) of the Turks & Caicos Islands

As noted above, background information on the beetles of the Turks & Caicos Islands is almost non-existent. Consequently, the work conducted by Dr Roger Booth under the Darwin Initiative project represents the first assessment of the islands' coleopteran fauna. Under these circumstances, species-level determinations for all specimens collected cannot be expected in the short-term. However, the following represents a summary of the material processed thus far:

Family: CARABIDAE – 12 species
Family: DYTISCIDAE – 5 species
Family: GYRINIDAE – 1 species
Family: HYDROPHILIDAE – 5 species
Family: HISTERIDAE – 2 species
Family: HYDRAENIDAE – 1 species
Family: PTILIIDAE – 4 species
Family: STAPHYLINIDAE – 18 species
Family: SCARABAEIDAE – 1 species
Family: SCIRITIDAE – 5 species
Family: PTILODACTYLIDAE – 1 species
Family: HETEROCERIDAE – 1 species
Family: LIMNICHIDAE – 1 species
Family: BUPRESTIDAE – 1 species
Family: ELATERIDAE – 2 species
Family: ANOBIIDAE – 3 species
Family: PTINIDAE – 2 species
Family: BOSTRICHIDAE – 4 species
Family: TROGOSSITIDAE – 1 species
Family: NITIDULIDAE – 2 species
Family: LAEMOPHLOEIDAE – 1 species
Family: LANGURIIDAE – 1 species
Family: PHALACRIDAE – 3 species
Family: CORYLOPHIDAE – 1 species
Family: COCCINELLIDAE – 5 species
Family: MYCETOPHAGIDAE – 1 species
Family: TENEBRIONIDAE – 7 species
“Family”: ALLECULINAE – 3 species
Family: MONOMMIDAE – 1 species
Family: OEDEMERIDAE – 2 species
Family: MELOIDAE – 1 species
Family: CERAMBYCIDAE – 11 species
“Family”: BRUCHINAE – 1 species
Family: CHRYSOMELIDAE – 4 species
Family: ANTHRIBIDAE – 1 species
Family: CURCULIONIDAE – 18 species
“Family”: SCOLYTINAE – 3 species
Family: ?? – 1 species

This gives a total of 137 species across 38 families. These totals will increase as on-going analysis of material progresses.

Amongst the fauna identified to date, species with a range of distributions and ecologies are represented. For example, amongst the coccinelid (ladybird) beetles, are found *Cycloneda sanguinea* (a widespread, New World, aphid predator), *Diomus rosecollis* (a likely scale insect predator with a Caribbean distribution) and *Psyllobora schwarzi* (a likely mould-feeder, known from Cuba, Hispaniola, the Bahamas, Grand Cayman and South Caicos – making it one of the few beetles previously recorded from the Turks & Caicos Islands). Amongst the bostrichid beetles (which typically feed in dry, dead wood) are *Xylomeira tridens* and *Tetrapriocera longicornis*, both of which are relatively widespread in the Caribbean. Widespread species tend, not surprisingly, to be more easily identified to species during an initial sorting of material. Species with more restricted distributions are more challenging, as they may not be represented in reference collections (or may not have been collected before, requiring a formal description of the new species to be drawn up).

2.2.3.6. Other insects of the Turks & Caicos Islands

Dragonflies and Damselflies (Odonata)

Dunkle (1989, 1990) notes that the Turks & Caicos Islands are faunistically like the Bahamas, and lists the following 6 species of Damselfly and 27 species of Dragonfly under a checklist for the Bahama islands. The Turks & Caicos fauna will, therefore, constitute a subset of this checklist:

Order: ODONATA

Sub-order**:** ZYGOPTERA **(Damselflies)**

Family: LESTIDAE (Spreadwings)
Lestes scalaris Gundlach, 1888 (Dusty Spreadwing)
Lestes spumarius Hagen in Selys, 1862 (Antillean Spreadwing)

Family: COENAGRIONIDAE (Pond Damsels)
Enallagma civile (Hagen, 1861) (Familiar Bluet)
Ischnura hastata (Say, 1839) (Citrine Forktail)
Ischnura ramburii (Selys, 1850) (Rambur's Forktail)
Nehalennia minuta (Selys, 1857) (Tropical Sprite)

Sub-order: **ANISOPTERA** (Dragonflies)
Family: AESHNIDAE (Darners)
Anax concolor Brauer, 1865 (Blue-waisted Darner)
Anax junius (Drury, 1770) (Common Green Darner)
Coryphaeschna ingens (Rambur, 1842) (Regal Darner)
Epiaescha heros (Fabricius, 1798) (Swamp Darner)
Gynacantha ereagris Gundlach, 1888 (Cuban Darner)
Gynacantha nervosa (Rambur, 1842) (Twilight Darner)
Triacanthagyna trifida (Rambur, 1842) (Phantom Darner)

Family: LIBELLULIDAE (Skimmers)
Brachymesia furcata (Hagen, 1861) (Red Pennant)
Celithemis eponina (Drury, 1773) (Halloween Pennant)
Dythemis rufinervis (Burmeister, 1839) (Red Setwing)
Erythemis simplicollis (Say, 1839) (Eastern Pondhawk)
Erythemis vesiculosa (Fabricius, 1775) (Great Pondhawk)
Erythrodiplax berenice (Drury, 1770) (Seaside Dragonlet)
Erythrodiplax justiniana (Selys in Sagra, 1857) (Antillean Dragonlet)
Erythrodiplax umbrata (Linnaeus, 1758) (Band-winged Dragonlet)
Idiataphe cubensis (Scudder, 1866) (Metallic Pennant)
Libellula needhami Westfall, 1943 (Needham's Skimmer)
Macrodiplax balteata (Hagen, 1861) (Marl Pennant)
Micrathyria didyma (Selys in Sagra, 1856) (Three-striped Skimmer)
Orthemis ferruginea (Fabricius, 1775) (Roseate Skimmer)
Pachydiplax longipennis (Burmeister, 1839) (Blue Dasher)
Pantala flavescens (Fabricius, 1798) (Wandering Glider)
Pantala hymenaea (Say, 1839) (Spot-winged Glider)
Tramea abdominalis (Rambur, 1842) (Vermilion Glider)
Tramea insularis Hagen, 1861 (Antillean Glider)

Tramea lacerata Hagen, 1861 (Black-mantled Glider)
Tramea onusta Hagen, 1861 (Red-mantled Glider)

Dunkle (1989, 1990) notes that none of these species are endemic to the Bahamas (clearly, therefore, none can constitute Turks & Caicos endemics), and that some of these (and other) dragonflies may simply be vagrants there. Dunkle (1989, 1990) also notes that most species fly all year, and that most habitats for Odonata in the Bahamas occur on the larger islands, in the form of ponds, rock pits and marshes (there are no fresh water streams); many Bahamian surface waters are too brackish for Odonata, with the exception of a few dragonflies.

2.2.4. Reptiles and Amphibians

Under the Darwin Initiative project, surveys of herpetiles (reptiles and amphibians) were undertaken by Glenn Gerber and Tandora Grant (San Diego Zoological Society, Centre for the Reproduction of Endangered Species), and Bryan Naqqi Manco. This survey work was centred on Middle and North Caicos, but results also draw on observations made elsewhere in the Islands. Fortunately, one of the survey periods in November 2000 included several cooler and rainy days, which provided the ideal conditions for many important finds. A number of endemic reptiles were identified, and an endemic gecko (*Aristelliger hetchi*) reported from an earlier survey but thought to be extinct was rediscovered. Marine turtles were not included in the survey, which recorded: two species of frog (both introduced); nine species of lizard (one of which is introduced); and three species of snake. Further information suggests the presence of one (introduced) species of freshwater turtle on Pine Cay, and other introduced amphibians on Providencialis. The species identified by this survey work are summarised below, and further information on the herpetofauna of the wider region is given by Schwartz & Henderson (1991).

2.2.4. 1. Amphibians

2.2.4. 1.1. Frogs

Elutherodactylus planirostris (ground frog) Greenhouse Frog
A small, nocturnal, largely terrestrial, insectivorous frog. This species is native to Cuba and the northern and central Bahamas. Three subspecies are recognized, one of which, *E. p. planirostris*, has been introduced to North Caicos and possibly some cays to the west. The species was not known previously from Middle Caicos but has recently spread there. Also introduced to Florida, Mexico, Jamaica, and the Cayman Islands.

Osteopilus septentrionalis (Cuban Treefrog)
A large, nocturnal, arboreal, primarily insectivorous treefrog. This species is native to Cuba, the Cayman Islands, and the northern and central Bahamas. No subspecies are described. Introduced to Pine Cay and North Caicos . Not present on Middle Caicos in 1995 but has spread there since. The species has also been introduced to Florida, Puerto Rico, the Virgin Islands, and Anguilla.

2.2.4. 2. Reptiles

2.2.4. 2.1. Lizards

Anolis scriptus (anole or tree lizard) Turks & Caicos Bark Anole
A moderately-sized, diurnal, arboreal, insectivorous lizard. This species is native to the southern Bahamas and the Turks and Caicos. Four subspecies are recognized, one of which, *A. s. scriptus*, is endemic to the Turks and Caicos Islands, including Middle Caicos.

Aristelliger hechti (gecko, croaker, or woodslave)
A moderately-sized, nocturnal, arboreal, insectivorous lizard. This species is endemic to the Turks and Caicos. No subspecies are recognized. The species is known only from the Caicos Bank. It does not appear to have been

collected from Middle Caicos but has been reported from East and North Caicos and so probably does occur on Middle.

Cyclura carinata (iguana) Turks & Caicos Rock Iguana
A very large, diurnal, mostly terrestrial, herbivorous lizard. This species is native to the Turks and Caicos and to Booby Cay off Mayaguana Island in the southern Bahamas. Two subspecies are recognized, one of which, *C. c. carinata*, is endemic to the Turks and Caicos Islands. This subspecies is abundant on some of the small cays off Middle Caicos, but appears to have been extirpated from Middle proper. The other subspecies, *C. c. bartchi*, is endemic to the small island of Booby Cay off Mayaguana.

Note: Both subspecies are listed: (1) as "Critically Endangered" (IUCN, 1996); (2) in Appendix I of the Convention on International Trade in Endangered Species (CITES, 1992); and (3) as "Threatened" by USFWS (1994).

Hemidactylus mabouia (house gecko or wood slave)
A moderately-sized, nocturnal, arboreal, insectivorous lizard. This species is a native of Africa. It was introduced to the Caribbean centuries ago on wooden sailing vessels associated with the slave trade. It is now found throughout much of the Caribbean, including the Turks and Caicos. In the Turks and Caicos, the species is known to occur on Grand Turk, South Caicos, and Providenciales. It has now been found on Middle and North Caicos and Parrot Cay as well. It is most likely to be found around settlements.

Leiocephalus psammodromus (curly-tailed or lion-headed lizard) Curly Tail
A large, diurnal, terrestrial, omnivorous lizard. This species is endemic to the Turks and Caicos, including Middle Caicos. Six subspecies are recognized, but the animals from Middle Caicos are unassigned subspecifically.

Mabuya mabouya (skink or slippery back or snake doctor) Mabuya Skink
A moderately-sized, diurnal, terrestrial, insectivorous lizard. This species is native to Jamaica, Hispaniola, Puerto Rico, the Virgin Islands, the Lesser Antilles, and the Turks and Caicos. Three subspecies are recognized, one of which, *M. m. sloanei*, is found throughout the Turks and Caicos, including Middle Caicos.

Sphaerodactylus caicosensis (pygmy gecko) Caicos Islands Reef Gecko
A very small, mostly nocturnal, mostly terrestrial, insectivorous lizard. This species is endemic to the islands of the Caicos Bank, including Middle Caicos. No subspecies are recognized.

Sphaerodactylus mariguanae (pygmy gecko)
A very small, mostly nocturnal, mostly terrestrial, insectivorous lizard. This species is known only from Mayaguana Island and Booby Cay in the southern Bahamas and from Grand Turk in the Turks and Caicos. No subspecies are recognized. This species is not known to occur on Middle Caicos.

Sphaerodactylus underwoodi (pygmy gecko)
A very small, mostly nocturnal, mostly terrestrial, insectivorous lizard. This species is endemic to the islands on the Turks Bank. No subspecies are recognized. This species is not likely to occur on North, Middle and East Caicos.

2.2.4. 2.2. Snakes

Epicrates chrysogaster (boa) Bahaman Rainbow Boa
A moderately-sized, mostly nocturnal, semi-arboreal, constricting snake. This species is native to the southern Bahamas and the Turks and Caicos. Three subspecies are recognized, one of which, *E. c. chrysogaster*, is endemic to the Turks and Caicos Islands, including Middle Caicos. Several varieties of this boa exist, including at least two distinct pattern types. One type, the more frequent, is spotted, while the rarer variety is striped; patterns representing a combination of stripes and spots are also seen occasionally. Although this species is not currently listed as threatened or endangered, several other Caribbean species of *Epicrates* are threatened or endangered.

Note: This species is protected under Appendix II of the Convention on International Trade in Endangered Species (CITES, 1992).

Tropidophis greenwayi (pygmy boa) Caicos Islands Trope Boa
A small, mostly nocturnal, semi-arboreal, constricting snake. This species is endemic to the islands of the Caicos

Bank. Two subspecies are recognized, one of which, *T. g. greenwayi*, occurs on Middle Caicos. The other subspecies, *T. g. lanthanusi*, is endemic to the Ambergris Cays.

Note: This species is protected under Appendix II of the Convention on International Trade in Endagered Species (CITES, 1992).

Typhlops richardi (blind snake)
A very small, secretive, burrowing snake that specializes on termites. This species is native to Puerto Rico, the Virgin Islands, and the Turks and Caicos. No subspecies are recognized. It is not known from Middle Caicos but probably occurs there.

2.2.4.2.3. Turtles

Trachemys terrapen (pond slider)
A moderately-sized, diurnal, aquatic (freshwater), omnivorous turtle. This species is native to Jamaica and the central Bahamas. No subspecies are described. Although unconfirmed, a small introduced population is reported to occupy one or more of the freshwater ponds on Pine Cay. Very unlikely to be on Middle Caicos.

Marine turtles.
Marine turtles were not the subject of the current study, but work by others including the Department of Environmental & Coastal Resources shows the importance of the area for nesting of the important and vulnerable species *Chelonia midas, Eretmochelys imbricata, Caretta caretta*.

2.2.4.3. Habitat usage by herpetiles

Lizards are infrequent on the salt marsh and tidal flat areas, but are common throughout the islands' scrub habitats (although *Mabouya mabuya sloanei* is most frequent in higher scrub forest with a more open understory). All of the lizards may be found in areas of human settlement, and *Anolis scriptus scriptus* is often found inside houses. Vital for lizards are the small pockets of freshwater-influenced, moist habitats such as caves and sinkholes. For example, whilst *Sphaerodactylus caicosensis* may be encountered under leaf-litter in all scrub habitats and around human dwellings, it is most frequent around the mouths of caves and sinkholes: in areas where the ground is relatively moist and leaf litter has had a chance to accumulate deeply. Similarly, this endemic species favours the moist, shady microclimate under large trees (not exclusively native tree species).

Snakes may also be found in all areas of scrub habitat but are most frequent, like lizards, in moister habitats. *Tropidophis greenwayi greenwayi* is commonly encountered under rocks and logs beside freshwater ponds. It is also common wherever *Sphaerodactylus caicosensis*, one of its major prey, is abundant. Similarly, *Epicrates chrysogaster chrysogaster* preys on lizards, but also on mice, and is often found near houses, under building materials and in high grass. The blind snake *Typhlops richardi* (or thread snake as it is locally called), is found only after heavy rains in rich, loose organic soils. They are fast moving, difficult to find, and conditions do not often favour their finding. More work must be done positively to identify this animal. It is assumed, like other similar snakes, to feed underground on termites and other soft-bodied insects. Like the other Turks & Caicos herpetiles, it is most likely encountered in the moist microclimates under large trees.

2.2.4. 4. Threats to herpetiles

As elsewhere, the most significant threat to herpetiles in the Turks & Caicos Islands is probably habitat loss. There is evidence that even small-scale destruction of habitat leads to direct mortality, as well as disrupting the ecology of local species: walks through fields recently burned for small-scale agriculture often revealed several charred snake bodies. Apart from habitat loss, the biggest threat to snakes in the Turks & Caicos Islands is probably persecution. Here, as in many parts of the world, snakes are amongst the least respected of all animals. Powerful religious symbolism and widespread misconceptions (so-called "common knowledge") underpin a fear of snakes in the Islands, and many are killed as soon as they are seen. (Whilst the Biblical association of snakes with evil is common around the world, there is one snake story unique to this region that is worthy of mention. It is said that a cat can kill a snake by allowing the snake to wrap around its body - the cat then inflates its body, and breaks the snake into pieces! No one has apparently ever seen this happening. . .) It is commonly assumed that the local snakes are venomous, but this is not the case - two of the three species documented are constrictors, and the third is a minuscule termite-eating worm snake. This negative attitude can be changed only by education, and early indications suggest that progress can be made in this area. Younger children responded well to snakes that were used as classroom exhibits in work conducted by the Darwin Initiative project with local schools on Middle Caicos.

2.2.5. Bats

Over 100 bat species occur in the Caribbean, including many endemic to particular islands or groups of islands. Although the Turks & Caicos have some good caves, the small, remote, low lying character of the islands, and their lack of forest vegetation, limits the number of bat species found here. In January and November 2001, Dr Tony Hutson, a leading bat expert from the UK, and Tim McCarthy, from the Carnegie Museum of Natural History in Pittsburgh, conducted surveys of the bats on Middle Caicos. Known caves and other likely roost sites were visited, to record numbers and behaviour of the different species.

2.2.5.1. Introduction and background

As one aspect of the Darwin Initiative Project on Turks & Caicos Islands, the bat work was designed to:

1. assess available knowledge of bats of the Turks & Caicos Islands;
2. carry out a bat survey on Middle Caicos;
3. provide training to local people from TCI National Trust (TCNT) staff and its members and others;
4. provide equipment, literature and other resources to enable local people to continue bat studies on the islands;
5. provide local education;
6. offer a population monitoring programme for resident bats
7. provide recommendations for further work to assist in the conservation of the resident bats.

A first visit was made to Middle Caicos, TCI, on 10-24 January 2001. Prior to this visit, the available literature on the bats of Turks & Caicos Islands (TCI) and surrounding areas was accumulated and reviewed, and a draft illustrated key to the (potential) species prepared.

In this brief (2-week) visit to Middle Caicos, cave, building and other roost sites or potential roost sites were investigated, counts were made of the bats in the principal cave (Conch Bar Village Cave), evening bat detector surveys were carried out, some mist-netting away from roosts was attempted, and some local training and education was achieved.

A number of other potential sites for investigation were identified.

Five bat species were identified, most of them Caribbean endemics.

2.2.5.2. Historical review of bats of TCI and findings of 2001 study

Most recent reviews of the bat fauna of the Antilles have not included the Turks & Caicos or have included them within the Bahamas (e.g. Koopman 1989; McFarlane 1991; Breuil & Masson 1991). The fauna has been included in discussions about the Bahamas (e.g. Koopman *et al*. 1957; Buden 1985; Morgan 1989). Morgan (1989) discusses the origins and affinities of the Bahamian (including Turks & Caicos) fauna and its relationship to island size and location. In two reviews of the biodiversity and conservation of UK Overseas Territories, one lists five bat species (Oldfield 1987) for TCI and one does not mention bats (Procter & Fleming 1999). A number of the earlier papers have discussed bats from the Turks & Caicos, but this literature is scattered.

It would appear that ten species of bat have been recorded from TCI (one apparently in error and at least two only from (sub)fossil material). Each species and reference to its occurrence on TCI is discussed below. Population data are included where available.

2.2.5.2.1. Family Phyllostomidae (spear-nosed bats)

1. *Macrotus waterhousii* Gray 1843. Big-eared bat

The species is found from the extreme south-west of USA through Mexico possibly to Guatemala, and through the Greater Antilles to Hispaniola, and in the Bahamas. The populations in USA and much of Mexico are often regarded as a separate species, *M. californicus*. IUCN Red List status: LRlc.

Shamel (1931) described an adult male from Kingston, Providencialis (sic), collected from a cave on 23 July 1930, as a new subspecies, *Macrotus waterhousii heberfolium*. It was the only occupant of the cave. Buden (1975b) recorded 15 specimens from Providenciales (at least three were from an unnamed cay in Chalk Sound) and one from North Caicos. On North Caicos, Buden (1975a) noted this species in a solution hole near Sandy Point (several miles north west of Kew). He recognized only two subspecies in the West Indies and included the TCI material in *M. w. waterhousii*. Bats of this species collected in 1985 by Operation Raleigh (Moss, 1985) from Conch Bar Cave, Middle Caicos, were identified by Hill (1985) also as subspecies *M. w. waterhousii*. Morgan (1989) recorded fossil material from Conch Bar Cave.

In January 2001, the species was found at Conch Bar Cave (c.20 on 11 January, 15 on 15 January, 10 on 21 January); Indian Cave (5 seen on 11.i, 17 trapped at emergence on 12 January, 2 trapped at emergence on 18 January); Mango Tree Hole, near Lorimers (3 in small cave on 12 January); Miss Angela Hall's house, Lorimers (6 in roof on 12.i and 14.i); Charlotte Hall's house, Lorimers (1 in roof on 14 January, locals surprised and said there used to be up to 50).
[Buden 1975a: The three Chalk Sound bats were in an early stage of pregnancy on 27 February 1972]

2. *Brachyphylla cavernarum* Gray, 1834.

Oldfield (1987) lists this species as from TCI. No record has been found and the species is unlikely to occur here. This listing probably arises from reference to earlier works where the *Brachyphylla* sp. on TCI was sometimes considered a subspecies of *B. cavernarum* (e.g. Buden, 1977, considered the TCI population to belong to *B. cavernarum pumila*). As currently understood the species occurs from Puerto Rico eastwards through the Antilles.

3. *Brachyphylla nana* Miller, 1902

The species is recorded from Cuba, Cayman Islands, Hispaniola and Turks & Caicos. Morgan (1989) refers to fossil (or more recently extinct) material from Jamaica and northern Bahamas. IUCN Red List status: LRnt.

Buden (1977) collected 19 specimens from Conch Bar Cave, Middle Caicos, in March 1975. Although the bats occurred in several roost sites during his visits, he only ever found one group of no more than 30-40 individuals on any one visit. Of the 19 bats collected, all 12 females were gravid. He assigned his material to *B. cavernarum pumila*. Bats of this species collected in 1985 by Operation Raleigh (Moss, 1985) from Conch Bar Cave, Middle Caicos, were identified by Hill (1985) as *B. nana*. Morgan (1989) recorded fossil material from Conch Bar Cave, Middle Caicos.

In January 2001, the species was located in one or both of two very adjacent roost sites in Conch Bar Cave on all visits and the colony was estimated to comprise 500-1000 individuals. Five adult males were trapped at the roost on 15 January and three adult males trapped outside the cave on 20 January

4. *Erophylla sezekorni* (Gundlach, 1860) Buffy flower bat

The species is recorded from through most of the Bahaman Archipelago (including Turks & Caicos), Cuba, Cayman Islands, Jamaica, Hispaniola and Puerto Rico. The populations from the latter two localities are often separated as the subspecies *E. s. bombifrons*. IUCN Red List status: LRlc.

Shamel (1931) recorded 16 specimens (as *E. planifrons*) from Stubbs Guano Cave, East Caicos. Buden (1976) recorded it from Providenciales, North Caicos and Middle Caicos. He observed groups of usually 4-30 individuals, and two groups of about 50. On North Caicos, Buden (1975a) noted this species in a solution hole near Sandy Point (several miles north-west of Kew). Bats of this species collected in 1985 by Operation Raleigh (Moss, 1985) from

Conch Bar Cave, Middle Caicos, were identified by Hill (1985).

In January 2001, the species was found roosting in Conch Bar Cave in groups of between one and c.30 individuals, with one exceptional group of 60-70. A count on 15 January located c.460 individuals and 425 on 21 January Fourteen were trapped near the entrance to Conch Bar Cave on 20 January The species was not found roosting elsewhere but five trapped emerging from Indian Cave on 12.i must have been roosting there or close by.

5. *Monophyllus redmani* Leach, 1821 Leach's long-tongued bat

The species is recorded from Cuba, Jamaica, Hispaniola, Puerto Rico and the southern Bahaman Archipelago (including Turks & Caicos). IUCN Red List status: LRlc.

Buden (1975a) recorded individuals or small groups of up to 15-20 individuals in the Bahamas (including TCI) but considered it uncommon (but also states that he collected 30 specimens and 'saw few others'). Apart from at roosts, he netted one in semixeric woods near Kew, North Caicos, in February 1972. He also found it on Middle Caicos. Morgan (1989) refers to Buden (1975a) also recording the species from Providenciales, but there appears to be no mention of Providenciales in Buden's discussion on this species. Bats of this species collected in 1985 by Operation Raleigh (Moss, 1985) from Conch Bar Cave, Middle Caicos, were identified by Hill (1985). Morgan (1989) recorded fossil material from Conch Bar Cave; he also recorded fossil material of this species from Andros and New Providence in the more northern Bahamas, where it has not been recorded in recent times.

In January 2001, the species was found roosting in Conch Bar Cave in groups of 1-20. Two counts of the whole cave gave very different counts for this species: 16 on 15 January and 117 on 21 January One was trapped near the entrance at dusk on 20 January No individuals of this species were seen roosting in Indian Cave, but two trapped emerging on 12.i and one on 18 January must have been roosting there or close by. Two were also trapped in a road cutting south east of Bambarra on 21 January

6. *Artibeus jamaicensis* Leach, 1821

A widespread species of the Caribbean (including Bahamas) and Central and South America, recorded from TCI by Buden, 1974 (and restated in Buden, 1985). Buden collected two individuals (an adult male and a gravid female) on Providenciales 'from an undercut section of a solution hole located near the north coast, between the settlement of Blue Hills and the Third Turtle Inn'. Buden also found one skull in prey remains of barn owl in a cave 'located less than 0.5 miles (0.8 km) north of the airport at Blue Hills [Providenciales] on 25 February 1972'. These locations were not investigated during the present visit, but undercut cliffs with hollows were noted on the north coast by Third Turtle Inn; however, much of this area is now developed. There should be investigation to assess whether the species persists on TCI.

IUCN Red List status: LRlc.

2.2.5.2.2. Family Natalidae (funnel-eared bats)

7. *Natalus stramineus* Gray, 1838

Morgan (1989) records subfossil remains of *N. major* (currently considered a synonym of *N. stramineus*) from Conch Bar Cave, Middle Caicos. *N. major* was recognised from Jamaica and Hispaniola (with extinct populations on Cuba, Isle of Pines, Cayman and northern Bahamas). *N. stramineus* is widely distributed from Mexico to Brazil. Two other *Natalus* spp. (*tumidifrons* and *lepidus*) are recorded from the Bahamas and it seems reasonable to postulate that the genus may still occur on the Turks and Caicos.

IUCN Red List status: LRlc.

2.2.5.2.3. Family Vespertilionidae (vesper or plain-nosed bats)

8. *Lasionycteris noctivagans* (Le Conte, 1831)

A widespread species of Canada and USA south to northern Mexico and Bermuda. It is a known migrant. The only record from TCI (and Bahamas?) is reported by Buden (1985). A female was found five miles east of the Third

Turtle Inn, Providenciales in 15 October 1970. The bat was found in a semi-torpid condition behind a window shutter on the outside of a house.

IUCN Red List status: LRlc.

9. *Lasiurus borealis* (Muller, 1776) Red bat

A widespread species of Canada and USA south through the Caribbean and Central America to Chile and Argentina. IUCN Red List status: LRlc.

Koopman *et al*.(1957) record a single specimen (as *L. minor*) 'from the Caicos' collected in 1891. Buden (1985) reported two incomplete skulls he had found in a cave on Providenciales on 9 January 1975 as *L. b. minor*.

Bats assumed to be this species were heard on a bat detector near Bambarra, Middle Caicos, in January 2001 and one was mist-netted there on 22 January. That individual is now preserved in the British Museum (Natural History). At the time that this bat was in the hand, at least one other individual was still flying in the area. The species is likely to be resident on TCI.

2.2.5.2.4. Molossidae (free-tailed bats)

10. *Tadarida brasiliensis* (Geoffroy, 1824)

A widespread species of southern USA, through Central America and much of the Caribbean and into South America. The only record for TCI is of fossil material from Conch Bar Cave, Middle Caicos (Morgan, 1989). The species occurs widely in the Bahamas and Greater Antilles and may well occur in TCI. However, the species usually emerges early and is obvious in flight, and the echolocation calls of free-tailed bats heard through a bat detector are characteristic; nothing resembling a free-tailed bat was seen or heard on Middle Caicos in January 2001.

IUCN Red List status: LRnt.

2.2.5.2.5. Summary of known bat fauna

It can, then, be said that the current known bat fauna of TCI comprises big-eared bat *Macrotus waterhousii*, Cuban fruit-eating bat *Brachyphylla nana*, buffy flower bat *Erophylla sezekorni*, Leach's long-tongued bat *Monophyllus redmani* (all family Phyllostomidae) and red bat *Lasiurus borealis* (Vespertilionidae). In addition, *Artibeus jamaicensis* and *Lasionycteris noctivagans* have been recorded in recent times; *Natalus stramineus* and *Tadarida brasiliensis* are recorded from fossil material only; *Brachyphylla cavernarum* has been recorded in error.

Apart from the other species mentioned above, there is the possibility or likelihood of some other species being found on TCI. These include other species of *Natalus* (Natalidae), *Eptesicus fuscus* (Vespertilionidae) and possibly *Molossus molossus* (Molossidae). It is even possible that the fishing bat (*Noctilio leporinus* – Noctilionidae) may occur.

Further information on these bats can be found in Novak (1994) and a key to identification of the bats of the region is available in Baker *et al*. (1984). Many of the species are covered by species accounts in the *Mammalian Species* series published by the American Society of Mammalogists.

2.2.5.3. 2001 survey

Survey and bat studies were carried out mainly in the northern parts of Middle Caicos around the east-west limestone ridge and road, and from there to the north coast.

2.2.5.3.1. Caves

Known caves were surveyed, concentrating on the main caves of Conch Bar Village Cave and Indian Cave. Additional caves were searched for in likely areas or areas identified by other residents.

Conch Bar Village Cave, Conch Bar

Conch Bar Village Cave is an extensive cave system and a map from Moss (1985) is presented at 4.5.2.14 Annex 2. Locality names from the current interpretative board outside the cave have been added. A local cave guide advised that the wet chamber/passage at the east end led through to further cave areas that opened to the surface near Buttonwood Pond; this area was not investigated during the current visit.

On 11 January a general investigation of the main tourist areas was carried out. All four recorded species were seen, including about 20 *Macrotus* and one group of c.10 *Monophyllus*. Most of the *Macrotus* and the *Monophyllus* were in the light or threshold zone, *Erophylla* mostly further into the dark zone. A number of feeding sites of *Macrotus* were noted.

On 15 January a full survey of the system was carried out with the location of all bats marked on a map. Totals are given in Table 2.2.5a. The presence of *Brachyphylla* was confirmed by catching five from the main group.

A repeat survey was carried out on 21 January On the previous count it had been difficult to locate individual (groups of) bats on the map (perhaps due to our unfamiliarity with the site), so on this occasion, the cave was divided into 21 identifiable areas and (groups of) bats allocated to individual areas. This may be a better method for long-term monitoring, but may lose some information of the detailed distribution of species within the cave. Totals are given in Table 2.2.5a. A cave guide who had assisted the Operation Raleigh survey in 1985 thought that the bat numbers were about the same then as now.

On the evening of 20 January a single 6-m net was set on the edge of the clearing about 30m from the cave entrance; 14 *Erophylla*, 1 *Monophyllus* and 3 *Brachyphylla* were examined.

On the morning of 22 January the cave was revisited to catch individuals of each species for portrait photographs.

Table 2.2.5a. Full counts of bats in Conch Bar Village Cave, Middle Caicos.

	Macrotus	*Erophylla*	*Monophyllus*	*Brachyphylla*
15 January 2001	15	c.559	16	500-1000
21 January 2001	10	c.425	117	500-1000

Indian Cave, west of Conch Bar, near Blue Horizon

This ‘cave’ is really more like an arch stretching for about 30m north to south. At the south end the roof is low (c.2m), at the north end it is high (c.10m) with various hollows and deep crevices (and may possibly connect to a cave system). There are holes in the roof through which grow well-established *Clusia* and *Ficus* trees.
On 11 January, the cave was searched during the day and 5 *Macrotus* were recorded on the north wall. On the evening of 12 January, 1x18-m 1x10-m and 1x6-m mist nets were set within the covered area. *Macrotus* (17), *Erophylla* (5) and *Monophyllus* (2) were caught. These species and numbers bear little relation to what was found there during the day and many bats were caught very soon after dusk, so it is assumed that there is access to a more extensive cave system either directly from Indian Cave or in the close vicinity (indeed, at one stage it is thought that bats were entering the cave through a hole in the roof). On 18 January 2x12-m and 1x6-m mist nets inside the ‘cave’ between 17.30 and 20.00 caught only two *Macrotus* and one *Monophyllus*; there was generally very little activity on this night and certainly much less than on the previous netting night. On 20 January an hour was spent in the morning searching through owl pellet debris for bat remains; probably 95% of remains were rat, 5% bird and no bat remains were found.

Blue Horizon

On 17 January two sea caves were examined. These had potential as bat roosting sites, but none was found. At the time there was a strong north wind blowing into the caves and it is possible that bats use these caves in a different season. There are many small surface holes in this area, but none suitable for bats was found. The owner of the Blue Horizon Resort, Mr Witt, reported that bats lived in a cave to the east of the main house. On 20 January the hill to the east of the property was searched. Many small surface holes, some quite deep, were found, but nothing that looked particularly suitable for bats was identified. A group of four shallow surface holes associated with a scruffy *Clusia* tree lower down near the road were also searched. Again these did not look particularly suitable, but were under shade and had overhanging rims. Here Bryan Manco reported a small broad-winged sandy-coloured bat fly across one hole, but the bat could not be relocated. The site would be worth rechecking.

Charles Rigby Hole, nr Lorimers

Bats are reputed to use this site, which was visited on 12 January It has a circular horizontal entrance about 6m across, partly overgrown. The floor at the entrance is about 6m down. There is a considerable overhang under all of the rim of the entrance. From the surface a barn owl was seen, but no bats or signs of bats. Since it would be difficult to catch bats emerging vertically from this cave, a return visit was made at about 04.15 on 16 January with a view to catching bats returning to the site in the morning. By 06.00 it was too light for bats still to be out and no bat had been seen or heard on a bat detector. It is, nevertheless, possible that bats had returned before our observations or that the site has seasonal use. It looks extensive enough to justify further exploration.

Mango Tree Hole, nr Lorimers (19 221 656 E, 24 117 51 N)

Visited on 12. i., the site is possibly a collapsed cave passage. It is an oblong pit with rock faces on three sides and soil/debris sloping up to the fourth side. At the end of each of the shorter (transverse) walls away from the main rock face is a short low passage. Standing with ones back to the main central rock face the passage at the end of the left wall had three *Macrotus waterhousii* roosting in a solution hole ('chimney') in the ceiling; the passage at the end of the right wall had no bats and no particular roost features.

Fig Tree Hole, nr Lorimers

Visited on 12 January, the site is similar to Charles Rigby Hole, but with a smaller (5m) surface entrance and shallower (c.3m) drop to floor level. Access was effected via a 'fig' tree growing out of the hole; there was only a shallow rock overhang, no underground extension and no bats.

2.2.5.3.2. Buildings

As a result of requests for information on bats, buildings reported to be used by bats were investigated, as well as some gardens where bats (fruit-eating bats) might feed.

Two or three gardens in Bambarra were investigated for fruiting/flowing trees. Miss Gertie Forbes's house seemed the richest, but see below under mist-netting.
At Lorimers, Miss Angela Hall's old house (behind new house; 19.221993E, 2412570N; 8m) was investigated on 12 January; 6 *Macrotus* were present and were still present on 14 January

Charlotte Hall's House was investigated on 14 January and a single *Macrotus* was identified. This surprised locals because they thought there had been up to 50 there. The house is now surrounded by dense scrub; this might be a disturbing factor or the roost might have seasonal use.

2.2.5.3.3. Bat detector survey

Two Stag Electronic Bat Box III bat detectors were used for evening survey work to find foraging and commuting bats, mainly between Lorimers and the west end of Montpeller Pond, plus one evening in Conch Bar village.

On 11 January, the area around Bambarra village, especially Miss Miss Gertie Forbes's garden and down to the well area and Miss Constance's fruit garden, were checked. Two bats, later identified as *Lasiurus*, were heard at Miss Miss Gertie Forbes's well.

Various sections of the road between Lorimers and Turnup Pond, and down to the accommodation at Simply Heaven were checked on 13 January, 14 January, 15 January, 16 January, 19 January, 21 January, 22 January and 23 January Particular attention was paid to garden/fruit areas (particularly on the south side of Bambarra village), the quarry with fresh-water pools near Lorimers, the deep road cutting south of Bambarra and other pond areas.

Apart from the two at Miss Miss Gertie Forbes's well, *Lasiurus* was heard at the road cutting on 14 January, 19 January and 22 January (and not at this spot on 15 and 21 January); at least two were present on 22 January

Bat detector survey around Conch Bar village on 17 January, paying particular attention to fruiting trees, produced no bats seen or heard.

It is perhaps worth noting that until the *Lasiurus* was caught, AMH had considered that this was probably an *Eptesicus* sp. (*E. fuscus*). Since *Eptesicus* spp. are largely house bats, particular attention was directed to try to identify which settlement these bats were coming from. *Lasiurus* is a tree bat, roosting in vegetation, and hence this focus of the search for a roost site was totally misplaced.

2.2.5.3.4. Mist-netting

Mist-nets were erected in the evening near or in Bambarra on four evenings, in Conch Bar village (one evening) and at Indian Cave (two evenings) and Conch Bar cave (one evening); the results of netting in or by caves is reported above under 2.2.5.3.1 Caves.

On the evening of arrival (10 January), 1x18-m and 1x12-m mist nets were erected in the garden of our accommodation at Simply Heaven (Kehl Villa), near Bambarra. No bats were caught or seen (or expected!).

On 11 January, 1x18-m and 1x12-m nets were set in Miss Miss Gertie Forbes's garden, Bambarra. One bat was seen and none caught.

On 17 January, a 6-m net was set by a *Terminalia* tree with ripe fruit outside Felix's Bar, Conch Bar Village. No bats were seen or trapped.

A 6-m net was hand-held across the road in the cutting south of Bambarra on 21 January Two *Monophyllus* were trapped, both heavily dusted with pollen. The exercise was repeated on 22 January when a single *Lasiurus* was caught.

2.2.5.3.5. Talking to people

People were asked for information about bats and bat sites. These included general public, islanders and cave tour guides. Most people seemed interested in bats, had no concerns about them and, indeed, considered them good things to have around.

2.2.5.3.6. Data from bats found

Details of bats found are given above and summarised here.

All bats examined in the hand were aged, sexed, reproductive state assessed, weighed and the forearm measured. In all, 55 bats were examined.

In addition, attempts were made to investigate the diet of captured bats by collecting pollen from fur and droppings from bags used to hold the bats during processing.

To collect pollen, a small piece of (opaque) Scotch Magic Tape was wiped over the head of pollinivorous bats; the tape was then fixed to a normal 3x1" glass slide. Peter Stafford at the Department of Botany, The Natural History Museum, London, agreed to have a preliminary look at the eight slides so collected. He also had one tube containing fruit seeds in droppings. The BM has no reference material of pollens of the area and Peter was hoping that the material would be under clear tape to allow a superficial examination without removing the tape. In view of these difficulties he has returned the material to AMH. However, he looked at one sample from bat 54 (*Monophyllus*, near

Bambarra, 21 January01) from which pollen of Cactaceae (cf. *Cleome*) is identified.

Three droppings from the single insectivorous *Lasiurus* were examined by AMH. Almost all of the remains were of small Lepidoptera, plus evidence of about three small beetle species. This agrees with published data on the diet of this species (e.g. Schmidly's *Bats of Texas*, 1991). The sample has been passed to Roger Booth to see if anything further can be said about the beetles.

Ectoparasites (Diptera; Streblidae)were collected from two *Monophyllus redmani*; ectoparasites were not obvious on the other species examined. It is not known that there have been any ectoparasites collected from these islands before.

2.2.5.3.7. Other observations

Additional observations were made on the bats where possible. Two observations of note are recorded here, although it is accepted that a full literature search has not yet been made.

Macrotus. In Indian Cave on 18 January and some time after dusk, several individuals were hanging on the wall making a 'chip' with a frequency from ultrasonic to much less than 10 kHz (quite audible to the human ear). These bats were also shaking half-opened wings and twisting the head around. Other individuals were visiting and hanging nearby. It is likely that this was some territorial/mating display. The same display was observed in Conch Bar Village Cave during the day on 21 January

Erophylla. With many of the groups in Conch Bar Village Cave there was single individual at the top of a 'chimney' in the cave roof repeatedly flapping its wings in short bursts; this could be heard easily before the roost was visible. Whether this was warning of our approach or a (?male) display to other bats is not clear.

There was no evidence of mating, pregnancy or lactation in any bats examined.

2.2.5.3.8. Recordings of bat sounds

It was intended to make recordings of bat sounds as heard through the bat detector for the purpose of developing an identification tape. Recordings of *Macrotus* echolocation calls in flight and social calls while at rest on cave wall, and of *Lasiurus* in flight and foraging were made. These need to be edited and the other species similarly recorded. Nevertheless, it could be said at this point that differentiation of some of the species using the caves may be difficult or impossible with the kind of detector currently available on the island. Further, *Macrotus*, *Erophylla*, *Monophyllus* and *Brachyphylla* all produce relatively quiet echolocation calls, which cannot be detected in the field except at very close range.

Notes were taken in the field re *Macrotus*, *Monophyllus*, *Lasiurus*; other details are available for some species from the literature/personal contacts.

2.2.5.3.9. Training

TCNT staff

Bryan Manco, Project Officer for TCNT, accompanied the specialists most of the time in the field.

The following equipment was provided for use on the islands:
Two Stag Electronics Bat Box III bat detectors with headphones, two pairs of gloves, one folding-frame hand net and handle, one set dial calipers, one 100g P esola balance, guy cord, batteries.

The following literature was supplied for use on the island:

General: *Walker's Bats of the World*, *The Bats in Question*;

Field techniques: *The Bat Worker's Manual*, *Field Techniques - Bats*, *Ecological and Behaviorial Methods for the Study of Bats*;

Bat detector guidance: *The Bat Detective* (booklet & CD);

Relevant regional literature: A range of papers on the bats of Bahamas/Antilles, species accounts where available for recorded or likely species from *Mammalian Species*;

Key to recorded/possible bat species on TCI: a draft key with notes and illustrations of likely bat species was prepared prior to the visit; this will be developed to provide a guide to identification in the hand, in roosts, by bat detector, and to include brief notes on behaviour, distribution, local observations, Red List status;

'A level' students and DECR staff

The Biology A Level class from Providenciales visited Middle Caicos on 18/19 January. In the afternoon of 18^{th} a session was held on bats (biology, diversity, conservation, local fauna, etc). This was followed by a visit to Indian cave in the evening to see and hear bats in the field. Senior students from the High School on North Caicos and junior and DECR staff joined the specialists in November 2001.

Elementary school

On the last morning of the January visit, Bryan Manco gave a very impressive introduction to bats to, first, the older children and then the whole school. They were also able to see a live bat (the red bat, *Lasiurus*) and to hear it through the bat detector. This was part of a wider programme with the school.

Cave tour guides

A discussion meeting was arranged for cave tour guides. It was agreed that the TCNT would rearrange such a meeting to consider the Code of Conduct for Tour Guides and related matters.

2.2.5.3.10 Additional information

Cave tours

More visits were made to Conch Bar Village Cave than would have been approved at such a site in UK. It was clear that tourist visits are also frequent and not controlled. It is difficult to say that such a level of disturbance is affecting the bats because the bats are still there and it seems reasonable to assume that there are other suitable (but perhaps not as ideal) sites. Until now there has been no approval or licensing of tour guides and no record of frequency, areas visited, length of visits, periodicity, number of visitors. This and the showing of bats to the public and lack of 'sanctuary' areas may be a long-term problem and needs to be considered. The proposed Code of Conduct for Tour Guides, as well as Health and Safety requirements for the guides and their customers and the involvement of nature conservation interests in the management of this (and similar) sites may assist in assuring a sustainable use of the cave to demonstrate its geomorphology, history and natural history. It is of, course, essential that the guides are committed to the conservation of the cave and its fauna (including for their own interests), but it is also highly desirable from the point of view of them being in the best position to monitor the site and identify problems. Tour companies should also be provided with the code (principal companies identified by a cave guide included J&B and Silver Deep).

Archaeological data on cave bats from Indian Cave

Archaeological work is going on in Indian Cave under the leadership of David Steadman, University of Florida, USA. It would seem that long-term field work at this site is probably no problem for the bats, but it certainly would be if carried out in, say, Conch Bar Village Cave. Much of the history of the mammal fauna of Turks & Caicos and the Bahamas has been acquired from cave deposits. The present work seems to have been going on for some time (in phases), but the present researchers are not aware of any data having been published, although in a very brief conversation, David Steadman said that he had a lot of bat remains.

Visit to Providenciales

On the return journey on 24 January, Tony Hutson and Roger Booth had a few hours in Providenciales. After a brief visit to the TCNT office, they were given a quick tour around part of the island by Fleur Stanbrook (a resident). This included a look at the hills and cliffs around Turtle Cove, Grace Bay and across to Chalk Sound. Most of the central and eastern parts of the island looked very developed and with a lot of current development, such that its importance to bats may be more from foraging habitat than roosting sites. Fleur Stanbrook reported that she had seen bats in the evenings around Grace Bay. The area is undoubtedly very different from when Buden visited in the early 1970s.

2.2.6 Birds

Within the Darwin Initiative project and other work since 1998 at most seasons of the year, a great deal of bird observations have been made in the plan area and other parts of TCI, co-ordinated by Dr Mike Pienkowski, UK Overseas Territories Conservation Forum, with the help of several observers including local residents and visiting specialists. These add substantially to earlier information. At the time of preparing this version, an analysis is in progress on Important Bird Areas (IBAs) in the Turks & Caicos Islands. This is part of a world-wide analysis applying a common framework of assessment. In future versions of this Plan, the final results of the IBA analysis will be incorporated. Further analyses will also be undertaken. In the interim, the summary of information below and its use have taken into account the developing IBA results.

The following list of birds is based on Patricia Bradley's (1995) *Official Checklist* published by TCNT, and has been updated as part of the present study.

The listing is interrupted to provide summaries, based on current work, of the status of key species relevant to management planning in this context. Not all species are annotated. In several cases, notes on several species are grouped together.

The abbreviations used are the system from Bradley (1995):

RELATIVE ABUNDANCE
a = abundant in habitat
c = common
u = uncommon
r = rare

STATUS
BR = breeding resident
BSV = breeding summer visitor
(SV) = summer visitor, breeding not proved
(BR) = breeding suspected, not proved
R = present throughout year, not breeding
WV = winter visitor, not breeding
(WV) = suspected winter visitor
P = in passage, mainly fall (autumn) and spring
V = vagrant or irregular casual visitor
I = introduced by man, feral
? = unconfirmed sightings

OCCURRENCE ON EACH ISLAND GROUP
PR Providenciales
WC West Caicos

NC North Caicos
MC Middle Caicos
EC East Caicos
SC South Caicos
PC Pine Cay
CI* Caicos small cays
CI Caicos Islands (including all the above group)

GT Grand Turk
S Salt Cay
TI* Turks small cays
TI Turks Islands (including all the above group)

TCI Turks & Caicos Islands (i.e. the whole country)

EXAMPLE OF HOW TO USE THIS KEY:

Species	Status
Blue-winged Teal *Anas discors*	cWV.Cl:uWV.TI

(common winter visitor on Caicos Islands; uncommon winter visitor on Turks Islands)

Several species newly reported in TCI since Bradley's book have been added. These species are marked by underlining.

FAMILY/COMMON NAME	**SPECIES**	**STATUS**
	GREBES – PODICIPEDIDAE	
Least Grebe	*Tachybaptus dominicus*	uBR.Cl:WVTI
Pied-billed Grebe	*Podilymbus podiceps*	uBR.Cl:WV.TC1

Least Grebe resident on many ponds but favours particularly small, deep sink-holes such as Nanny Pond and Cottage Pond. Pied-billed Grebe may use these too, but favours larger ponds and the shallow water inshore over the reef.

	SHEARWATERS - PROCELLARIIDAE	
Audubon's Shearwater	*Puffinius lherminieri*	uBSV.TCI
	TROPICBIRDS - PHAETHONTIDAE	
White-tailed Tropicbird	*Phaethon lepturus*	uBSVTCI
	BOOBIES - SULIDAE	
Masked Booby	*Sula dactylatra*	V
Brown Booby	*Sula leucogaster*	(BR).TI
Northern Gannet	*Sula bassanus*	?V.PR

This group of seabirds are essentially marine and visit land mainly for nesting. The cliffs of northwestern Middle Caicos, below that part of Crossing Place Trail, is an important nesting area for the white-tailed tropicbird, and is one of the few places in the islands with suitable cliffs. The adjacent Highas Cay is similarly used. Local residents familiar with birds describe Audubon's shearwater breeding in this area and the islets off the cliffs. This burrow-nesting species visits land only at night, so records are few, and these reports important.

PELICANS – PELECANIDAE

Brown Pelican	*Pelecanus occidentalis*	uBR.EC:R.TCI

Commonly seen gliding on the wind along the reefward shore, while searching for fish, and also on the ponds. Breeding sites include Flamingo Pond, East Caicos.

CORMORANTS – PHALACROCORACIDAE

Double-crested Cormorant	*Phalacrocorax auritus*	?V.PR&GT
Olivaceous Cormorant	*Phalacrocorax olivaceus*	uWV/P.GT

FRIGATEBIRDS – FREGATIDAE

Magnificent Frigatebird	*Fregata magnificens*	uBR.TCI

An important and long-established breeding colony of these, also known as man o'war birds, occurs on the mangrove bush off the south coast of Middle Caicos, suitably named Man o'War bush. Although marine feeders, snatching food from the surface or from other birds, the frigate-birds never land on water. The birds are seen in small numbers ranging widely over its feeding areas around the islands and beyond.

HERONS – ARDEIDAE

American Bittern	*Botaurus lentiginosus*	?V.GT
Least Bittern	*Ixobrychus exilis*	rWV.GT&PC
Great Blue Heron	*Ardea herodias*	uWV.TCI
Great Egret	*Casmerodius albus*	uWV.TC1I
Snowy Egret	*Egretta thula*	uR/WV.TCI
Little Blue Heron	*Egretta caerulea*	uR/WV.TCI
Tricolored Heron	*Egretta tricolor*	cBR.TCI
Reddish Egret	*Egretta rufescens*	uBR.TCI
Cattle Egret	*Bubulcus ibis*	uBR.TCI
Green Heron	*Butorides virescens*	cBR/WV.TCI
Black-crowned Night Heron	*Nycticorax nycticorax*	uWV.TCI
Yellow-crowned Night Heron	*Nyctanassa violacea*	cBR.TCI

The herons and egrets are some of the most typical birds of the area, making use of the ponds and marshes. Although seen most frequently at the accessible ponds, surveys on foot, by boat and from the air demonstrate usage throughout the extensive flats, mangroves and waterways, suggesting substantially important populations of the main species in these areas, including great blue heron, great egret, snowy egret, tricolored heron, reddish egret and green heron.

Cattle egrets are more terrestrial birds, typically of farmed lands. A sizeable flock frequents the areas along the main road on Middle Caicos.

The yellow-crowned night-heron also uses both terrestrial and wetland areas, often eating crabs and lizards. The low scrub vegetation along Crossing Place Trail west of Conch Bar and the associated Fish Ponds seem to be particularly favoured, although the species occurs widely.

IBIS AND SPOONBILLS - THRESKIORNITHIDAE

Glossy Ibis	*Plegadis falcinellus*	V.CI
Roseate Spoonbill	*Ajaia ajaja*	V.GT

These two vagrant species are occasionally seen, the spoonbill more frequently. Flamingo Pond and, when flooded, the flats on Middle Caicos seem to be favoured sites but various temporary wetlands have also been used.

FLAMINGOS – PHOENICOPTERIDAE

Greater Flamingo	*Phoenicopterus ruber*	cBR.Cl:uP.TI

Some hundreds to thousands of flamingos use the ponds of the Caicos Islands. It is quite likely that the number is variable because these birds often act as a population ranging over a wide area, partly because suitable breeding conditions tend to occur irregularly and infrequently. The main ponds used are the three Flamingo Ponds (on each main island), Big Pond, the unnamed waterway between the main part of East Caicos and Hog Cay, Fish Ponds and the pond complex in northwestern North Caicos; other ponds may be used to a lesser degree. Signs of nesting activity have been reported from Flamingo Ponds on North and Middle Caicos, Big Pond and some smaller ponds in Middle Caicos and some of the NW North Caicos ponds.

	GEESE AND DUCKS - ANATIDAE	
Fulvous Whistling Duck	*Dendropygna bicolor*	V.TCI
West Indian Whistling Duck	*Dendrocygna arborea*	u(BR).Cl
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	?V
Canada Goose	*Branta canadensis*	I.PR
Green-winged Teal	*Anas crecca*	rP.WC
Mallard	*Anas platyrhynchos*	I.PR
White-cheeked Pintail	*Anas bahamensis*	cBR.TCI
Northern Pintail	*Anas acuta*	rWV.GT
Blue-winged Teal	*Anas discors*	cWV.Cl:uWV.TI
Northern Shoveler	*Anas clypeata*	RWV/1P.TCI
American Widgeon	*Anas americans*	RWV/P.TCI
Redhead	*Aythya americana*	RWV.PR&PC
Ring-necked Duck	*Aythya collaris*	rP.CI
Lesser Scaup	*Aythya affinis*	uWV.TCI
Hooded Merganser	*Lophodytes cucullatus*	rWV.TCI
Ruddy Duck	*Oxyura jamaicensis*	uBR.CI
Masked Duck	*Oxyura dominica*	rWV.pc

The important and vulnerable West Indian whistling duck breeds in, and or otherwise depends on, several wetlands. These include Village Pond, Lorimers Quarry, Nanny Pond, Duck Pond, parts of the North Caicos Flamingo Pond complex, and some of the East Caicos ponds. Despite being such a large and conspicuous bird in some situations, it can be surprisingly secretive and inconspicuous. Some of its other sites in wetlands in the woodland and scrub almost certainly remain undiscovered. The bird is known locally as the "brown bomber", apparently because of being viewed as an aerial attacker of grain fields.

Other commonly seen ducks include white-cheeked pintail, blue-winged teal, American widgeon and lesser scaup, with some of the other species seen less commonly. The main habitats are the ponds, with usage varying according to the water levels. Flamingo Pond on North Caicos is particularly important, and may hold large flightless moulting flocks, e.g. of white-cheeked pintail. Other ponds which are particularly important in some situations include Fish Ponds, Village Pond, Middle Caicos Flamingo Pond, Turnup and Montpeller Ponds, Washing Pond, Duck Pond, Topham Pond, Daddy Long Pond, the East Caicos ponds and many of the marshes.

	HAWKS – ACCIPITRIDAE	
Osprey	*Pandion haliaetus* cBR.TCI	
Northern Harrier	*Circus cyaneus* rP.TCI	
Sharp-shinned Hawk	*Accipiter striatus*	V.TCI
Red-tailed Hawk	*Buteo jamaicensis*	V.GT

	FALCONS – FALCONIDAE	
American Kestrel	*Falco sparverius*	cBR/(WV).TCI
Merlin	*Falco columbarius*	uWV11P.TCI
Peregrine Falcon	*Falco peregrinus*	uWV1P.TCI

Ospreys occur throughout the area, both as visiting wintering birds and particularly as the breeding residents, which are part of a distinctive race of TCI and southern Bahamas (*Pandion haliaetus ridgwayi*). They tend to nest on islets off the north coast or on trees/telegraph poles, and range widely hunting fish.

The most abundant bird of prey is the American kestrel, seen throughout the islands, including on the flats, but most readily seen spread regularly along the telegraph wires watching for prey. The related merlin and peregrine are less commonly seen, but regular.

	QUAIL & GUINEAFOWL – PHASIANIDAE	
Gambel's Quail	*Callipepla gambelli*	I.PR
Helmeted Guinea-fowl	*Numida meleagris*	I.Cl
	RAILS AND COOTS – RALLIDAE	
Clapper Rail	*Rallus longirostris*	uBR.TC1
Sora	*Porzana carolina*	uWV.TCI
Purple Gallinule	*Porphyrula martinica*	rWV/P.CI
Common Moorhen	*Gallinula chloropus*	uBR.TC
American Coot	*Fulica americana*	cWV/R.Cl:uWV.GT

Coots are commonly seen on the same waterbodies as the ducks described above. Moorhens tend to use some of the smaller ponds and marshes. The "walking" rails, clapper and sora are particularly difficult to see, as they tend to stay in tall vegetation in marshes. Clapper rails breed in the area, and have been observed in small pools such as Village Pond and some of the ponds and marshes in the woodland/scrub areas.

	LIMPKINS - ARAMIDAE	
Limpkin	*Aramus guarauna*	V.TI
	PLOVERS - CHARADRIIDAE	
Black-bellied Plover	*Pluvialis squatarola*	cWV/P.TCI
Lesser Golden-Plover	*Pluvialis dominica*	rWV/P.TCI
Snowy Plover	*Charadrius alexandrinus*	cBSV.CI
Snowy Plover	*Charadrius alexandrinus*	cBSV.TCI
Wilson's Plover	*Charadrius wilsonia*	cBSV.TCI
Semipalmated Plover	*Charadrius semipalmatus*	cWV/P.TCI
Piping Plover	*Charadrius melodus*	rP.TCI
Killdeer	*Charadrius vociferus*	cBR.TCI
	OYSTERCATCHERS - HAEMATOPODIDAE	
American Oystercatcher	*Haematopus palliatus*	uBR.TCI
	STILTS - RECURVIROSTRIDAE	
Black-necked Stilt	*Himantopus mexicanus*	cBR.TCI
American Avocet	*Recurvirostra americana*	V.GT
	SANDPIPERS - SCOLOPACIDAE	
Greater Yellowlegs	*Tringa melanoleuca*	uWV/cP.TCI
Lesser Yellowlegs	*Tringa flavipes*	cWV/P.TCI
Solitary Sandpiper	*Tringa solitaria*	uP.TCI
Willet	*Catoptrophorus semipaimatus*	cBSV/.uWV.TCI
Spotted Sandpiper	*Actitis macularia*	uWV/cP.TCI
Upland Sandpiper	*Bartramia longicauda*	rP.MC
Whimbrel	*Numenius phaeopus*	uWV/P.TCI
Hudsonian Godwit	*Limosa haemastica*	rP.PR&PC
Ruddy Turnstone	*Arenaria interpres*	cP/R.TCI
Red Knot	*Calidris canutus*	rP.TCI

Sanderling	*Calidris alba*	cWV/P.TCI
Semipalmated Sandpiper	*Calidris pusilla*	cWV/P.TCI
Western Sandpiper	*Calidris mauri*	uWV/P.TCI
Least Sandpiper	*Calidris minutilla*	cWV/P.TCI
White-rumped Sandpiper	*Calidris fuscicollis*	uP.TCI
Pectoral Sandpiper	*Calidris melanotos*	uP.TCI
Dunlin	*Calidris alpina*	rWV/P.TCI
Stilt Sandpiper	*Calidris himantopus*	cWV/P.TCI
Short-billed Dowitcher	*Limnodromus griseus*	cWV/P.TCI
Common Snipe	*Gallinago gallinago*	uWV.TCI

Some arctic-breeding shorebirds occur in large numbers in the spring and autumn (fall) migration periods. Some remain in smaller numbers in the winter, and small numbers of immature birds may also occur in the summer. These species occur in shallow pools, exposed mud, the flats and the shallow waters. Although individual flocks are rarely huge, there is such an extent of suitable habitat that total numbers using the area must be quite large, especially when migratory turnover is taken into account. There are slight habitat differences between species, but large overlap. The commonest are: black-bellied plover, semi-palmated plover, lesser and greater yellowlegs, willet (which is also a breeding species in summer), spotted sandpiper, whimbrel, ruddy turnstone, sanderling, semipalmated sandpiper, western sandpiper, least sandpiper, stilt sandpiper, short-billed dowitcher.

On the sandy coasts, there are increasing non-breeding records (which sadly probably reflect better coverage, rather than an increase) of the vulnerable piping plover.

On these coasts and sandy shores of ponds and salinas, Wilson's and snowy plovers breed, as do the resident killdeers. Resident oystercatchers nest on sea shore sites.

Black-necked stilts are common breeding residents, occurring in very many of the ponds. Stilts and willets may breed in substantial numbers on the flats when wet conditions occur.

	GULLS AND TERNS - LARIDAE	
Laughing Gull	*Larus atricilla*	cBSV.TCI
Bonaparte's Gull	*Larus philadelphia*	V.PC
Ring-billed Gull	*Larus delawarensis*	rWV.TCI
Herring Gull	*Larus argentatus*	uWV.TCI
Gull-billed Tern	*Sterna nilotica*	cBSV.TCI
Caspian Tern	*Sterna caspia*	rWV1P.GT&PR
Royal Tern	*Sterna maximus*	cBR.TC1
Sandwich Tern	*Sterna sandvicensis*	uWV/cBSV.TCI
Roseate Tern	*Sterna dougallii*	uBSVTCI
Common Tern	*Sterna hirundo*	rP.TCI
Least Tern	*Sterna antillarum*	cBSV.TCI
Bridled Tern	*Sterna anaethetus*	cBSV.TCI *
Sooty Tern	*Sterna fuscata*	aBSV.TCI *
Black Tern	*Chlidonias niger*	rP.TCI
Brown Noddy	*Anous stolidus*	aBSVTCI*
Black Skimmer	*Rhynchops niger*	V.P&GT

Laughing gulls are the common breeding gull of the area, nesting particularly on islets in various situations. These are replaced in winter by mainly juvenile herring and ring-billed gulls. The shallow waters and ponds are important feeding areas for both, Fish Ponds and the Flamingo Ponds being particularly favoured feeding and roosting areas.

Royal terns are breeding residents, although individuals probably range widely at sea outside the brreding season. In summer, they are is joined by breeding least terns, Sandwich terns, roseate terns, bridled terns, sooty terns and brown noddies. Many of these use small cays, and work is in hand to detail the distributions. In suitably wet seasons, gull-billed terns may breed on the flats.

LANDBIRDS

	PIGEONS AND DOVES - COLUMBIDAE	
White-crowned Pigeon	*Columba leucocephala*	uBR.TCI
White-winged Dove	*Zenaida asiatica*	uBR.TCI
Zenaida Dove	*Zenaida aurita*	cBR.TCI
Mourning Dove	*Zenaida macroura*	cBR.TCI
Common Ground-Dove	*Columbina passerina*	cBR.TCI
Key West Quail-Dove	*Geotrygon chrysia*	r(BR).NC&PC
Blue-headed Quail-dove	*Starnoenas cyanocephala*	V.NC

White-winged, zenaida and mourning doves and common ground-dove occur commonly, especially in the woodland and scrub areas. White-crowned pigeon also occurs widely in this habitat, but is less common. Locations are variable, probably depending on the fruit crop, but the woodlands of north-western North Caicos seem favoured.

Key West Quail-dove is reported from the woodland areas of the Caicos Islands, but there are few recent sightings. There have, however, been several sightings in 2001-2 in the woodlands of the Wades Green area of blue-headed quail-dove, a Cuban endemic.

	CUCKOOS – CULCULIDAE	
Yellow-billed Cuckoo	*Coccyzus americanus*	cP.TCI
Mangrove Cuckoo	*Coccyzus minor*	uBR.TCI
Smooth-billed Ani	*Crotophaga ani*	cBR.TCI

Occurring mainly in scrub and woodland, the latter two species are residents, the first a passage migrant albeit in very large numbers.

	BARN OWLS – TYTONIDAE	
Barn Owl	*Tyto alba*	uBR.Cl.

A nocturnal hunter which uses many of the caves as day-time roosts (and probably nesting sites).

	OWLS-STRIGIDAE	
Short-eared Owl	*Asio flammeus*	V.GT

	NIGHTHAWKS – CAPRIMULGIDAE	
Common Nighthawk	*Chordeiles minor*	uP.TCI
Antillean Nighthawk	*Chordeiles gundlachii*	cBR.TCI
Chuck-will's-widow	*Caprimulgus carolinensis*	rWV.TCI

The Antillean nightjar is nocturnal hunter of insects, which generally roosts on open ground. Widespread through the islands

	SWIFTS - APODIDAE	
Black Swift	*Cypseloides niger*	?V.GT
Chimney Swift	*Chaetura pelagica*	rP.TCI

	HUMMINGBIRDS - TROCHILIDAE	
Bahama Woodstar	*Calliphlox evelynae*	aBR.TCI
Bee Hummingbird	*Mellisuga helenae*	V.PR
Cuban Emerald	*Chlorostilbon ricordii*	V.EC

The Bahama woodstar is common throughout the islands. The Cuban Emerald, endemic to Cuba, has been recorded in East Caicos in the 1930s and in 1998, these actually representing quite a high proportion of the visits by ornithologists to this uninhabited island.

KINGFISHERS – ALCEDINIDAE

Belted Kingfisher	*Ceryle alpyon*	uWV.TCI

Winter visitor, using a wide range of water bodies, including ponds, shallows and creeks.

WOODPECKERS – PICIDAE

Yellow-bellied Sapsucker	*Sphyrapicus varius*	uWV.TCI
Hairy Woodpecker	*Picoides villosus*	V.PR

TYRANTS –TYRANNIDAE

Eastern Wood Pewee	*Contopus virens*	rP.GT&PR
Greater Antillean Pewee	*Contopus caribaeus*	V.PR
Eastern Kingbird	*Tyrannus tyrannus*	rP.PR
Gray Kingbird	*Tyrannus dominicensis*	aBSV.TCI

Gray Kingbird is a common breeding summer visitor, most easily seen spaced along the telephone wires. Giant Kingbird *Tyrannus cubensis*, now restricted to Cuba, used to occur in the Caicos Islands, and there have been some possible recent sightings.

SWALLOWS - HIRUNDINIDAE

Purple Martin	*Progne subis*	uP.TCI
Caribbean Martin	*Progne dominicensis*	V.GT
Tree Swallow	*Tachycineta bicolor*	rP.TCI
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	rP.TCI
Bank Swallow	*Riparia riparia*	uP.TCI
Cliff Swallow	*Hirundo pyrrhonota*	rP.TCI
Barn Swallow	*Hirundo rustica*	uP.TCI

CROWS - CORVIDAE

Cuban Crow	*Corvus nasicus*	cBR.Cl

Cuban crow occurs only in Cuba and in the Caicos Islands. The population in the latter seems particularly important. The bird uses the scrub, woodland and mangrove habitats and the village surrounds, particularly foraging for fruit.

GNATCATCHERS & THRUSHES – MUSCICAPIDAE

Blue-gray Gnatcatcher	*Polioptila caerulea*	cBR.TCI
Grey-cheeked Thrush	*Catharus minimus*	rP.PR&GT
American Robin	*Turdus migratorius*	V.PR&PC

Blue-gray gnatcatcher is a common bird of dense scrub and woodland, with particularly high densities in the woodland between Lorimers and Bambarra.

MOCKINGBIRDS – MIMIDAE

Gray Catbird	*Dumetella carolinensis*	cWV.TCI
Northern Mockingbird	*Mimus polyglottos*	aBR.TCI
Bahama Mockingbird	*Mimus gundlachii*	aBR.TCI
Pearly-eyed Thrasher	*Margarops fuscatus*	uBR.CI:(BR).TI

Both the three breeding residents and the wintering visiting catbird occur throughout the islands.

WAGTAILS & PIPITS - MOTACILLIDAE

American Pipit	*Anthus spinoletta*	V.MC

First recorded (a single bird) at Conch Bar, Middle Caicos in November 2001, following prolonged gales.

WAXWINGS – BOMBYCILLIDAE

Cedar Waxwing	*Bombycilla cedrorum*	rWV.PR&GT

STARLINGS – STURNIDAE

European Starling	*Stumus vulgaris*	V.GT

VIREOS – VIREONIDAE

White-eyed Vireo	*Vireo griseus*	uWV/P.TCI
Thick-billed Vireo	*Vireo crassirostris*	cBR.Cl
Yellow-throated Vireo	*Vireo flavifrons*	uWV.TCI
Philadephia Vireo	*Vireo philadelphicus*	rP.PR&GT
Red-eyed Vireo	*Vireo olivaceus*	rP.TCI
Black-whiskered Vireo	*Vireo altiloquus*	c(SV).TCI

Thick-billed Vireo is restricted to Bahamas, TCI, Cayman and a few small cays. In TCI, it is restricted to the Caicos Islands, where an endemic subspecies *Vireo crassirostris stalagmium* is recognised. It is an abundant bird in dense scrub and woodland, with particularly high densities in the woodland between Lorimers and Bambarra.

Black-whiskered vireo is a common summer visitor from its South American breeding grounds and the white-eyed vireo a less common winter visitor from the north.

WOOD-WARBLERS - PARULIDAE

Blue-winged Warbler	*Vermivora pinus*	rP.PR&GT
Tennessee Warbler	*Vermivora peregrina*	uP.PR
Nashville Warbler	*Vermivora ruficapilla*	rP.TCI
Northern Parula	*Parula americana*	cWV.TCI
Yellow Warbler	*Dendroica petechia*	aBR.TCI
Chestnut-sided Warbler	*Dendroica pensylvanica*	rP.PR
Magnolia Warbler	*Dendroica magnolia*	uWV.TCI
Cape May Warbler	*Dendroica tigrina*	aWV.TCI
Black-throated Blue Warbler	*Dendroica caerulescens*	uWV.TCI
Yellow-rurnped Warbler	*Dendroka coronata*	cWVTCI
Black-throated Green Warbler	*Dendroka virens*	uWV/P.TCI
Blackburnian Warbler	*Dendroica fusca*	rP. PR
Yellow-throated Warbler	*Dendrolca dominica,*	uWV/P.TCI
Kirtland's Warbler	*Dendroica kirtlandii*	rWV.GT,NC,SC
Prairie Warbler	*Dendroica discolor*	UWV/P.TCI
Palm Warbler	*Dendroica palmarum*	aWV.TCI
Bay-breasted Warbler	*Dendroica castanea*	rP.PR&GT
Blackpoll Warbler	*Dendroica striata*	uP.TCI
Cerulean Warbler	*Dendroica cerulea*	?V.GT
Black-and-white Warbler	*Mniotilta varia*	cWV.TCI
American Redstart	*Setophaga ruticilla*	cWV.TCI
Prothonotary Warbler	*Protonotana citrea*	rP.TCI
Worm-eating Warbler	*Helmitheros vermivorus*	uWV/P.TCI
Ovenbird	*Seiurus aurocapillus*	cWV.TCI
Northern Waterthrush	*Seiurus noveboracensis*	cWV.TCI

Louisiana Waterthrush	*Seiurus motacilla*	rWV.NC.GT
Kentucky Warbler	*Oporomis formosus*	RP.TCI
Connecticut Warbler	*Oporomis agilis*	?rP.Cl
Mourning Warbler	*Oporomis philadelphia*	RP.NC
Common Yellowthroat	*Geothlypis trichas*	cWV.TCI
Hooded Warbler	*Wilsonia citrina*	uWV/P.TCI

The wood warblers are a large and complex group, mainly migrant visitors at various seasons. The yellow warbler is a breeding resident. All the warblers tend to use a range of scrub and woodland habitat, including mangroves as well as other woodlands. The area from the savannah mangrove flats north of Big Pond northwards through the woodlands between Lorimers and Bambarra, to the Haulover shore area seems to be particularly important. This is also the area in which sightings have been made of Kirtland's warbler, one of the rarest and most vulnerable species in North America. (This species breeds only in certain areas of Michigan state, USA.)

	BANANAQUITS - COEREBIDAE	
Bananaquit	*Coereba flaveola*	cBR.TC1
	TANAGERS - THRAUPIDAE	
Stripe-headed Tanager	*Spindalis zena*	u(BR).PR&NC
Summer Tanager	*Piranga rubra*	uP.GT
Scarlet Tanager	*Piranga olivacea*	rP.TCI
	GROSBEAKS - CARDINALIDAE	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	uP.TCI
Blue Grosbeak	*Guiraca caerulea*	cP.TCI
Indigo-bunting	*Passerina cyanea*	uWV/aP.TCI
Painted Bunting	*Passerina ciris*	?V.PR
Dickcissel	*Spiza americana*	?V.GT
	EMBERIZIDAE	
Black-faced Grassquit	*Tiaris bicolor*	cBR.Cl
Greater Antillean Bullfinch	*Loxigilla violacea*	cBR.MC&EC
White-crowned Sparrow	*Zonotrichia leucophrys*	rWV.MC
Bobolink	*Dolichonyx oryzivorus*	cP.TCI
Brown-headed Cowbird	*Molothrus ater*	?V.PR
Northern Oriole	*Icterus galbula*	uP.TCI

Bananaquits are common in dense bush throughout.

The Greater Antillean Bullfinch is also a bird of dense scrub, but is restricted in TCI to Middle and East Caicos, where it is an endemic subspecies *Loxigilla violacea ofella*. It is replaced on North Caicos (and Providenciales) by the ecologically similar (but not closely related) stripe-headed tanager. It is remarkable to witness such marked distributional differences over such a small area as between such close islands.

The black-faced grassquit is a common but inconspicuous bird of open areas.

Some of the other species, such as blue grosbeak and indigo bunting are common passage migrants.

In addition to the observational work, a good deal of training and awareness raising has been undertaken. A supply of reconditioned binoculars, a telescope, GPS and other equipment as well as field guides has been available for use by local personnel.