

Sustainable tourism on Green Island, Great Barrier Reef Marine Park

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Heather Zeppel, School of Business, James Cook University Cairns (heather.zeppel@jcu.edu.au)

Introduction

This chapter reviews the environmental management of tourism on Green Island a coral cay located 45 minutes from Cairns in Tropical North Queensland, Australia. This 12-hectare coral cay is the single most visited destination on the Great Barrier Reef, attracting over 350,000 visitors a year. Green Island is a designated National Park, Marine Park and Recreation Area located within the Great Barrier Reef Marine Park and World Heritage Area. Since 1990, a Green Island and Reef Advisory Committee oversees tourism on the cay, with the protected areas managed by a marine park ranger of the Queensland Parks and Wildlife Service (QPWS). Private leaseholders on Green Island are the Green Island Resort and Marineland Melanesia, a captive wildlife attraction with sea turtles and crocodiles on display. Other marine tourism businesses on Green Island include diving, sea walking (helmet diving) and parasailing operators. The history of human and tourism use of this coral cay and former detrimental impacts is first covered. This chapter then evaluates the regulatory, physical, economic and educational strategies now used to manage tourism sustainably on Green Island. It reviews the collaboration between Queensland Parks and Wildlife Service, Green Island Resort and other key stakeholders on this coral cay. The chapter will describe initiatives taken since the mid-1990s to manage tourism sustainably on Green Island, including the park management plans, environmental guidelines and negotiations with traditional Aboriginal owners. This co-operative management is necessary for sustainable tourist use of this cay.

Coral cay tourism in the Great Barrier Reef

The Great Barrier Reef (GBR) attracts 1.9 million visitors a year and generates AUD\$5.1 billion from marine tourism activities including diving, snorkelling, fishing, boating, island resorts and other services (Access Economics, 2009). There are 300 coral cays in the Great Barrier Reef Marine Park (GBRMP) with several sandy cays visited regularly by reef tour operators. These include Michaelmas cay, a major seabird nesting area (Muir, 1993) and Upolu cay, both off Cairns; Low Isles off Port Douglas and Beaver cay off Mission Beach. Various reef day tours visit these coral cays that have minimal or no facilities and no overnight stays allowed. Only a few coral cays on the GBR in the southern Capricorn section have permanent tourist resorts such as Heron Island and Lady Elliott Island, with a luxury tented camp for 12 guests operating on Wilson Island that is closed 26 January-28 February during the bird-nesting season (Voyages, 2009). Camping is allowed on Lady Musgrave, Northwest and Masthead Islands in the southern Capricorn Bunker group. The Green Island Resort near Cairns is the only resort on a coral cay in the northern section of the GBR. All other island resorts in the GBRMP are located on continental islands that are fringed by coral reefs (i.e. Lizard, Fitzroy, Dunk, Bedarra, Hinchinbrook, Orpheus, Magnetic, Lindeman, Brampton, Great Keppel, Keswick and the Whitsunday Islands). This chapter evaluates how tourism is managed for sustainability on Green Island. Information is drawn from published reports, park management plans, conservation and tourism research and other news articles about Green Island. Additional site information is drawn from student field trips to Green Island from 2002-2009 led by the author, with presentations given by QPWS park rangers and environmental managers of Green Island Resort about key management issues.

History of human use of Green Island

The Gungandji Aboriginal name for Green Island is *Wunyami*, meaning ‘a place of spirits’, or *Dabuukji* ‘the place of the hole in the nose’, with the island traditionally used as an initiation site for young Aboriginal men (Martyn, 1993). Park visitor brochures mention the Aboriginal significance of Green Island for ceremonies and the traditional use of sea country, for hunting and fishing (EPA, 1999, 2007). Captain James Cook named this coral cay as Green Island in 1770. European exploitation of Green Island in the mid to late 1800s included beche-de-mer fishermen cutting down the forest to smoke sea cucumbers and also a turtle soup cannery (Baxter, 1990; Martyn, 1993). A turtle cannery also operated on Heron Island (1926-1929) and North West Island (1924-1928) in the southern GBR. In many areas of the reef, early tourists also rode on the backs of nesting turtles (Lucas, 2008). Green Island has been a popular tourist site for over 100 years, with organised pleasure cruises to the cay made since 1890. Coconut trees were planted in 1899 for shipwreck survivors while a beachcomber lived on Green Island until his death in 1907 (Martyn, 1993). It was originally declared as a recreation reserve under Cairns Town Council in 1906, with regulations to prevent the removal of coral and shells around the cay. Passenger ferries have visited the coral cay since 1924, the first hotel was built in 1942, the world’s first glass bottom boat tour occurred in 1948 and the world’s first underwater observatory opened in 1954 that is still operating (Green Island Resort, 2009). Coral formations were placed around the observatory to attract reef fish (Martyn, 1993). Two pioneering GBR photographers, Noel and Kitty Monkman, also lived on Green Island from 1956. In 1958, camping was no longer allowed on the coral cay. By 1961, other visitor attractions on Green Island were the Coral Cay Hotel, Great Barrier Reef Theatre and Marineland. Environmental impacts of the hotel included raw sewage seeping onto the reef flat with cardboard and paper rubbish burnt on the cay (Harris and Leiper, 1995). Up to the 1980s, the hotel and other tourism operators on the cay also relied on collecting rain water for their needs (EAA, 1983). Seaplane access began in 1978.

Green Island National Park

The Green Island National Park comprises 7.93 ha of the island covering the middle and eastern portions of the coral cay. Green Island was declared a Fauna Sanctuary in 1934; as the first island national park in Queensland in 1937 (including the foreshore and reef out to one mile below the low tide mark); and a marine national park in 1974 (out to 1.6 km beyond the reef platform), combined into the Cairns Marine Park in 1989 (below high tide mark out to 1.6 km). Green Island also became part of the Great Barrier Reef Marine Park in 1975 and part of the Great Barrier Reef World Heritage Area in 1981 (EPA, 2003). The reefs around the island are zoned as a green zone or no-take zone with no fishing or collecting allowed. In 1990, the surrounding reef, beaches and public areas of Green Island were also declared as a recreation area. The Green Island Recreation Area includes the island national park, a public esplanade and jetty, mooring areas and navigation channel and the marine park from the edge of the reef out to 1.6 km. The national park, marine park and recreation area at Green Island is managed by the Queensland Parks Service, with a marine park ranger living on the cay. Since 1990, a recreation area levy of \$1.80c per visitor collected by all reef tour operators to Green Island provides funding to QPWS for the ranger-in-charge, all capital works (i.e. board walks, ranger building, and bulldozing sand to protect the esplanade), pest control (i.e. rat baiting), interpretive signs, and a lifeguard at the designated swimming beach. In 2004 this recreation levy generated AUD\$643,915 in funds, for QPWS and GIRAC to manage Green Island. A self-guided eco-walk through the rainforest on Green Island has been listed as one of the top ten bushwalks in Queensland (*The Cairns Post*, 2009b). A Queensland Centenary of Parks celebration day was held on Green Island in May 2008, with turtle releases, sea cucumber presentations, a poster display on sea grasses, and reef films (Anthony, 2008).

Green Island

Green Island is a sandy coral cay that supports a closed vine-thicket rainforest up to 25 m high with some 134 species of plants. It also has 35 species of seabirds and 28 species of forest birds with seven species breeding on the cay including the pied imperial pigeon which nests from October to May (EPA, 2003; 2009a). Flightless buff-banded rails are also commonly seen on Green Island, recovering after a successful rat-baiting program by QPWS. It is the only coral cay in the Great Barrier Reef that has a rainforest on it, sustained by an aquifer. Green Island has a circumference of 1.6 km and is fringed by coastal plants, sandy beaches and reef flats. It takes about 30-45 minutes to walk around Green Island with views out over the reef. The coral cay is surrounded by a platform coral reef (710 ha) with giant clams, diverse tropical fish, stingrays, green turtles and hawksbill turtles, dugong and reef sharks. There are over 190 hard coral species and over 100 soft coral species found at Green Island (Great Adventures, 2009a). The fringing coral reefs around Green Island are still recovering from coral-eating *Drupella* snails and previous outbreaks of crown-of-thorns starfish in 1963-64, 1969-1972 and 1979-1982 (Baxter, 1990). In 1964, a diver removed over 400,000 crown of thorns starfish from the reef around Green Island (Martyn, 1993). Coral bleaching episodes on the GBR in 1998, 2002 and 2006 (far southern section) caused white patches of dead coral on fringing reefs (Siebeck et al., 2006). These bleached patches of coral were noticeable since 2003 at Green Island but the reef has since recovered, with no further bleaching recorded at this site on reef surveys in 2006 (GBRMPA, 2007). There are abundant seagrass beds on the reef flats around Green Island grazed by green turtles and dugongs. Mainly juvenile turtles foraged around Green Island (Fuentes *et al.*, 2006). A seagrass watch monitoring program at Green Island since 2000 has found stable coverage of seagrass species at two sites with the highest abundance recorded in 2008 and no traces of herbicides washed out from sugar cane farms on the mainland (*Seagrass-Watch*, 2008). Tourists snorkelling, diving or on boat tours at Green Island can see hard and soft corals, giant clams, colourful reef fish, and green turtles. In August 2009 a migrating humpback whale was seen just 100m offshore inside the reef and observed underwater from a semi-submersible at Green Island (Dickson, 2009). Green turtles are also starting to nest again on Green Island with resort guests watching 100 turtle hatchlings scramble to the ocean in February 2009 (*The Cairns Post*, 2009a). Rangers have recorded up to 640 turtle hatchlings from 12 nests (Wells, 2003), with a turtle research and monitoring program operating on Green Island since 1988.

Marine tourism on Green Island

Some 70% of GBR tourism (749,000 visitors) based on coral reef visitation occurs within the Cairns region of the GBRMP (Tessler, 2009). From 1999 to 2004, the number of visitors to Green Island increased from 235,080 to 385,211 a year. The average visitation over the 10 years up to 2004 is 280,000 per year and 787 visitors per day. The maximum daily number of visitors is capped at 2,240 people in one day, mainly to the five reef tour operators with permits to bring passengers to Green Island (EPA, 2003). Some of this visitor capacity is allocated to roving reef operators who visit other sites and to allow for rough weather when the permitted operators cannot go to the outer reef but can still take visitors to Green Island. Daily visitation has been up to 1,900 visitors but has declined to a maximum of about 1,200-1,500 day visitors. A social carrying capacity study on Green Island recommended a daily maximum of 1,200 to 1,345 visitors (Beaumont, 1996 in EPA, 2003; Beaumont, 1997). About 95% of visitation to Green Island is day trip visitors (Baxter, 1990). Tourists on Green Island derive from Japan, China, South Korea, Europe, USA, Australia and other countries. Most tourists arrive at Green Island on two large catamaran services with two to four return trips a day from Cairns, other smaller reef tour boats, private boats and yachts. A helicopter and a seaplane also fly to Green Island, with a maximum of five flights a day allowed on a

restricted flight path (EPA, 2003) (Figure 1). Current tourist facilities on Green Island include a jetty (Figure 2); day use area with cafes, bars, shops and a pool; a patrolled beach; boardwalks with interpretive signs; Marineland Melanesia with captive turtles, fish and crocodiles; and the Green Island Resort. The Monkman Reef Research Station located on Green Island is not usually open to visitors. All buildings on Green Island are below the rainforest canopy, with only a tall radio tower and the jetty visible from sea. A public esplanade area at the western end includes a retaining sea wall, brick-paved walkways, signage and a patrolled swimming beach with a lifeguard on duty. Marine activities at Green Island include swimming, diving, snorkelling, 'sea walking' (helmet diving), fish feeding by permitted operators, glass bottom boats (Figure 3) and semi-submersibles, the underwater observatory, and boating, fishing or parasailing offshore. Fishing and motorised water sports are not permitted in the waters surrounding Green Island (EPA, 2003). A self-guided snorkel trail previously operated from 1982-1987 at the western end of the cay but was removed (Baxter, 1990). Green Island Resort operates most of the tourist facilities on the coral cay including accommodation, a restaurant, cafes and bars, a swimming pool, information centre, boutiques and public toilets. The lease for Green Island Resort and the day use visitor facilities covers 1.8ha at the western end of the cay. The Resort operates under stringent environmental conditions such as no gutters or collection of rainwater (to replenish the aquifer), with buildings and walkways erected on piles (to not impede animal movement), a tertiary sewage treatment plant and a water desalination plant. QPWS works with the Green Island Resort, reef tour operators and other government stakeholders to manage tourism on Green Island. QPWS has planted Casuarina or coastal she-oak seedlings; monitored nesting turtles; installed public moorings; surveyed for crown-of-thorns starfish; run rat-baiting programs and built boardwalks (Wells, 2003).

Green Island Resort

In 1991, Daikyo Pty Ltd purchased the resort (closed in 1989) and ferry service on Green Island. During 1992-1994, Daikyo demolished a previous resort and constructed the current Green Island Resort at a cost of AUD\$43 million to accommodate 90 guests and other day visitors. The 5-star resort has 46 luxury suites with a pool, restaurant and meeting room. Daikyo developed an environmental code of practice for the construction company and the contractors building the resort, with environmental bonds for any damage caused. This code covered building materials, removal of rubbish and liquid waste, and protection of plants and animals. Scaffolding was erected around trees while the trimming or removal of branches was not allowed (Harris and Leiper, 1995). Permit conditions for the resort redevelopment set by the Department of Environment and Heritage and GBRMPA stated that sewage had to be tertiary treated, rainwater had to fall on the ground to recharge the aquifer (i.e. no gutters on roofs), natural colours for construction materials, building slabs suspended on concrete piles, a raised wooden walkway, and few trees cut down (Figure 4 & 5). Landscaping of the resort and lease area involved 6,000 native plants from 60 species. This revegetated a previously degraded resort site proving bird habitat and amenity for visitors (Harris and Leiper, 1995). The resort is described as 'one of the most eco-sensitive developments in the world.' However, air conditioning is left on in rooms for the comfort of guests and to prevent mould growing on surfaces in the humid tropical climate. Green Island Resort and Great Adventures Cruises were sold in 2005 to a local reef tourism company, Quicksilver Connections. A dedicated environmental management officer for the Resort was not replaced in 2009, with this role included in the duties of the overall environmental manager at Quicksilver Cruises. From 2000-2004, Green Island Resort won awards for resource conservation and waste management from the Environmental Protection Agency, along with cleanest beach awards.

Strategies to manage marine tourism

There are four main strategies employed by park agencies to control and manage marine tourism, these include regulatory, physical (i.e. infrastructure), educational and economic strategies (Orams, 1999). Regulatory strategies include park rules, regulations and zoning plans to restrict visitor numbers, prohibit activities, separate conflicting activities (temporal, spatial), closing areas, and requiring skill levels (i.e. certification of divers or tour operators). Regulations are included in permits, lease and licence requirements and included in voluntary codes of practice for marine activities. Physical strategies include site hardening, intensive use or 'sacrifice' areas, placement and design of facilities, altering sites, and rehabilitation. Economic strategies include fees for operators or visitors, damage bonds or deposit, fines, and rewards. There is an environmental management charge of AUD\$5 for every visitor to the GBRMP collected by reef tour operators. Ecotourism certified reef tour operators also receive 15-year operating permits, instead of the usual 5-years (GBRMPA, 2009). Educational strategies include various types of park interpretation such as brochures, signs, guided or self-guided walks, visitor centres, ranger contact, and other educational activities (i.e. beach clean up). Outcome indicators are used to measure the success of management strategies in reducing tourism impacts, and to monitor and assess improvements in the environment and visitor behaviour. Improvements to the marine environment include minimising disturbance, habitat protection and contributing to the longer-term health and viability of marine and coastal ecosystems (Orams, 1999). A cooperative management approach is used in the GBRMP to manage recreation and tourism and minimise the impacts of marine tourism and other reef activities (Harriott, 2002; Ilet *et al.*, 2000; TRRAC, 2002). This chapter assesses management strategies for sustainable tourism on Green Island.

Managing tourism on Green Island: Regulatory strategies

A QPWS marine park ranger is responsible for day-to-day management of Green Island Recreation Area and the surrounding reef. Regulation of tourism activities in the reefs and waters around Green Island comes under Queensland legislation for the GBR Coast Marine Park (*Marine Parks Act 2004*) and Federal legislation for the Great Barrier Reef Marine Park (*Great Barrier Reef Marine Park Act 1975*). The marine parks permit for Quicksilver Connections (2006-2022) authorises reef tourist activities, vessel charter, guided kayak tours and mooring at Green Island (GBRMPA, 2006). Other Queensland legislation applies for the national park (*Nature Conservation Act 1992*), jetty and public esplanade (*Local Government Act 1993*, *Integrated Planning Act 1997*). Cairns Port Authority (CPA) manages the jetty at Green Island with the public esplanade and swimming beach under the control of Cairns City Council (CCC). The *Environmental Protection Act 1994* (Qld) covers environmental impacts and polluting activities in land or sea areas. Under the *Recreation Areas Management Act 2006*, the main public areas of Green Island and the fringing reef are managed for both conservation and nature-based tourism or recreation. A Green Island and Reef Advisory Committee includes QPWS, GBRMPA, the Cairns Council, CPA, the Department of Natural Resources, native title claimants, Green Island Resort, and reef tour operators (EPA, 2003). Reef tourism operators and resort staff advise the QPWS ranger of people illegally fishing, collecting shells or marine life, sick or injured animals, fauna sightings such as nesting turtles, or other activities requiring attention on Green Island.

The overall approach to managing visitors and commercial enterprises on Green Island is guided by the zoning, regulations and guidelines set out in the *Green Island Recreation Area and Green Island National Park Management Plans* (EPA, 2003). The plans recognise the natural, cultural and scenic values of Green Island and support low-impact recreation activities that do not adversely affect these values and ecological sustainability. The plans

stipulate codes of practice and guidelines for beach hire equipment, helicopter operations, seaplane operations, and reef activities on or around Green Island. This includes limitations on vessel size, visitor numbers, areas and types of activities. Fish feeding guidelines are stipulated in marine parks permits as to location, type and amount of food fed. Guidelines for restricted, prohibited or limited tourism activities are also included in the management plans. Other marine park zoning provisions for the Great Barrier Reef Marine Park as outlined in the *Cairns Area Plan of Management*, prohibit fishing, motorised water sports or vessels over 35m in length at Green Island. In this plan, Green Island is designated as a sensitive location with high natural values and significant tourism use opportunities. There is a limit of four tourism vessels a day on the reef around Green Island, with a maximum group size of 15 on diving or snorkelling trips in the western section of the fringing reef. Anchoring was not permitted within 50 metres of moorings installed north of the jetty (EPA, 2003). Limitations on anchoring and fishing bans help protect the fringing reef around Green Island.

Managing tourism on Green Island: Physical strategies

The infrastructure and physical facilities to manage tourism on Green Island include the resort and associated amenities for day-use visitors (i.e. pool, café, bar, restaurant, shops, bins, toilets, showers, lockers). This concentrates visitor use around the main arrivals area where these facilities are located. In 2008 a wire mesh enclosure was built over one main food area to keep out birds but small silvereyes still slip through. Small metal bins and other small portable plastic containers are provided for smokers to extinguish their butts. The resort operates an AUD\$5 million tertiary treatment sewage plant for all toilets on the cay with sludge residue barged back to the mainland. This sewage plant was the first on any island in 1993. The outfall pipeline for treated effluent was built through an area with no coral cover to minimise disturbance (Harris and Leiper, 1995). Some 40% of treated water is used in flushing toilets, taps and showers, and garden irrigation. Water is obtained from a seawater desalination plant that started operating in 2001, with an outlet pipe for discharged brine extending underwater to the north of the cay. The plant produces 55,000 litres of freshwater daily (Great Adventures, 2009b). Previously all freshwater for the resort and for day-visitor use was barged over from the mainland at a significant cost. Other solid waste and recycled material such as cardboard, plastic and tins are sent back to the mainland (EPA, 2003). Vegetable waste is composted and used on resort gardens where no pesticides are used, while only biodegradable and nitrate free cleaning products are used. Chemicals affect the bacteria in the tertiary sewage treatment plant that breaks down human wastes. Four diesel generators provide power for the island in an insulated building with concrete troughs under fuel storage tanks to contain any spillage. The resort's hot water system is preheated by the generating system (Harris and Leiper, 1995). Solar panels have been considered for resort power but this is limited by the rainforest setting. A hybrid solar diesel power station installed on Lady Elliott Island Eco Resort in the southern GBR has cut use of diesel fuel by 40-55% (Lady Elliott Island, 2009). Bio-diesel fuel is used in ten Quicksilver coaches (*Cairns Sun*, 2009).

In 1993, a 230 m brick seawall was built on the western end of Green Island, to protect the esplanade and lease areas from erosion caused by sand and tidal movements around the coral cay. Erosion has continued at the northern end of the seawall with QPWS organising beach restoration work since 1995 at a cost of AUD\$10,000 a year (EPA, 2003), with a bulldozer brought over by barge to move sand back to this area. Any machinery brought over to Green Island has to first be cleaned on the mainland while any soil or materials brought to the island must be sterile and weed free. Only plants native to the cay can be grown, using seed stock sourced from Green Island. There are brick-paved walkways around the high-use area of the esplanade between the swimming beach, jetty and snorkelling area. The boardwalk in the

main facility area is built around existing trees with holes cut around tree trunks. Raised wooden boardwalks cross other areas of the cay, with seats provided at viewing or rest areas. The infrastructure for reef tour operators includes the navigation channel and jetty for berthing catamarans, with 32 mooring buoys to the north of jetty for glass bottom boats, semi-submersibles, the parasailing power boat, the seaplane and other permitted operators. To facilitate sea walking or helmet diving, a short concrete path and a handrail were built underwater on one section of the sandy reef flat. A concrete helipad is located on the southern side of the cay, jutting out from the bushes over the fringing reef. A raised wooden boardwalk through the rainforest in the middle of the cay has reduced visitor impacts on vegetation, with short sandy paths diverting to the beach or reef edge. QPWS staff also planted 1,000 Casuarina seedlings for revegetation and shade around the coastal edge of the cay (Wells, 2003). Reef tourism operators had prior permits for reef walking on Green Island but chose not to use these to reduce tourism impacts on the fringing reefs. Instead, visitors are taken on glass-bottom boats and semi-submersibles or can snorkel on the fringing reef.

Managing tourism on Green Island: Economic strategies

Since 1990, a recreation area levy of \$1.80c per visitor collected by all reef tour operators to Green Island provides funding to QPWS for the ranger-in-charge, all capital works, interpretive signs and lifeguards at the swimming beach. This visitor levy generates annual income of AUD\$600,000 for QPWS to manage the Green Island Recreation Area. Visitors to Green Island on private boats and yachts do not pay this recreation levy. Reef tourism operators pay permit fees to GBRMPA, with land-based tourist activities on the cay requiring commercial permits from QPWS. Fines apply for visitors breaching marine park rules such as illegal recreational fishing by local people, or tourists collecting live animals or shells from the beaches or reef. Tourists collecting shells or sea cucumbers are given a warning by the park ranger or by resort staff who return these to the beach or reef. There are also language difficulties with Asian tourists and fines for international tourists are hard to follow up. Larger fines apply for reef operators breaking permit conditions, or if the resort pollutes the marine environment of the GBRMP where the resort manager is also held responsible and can be fined AUD\$100,000 for any breach of environmental compliance. The resort and EPA regularly test the sewage plant and the desalination plant discharge to comply with environmental guidelines. Both the Green Island Resort and Great Adventures Cruises are eco-certified as Advanced Ecotourism since 2001 by Ecotourism Australia. This eco-certification is mentioned in brochures and on the website for both ventures. These high standard eco-certified reef tourism operators receive 15-year permits (GBRMPA, 2009). The Quicksilver group of companies is also certified as a Climate Action Innovator by reducing emissions and auditing their carbon footprint. The other main operator to Green Island, Big Cat Cruises, is also Advanced Ecotourism and Climate Action certified. When Daikyo owned the Green Island Resort it supported the work of WWF (World Wide Fund for Nature) with WWF newsletters, books and an AUD\$10 gift certificate for guests that could be donated (Harris and Leiper, 1995). This has not been continued by Quicksilver and, at present, there is no opportunity for resort guests or day-use visitors to donate to conservation work. The resort, however, sponsors annual beach clean ups and half-price family fun days on Green Island.

Managing tourism on Green Island: Educational strategies

The education and interpretation activities for visitors to Green Island include videos and brochures about the GBR onboard catamarans and interpretive reef talks onboard glass bottom boats and semi-submersibles, delivered in both English and Japanese (Aiello, 1998). Brochures for Great Adventures Cruises list laws and guidelines for the GBRMP in 'Today's Activities and Information' and best practice snorkelling guidelines to preserve the reef in

their 'Enjoy Safe Snorkelling' brochure. Videos also present these reef messages but not all tourists watch these presentations onboard due to being outside, being sick or busy, not hearing, not watching or not understanding. At Green Island there is a visitor information centre on arrival; a park brochure; directional signs about park rules and activities in seven languages (Figure 6); a guided island bushwalk; and a self-guided walk with interpretive signs in six languages about the history, Aboriginal significance, wildlife and ecology of Green Island, along with visitor care codes for the reef ecosystem. Panels interpret the topics of reef and cay formation; an Aboriginal place; early fishing and tourism; and management today with appropriate visitor behaviours on the cay depicted on a panel (Swartz, 2006). Visitors lift flaps on colourful panels and turn tumblers to read environmental messages about Green Island in their selected language (Parkkali, 2006). The resort also provides eco-fact sheets for guests about the history and ecology of Green Island, environmental best practices at the resort and other topics (Green Island Resort, 2009). The environmental manager for the resort provides training for all staff about the environmental values of Green Island and the need to use biodegradable cleaning or personal care products to not affect the sewage plant. The resort gives talks to university and school groups about their environmental practices.

Aboriginal management issues on Green Island

Gungandji Aboriginal people were involved in developing a new interpretive display about the Aboriginal cultural values of Green Island including photos, stories and Aboriginal designs (Swartz, 2006). A self-guided eco-walk on Green Island also interprets Aboriginal uses of plants for food, medicine, crafts and cooking. In June 2006, QPWS signed a memorandum of understanding with the Guru-Gulu Gungandji Aboriginal Corporation about sustainable reef harvesting and cultural practices. This included cultural advice on managing land and sea country, input in monitoring and research and setting aside areas on Green Island for cultural activities (EPA, 2009). Traditional dancing by Guru-Gulu Gungandji people was also part of the Queensland Centenary of Parks celebration day held on Green Island on 17 May 2008 (Anthony, 2008). Apart from this event, or occasional visits by an Aboriginal ranger, other local Aboriginal people are rarely seen visiting Green Island.

Aboriginal people from a nearby village at Yarrabah hunt turtles, fish and gather marine resources around Green Island (EPA, 2003). Hunting by traditional Aboriginal owners on their traditional country for subsistence use is allowed under the *Native Title Act 1993*; including endangered species such as turtles within marine parks. Adult green turtles are rarely seen on the reefs at Green Island due to Aboriginal hunting (Fuentes *et al.*, 2006). Reef tourism operators at Green Island are in conflict with Aboriginal people from Yarrabah hunting green turtles on the reefs around the island. Some of this Aboriginal hunting has occurred in daylight in front of tourists on glass bottom boat tours. Dugong and turtle meat is being sold illegally around Cairns for AUD\$25 to \$50 a kilogram by Aboriginal hunters from Yarrabah who are not the traditional owners of the area (Jenkin, 2009a). A 2009 survey found a decline of 80% in green turtles around Green Island due to Aboriginal hunting and other impacts (Jenkin, 2009b). QPWS has negotiated with Aboriginal people at Yarrabah to confine their hunting of turtles to the western side of Green Island and after 5pm when day visitors leave the cay. In 2009, an Aboriginal ranger (and traditional owner) was deployed to Green Island to further negotiate these hunting agreements with people from Yarrabah. Rangers on Green Island also leave turtle nesting sites unmarked to dissuade people from removing eggs. Tourism operators at Low Isles, near Port Douglas, were also concerned about Aboriginal hunting in front of tourists with four turtles taken over one weekend in August 2009 and, overall, numbers have decreased from 100 to 40 turtles (Koser, 2009).

Impacts of tourism on Green Island

Conflicts between conservation and commerce on Green Island include the impacts of some permitted tourism activities and other visitor impacts on the marine environment. The impacts of tour operations include helicopters disturbing breeding sea birds and also island visitors. The helicopter noise has caused birds to move to the western end of the island or to other cays while the downdrafts from rotor blades scatters the flimsy stick nests of pied imperial pigeons. Catamarans and boats also stirred up sediment over corals; motors on boats caused oil slicks on the water and petrol fumes smelt by visitors; and boat propellers caused scarring in seagrass meadows (*Seagrass-Watch E-Bulletin*, 28 April 2008). The permitted fish feeding by boat operators also attracted large congregations of aggressive fish such as trevally that are usually found in deeper water. GBRMPA permit conditions for fish feeding limit the amount and type of food fed by operators but some people question this practice in a marine park and World Heritage Area (Macpherson, 2007). Visitor impacts include tourists feeding birds in the open food areas; collecting shells on beaches and bringing live coral or sea cucumbers up from reefs; tourists standing on or breaking coral while snorkelling; vegetation disturbance and track erosion along some sandy paths; and littering. Rangers have had to remove aggressive reef herons from Green Island that were preying on other small birds around the food area. A wire mesh cage was built over one main food area but bird feeding by visitors still occurs in other areas with birds snatching food from tables and from the hands of visitors. Asian tourists have also been found at the Green Island jetty with a cold esky full of live sea cucumbers that were confiscated and returned to the reef. Other impacts include illegal recreational fishing by local people on the fringing reefs around Green Island, mainly at night. One ranger watching for illegal fishing at night broke his arm falling off the concrete helipad but has since recovered. These current tourism impacts on Green Island are minimal compared to previous exploitation of reef resources such as turtles canned for soup.

Conclusion

Regulatory, physical, economic and educational strategies are now used to manage tourism sustainably on Green Island. The regulatory strategies include: Limit visitor numbers (daily visitor cap of 2,240, max. 15 on snorkel or dive trips); Prohibit certain activities (no fishing or motorised watersports); Close areas to activities/use (snorkel trail removed), and Separate activities (park zoning). Physical strategies include: Site hardening (brick pathways), Facility placement (boardwalks, signs); Facility design (low impact resort); Sacrifice areas (day use visitor facilities); Remove/alter attraction (resort redeveloped); and also Rehabilitation (revegetation of resort lease, coastal tree planting). Economic strategies include: Fees (GBRMPA & QPWS permits, eco-certification, recreation levy); Damage bond (resort construction company & contractors, resort manager liability); Fines (illegal fishing); and Rewards (15-year permits for eco-certified operators in GBRMP). Educational strategies include: Printed material (QPWS brochure, self-guided eco-walk, resort fact sheets); Signs (Interpretive signs in six languages); a Visitor centre (island information centre); Activities (beach clean up, turtle release, Aboriginal dancing); and also Personal contact (QPWS ranger, resort naturalists, reef interpreters). All these strategies are used by QPWS and the Advisory Committee to manage tourism sustainably on Green Island. A recreation levy provides the funding for visitor facilities and environmental improvement activities. These minimize disturbance, protect habitats and also improve marine and coastal ecosystems (Orams, 1999). The journey towards sustainability on Green Island has involved knowledge of coral cay ecology and strict environmental legislation and guidelines, supported by enforcement, monitoring and co-operative management between park agencies and tourism operators. QPWS guidelines and boardwalks, along with resort design and operation minimizes visitor disturbance of the coral cay's natural environment. Rainforest and reef habitats at Green

Island have been protected through legislation, zoning, permits and facility design mainly since the 1990s. The health and viability of marine and coastal ecosystems on Green Island has been improved through a park management plan with strict guidelines for tourism, infrastructure, revegetation, pest control, and monitoring of sites. Negotiations with traditional Aboriginal owners about turtle hunting around Green Island are ongoing to minimize conflicts with reef tourism operators. Other ways to improve sustainability would be the voluntary cessation of fish feeding by reef tour operators and opportunities for visitors to donate or contribute to conservation work. This type of co-operative management is essential to manage all types of impacts and ensure the sustainable tourist use of Green Island.

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Figure 1: Helicopter landing pad, Green Island. Noise from rotor blades disturbs nesting birds.



Figure 2: Jetty at Green Island with underwater observatory and moored catamaran at the end.

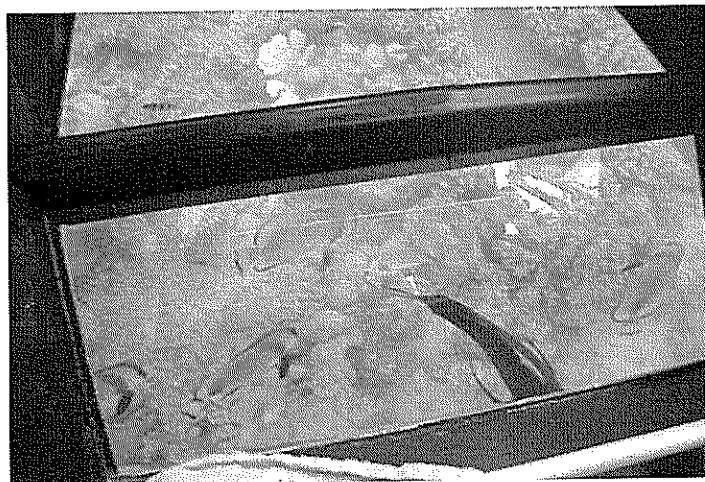


Figure 3: Glass bottom boat tour, where reef fish follow the boat waiting to be fed.

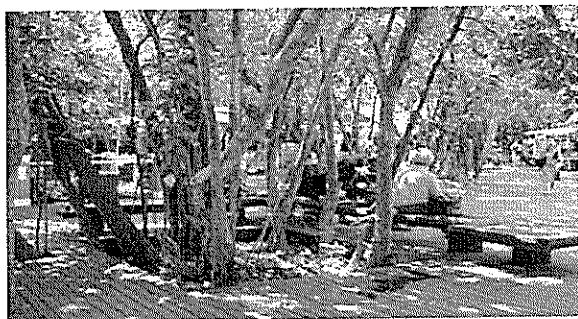


Figure 4: Raised wooden boardwalk built around trees, Green Island



Figure 5: Elevated building with no roof gutters, Green Island Resort

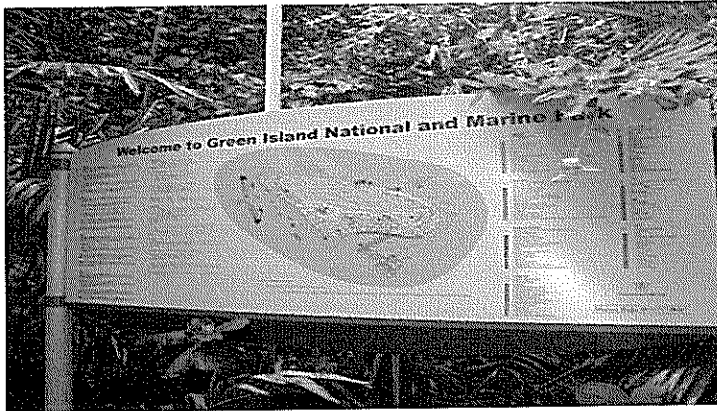


Figure 6: Main sign on arrival at Green Island in seven languages