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MANAGEMENT OF HUMAN VISITATION TO SEABIRD ISLANDS OF THE GREAT BARRIER REEF MARINE PARK REGION

TONY STOKES,[1] KEES HULSMAN,[2] PETER OGILVIE[3] and PAUL O'NEILL[4]

[1]Great Barrier Reef Marine Park Authority, P.O. Box 1379, Townsville, Qld 4810
[2]Faculty of Environmental Studies, Griffith University, Nathan, Qld 4111
[3]Department of Environment and Heritage, P.O. Box 155, Brisbane (Albert Street), Qld 4002
[4]Department of Environment and Heritage, P.O. Box 3130, Rockhampton Shop Fair, Qld 4701

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Millions of seabirds of 22 species breed on over 78 islands surrounded by the Great Barrier Reef Marine Park (GBRMP) of Australia. Although many of the islands are Queensland national parks, some are part of the GBRMP, are vacant crown land or are under a lease arrangement. The importance of the islands to the breeding of each seabird species varies from those that provide for significant numbers with predictable, regular breeding to those with insignificant numbers and/or unpredictable sporadic breeding. The number of tourists visiting the Great Barrier Reef (GBR) has increased enormously in recent years and the trend is expected to continue. During the past decade, park management agencies have been hard put to respond adequately to the large increases that are occurring in tourist and private recreational use on the Reef. Many places previously considered to be remote are now within one-day cruising range of major urban centres due to advances in vessel technology. Increasing tourism is bringing increasing demand to allow visitation to previously unvisited places and to vary the nature of existing visitation. Currently about 20 per cent of the Great Barrier Reef region and more than 30 per cent of seabird islands are within one-day operational range of major mainland departure points. By 2001 it is possible that over three-quarters of the region and its seabird islands will be within one-day range. Such advances in vessel technology are expected to exacerbate the demand on park management to 'cater for' visitors and to 'open up' new areas. The current growth in 'ecotourism' may also foster an increasing demand for tourist visitation to seabird islands. This paper examines access to GBR seabird islands for commercial and private recreational, research and other purposes in the light of increasing visitation to the Reef. The current management of human visitation to the islands is outlined. The paper concludes that human visitation to certain tropical seabird islands on the GBR is sustainable and justifiable provided that it is well regulated and that adequate monitoring occurs. A code of conduct for people visiting seabird islands is proposed. A project to prepare Australian national guidelines for the management of human visitation to marine islands with breeding seabirds is now underway.

INTRODUCTION

Twenty-two species of seabird breed on more than 78 islands in the Great Barrier Reef Marine Park (King 1993; Ogilvie and King 1993; Paul O'Neill, pers. comm. 1993). King (1993) and Ogilvie and King (1993) assessed seabird island status against two rankings, significant and minor. Undoubtedly these categories will be re-assessed with future surveys and comparisons, and already another 'significant' island is proposed (Table 1). In addition, Frazer Muir (pers. comm. 1994) says that there are *'well over 50 islands in the Cairns and Far Northern Sections of the GBRMP that . . . (have) . . . more than minor nesting'*.

TABLE 1

Great Barrier Reef region seabird islands within one-day tourist vessel range. (Per cent and Number. Status derived from King 1993, but including Riptide Cay, 21°14′S, 151°51′E, and separating Pelican Rock and Akens Island.)

Year	Significant islands	Minor islands	Combined
1985	9%, 5/58	25%, 5/20	13%, 10/78
1990	24%, 14/58	45%, 9/20	30%, 23/78
1994–2000	53%, 31/58	75%, 15/20	59%, 46/78
2001+	83%, 48/58	95%, 19/20	86%, 67/78

Many factors determine the success of seabird breeding (Ogilvie and King 1993). Natural factors include variation in the abundance of prey fish and in the capacity of the birds to capture them depending on climatic and oceanographic conditions; island-specific factors which affect nesting such as cay movement and topographic/vegetative factors; nest disruption by turtle nesting; disease and tick infestation; predation by gulls and raptors; and vegetation factors on islands such as sticky fruits that immobilize birds. Human-related factors include indirect alteration of food supply by for example, fishing and coastal development; alteration of islands by commercial development and habitation; introduction of noxious plants and animals; direct and indirect increase in nest disturbance with resulting mortality; and direct and indirect predation.

Although most human-related factors affecting seabird breeding success are negative (Walker 1993), some effects on breeding seabirds may result in increased breeding success. For example, changes to the resort cay of Heron Island since human occupation has not significantly inhibited nesting by Black Noddies *Anous minutus* and Wedge-tailed Shearwaters *Puffinus pacificus* (Hill and Rosier 1989; King 1993). In fact, an exponential increase in the number of breeding Black Noddies on the Island appears to have been occurring since the turn of the century (Ogden 1993). However, the noddy and shearwater are the only seabirds now nesting on the island and Walker (1991) speculates that *'there can be little doubt that seven or more species of seabird and oystercatchers nested* (there) *prior to human occupation'*.

The Great Barrier Reef Marine Park (GBRMP) is managed by the GBRMP Authority (GBRMPA), a Federal Government agency responsible for the Park's conservation, wise and ecologically sustainable multiple use, and for education and appreciation in relation to it. Most of the GBR region is within the boundary of the GBRMP. The GBRMP extends to low water mark on land and includes islands owned by the Federal Government at the time that GBRMP zoning plans came into force in the four different sections of the Park (between 1983 and 1988). Complementary Queensland State marine parks are declared to high water mark over many inshore areas, embayments and estuaries which are part of and/or adjacent to the GBRMP, except in the Far Northern Section of the GBRMP where there are no State marine parks (approximately north of Lizard Island, latitude 14°40′S).

Most islands on the Great Barrier Reef (GBR) are under State Government jurisdiction and are declared national parks whilst some are vacant crown land or are under a lease or other arrangement (Ogilvie and King 1993). Commonwealth and State park areas are managed collaboratively and with complementary management arrangements. Day-to-day management of the GBRMP is carried out on the GBRMPA's behalf by the Queensland Department of Environment and Heritage (QDEH). The Department also manages the State marine and national parks. The GBR region including islands, is listed on the World Heritage Convention.

The GBRMP is often thought to be the equivalent of a terrestrial national park. However, this is not so. The GBRMP is for multiple use and the purposes and manner for which it is managed differ significantly from terrestrial national parks. For instance, with few exceptions, most forms of commercial and recreational use can be permitted within the Marine Park, including permanent and semi-permanent habitation, resource extraction, hunting (fishing) and farming (mariculture). When the GBRMPA was established in 1975, the principle early initiative was to establish a zoning regime in each of the sections of the Marine Park. This was achieved by the establishment of zoning prescriptions relating mainly to the conservation and extractive use of the GBRMP. During the past 15 years large increases in tourism and residential settlement of

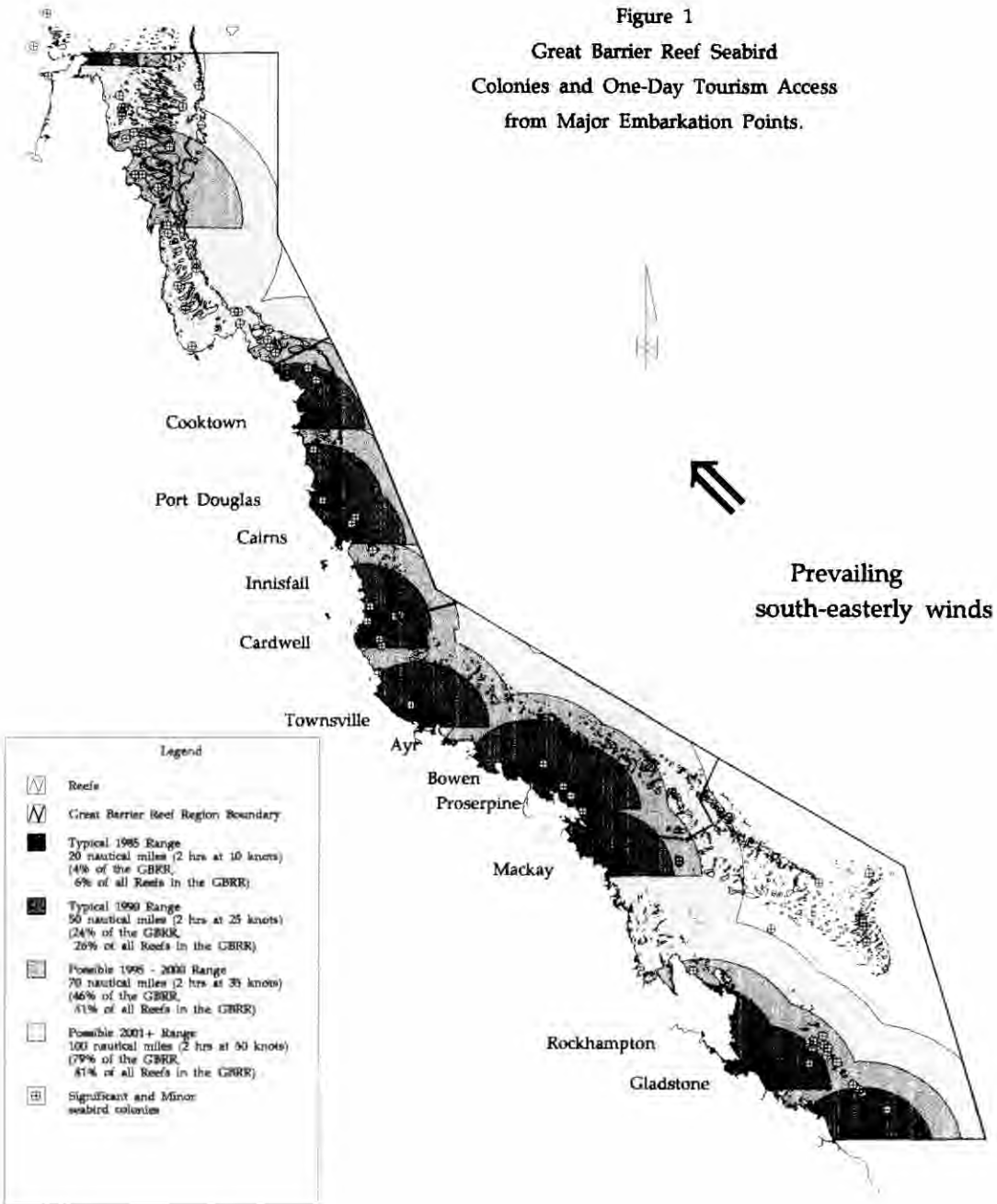

Figure 1. *Great Barrier Reef seabird colonies and one-day tourism access from major embarkation points.*

coastal areas adjacent to the Park have brought prominence to tourism and recreational concerns in Queensland and Federal marine parks.

CHANGING VISITOR USE OF THE GBR REGION

The GBRMP has been experiencing a large increase in tourism and visitation since the early-to-mid 1980s (Craik 1992). In areas such as offshore Cairns the increase has been most pronounced and there are as yet, no signs of the trend abating. Concomitant with the increase has been a large expansion of tourism infrastructure, both on the mainland adjacent to the Park and on the 19 resort islands within the Park boundary. The past 15 years has also ushered in the era of large permanently moored pontoons at many reefs which provide one-day *'reef experiences'* for thousands of visitors. Vessel technology has also improved dramatically in the period allowing far greater numbers of people to be taken to more distant locations to view the Reef (Fig. 1). For example, from the 1970s to about 1985 the bigger commercial charter vessels carried up to 50 passengers at speeds of 10 knots, allowing the vessels a maximum one-day range of 20 nautical miles from embarkation point (proportionally, very few visitors take overnight cruises). This operational range included about four per cent of the GBR region and 13 per cent of significant and minor seabird islands.

The size and range of vessels increased throughout the 1980s to the point now where there are 19 large vessels typically carrying 140–400 passengers at speeds of 25 knots, to destinations up to 50 nautical miles from embarkation points. This operational range includes about 24 per cent of the GBR region and >30 per cent of seabird islands.

Marine Park permit applications are now being received to operate one-day charter vessels with capacities for up to 450 passengers and capable of speeds to 35 knots. Such changes are likely to bring vast, previously remote, areas of the GBR to within one-day cruising range of the major tourist embarkation points. By 2001 it is possible that 79 per cent of the GBR Region, 81 per cent of all reefs and 87 per cent of seabird islands will be within one-day operational range of tourist vessels. The demand for access to increasing numbers of areas and islands is already evident.

A large part of the attraction behind tourism development on the Queensland coast north of Fraser Island is undoubtedly the natural *'wonder of the Reef'*, but the constant concern of park managers is to ensure that the Reef and islands with their plants and animals are not *'loved to death'*.

MANAGEMENT OF VISITOR IMPACTS ON SEABIRD ISLANDS

Human visitation to seabird islands on the Great Barrier Reef is managed under a variety of Federal and State legislation. Jurisdiction and management responsibility depends upon whether the islands are declared State national parks or other reserves, included within the GBRMP, leased for private or commercial purposes, or used to site lighthouse and other ship navigation aids. Conditions allowing island access may also depend upon whether the surrounding waters are part of the GBRMP (to low water mark) and/or State marine park (to high water mark).

The multiplicity of laws results in an array of permit requirements for people wishing to visit GBR seabird islands and waters adjacent to them. However, since most of the islands are State national parks, the most common form of management control over island access is the requirement for Queensland Department of Environment and Heritage (QDEH) permits for camping, and for non-recreational activities such as to conduct commercial or scientific activities. Permits are also required for access to designated Scientific Areas on island national parks.

In the Far Northern Region of the GBR, including offshore Cairns, Commercial Activity Permits issued by QDEH for island national park access carry a list of islands of seabird management concern, periods of recommended access, including reasons, and guidance on recommended behaviour. This management policy extends to islands under other Government tenure in the Region, e.g. other reserves and vacant crown land. In the same Region, permits for aircraft operations to islands, including overflights and landings, detail where permitted operations are allowed access, the period of access and reasons.

Access to GBRMP waters surrounding seabird islands is regulated by zoning plan prescriptions and permitting requirements which reflect the

TABLE 2

Seabird Island areas of the Great Barrier Reef Marine Park designated for possible seasonal closure.

Raine Island	Sandbank No. 8	Eagle Island
South Barnard Islands	Sudbury Cay	Beaver Cay
Taylor Cay	Pelican Rock	Distant Cay
Bacchi Cay	Thomas Cay	Frigate Cay
Price Cay	Gannet Cay	Hoskyn Island
Fairfax Island	Riptide Cay	

complementary management arrangement with the Queensland government. A few seabird islands owned by the Federal government are also included within the GBRMP, e.g. Eshelby, Lady Elliot, Akens Island and Pelican Rock. In these instances, GBRMP zoning prescriptions and permit requirements apply to the islands as well as to the surrounding waters.

The waters surrounding two of the major seabird islands identified by King (1993) in the GBRMP — Eshelby and Wreck Islands — are preservation zones and are closed to all forms of visitation except approved research. Research on the Islands is only approved where it can be shown that it cannot be undertaken in any other zone and is consistent with the objective of the preservation zone which is, *'to provide for the preservation of areas of the GBRMP in their natural state undisturbed by human activities'* (Great Barrier Reef Marine Park Authority 1987). The likely effects on adjacent areas such as the islands are considered as far as possible in determining whether to issue a permit to visit.

Three seabird island areas — Pelican Rock, Akens Island and the South Barnard Islands — are in Defence Areas and may be closed to visitation during Defence activities. The waters around 17 other seabird islands are within GBRMP Seasonal Closure Areas and, if required, may be closed to access during seabird breeding seasons (Table 2).

Marine park aerial surveillance records between 1989–93 and existing marine park permits suggest that twelve of the seabird island areas in the GBR currently have very high to high numbers of vessels visiting waters adjacent to them (mean >3 vessels per flight), six have moderate vessel visitation (mean 1–3 vessels per flight), and 60 low to very low vessel visitation (Table 3). However there is probably higher vessel visitation to many of the GBR seabird island areas than is indicated by these figures because most of the GBR is infrequently patrolled (average 650 flights p.a. over the GBR, surveying an average 4.3 per cent of the GBR per flight). The patrol programme of the GBRMP provides for an average of about one x 2-minute visit by aircraft to all locations in the Park every two weeks, and much lower frequency of visits by vessel patrols. Many seabird islands experiencing moderate to very high visitation have resorts and/or research stations, or are used extensively for overnight camping, and/or day visitation, or are favoured anchorages for commercial fishers such as trawlers and for recreational vessels. Island visitation by people from anchored vessels probably varies. However, John Cornelius (pers. comm. 1994) reports that in the Far Northern Section of the GBRMP crews often go ashore for beach parties and to relieve monotony. He adds that at places such as Combe Islet, where Australian Pelicans *Pelecanus conspicillatus* breed, such visits can be a problem, and shooting of breeding terns has occurred at Two Isles in recent years.

Records from site-specific permits (see next section) provide another indication of the extent of visitation to seabird islands and surrounding waters A combined appraisal of both site-specific permits and aerial surveillance records suggests that at least fifteen seabird island areas experience high visitation (Table 4). On Michaelmas Cay, visitation is subject to a management plan which provides for a 100 person limit on the Cay at one

TABLE 3

Great Barrier Reef Marine Park aerial surveillance records (September 1989 to July 1993).

	Very High (>10 vessels per flight)	High (3–10 vessels per flight)	Moderate (1–<3 vessels per flight)	Low (<1 vessel per flight)
No. of seabird islands (as per King 1993)	2	10	6	60

TABLE 4

Great Barrier Reef Marine Park seabird breeding islands with existing high human visitation. [From King 1993: WS = Wedge-tailed Shearwater, SG = Silver Gull, ST = Sooty Tern, BT = Bridled Tern, RT = Roseate Tern, BNT = Black-naped Tern, LT = Little Tern, CT = Crested Tern, LCT = Lesser Crested Tern, CN = Common Noddy, BN = Black Noddy, RTB = Red-tailed Tropicbird. Breeding status (pairs): 1, <10; 2, 10 to <100; 3, 100 to <1 000; 4, 1 000 to <10 000; 5, 10 000 to <100 000; 6, 100 000 to 1 000 000.]

Island	Mainland access point; Island latitude and size	Breeding seabirds (breeding status)	Nature of visitation and other comments
Low Isles (Woody Islet)	Port Douglas 16°23′S, 48 ha	From J. Cornelius (1993, pers. comm.): BNT(1), BT(2), CT(?), LCT(?)	A seaonal closure period may be promulgated over GBRMP waters to assist seabird conservation.
Michaelmas Cay	Cairns; 16°36′S, About 1.8 ha	SG(1), ST(5), BT(1), RT(1), BNT(2), CT(4) LCT(4), CN(5), BN(1)	Day visits only; limited to six regular operators carrying up to 550 tourists; and 25 smaller operators with access twice per week carrying up to 380 people, but only 15 operators regularly visit; visitors restricted to about 25 per cent of foreshore perimeter; no planes or helicopters permitted.
South Barnard Islands	Innisfail, 17°44′S, 12 ha and 2.5 ha	BT(3), RT(3), BNT(2), LT(1), CT(2), LCT(3)	Three GBRMP tourist permits are on issue for vessels carrying relatively few people to waters near the islands: two kayak operators, one coral viewing. However, aerial surveillance records suggest a high vessel usage of the waters (>3 vessels recorded per flight). A seaonal closure period may be promulgated over GBRMP waters to assist seabird conservation.
Purtaboi Island	Mission Beach 17°55′S, 0.6 ha	BT(2), RT(1), BNT(3) LCT(2)	Adjacent to Dunk Island resort. Aerial surveillance indicates very high use of waters near Purtaboi (average 46 vessels recorded per flight). 39 GBRMP tourist permits are on issue to carry up to 640 people in the area. A seasonal closure of access to the island occurs from October to March to protect nesting seabirds.
Double Cone Island	Airlie Beach 20°08′S, 40 ha	SG(?)	Nearby waters are listed on 24 GBRMP permits for approved visitation and are popular amongst private fishers. Recent Draft Management Plan proposes closure of island to visits to protect nesting Beach Stone-curlew *Esacus neglectus* and Pied Imperial Pigeons *Ducula bicolor*. Validity of designation by King (1993) as seabird island of minor significance requires confirmation since only breeding seabird appears to be Silver Gull.
Tryon Island	Yeppoon; 23°15′S, 11 ha.	WS(5), SG(2), BT(3) BNT(2)	Maximum 30 campers permitted; extended charter vessels allowed up to 2 × 24 hr visits per week; no engine-driven equipment permitted; no aircraft permitted within 500 metres of island.
Northwest Island	Yeppoon; 23°17′S, 105 ha	WS(6), BN(6)	Maximum of 150 campers permitted; overnight charter operators allowed up to 2 × 24 hr visits per week; no generators permitted; compressors permitted in restricted area of campground; no aircraft landing permitted within 500 metres of island.

Table 4 — *continued.*

Island	Mainland access point; Island latitude and size	Breeding seabirds (breeding status)	Nature of visitation and other comments
Wilson Island	Yeppoon/Gladstone; 23°18′S, 5 ha	WS(4), SG(2), BT(1) BNT(2)	Maximum of 75 Heron Island guests at one time including 25 camping; maximum two day trips per week (October to March) and three per week (other months); generators and compressors permitted; no aircraft landings within 500 metres of island.
Heron Island	Gladstone; 23°26′S, 18 ha	WS(4), BN(5)	Resort for up to 370 guests and staff; research station for up to 90 guests and staff; generators and compressors permitted; unrestricted helicopter use; no aircraft landings within 500 metres of island.
Lady Musgrave Island	Gladstone/ Bundaberg; 23°54′S, 19 ha	WS(4), SG(2), BT(3) RT(2), BNT(2), BN(4)	Maximum 50 campers permitted at one time; regular day visits restricted to two vessels with a combined maximum number of 400 visitors, with a maximum of 50 per vessel permitted on island at one time; maximum of eight seaplane visits per day permitted; occasional part closure of beach by fencing to protect nesting terns.
Erskine Island	Yeppoon/Gladstone 23°30′S, 1.5 ha	WS(3), RH(1), SG(1), BT(2), RT(2), BNT(2), CT(3), LCT(2)	One tourist operator visits island three times per week with up to 17 people in tourist season; aerial surveillance indicates moderate usage (1–3 vessels in nearby waters per flight).
Masthead Island	Yeppoon/Gladstone 23°32′S, 40 ha	WS(5), SG(2), BT(3), RT(3), BNT(2), CT(3) BN(5)	Maximum 60 campers permitted; extended charter vessels allowed up to 2 × 24 hr visits per week; no aircraft permitted within 500 metres of island.
Hoskyn Island	Yeppoon/Gladstone; 23°48′S, 2 cays (2 ha and 7 ha)	WS(4), BB(3), BT(3), RT(2), BNT(2), BN(3)	On 68 surveillance flights an average 3.9 vessels per flight were seen in waters near the island. The island is closed to public access above high water as National Park (scientific). The adjacent GBRMP waters are zoned General Use 'B' and visitors are allowed although a seasonal closure period may be promulgated over the waters from October to March to assist seabird conservation. Currently three tourist permits allow up to 29 passengers to go to GBRMP waters near the island.
Fairfax Islands	Bundaberg; 23°52′S, 2 cays (18 ha and 3 ha)	WS(3), BB(4), BT(1), CT(1)	Currently two GBRMP tourist permits allow up to 26 passengers to go to GBRMP waters near the island. Although the island itself is closed to public access above high water as National Park (scientific), access is permitted to the beach below high water.
Lady Elliott Island	Bundaberg; 24°07′S, 35 ha	WS(3), RTB(1), SG(2) BT(3), BNT(2), CT(4), CN(2), BN(3)	Resort for up to 175 guests and staff; regular aircraft access on airstrip permitted; access to seabird colonies prohibited from October to March; a number of seabirds killed by aircraft each year (TS, pers. obs., 1994); generators permitted.

time. However the limit is frequently exceeded, visitor supervision is minimal and at times of peak usage, the Cay has a *'resort beach atmosphere'* (Muir and Chester 1992). Visitation is currently fully allocated between six tourist operators that are permitted to carry a combined maximum of 550 passengers. Visitors to Michaelmas are restricted to a small part of the beach marked by poles which are moved by park managers according to seabird activity and sensitivity and beach erosion and accretion (GBRMPA 1986). The high level of visitation to the Cay appears to have contributed to an overall decline in the breeding populations of Common Noddies *Anous stolidus,* Sooty Terns *Sterna fuscata* and Crested Terns *Sterna bergii* breeding there (King *et al.* 1992; De'ath 1994). Management Plans are in preparation or in draft stage for the seabird islands of Eshelby and East Rock (Whitsunday group) and for the Brook Islands.

GBRMPA CONSIDERATION OF PERMITS TO VISIT SEABIRD ISLAND AREAS

People in the GBRMP may visit waters surrounding seabird islands without written permission for purposes other than commercial, scientific or educational reasons, provided they abide by zoning and regulation requirements. A permit is required for commercial, scientific or educational visits. Similarly private visits to seabird islands that are national parks or are within the GBRMP, other than those in marine park preservation zones, may be undertaken without written permission or notification of park managers, but regulations and marine park zoning must be followed.

Two basic types of permit are issued — site-specific and roving. The former lists specific locations in the GBRMP that may be visited on a regular basis (usually >2 days per week). Roving permits do not list specific locations but usually provide that any one location may be visited only infrequently (usually up to twice per week). At present, the nature of roving permits does not allow analysis of visitation patterns. However, since mid-1993 tourist operators have been required to submit log book returns to GBRMPA and in the future these should provide such information. Many hundreds of roving permits are on issue and, with commercial fishing and private recreational vessels, they would carry an unknown but probably large percentage of visitors to the GBR seabird islands.

Applications for permits to visit and use areas within the GBRMP for specific activities are considered on their merits and in accordance with legislative and zoning requirements. Whereas the process of preparing zoning and management plans involves both proactive and reactive decision making and occurs with considerable public consultation, the process of considering permit applications is reactive and usually occurs with minimal public consultation. However, public consultation may be required if the reasonable use by other users of the Park is likely to be affected. All decisions are based upon the best available information. The factors involved in considering a permit application are illustrated in Figure 2. The assessment criteria under the GBRMP regulations relate to:

- the objective of the marine park zone that the island area is within;
- the need to protect cultural and heritage values held in relation to the GBRMP by traditional inhabitants and other people;
- the need to ensure the orderly and proper management of the Marine Park;
- the likely effect of granting permission to visit a seabird island area or its surrounding waters on future options for the Marine Park;
- the conservation of the natural resources of the Marine Park;
- the nature and scale of the proposed use in relation to the existing use and amenity, and the future or desirable use and amenity, of the seabird island and of nearby areas;
- the likely effects of the proposed use on adjoining and adjacent areas and any possible effects of the proposed use on the environment and the adequacy of safeguards for the environment;
- the means of transport for entry into, use within or departure from the seabird island area and the adequacy of provisions for aircraft or vessel mooring, landing, taking off, parking, loading and unloading;
- in relation to any structure, landing area, farming facility, vessel or work to which the proposed use relates:
  i) the health and safety aspects involved, including the adequacy of construction; and

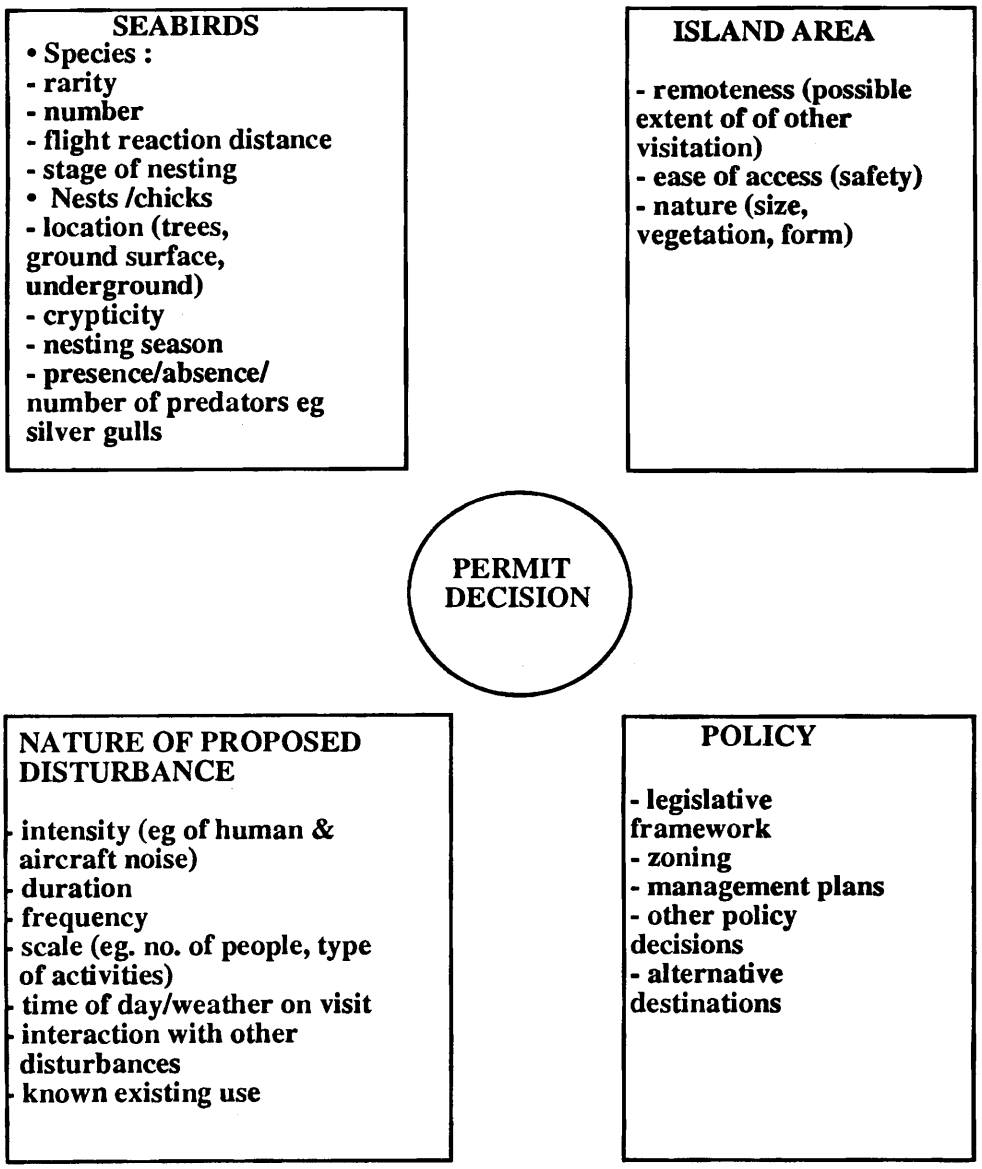

Figure 2. *Elements of a GBRMP permit decision about visits to Seabird Island areas (many cause and effect linkages exist between and within boxes).*

ii) the arrangements for removal upon expiration of the permission;

- the arrangements for making good any damage caused to the Marine Park by the proposed activity.

In the GBRMP, decisions on permit applications to visit seabird island areas are based principally upon minimising or negating risks of unacceptable impacts on the environment especially seabirds. Visitor management strategies for GBR seabird island areas accord with the following principles of seabird-human interactions (adapted from Graefe *et al.* 1990):

1. **The principle of impact interrelationships:** This principle recognizes that there is no single, predictable response by nesting, resting and roosting seabirds to human visitation. Instead, an interrelated set of potential impacts are possible at each location and for each situation. Despite this broad principle, it should be recognized that there are individual and species specific characteristics of seabird responses to human visitation which do allow their reactions to be predicted to some extent based on prior experience. Some are more direct and obvious than others, for example nest and/or island desertion, but any impact indicator or combination of indicators can be used to form the basis of a visitation management strategy.

   The impacts on seabird islands can result directly from disturbance or harassment, or indirectly through habitat alteration. A compilation of past impacts in the GBR region is provided by Ogilvie and King (1993) and King (1993), while Walker (1991) reviewed disturbance effects on Heron and Wilson Island seabirds and Hockin *et al.* (1992) summarized the effects of disturbance on European birds. Human disturbance can result in changes in physiology, behaviour, reproduction, population levels and species composition and diversity. Changes may be positive or negative and temporary or persistent. Heron Island, a small vegetated cay with a permanent tourist resort and research station, appears to illustrate a situation where species more tolerant of human activity have adapted to disturbance and increased in numbers, whilst other species have stopped nesting their altogether.

2. **The principle of visitor use-impact relationships.** This principle recognizes that impacts are related to the amount and type of visitation that a seabird island receives. However, the strength and nature of the relationship varies widely depending on the types of impact. Often there is not a direct linear relationship with the number of visitors. The impacts vary for different measures of visitor use and are affected by a variety of situational factors. There are few studies of the point at which flight occurs in seabird species, and it varies according to the population and the frequency of visitation. Habituation to human activity may reduce the distance at which flight occurs in specific populations.

3. **The principle of activity-specific relationships.** This principle recognizes that some forms of visitor activity create impacts faster or to a greater degree than other forms. Impacts can vary even within a particular activity according to the type of transportation or equipment used and the behaviour and number of visitors. Seabirds probably identify and react more intensively to human actions perceived as threats. Certainly unusual and loud noise disturbs seabirds, for example from seaplanes (Hicks *et al.* 1987). John Cornelius (pers. comm. 1994) suggests that a sudden aerial intrusion near a seabird colony such as a kite being launched or the watersport of para-sailing, could elicit a *'dred'* of almost immediate lift-off by nesting and roosting birds.

4. **The principle of site-specific relationships.** This principle recognizes that the impacts of visitation are influenced by a variety of site-specific and seasonal variables. The outcome of increasing visitation tc a seabird island will often depend on the time and place of the disturbance. People may have critically adverse effects at some times and no effect on the same species under other situations. Characteristics that can effect the outcome of seabird-human interactions include topography, time of day, weather, vegetation nature and extent, and food availability. Chicks especially may suffer or die if disturbance occurs whilst they are under stress from limited food and/or inclement weather.

DISCUSSION

No GBR breeding seabirds are endangered although some are nationally or regionally rare (e.g. Herald Petrel *Pterodroma arminjoniana*, Red-tailed Tropicbird *Phaethon rubricauda*) or the GBR islands comprise one of the few breeding locations of the species near the Australian mainland. However, such species and locations are adequately managed by park authorities in the GBR region.

There does not appear to be justification for a general ban on human visitation to GBR seabird islands and it would be impracticable. However in the GBRMP region, a major problem in determining a visitation policy to seabird islands and their waters is inadequate knowledge of the extent of private and unauthorised commercial visitation to the islands. Although disturbance to nesting seabirds is not automatically unacceptable, large-group and/or noisy or persistent disturbance can cause nest failure. Such an effect may be cumulative or it may lead to greater toleration of the disturbance by some species in some situations. The potential impact of disturbance to nesting seabirds depends upon each situation. Each proposal to incorporate a seabird island within a commercial tourist programme therefore requires careful consideration. In all cases the precautionary principle should operate whereby, *unless impacts associated with a proposed activity or use are known with reasonable assurance, we should proceed cautiously while ensuring that substantial and irreversible impacts are not imposed* (GBRMP 1993). In recognition of this principle there is justification on specific islands for controlling access due to biological, physical, human, legislative and policy reasons. The GBRMP Seasonal Closure Areas are an example of this. Similarly in regard to burgeoning tourism on the Reef, regular access should not be granted to small islands where a high unacceptable level of Silver Gull *Larus novaehollandiae* predation on the eggs and young of other seabirds is likely to occur when the adults are disturbed. It is almost impossible to land on some small cays in the GBR without nesting adults taking flight, with resulting silver gull predation.

Nevertheless in some situations on larger cays and islands, GBR seabird populations could probably sustain a few visits per nesting season by small (<20) guided groups of well-informed people sensitive to bird conservation practices. Such visits would need to be restricted to early daylight and benign weather. Landing should occur as far as possible from the nesting birds and people should be kept on the strand below high water level and away from vegetation. Careful watch would be needed to avoid the cryptic nests and eggs of species such as small terns, and as far as possible, the approach limit of people to nesting individuals would need to be beyond the point where the adult leaves the nest.

The four principles of seabird-human interactions listed in the previous section probably apply to management situations on all seabird islands. From them we have derived a general *Code of Conduct for people visiting Seabird Islands* (Table 5) which appears to be applicable to all seabird islands, regardless of location. We recommend that island and park management agencies adopt such a Code as a basis for regulating human visitation to seabird islands. More specifically, we recommend that adherence to the Code be included as a condition on GBRMP and QDEH permits to visit seabird islands and adjacent waters in the GBR region. The Code should also form the basis for educating visitors prior to their approaching or landing on the islands. Additional provisions could be added in instances where other issues on islands need to be addressed, e.g. breeding turtles.

ADDENDUM (November 1994): In 1994, GBRMPA and Australian Nature Conservation Agency (ANCA) received a government grant to prepare comprehensive guidelines for the management of human visitation to marine islands with breeding seabirds. The guidelines are being developed in collaboration with all State and Territory conservation agencies and are intended for national application. The guidelines will be available for consideration in mid-1995. The project arose from the recommendations of a national seabird conservation workshop convened by ANCA in November 1993 at which a summary of this paper was presented.

TABLE 5

Code of conduct for people visiting seabird islands (not in any particular order).

Issue	Code	Reason
1. Minimum impact visits	Leave the island as you find it.	Long-term maintenance of island ecology and sustainable use.
2. Sound and movement	Be quiet and avoid rapid or sudden movement.	Unusual noise and rapid or sudden movement such as removing a coat and waving it, frightens birds and may cause nest failure.
3. Approach distance	Do not approach seabirds to the point where they move from their nests or young. Do not walk into nest colonies.	Unattended, unshaded eggs and chicks die from exposure to weather and predators.
4. Burrow collapse	Avoid walking near or over areas of burrow nesting species.	Burrows collapse causing nest death of parents, chicks and eggs.
5. Rubbish	Take it off the island. Do not bury it.	Rubbish attracts scavengers and predators, e.g. gulls. Seabirds may become entangled causing distress and possible death. It is also unsightly.
6. Fires	Do not light fires. Avoid carrying tobacco. Restrict smoking to vessels.	A wildfire on a seabird island would kill many birds, destroy nests and habitat and cause island erosion and possible instability.
7. Exotic plants and animals	Take no plants and animals ashore. Before landing, check clothing and shoes for seeds.	Weeds, predators and disease could be introduced to the detriment of seabirds.
8. Collecting	Do not take plants and animals from the island.	Collecting interferes with the naturalness of the island and may damage sensitive rare species.
9. Night activity	Minimize and if possible avoid using torches and other lights at night near or in colonies.	Birds may appear more approachable at night but disturbance increases the risk of nest failure. If a nest is vacated, it is possible that the parent may not relocate it until morning.
10. Washing	If it is necessary to wash clothes and utensils, do so near or in the sea.	Allows the waste to be dissipated by the tide.
11. Toilet	Preferably use boat facilities. If essential, use a pit below high water mark away from the colony.	Minimises human impact and the chance introduction of damaging micro-organisms.
12. Danger periods for seabirds when care during visits is especially needed	Take particular care on seabird islands at the following times: (i) late afternoon-early evening; (ii) hottest part of the day; (iii) wet and/or cold weather; (iv) moonlit nights; (v) when eggs, naked or downy chicks are in nests	Minimize the risk of adverse impacts because the periods are when: (i) the majority of seabird species feed their chicks; disturbance may cause regurgitation and starvation; (ii) eggs/chicks can die rapidly from exposure; (iii) eggs/chicks can die rapidly from exposure; (iv) people are more visible to seabirds and disturbance is greater (v) there is greater chance of death from exposure as the eggs and chicks depend on the parent to control their body temperatures.

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HABITUATION TO HUMAN DISTURBANCE BY BREEDING BRIDLED TERNS *Sterna anaethetus*

J. N. DUNLOP

162 Swansea St East, East Victoria Park, Western Australia 6101

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Bridled Terns *Sterna anaethetus* breeding on Penguin Island in south-western Australia allow much closer human approach than they do on remote Bridled Island off the Pilbara coast. This difference in behaviour is attributed to the gradual habituation of Penguin Island terns to the regular presence, and relatively predictable activity, of people at that colony. The management implications for planning human visitation to seabird colonies are discussed.

INTRODUCTION

Wildlife managers such as the Australian Nature Conservation Agency are developing guidelines to control the effect of human visitation to seabird islands. The concept of "critical distance" is prevalent in the literature; that is the distance at which breeding seabirds could be approached without eliciting escape or anti-predator behaviour.

Erwin (1989) measured critical distances in a variety of colonial waterbird species breeding at coastal sites in Virginia and North Carolina. This