

**Avifauna Management Plan for the Long Island Tourism
Development, Wallabi Group, Houtman Abrolhos, Western
Australia.**

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1 Introduction

Birds are the most conspicuous element of the fauna of the Houtman Abrolhos. On Long Island, they comprise the largest group of animals by numbers and by biomass. Long Island in the Wallabi Group is the third most significant breeding island after West Wallabi and Beacon Islands, and therefore careful management and monitoring of this natural resource is required.

This document aims to provide an Avifauna Management Plan aimed at reducing and managing the potential impacts of the Long Island Tourism Development upon the island's avifauna. There has been much discussion on the merits and costs of visitors to seabird breeding islands. It may be argued that encouraging well managed visits to seabird islands encourages public appreciation of conservation issues (Beale and Monaghan 2005). Conversely, poorly managed access to seabird islands can cause increases in seabird mortality and declines in bird numbers and reproductive performance.

This document is broken into three main sections: the first describes potential impacts and mitigation during the construction phase; the second describes potential impacts associated with operations and visitor activities and their mitigation; and the third provides a detailed annual monitoring plan to assess annual changes in the Long Island avifauna.

Throughout this document there are terms used to describe seabird breeding behaviour which may not be familiar to the layperson. Definitions of these terms are provided in Section 7.

2 Birds of Long Island

Twenty eight species of birds have been recorded on Long Island (Burbidge and Fuller 2004, Storr *et al.* 1986, Surman 2006). Of these, twelve species have been confirmed as breeding regularly; these are the White-breasted Sea Eagle *Haliaeetus leucogaster*, Osprey *Pandion haliaetus*, Pacific Gull *Larus pacificus*, Silver Gull *Larus novaehollandiae*, Caspian Tern *Sterna caspia*, Crested Tern *Sterna bergii*, Bridled Tern *Sterna anaethetus*, Eastern Reef Egret *Egretta sacra*, Pied Oystercatcher *Haematopus longirostris*, Grey Breasted White Eye *Zosterops lateralis*, Little Shearwater *Puffinus assimilis* and White-faced Storm Petrel *Pterodroma marina* (Surman 2006). Two other species not recorded during surveys in 2005 have been recorded breeding previously; the Roseate Tern *Sterna dougalli* (Burbidge and Fuller 2004) and Wedge-tailed Shearwater *Puffinus pacificus* (CALM SBID).

Of the 28 species recorded on Long Island, 20 were reported during surveys conducted in September/October and December 2005, and included a new record, the Sooty Tern *Sterna fuscata* (Surman 2006). Sooty Terns were recorded prospecting over the northern end of the colony in association with Bridled Terns. No formal estimate of the White-faced Storm Petrel has been undertaken prior to the Avifauna survey in 2005, although Kirsten (2001) reported this species as breeding. Species not recorded during the 2005 surveys were mainly migratory waders and included; Bar-tailed Godwit *Limosa lapponica*, Greenshank *Tringa nebularia*, Grey Plover *Pluvialis squatarola*, Sanderling *Calidris alba*, Spotless Crake *Porzana tabuensis* and Brush Bronzewing *Phaps elegans* (Storr *et al.* 1986, Coate 2005).

Given the diversity of the seabird fauna based on surveys for this management plan previous records, Long Island has a diverse avifauna relative to its land area. In the Wallabi Group, Long Island is the third most significant seabird breeding island in terms of biomass after West Wallabi and Beacon Islands. It has significant breeding populations of the White-faced Storm Petrel, Bridled Tern and Little Shearwater (Surman 2006).

3 Vulnerability of birds to disturbance

Seabirds are particularly vulnerable to disturbance during the early parts of their breeding cycle, particularly the courtship and colony establishment stage (GBRMPA 1997). In Western Australia, Crested Terns were found to be increasingly tolerant of benign human activities as their incubation period progressed, exhibiting smaller CAD's (Critical Approach Distance) and shorter return times to the nest-site (Barter 2004). The sensitivity to disturbance from human activities varies greatly from one species to the next. At the Houtman Abrolhos, the most vulnerable species tend to be those that nest in sandy areas in burrows, or those that nest in exposed situations. Two ground-nesting species that occur at the Houtman Abrolhos are particularly vulnerable to disturbance during the colony establishment and early incubation periods; the Roseate Tern and Fairy Tern.

3.1 Threat Status

Components of the avifauna at the Houtman Abrolhos are protected under three National and State Acts; the EPBC Act 1999, the CALM Threatened and Priority Fauna Database and the Wildlife Conservation (Specially Protected Fauna) Notice 2005. Migratory Waders are protected under the EPBC Act (1999), and are included in the Japan Australia Migratory Bird Agreement (JAMBA) and the China Australia Migratory Bird Agreement (CAMBA). Of these, all Long Island waders listed in Surman (2006), as well as the Eastern Reef Egret, Bridled Tern, Caspian Tern and Crested Tern, Osprey and White-breasted Sea Eagle are listed under migratory bird agreements with either Japan or China. Eight bird species found at the Houtman Abrolhos are also listed under the CALM Threatened and Priority Fauna Database, although only two of these species, the Lesser Noddy *Anous tenuirostris* and Painted Button Quail *Turnix varia*, are likely to be found occasionally on or adjacent to Long Island. Currently, there are no records of these two species from Long Island.

Similarly, the two marine raptors, the White-breasted Sea Eagle and Osprey are particularly vulnerable to disturbance. The Wallabi Group is the most significant nesting site of the White-breasted Sea Eagle both at the Houtman Abrolhos and in Western Australia with up to 18 pairs potentially nesting within the group (Kirsten 2001). Of these, a single pair nest on Long Island. Figure 1 presents a diagrammatic representation of the breeding schedules of avifauna at Long Island.



Figure 1: Breeding chronology of the Long Island, Houtman Abrolhos avifauna. Data based on Storr *et al.* 1986, Surman 1994, Surman 1998, Surman 2006, Kirsten 2001. The presence of each species is represented by the open bar, the period of breeding activity is indicated by the solid bar.

3.2 Vulnerability to disturbance

The GBRMPA (1997) lists several factors that influence the vulnerability of various seabird species to disturbance, which reflect ecological and behavioural characteristics. This report describes behavioural changes which could occur based upon the data collected and local knowledge of the author. Key points to consider when assessing the sensitivity/vulnerability to disturbance are;

- Timing of breeding
- Whether ground, tree or burrow-nesting
- Critical Approach Distances
- Composition and fragility of nesting habitat
- Sensitivity of species to desertion or changes in colony distribution
- Propensity to acclimatise to disturbance over time

3.3 Responses to Disturbance

A recent assessment of the vulnerability to disturbance of seabirds in Western Australia (2004) found that

- Responses varied between species
- Responses varied according to the stage of breeding and
- Tolerance in some species increased over time.

The response to disturbance also varies within species dependent upon the past history of interactions with humans. Nesting Bridled Terns on Penguin Island, Rockingham, are highly tolerant of human traffic, but at the Lowendal Islands, North West Shelf, have a CAD within 20-30m and at the Houtman Abrolhos within 5-10m (Surman *pers. obs.*). However, Bridled Terns have acclimatised to human activity on Penguin Island which is a very frequently visited site, and have colonised areas closer to high impact areas, suggesting that over time this species is able to breed successfully in frequently visited areas if human traffic is managed well (Barter 2004). Similarly, at the Houtman Abrolhos, Bridled Terns have colonised areas under fishing camps and rocklobster pots.

Other studies (Barter 2004, GBMRPA 1997) conclude that a combination of predictable human behaviours, adequate setback distances (based on critical approach distances) and benign interactions are best management practices on seabird islands where development is to take place.

Barter's (2004) study showed that the Critical Approach Distance for seabirds breeding on islands south of the Houtman Abrolhos ranged from 5m for Brown Noddy to 52m for Crested Terns. Asmussen (2001), in an unpublished document, recorded a mean CAD for the White-breasted Sea Eagle at the Wallabi Group at 240 m (range 50-450 m).

A review published by the GBRMPA found that seabirds are subject to a wide variety of disturbances including human traffic (tourist and recreational), trampling, boat traffic, fixed and rotary aircraft, fishing activities, navigational aids and research activities.

The general effects of disturbance to seabird colonies may include

- Desertion of colonies

- Shifts in colony distribution
- Delayed breeding
- Predation of eggs and young
- Exposure of eggs and young
- Stampedes
- Interruption to feeding events
- Stress related behavioural changes
- Injury from collision with structures
- Disorientation due to lighting impacts
- A decrease in reproductive output

4 Impact sources and control measures

The following section describes those activities that are associated with construction and operation of the Houtman Abrolhos Tourism Facility and the likely impacts upon avifauna and potential mitigation measures.

4.1 Timing of operations – Annual sensitivity

Surman (2006) provides a detailed account of the population of avifauna on Long Island. The timing of breeding of each species, and the location of nesting areas will determine the level of sensitivity.

The site to be developed covers the highest portion of the mid part of Long Island, and is characterised by predominately broken coral ridges to the west and sandy, low dune areas to the east. From a seabird perspective, the most sensitive areas that will be developed are the sandy areas, where much of the accommodation blocks will be constructed. In these areas are low density Little Shearwater and White-faced Storm-petrel burrows, and under the dense *Nitraria billardi* and *Myoporum insulare* bushes are Bridled Terns. Depending upon when construction will take place, either Little Shearwater and White-faced Storm-petrel colonies may be disturbed through collapsing of burrows or trampling of habitat, or Bridled Terns will be disturbed through removal of vegetation.

The optimal timing to reduce overlap with seabird breeding times would be a commencement date of on island construction of infrastructure requiring excavation commencing in the period late January - June. This would coincide with the lowest number of breeding seabirds on Long Island as well as coinciding with the absence of both Little Shearwater and White-faced Storm-petrel in nesting burrows, and therefore the risk of upsetting a breeding attempt or displacing young. However, the total on-island construction period will last 38 weeks, and regardless of the commencement date, construction activities will overlap at some stage with seabird breeding periods.

4.2 Building Footprint

The total footprint of the Development in the main lease area will be approximately 0.64 ha. Of this approximately 0.4 ha will comprise accommodation blocks and boardwalks lying over sandy areas that contain Little Shearwater and White-faced Storm-petrel burrows. Within the lease area approximately 0.3 ha of burrow habitat exists. Much of this will be overlain by suspended floors 500mm above the existing ground levels. Two options for management of areas under suspended floors are;

- Fence off under accommodation areas to prevent recolonisation and noise from seabirds
- Leave unfenced to encourage through traffic of wildlife.

The first option, to fence off areas under accommodation blocks, would reduce the total nesting area available to both burrow nesting and surface nesting birds on Long Island. It is estimated that this may reduce the potential nesting habitat available to burrow-nesting birds on Long Island by up to 50%.

The second option will encourage continuation of nesting by both Little Shearwater, White-faced Storm-petrel and Bridled Terns, all of which have a history of adapting to nesting under man-made structures at the Houtman Abrolhos. However, with this would come a seasonal increase in noise from the catterwailing cries of the Little Shearwaters, which is likely to disturb visitors.

4.3 Construction Activities

Crothers Construction Pty Ltd plans to conduct construction activities on Long Island for a period of 38 weeks. Figure 1 shows that irrespective of when the construction phase commences, it will at times overlap with the breeding times of some seabirds that use Long Island.

The following section details potential impacts to avifauna during the construction process, and suggests mitigation measures. In general, construction staff will be required to remain within the immediate working area, or areas set aside for work breaks. Rest areas on island will be established immediately adjacent to the coast.

4.3.1 Impacts of construction activities

The impacts of construction activities upon avifauna will vary depending upon the time and length of the proposed construction period. The construction process will involve a prolonged period of intense activity on Long Island, with construction personnel present during daylight hours over the 34 weeks planned for the construction period. Activities associated with the construction process, including the use of support vessels and supply barges, as well as the use of Rock Lobster fisher camps for island accommodation are included in this section.

Major impacts upon avifauna or their habitat are;

- Habitat Loss (removal of sand/vegetation)
- Erosion due to vegetation loss
- Trampling of habitat due to construction process
- Desertion of Bridled Terns / Grey-breasted White-eye nests in shrubs
- Desertion (or acclimatisation) of surface nesters due to increased activities associated with construction
- Increased attendance by gulls associated with human presence
- Collision with infrastructure at night
- Fire from welding/smoking/ grinding activities
- Increased boat and air traffic

4.3.2 Control and Mitigation Measures

To reduce the potential impacts of construction activities upon the island avifauna, construction staff will at first be given an environmental induction which will include a description of which species exist on the island, and what species they are likely to encounter at that particular time.

In addition the following will be undertaken;

- Flagging of all active burrows and shrubs with Bridled Tern nesting attempts
- Establishment of pathway to access construction areas

- Establishment of buffer zones
- Establishment of lunch/smoko areas at appropriate area
- Waste disposal in sealed containers
- No nocturnal construction or lighting
- Lighting management on board vessels and Rock Lobster fishing camps

4.3.2.1 Pre –construction site visit

The proponent will engage an avifauna expert familiar with the site to be present during the initial stages of construction and when appropriate elsewhere during the construction process. The consultant will induct the staff into the avifauna management plan, the identification of potential nesting areas and the protocol to be followed when encountering active burrows/and or nests.

Prior to commencement of construction activities the consultant will brief the construction manager and identify those areas required for construction activities. In cooperation with the construction manager, the consultant will flag off no-go areas north and south of the lease area to reduce foot traffic in areas outside of the lease area. Together with the construction manager, pathways/thoroughfares to access areas of the lease for construction purposes will be marked out and checked for the presence/absence of avifauna. All attempts will be made to keep both human and vehicular traffic to these marked thoroughfares. The consultant will mark active burrows and nests that lie in the path of the construction area with colour-coded flags.

4.3.2.2 Burrow reorientation

In the event that a burrow will be impacted by construction activities, all attempts will be made to reorient the burrow.

If adults are present, adults will be removed and stored in a ventilated cardboard box, and either released at dusk, or returned to the altered burrow. Depending upon the timing of construction activities, some burrows may contain eggs or nestlings. Wherever possible, the consultant will reorientate the burrow chamber, pivoting on the axis of the burrow entrance. In this way, the entrance will remain intact and at the same location and will be able to be relocated by the attending adult. Materials will be kept on hand to secure altered burrows, including half-pipe PVC.

A log will be kept of the location and contents of altered burrows. A burrow-scope will be used to monitor the contents of altered burrows for three days after alteration.

4.3.2.3 Surface nesting seabirds

The most likely species to be disturbed during the construction process is the Bridled Tern, a surface-nester that prefers nesting under low shrubs. Whilst every attempt will be taken to prevent the removal of vegetation, in some cases this may not be possible. Plywood artificial lean-toos will be on site to provide shelter for eggs or young chicks if the nesting bush is removed. A log will be kept of all altered surface-nesting nest sites and their progress post alteration will be monitored.

4.3.2.4 Silver Gulls

Staff will be made aware of the presence of Silver Gulls, and their ability to take advantage of food scraps and other feeding opportunities. A “no feeding wildlife” policy will be undertaken, and all organic/edible waste disposed of shall be in sealed containers for removal to the mainland.

4.3.2.5 Protocol for Wildlife Encounter

During the construction process, and in particular if this overlaps with the breeding schedule of avifauna, construction staff will be inducted into methods for reporting disturbance to wildlife. We define an encounter as any activity that actually or potentially may alter the behaviour of, or interfere with the normal activities of wildlife found on Long Island.

Protocol for Wildlife Encounter

- Stop activity
- Notify Supervisor of what has been observed and location
- Advise Consultant immediately. If a burrow has been identified which was not previously marked, the consultant will ascertain whether burrow is active or not, and make decision on whether work can continue without alteration, based upon burrow contents.
- If an egg, adult or chick is present consultant will advise on best action in liaison with construction manager and staff.
- Reorientate burrow, or relocate chick as described above.

Any avifauna injured will be housed in a ventilated cardboard box, in a cool, shaded area, until they are able to be transported back to an appropriate hospice for treatment on the mainland. A log will be kept of the locations and outcomes of all avifauna-related incidents during the construction phase and a regular report issued to the proponent tabling progress.

4.3.2.6 Nesting White-breasted Sea Eagle

A single pair of White-breasted Sea Eagles nest on Long Island. Their nest is located approximately 130m to the south east of the proposed helipad. This is below the mean CAD observed by Kirsten (2001) (mean 240m, range 40-450m) but falls well within the range of measured CAD's. The nest is fully shielded from the helipad and boardwalk by coral ridges and vegetation that lie between the nest site and the helipad. In discussions with the Conservation Council, two alternatives to minimise disturbance were proposed.

The first is, prior to construction, and prior to the commencement of breeding, the nesting material of the White-breasted Sea Eagle nest will be removed to discourage nesting at this site by this pair. The pair may continue to nest on Long Island elsewhere, and potentially may establish again at the northern or southern portions of the island, or they may relocate to another island. During the 2005 breeding season there were no White-breasted Sea Eagles nesting on Eastern Island, Seal Island, Dakin Island, First Sister Island and Dick Island, so relocation to these islands may occur. However, the presence of Osprey on Dick Island may prevent nesting of White-breasted Sea Eagles on this island.

The second option is to leave the nest intact and to monitor the reaction of the nesting pair during construction activities. Depending upon the timing of breeding, the pair may acclimatise slowly to the increased levels of human activity on Long Island. Given that the nest site is shielded from the helipad and partially shielded from northern aspects of the island, where much of the construction

activity will take place, it is possible that the birds will acclimatise. The nest site currently lies approximately 375m south of the proposed jetty area, and 470m south of the southern boundary of the main construction area within the lease.

4.3.2.7 Staff Movements

Staff will be advised to remain within the lease area. There will be no unauthorised access to other areas of the island without prior consultation with the construction manager.

4.3.2.8 Vessel Transfers and Mooring

Vessel transfers between Long Island, transport vessels and accommodation island(s) will be conducted during daylight hours. Vessels will keep clear of other islands en route to Long Island. Only Wann Island lies in the path of vessels en route to/from the Pigeon Islands, and wherever practicable vessels will keep as far as practicable from this island. No unnecessary use of spotlights will be undertaken. Vessels will use regular routes to and from the island.

Vessel-island transfers will be undertaken in smaller vessels. It is recommended that these approach the designated landing area directly at a speed of 5kts or less. Small vessel traffic will be limited in the vicinity of Long Island to personnel transfers and are unlikely to disturb avifauna in other parts of the island.

Vessel operators will ensure all deck lighting, apart from navigation lighting is extinguished. The use of external lighting will be kept to a minimum, and no spotlights, or other bright light sources will be used at night from moored vessels for fishing purposes. Where fitted, windows on vessels shall be covered to reduce light spill overnight. This minimises the disorientation of birds approaching and/or leaving their nesting colonies at night.

All seabirds landing on deck areas of vessels will be reported. Seabirds found on deck will be approached slowly with a towel and caught being careful of the wings, inspected for obvious signs of injury, and released into the wind, away from lighting and clear of obstructions to allow them to take flight. Injured birds should be placed into a well-ventilated box overnight and reassessed the following morning.

4.3.2.9 Accommodation Areas

Staff will most likely be accommodated during the construction phase in rock-lobster fisher camps. During the tenure, the Person in Charge will request the owners of the camp to keep external lighting to minimum. Jetty lighting will be reduced in accordance with the lighting protocols outlined in Section 7.6.3. No bright point sources of light will be directed in a manner that may attract and disorientate passing seabirds.

4.4 Operational Activities

During the commencement of operations of the tourist resort, there will be various activities undertaken for the amenity of both visitors and staff. The following section identifies activities most likely to disturb avifauna and possible control and reporting procedures to reduce and record impacts from these activities.

4.4.1 Day Visits to Other Islands and Visitor Activities

As part of the planned visitor activities for guests at Long Island, escorted day trips utilising watercraft such as Jet Skis are planned to be undertaken to other islands. Similarly, some guests may wish to windsurf from Long Island. Other visitors may wish to partake of guided nature-based tours.

As part of the process of assessing impacts, several islands have been identified as suitable for day visits, based on the sensitivity of avifauna, as well as the proximity to Long Island. These islands may need to be closed seasonally, dependent upon nesting seabirds and marine raptors.

West Wallabi Island was originally earmarked as a potential island of interest for day visitors, due to its high historical and biological values. However, due to the difficulty in landing, and the presence of high density breeding White-breasted Sea Eagles, this island will not be included as part of day tours.

Table 1: Islands earmarked for potential day trips, and likelihood of adopting a seasonal closure based on avifauna sensitivity.

Island	Activities	Seasonal Closure	Period	Reason
First Sister	Sea lion observation, Beach, snorkelling	YES	Dec-Mar.	Roseate Terns, Sealions
Second Sister	Surf	NO		
Third Sister	Sea lion observation, Beach, snorkelling	YES	July- Nov.	Osprey
Dick Island	Swimming, beachcombing, surf, seabirds	YES	July- Nov.	Osprey
Beacon Island	Historical	NO		
Eastern Island	Swimming, beachcombing, seabirds	NO		
East Wallabi Island	Swimming, beaches, snorkelling	NO		

Potential Impacts

- Disturbing nesting seabirds during establishment period
- Wandering off shoreline and disturbing nesting birds, collapsing burrows.
- Encouraging Silver Gulls to eat food scraps
- Disturbing breeding sealions

Code of Conduct

To facilitate the management of visitors to islands inhabited by seabirds, the proponent will induct visitors into the code of conduct. The code of conduct aims to reduce to a minimum the impact of visits to these islands, and to facilitate visitor enjoyment during their visits. Typically, when visitors stray off paths and collapse burrows or flush chicks from nests, they themselves become distressed when faced with an injured chick or a chick being harassed by Silver Gulls.

The Code of Conduct

- Approach islands by sea at low speed, and from one direction.
- Keep noise to a minimum by talking normally and being mindful of anchor and chain noise. Do not rev engines.
- Keep to the edges of the island at all times.
- Aside from the beaches, avoid other sandy areas at all times
- If nesting seabirds are observed, retreat quietly and abort landing
- Remove all waste
- Keep your profile low by sticking to the beach, the taller you are the bigger the threat to nesting birds

4.4.2 Human Traffic

There are likely to be after dark walks along boardwalks undertaken by visitors to Long Island. Whilst there will be minimal lighting of boardwalks, guests may wish to carry a flashlight to aid in negotiating the boardwalks. This may;

- Disturb surface-nesting seabirds.
- Disorientate returning burrow-nesting species
- Cause collision between guests and wildlife.

At certain times of year, guests may wish to observe the after-dark activities of nesting seabirds, and this may be done with a well informed guide. Similarly, at times, some particularly sensitive surface-nesting species (i.e. Roseate Tern) may breed on Long Island, and possibly adjacent boardwalks. During the initial stages of nesting these species may desert colonies if disturbed. When the burrow-nesting species (Little Shearwaters and White-Faced Storm-petrels) nest between July and late-January (with some overlap), torch lights across colonies is inappropriate, especially during their return times (about from dusk to 2 hours after depending upon the night). These birds may fly towards bright lights or into the torch bearer. To reduce impacts upon seabirds the proponent will;

- Monitor nesting activity and seasonally gate off areas as required
- Seasonally restrict walks at night to be permitted 2 hours after sunset to 2 hours before sunrise (July – January).
- Provide guests with low-wattage red coloured torches, if torches are needed.
- Induct guests into wildlife encounters.

4.4.3 Light Management

The anthropomorphic effects upon seabirds from urban development are well documented. Apart from coastal development destroying nesting habitat, lighting is perhaps the largest contributor to seabird mortality in developed areas. Where seabirds continue to nest adjacent to urban or developed areas, “fallout”, or the collision of birds with structures, is very high. There have been several published precedents on the effects of lighting upon seabirds, including mortality from offshore oil platforms (Wiese *et al.* 2001), lighthouses (Coates *pers comm.*) and due to urban development (Podolsky *et al.* 1998). There is a continuing community education process to limit

the effects of urban lighting on several species of rare shearwaters on the Hawaiian Island of Kauai (ANON 2000, Podolsky *et al.* 1998) and Reunion Island (Minatchy *et al.* 2004).

Fallout caused by poorly designed lighting occurs as a result of the collision of birds with unseen objects (buildings, telegraph poles, guy wires etc), and may lead to injury, disorientation, regurgitation of meal, desertion of breeding attempt and death. At the Houtman Abrolhos, shearwaters regularly collide with buildings on Little Pigeon and Big Pigeon Island, which is situated adjacent to the largest Wedge-tailed Shearwater colony at the Houtman Abrolhos. Similarly, but to a lesser extent, the lighthouse at Wreck Point, Pelsaert Island, forms a collision hazard for Wedge-tailed Shearwaters (Coate 2005, Surman *pers obs*). There has also been anecdotal evidence of disorientation of both Little Shearwaters and White-faced Storm-petrels due to the search lights of vessels moored adjacent to breeding islands.

Design

Seabirds are sensitive to the blue/white end of the light spectrum, in a manner similar to marine turtles. Previous studies have found that the use of red-coloured filters over lighting reduced seabird fallout by 80%. Both marine turtles and seabirds are less attracted by Low Pressure Sodium vapour lights, and there are practical examples of this on Reunion Island (Minatchy *et al.* 2004) and for low impact lighting for Blue Penguin rookeries in New Zealand (Dave Houston *pers. comm.*).

Management and mitigation measures

The key period likely to have the greatest impact upon seabirds is during the fledging periods of each species. Simple measures such as extinguishing lighting in non-essential areas during this time, reducing light usage in other areas and informing patrons of this proactive exercise greatly decrease the chance that fledgling petrels become disorientated and injured. The most vulnerable periods for each species that inhabits the Wallabi Group is;

- Wedge-tailed Shearwater 24 April- 8 May
- Little Shearwater 15 November- 1 December
- White-faced Storm-petrel 20 January – 6 February

The key to reducing the impact upon seabirds from lighting is to reduce light overspill. This may be done by;

- Utilising low wattage luminaries
- Installing wildlife-friendly Low Pressure Sodium Vapour lighting
- Orientating lights by either directing, shielding, or focusing
- Tinting windows or using drapes at night
- Extinguishing non-essential luminaries.

Throughout the life of the project, the proponent will;

- Utilise seabird friendly light design in the design phase
- Reduce reflectivity of lights off glass and building surfaces
- Eliminate light cast horizontally and vertically
- Ensure colony areas adjacent to development remain in shadow
- Monitor the effects of installed lighting
- Report on fallout and adjust or extinguish lighting in problem areas
- Educate staff and visitors

- Extinguish non-essential lighting during peak fledging periods for Little Shearwaters, Wedge-tailed Shearwaters and White-faced Storm-Petrels

Rescue of fallen seabirds

At some times birds may collide with infrastructure. The following procedure should be followed in these cases.

- Pick up bird with towel, keeping lightly wrapped and in particular the wings contained. Be aware of the sharp bill.
- Place the bird in a well-ventilated cardboard box, and place in a covered, quiet location.
- Record and report the species, number, location found, likely cause of fallout and any injuries
- Give nil by mouth
- If the bird has no obvious signs of injury then the bird may be released
- Take the bird to a quiet part of the island at dawn, release bird onto ground and orientated into wind.

4.4.4 Pest Species

Gull Control

Silver Gulls will initially be attracted to new activities through their association with humans. Careful management of waste disposal should prevent this association developing into a feeding opportunity/signal for Silver Gulls. Uncontrolled, or unmonitored, Silver Gulls are able to quickly adapt to new feeding and breeding opportunities. They are well known for feeding on refuse. Issues that may potentially lead to an increase in Silver Gull numbers are;

- Availability of food scraps, restaurant meals, feeding
- Increased availability of freshwater through leaking pipes or storage tanks
- Availability of unsecured fishing bait or fish carcasses

Silver Gulls are dependent upon fresh water, being less efficient at extracting salt from saltwater as other seabird species. An increase in gull numbers has undesirable impacts for both native wildlife and visitors. Impacts upon native wildlife include increased predation of seabird eggs and young, increased likelihood of losing food for chicks and competition for nesting areas under sparse shrubs with Bridled Terns. Impacts upon clientel include harassment along boardwalks, risk of disease and interruption to alfresco meals.

Management and mitigation measures

- All fresh water plumbing, and storage facilities will be sealed and regularly checked for leaks.
- All organic waste, including food scraps and fish frames will be disposed of in sealed containers and returned to the mainland for disposal. No food of any type should be disposed of inappropriately on the island, or from any vessels nearby. This means no fish frames or food of any kind should be disposed over the side of vessels.
- Cleaning of fish should be done away from the island, the mooring areas and out of sight of birds.
- Tables in the outside areas adjacent to the restaurant will be kept free from unattended meals.
- Patrons will be encouraged, through induction, not to feed wildlife, or to leave food unattended at the restaurant or in their rooms.

- Silver Gull numbers will be monitored regularly as part of the long-term monitoring program on Long Island and adjacent islands. It is planned to plot all existing gull nests prior to the commencement of construction (see Section 5 below).

If Silver Gulls are concentrated around sites, an assessment of why they are there should be undertaken. Assess whether food scraps being left, or whether some personnel/guests are inadvertently or deliberately feeding gulls.

4.4.5 Air traffic

There are a few examples of aircraft activity close to islands and their impacts on seabirds on islands. Seaplanes may illicit a flight response in terns within 400m (Hicks *et al.* 1987). Helicopters will produce a similar level of noise and will be landing only 20m from shore, creating large amounts of disturbance to ground-nesting birds, particularly if there are sporadic, random flights. Only through regulated flight times, as well as regular and strictly controlled flight paths have seabirds become accustomed to helicopter activities in offshore islands throughout north-western Australia (Nicholson *pers comm.*). However, other studies indicate that some ground-nesting species will tolerate aircraft at close proximity. There have been no known impacts on burrow-nesting species (such as Little Shearwaters, White-faced Storm-petrels) from helicopter activity, however this is because these birds remain in the burrows during daylight hours and helicopters do not operate at night. On Heron Island (Queensland) helicopters land close to breeding noddies, but since there were no pre-impact assessments, nor ongoing studies to assess the effects on the birds since helicopter activity started. Aircraft will create disturbance to nesting birds, even during established routine flights. Irregular flights during the breeding season will exacerbate the problem, possibly leading to lower breeding success and colony desertion.

Helicopters and fixed-wing aircraft

The GBRMPA has the following guidelines which have been adopted by HLD;

- No overflight of seabird breeding islands. If necessary for safety reasons, flights must be at no less than 1500 feet
- No lateral approach closer than 1000m (other than when landing)
- Seaplanes are not permitted to land or takeoff within 300m of seabird islands.

Furthermore, GBRMPA guidelines for managing seabird islands recommend the following;

- Helicopter operations only between sunrise and sunset.
- Helicopter landings and takeoffs only from the sea, at the edge of the island and at least 300m from any nesting birds.
- Helicopters are not permitted to operate when surface nesting seabirds exist, unless a formalised monitoring program of impacts is undertaken.

4.4.6 Windsurfers/Kite Surfing

There are some studies and anecdotal evidence suggesting that windsurfing has a greater potential impact on seabirds than motor or row boats (Dietrich and Keopff 1986). The mast and sail present a tall, moving object, and unset sails flap and generate loud, sharp noise. The GBRMPA consider such activities inappropriate adjacent to seabird islands, where surface-nesting seabirds and marine raptors exist. More recently, kite-surfing has become a popular water sport. However, the

extended height (15 m) of the kite presents a major disturbance to avifauna, and is inappropriate adjacent to any islands with seabirds, migratory waders or raptors.

Mitigation and monitoring

Windsurfing activities will be regulated to reduce impacts in the following way;

- A rigging and setting-off area will be established on Long Island away from nesting birds
- Windsurfers will not be permitted to approach other islands
- Kite-surfing will not be permitted at any time.

4.4.7 Oil Spill contingency plan

In the unlikely case of an oil spill on or adjacent to the island during construction, the spill will be contained and mopped up using oil spill kit, and disposable booms. All soiled equipment and kit will be isolated and returned to the mainland for disposal. The size and extent of the spill will be reported directly to EPA, CALM and FWA. Details of this are presented in the construction management plan.

Any oiled wildlife, likely in the event of an over water spill, will be captured and treated according to the guidelines set out in Walraven (1992), under the guidance of the avifauna consultant.

Depending on the circumstances, the avifauna consultant may require measures as suggested in Walraven (1992) such as:

- Secure a sheltered area with running hot/cold water for cleaning purposes
- Capture oiled birds
- Transport to treatment/cleaning facility
- Identify species and assess need using Triage
- Wipe bird with clean paper towel
- Remove oil from eyes, nostrils and mouth with swabs
- Assess health of bird
- Administer oral fluids to prevent dehydration
- Clean only active and alert birds at normal body temperature
- Prepare large (80l) tubs with warm (40°C) water
- Add 1% detergent depending upon oiling
- Agitate feathers carefully then remove bird to next tub when water becomes oily
- Repeat procedure as required until there is no residue in water
- Rinse bird in clean, detergent free tub
- Pat dry birds with clean towels
- Tube-feed if necessary
- Place bird in a designated warm, quiet drying room.
- Keep in holding pens/boxes until assessed for release.

5 Monitoring Change

5.1 Monitoring

Three monitoring surveys will be undertaken during each year of operation of the Long Island Tourism Development. The monitoring program aims to meet those guidelines set out by the Environmental Protection Agency (EPA) Fauna guidelines: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (Guidance No. 56)* states that fauna surveys should "... report fully on natural values, potential impacts, cumulative impacts and options to minimize impacts." The guidelines also state that surveys should be undertaken at an appropriate time of year depending upon the nature of the assemblages and should be undertaken by a suitably qualified scientist.

Given this the objectives of the proponent are to:

- Maintain the current diversity of the Long Island avifauna,
- Monitor and respond to changes in any distribution or abundance of species,
- Monitor reproductive performance against background environmental levels.

The main objectives of the annual monitoring program are to:

- Map the distribution of breeding seabirds on Long Island
- Provide population estimates of avifauna,
- Assess the annual reproductive performance of breeding populations

The proposed survey for avifauna is designed to take into account the seasonal nature of breeding seabirds and migratory behaviour of waders. Seabirds at the Houtman Abrolhos fall into three classes of breeder: Spring/Summer nesters, Autumn nesters and Winter/Spring nesters. Surman (1998) describes the breeding chronology for 14 seabird species from the Pelsaert Group using these classes. The first field visit will coincide with the chick rearing of Little Shearwaters, Pacific Gull (*Larus pacificus*) and Silver Gulls (*Larus novaehollandiae*); late incubation or young chicks for any Caspian Terns (*Sterna caspia*) present on the islands; large nestlings and fledglings of the two marine raptors the Osprey (*Pandion haliaetus*) and White-breasted Sea Eagle (*Haliaeetus leucogaster*); and pre-breeding excavation of burrows and attendance by Wedge-tailed Shearwaters, as well as the presence of pre-breeding Crested Terns (*Sterna bergii*) and Bridled Terns (*Sterna anaethetus*).

Estimates of breeding numbers will be undertaken by;

- Complete counts of all nests of individual nesting species (eg Pacific Gull, Osprey)
- Estimated colony size based on line-transect methods to assess nesting density (eg. Little Shearwater)
- Complete counts of open-nesting terns using head counts of incubating adults remotely using binoculars (eg. Roseate Terns, Crested Terns and Fairy Terns)

Colony areas will be identified and mapped out on hard-copy aerial photographs of the area. For burrow-nesting species, the density of nesting birds will be assessed using 5m x 5m quadrats along set transect lines bisecting the colony area. Within each 5m x 5m quadrat each burrow will be counted and its contents assessed using a Burrowscope (an electronic video monitor attached to a length of flexible tubing that can remotely detect nest contents using an infra red light source). Transect start and end points will be marked with wooden stakes and aluminium tags for future reference and reference points collected. Similarly, the colony area of surface-nesting species (notably terns) will be mapped out using aerial photographs of the island. Where complete

counts of nests are not practicable, nesting density will be estimated based on randomly selected quadrats of varying size dependent upon the species and nesting habitat in question. In the case of surface-nesting species such as Bridled Terns, Pacific Gulls and Osprey, each nest-site will be plotted for mapping purposes using GPS.

All Bridled Tern and Silver Gull nest sites will be plotted on an annual basis. This will provide an accurate assessment of any potential displacement of these species, as well as indicating any increase in Silver Gull numbers that may be due to resort activities. Colony and nest areas will be plotted on aerial photographs annually and presented in the annual report.

Throughout both surveys particular attention will be paid to the nesting locations of Silver Gulls. Silver Gulls are known to take advantage of human development, so the presence of any colonies in the Wallabi Group will be established and used as baseline data to assess any increases in colony size that may be attributed to the development.

The survey will be undertaken in a manner specified to assess Before After Control Impact (BACI) based study. Whilst it is envisaged that impacts from the development (particularly the construction phase) will be readily monitored, choosing a site either on Long Island or adjacent to Long Island to monitor as control colonies may prove problematic given the difference in nesting habitats and their proximity to other disturbances (i.e. rock lobster fishing camps). Two islands that have been identified as suitable control sites are Dick Island and Eastern Island. Both have established populations of burrow-nesting seabirds, and both have evidence of both Little Shearwater and White-faced Storm-petrel nesting, as well as Bridled Terns. Beacon Island has been rejected as a potential control due to its habitation by Rock-lobster Fishers, and the presence of associated infrastructure.

Three transects have been established on Long Island for monitoring burrow-nesting species. These are described in Surman (2006). One transect runs through the central sandy portion of the main lease area, whilst the other two transects occur outside the lease areas.

5.2 Remedial Action

During construction, inspections will be carried out to determine whether bird breeding areas are being avoided and whether noise levels are impacting on birds. Should results indicate that breeding areas are being disturbed, remedial action could include the following:

- A stop of activity, and
- Assessment of the disturbance,
- Assessment of alternative routes/actions,
- Cessation of activities in the area until breeding stops, or in round-nesting species, late incubation is reached.
- There is a possibility of erecting shade cloth (dark green) barriers that may partially shield any colonially ground-nesting species from construction activities. Ground-nesting/surface-nesting species refers to those such as Roseate Terns, Crested Terns, Fairy Terns. Bridled Terns nest in low density colonies, usually under dense shrubs or coral slabs, these therefore would receive some buffering from activities already.
- If noise levels, such as sharp sounds, are disturbing birds, this will be indicated by repeated dreads, where birds lift off on the sound, or continuously fly around/above colony. The remediation is the temporary cessation of that activity and assessment of alternatives.

If the triannual monitoring indicates changes in distribution, abundance or success of breeding birds in the area, then the likely causes of these changes will be identified. There is some considerable annual variability in the reproductive performance and participation of seabirds due to natural variation in food supply and the Leeuwin Current. More obvious distributional changes linked to changes in available nesting habitat will be assessed. Any areas colonised by a shift in distribution of burrow-nesting species on Long Island will be monitored and marked out as sensitive areas.

If Silver Gulls are concentrated around sites either during construction or operation, an assessment of why they are there should be undertaken. Assessment will be carried out on whether food scraps are being left, or whether some personnel/guests are inadvertently or deliberately feeding gulls. Following cessation of the inappropriate activity, gull numbers are expected to normalise.

6 Glossary

Courtship	The establishment of pair bonds and mating prior to nesting
Establishment Period	The period when ground-nesting terns first locate and commence breeding at a nesting site
Incubation Period	That period during which adult birds incubate their egg (s).
Nestling Period	That period during which chicks and runners (mobile, older chicks) are present.
CAD	Critical Approach Distance – the minimum distance that nesting seabirds may be approached before eliciting a visible behavioural change.
GBRMPA	Great Barrier Reef Marine Park Authority

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