6.1 c Cassowary Survey Nov. 2009 P. Buosi

Supplementary Survey (November 2009) for the Southern Cassowary (*Casuarius casuarius johnsonii*) at the Proposed Ella Bay Integrated Resort

NRA Environmental Consultants

NATURAL RESOURCE ASSESSMENT AND MANAGEMENT

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Report Summary	
Key Words	Ella Bay; Southern Cassowary; Satori
Abstract	A Cassowary survey by undertaken at Ella Bay in November 2009. The information will inform the planning and impact assessment process for the proposed Ella Bay Integrated Resort Development. The report provides data on the activity of 8 adult Cassowaries, 3 subadult Cassowaries and 11 Cassowary chicks.

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1. Introduction

At the request of Satori Resorts Ella Bay Pty Ltd (Satori), NRA Environmental Consultants (NRA) recently reviewed Southern Cassowary (*Casuarius casuarius johnsonii*) survey and assessment work (Moore 2006, 2007, 2009) for the proposed Ella Bay Integrated Resort Development (EBIRD) (NRA 2009). While the review concluded that there was sufficient and reliable information on the resident Southern Cassowary (hereafter referred to as Cassowary) for the impact assessment process to proceed it was noted that the process would benefit from further information on the following.

- The abundance, distribution and movement pathways of subadult population during ambient conditions.
- The distribution and movement pathways of adult Cassowaries during ambient conditions especially around the coastal fringe and near potential impact areas (particularly proposed roads).
- The presence of female Cassowaries in and near the project area.
- Revised habitat assessment using a consistent and transparent methodology for all areas that includes consideration of any further field data.

In response Satori commissioned NRA to conduct a field survey to collect information on the abundance, distribution, sex ratio, age class structure and movement pathways of Cassowaries living on or immediately adjacent to the proposed EBIRD site and access roads (referred to as the study area in this report (**Figure 1**).

The survey was timed to coincide with the general period when new generations of Cassowary chicks begin to appear. The advantage of surveying during this period is that family parties are easier to locate than single birds and information on breeding and recruitment can be obtained. The survey timing is consistent with advice provided by Moore (2009) and replicates the timing of his original survey of the area (Moore 2006).

2. Approach

A field survey was undertaken by Peter Buosi (NRA) with assistance from Satori staff (Adrian Hogg and Steve Garrad) between 23 and 27 November 2009. The survey involved daily searches for Cassowaries and their signs (primarily scats and foot prints) along designated transects. Survey transects are described in **Table 1** and are shown on **Figure 1**. Each transect was surveyed on a single occasion. Data on Cassowaries and their sign were recorded in accordance with the categories described in **Table 2**.

Surveillance cameras were also used to collect Cassowary data. Twelve cameras were deployed in the week prior to and during the week of the survey and 11 were deployed in the week following the survey. Camera locations are shown on **Figure 1** (camera numbers on **Figure 1** are not consecutive).

Table 1: Description of survey transects used during the November 2009 Cassowary survey at Ella Bay.

Transect Number	Transect Length (km)	Description
1	3	Beach and fore dune commencing at north-east corner of clearing and terminating at a headland 3 km to the north.
2	2.5	Forest edge along northern boundary of clearing.
3	3.3	Forest edge along western boundary of clearing.
4	2.8	Forest edge along southern boundary of clearing.
5	1.8	Beach and fore dune commencing at north-east corner of clearing and terminating at south-east corner of clearing.
6a	1.8	East-west creek. Effort concentrated along stream channel and northern forest edge.
6b	0.7	Forest edge on northern and southern side of east-west creek. The presence of crocodiles prevented a survey along creek channel.
7	1.2	Random meander along channel, forest and forest edge (eastern and western) of north-south creek.
8	1.4	Track up hill at Little Cove.
9	1.1	Network of tracks around Little Cove.
10	1.7	Ella Bay Road between house/shed (on EBIRD site) and Heath Point Headland.
11	0.6	Little Cove beach and fore dune.
12	1	Flying Fish Point Beach and fore dune adjacent fish farm.
13	1.5	Ella Bay Road between Heath Point (adjacent to car park) and intersection with Ruby Street.
14	1.1	Random meander through Flying Fish Point Reserve and along eastern and southern edge.
15	1	Vicinity of proposed road alignment over Seymour Range between Flying Fish Point Road and Ella Bay Road.
Total	**26.5**	

PROJECT:Supplementary Cassowary Survey (November 2009) at the Proposed Ella Bay Integrated Resort TITLE: Ella Bay Study Area and Survey Sites *T:_AAA\340\WOR\340003\340003 Fig 1a General Map North Section 2010-01-22.wor*	JOB NO: 340003 DATE: January 2009 SOURCE: NRA/ Google Earth	NRA Environmental Consultants NATURAL RESOURCE ASSESSMENT AND MANAGEMENT	Figure 1a

Recommended print size: A3

Legend

Camera Locations November 2009

Fish Farm

Flying Fish Point Reserve

Access Road Study Area

EBIRD Study Area

Heath Point

Ella Bay Road

Transect 13

Transect 12

14

Transect 14

19

13

Ruby Street

Transect 15

Heath Point

0 250 500

Meters

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PROJECT: Supplementary Cassowary Survey (November 2009)
at the Proposed Ella Bay Integrated Resort
TITLE: Ella Bay Study Area and Survey Sites

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DATE: January 2009
SOURCE: NRA/ Google Earth

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Figure 1b

Recommended print size: A3

Table 2: Description of attributes used to record data on Cassowaries and their sign during surveys at Ella Bay in November 2009.

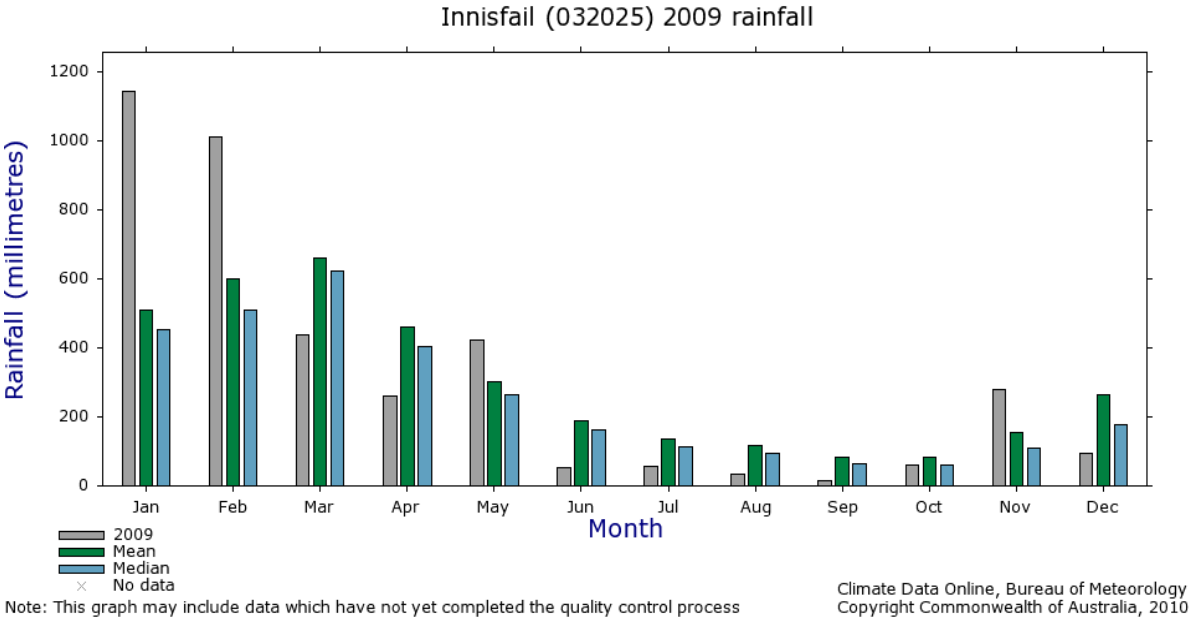
Cassowary Sign	Primary Attribute	Secondary Attribute	Tertiary Attribute
Scats	Age of scat. • Very fresh. Dropping is raised from ground surface and has complete structure; very wet and sometimes steaming; negligible sign of oxidisation; fruit still fleshy. • Fresh. Dropping is raised and has complete structure; thin outer layer is dry but dropping is otherwise wet; signs that outer layer is oxidising; fruit still fleshy. • Recent. Dropping is raised and has complete structure; dry outer layer but wet in centre and base; outer layer is oxidised; fruit partly fleshy. • Old. Dropping is slightly raised but has weak structure; completely dry; fruit in advanced state of decay. • Very old. Dropping is flat and lacking structure; very dry and deteriorated; no sign of fleshy fruit; some seeds might be germinating.	Size of scat. • Small (< 12cm diameter) • Large (> 12cm diameter)	Contents of scat.
Footprint	Social structure. • Independent bird. No chick prints accompany adult print. • Family group. Chick prints accompany adult print. Including number of chicks discernable from foot prints.	Footprint quality. Footprints to be measured from tip of middle toe to back of heel. High quality. Tip of toenail and back of heel are clearly defined; scale imprints are often visible; print is on relatively flat surface and not speared into or smudged on substrate. Low quality. Tip of toe nail and edge of heel not clearly defined, obscured by vegetation, smudged or speared into substrate.	Length of each measured print in mm and direction of travel.
Sighting	Social structure. • Family group. Adult male and number of chicks. • Independent adult. Feathers totally black; blue and red on face and neck; well developed casque. • Independent subadult. Feathers totally brown or contain proportion of brown; face and neck may or may not be blue and red; casque small.	Sex. • Male. Tail droops below body line; smaller than fully grown female; with or without chicks. • Female. Tail small and does not droop below body line; larger than male when fully grown; without chicks.	Description of casque (bends, notches, colours), wattles (length and colour) and/or other distinguishing face or body markings.

3. Results

3.1 Weather Conditions

It rained immediately prior to (16.6 mm, 22 November 09) and during the survey (7.4 mm and 8.8 mm on 25 and 26 November 2009 respectively). No cyclones occurred in 2009 and no extreme weather events (flooding, extended dry or gale force winds) occurred during or immediately prior to the survey.

Rainfall for the 2009 calendar year is shown on **Graph 1**. Weather data is based on the Innisfail weather station and obtained from the Bureau of Meteorology web site (http://www.bom.gov.au).



Graph 1: Rainfall data from the Innisfail weather station

3.2 Cassowary Survey Results

3.2.1 Overview

Eighty-eight scats (36 were recent or fresher) and 21 sets of footprints (including six high quality prints) were recorded along the field survey transects. Surveillance cameras captured photographs of Cassowaries at eight locations. No birds were sighted during the survey although at least one bird was heard retreating into the forest in response to our presence. The location of Cassowary sign recorded during the field survey is shown on **Figure 2**.

PROJECT: Supplementary Cassowary Survey (November 2009) at the Proposed Ella Bay Integrated Resort TITLE: Field Survey Results (November 2009) T:_AAA\340\WOR\340003\340003 Fig 2a Ella Bay Cassowary Survey 2010-01-22.wor	JOB NO: 340003 DATE: January 2009 SOURCE: NRA/ Google Earth	NRA Environmental Consultants Natural Resource Assessment and Management	Figure 2a

Recommended print size: A3

PROJECT: Supplementary Cassowary Survey (November 2009) at the Proposed Ella Bay Integrated Resort TITLE: Field Survey Results (November 2009) T:_AAA\340\WOR\340003\Fig 2b Ella Bay Cassowary Survey 2010-01-22.wor	JOB NO: 340003 DATE: January 2009 SOURCE: NRA/ Google Earth	NRA Environmental Consultants NATURAL RESOURCE ASSESSMENT AND MANAGEMENT	Figure 2b

Recommended print size: A3

3.2.2 Estimates of Population Abundance, Sex, Age and Social Class

At the time of the survey, it was estimated that eight adult birds (six male and two female), three subadult birds and 11 chicks (**Table 3**) were using the study area. The identities of these birds are summarised as follows.

- Male A + 2 chicks. Chicks small (chicks back is just below height of adult underbelly), brown and lack casques. Cannot discount possibility of more chicks in group. The male appears to have uneven sized wattles (left wattle shorter than right). Moore (2006) recorded an adult female in the same vicinity with a shorter left wattle.
- Male B + 3 chicks. Chicks small to medium (back of chicks is about height of adult underbelly), brown and lack casques. Definitely three chicks. Male conspicuous by the absence of wattles.
- Male C + 2 chicks. One small chick (stripy) and one medium sized (back of chick is about height of adult underbelly) brown chick. Both chicks lack casques. Cannot discount possibility of more chicks in group. No identifiable features on male due to poor photo quality.
- Male D + 3 chicks. Chicks small (back of chicks just below height of adult underbelly), brown and lack casques. Definitely three chicks. Adult male has features on casque that may aid identification (*eg* notch, tilt and blemishes).
- Male E + 1 chick. Chick small (stripy). Definitely one chick. Adult male has features on casque that may aid identification (*eg* notch, tilt and blemishes).
- Male F (no chicks). Adult male has subtle features on casque that may aid identification (*eg* notch, curve and blemishes). Casque is small suggesting it is a young male.
- Female A. Tall casque with other features that may aid identification (*eg* prominent indentation and flat spot on casque).
- Female B. Tall casque and possibly other features that may aid identification (*eg* raised vertical posterior ridge and blemish).
- Female C. (identity and presence requires confirmation). Identifiable blemishes and indentations on casque.
- Subadult A. Brown with very small casque suggesting it is a young subadult.
- Suabdult B. Brown with very small casque suggesting it is a young subadult. Cannot separate from Subadult A based on physical features. Assumed to be different birds based on distance between records.
- Subadult C. No photos. Record based on two small scats (recent) collected in Flying Fish Point Reserve.

The areas used by identified Cassowaries are shown on **Figure 2.** These areas should be interpreted as sections of the home ranges of identified birds, *ie* they are not entire home ranges.

Some observations could not be conclusively attributed to specific Cassowaries and these are summarised as follows.

- It is not clear if Male C (with one large and one small chick) photographed at camera location 9 (**Figure 2**) is the same as Male E (one small chick) photographed at camera location 15 (**Figure 2**). While Male E only has one chick, a young subadult (similar size to large chick with Male C) was photographed in the same area as Male E but at slightly different times (suggesting no association between Male E and the young subadult). While the evidence is inconclusive they are probably, and have been treated as, separate family groups. The 'possible' estimate for adult males, chicks and family groups shown in **Table 3** reflects the possibility that Male C and Male E are the same.

- As described above Subadult A cannot be separated from Subadult B based on physical features. While the distance between the sightings (photos from camera locations 1 and 15) is within the movement range of subadult birds (< 4 km of forest separate the sightings) such a movement at this site seems unlikely given the amount of potential habitat between the two areas. They are assumed to be different birds in this report.
- Only two adult Cassowaries were recorded along the access road. This is lower than we expected given the area of available habitat and the density of Cassowaries observed at the EBIRD site. While the foot prints (poor quality) collected on Seymour Range (near Flying Fish Point Road) are within the movement range of Cassowaries recorded near the fish farm the prints are suspected to be from an additional adult bird. The potential presence of this additional bird is flagged but not incorporated into abundance estimates shown in **Table 3.**
- Photos and video of Cassowaries taken in the north-west of the EBIRD site in the months before and after the survey period were used to confirm the presence of two family groups in that area. The same images suggest the presence of an additional adult female in the north-west of the EBIRD site. Further survey data is required to confirm the presence and identity of this female bird. It is shown in **Table 3** as a 'possible' female in the EBIRD site.

Table 3: Estimate of Cassowary population abundance, sex, age and social class using the Ella Bay survey area during November 2009[1]

Category	EBIRD Site	Access Road	Total
Adult male	5 (possibly 4)	1	6 (possibly 5)
Adult female	1 (possibly 2)	1	2 (possibly 3)
Subadult	2	1	3
Family groups	5 (possibly 4)	0	5 (possibly 4)
Chicks	11 (possibly 9)	0	11 (possibly 9)

1: Some observations could not be conclusively attributed to specific Cassowaries and a likely and possible estimate is provided.

3.2.3 Diet, Habitat and Areas of Activity

Twenty-six different food items were found in recent, fresh and very fresh scats and indicate what Cassowaries were eating during and immediately prior to the survey (**Table 4**). The food items were predominantly fruit but a few scats also contained fungi and fern fronds. While no food items were especially dominant in the scats, *Calamus* species (Wait-a-while), *Myristica insipida* (Native Nutmeg) and *Prunus turneriana* (Wild Almond) were the most commonly occurring items. The scats contain food items which are widespread in coastal forest communities and do not indicate a preference for any particular habitat type or area.

A further eight species of fruit (*Davidsonia pruriens*, *Achronychia* species, *Eleocarpus grandis*, *Endiandra Montana*, *Archontophonenix alexandraewere* and three unknowns) were recorded in old and very old scats but not recorded in recent, fresh and very fresh scats.

PROJECT: Supplementary Cassowary Survey (November 2009)
at the Proposed Ella Bay Integrated Resort
TITLE: Areas utilised by Cassowaries during and immediately preceding the field survey

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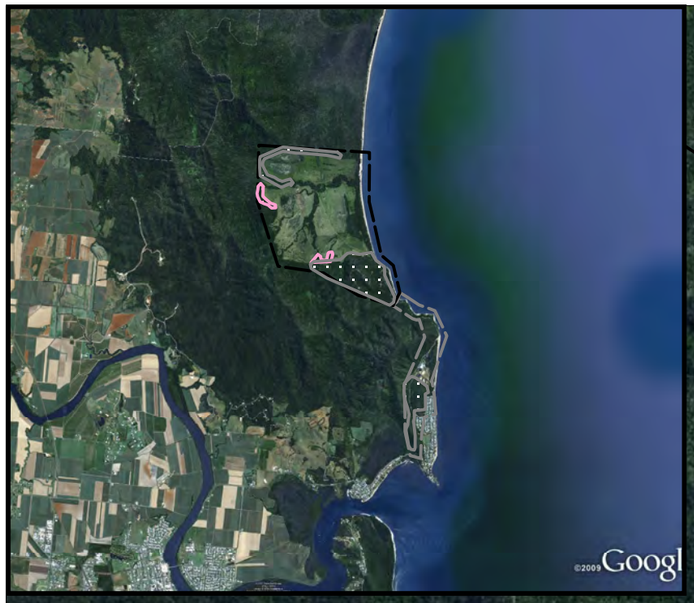
Figure 3a

Recommended print size: A3



Heath Point

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Legend

Cassowary Activity During Field Survey

Access Road Study Area

EBIRD Study Area

PROJECT: Supplementary Cassowary Survey (November 2009)
at the Proposed Ella Bay Integrated Resort
TITLE: Areas Utilised by Cassowaries During
and Immediately Preceding the Field Survey

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Meters

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JOB NO: 340003
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SOURCE: NRA/ Google Earth

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Figure 3b

Recommended print size: A3

Areas of activity during the survey period (based on recent or fresher sign) and prior to the survey (based on old and very old scats) are shown on **Figure 3** There are no detectable correlations between areas of activity and vegetation communities (Regional Ecosystems) as mapped by 3D Environmental (2009). The lack of correlation may reflect the mapping scale used for Regional Ecosystem mapping. Based on field observations, Cassowaries were generally using areas of better developed rainforest *eg* in or near to gullies. Cassowaries are also feeding on planted mangoes (*Mangifera indica*), *eg* Male D + 3 chicks regularly visited the mango beside the house/shed during the survey period. There was a conspicuous absence of sign from the north-south creek, the downstream section of the east-west creek, the south-western boundary of the EBIRD site and the beach and foredune areas.

Table 4: Relative proportion of each food item observed in recent, fresh and very fresh scats at Ella Bay in November 2009

Species[1]	Occurrence of Food Items in Scats	Proportion of Scats Containing Food Item (%)
Calamus species	21	17
Myristica insipida	18	15
Prunus turneriana	13	11
Pandanus species	9	7
Chionanthus ramiflorus	9	7
Mangifera indica	9	7
Gomphrandra australiana	8	7
Cryptocarya species	5	4
Cerbera floribunda	4	3
Fungi	3	2
Aceratium megalospermum?	3	2
Hydriastele wendlandiana	2	2
Ficus species	2	2
Irvingbaileya australia	2	2
Eleocarpus bancroftii	2	2
Faradaya splendida	2	2
Semecarpus australiensis	2	2
Fern, unknown (corkwood?), *Hornstedia scottiana, Aleurites moluccana, Sysigium forte,* unknown *Lauraceae, Baringtonia alyptera, Endiandra species, Acmena graveolens.*	Each item occurred in one scat.	Each item accounted for <1%.

1: A '?'= identification uncertain

4. Discussion

4.1 Population Estimates

Population estimates from the current and previous Cassowary surveys are shown in **Table 5**. The results show that a greater number of Cassowaries were recorded during the current survey compared with previous surveys by Moore (2006, 2009).

While the survey areas for the three studies are relatively similar the environmental conditions during or preceding each survey differed greatly. The November 2006 survey (Moore 2006) occurred approximately 8 months after Cyclone Larry when forests were still heavily damaged and Cassowary food resources were very low. This probably accounts for the lower number of Cassowaries (especially younger cohorts) recorded by Moore compared with the current study. The February 2009 (Moore 2009) survey occurred during heavy rain and flooding associated with Cyclone Ellie. These conditions affect Cassowary behaviour and detectability and probably explain the low number of Cassowaries recorded during that survey. Moore (2009) also reported the suspected death of the adult female (labelled Cassowary #4) Cassowary previously inhabiting forests adjacent to the proposed access road and the emigration of an adult male (labelled Cassowary #1 in Moore 2006 and #5, *aka* 'Hightower' in Moore 2009) to the western slopes of the Seymour Range (near Taluba Road).

Table 5: Comparison of population estimates between the current and previous (Moore 2006, 2009) Cassowary surveys at Ella Bay.

Category	November 2006		February 2009		November 2009	
	EBIRD Site	**Access Road**	**EBIRD Site**	**Access Road**	**EBIRD Site**	**Access Road**
Adult male	2	2	1	1	5 (possibly 4)	1
Adult female	1	1	0	0	1 (probably 2)	1
Adult sex uncertain	0	0	0[1]	1[2]	0	0
Subadults	0	0	1	0	2	1
Family groups	0	1	1	1	5 (possibly 4)	0
Chicks	0	1	2	2	11 (possibly 9)	0
Total adults	6 (3male + 3 female)		3 (2 male + 1 unknown)		8 (6 male + 2 female)	
Total subadults	0		1		3	
Total chicks	1		4		11	

1: Moore (2009) recorded scats along the north-eastern edge of the EBIRD clearing. While he could not definitively assign these scats to a separate bird they were > 3 km from other Cassowary sign and our experience suggests that they may have been from an additional bird.

2: Moore (2009) recorded this adult Cassowary in the swamps west of Flying Fish Point approximately 3 km south-west of the proposed access road and 6 km south of the EBIRD site. This is outside the current (NRA) survey area.

4.2 Re-sighted Cassowaries

Photographs and descriptions contained in Moore (2006) were compared with data collected during the current study. None of the Cassowaries could be matched. Imperfect photo quality (all surveys) and lack of detailed physical identity descriptions in Moore (2006, 2009) probably account for this result. Identity profiles of the Cassowaries photographed during the current study are being prepared and will aid re-identification in future surveys.

4.3 Areas of Cassowary Activity and Movement Pathways

4.3.1 EBIRD Site

In November 2006 Moore (2006) attributed Cassowary sign collected in and immediately adjacent to the EBIRD site to the activity of two adult Cassowaries. The centre of activity of the third Cassowary was approximately 1 km north of the EBIRD site. Currently six or seven adult Cassowaries are thought to be using the same area. This is a substantial increase and may highlight the impact of cyclones on population size. Further surveys during similar 'ambient' conditions are required to confirm the stability of the estimates observed during the current study.

Although the current survey recorded more Cassowaries in the EBIRD site the areas of activity are much smaller compared to Moore's (2006) findings. The larger areas of activity recorded in 2006 may have been due to birds ranging widely to access limited (post-cyclone) food resources. While further survey work is required to ascertain the consistency of observed use patterns the areas not used by Cassowaries during the current study are of potential interest to the planning and impact assessment process and are briefly discussed below.

- **East-west and north-south creeks**. The absence of Cassowary activity in the north-south creek and downstream sections of the east-west creek is puzzling given that food plants are plentiful, readily accessible and were producing fruit at the time of the survey. If this is found to be a regular behaviour/use pattern then it may be because the riparian forests are narrow and Cassowaries using the areas feel vulnerable to predation/harassment. Such a finding may be an insight into the level of harassment that resident Cassowaries have historically been exposed to.
- **South-western boundary of EBIRD clearing**. Very little Cassowary activity was recorded in this area. Acacias dominate some sections of this area and the resultant reduction in fruiting plants may explain the absence of Cassowary sign.
- **Beach and foredune communities**. No Cassowary sign was observed in these areas. Very few plants were fruiting in these areas during the survey and this may explain the absence of Cassowary sign. However, food plants do occur in many of these areas and surveys at different times of the year (especially between February and March) are required to confirm use patterns.

It is not possible to define precise movement pathways on existing data. Preliminary observations suggest that many movement pathways occur within the mapped areas of activity (**Figure 3**). Cassowaries are unlikely to be venturing very far from remnant forest.

4.3.2 Proposed Access Road

The current survey recorded a similar number (to Moore 2006) of Cassowaries using habitats adjacent to the proposed access road. Cassowaries appear to be using all available habitats in this area except for the thin strip of forest east of the fish farm. The absence of Cassowary activity in this area may have been due to the low number of fruiting plants and/or avoidance of the area in response to the high level of human and dog activity along the adjacent beach. Food plants occur in this area and additional surveys (especially between February and March) are required to confirm use patterns.

An area of high Cassowary activity was identified along the transect in the Flying Fish Point Reserve. A camera at this location captured images of two adult Cassowaries. Future surveys should allow for more transects in this area to establish whether other areas of high activity occur.

Although no active road crossing points were recorded during the field survey there was evidence of Cassowaries walking along the road shoulders of Ella Bay Road between Ruby Road and the southern end of the fish farm fence. Cassowaries will probably cross anywhere along this section of road. Cassowary activity along the section of Ella Bay Road adjacent to and north of the fish farm fence to Heath Point is unclear from the available data. While it is possible that Cassowaries enter this section of roadway, actual road crossings are inhibited by the fish farm fence.

4.4 Impact Assessment Process

As described in Section 1, NRA's review of previous Cassowary survey and assessment work identified information that would benefit the impact assessment process. The current study has provided information on the identified issues as summarised below.

- **Subadult Cassowaries**. The location of three subadults has been identified. The territories of these subadult birds overlap with adult birds. Subadults are the most likely age class to move into areas of suboptimal habitat which may include some of those areas where Cassowary activity was not recorded during the current study.
- **Adult Cassowaries**. The number and distribution of adult Cassowaries observed during the current study differs markedly from that observed by Moore (2006) and reflects the situation during more 'ambient' conditions. Further surveys at other times of the year (February to March) are required to confirm use patterns around the coastal fringe.
- **Female Cassowaries**. Moore (2009) concluded that the study area (EBIRD site + proposed access road) contained a single adult female Cassowary. The current study estimates that the same area now contains two (probably three) adult female Cassowaries. A camera on the western slopes of Seymour Range approximately 2.2 km west of the EBIRD site also captured images of a separate adult female Cassowary. As the area is beyond the geographic scope of the study the finding is not discussed in this report.
- **Habitat assessments**. Information from the current study can be used in the suggested review of Cassowary habitat assessments.

5. References

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