Sanjiv Ridge
2024 Northern Quoll Monitoring

Report to Atlas Iron Pty Ltd

27 March 2025

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Executive Summary

Atlas Iron Pty Ltd (Atlas) operate the Sanjiv Ridge Iron Ore Project (the Project) located 33 kilometres south of Marble Bar, in the Pilbara region of Western Australia. The northern quoll (*Dasyurus hallucatus*), which is listed as Endangered under federal and state legislation, has previously been recorded in the Project area. To help mitigate the potential impact of mining on northern quoll, Atlas developed the *Sanjiv Ridge Significant Species Management Plan* (SSMP; 179-LAH-EN-PLN-0001 v3), which prescribes a survey program to monitor the local population of the species for the life of the Project. The specific requirements of the monitoring program are outlined in the *Sanjiv Ridge Northern Quoll Monitoring Procedure* (NQMP) and annual monitoring has been ongoing since 2018.

Atlas commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake the seventh annual monitoring survey of northern quoll for the Project. The overarching objective of this survey was to monitor the presence of northern quolls at monitoring sites and to compare this to Project developments, seasonal fluctuations and other environmental variables, with specific comment on whether the relevant key performance indicator set by the SSMP has been triggered. A total of nine sites were monitored via deployment of camera traps over four consecutive nights during the field survey (15–25 July 2024) including five impact sites and four control sites.

Mining commenced in Stage 1 in 2020, with active mining operations continuing during the 2021, 2022, 2023 and current monitoring surveys. Mining-related activities during the current survey included active mining at three open pits (Sparrow Lake [formerly Split Rock], Runway North, and Razorback), clearing associated with construction of infrastructure and haul roads, and traffic on existing haul and access roads. Mining-related disturbances approached no closer to impact sites than the distances reported during the previous 2023 monitoring survey, and the intensity of mining-related activities also remained consistent between the current survey and the previous survey.

During the current survey, a total of 37 individual northern quolls were identified from 61 capture events on camera traps at six of the nine monitoring sites. This included 16 capture events at three (out of five) impact sites and 45 capture events at three (out of four) control sites. The total number of individuals captured (excluding individuals recorded at control site CO-WS-08, which was established in 2022) is consistent with the previous northern quoll abundances at monitoring sites, where quoll numbers ranged between 14 (2018 baseline survey) and 44 (2021 monitoring survey). None of the individuals captured during the current survey were observed at more than one site, with 62.00% of individuals recorded as single capture events. This suggests they were more likely transiting through monitoring sites, than residing or spending long periods of times in each location.

The overall capture rate across all monitoring sites during the current survey was 1.03 individuals per sampling night. This is higher than the overall capture rates for 2022 and 2018 baseline (n = 0.92 and 0.43, respectively), and lower than 2023 (n = 1.17), 2021 (n = 1.44), 2020 (n = 1.44) and baseline 2019 survey (n = 1.41). Capture rates at impact sites ranged from no (CO-SY-OM and NQ-SY-SL) to one (CO-WS-01) individuals per sampling night and no (CO-WS-08) to 4.75 (NQ-TR-01) individuals per sampling night for control sites. The estimated population size at each of the sites ranged from 2.41 at NQ-MC-02 to 22.88 individuals at NQ-TR-01.

At four of the five impact sites, northern quolls were recorded at lower or similar numbers during the current survey as previously observed throughout the monitoring program. The exception was CO-SY-OM, where, for the first time since monitoring commenced, no northern quolls were recorded (previously recorded 3–10 individuals annually). The proportion of quolls captured at grouped impact sites (n = 9, 24.32%), relative to the total number captured at all monitoring sites is considerably lower than observed in previous years (51.72–68.17% of total individuals captured at impact sites). The reason for the lower number of quolls at impact site CO-SY-OM, and lower overall capture rate at grouped impact sites during the current survey compared to previous years cannot be explained by any changes in mining-related intensity or proximity. No clear trend between current quoll numbers and previous monitoring years were observed at control sites, with quoll numbers being observed at slightly lower numbers or consistent with previous monitoring years at two control sites (NQ-MC-03 and NQ-MC-07), considerably higher at NQ-TR-01 and lower at CO-WS-08.

Overall it appears that changes in the abundance and distribution of northern quolls using the Study Area between the current survey and the previous 2023 survey cannot, with certainty, be attributed to advancements and intensity of mining activity occurring at the Project. Ongoing monitoring will help reveal whether the relatively low numbers recorded at impact sites this year represent the start of a sustained period of relatively low activity in the Study Area, or is part of natural variation in the northern quoll population across the Study Area in response to natural factors such as reduced annual rainfall during 2024.

In accordance with the SSMP, Atlas is committed to employing specific management actions when the key performance indicator has been triggered. The key performance indicator being the ‘absence of northern quoll at 50% of monitoring sites over two consecutive annual monitoring periods’. As northern quoll were recorded at 60% of impact sites during the current survey and captured at all five impact sites during the previous 2023 survey, the key performance indicator outlined in the SSMP was not triggered during the current monitoring period.

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1 Introduction

1.1 Background

Atlas Iron Pty Ltd (Atlas) are currently operating the Sanjiv Ridge Project (formerly known as the Corunna Downs Project), an iron ore project located in the Pilbara region of Western Australia, approximately 33 kilometres (km) south of Marble Bar (Figure 1.1). Stage 1 of the Sanjiv Ridge Project (the Stage 1 Project) is already approved (Ministerial Statement Number: 1125, approved 12 March 2020), and mining commenced in 2020.

As part of the Project's approvals, a *Significant Species Management Plan* (SSMP, 179-LAH-EN-PLN-0001 v3) was developed to manage several species of significance recorded within the Study Area (Atlas Iron, 2017). The SSMP requires Atlas to undertake an annual monitoring survey for the northern quoll (*Dasyurus hallucatus*), to ensure the effectiveness of Atlas's management measures against performance objective (Atlas Iron, 2017), specifically:

Performance Objective: persistence of northern quoll within the Study Area during operations.

Key Performance Indicator: absence of northern quoll at 50% of monitoring sites over two consecutive annual monitoring periods

Should this key performance indicator be triggered, Atlas will be required to implement a series of response actions, as detailed within the SSMP (Atlas Iron, 2017). The specific requirements of the monitoring program are outlined in the *Northern Quoll Monitoring Program* (NQMP) and include baseline population surveys, annual monitoring, opportunistic monitoring, and rehabilitation monitoring (Appendix C of Atlas Iron (2017)).

To ensure Atlas's production portfolio was maintained, Atlas have progressed studies to support the future Sanjiv Ridge Stage 2 Project (the Stage 2 Project). The Stage 2 Project lies wholly within an area previously surveyed by MWH (2018) for the Stage 1 development (hereafter referred to as the Study Area; Figure 1.1). Construction associated with Stage 2 commenced in November 2023.

Northern quolls were first recorded in the Study Area in 2014 during a two-season terrestrial vertebrate fauna survey (MWH, 2018). Baseline monitoring surveys were conducted in the Study Area in 2018 and 2019, prior to the commencement of production (blasting and ore-extraction) activities (Biologic, 2019a, 2019b). Monitoring was then conducted in 2020 as construction was beginning (Biologic, 2021a), and in 2021, 2022 and 2023 during mining operations for the Stage 1 Project (Biologic, 2021b, 2023, 2024).

1.2 Scope and Objectives

In April 2024, Atlas commissioned Biologic to undertake the seventh annual monitoring survey of northern quoll for the Project. This survey represents the fifth survey since the commencement of production (blasting and ore-extraction) at Stage 1 and the first survey since the commencement of construction for Stage 2. The overarching objective of the survey was to monitor the presence of northern quolls at monitoring sites, in consideration of project developments, seasonal fluctuations and other environmental variables (where possible), with specific comment on whether the key performance indicator outlined in the SSMP has been triggered. Specifically, this report provides:

- information on the habitat condition at pre-established photo monitoring points;
- quantitative data on northern quoll presence and distribution within the Study Area, and
- a comparison of northern quoll captures between this survey and previous surveys to discern northern quoll population trends.

1.3 Compliance

The monitoring was carried out in acknowledgement of the following guidelines and recommendations developed by the relevant state and federal regulatory bodies and the Sanjiv Ridge SSMP:

- Atlas Iron (2017) Significant species management plan - Sanjiv Ridge, specifically Appendix A - northern quoll monitoring procedure;
- DoE (2016) EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus*, and
- EPA (2020) Technical guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment.

760000 770000 780000

7640000 7630000 7620000

NQ-SY-SL
NQ-MC-01
CO-SY-0M
NQ-TR-01
CO-WS-01
NQ-MC-02
CO-WS-08
NQ-MC-03
NQ-MC-07

LEGEND

- Study Area

Fauna Habitat

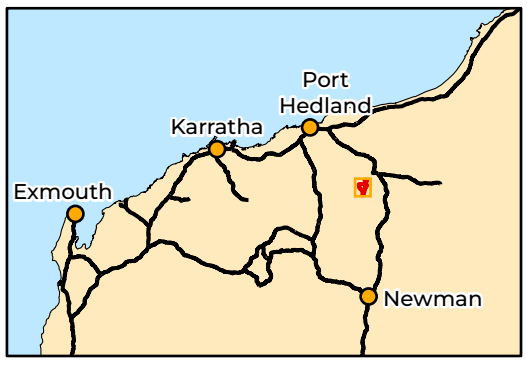
- Calcrete
- Drainage Line
- Granite Outcrop
- Granitic Upland
- Ironstone Ridgetop
- Riverine
- Rocky Foothill
- Rocky Ridge and Gorge
- Sandy Plain
- Spinifex Stony Plain
- Stony Rise

Monitoring Site

- Control
- Impact

Scale 1:110,000
0 2 4 Km

Coordinate System: GDA2020 MGA Zone 50
Transverse Mercator Created: 08/10/2024



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Sanjiv Ridge 2024
Northern Quoll Monitoring

Figure 1.1: Study Area and monitoring sites

1.4 Northern Quoll

The northern quoll is listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Western Australian *Biodiversity and Conservation Act 2016* (BC Act). The species was once widely distributed across northern Australia; however, it is now restricted to three isolated populations: the Pilbara, the Kimberley and Northern Territory, and Queensland, in addition to a number of islands along the north coast (DoE, 2016). Northern quolls are opportunistic omnivores, consuming a variety of invertebrates and small vertebrates as well as fruit, nectar, carrion and human refuse (Dunlop *et al.*, 2017).

As a result of facultative die-off, the abundance of the species is cyclical, and the annual reproduction is highly synchronised (Oakwood *et al.*, 2001). In the Pilbara, abundance is highest in summer, prior to the mating season (prior to male die-off) and when juveniles have begun foraging independently (Braithwaite & Griffiths, 1994; Hernandez-Santin *et al.*, 2019; Oakwood, 2000). Females typically have a higher probability of survival than males in the Pilbara. Male survival is at its lowest after the breeding season (September – April) and female survival is at its highest between September – April (Hernandez-Santin *et al.*, 2019). Schmitt *et al.* (1989) reported relatively small home ranges in rugged habitat in the Kimberley (2.3 ha for females and 1.8 ha for males), whereas in the north and west Pilbara, mean short-term home ranges were much larger in similar rugged habitat (34 ha for females and 193 ha for males in (Hernandez-Santin *et al.*, 2020) and between 14–33 ha for females and 301–931 ha for males in Cowan *et al.* (2020)).

The northern quoll is both arboreal and terrestrial, inhabiting ironstone and sandstone ridges, scree slopes, granite boulders and outcrops, drainage lines, riverine habitats (Braithwaite & Griffiths, 1994; Oakwood, 2002), dissected rocky escarpments, open forest of lowland savannah and woodland (Oakwood, 2002, 2008). Rocky habitats tend to support higher densities, as they offer protection from predators and are generally more productive (Braithwaite & Griffiths, 1994; Hernandez-Santin *et al.*, 2016; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al.*, 2008). Dens occur in a wide range of situations including rock overhangs, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings/ infrastructure, where individuals usually den alone (Oakwood, 2002; Woinarski *et al.*, 2008). At present, northern quolls are relatively common in the northern Pilbara region (generally within 150 km of the coast) but are much less common in southern and south-eastern parts of the region (Cramer *et al.*, 2016).

The species has experienced a precipitous decline in much of its former range in northern Queensland and the Northern Territory in direct association with the spread of the cane toad (*Bufo marinus*) (Braithwaite & Griffiths, 1994; Fitzsimons *et al.*, 2010), and now faces a population collapse within the Kimberley region of WA from the cane toad (Hohnen *et al.*, 2016). Other threats include predation from feral predators such as foxes (*Vulpes vulpes*) and cats (*Felis catus*), inappropriate fire regimes, disease, habitat degradation through grazing and weed invasion, habitat destruction through mining and agriculture (Woinarski *et al.*, 2011). The potential invasion by the cane toad is regarded as the most significant future threat to the northern quoll in the Pilbara. However, there is little knowledge of the relative impact of the other key threats, and their interactive effects, currently and in the future (Cramer *et al.*, 2016).

2 Methods

2.1 Survey Timing

The current field survey was conducted from 15–25 July 2024. Survey timing corresponds with the Pilbara 'winter' months and the end of the wet season, avoiding the heavy rains and high temperature of summer, as well as most of the breeding season (July to September in the Pilbara), and periods of semelparity (male die-off) for northern quoll (DoE, 2016). The species has now been sampled across multiple years, and at a similar time each year, providing consistent information on potential impacts, growth or decline of the local population in the Study Area.

The Bureau of Meteorology (BoM) weather station (station 004106) located at Marble Bar, approximately 14 km north-east of the Study Area, provides comprehensive climate data relevant to the Study Area. During the 12 months prior to the survey (July 2023 to June 2024), this station recorded 288.0 millimetres (mm) of rainfall, which is lower (by 102.0 mm) than the long term average (LTA) rainfall for the same period (390.0 mm) (BoM, 2024) (Figure 2.1). Following a dry start to the year with rainfall well below average for December (0.8 mm compared to LTA 34.6 mm), January (37.6 mm compared to LTA 107.3 mm), and February (39.6 mm compared to LTA 82.7 mm), higher than average rainfall occurred in March 2024 (when 171.0 mm of rainfall was recorded, versus a long-term average of 77.9 mm) and June 2024 (the month preceding the survey, when 31.4 mm of rainfall was recorded, versus a long-term average of 22.4 mm). April and May were also dry in comparison to the long-term average rainfall (1.2 mm in April 2024 compared to LTA of 22.5 mm, and 5.8 mm in May compared to LTA of 13.4 mm) (Figure 2.1). No rainfall was recorded during the current monitoring survey.

The average monthly daytime temperatures recorded at Marble Bar during the 12 months preceding the survey were generally similar to long-term conditions; however, hotter than average conditions was recorded in September, October, November 2023, as well as January and February 2024 (Figure 2.1). While average monthly overnight temperatures recorded at Marble Bar during the 12 months preceding the survey were generally similar to long-term conditions, warmer conditions were recorded during August, September 2023, and February 2024. (i.e. 1.8 – 2.2°C warmer than the long-term average) (Figure 2.1). The average minimum (13.1°C) and maximum (28.2°C) temperatures recorded during the survey were higher than their long-term averages (minimum of 12.2°C and maximum of 27.7°C in July 2024; Figure 2.1; Table 2.1). The overall weather conditions during the survey were suitable for northern quoll activity and detection.

Table 2.1: Daily climate data recorded at Marble Bar Station during the survey

Date	Min temperature (°C)	Max temperature (°C)
15/07/2024	11.9	30.2
16/07/2024	15.8	27.7
17/07/2024	14.0	27.5
18/07/2024	-	29.5
19/07/2024	13.4	27.9
20/07/2024	17.4	26.9
21/07/2024	11.9	26.9
22/07/2024	10.9	29.8
23/07/2024	9.7	29.9
24/07/2024	12.3	28.2
25/07/2024	13.4	25.2
Average	**13.1**	**28.2**

Source: BoM (2024)

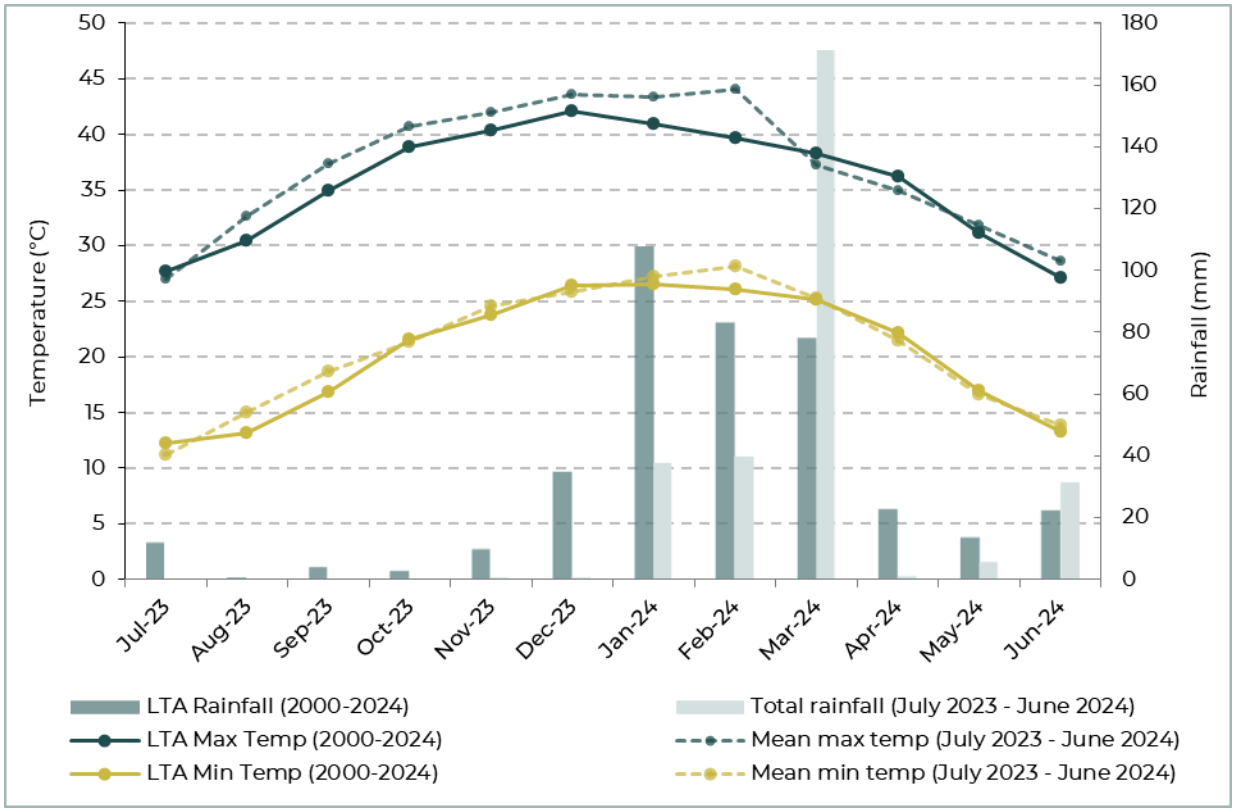

Figure 2.1: Long-term average climatic data at Marble Bar Station.

2.2 Personnel

The field survey was undertaken by experienced Biologic zoologists (Table 2.2), under the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) Regulation 27 licence for fauna taking (BA27000450-2b) and a Section 40 authorisation to take or disturb threatened fauna (TFA 2021-0065-2) issued to Chris Knuckey.

The survey was conducted under the *Animal Welfare Act 2002* Licence to Use Animals for Scientific Purposes (License No. U244/2022-2024), administered through the Department of Primary Industries and Regional Development (DPIRD). This licence is enabled through Biologic's chosen Animal Ethics Committee (AEC), Murdoch University, under permit RW3354/21.

Table 2.2: Field survey personnel

Biologic Personnel	Position	Qualification	Experience
Mark Gresser	Senior Zoologist	BSc (Hons) Biological Sciences, Conservation and Wildlife Biology, Animal Biology	10 years' fauna zoology/ ecology 9 years' EIA (consulting) 10 years' field survey
Aidan Williams	Senior Zoologist	BSc Conservation Biology and Botany	10 years' field survey 9 years' EIA (consulting) 7 years' vertebrate fauna zoology/ ecology
Georgina Mattner	Zoologist	BSc Animal Ecology	3 years' field survey 3 years' EIA (consulting) 3 years' vertebrate fauna zoology/ ecology
Stephen McGrath	Zoologist	BSc Animal Ecology	6 years' field survey 8 years' EIA (consulting) 2 years' vertebrate fauna zoology/ ecology

2.3 Monitoring Sites

In accordance with the NQMP, eight monitoring sites were established in 2018, including five impact sites (located within 1 km of current and anticipated mining disturbance) and three control sites (located further than 1 km from current and anticipated mining disturbance). In 2022, a fourth control site (CO-WS-08) was added to the monitoring program, as it was recognised that a previously established site (NQ-TR-01) would eventually lose its status as a control site during the development of Stage 2 of the Project. Although construction commenced on Stage 2 in November 2023, NQ-TR-01 was still considered a control site for the current monitoring survey, as new construction activity (comprising clearing for the Glen Herring haul road) was further than 1 km from the site at the time of the current survey. It is anticipated that NQ-TR-01 will become an Impact site when adjacent pits are developed. Consequently, nine monitoring sites were assessed during the current survey, five impact sites and four control sites (Table 2.3; Figure 1.1). As CO-WS-08 was established later, baseline data from 2018 and 2019 are not available. This site has been included in the report for context.

Table 2.3: Location of monitoring sites for the survey

Site	Category	Location		Habitat Type
		Latitude	Longitude	
NQ-MC-01	Impact	-21.3682	119.6864	Rocky Ridge and Gorge
NQ-MC-02	Impact	-21.4196	119.6729	Rocky Ridge and Gorge
CO-WS-01	Impact	-21.4105	119.6872	Drainage Line
NQ-SY-SL	Impact	-21.3534	119.7011	Riverine
CO-SY-OM	Impact	-21.3764	119.6871	Rocky Foothills
NQ-MC-03	Control	-21.4664	119.6490	Rocky Ridge and Gorge
NQ-MC-07	Control	-21.4953	119.6643	Rocky Ridge and Gorge
NQ-TR-01	Control	-21.3878	119.6528	Rocky Ridge and Gorge
CO-WS-08	Control	-21.4520	119.6509	Rocky Ridge and Gorge

2.4 Field Survey Methods

2.4.1 Photo Point Monitoring

During the 2018 surveys, two photo monitoring points were installed at each of the monitoring sites (except CO-WS-08, which was added later). Each point was marked with a fence dropper and a single photo being taken from each point (Appendix A).

Photos were taken from the same points during the annual monitoring surveys, to provide a pictorial record of habitat changes at each site. Habitat changes, including those caused by natural events (e.g. fire) or by anthropogenic disturbance (e.g. mining activity) are of particular interest as these may help to explain patterns in the abundance of northern quolls recorded at the monitoring sites.

2.4.2 Camera Traps

Camera trap data were used to confirm the presence of northern quolls across the Study Area, as well as verify patterns in northern quoll movement and activity. At each monitoring site, ten Swift Enduro camera traps were deployed at previously established locations (Biologic, 2019b) spaced approximately 100 metres (m) apart within areas of optimal northern quoll habitat (Appendix B). Following the 2020 monitoring survey, a haul road was constructed immediately adjacent to CO-WS-01. This haul road intersected with three established camera trap locations. Consequently, the location of these three camera traps were relocated during the 2021 survey (Biologic, 2021b).

Each camera was bolted perpendicular to a vertically placed star picket (Plate 2.1). A bait tube (~20 cm long perforated and capped PVC pipe) containing universal bait (peanut butter, rolled oats and sardines) was placed at the base of the star picket. This camera setup allowed the capture of standardised dorsal images of northern quoll. Overall, 90 camera traps were deployed for a total of 360 camera nights (four nights per camera trap). In accordance with the SSMP and previous baseline monitoring surveys, data captured during the first four nights of deployment at each site were considered for subsequent spot patterning (refer to Section 2.4.3) and population estimate analyses (refer to Section 2.4.4).

Plate 2.1: Example of a camera trap set-up

2.4.3 Northern Quoll Identification

Camera trap photos were reviewed to identify images containing northern quolls, and a manual review of all images was undertaken to identify individual northern quolls based on physical characteristics such as spot pattern, size and condition, as well as the timing of captures (Hohnen *et al.*, 2012). To verify the results of the manual review and further investigate any images of unidentified individuals, an analysis using Wild-ID software (Dartmouth University, 2011) was conducted. To assist this analysis, images were cropped (to eliminate background information), rotated (so each captured individual faced in the same direction) and edited (to highlight spot patterns) to produce a set of highly comparable images. These were inputted into Wild-ID, which automatically compared all images and produced a similarity rating between 0 and 1 for each pair (0 indicating no similarity and 1 indicating a perfect match). Potential matches (i.e. pairs which were assigned a similarity rating of greater than 0) identified by the software, were then reviewed manually and either accepted or rejected. Images that did not capture enough of the individual (i.e. just the tail or head) or were of too poor quality were not included in the analysis.

2.4.4 Capture Analysis

2.4.4.1 Capture events

The occurrence of a unique northern quoll being recorded on a camera trap at a site during a given night is referred to as a capture event. If the same individual was detected at a site multiple times during the same night, it was considered to have been 'captured' only once that night. The capture rate of a given site is defined as the number of unique individuals recorded at the site each night (i.e. the number of unique individuals captured at a site divided by the number of sampling nights).

In previous years the calculation of sampling effort has been based on camera nights (where ten cameras deployed at a site over four nights equates to 40 camera nights), with capture rate being calculated as the number of capture events divided by the number of camera nights. This meant that the capture rate of a site was adjusted based on the number of functional cameras at the site. This year, sampling effort was based on sampling nights (four nights) rather than camera nights, so the capture rate was calculated as the number of capture events divided by the number of sampling nights. This is in recognition of recent findings which suggest that the ability of a site comprising ten cameras to detect northern quolls within a 1 km transect won't be significantly reduced if a low number of these cameras are nonfunctional (Dunlop *et al.*, 2024). Consequently, in instances such as the current monitoring program where non-functional cameras are a rare occurrence, basing sampling effort on the number of functional cameras is considered less practical than basing it on the number of sampling nights. To allow for direct comparison between years, capture rates from previous monitoring periods were recalculated based on sampling nights.

The proportion of capture events which represent 'recaptures' – where an individual is recorded at the same site on a subsequent night of the monitoring period – is referred to here as the 'recapture rate' (the number of recaptures divided by the total number of capture events multiplied by 100). Recapture rates can indicate the likelihood that more northern quolls were present than were detected, with relatively high recapture rates suggesting the monitoring period was successful in identifying the majority of individuals which were present at the time of the monitoring period.

2.4.5 Population Estimate

Capture event data were used to estimate the size of the northern quoll population inhabiting each site using a Huggins closed mark recapture model (Huggins, 1989) via the "RMark" package (Laake, 2013) in the R environment (R Core Team, 2020) and MARK software (White & Burnham, 1999). Abundance estimates indicate numbers of individuals using the sites during the four-night period of the survey.

Huggins models are parameterised in terms of p, the probability of being captured and identified for the first time, and c, the probability of recapture after being captured at least once before. A recapture is considered to be a sighting on one of the nights following the first capture so that the maximum possible number of recaptures of an individual was three. The model variations applied were those described by Otis *et al.* (1978) and others extended to allow the possibility of site dependent recapture:

- M0 ~Pc = Cc
- Mb ~PcCc
- Mt ~P.time = C.time
- Msite ~P.site = C.site
- Msiteb ~P.siteC.site
- Mtb ~P.timeC.time

M0 describes equal probability of capture for all animals on each night (P and C are constant and equal). Mb describes a behavioural response to capture, where being caught once influences future recapture i.e. trap happiness or trap-shyness (P and C are constant, but different). Mt describes a probability of capture that is the same regardless of previous capture but varies depending on night (P and C are equal, but different each night). Msite describes a probability of capture that is the same regardless of previous capture but varies depending on site (P and C are equal, but different for each site). Msiteb and Mtb describe behavioural response versions of Msite and Mt. Individual heterogeneity could not be detected and accounted for with only four occasions.

Model fits are represented in Table 2.4, where; 'npar' is the number of estimated parameters, 'AICc' is a measure of model fit where smaller values indicate better fit, 'Delta AICc' is the difference in AICc between a model and that of the model above in the table, 'weight' is the relative likelihood of the model, 'Deviance' is a measure of difference between the model and that of a saturated ('perfect') model and is a measure of model fit, although this measure is influenced by the number of parameters.

Table 2.4: Model fit table

Model		npar	AICc	DeltaAICc	Weight	Deviance
M0	p (~1) c ( )	1	192.9872	0.000000	0.621514808	196.5423
Mb	p (~c) c ( )	2	195.0313	2.044071	0.223659333	196.5310
Mt	p (~time) c ( )	4	196.4586	3.471313	0.109563384	193.7613
Mtb	p (~time+c) c ( )	5	198.5457	5.558468	0.038587399	193.7057
Msite	p (~site) c( )	6	202.6347	9.647467	0.004994943	195.6215
Msiteb	p (~site+c) c ( )	7	204.8138	11.826573	0.001680134	195.5963

To help mitigate the effect of model uncertainty, model-averaged abundance estimates ($\hat{N}$) were obtained from this model set and 95% CI (confidence intervals) were calculated from the log-normal distribution of $\hat{N}$. These models assume that the population size of each site does not change during the sampling period, i.e. there is no immigration, emigration, recruitment or mortality. This is considered a reasonable assumption, given that sampling was conducted over four consecutive nights, during which time the potential for such changes is low. Due to the distance between sites and duration of the survey, this analysis also assumed that each site hosted a population that was distinct from those populations present at other sites, i.e. northern quolls present at a given site will not be present at any other site. It was also assumed that individuals were equally likely photographed, regardless of sex, camera placement or other factors. There is some bias associated with the fact that cameras were not placed randomly within the landscape, with suitable habitat being targeted for camera transects, and some sites being more likely to host northern quolls than others; however, annual population estimates can still be meaningfully compared between years because the survey design is consistent between years.

2.4.6 Opportunistic Observations

Opportunistic observations of evidence of northern quoll presence (i.e. direct sightings or indirect records such as scats, tracks or remains) or their predators were recorded. Additionally, northern quoll mortalities recorded during 2024 were investigated.

2.5 Temporal Trends Monitoring

To understand potential impacts of mining activities on the local northern quoll populations in the Study Area, the results of the current monitoring survey were compared with baseline levels (both average baseline levels where 2018 and 2019 survey data were averaged, as well as 2018 and 2019 individually) prior to the commencement of production (blasting and ore-extraction) activities. Capture rates were compared between years to identify temporal patterns in the number of individuals being detected at each site by a systematic deployment of camera traps. Comparing population size estimates between years provides additional information about changes in number of individuals believed to be present at each site.

It should be noted that results of the baseline terrestrial vertebrate fauna survey (MWH, 2016) could not be directly compared to the results of the current and previous monitoring surveys (Biologic, 2019a, 2019b, 2021a, 2021b, 2023, 2024) due to the different survey timing, techniques and intensities employed. In 2019, positioning of camera traps was adjusted and refined to generate more consistent and standardised images. Additionally, when analysing data for temporal trends, consideration is given to the addition of the fourth control site, CO-WS-08 in 2022, and how this may affect temporal comparisons of total northern quoll numbers captured and population estimates.

3 Results and Discussion

3.1 Disturbance and Site Conditions

The nine monitoring sites are broadly distributed across hills and ranges of banded ironstone formation supporting hummock grassland, within habitat types including Rocky Ridge and Gorge, Rocky Foothills, Drainage Line and Riverine (Table 3.1; Appendix A).

At the time of the current survey, mining was active at three open pits, including Sparrow Lake (previously Split Rock), Runway North and Razorback. Clearing operations at Razorback pit commenced in December 2023, with first blasting activities commencing in May 2024 and ore-extraction commencing in June 2024. Mining-related activities were ongoing through the current monitoring survey. Clearing operations relating to Stage 2 commenced for the Glen Herring haul road in November 2023, with blasting commencing in January 2024. Clearing and blasting activities were ongoing during the current survey. Mining-related activities at two pits, Runway South (approximately 500 m east and 1 km south-south-west of impact sites NQ-MC-02 and CO-WS-01, respectively) and Shark Gully (approximately 1.6 km east of control site CO-WS-08) ceased in March and May 2024, respectively, and were therefore not actively mined at the time of the current survey.

Mining-related activities have continued within the Study Area since the previous survey, however they have not approached any closer in proximity to monitoring sites (Biologic, 2024). While it was noted that mining-related noise was audible at some sites during the current survey, no additional physical disturbances were noted from photo monitoring undertaken at all sites (Table 3.1; Appendix A). The nature of mining-related activities occurring within the Study Area at the time of the current survey included:

- Ongoing development of Sparrow Lake pit, including drilling, blasting, clearing and grubbing, with the closest disturbance approximately 1.2 km east and 1.9 km north of the nearest camera associated with control sites NQ-MC-03 and NQ-MC-07, respectively;
- Development of Razorback pit, approximately 1.6 km east of nearest camera associated with control site NQ-MC-03 and 2.5 km south-east of nearest camera at control site CO-WS-08;
- Development of Glen Herring haul road, approximately 430 m west and 1 km south of nearest camera at impact site NQ-MC-02 and control site NQ-TR-01, respectively;
- Ongoing development of Runway North pit, including drilling, blasting and ore-extraction, approximately 200 m east and 1 km south-west of nearest cameras at impact sites NQ-MC-02 and CO-WS-01, respectively, and
- Use of haul roads and access tracks throughout the Study Area, with one haul road located immediately adjacent to impact site CO-WS-01, camp access track and haul roads as close as 350-380 m from impact sites NQ-MC-02 and CO-SY-OM, 1.3 km from control site NQ-MC-03 and 1.9 km from impact site NQ-MC-07.

A wildfire burned vegetation at impact sites NQ-MC-01 and NQ-MC-02, and control site NQ-TR-01 in December 2022. The fire burned the surrounding hills at NQ-TR-01 but did not affect the base of the gully. Regrowth of grasses and vegetation was evident at all sites affected by the 2022 fire at the time of the current monitoring survey (Table 3.1). Eight of the nine sites are located adjacent to, or near, seasonally inundated or permanent drainage lines. The distribution and surface levels of water pools present in the Study Area can vary between years (Table 3.1; Appendix A).

Table 3.1: Habitat information and disturbance

Site	Habitat Type	Site Attributes			Presence of water	Disturbance
		Landscape, soil and structural composition	Vegetation cover, and composition	Habitat structures		
Impact						
NQ-MC-01	Rocky Ridge and Gorge	Eastern face of a large, banded ironstone ridge. Site largely located within large boulders and rocky escarpments. Soil scarce and skeletal in presence.	Ridges with scattered *Eucalyptus leucophloia* and *Ficus* spp. with scattered *Acacia* spp. over *Triodia* hummock grassland.	Large rocky faces and boulder piles with large amounts of cracks, crevices and voids for shelter.	**2018–2024** – No water pools observed.	**2018-2019** - No disturbance recorded. **2020-2021** - Shallow surface excavation of Borrow pit ~535 m SE, construction of haul road ~837 m E. **2022** - No additional disturbance recorded. **2023** – Recent fire in late 2022. **2024** – No additional disturbance recorded. Vegetation regeneration after fire apparent.
NQ-MC-02	Rocky Ridge and Gorge	Banded ironstone gorge system surrounded by undulating hills and ridges upon elevated ironstone ridge. The most northern end comprises deep dissected cliffs petering out in the west. Soil scarce although some accumulations in pockets of dense vegetation.	*Eucalyptus camaldulensis* and/or *Melaleuca argentea* with scattered *Ficus* spp. Over mixed *Acacia* spp. shrubland and *Triodia* and *Eriachne* grasses through main gorge. Ridges with scattered *Eucalyptus leucophloia* and *Ficus* spp. with scattered *Acacia* spp. over *Triodia* hummock grassland.	Large rocky faces and outcropping with large amounts of cracks, crevices and voids for shelter. Area also contains numerous deep caves with stable microclimates.	**2018–2022** – Yes, water pools observed. **2023** – Not recorded. **2024** – No water pools observed.	**2018–2020** - No disturbance recorded. **2021** – Mining-related activities commenced at Runway North pit ~200 m E and Runway South pit ~500 m E. Haul road ~350 m SE. **2022-2023** - Recent fire. Mining-related activities continued at Runway North and Runway South pit. **2024** – Drilling, blasting, ore-extraction and haulage continued at Runway South pit until March 2024 and were ongoing at Runway North pit. Vegetation regeneration after fire apparent. Construction of Glen Herring haul road commenced approximately 430 m W.
CO-WS-01	Drainage Line	Shallow gorge/ gully surrounded by undulating hills and feeding from elevated ironstone ridge. Gully is steeply dissected in the far south and peters to a minor drainage line in the far north.	*Acacia* spp. shrubland and *Triodia* and *Eriachne* grasses through main gorge. Scattered *Ficus* spp. Trees and Melaleuca spp. Shrubs in southern end along water channel.	Large rocky faces and boulder piles with large amounts of cracks, crevices and voids for shelter.	**2018–2022** – Yes, water pools observed. **2023** – Not recorded. **2024** – Yes, water pools observed.	**2018** - No disturbance recorded. **2019** - Recent fire. **2020** – No additional disturbance recorded, regeneration post fire. **2021** - Haul road bisects the northern portion of the site and runs southward immediately adjacent to site. Substantial rockfall observed at the southern end of the site. Mining-related activities commenced at Runway South pit ~1 km SSW and Runway North pit ~ 1 km SW. **2022** - Previous rockfall remains in-situ. Drilling, blasting, ore-extraction and haulage continued at Runway North and Runway South pit. **2023** – Weed invasion (*Typha* sp. and *Passiflora foetida*). Mining-related activities continued at Runway North and Runway South pit, constant noise from haul road, which runs parallel, and within 50 m of the camera transect. Material from haul road (i.e. rocks) has spilled downslope from edge of haul road, into the drainage line within the gully. **2024** - No additional disturbance. Drilling, blasting, ore-extraction and haulage continued at Runway South pit until March 2024 and was ongoing at Runway North pit.

Site	Habitat Type	Site Attributes			Presence of water	Disturbance
		Landscape, soil and structural composition	Vegetation cover, and composition	Habitat structures		
NQ-SY-SL	Riverine	The margin of a large riverine system, specifically the dense woodland which sits on the periphery of such a habitat. Brown loamy-sand on margins and deep course river sands in the main drainage channel.	Woodland of *Eucalyptus victrix, Eucalyptus camaldulensis* and/or *Melaleuca argentea* over shrubland of *Hakea lorea, Melaleuca glomerata* and/or *Grevillea pyramidalis* with pockets of *Triodia* hummock grassland and *Cenchrus ciliaris* tussock grassland.	Habitat comprises dense woodlands dominated by *Eucalyptus victrix, Eucalyptus camaldulensis*. Various fallen trees and dense grasses provide ground shelter. No rocky habitat features present.	**2018–2020** – No water pools observed. **2021** - Yes, water pools observed. **2022, 2024** – No water pools observed.	**2018** - Weeds present, cattle grazing. **2019** - Recent fire. **2020** - Regeneration post fire, shallow surface excavation of haul road ~150 m W. **2021** – Continuation of haul road construction ~120 m W and shallow surface excavation of Borrow pit ~930 m NW. Possibly some surface erosion. **2022** - No additional disturbance recorded. **2023** – Cattle grazing. **2024** – No additional disturbance recorded.
CO-SY-OM	Rocky Foothills	Banded ironstone gorge system surrounded by undulating hills and ridges upon elevated ironstone ridge. The most eastern comprises sandstone outcropping while the western comprises a deep dissected gorge. Soil scarce although some accumulations in pockets of dense vegetation.	*Eucalyptus leucophloia* and *Ficus* spp. with scattered *Acacia* spp. over *Triodia* hummock grassland. Scattered *Corymbia hamersleyana* trees over, scattered- open shrubland dominated by *Grevillea wickhamii* and/or *Acacia inaequilatera* over hard spinifex on stony red clay loam.	Large rocky faces and boulder piles with large amounts of cracks, crevices and voids for shelter.	**2018–2024** – Yes, water pools observed.	**2018-2019** - No disturbance recorded. **2020** - Shallow surface excavation of Borrow pit ~300 m NE, construction of camp access road ~379 m E. **2021-2024** - No additional disturbance recorded.
Control						
NQ-MC-03	Rocky Ridge and Gorge	Small sandstone gorge system surrounded by undulating hills and ridges. Gorge feeds into major drainage line with instances of rocky outcropping. Soil scarce although some accumulations in pockets of dense vegetation.	*Eucalyptus camaldulensis* woodland in eastern section, peters out quickly to a mixed *Acacia* spp. And *Melaleuca* spp. shrubland. Scree slopes on the margins comprise *Triodia* and *Eriachne* grasses. with scattered *Acacia* spp. and *Grevillea* sp. shrubs.	Rocky habitat with boulder piles with moderate amounts of cracks, crevices and voids for shelter.	**2018–2021** – Yes, water pools observed. **2022** – No water pools observed. **2023** – Yes, water pools observed. **2024** – Yes, water pools observed.	**2018** - Cattle grazing. **2019–2020** - No additional disturbance recorded. **2021** – Mining-related activities commenced at Split Rock pit ~1.20 km E. **2022-2023** – Mining-related activities continued at Split Rock pit. **2024** – Construction of haul road ~1.30 km SE. Drilling, blasting, ore-extraction and haulage continued at Sparrow Lake (formerly Split Rock) pit. Clearing, drilling, blasting, ore-extraction and haulage commenced at Razorback pit ~1.80 km E.
NQ-MC-07	Rocky Ridge and Gorge	Banded ironstone gorge system with deep dissected cliff faces in the western extent and developing into a steep hill of large boulders in the east. Soil scarce although some accumulations in pockets of dense vegetation.	*Eucalyptus leucophloia* and *Ficus* spp. with scattered *Acacia* spp. With scattered tussock grasses.	In the west moderately large cliff faces with and in the east large boulder piles overlaying the drainage channel. Large amounts of cracks, crevices and voids for shelter.	**2018–2024** – Yes, water pools observed.	**2018–2020** **2021** – Mining-related activities commenced at Split Rock pit ~2.20 km N. 2022-2023 – Mining-related activities continued at Split Rock pit. **2024** – Drilling, blasting, ore-extraction and haulage continued at Sparrow Lake (formerly Split Rock) pit. Construction of haul road ~1.90 km N.

Site	Habitat Type	Site Attributes			Presence of water	Disturbance
		Landscape, soil and structural composition	Vegetation cover, and composition	Habitat structures		
NQ-TR-01	Rocky Ridge and Gorge	Banded ironstone gorge system with deep dissected cliff faces in the western extent and developing into a steep hill of large boulders in the east. Soil scarce although some accumulations in pockets of dense vegetation.	*Eucalyptus leucophloia* and *Ficus* spp. with scattered *Acacia* spp. With scattered tussock grasses.	In the west moderately large cliff faces with and in the east large boulder piles overlaying the drainage channel. Large amounts of cracks, crevices and voids for shelter.	**2018–2024** – Yes, water pools observed.	**2018–2020** - No disturbance recorded. **2021** - Drilling ~600 m SE. **2022** - No additional disturbance recorded. **2023** – Recent fire (December 2022, burned the surrounding hills but did not affect the base of gully). Clearing and earthworks associated with track construction within 1 km (south) of the camera transect. **2024** - No additional disturbance. Vegetation regeneration after fire apparent Construction of Glen Herring haul road commenced approximately 975 m S.
CO-WS-08	Waterhole	Waterhole within a banded ironstone gorge system. Soil, vegetation litter and woody debris are scarce.	*Acacia* shrubland, spinifex hummock grassland.	Moderately sloping landform with extensive outcropping, small rocks (11-20 cm) and large amounts of cracks, crevices and voids for shelter.	**2018–2020** – Not recorded. **2021–2024** – Yes, water pools observed.	**2018** - No disturbance recorded. **2019** – Weeds. **2020** – No additional disturbance recorded. **2021** – Mining-related activities commenced at Shark Gully Pit (and haul road) ~1.6 km E. **2022-2023** – Drilling, blasting, ore-extraction and haulage activities continued at Shark Gully pit. **2024** – Drilling, blasting, ore-extraction and haulage continued at Shark Gully pit until May 2024. Clearing, drilling, blasting, ore-extraction and haulage commenced at Razorback pit ~2.5 km SE.

- Not recorded

3.2 Northern Quoll Captures

A total of 37 northern quolls were identified from 61 capture events during the current survey (Figure 3.1; Table 3.2). Northern quolls were detected at six of the nine monitoring sites, with no quolls detected at impact sites CO-SY-OM and NQ-SY-SL, nor at control site CO-WS-08 (Table 3.2). This differs from the previous 2023 survey, where quolls were recorded at all nine sites (42 individuals, from 83 capture events) (Biologic, 2024) (Table 3.2). This is the first time in the monitoring program that no northern quolls were recorded at impact site CO-SY-OM. Three and ten individuals were recorded at CO-SY-OM during the baseline surveys in 2018 and 2019, respectively; and between five and eight individuals were recorded at the site between 2020 and 2023 (Table 3.2). The total number of capture events across all sites during the current survey is the second lowest recorded for all monitoring years, higher only than the 35 capture events recorded during the baseline 2018 survey (Table 3.2). This takes into consideration site CO-WS-08 (added in 2022 as an additional control site), with no capture events recorded at this site during the current survey.

Seven of the nine monitoring sites (all five impact sites and two of the four control sites; NQ-MC-03 and CO-WS-08) showed lower quoll numbers compared to the previous year. For two impact sites (NQ-MC-01 and CO-SY-OM) and the two above mentioned control sites, northern quoll numbers were the lowest recorded since monitoring began at those sites (noting that monitoring at site CO-WS-08 commenced in 2022) (Table 3.2). When compared against quoll numbers recorded during the two baseline surveys (2018 and 2019), four of the five impact sites (excluding CO-WS-01) recorded lower quoll numbers during the current survey than 2019, while two impact sites (NQ-MC-01 and CO-SY-OM) recorded lower numbers than the 2018 baseline survey.

During the current survey, approximately one quarter (n = 9, 24.32%) of the 37 individuals were recorded at impact sites. This differs substantially from all previous monitoring years, whereby the number of individuals detected at impact sites has been considerably higher, ranging from 51.72% (2022, n = 15 out of 29 individuals) to 68.17% (2021, n = 30 out of 44 individuals) of the total number of individuals. During the current survey, 28 individuals were detected at control sites with 19 of these individuals detected at control site NQ-TR-01. This is a considerably more individuals recorded than any previous survey for this site (highest record in previous surveys was 10 individuals in 2021). No individuals were observed at more than one site during the current survey.

760000 770000 780000

7640000 7630000 7620000

Minimum Number of Individuals Recorded

2017 2018 2019 2020 2021 2022 2023 2024

NQ-SY-SL
NQ-MC-01
CO-SY-0M
NQ-TR-01
CO-WS-01
NQ-MC-02
CO-WS-08
NQ-MC-03
NQ-MC-07

LEGEND

- Study Area
- Disturbance Footprint July 2023
- Disturbance Footprint July 2023-July 2024

Fauna Habitat

- Calcrete
- Drainage Line
- Granite Outcrop
- Granitic Upland
- Ironstone Ridgetop
- Riverine
- Rocky Foothill
- Rocky Ridge and Gorge
- Sandy Plain
- Spinifex Stony Plain
- Stony Rise

Monitoring Site

- Control
- Impact

Scale 1:110,000
0 2 4 Km

Coordinate System: GDA2020 MGA Zone 50
Transverse Mercator Created: 08/10/2024

Biologic

Port Hedland
Karratha
Exmouth
Newman

ATLAS IRON PTY LTD
Sanjiv Ridge 2024
Northern Quoll Monitoring

Figure 3.1: Northern quoll activity

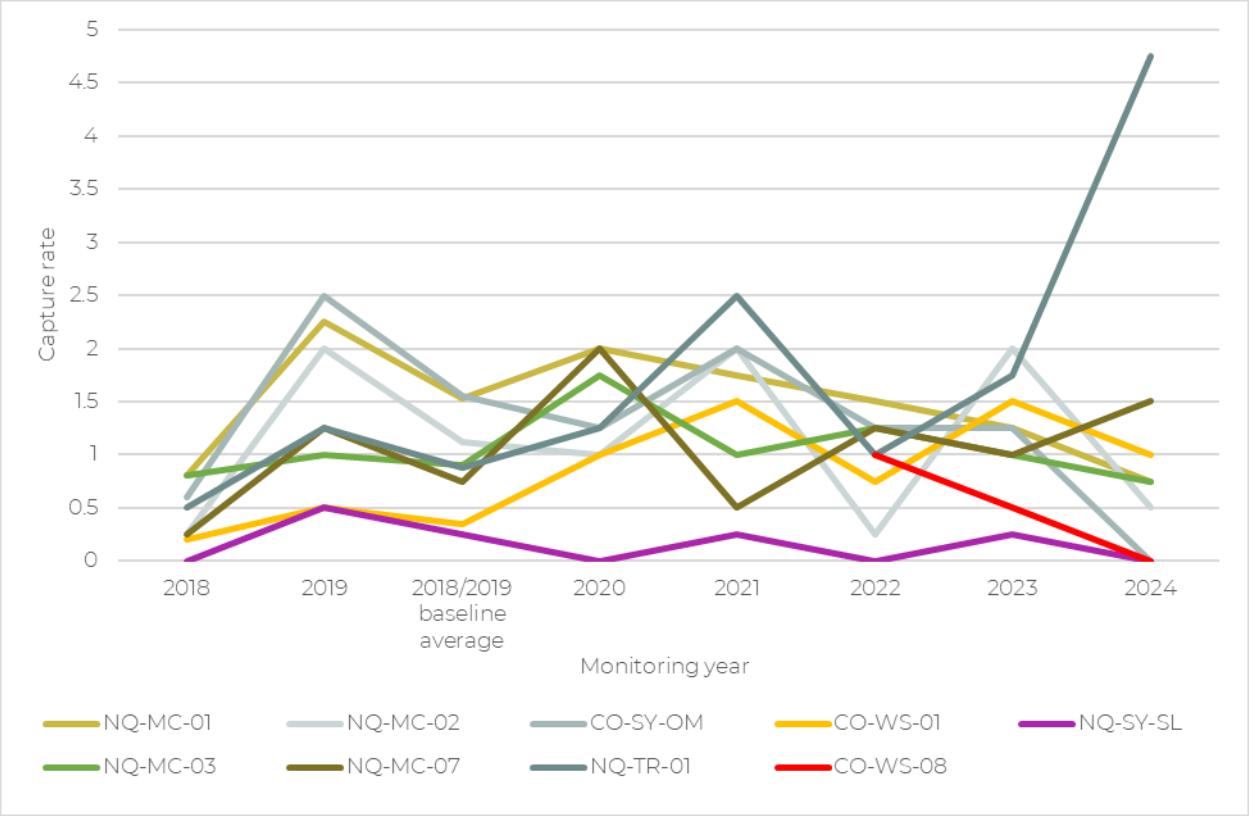

Figure 3.2: Northern quoll capture rates at monitoring sites over time

Note: monitoring commenced at site CO-WS-08 in 2022

Table 3.2 Northern quoll capture data

Site	Number of Individuals Identified (Capture Rate)							Number of Capture Events (Recapture Rate, %)							Population Estimate						
	2018	2019	2020	2021	2022	2023	2024	2018	2019	2020	2021	2022	2023	2024	2018	2019	2020	2021	2022	2023	2024
Impact																					
NQ-MC-01	4[1] (0.80)	9 (2.25)	8 (2)	7 (1.75)	6 (1.50)	5 (1.25)	3 (0.75)	10 (60.00)	22 (59.10)	17 (52.94)	14 (50.00)	14 (57.14)	11 (54.55)	6 (50.00)	7	10	11	7	6	5.32	3.61
NQ-MC-02	1[1] (0.25)	8 (2)	4 (11.00)	8 (2.00)	1 (0.25)	8 (2.00)	2 (0.50)	4 (75.00)	15 (40.00)	5 (20.00)	11 (27.27)	3 (66.67)	13 (38.46)	3 (33.33)	2	8	5	9	1	8.51	2.41
CO-SY-OM	3[1] (0.60)	10 (2.5)	5 (1.25)	8 (2.00)	5 (1.25)	5 (1.25)	0	7 (57.00)	21 (57.10)	12 (58.33)	10 (20.00)	8 (37.50)	10 (50.00)	0 (0)	5	11	5	17	5	5.32	N/A
CO-WS-01	1 (0.20)	2 (0.5)	4 (1.00)	6 (1.50)	3 (0.75)	6 (1.50)	4 (1.00)	1 (0)	5 (60.00)	6 (33.33)	8 (25.00)	7 (57.14)	10 (40.00)	7 (42.86)	1	3	5	7	3	6.38	4.82
NQ-SY-SL	-	2 (0.5)	0 (0)	1 (0.25)	0 (0)	1 (0.25)	0 (0)	0 (0)	5 (60.00)	0 (0)	1 (0)	0 (0)	1 (0)	0 (0)	N/A	3	N/A	N/A	N/A	1.06	N/A
Total (average rate)	9[1] (0.37)	31 (1.55)	21(1.05)	30 (1.50)	15 (0.75)	25 (1.25)	9 (0.45)	22 (59.09)	64 (54.41)	40 (47.50)	44 (31.82)	32 (50.00)	45 (44.44)	16 (43.75)	-	35	-	-	-	26.59	-
Control																					
NQ-MC-03	4 (0.80)	4 (1)	7 (1.75)	4 (1.00)	5 (1.25)	4 (1.00)	3 (0.75)	9 (56.00)	6 (33.30)	18 (61.11)	8 (50.00)	11 (54.55)	8 (50.00)	5 (40.00)	6	4	7	4	5	4.26	3.61
NQ-MC-07	1 (0.25)	5 (1.25)	8 (2.00)	2 (0050)	5 (1.25)	4 (1.00)	6 (1.50)	2 (50.00)	13 (61.50)	15 (46.67)	3 (33.33)	13 (61.54)	16 (75.00)	9 (33.33)	1	6	9	3	5	4.26	7.22
NQ-TR-01	2 (0.50)	5 (1.25)	5 (1.25)	10 (2.50)	4 (1.00)	7 (1.75)	19 (4.75)	2 (0)	8 (37.50)	12 (58.33)	16 (37.50)	7 (42.86)	12 (41.67)	31 (38.71)	2	6	5	13	4	7.45	22.88
CO-WS-08	-	-	-	-	4 (1.00)	2 (0.5)	0 (0)	-	-	-	-	7 (42.86)	2 (0)	N/A	-	-	-	-	5	2.13	N/A
Total (average rate)	7 (0.52)	14 (1.17)	20 (1.67)	16 (1.34)	18 (1.20)	17 (1.06)	28 (1.75)	13 (46.15)	27 (48.15)	45 (55.56)	27 (40.74)	38 (50.00)	38 (55.26)	45 (37.78)	9	16	21	20	19	18.1	-
Total (rate across all sites)	14[1, 2] (0.43)	41[2] (1.41)	39[2] (1.28)	44[2] (1.44)	33[3] (0.92)	42[3] (1.17)	37[3] (1.03)	35 (60.00)	91 (54.95)	85 (54.11)	71 (38.03)	70 (50.00)	83 (49.40)	61 (39.34)	-	51	-	-	-	44.69	-

[1] Represents the minimum number of individuals captured at this site. Four to six individuals were previously reported for NQ-MC-01 in 2018. This was updated for the current report, to exclude consideration of unclear photos from which individuals could not be identified, to align methods with those applied to the current survey .

[2] Totals do not include individuals caught at multiple sites

[3] Includes individuals recorded at the control site CO-WS-08, established in 2022

Excluding the three sites where no northern quolls were recorded, capture rates at monitoring sites ranged from 0.5 individuals per sampling night (impact site NQ-MC-02) to 4.75 individuals per sampling night (control site NQ-TR-01) (Table 3.2; Figure 3.2). The average capture rate of northern quolls across all monitoring sites for the current survey was 1.03 individuals per sampling night. This is higher than the baseline 2018 survey (0.43 individuals per sampling night) and 2022 (0.92 individuals per sampling night) capture rates, and lower than 2023, 2021, 2020 and baseline 2019 survey, which recorded capture rates of 1.17, 1.44, 1.28, and 1.41, individuals per sampling night, respectively (Table 3.2; Appendix C). Sixteen capture events were recorded across all impact sites during the current survey, with a capture rate of 0.45 individuals per sampling night. This is the second lowest capture rate at grouped impact sites since monitoring began, with the exception of the 2018 baseline survey, which recorded a capture rate of 0.37 individuals per sampling night (Table 3.2; Figure 3.2).

Conversely, there were 45 capture events across all control sites (capture rate of 1.75 individuals per sampling night), the highest capture rate at grouped control sites since monitoring began, and more than three times higher than grouped impact sites (Table 3.2). Previously, capture rates at impact and control sites have been more closely aligned (range between 1.1 to 1.6 times lower/ higher). The greater variance between impact and control capture rates during the current survey can be attributed dually to the lower number of individuals and associated decreased capture rates across all impact sites, coincident with a large increase in the number of individuals (n = 19) and amplified capture rate at one of the control sites, NQ-TR-01 (4.75 individuals per sampling night) (Table 3.2; Figure 3.2).

During the current survey, 62.00% of the individuals identified across all monitoring sites were recorded by single capture events only, compared to 43.00% in 2023 and 24.00% in 2022 (Table 3.2). This suggests that most of the identified northern quolls spent relatively short periods of time at each site during the current survey, particularly control sites where 67.00-68.00% of individuals were recorded only once compared to 33.00-50.00% of individuals at impact sites. The higher number of single capture events (compared to recaptures) across most sites is possibly due to animals temporarily moving through those sites rather than occupying the site as longer-term residents.

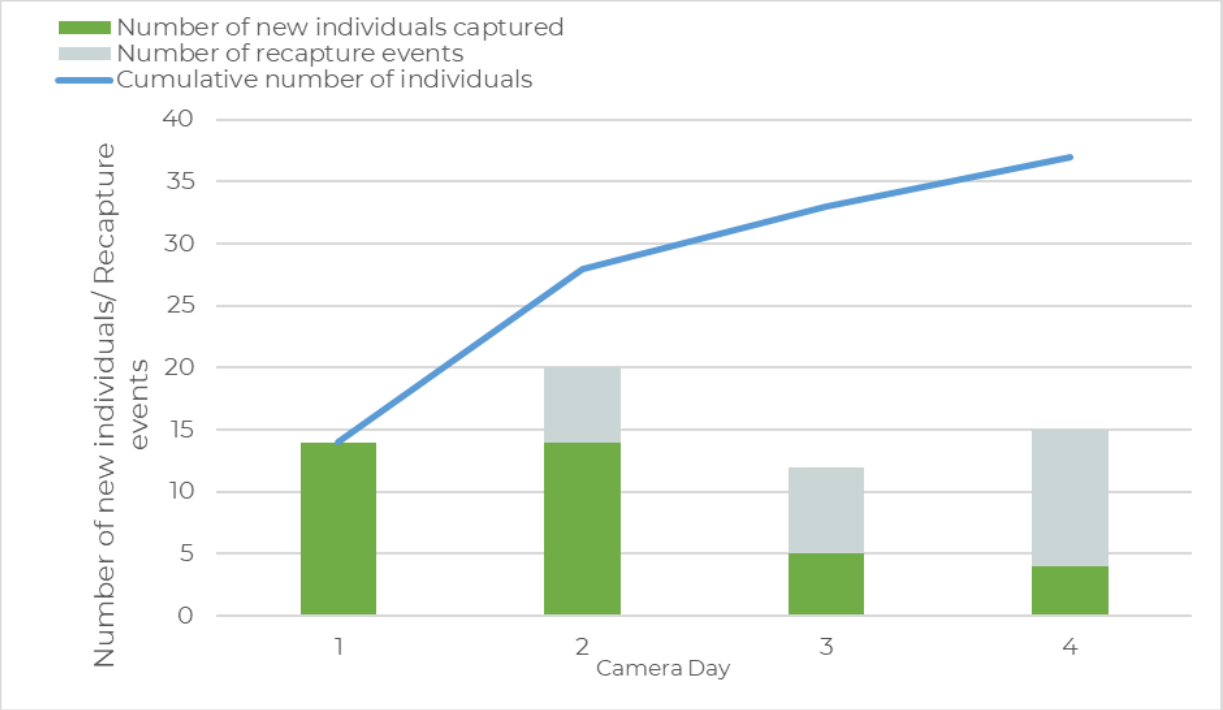

Figure 3.3: Number of individuals captured across the monitoring period

The full height of the columns represents the total number of capture events recorded each camera day. The number of recapture events is represented by the grey section of the columns and the number of new individuals captured is represented by the green section of the columns.

During the current survey, impact site CO-WS-01 was the closest impact site to mining operations, located approximately 27 m east of a haul road (Table 3.1). Despite being subject to ongoing traffic noise and weed invasions, northern quoll numbers at this site have ranged between three to six individuals over the monitoring period for the past five years since mining activities began, with more individuals being recorded each year between 2020 and 2024 than were recorded in either of the 2018 and 2019 baseline surveys (Table 3.2). Relatively stable numbers recorded at this site suggests that northern quolls are not being deterred from visiting this site by continued mining-related activities.

Impact site NQ-MC-01 is located approximately 840 m west of a haul road, constructed in 2020. Since 2021, there have been no further changes in proximity and mining-related activity levels related to the haul road during subsequent monitoring years (Table 3.1). The number of northern quolls recorded at impact site NQ-MC-01 during the current survey (n = 3) was slightly lower than the lowest number previously recorded at the site over the entirety of the monitoring program (between four to nine individuals) (Table 3.1).

Impact site NQ-MC-02 is located approximately 200 m west of Runway North pit and 430 m east of clearing activities associated with Stage 2 (Glen Herring) haul road operations. The number of northern quolls captured at this site during the current survey (n = 2) is consistent with the number of northern quolls previously recorded (ranging from one in 2018 and 2022 to eight in 2019, 2021 and 2023).

Impact sites CO-SY-SL and CO-SY-OM are located in close proximity (120 m and 380 m, respectively) of an access road that have been used since 2021. Similar to NQ-MC-01 and NQ-MC-02, the number of quolls recorded at impact site CO-SY-SL during the current survey (n = 0) is consistent with the low numbers of quolls recorded in previous monitoring years (0-2 individuals), including baseline surveys (Table 3.1). Northern quolls were not recorded at impact site CO-SY-OM during the current survey, the first instance since monitoring began where quolls were not observed at this site. Previously, between three and ten individuals have been recorded annually at this site. As no additional disturbances have been observed in close proximity to the site since 2023, and the level of activity at the nearby haul road has not changed since 2021, mining-related activity does not explain the absence of northern quolls at this site during the current survey.

Other than activities associated with the construction of Glen Herring haul road near NW-MC-02, there have been no additional mining-related disturbances (and subsequent changes to habitat quality) in close proximity to impact sites since the previous survey. Investigating the number of northern quolls recorded at control sites may assist in determining factors that affect northern quoll abundance and distribution across the Study Area. Control sites are located approximately 1.1 to 2.5 km from the current disturbance footprint, and therefore mining-related activities are unlikely to adversely affect northern quoll numbers.

During the current survey, there was no clear trend in the abundance and distribution of northern quoll at control sites, when compared to the previous year/s. Northern quoll numbers were higher than the previous survey at two control sites (NQ-MC-07 and NQ-TR-01), and lower than the previous survey at the remaining two control sites (NQ-MC-03 and CO-WS-08). Compared with all previous monitoring years, current northern quoll numbers were within (or slightly lower) than the range of northern numbers recorded between 2018-2023 for two sites (NQ-MC-03 and NQ-MC-07), considerably higher at one site (NQ-TR-01) and lower than all previous monitoring years (2022-2023) at one site (CO-WS-08). While a considerably higher number of northern quolls was recorded at NQ-TR-01 during the current survey (n = 19) than recorded previously (n = 2-10), there is no consistent pattern to suggest that quolls are avoiding impact sites in favour of control sites like NQ-TR-01.

One possible explanation for the relatively high number of quolls at NQ-TR-01 is that, given the relatively low rainfall preceding the survey (see Section 2.1), quolls contracted to this area because it offered more critical resources, such as more free-standing water, than other parts of the Study Area. However, there were no substantial differences in the amount of water observed at any monitoring sites this year compared with other years; and the number of quolls at NQ-TR-01 has not been elevated in other years when below average rainfall was observed. Overall, there is no consistent pattern between rainfall and the number of northern

quolls identified during a monitoring survey which might explain variations in quoll abundance at any of the sites, or in the Study area as whole.

Overall it appears that changes in the number of northern quolls using the Study Area between the current survey and the 2023 survey cannot be explained by advancements in the level of mining activity occurring at the Project. Ongoing monitoring will help reveal whether the relatively low number of northern quolls recorded across impact sites this year represents the start of a sustained period of relatively low activity ay impact sites, or is part of natural variation in the distribution and abundance of northern quolls across the Study Area.

3.3 Population Size – Current Survey

Estimations of population size based on statistical analysis of capture/ recapture data were achievable for six of the nine monitoring sites (Table 3.2; Table 3.3). As there were no captures at the remaining three sites, population estimates for these sites could not be determined. For the majority of the sites where estimations of population size were possible, the differences between the number of individuals identified and the estimated population size were fewer than one individual (NQ-MC-01, NQ-MC-02, CO-WS-01 and NQ-MC-03); or fewer than two individuals (NQ-MC-07) (Table 3.2; Table 3.3). This suggests that the number of individuals detected on cameras at the three sites for which estimations of population size were not possible, either approximate, or slightly underestimate, the population size at these sites during the current survey.

These results suggest the camera traps were successful in recording the majority of northern quolls present at these sites. This is supported by the fact that the increase in capture events across the survey period was largely due to an increase in recapture events rather than capture of new individuals (Figure 3.3). The exception to this trend was site NQ-TR-01, where 19 individuals were captured, with the population at this site estimated at 22.88 individuals. Further supporting the adequacy of sampling effort (four sampling nights per camera) during the current survey, the number of new individuals captured decreased across the monitoring period (Figure 3.3). Comparison of the total northern quoll population size within the Study Area during the current survey with each previous monitoring year could not be determined as a population estimate could not be determined at each monitoring site for every monitoring year.

The estimated total population size across all nine monitoring sites in the Study Area was 44.55 (Table 3.2; Table 3.3). The estimated population size at each of the sites ranged from 2.41 at impact site NQ-MC-02 to 22.88 at control site NQ-TR-01 (Table 3.2; Table 3.3). For those sites where population estimates for the current and previous survey are available, the sizes of the northern quoll populations at impact sites NQ-MC-01 and NQ-MC-02 during the current survey were lower than the previous year (24.45 and 71.68% less, respectively). When compared to 2018 and 2019 baseline surveys, the population estimate at impact site NQ-MC-

01 was 48.43% and 69.90% less than the baseline 2018 and 2019 surveys, respectively. The population estimate at NQ-MC-02 during the current survey was 69.88% less than the 2019 baseline population estimate. Conversely, the current estimated population size at impact site NQ-MC-02 was 20.5% more than the 2018 baseline population estimate, and 382.00% and 60.67% greater than the 2018 and 2019 baseline population estimates, respectively, at CO-WS-01 (Table 3.2; Table 3.3).

Table 3.3: Northern quoll population estimate

Site	Individuals Captured	Estimated Population Size and 95% CI
NQ-MC-01	3	3.61 (3.07, 8.39)
NQ-MC-02	2	2.41 (2.04, 6.48)
CO-WS-01	4	4.82 (4.11, 10.24)
NQ-SY-SL	0	N/A
CO-SY-OM	0	N/A
NQ-MC-03	3	3.61 (3.07, 8.41)
NQ-MC-07	6	7.22 (6.19, 13.79)
NQ-TR-01	19	22.88 (19.89, 35.88)
CO-WS-08	0	N/A
Total	**37**	**45.55**

3.4 Opportunistic Records

There were four opportunistic records of northern quoll, recorded during the concurrent Pilbara leaf-nosed bat and ghost bat 2024 monitoring surveys undertaken in accordance with the SSMP (Atlas Iron, 2017, 2023) (Table 3.4). These included four scat records at Pilbara leaf-nosed bat and/or ghost bat monitoring sites.

Table 3.4: Northern quoll opportunistic records

Record Type	Site Type	Latitude	Longitude	Date
Scat	Cave (CO-CA-10)	-21.4188	119.6754	16/07/2024
Scat	Cave (CO-CA-05)	-21.4248	119.6741	16/07/2024
Scat	Cave (CO-CA-33)	-21.5196	119.6612	17/07/2024
Scat	Cave (CO-CA-30)	-21.4032	119.6518	17/07/2024

3.5 Northern Quoll Mortalities

Three northern quoll mortalities as a result of vehicle strike have been recorded in the Study Area since the last mortality reported in December 2023 (Biologic, 2024). Two mortalities were recorded in January 2024 and one in late July 2024 (following the current survey). In 2023, there were four reported mortalities across the same months (January to July) and ten mortalities reported between January and December.

Vehicle-related mortalties may be due to northern quolls using the roads in the Study Area as dispersal corridors or entering the roadway to forage or drink the water sprayed onto the haul roads at night for purposes of dust supression. Mortalities likely reflect population trends within the Study Area. When the population levels are relatively high (as in 2023, when 42 individuals were recorded on camera), mortalities are likely to be more frequent because more individuals may be interacting with vehicles or mining-related infrastructure.

3.6 Predator Observations

Two species that prey on northern quolls and may occur in the Study Area are feral dogs (*Canis familiaris*) and cats (*Felis catus*). During the current survey, cats were recorded on camera at four sites: impact sites NQ-MC-01 and NQ-SY-SL, and control sites NQ-MC-07 and CO-WS-08) (Table 3.5; Plate 3.1). Based on the dates and times recorded, the distance between sites, and an assessment of cat features and individual markings, three or four cats were recorded. Cats were also recorded in the Study Area in 2023, at two impact sites (CO-SY-OM and CO-WS-01) and one control site (NQ-MC-03) (Biologic, 2024). While no feral dogs were detected on camera images during the current survey, they have been detected in previous years and are likely to continue to be present within the Study Area.

Table 3.5: Predators recorded

Species	Site	Date	Number of Detections
Cat (*Felis catus*)	NQ-MC-01	20/07/2024	4 images, Individual 1
	CO-WS-08	21/07/2024	4 images, Individual 2
	NQ-SY-SL	21/07/2024	3 images, Individual 3
	NQ-MC-07	19/07/2024	6 images, Individual 4

Plate 3.1: Feral cat recorded at NQ-MC-01

3.7 Limitations and Constraints

The EPA Guidance Statement No. 56 outlines several factors that can affect the adequacy of fauna surveys (EPA, 2020). No material limitations or constraints were applicable to the survey (Table 3.6).

Table 3.6: Survey limitations and constraints

Potential limitation or constraint	Applicability to this survey	Limitation
Availability of data and information	MWH (2016) details contextual information on the habitats and landforms present, as well as previous records of northern quolls, within the Study Area. This information was used to choose the monitoring sites. Six monitoring surveys have been conducted prior to the current monitoring survey. All relevant resources and expertise required to complete the survey were available.	No
Competency/ experience of the survey team	The field personnel involved in the survey have a combined total of 29 years' experience undertaking fauna surveys, including the previous monitoring surveys for this Project.	No

Potential limitation or constraint	Applicability to this survey	Limitation
Scope of the survey	The scope was a monitoring survey and was conducted within that framework. All methods were able to be undertaken as expected to sample the target fauna.	No
Timing, weather and season	As per the SSMP, northern quoll monitoring within the Study Area is required to occur between April and September. The timing of the current monitoring survey was undertaken at the same time of year as the previous monitoring surveys. Weather conditions were appropriate for detecting northern quoll (i.e. no rainfall and mild temperatures). Below average annual rainfall fell in the 12 months prior to the survey but was not expected to affect the detection of northern quolls.	No
Disturbance that may have affected results	In December 2022, a wildfire burned vegetation at the following sites: NQ-MC-01, NQ-MC-02, and NQ-TR-01. Vegetation was recorded to be re-establishing on all sites and no other further disturbance affecting the ability to survey the site was noted.	No
Adequacy of the survey intensity	The survey was undertaken using standardised and well-established techniques which are considered suitable for an ongoing monitoring program (DoE, 2016; Dunlop & Birch, 2019). The survey employed the same methods as were applied in previous years.	No
Proportion of survey achieved	Nine monitoring sites were sampled over a minimum of four consecutive nights as planned. The data collected allowed an analysis of the size of the local northern quoll population present at each monitoring site, supporting a comparison of northern quoll abundance and distribution between years.	No
Access problems	The Study Area was largely accessible either by vehicle or on foot, thus the sampling techniques used during this survey were unconstrained by accessibility or remoteness.	No
Problems with data and analysis	In addition to the 61 capture events, there were 12 records which were omitted from the analysis because they comprised unclear photos (e.g. images which were blurry, overexposed, or only captured a partial view of the animal); these were from NQ-MC-01, CO-WS-01, and NQ-MC-07. Whether these records are from new or otherwise identified individuals is not known. Importantly, unclear images were treated the same way by the monitoring surveys completed previously for the Project.	No

4 Conclusion

The current survey was successful in assessing northern quoll abundance across the nine monitoring sites (five impact sites and four control sites). This information will assist Atlas to identify whether mining activities associated with the Project are having a significant impact on northern quolls, and whether specific actions are required to manage this species.

The performance objective outlined in the SSMP is the persistence of northern quoll within the Study Area during operations (Atlas Iron, 2017). In accordance with the SSMP, Atlas are committed to employing specific management actions when the following key performance indicator is triggered: absence of northern quoll at 50% of monitoring sites over two consecutive annual monitoring periods.

Northern quolls were recorded at 60% of impact sites during the current survey, and were captured at all five impact sites during the previous 2023 survey. Therefore, the key performance indicator outlined in the SSMP was not triggered during the current survey.

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Appendix A: Photo monitoring point photo

NQ-MC-01 (Impact)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
MC-01 PP1A	-21.3658	119.6889	MC-01 PP2A	-21.3704	119.6870
2018			2018		
2019			2019		
2020			2020		

NQ-MC-01 (Impact)			
2021		2021	
2022		2022	
2023		2023	

NQ-MC-01 (Impact)			
2024		2024	

NQ-MC-02 (Impact)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
MC-02 PP1	-21.4190	119.6739	MC-02 PP2	-21.4195	119.6747
2018			2018		
2019			2019		
2020			2020		

NQ-MC-02 (Impact)			
2021		2021	
2022	No photo available	2022	
2023		2023	

NQ-MC-02 (Impact)			
2024		2024	

CO-WS-01 (Impact)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
WS-01 PP1	-21.4103	119.6875	WS-01 PP2	-21.4121	119.6871
2018			2018		
2019			2019		
2020			2020		

CO-WS-01 (Impact)			
2021		2021	
2022		2022	
2023		2023	

CO-WS-01 (Impact)			
2024		2024	

NQ-SY-SL (Impact)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
SL PP1	-21.3539	119.7002	SL PP2	-21.3559	119.7011
2018			2018		
2019			2019		
2020			2020		

NQ-SY-SL (Impact)			
2021		2021	
2022		2022	
2023		2023	

NQ-SY-SL (Impact)			
2024		2024	

CO-SY-OM (Impact)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
OM PP1	-21.3752	119.6858	OM PP2	-21.3752	119.6858
2018			2018		
2019			2019		
2020			2020		

CO-SY-OM (Impact)			
2021		2021	
2022		2022	
2023		2023	

CO-SY-OM (Impact)			
2024	No photo available	2024	

NQ-MC-03 (Control)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
MC-03 PP1	-21.4662	119.6492	MC-03 PP2	-21.4665	119.6483
2018			2018		
2019			2019		
2020			2020		

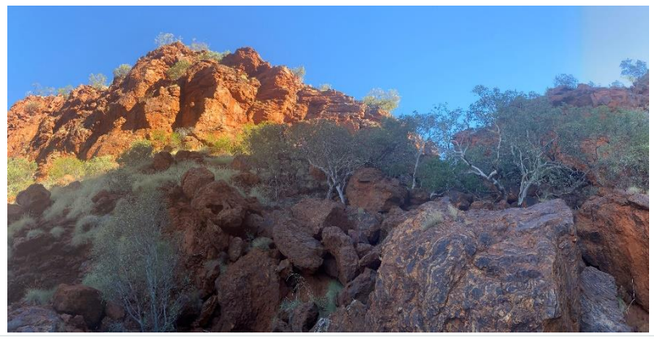
NQ-MC-03 (Control)			
2021		2021	
2022		2022	
2023		2023	

NQ-MC-03 (Control)			
2024		2024	

NQ-MC-07 (Control)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
MC-07 PP1	-21.4951	119.6642	MC-07 PP2	-21.4950	119.6657
2018			2018		
2019			2019		
2020			2020		

NQ-MC-07 (Control)			
2021		2021	
2022		2022	
2023		2023	

NQ-MC-07 (Control)			
2024		2024	

NQ-TR-01 (Control)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
TR-01 PP1	-21.38767	119.6529	TR-01 PP2	-21.3874	119.6536
2018			2018		
2019			2019		
2020			2020		

NQ-TR-01 (Control)			
2021		2021	
2022		2022	
2023		2023	

NQ-TR-01 (Control)			
2024		2024	

CO-WS-08 (Control)					
Photo Point	Location		Photo Point	Location	
	Latitude	Longitude		Latitude	Longitude
WS-08 PPA	-21.4520	119.6509	WS-08 PPB	-21.4520	119.6509
2021			2021		
2022			2022		
2023			2023		

CO-WS-08 (Control)			
2024		2024	

Appendix B: Camera trap locations

Name	Location		Date		Total sampling nights
	Latitude	Longitude	Deployed	Retrieved	
NQ-MC-01	-21.3695	119.6869	18/07/2024	22/07/2024	4
	-21.3712	119.6858	18/07/2024	22/07/2024	4
	-21.3704	119.6864	18/07/2024	22/07/2024	4
	-21.3672	119.6877	18/07/2024	22/07/2024	4
	-21.3692	119.6870	18/07/2024	22/07/2024	4
	-21.3709	119.6860	18/07/2024	22/07/2024	4
	-21.3701	119.6867	18/07/2024	22/07/2024	4
	-21.3657	119.6880	18/07/2024	22/07/2024	4
	-21.3678	119.6873	18/07/2024	22/07/2024	4
	-21.3666	119.6874	18/07/2024	22/07/2024	4
NQ-MC-02	-21.4194	119.6723	19/07/2024	23/07/2024	4
	-21.4178	119.6763	19/07/2024	23/07/2024	4
	-21.4195	119.6738	19/07/2024	23/07/2024	4
	-21.4187	119.6753	19/07/2024	23/07/2024	4
	-21.4165	119.6765	19/07/2024	23/07/2024	4
	-21.4192	119.6741	19/07/2024	23/07/2024	4
	-21.4186	119.6747	19/07/2024	23/07/2024	4
	-21.4198	119.6728	19/07/2024	23/07/2024	4
	-21.4196	119.6735	19/07/2024	23/07/2024	4
	-21.4199	119.6739	19/07/2024	23/07/2024	4
CO-WS-01	-21.4080	119.6879	18/07/2024	23/07/2024	4
	-21.4105	119.6871	18/07/2024	23/07/2024	4
	-21.4119	119.6872	18/07/2024	23/07/2024	4
	-21.4111	119.6870	18/07/2024	23/07/2024	4
	-21.4088	119.6877	18/07/2024	23/07/2024	4
	-21.4102	119.6876	18/07/2024	23/07/2024	4
	-21.4097	119.6877	18/07/2024	23/07/2024	4
	-21.4093	119.6877	18/07/2024	23/07/2024	4
	-21.4122	119.6872	18/07/2024	23/07/2024	4
	-21.4124	119.6872	18/07/2024	23/07/2024	4
NQ-SY-SL	-21.3597	119.7015	18/07/2024	22/07/2024	4
	-21.3534	119.7009	18/07/2024	22/07/2024	4
	-21.3605	119.7016	18/07/2024	22/07/2024	4
	-21.3549	119.7005	18/07/2024	22/07/2024	4
	-21.3566	119.7009	18/07/2024	22/07/2024	4
	-21.3590	119.7014	18/07/2024	22/07/2024	4
	-21.3557	119.7007	18/07/2024	22/07/2024	4
	-21.3571	119.7009	18/07/2024	22/07/2024	4

Name	Location		Date		Total sampling nights
	Latitude	Longitude	Deployed	Retrieved	
	-21.3580	119.7011	18/07/2024	22/07/2024	4
	-21.3542	119.7009	18/07/2024	22/07/2024	4
CO-SY-OM	-21.3749	119.6850	18/07/2024	22/07/2024	4
	-21.3751	119.6859	18/07/2024	22/07/2024	4
	-21.3751	119.6865	18/07/2024	22/07/2024	4
	-21.3746	119.6867	18/07/2024	22/07/2024	4
	-21.3770	119.6865	18/07/2024	22/07/2024	4
	-21.3749	119.6874	18/07/2024	22/07/2024	4
	-21.3759	119.6871	18/07/2024	22/07/2024	4
	-21.3762	119.6869	18/07/2024	22/07/2024	4
	-21.3752	119.6856	18/07/2024	22/07/2024	4
	-21.3765	119.6868	18/07/2024	22/07/2024	4
NQ-MC-03	-21.4664	119.6459	19/07/2024	23/07/2024	4
	-21.4660	119.6487	19/07/2024	23/07/2024	4
	-21.4659	119.6509	19/07/2024	23/07/2024	4
	-21.4664	119.6468	19/07/2024	23/07/2024	4
	-21.4665	119.6484	19/07/2024	23/07/2024	4
	-21.4663	119.6495	19/07/2024	23/07/2024	4
	-21.4661	119.6502	19/07/2024	23/07/2024	4
	-21.4667	119.6481	19/07/2024	23/07/2024	4
	-21.4666	119.6474	19/07/2024	23/07/2024	4
	-21.4667	119.6445	19/07/2024	23/07/2024	4
NQ-MC-07	-21.4949	119.6668	17/07/2024	24/07/2024	4
	-21.4954	119.6636	17/07/2024	24/07/2024	4
	-21.4950	119.6659	17/07/2024	24/07/2024	4
	-21.4950	119.6638	17/07/2024	24/07/2024	4
	-21.4945	119.6625	17/07/2024	24/07/2024	4
	-21.4934	119.6608	17/07/2024	24/07/2024	4
	-21.4951	119.6644	17/07/2024	24/07/2024	4
	-21.4949	119.6656	17/07/2024	24/07/2024	4
	-21.4953	119.6647	17/07/2024	24/07/2024	4
	-21.4950	119.6651	17/07/2024	24/07/2024	4
NQ-TR-01	-21.3875	119.6538	18/07/2024	24/07/2024	4
	-21.3882	119.6520	18/07/2024	24/07/2024	4
	-21.3873	119.6548	18/07/2024	24/07/2024	4
	-21.3873	119.6543	18/07/2024	24/07/2024	4
	-21.3878	119.6527	18/07/2024	24/07/2024	4
	-21.3876	119.6537	18/07/2024	24/07/2024	4

Name	Location		Date		Total sampling nights
	Latitude	Longitude	Deployed	Retrieved	
	-21.3879	119.6525	18/07/2024	24/07/2024	4
	-21.3875	119.6535	18/07/2024	24/07/2024	4
	-21.3876	119.6530	18/07/2024	24/07/2024	4
	-21.3875	119.6538	18/07/2024	24/07/2024	4
CO-WS-08	-21.4520	119.6504	19/07/2024	23/07/2024	4
	-21.4527	119.6470	19/07/2024	23/07/2024	4
	-21.4523	119.6493	19/07/2024	23/07/2024	4
	-21.4531	119.6474	19/07/2024	23/07/2024	4
	-21.4522	119.6494	19/07/2024	23/07/2024	4
	-21.4524	119.6465	19/07/2024	23/07/2024	4
	-21.4527	119.6486	19/07/2024	23/07/2024	4
	-21.4529	119.6479	19/07/2024	23/07/2024	4
	-21.4519	119.6508	19/07/2024	23/07/2024	4
	-21.4519	119.6500	19/07/2024	23/07/2024	4

Appendix C: Northern quolls recorded during the survey

Site	Date	Latitude	Longitude	Method	Individual ID
CO-CA-10	16/07/2024	-21.4188	119.6754	Opportunistic (Scat)	-
CO-CA-05	16/07/2024	-21.4248	119.6741	Opportunistic (Scat)	-
CO-CA-33	17/07/2024	-21.5196	119.6612	Opportunistic (Scat)	-
NQ-TR-01	18/07/2024	-21.3877	119.6528	Opportunistic (Scat)	-
CO-CA-30	17/07/2024	-21.4032	119.6518	Opportunistic (Scat)	-
NQ-MC-01	19/07/2024	-21.3712	119.6858	Camera Trap	Individual 1
NQ-MC-01	21/07/2024	-21.3712	119.6858	Camera Trap	Individual 1
NQ-MC-01	18/07/2024	-21.3712	119.6858	Camera Trap	Individual 2
NQ-MC-01	18/07/2024	-21.3712	119.6858	Camera Trap	Individual 3
NQ-MC-01	19/07/2024	-21.3712	119.6858	Camera Trap	Individual 3
NQ-MC-01	21/07/2024	-21.3712	119.6858	Camera Trap	Individual 3
NQ-MC-03	21/07/2024	-21.4666	119.6474	Camera Trap	Individual 4
NQ-MC-03	19/07/2024	-21.4666	119.6474	Camera Trap	Individual 5
NQ-MC-03	20/07/2024	-21.4666	119.6474	Camera Trap	Individual 5
NQ-MC-03	21/07/2024	-21.4666	119.6474	Camera Trap	Individual 5
NQ-MC-03	21/07/2024	-21.4666	119.6474	Camera Trap	Individual 6
CO-WS-01	20/07/2024	-21.4088	119.6877	Camera Trap	Individual 7
CO-WS-01	20/07/2024	-21.4088	119.6877	Camera Trap	Individual 8
CO-WS-01	19/07/2024	-21.4088	119.6877	Camera Trap	Individual 9
CO-WS-01	20/07/2024	-21.4088	119.6877	Camera Trap	Individual 9
CO-WS-01	20/07/2024	-21.4088	119.6877	Camera Trap	Individual 9
CO-WS-01	20/07/2024	-21.4088	119.6877	Camera Trap	Individual 10
NQ-MC-02	19/07/2024	-21.4197	119.6735	Camera Trap	Individual 11
NQ-MC-02	20/07/2024	-21.4197	119.6735	Camera Trap	Individual 11
NQ-MC-02	21/07/2024	-21.4197	119.6735	Camera Trap	Individual 12
NQ-MC-07	19/07/2024	-21.4934	119.6608	Camera Trap	Individual 13
NQ-MC-07	17/07/2024	-21.4934	119.6608	Camera Trap	Individual 14
NQ-MC-07	18/07/2024	-21.4934	119.6608	Camera Trap	Individual 15
NQ-MC-07	17/07/2024	-21.4934	119.6608	Camera Trap	Individual 16
NQ-MC-07	18/07/2024	-21.4934	119.6608	Camera Trap	Individual 16
NQ-MC-07	17/07/2024	-21.4934	119.6608	Camera Trap	Individual 17
NQ-MC-07	18/07/2024	-21.4934	119.6608	Camera Trap	Individual 17
NQ-MC-07	19/07/2024	-21.4934	119.6608	Camera Trap	Individual 17
NQ-MC-07	20/07/2024	-21.4934	119.6608	Camera Trap	Individual 18
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 19
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 19
NQ-TR-01	20/07/2024	-21.3882	119.6520	Camera Trap	Individual 19
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 19
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 20

Site	Date	Latitude	Longitude	Method	Individual ID
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 20
NQ-TR-01	20/07/2024	-21.3882	119.6520	Camera Trap	Individual 20
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 20
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 21
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 22
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 22
NQ-TR-01	20/07/2024	-21.3882	119.6520	Camera Trap	Individual 22
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 22
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 23
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 24
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 25
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 26
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 27
NQ-TR-01	20/07/2024	-21.3882	119.6520	Camera Trap	Individual 27
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 28
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 29
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 29
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 30
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 31
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 32
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 33
NQ-TR-01	18/07/2024	-21.3882	119.6520	Camera Trap	Individual 34
NQ-TR-01	21/07/2024	-21.3882	119.6520	Camera Trap	Individual 35
NQ-TR-01	20/07/2024	-21.3882	119.6520	Camera Trap	Individual 36
NQ-TR-01	19/07/2024	-21.3882	119.6520	Camera Trap	Individual 37