BARROW ISLAND NATURE RESERVE
ROCK-WALLABY SURVEY NOVEMBER 2004

Andrew A Burbidge[1] and Michelle Drew[2]

[1] Research Fellow, Science Division, Department of Conservation and Land Management
WA Wildlife Research Centre, PO Box 51, Wanneroo WA 6946

[2] Bowman Bishaw Gorham, 290 Churchill Ave, Subiaco, WA 6008

Department of Conservation and Land Management
Western Australian Wildlife Research Centre
Wildlife Place, Woodvale, WA
PO Box 51, Wanneroo, WA 6946

CONTENTS

INTRODUCTION

The Black-flanked Rock-wallaby *Petrogale lateralis lateralis* is a listed threatened species under State and Commonwealth legislation. A formerly widespread distribution in the western deserts (Great Sandy, Little Sandy, Gibson and Great Victoria), western Pilbara, Cape Range and the south west of Western Australia has shrunk to a few isolated populations, largely due to predation by the introduced European Red Fox (*Vulpes vulpes*) (Burbidge *et al.* 1988, Kinnear *et al*. 1988, 1998, Pearson 1992, Pearson and Kinnear 1997). (The subspecies/chromosomal race identification of many of the now extinct desert populations is unknown, and some may be referable to the 'West Kimberley race' or the 'MacDonnell Ranges race'.) The subspecies occurred on three offshore islands: Depuch and Barrow in the Pilbara and Salisbury in the Southern Ocean off Cape Arid (Abbott and Burbidge 1995, Pearson and Kinnear 1997). A natural spread of foxes to Depuch Island in the first half of the 20th Century led to that population becoming extinct (Hall and Kinnear 1991, Pearson and Kinnear 1997).

The Black-flanked Rock-wallaby is the least abundant of the mammals occurring on Barrow Island. Two population estimates are available. Butler (1970) stated "I estimate there are 500+ individuals in the multiple cliff colonies which extend over some eight miles of coast and in places go two miles inland" (p. 154). Hall *et al*. (1993) provided an estimate of 116 to 154 based on searching, trapping and spotlighting during one week in late February and early March 1993. Hall and Kinnear (1991) in a draft recovery plan for *P. l. lateralis* stated that the subspecies was 'conspicuously abundant in suitable habitat, which is of restricted distribution' (p. 6).

Recent monitoring of mammal populations on Barrow Island by The Department of Conservation and Land Management (CALM) and ChevronTexaco (Burbidge *et al.* 2003 and earlier reports) has concentrated on species that are captured in Sheffield cage, medium Elliott or pit-fall traps or which are readily observed at night from vehicles using spotlights. Attempts were made to trap rock-wallabies near their daytime shelter habitat on the west coast of the island; however, the prevalence of other mammals, especially Brushtail Possums (*Trichosurus vulpecula arnhemensis*) and to a lesser extent Golden Bandicoots (*Isoodon auratus*) in this habitat meant that while rock-wallabies were occasionally trapped, most traps captured possums or bandicoots, particularly the former. The collection of reliable trap data with repeated recaptures, allowing mark-and-recapture population estimates, seemed unachievable during short duration monitoring episodes. Our previous reports recommended that other methods of monitoring rock-wallabies needed to be investigated.

Aspects of rock-wallaby biology

There have been only limited studies on the biology and ecology of *P. lateralis*. Research in the southwest of Western Australia showed that breeding commences at 18 months and that some individuals may live longer than 12 years (Kinnear *et al*. 1988). Pearson (1992) reported that, in central Australia, *P. lateralis* was capable of moving long distances between rock outcrops, with Aboriginal informants reporting tracks up to 4 km from the nearest rockpile.

Considerable work on *P. assimilis* at 'Black Rock', 250 km west of Townsville, Queensland, has shown that females become mature at 18 months of age and males at 24 months, and that animals have an average life expectancy of five to eight years with some known to live to 14 years. Recruitment is spasmodic and requires good seasons (Delaney, 1997). Horsup (1994, 1996) showed that males defended territories and that home ranges were small (mean 11.9 ha) and elongate, radiating out from the rockpile where they sheltered. Male and female home ranges

were similar in size. Home ranges became larger in dry seasons with animals moving further to feed and feeding on less palatable plants.

In a study of *P. xanthopus*, another arid-zone species, only one of about 100 tagged animals moved between colonies only 600 m apart (Sharp, 1997a). The use of caves and rockpiles varied with season and increased in the hottest time of the year. Many adults did not use deep caves but sheltered among trees, and shrubs. Females used deep shelter more than males, while juveniles used deep caves almost exclusively (Sharp, 1997b).

Telfer *et al*. (2004) showed that for *P. brachyotis*, a species of the wet-dry tropics, scat distribution is not correlated strongly with the home ranges of rock-wallabies; scats were, however, a good indicator of rock-wallaby core areas and shelter sites.

METHODS

During the November 2004 visit we trialed three monitoring techniques:

1. daytime searching of shelter habitat,
2. dusk watching, and
3. night time spotlight transects.

Daytime searching

Commencing in the afternoon of 2 November and finishing on the morning of 9 November 2004, all prospective shelter habitat on and near the west coast was visited by two (occasionally three) people. Search methods depended on the local topography: where possible one person walked below the cliff or scree while the other walked on the plateau above. Where topography prevented access below the cliff top, both persons walked near the cliff edge and, when safe to do so, looked below the cliff top. Search areas were marked onto colour air photographs (Appendix 1, 1:15 000, 7 August 1980). Areas marked in Appendix 1 are those where rock-wallaby scats and/or animals were recorded; areas searched where no scats or wallabies were seen are not marked. For each area we recorded the number of rock-wallabies sighted and made a judgement of scat relative abundance on a scale of 0 to 5, where 0 meant no scats were seen and 5 meant that scats were abundant in and near suitable shelter habitat.

All locations from Obe's Beach to Biggada Creek were visited twice, with the higher rock-wallaby sighting count being used in the results. Areas north of Obe's Beach and south of Biggada Creek were visited once, as these areas showed little or no sign of rock-wallaby activity. Because we usually sighted more rock-wallabies early in the morning (up to about 0930 or 1000 hrs), areas that were first searched late in the morning or during the afternoon were revisited in the early morning.

Spotlighting

Night time spotlight traverses were walked by two people along transects established in 2003 (Burbidge *et al*. 2003). One person carried a sealed lead acid battery on a backpack frame plus a 75 W spotlight, while the other navigated using a GPS receiver and where necessary identified any animals with 10x40 binoculars. Two routes were walked: one from John Wayne Country to the coastal termination of a track passing well YS88 and the other from above the Boodie Warren Cave to the headland just south of Obe's Beach (near Cape Malouet). The transects were walked south to north and searching commenced 30 minutes after local sunset. All mammals sighted were noted together with the time of sighting; for rock-wallabies the habitat was also recorded.

Dusk watching

At the isolated colony near Well Q21 (Area 7), we watched for rock-wallabies emerging from shelter in the late afternoon and evening to feed. On 7 November four people sat 150-200 m below the cliff face and watched from 1615 to 1900, using 10x40 binoculars and a 20x-40x spotting telescope. On 8 November two people watched from the same position and one person watched from above the cliff.

RESULTS

Daytime searching

We searched near-coastal and inland areas from the southern end of Whites Beach south to The Chair. Rock-wallaby scats or the wallabies themselves were located in suitable shelter habitat from the headland immediately north of Obe's Beach south to near The Ledge (see Appendix 1), a distance of about 12 km. Most sites with scats, or wallabies and scats, were near the coast; however, some sites south of Boodie Warren Cave and in and near John Wayne Country extended inland up to 0.8 km. Rock-wallabies also occur at an isolated cliff immediately southwest of Well Q21, 2.3 km from the west coast.

Scat locations were very patchy and densities varied considerably from place to place and our estimates of scat abundance did not prove useful in providing a population monitoring method. While we often noted greater scat abundance at places where rock-wallabies were sighted, this was not consistent.

Table 1 shows the higher number of rock-wallabies recorded in each area. In all we sighted 59 animals or 63 if the additional animals sighted at Q21 during the dusk watch are included.

Spotlighting

Table 2 shows the results of the spotlight traverses, as well as the wind and moon conditions and the vegetation of the site where each rock-wallaby was sighted. Numbers seen varied from zero to ten on the northern route and from zero to three on the southern route. Places where rock-wallabies were sighted were white sand dunes behind beaches among *Spinifex longifolius* (one rock-wallaby, presumably the same individual, was twice seen feeding a *Cynanchum floribundum* growing among *Spinifex*), among *Triodia*, and near the cliff edge with no vegetation.

Dusk watching

Five rock-wallabies were seen leaving shelter at the Q21 colony on the evening of 7 November: at 1650, 1755, 1812, 1820 and 1838 hrs. On 8 November two rock-wallabies were sighted at 1725 and the same two were seen later.

DISCUSSION

Daytime searching proved more successful in locating rock-wallabies than spotlighting. When the same areas were compared, even the highest spotlighting total was lower than the number of rock-wallabies sighted during daytime searching. Spotlighting did not produce consistent results, and it was abandoned as a monitoring technique after two walks on each traverse.

The total of 59 rock-wallabies sighted during daytime searching was higher than the 38 seen by Hall *et al*. in 1993. These authors did not provide a detailed description of their methods, and we are unable to provide an explanation for this difference; however, we did search all high density

rock-wallaby areas twice and ensured that all such areas were searched at least once in early morning.

We can not be sure that the difference in numbers seen between the two counts reflects a real difference in the number of animals basking or sheltering outside deep rockpile shelter or whether there was movement of animals into sites from other sites. What is known about rock-wallaby behaviour, however, suggests that more animals are visible in the early morning than later in the day. Available knowledge also shows that rock-wallabies have small home ranges and rarely move beyond them (Horsup, 1996).

At some sites we recorded scats but sighted no animals. Some of these sites were on the edges of areas where we saw animals; others were located between places where we saw animals; yet others were some distance from a site where rock-wallabies were sighted. These peripheral sites with scats but no sightings were on the northern side of Obe's Beach (Area 1), in inland parts of Area 3, and the whole of Area 9. It may be that some of these areas are not currently used by rock-wallabies, are used occasionally by rock-wallabies from nearby areas, or used during cooler months when deep shelter is less important. A winter survey might help clarify this issue.

Our aim was to develop a method of monitoring rock-wallabies on Barrow Island, not to provide an estimate of the total population. We believe that the method described as 'daytime searching' could provide a technique for monitoring relative abundance. However, further counts will be necessary to test this hypothesis.

Hall *et al*. (1993) gave an estimate of the total population on Barrow Island of 116 to 154. This was derived by assuming that between 25% and 33% of the total population was sighted. This correction factor was based on work by Kinnear and others (cited in Hall *et al*. 1993) on isolated granite rocks in the southwest of Western Australia, where repeated trapping and spotlighting had been conducted. We do not believe that this correction factor can be validly applied to Barrow Island, where conditions and habitat are different.

There are two lines of evidence for an assumption that we did not sight all animals present within an area. Firstly, we often saw different numbers in one site within an 'Area' when conducting the two searches. Secondly, dusk watching revealed five rock-wallabies in Area 7 (the isolated cliff near Well Q21), while we sighted only a single animal on each of the two daytime searches. It seems likely that some rock-wallabies were sheltering in deep, well-protected locations and did not move when we walked nearby. We had the impression that we only flushed animals that were either basking in the early morning sun, or were in poor quality shelter, such as clumps of figs or shallow caves. We searched under relatively cool conditions for the time of year (Table 3); however, we did see rock-wallabies in mid-afternoon when shade temperatures were near 30ºC.

Elsewhere, rock-wallabies tend to bask in the sun more in cool weather than in hot weather, and anecdotal information suggests that this is the case on Barrow Island. Thus, searches in winter may result in more rock-wallaby sightings than in early summer, when we did our work.

A sighting of 63 rock-wallabies (59 plus the additional four sighted at Q21 during dusk watching) suggests a small total population on Barrow Island. Eldridge *et al*. (1999, 2004) reported that the Barrow Island population of *P. lateralis* has unprecedented low levels of genetic variation and suffers from inbreeding depression (reduced fecundity, skewed sex ratio, increased levels of fluctuating asymmetry) and a small effective population size. Nevertheless, this population has survived a long period of isolation (*ca* 1600 generations).

Obtaining a statistically valid total population estimate of rock-wallabies on Barrow Island would require extensive trapping and individual marking of rock-wallabies, plus radio-tracking to show whether animals have fixed home ranges. This work would require two people making repeated field trips of two to three weeks to Barrow Island over several years.

RECOMMENDATIONS

Further work is needed to validate the 'daytime searching' method as being a repeatable monitoring technique. Also a winter search is required to see whether rock-wallabies are more easily sighted basking in the morning in the cooler months.

We recommend:

1. The 'Daytime searching' method be repeated in winter 2005.
2. Depending on the results of that work, further 'daytime searching' counts be undertaken in either winter or early summer over the next two years to see whether the counts produce consistent results.

ACKNOWLEDGEMENTS

We thank Keith Morris, Peter Kendrick and Felicity Donaldson for assisting with some of the daytime searching and dusk watching. Keith and Peter also provided helpful comments on a draft of this report. Ursula Davies provided liaison and support while we were on Barrow Island.

REFERENCES

Abbott, I. and Burbidge, A.A. (1995). The occurrence of mammal species on the islands of Australia: a summary of existing knowledge. *CALMScience* **1**(3), 259-324.

Burbidge, Andrew A., Johnson, K.A., Fuller, Phillip J. and Southgate, R.I. (1988). Aboriginal knowledge of the mammals of the central deserts of Australia. *Australian Wildlife Research* **15**, 9-39

Burbidge, A.A., Drew, M., Pearson, D. and Kendrick, P. (2003). Mammal monitoring Barrow Island Nature Reserve October 2003. Department of Conservation and Land Management, Woodvale.

Butler, W.H. (1970). A summary of the vertebrate fauna of Barrow Island, W.A. *Western Australian Naturalist* **11**, 149-160.

Delaney, R. (1997). Reproductive ecology of the Allied Rock-wallaby, *P. assimilis*. *Australian Mammalogy* **19**, 199-208.

Eldridge, M.D.B., King, J.M., Loupis, A.K., Spencer, P.B.S., Taylor, A.C., Pope, L.C. and Hall, G.P. (1999). Unprecedented low levels of genetic variation and inbreeding depression in an island population of the black-footed rock wallaby. *Conservation Biology* **13**, 531-5.

Eldridge, M.D.B., Kinnear, J.E., Zenger, K.R., McKenzie, L.M. and Spencer, P.B.S. (2004). Genetic diversity in remnant mainland and pristine island populations of three endemic Australian macropodids (Marsupialia): *Macropus eugenii*, *Lagorchestes hirsutus* and *Petrogale lateralis*. *Conservation Genetics* **5**, 325-338.

Hall, G.P. and Kinnear, J.E. (1991). Recovery Plan for the Black-flanked Rock-wallaby *Petrogale lateralis lateralis* (Gould). A report submitted to the Australian National Parks and Wildlife Service. Department of Conservation and Land Management.

Hall, G., Onus, M. and Kinnear, J. (1993). A survey of Barrow Island for the Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*). Unpublished report, Department of Conservation and Land Management. 6 pp.

Horsup, A. (1994). Home range of the Allied Rock-wallaby, *Petrogale assimilis*. *Wildlife Research* **21**, 65-84.

Horsup, A.B. (1996). The behavioural ecology of the Allied Rock-wallaby *Petrogale assimilis*. PhD thesis, Department of Zoology, James Cook University of North Queensland.

Kinnear, J.E., Onus, M.L. and Bromilow, R.N. (1988). Fox control and rock wallaby population dynamics. *Australian Wildlife Research* **15**, 435-450.

Kinnear, J.E., Onus, M.L. and Sumner, N.R. (1998). Fox control and rock wallaby population dynamics. II, an update. *Wildlife Research* **25**, 81-88.

Pearson, D.J. (1992). Past and present distribution and abundance of the black-footed rock-wallaby in the Warburton Region, of Western Australia. *Wildlife Research* **19**, 605-622.

Pearson, D.J. and Kinnear, J.E. (1997). A review of distribution, status and conservation of rock-wallabies in Western Australia. *Australian Mammalogy* **19**, 137-152.

Sharp, A. (1997a). Insights into the dispersal patterns of Yellow-footed Rock-wallabies, *Petrogale xanthopus*. *Australian Mammalogy* **19**, 229-238

Sharp, A. (1997b). The use of shelter sites by Yellow-footed Rock-wallabies, *Petrogale xanthopus*, in central Australia. *Australian Mammalogy* **19**, 239-244.

Telfer, W.R., Griffiths, A.D. and Bowman, D.M.J.S. (2004). (Abstract). Is scat distribution a good surrogate for rock-wallaby activity? Australian Mammal Society Newsletter October 2004.

Table 1. Maximum number of rock-wallabies sighted in different Areas of Barrow Island Nature Reserve.

Area[#] No.	Maximum number of Rock-wallabies sighted
1	6
2	4
3	9
4	1
5	6
6	13
7	1*
8	19
9	0
TOTAL	**59**

* A single animal seen on daylight walks. Five seen during dusk watching.
[#] See Appendix 1 for location of Areas.

Table 2. Results of spotlighting traverses on the west coast of Barrow Island.

Date	No. of rock-wallabies sighted	Wind	Moon
Southern traverse			
24 October 2003	0	W, 25-30 knots	none
2 November 2004	2	SW, 5-10 knots	none
4 November 2004	10	W <3 knots	none
Northern traverse			
29 October 2003	3	W, 25-30 knots	1st quarter, moonset at 10.41 pm
3 November 2004	3	SW, 10-15 knots	none
6 November 2004	0	W, 5 knots	none

Details of vegetation where sighted

Southern Traverse
2/11/04
1902 hrs, start
2001 hrs, on white sand with *Spinifex longifolius* below cliff, Flacourt Bay
2008 hrs, on white sand dune Flacourt Bay feeding on *Cynanchum floribundum*
2030 hrs, finish
4/11/04
1904 hrs, start
1915 hrs, ca 10 m from edge of cliff, among *Triodia*
1915 hrs, ca 10 m from edge of cliff, among *Triodia*
1955 hrs, among dense *Triodia* near cliff edge
1955 hrs, among dense *Triodia* near cliff edge
2006 hrs, among *Triodia* and *Spinifex* on white sand near base of cliff, Flacourt Bay
2010 hrs, on white sand dune Flacourt Bay feeding on *Cynanchum floribundum*
2010 hrs, among *Spinifex longifolius* on white sand, Flacourt Bay
2015 hrs, on rocky slope among *Triodia*
2025 hrs, among *Triodia* near cliff edge
2026 hrs, among *Triodia* near cliff edge
2030 hrs, finish

Northern Traverse
3/11/04
1905 hrs, start
1930 hrs, among *Spinifex longifolius* on white sand behind beach
1940 hrs, on cliff edge, no vegetation
2000 hrs, among *Triodia* on plateau above cliff
2002 hrs, finish

5/11/04
1902 hrs, start
2000 hrs finish

Table 3. Barrow Island daily weather observations, November 2004. Bureau of Meteorology data

Date	Min Temp °C	Max Temp °C	Rain (mm)	Max wind gust km/h		
				Direction	Speed	Time
2	24.6	28.7	0	SW	54	22:04
3	22.0	28.1	0	SSW	52	9:58
4	23.0	32.0	0	SSW	43	2:33
5	19.9	29.5	0	NE	59	11:24
6	22.8	30.3	0	SW	35	23:51
7	22.5	27.1	0	SW	48	0:00
8	21.4	27.6	0	SSW	52	7:00
9	20.6	27.4	0	SW	57	21:06

Date	9:00 AM observations				3.00 pm observations			
	Temp °C	RH %	Wind dir	Speed	Temp °C	RH %	Wind dir	Speed
2	25.8	61	SW	28	28.3	59	WSW	31
3	23.0	58	SSW	44	27.9	41	SW	35
4	25.8	47	S	31	29.2	46	SW	15
5	28.0	53	ENE	35	28.9	44	NE	35
6	23.7	70	E	13	29.8	59	SW	20
7	24.6	64	SW	28	26.2	57	SW	37
8	22.7	71	SW	37	26.8	54	WSW	35
9	21.9	65	SSW	41	26.8	45	WSW	39

Appendix 1. Aerial photographs of the west coast of Barrow Island showing ‘Areas’ searched where we observed rock-wallaby scats or live animals.

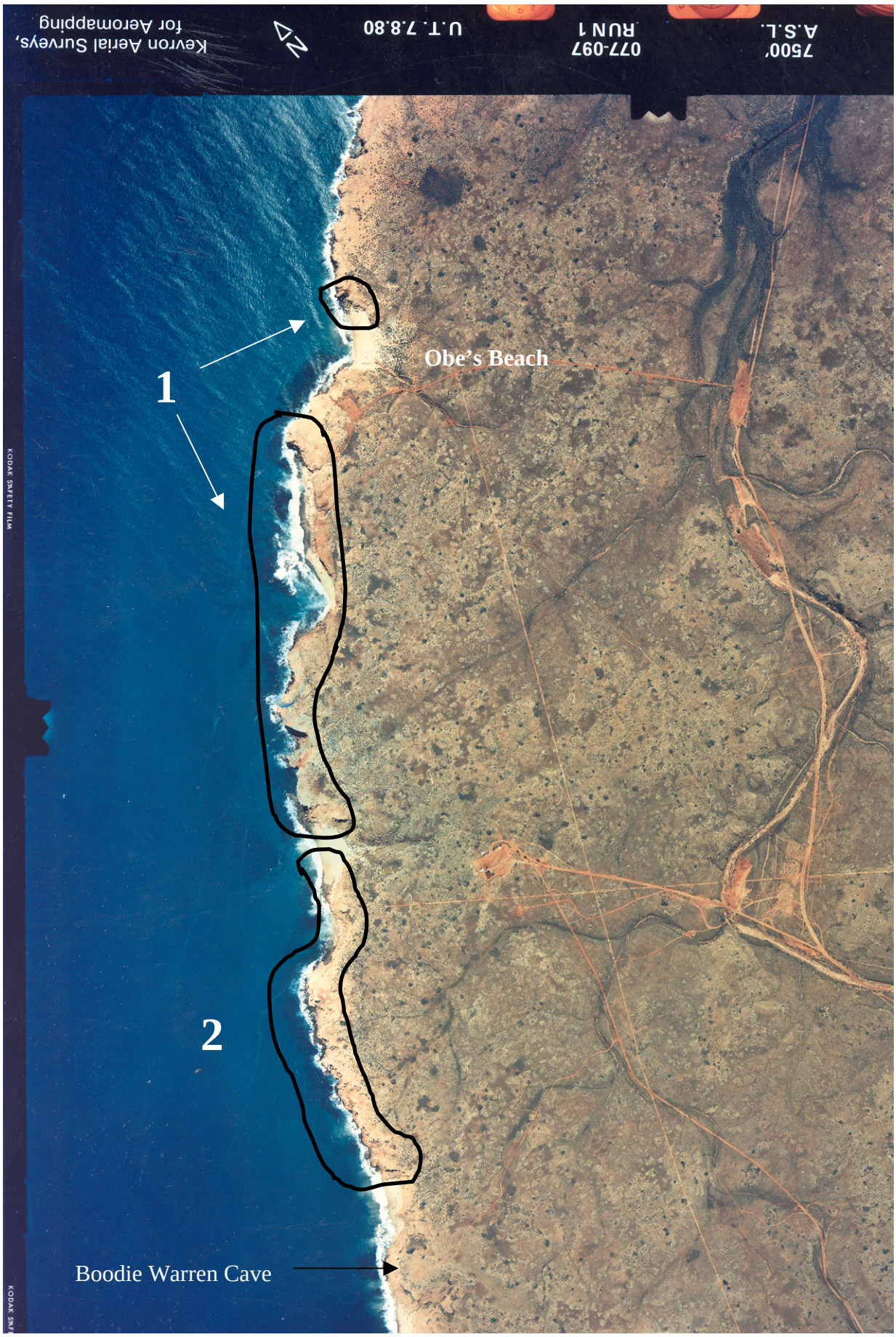

Photo 91

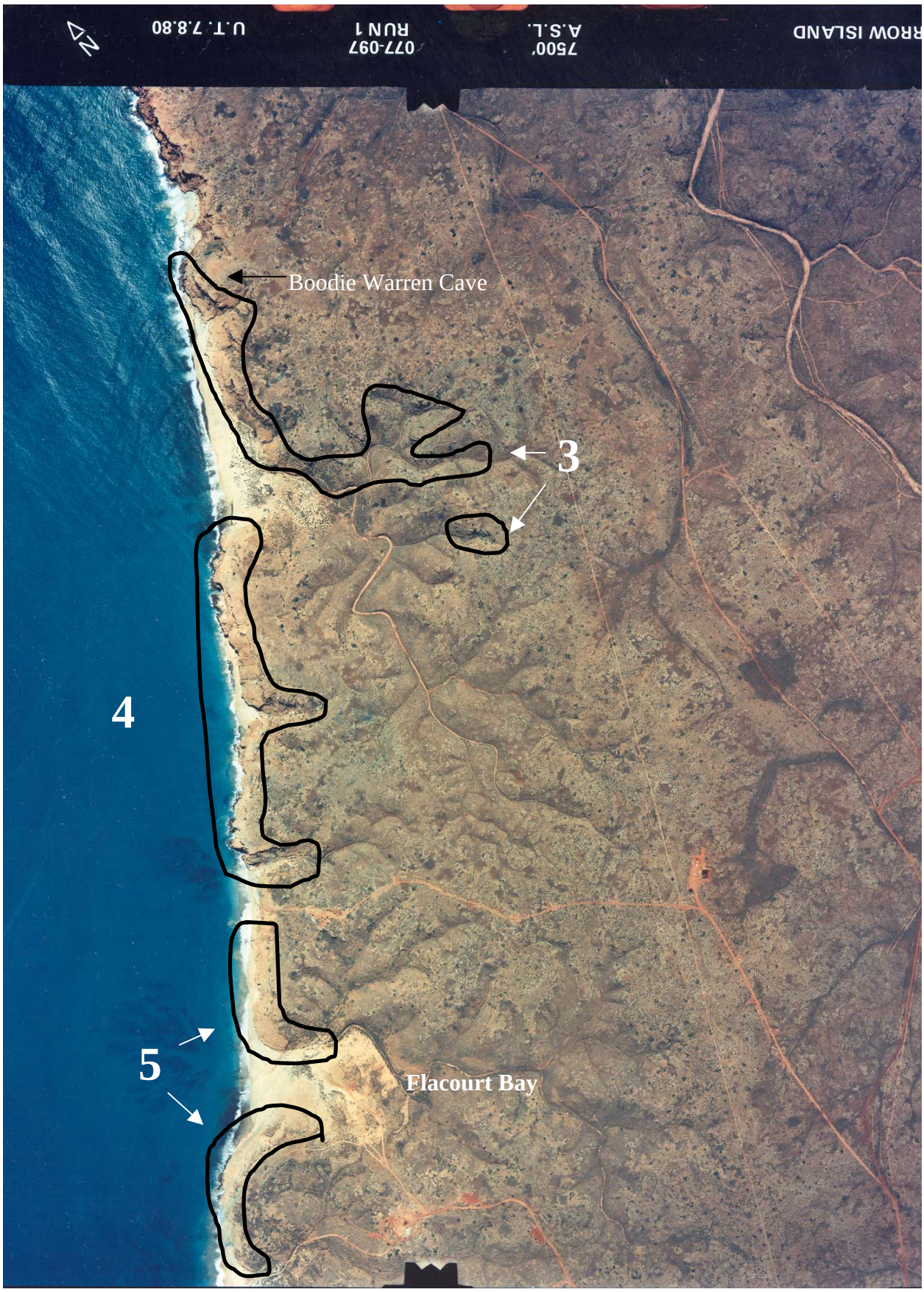

Photo 89


Kevron Aerial Surveys,
for Aeromapping
N
U.T. 7.8.80
077-097
RUN 1
7500'
A.S.L.
6
John
Wayne
Country

Photo 87

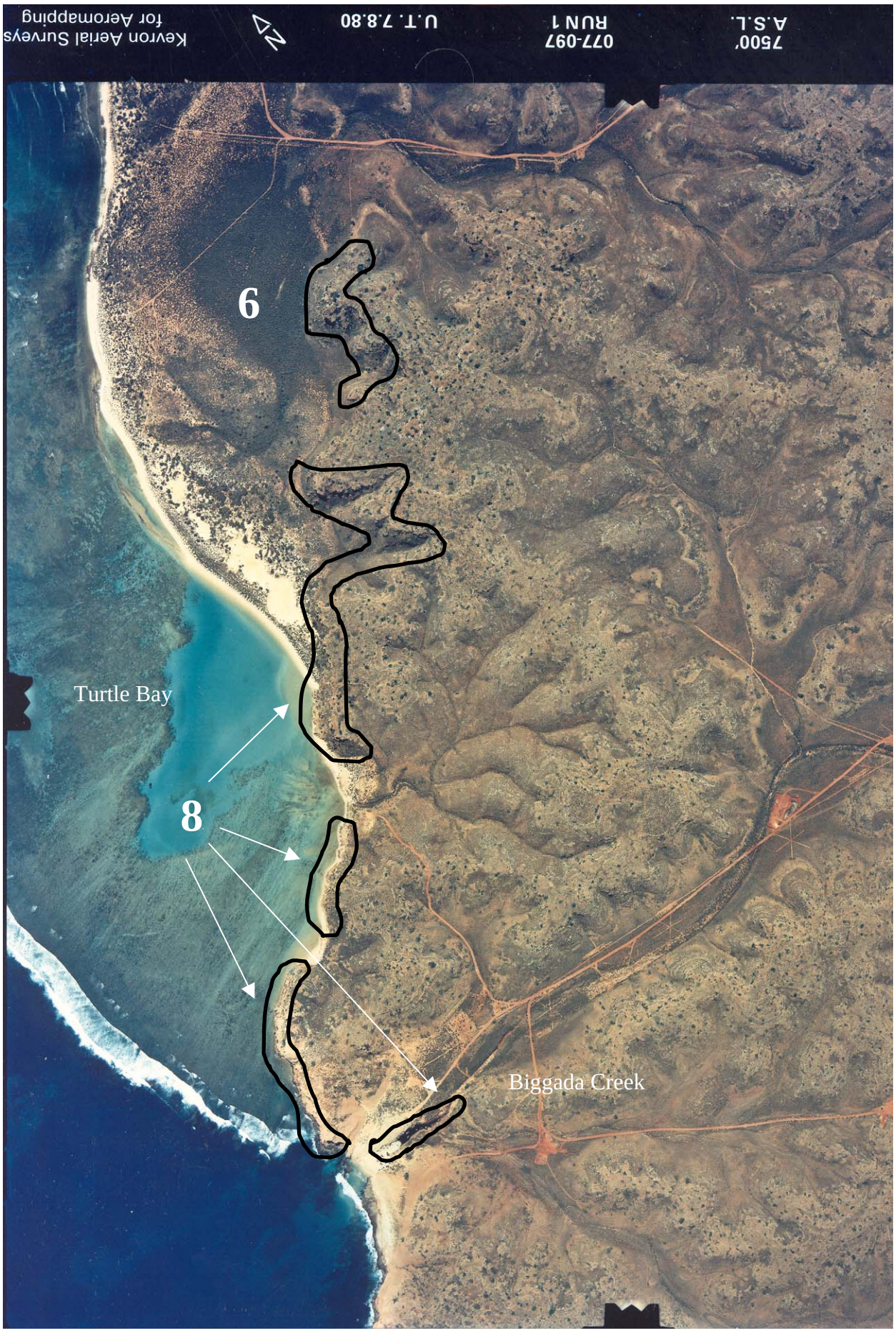
Kevron Aerial Surveys
for Aeromapping
U.T. 7.8.80
RUN 1
077-097
7500'
A.S.L.
6
8
Turtle Bay
Biggada Creek

Photo 85

Photo 85, inland

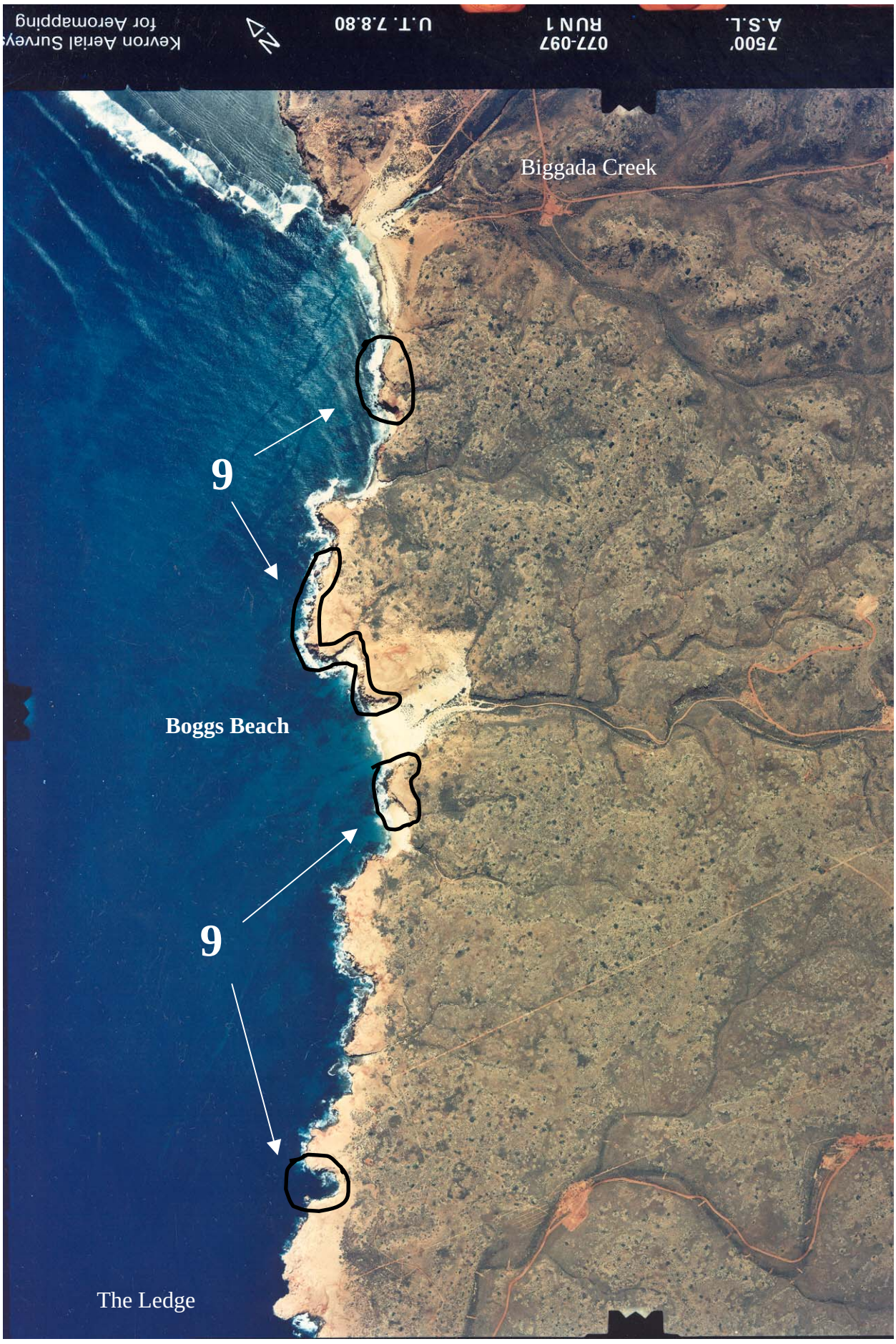

Photo 83