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Frogs of the Gibb River Road, Kimberley Division, Western Australia

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Abstract

Sampling the frog fauna along a 390 km transect between Derby and Gibb River Station resulted in the collection of 28 species; representing 74% of the frog fauna of the Kimberley Division. Three assemblages could be recognised: a ubiquitous group common to all sampling sites, one restricted to the area around Derby, and a further group confined to rocky creeks in the Phillips Range area. Comparison of the fauna of each site along the transect suggests that a major change occurs between Lennard River and the King Leopold Ranges.

Notes are provided on species representing significant range extensions. Morphometric and osteological data for *Uperoleia mjobergi* and *U. crassa*, and a summary of call variation in these two species and *U. lithomoda* are provided. *U. variegata* is referred to the synonymy of *U. lithomoda*.

Introduction

Since 1977 zoologists from the Universities of Adelaide and Melbourne have made eight visits to the Kimberley Division of Western Australia to study and collect frogs. The visits have occurred in the wet season, supplemented by two dry season visits by one of us (M.J.T.) to Derby and the Mitchell Plateau respectively. In consequence of these visits the known frog fauna of the Kimberley has been increased to its present figure of 38 species (Tyler, Smith and Johnstone 1984).

Previously, our collecting activity has occurred on the periphery of the Kimberley, but in January-February 1985 we travelled 390 km from Derby, in the south-western Kimberley, to Gibb River Station near the centre of the Division. A major purpose of the exercise was to examine the frog fauna, seeking the northern limits of distribution of the fauna of the Derby area which contains elements not known from other localities. (Tyler, Davies and Martin 1981a). We also were able to supplement biological knowledge of some of the species and, from a study of the collections made, add to knowledge of morphological and call variation.

Materials and methods

Details of transect

The transect extended along the entire length of the Gibb River Road. The road starts at the southern outskirts of the coastal town of Derby, 16 km SW of

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the town centre and trends north-east for a distance of 374 km to Gibb River Station in the centre of the Kimberley. It runs through high country separating the north-western coastal drainages (e.g. Isdell River) from the tributaries of the Fitzroy River, which initially trends south-east, and then west forming the southern boundary of the Kimberley.

Major geographic features of likely biogeographic significance to frog distribution are the King Leopold Range and the blacksoil plains at its southern flank, and the Phillips Range further inland (Figure 1). In addition, the creeks with rocky floors provide a habitat for species adapted to lotic conditions.

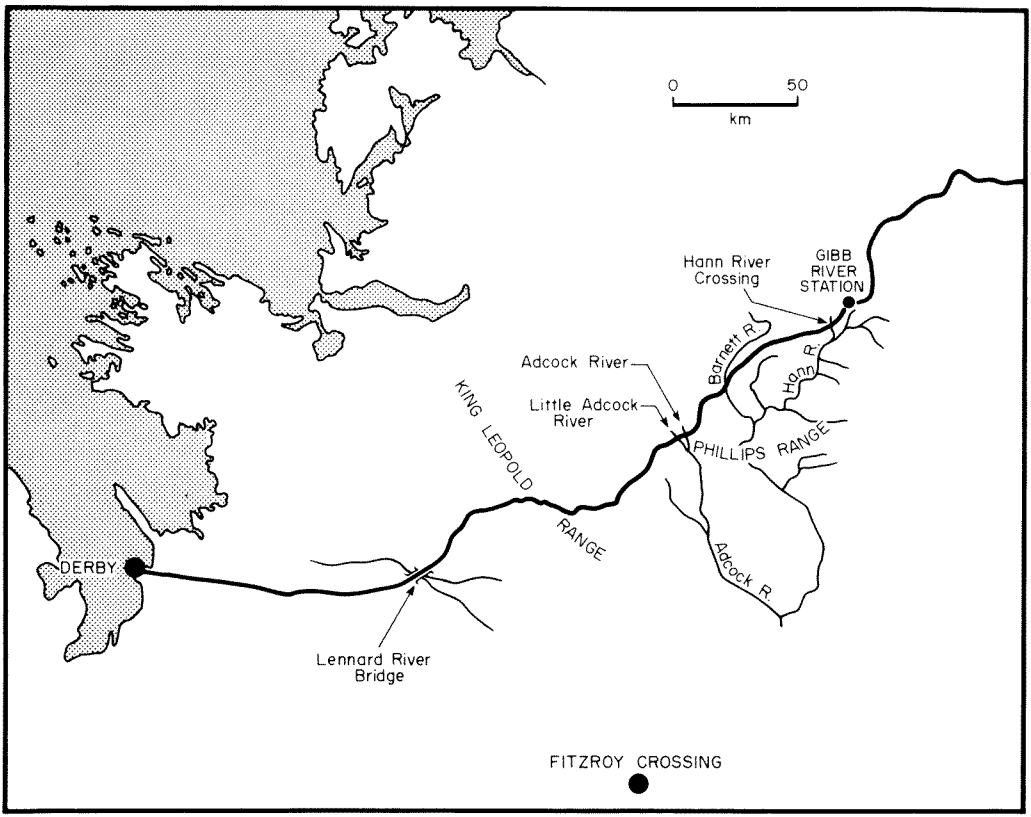

Figure 1 Gibb River Road, Kimberley Division, Western Australia. Collecting sites are indicated.

Collecting stations

Collecting stations were grouped into four separate geographic areas (see Figure 2):

Derby: Township to 40 km S. Roadside pools and gravel scrapes.

Lennard River: Gibb River road *c.* 30 km SW and NE of bridge over river. Open grassland largely inundated on our return journey.

Little Adcock River: Located at sourthern foot of Phillips Range. Boulder-strewn, with rocky floor. Adjacent areas of open grassland in undulating country. Collections principally at Little Adcock River and area 20 km N.

Gibb River Station: Collecting activities concentrated upon a recently-filled billabong adjacent to the homestead, supplemented by road transects to the north bank of the Hann River, 11 km SW of the station entrance.

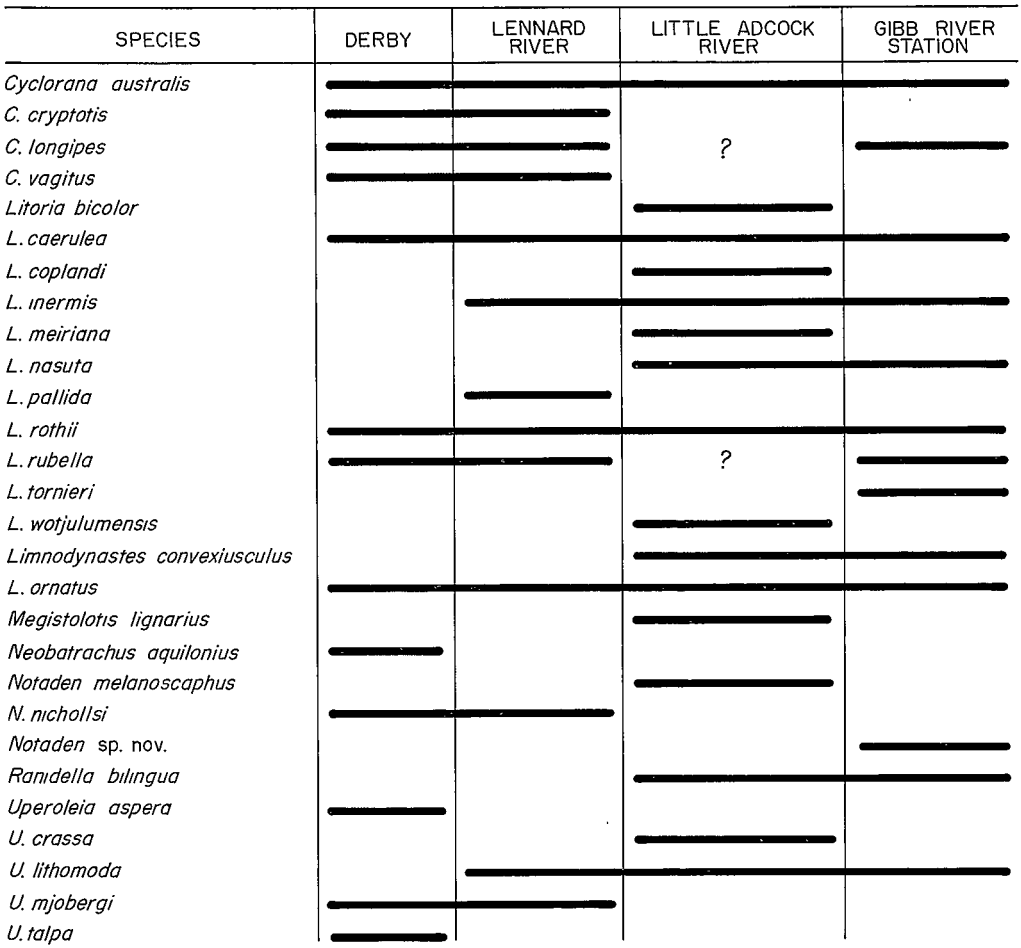

Figure 2 Distribution of species of frogs between Derby and Gibb River Station. Data for Derby are derived from Tyler *et al.* (1981a). Question marks indicate expectations of the occurrence of species, and may reflect inadequate collecting.

Collecting activities

Most specimens were collected at night either on the road, or located by their vocalisation from choruses in areas adjacent to the road.

Samples

Voucher specimens were taken wherever possible and are lodged in the collections of the South Australian Museum (SAM), University of Adelaide, Department of Zoology (UAZ) and Western Australian Museum (WAM).

Morphology

Methods of measurement follow Tyler (1968) and osteological descriptions follow Trueb (1979). Measurements are expressed as mean ± standard deviation with range in parentheses. Osteological specimens were cleared and stained for bone after the technique of Davis and Gore (1947) and for bone and cartilage after Dingerkus and Uhler (1977).

Call data

Male advertisement calls were recorded with either a Sony tape recorder (TC-510-2) or Sony cassette recorder (WM-D6) using either a Beyer M88 dynamic microphone or Sennheiser ME88 microphone head with K3U powering module. Wet-bulb air temperatures, measured close to the calling site of males were obtained with a Schultheis quick-reading thermometer. Calls were analysed using a digital processing oscilloscope (Norland 3001/DMX) after playback on a Revox B7711 stereo tape recorder or Nakamichi Dragon cassette deck.

Results

The 28 species found at the four major collecting sites are listed in Figure 2. The following species accounts are confined to those that represent significant extensions to known distributions, or for which we can now provide supplementary biological or morphological data.

Family: Hylidae

Cyclorana vagitus Tyler, Davies and Martin

Previous records of this species in the Kimberley have been confined to the Great Northern Highway between Derby and Kununurra. The species extends into the Northern Territory at Newry Station (Tyler *et al.* 1983). On 4 February 1985 a single adult male (SAM 29085) was collected 22.1 km N of the Lennard River bridge, following torrential rain.

Litoria inermis (Peters)

In the redefinition of the species by Davies, Martin and Watson (1983), WA records comprise Mitchell Plateau and sites around Kununurra. We encountered

the species calling at the Lennard River, Little Adcock River and Gibb River Station, so extending the known range of the species significantly.

The records comprise SAM R29089-90, WAM R94323-26: Gibb River Station 1-2.2.85; WAM 94327: 6.2 km NE Gibb River Station; WAM R94330: 7.4 km N Adcock River; WAM R94329: 0.6 km N Adcock River; WAM R94328: 22.1 km NW Lennard River.

Litoria pallida Davies, Martin and Watson

In the original description Davies *et al.* (1983) record the species from three sites in WA: between Broome and Derby and at Camballin and Kununurra.

These localities are bridged by our collection of a single specimen 15.4 km NW of Lennard River (WAM R94315).

Litoria tornieri (Nieden)

The two previous records of this species in WA are at Pago Mission Ruins, Mission Cove, Napier Broome Bay and Drysdale River N.P. (Davies *et al.* 1983). We collected a single specimen (WAM R94313) at Gibb River Station bridging the gap in this distribution.

Family: Leptodactylidae

Notaden melanoscaphus Hosmer

Throughout Australia the species of *Notaden* are allopatric. Within WA, records of *N. melanoscaphus* are confined to the area round Kununurra and Wyndham (Tyler *et al.* 1984, Fig. 56). We took a single specimen (WAM R94341) on 3 February 1985, 2.2 km N of Little Adcock River, so extending the known range of the species by 300 km W.

Notaden nichollsi Parker

This species is abundant at Derby which has been considered the northern limit of its distribution (Tyler *et al.* 1984). We obtained a single specimen (WAM R94340) on 4 February 1985, 15.4 km NW of the Lennard River. The significance of this locality is its proximity (133 km) to the site at which we obtained *N. melanoscaphus* (see above). This may represent the shortest distance between congeners.

Notaden sp. nov.

Two specimens of an undescribed species of *Notaden* (WAM R83428-29) were collected by Harry Ehmann 24 km NW of Mt Elizabeth HS, on 29 November 1982. A third specimen (WAM R77419) has been taken at Mitchell Plateau.

Uperoleia crassa Tyler, Davies and Martin

The only previous record of this species is the material from the type locality on the Mitchell Plateau (Tyler *et al.* 1981b).

We located a large chorus in flooded grassland 2.4 km N of Little Adcock River on 3 February 1985 (SAM R28839-59, WAM R94353-55, UAZ A869-70, B871). The site extends the geographic range of the species by 250 km and the specimens permit the following redefinition. Also examined was a topotype, UAZ B483, for comparison.

Redefinition

Small to relatively large species (males 17-30 mm S-V, females 30-31 mm S-V) lacking maxillary teeth; frontoparietal fontanelle moderately widely exposed; toes fringed with basal webbing; six carpal elements present; anteromedial processes of anterior hyale of hoid short and slender; no ilial crest; advertisement call a rasping note of 6-8 pulses, with a call repetition rate of 41 calls min^{-1}.

External morphology

The series of frogs from 2.4 km N of Little Adcock River is smaller in length than the type series and has relatively longer hind limbs (TL/S-V 0.35 ± .02 [0.31 - 0.40] as opposed to 0.32 ± .02 [0.29 - 0.35] in the type series). The eye to naris distance is greater than the internarial span (E-N/IN 1.28 ± .18 [1.00 - 1.75]).

Osteology

Nasals moderately well ossified, widely separated posteromedially in all specimens except UAZ B483 in which moderately separated. Anterior extremities of nasals not crescentic; maxillary processes truncate or acuminate in equal proportions. Frontoparietal fontanelle always widely exposed, frontoparietal elements moderately slender with no anteromedial divergence on orbital edges. Anterior extremities of these elements extend just beyond anterior extremities of sphenethmoid.

Epiotic eminences of crista parotica moderately developed and incompletely ossified in about two-thirds of material. Zygomatic ramus of squamosal tiny and bifid in one specimen. Otic ramus short in two-thirds of specimens and slightly longer in other one-third. Pars facialis of maxillary always shallow, preorbital process usually small but occasionally more prominent. Palatines moderately acutely angled to ventral sphenethmoid, reduced laterally to extent that do not extend beyond maxillary process of nasals.

Vomers absent. Anterior ramus of pterygoid in long contact with prominent pterygoid process of palatal shelf of maxillary. Medial process long, acute, in bony content with prootic region. Cultriform process of parasphenoid broad, but occasionally slightly more slender; alae at right angles.

No ilial crest developed. Dorsal prominence well developed and wedge-shaped. Dorsal protuberance laterally placed. Pubis calcified. Hoid plate longer than wide. Anteromedial processes of anterior hyale slender and short. Alary processes

of plate not pedunculate. Posterolateral processes moderately broad, moderately long. Posterior cornua ossified.

Carpus of six elements with considerable torsion. Three distal tarsal elements present. Distal prehallical element small and slender extending from 1/3 - 1/2 length of O. metatarsus I.

Male advertisement call

Comparative call data are given in Table 1. The call is a rasping note of 6-8 pulses with a call repetition rate of 41 calls/minute. A second call was recorded in the Phillips Range population of *U. crassa.* This call is given infrequently and has a similar number of pulses as the advertisement call but is of much shorter duration and thus has a higher pulse repetition rate (Table 1). The function of this second call type is not known.

Uperoleia lithomoda Tyler, Davies and Martin

This species is the most widespread and morphologically most variable member of the genus, ranging from the vicinity of Kununurra to northern Queensland and southern New Guinea (Tyler and Davies 1984).

The material obtained by us represents a significant extension of range further west: Gibb River Station (SAM R28744-56, WAM R94346-47) and 22.1 km NW of Lennard River (SAM R28757, WAM R94348-50).

Uperoleia variegata Tyler, Davies and Martin, (1981) was described from a series of specimens taken at Gibb River Station and characterised by a smooth to sparsely tubercular skin, poorly developed inguinal and coccygeal glands, a very poorly-exposed frontoparietal fontanelle, no carotid canal groove and basally-webbed toes.

The collection of additional specimens indicates that *U. variegata* is, in reality, conspecific with *U. lithomoda.* Davies, McDonald and Corben (1986) have examined external morphology and osteology of *U. lithomoda* across its entire range and have established the limits of diversity within the species. *U. variegata* falls within those limits, its external morphology being influenced by the fact that the type series was collected from underground during the dry season (Tyler, *et al.* 1981b) and hence glandular development was minimal.

The characteristics of the calls of *U. lithomoda* from Gibb River Station are shown in Table 1 together with comparative data from other sites. The advertisement calls of the population from the Gibb River Station show some differences to calls of *U. lithomoda,* principally in the reduction in number of pulses per note which, in these very short calls, results in a considerable lowering in pulse repetition rate (Table 1). The reduction in number of pulses appears to be a continuation of an east-west trend seen in comparisons between populations from Katherine, NT and Lake Argyle, WA (Table 1). Despite these structural differences, the overall similarity of calls from the population at Gibb River Station indicate that they are conspecific with *U. lithomoda.*

Table 1 Physical characteristics of calls of *Uperoleia crassa, U. lithomoda* and *U. mjobergi.* Where appropriate, mean values are given with ranges in parentheses.

Species and Locality	N	No. of Pulses	Duration (msec)	Pulse repetition rate (pulses/sec)	Call repetition rate (calls/min)	Dominant Frequency (Hz)	Wet bulb temperature (°C)
U. crassa							
Amax Mining Camp, Mitchell Plateau, WA*	7	7.3 (7-8)	173.4 (170-180)	41.9 (40.0-44.4)	-	2356 (2100-2800)	24.0
2.4 km N of Little Adcock River, WA+	5 (long call)	6.8 (6-7)	186.8 (169-203)	31.2 (25.9-35.5)	40.7 (38.5-42.9)	2540 (2400-2700)	29.0
	1 (short call)	6	55.0	90.9	-	2700	29.0
U. lithomoda							
6.4 km N of Katherine, NT**	3	5.3 (5-6)	16.3 (13.0-20.0)	342 (250-462)	-	3250 (3150-3400)	26.5
11.5 km N of Lake Argyle Village, WA**	5	4.6 (4-5)	11.6 (9.0-13.0)	401 (333-456)	-	3420 (3200-3600)	26.0
Gibb River Station, WA+	5	3.2 (2-6)	17.5 (15.8-21.3)	118.9 (62.5-234.7)	86.8 (72.0-96.2)	3020 (2900-3100)	24.2-26.3
U. mjobergi							
28 km S of Derby, WA++	3	22.1 (20-25)	225 (210-240)	98.1 (94.5-102.1)	-	3272 (3166-3350)	25.6
12.4 NW of Lennard River, WA+	1	22	123	170.7	34.0	3100	29.0

*Tyler *et al.* (1981b) +Present study **Tyler *et al.* (1981c) ++Tyler *et al.* (1981a)

We therefore refer *U. variegata* Tyler, Davies and Martin 1981 to the synonymy of *U. lithomoda* Tyler, Davies and Martin 1981.

Uperoleia mjobergi (Andersson)

Our records represent the most northerly for this species: 12.4 km NW of Lennard River, SAM R28865, 19.3 km NW of Lennard River, SAM R28860-2, WAM R94352; 27.9 km NW of Lennard River, SAM R28863-4. Previous records are clustered around Derby and the Fitzroy River (Tyler *et al.* 1981a).

Examination of this material allows the following redefinition.

Redefinition

A small species (males 19.0-25.1 mm S-V, females 21.0-23.0 mm S-V) possessing maxillary teeth; toes fringed but unwebbed; inguinal glands hypertrophied; prominent tubercle on ventral surface of proximal head of tarsus; frontoparietal fontanelle poorly to moderately exposed; carpus of six elements; anteromedial processes of anterior hyale of hyoid slender and short; no ilial crest; call a short rasp of 20-25 pulses with a pulse repetition rate of 94-170 pulses sec^{-1}.

Morphology

Uperoleia mjobergi is conservative morphologically. Snout short, slightly rounded or truncated when viewed from above in approximately equal numbers of specimens. Eye to naris distance slightly greater than internarial span (E-N/IN 1.12 ± .12 [1.00 - 1.31]).

Fingers moderately long, slender, slightly fringed, with prominent subarticular tubercles. Palmar tubercles vary in prominence: both can be prominent, neither prominent, or tubercle on heel of hand prominent. These three states occur in approximately equal proportions.

Hind legs moderately long (TL/S-V 0.35 ± .02 [0.32 - 0.38]). Toes moderately long, moderately fringed, unwebbed with conical subarticular tubercles. Both inner and outer metatarsal tubercles prominent. Inner metatarsal tubercle oriented along long axis of first toe, outer metatarsal tubercle angled slightly to long axis of foot. Prominent tubercle present on skin overlying ventral surface of proximal head of tarsus.

Parotoid, inguinal, coccygeal and submandibular glands always well developed; inguinal glands hypertrophied to extend along flanks. Pair of lyrate skin folds occasionally occur between scapulae. Ventral surface granular. Dorsum moderately rugose with prominent markings. Pigmentation usually absent ventrally, but if present in form of fine suffusion of granules.

Osteology

Material examined: UAZ A582, 18 km S Derby; UAZ A880-9, 28 km S Derby, WA.

Sphenethmoid not ossified medially and not in bony contact with nasals. Epiotic eminences of crista parotica moderately prominent and completely ossified.

Frontoparietal fontanelle poorly exposed, elongate with slight medial expansion but occasionally shows slightly greater exposure. Orbital edges of frontoparietal elements curved anteromedially. Anterior extremities of frontoparietals barely reach posterior level of sphenethmoid dorsally, leaving substantial expanse of sphenethmoid to form anteromedial rim of orbit.

Nasals triangular, moderately ossified, moderately separated medially. Anterior edges not crescentic; maxillary processes not acuminate. Palatines slender, elongate bones extending laterally beyond extremities of maxillary processes of nasals; either poorly or moderately angled to sphenethmoid medially. Parasphenoid moderately robust with slender cultriform process. Alae at right angles to cultriform process.

Anterior ramus of pterygoid in long contact with well-developed pterygoid process of palatal shelf of maxillary. Squamosal moderately robust with prominent knobbed zygomatic ramus, bifid in one specimen. Otic ramus moderately long.

Maxillary and premaxillary dentate; vomers absent. Pars facialis of maxillary shallow with extremely prominent preorbital process.

No ilial crest. Dorsal prominence papillate, very prominent. Dorsal protuberance lateral.

Hyoid plate about as broad as long. Anteromedial processes on anterior hyale slender and short. Alary processes of hyoid plate not pedunculate; posterolateral processes moderately long, moderately slender. Posterior cornua ossified.

Carpus of six elements. Little torsion occurs.

Three distal tarsal elements present. Distal prehallical element large, extending 2/3 length of O. metatarsus I.

Advertisement call

Comparative call data are presented in Table 1. The advertisement call of the individual recorded near the Lennard River is similar to published values for this species except that the note duration is shorter with a consequent increase in pulse repetition rate. Differences in temperatures at the recording sites (Table 1) may account for the observed differences in these temperature-dependent characteristics.

Discussion

With the suppression of *Uperoleia variegata* but recognition of the existence of an undescribed species of *Notaden,* the frog fauna of the Kimberley remains a total of 38 species. It follows that the collection of 28 species along the transect from Derby to Gibb River Station is a substantial component (74%) of that fauna.

The data in Figure 2 demonstrate that there are significant differences in the frog fauna at each of the sites examined, and that the fauna can be divided into a series of components. The first component comprises species common to all sites: *Cyclorana australis, Litoria caerulea, L. rothii, Limnodynastes ornatus* and probably

C. longipes and *L. rubella.* Each of these species has an extensive pattern of distribution throughout northern Australia.

Three species are restricted to the Derby area: *Neobatrachus aquilonius* (which also occurs at similar latitudes in the NT), *Uperoleia aspera* and *U. talpa,* one to the Lennard River site *(Litoria pallida),* whilst a further four species are common to the Derby and Lennard River sites but do not (on this transect) extend further north-west *(C. cryptotis, C. vagitus, Notaden nichollsi* and *U. mjobergi).*

The Little Adcock River site has more unique components (in terms of our transect) than any other examined. Seven species were located only there: *Litoria bicolor, L. coplandi, L. meiriana, L. wotjulumensis, Megistolotis lignarius, Notaden melanoscaphus* and *U. crassa.* The first five of those listed are typical inhabitants of permanent creeks in rocky country. In contrast, only two species are confined to the Gibb River Station site: *L. tornieri* and the *Notaden* sp. nov. from Mt Elizabeth, and only two species *(L. nasuta* and *Limnodynastes convexiusculus)* are restricted to Little Adcock River and Gibb River Station.

It follows that the major barrier to amphibian dispersal is situated between Lennard River and Little Adcock River. We consider the most significant feature in that area to be the blacksoil plains located west of the King Leopold Range, and approximately 60 km NW of Lennard River.

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