POPULATION STATUS OF THE RARE DRAGONFLY *PETALURUS HESPERIA* ON THE DARLING RANGE AND SWAN COASTAL PLAIN, WESTERN AUSTRALIA.

Notes and Papers 1994-1995

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CONTENTS

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MEMO TO: **Matt Williams**
SID, Como Research Centre
FROM: PAUL BROWN
DATE: 24 May, 1995
YOUR REF:
OUR REF: SR: 52/01
SUBJECT: **SURVEY FOR PETALURUS HESPERIA BY SWAN REGION**

As you are aware a volunteer Steven Bastick and myself did some preliminary survey for this rare dragonfly species during the summer of 1994/95. Sorry about the delay forwarding information through to you.

Attached is a copy of Steven Basticks report. This project appears to be uninspiring to anyone except a very keen entomologist or a very diligent student. Although I found the work interesting and support any further surveys you have in mind.

In addition, I have attempted to collate available information on sightings with one record per page. Several of these are a complete account (with maps) from our survey and an interview with Tom Burbidge I did. The others are just copied from the literature or from your notes. I believe if all observers filled out detailed sheets with appropriate maps the information would be mush more useful. For example, it was very difficult to relocate sites where previous observers sighted or collected *P. hesperia*.

I look forward to next summers survey work. I hope this species can be nominated as rare and endangered within two to three years. Good luck.

P H Brown

PAUL BROWN
PROGRAM LEADER, NATURE CONSERVATION

7 February 1995

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Hamersley
Perth WA 6022
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Paul Brown
Dept of CALM
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Dear Paul,

Please find enclosed the updated version of my report on Petalurus hesperia.

Thankyou for giving me the oppurtunity to assist in the surveying of the Petalurus hesperia. Although the project was less than exciting, the experience was well worth my time and gave me some insight into the nature of CALM's work. Furthermore, I thankyou for taking time to read and correct my report and hope that it is of some help to you and others.

If you are ever in need of assistance on any projects in the future do not hesitate to contact me.

Yours Faithfully,

S Bastick

STEVEN BASTICK

FILE: 52/01	
ACTION	INFO
	PB 16/2

An Update Of The Population Status Of Petalurus hesperia At Previously Identified Sites In And Around Perth

By Steven Bastick
January 1995

Summary

This report outlines the results of the investigation of previously recorded sites where the Petalurus hesperia has been sighted.

Introduction

Petalurus hesperia belongs to a small family of dragonflies that are the remnants of a once larger family that date back to Jurassic times when it is thought they were dominant in numbers (Watson, 1965). There are now only ten species recognised worldwide of which four exist in Australia. Of these four only P. hesperia exists in West Australia (Williams, 1993).

P. hesperia is the fourth largest dragonfly in the world and the male is recognised easily via the presence of a pair of petal-like appendages at the end of the tail. The female lacks the petal structures but is basically the same in size shape and markings. Other easily recognisable features are:

1. its size reaching 10cm in length and 9cm in wingspan and
2. the eyes which are separate and do not meet in the middle

The P. hesperia larvae are semi aquatic and live in burrows in peaty swamps or bogs. When they are fully grown the larvae climb out of the water onto reeds where the adult dragonfly emerges from the pupal skin (exuvae) (Watson, 1965). The exuvae left behind by the dragonfly can also be used as a sign of P. hesperia presence.

P. hesperia is very localised in distribution due to the need for specialised breeding areas and the sedentary nature of the adult. It is thought to be limited to the headwaters of a number of freshwater streams in the Darling Scarp. Hence P. hesperia's need for specialised habitat together with evidence of low population numbers at recognised sites (Williams, 1993) suggests that P. hesperia is rare and may even deserve to be classed as endangered.

3

Methods

The sites surveyed were selected from a list by Williams (1993) of areas where P. hesperia has been located historically.

The sites were visited between December 20 and December 30. At each site two to four hours were spent walking along the length of stream where the previously identified population was said to exist. P. hesperia does not necessarily exist directly next to te running water and has been found up to 100 metres away, hence surrounding vegetation was also surveyed. P. hesperia is generally not a hawking dragonfly and tends to spend a majority of its time perched on the vertical woody stems of trees and and large plants (Watson, 1965) so much effort was put in to the scrutiny of these features.

Summary of results

Manjedal Brook, Manjedal Scout Camp

This area (indicated on map 1) was surveyed on December 20 and December 22. The first survey yielded only three less than certain identifications of P. hesperia and the second visit resulted in one definite sighting of a male in an area where fast flowing water was present. These results when compared to numbers sighted in previous years may indicate that a decline in population has occurred however more research is required.

Lesmurdie

Three hours of surveying at this site on December 20 resulted in no P. hesperia being sighted. This may be a result of extensive degredation in flora, fauna and water quality due to encroaching urban development.

Bullcreek

This area (see map 2) was surveyed on December 20 and December 21. Two adults were sighted on the first visit (see map 2 for location) and none were seen on the second visit. This result suggests a decline in population numbers and enforces the assumption that populations of P. hesperia are dangerously low.

South Dandalup Dam and Serpentine Dam

These two sites were visited on December 30 and no sightings were recorded. However the large areas of both these sights and the large amount of streams present coupled with the sedentary nature of the species makes these results less than inconclusive.

A full report of methods used and results obtained from investigating the various sites

Manjedal Brook, Manjedal Scout Camp

Tuesday 20 December 1994

On the above date an initial check of the site was made by myself and Paul Brown. From 9.15 am to 11.15 am we surveyed the section of Mandejal Brook running from the dam, where the road leading to the BBQ site and camp crosses the brook, to the point where surrounding forest is succeeded by farmland (see map 1). The weather on this day was sunny, hot (25 - 32 deg. C), dry with a medium strength breeze present.

A possible sighting was made at 10am approximately 20m east of the flying fox cable. The exact location is indicated on map 1 and is marked sighting 1. However a 100% identification could not be made. The individual was perched on the vertical trunk of a Blackbutt (Eucalyptus patens) (50cm diameter) 1m from the waters edge, approximately 3m above the waters surface for approximately 10mins. The specimen was seen to have a pale cross striping on the abdomen, however this may have been mistaken for light reflecting of the segmentation of the body parts. The size and behavioural characteristics were all indicative of the P. hesperia. After leaving the tree the specimen landed on a large reed and then flew out of sight.

Two more less than 100% identification were made at 10.40am, 50m east of the first sighting. The exact location is given on map 1 and is marked sighting 2. The two dragonflies were seen flying together 2-3m above the ground for about 20secs in an area similar in vegetation to that of the first.

Another species of dragonfly was also sighted od this day at 10.30am. The individual had a light yellow body and tail tip. The leading edges of the wings were also yellow and the head and thorax a duller yellow brown. It was spotted flying 20-50m from the creeks edge on the Down road. It was not P. hesperia.

A second permanent stream 1.5km north of Mandejal Brook looked to have vegetation which may be suitable for P. hesperia habitat. However, only 1km of creek line was uncleared between clear private property blocks.

Thursday 22 December

On this date a second investigation of the same area of the brook was made between 11.00am and 3.00pm. The investigation was conducted by myself. The weather on this day was hot (approx. 40 deg C) and conditions were particularly good for species identification.

Despite the good conditions only one positive sighting was made. This occurred at 2.00pm when a large individual (approx 9cm in length) was sighted perched on the vertical stem of a small woody tree approximately 2m above the ground directly over a section of the brook where the water was flowing rapidly over a granite outcrop. The location of this sighting is indicated on map 1 and is marked as sighting 3. The individual was male and spent approximately 5 minutes perched on the stem before flying of to a distance of approximately 30m away from the stream. It then returned a few minutes later to the exact same perch.

Lesmurdie

Tuesday 20 December 1994

The area surveyed on this day was the length of creek in Whistle Pipe Gully from Lesmurdie Falls to approximately 300m upstream. The weather was hot and conditions good for P. hesperia sighting. The investigation was conducted by Paul Brown and myself. This area is surrounded by urban area and is showing extensive signs of degradation in flora fauna and water quality. The area was surveyed between 12.30pm and 1.30pm. No P. hesparia were sighted.

Bullcreek

Tuesday 20 December

The area surveyed on this day was the length of creek between Forster Court and the point where the creek meets the Canning River and was investigated by myself and Paul Brown. The weather was hot, sunny and dry. The survey was conducted between 1.45pm and 2.45pm. One definite sighting and capture was made and another sighting was also made. The specimen was captured on the northern side of the Leach Hwy in an open sandy area approximately 60m west of the creek, 5m out from the edge of the remnant vegetation and 100m from the edge of Leach Hwy (see map 2). The captured specimen was seen perched on the stem of a replanted bush and 1m above the ground. The specimen was male as indicated by the petal-like apendages at the rear of the abdomen.

The second individual was sighted about 10m north of the first (see map 2) perched 1m above the ground on a wooden post. It had no petal structures indicating that it was female and was slightly larger than the first.

Wednesday 21 December

On this day the area was surveyed, by myself, between the hours of 10.30am and 3.00pm. No P. hesperia were sighted on this day indicating that population numbers are extremely low. This decline in numbers from previous years could be explained by extensive urban development in the area. Also no specimens were observed at the location, that was previously pin-pointed by JAL Watson (1957), adjacent to Rossmoyne Senior High School. A possible explaination for the lack of P. hesperia at this

location could be that the area has recently been subject to fire.

South Dandalup Dam

Friday 30 December

On this day an investigation of some of the streams that feed South Dandalup Dam from the north was made by myself and Travis Edwards. The conditions on this day were extremely hot (approx 40 deg C) and good for sighting of P. Hesperia. Between the hours of 10.00am and 1.00pm we searched the areas around the streams that are accessible from North East Road. No sightings were made however the inaccessibility of these areas coupled with the sedentary nature of the species makes the drawing of any conclusions from the lack of sightings impossible.

Serpentine Dam

Friday 30 December

On this day an investigation of some of the streams that feed the northernmost spur of the Serpentine Dam was made by myself and Travis Edwards. These watercourses are accessible via the Solus Road which runs of the Albany Highway. This investigation was conducted from 2.00pm to 5.00pm and as in the other investigation made on this day at South Dandalup Dam no sightings were made but this result is inconclusive.

References

Watson, J.A.L., (1965). Petalurids Most Primitive Living Dragonflies. Animals Magazine, Vol 6 (5), 128-131.

Williams, M.R., (1993). Conservation Status of Petalurus hesperia Watson in Western Australia. Unpublished report to CALM.

POPULATION STATUS OF *PETALURUS HESPERIA*

Summary Sheets compiled from Literature

1994-1995

Paul H. Brown

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Dr. J.A.L. (Tony) Watson, Division of Entomology, CSIRO Canberra
L. M. Saunders, Zoology Department, University of Western Australia

Date: 04 December 1957 - 25 specimens

Site: Bull Creek

Collection: Zoology Department, University of Western Australia

Details: Four male (1 teneral), one female (teneral) and 20 exuviae (9 male and 11 female) collected at Bull Creek Riverton.
At Bull Creek it breeds in swampy ground alongside the creek itself. The swamp is densely vegetated with *Lepidosperma*, *Gahnia*, *Cladium* and other rushes under a brocken tree cover of *Melaleuca*, *Agonis* and *Eucalyptus*. The swamp contains a black peaty mud which is kept wet throughout the year by seepage from the adjacent hill slopes.
At all three localities Watson (1958) found *P. hesperia* lives in association with other mud-dwelling Odinata: *Argiolestes pusillus* Tillyard, *Synthemis macrostigma occidentalis* Tillyard, *Orthetrum caledonicum* (Brauer) and *Nannophya dalei occidentalis* (Tillyard).

Comments:

Notes: From notes within Watson (1958)

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Dr. J.A.L. (Tony) Watson, Zoology Department, University of Western Australia

Date: 04 - 07 December 1957

Site: Bull Creek

Collection: Western Australian Museum No. 1958-4 (Allotype female) 4/12/57
Western Australian Museum No. 1958-6 (Allotype exuviae male) 7/12/57

Details: Allotype female and allotype exuviae specimens found at Bull Creek, Riverton, 6.5 miles south of Perth.
At Bull Creek it breeds in swampy ground alongside the creek itself. The swamp is densely vegetated with *Lepidosperma*, *Gahnia*, *Cladium* and other rushes under a brocken tree cover of *Melaleuca*, *Agonis* and *Eucalyptus*. The swamp contains a black peaty mud which is kept wet throughout the year by seepage from the adjacent hill slopes.
At all three localities Watson (1958) found *P. hesperia* lives in association with other mud-dwelling Odinata: *Argiolestes pusillus* Tillyard, *Synthemis macrostigma occidentalis* Tillyard, *Orthetrum caledonicum* (Brauer) and *Nannophya dalei occidentalis* (Tillyard).

Comments:

Notes: From notes within Watson (1958)

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Tom E. Burbidge,
CALM Science and Information Branch, COMO. Phone: 3340305

Date: A single adult Male specimen collected 12 December 1991, 08.30 pm

Site: Bull Creek

Collection: Personal collection (T.E. Burbidge)

Details: Specimen collected at the main door way to the All Saints College chapel door 300-400 m south of intersection between Bull Creek and Leach Highway. Specimen was alive when caught at about 08.30 pm on the main door post to the chapel. It did not move, possibly because of the cooler temperatures at that time of night. Tom thought it was attracted to the chapel lights (including a large spotlight on the chapel cross) which are kept on every evening between sundown and midnight.

Comments: Tom Burbidge uses the chapel regularly, but has not seen a Western Petalura Dragonfly previously or since. He has never actively searched for the dragonfly at the Bull Creek or any other site.

Notes: Paul Brown discussed this issue with Tom Burbidge on the morning of 23 December 1994 and compiled these notes from that discussion. Notes completed 24 December 1994.

WESTERN PETALURA DRAGONFLY COLLECTION/OBSERVATION RECORD

Collector: Paul Brown, CALM Swan Region Kelmscott. Phone: 3905977
Steven Bastick, CALM Volunteer, 538 Beach Rd, Hamersley, WA 6022.
Phone 4474969

Date: Tuesday 20 December 1994, 1.45 - 2.45 pm.

Site: Bull Creek

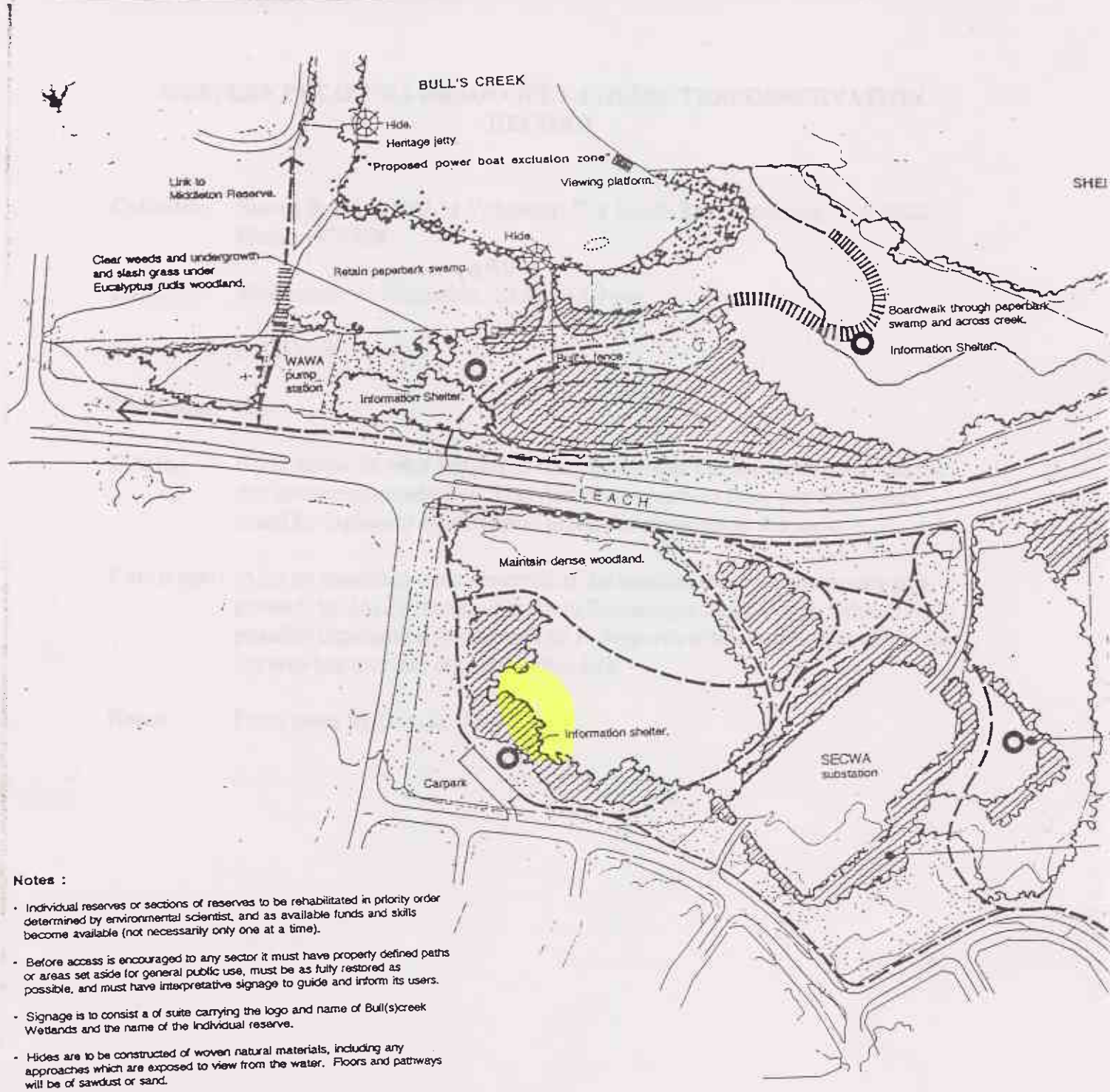
Collection: CALM Como

Details: The area surveyed on this day was the length of creek between Forster Court and the point where the creek meets the Canning River. The weather was hot sunny and dry. A specimen of *P. hesparia* was captured on the northern side of the Leach Hwy in at open sandy area approximately 60 m west of the creek 5 m out from the edge of the remnant vegetation and 100 m from the edge of Leach Hwy (Map 2). The capture specimen was seen perched on the stem of a replanted bush about 1 m above the ground. The specimen was male as indicated by the petal-like appendages at the rear of the abdomen.

A second individual was sighted about 10 m north of the first (Map 2). It was perched 1m above the ground on a wooden post. It had no petal structures and was slightly larger than the first, thus we believe it was a female.

Comments:

Notes: From notes by Bastick (1994)



Notes :

- Individual reserves or sections of reserves to be rehabilitated in priority order determined by environmental scientist, and as available funds and skills become available (not necessarily only one at a time).
- Before access is encouraged to any sector it must have properly defined paths or areas set aside for general public use, must be as fully restored as possible, and must have interpretative signage to guide and inform its users.
- Signage is to consist a of suite carrying the logo and name of Bull(s)creek Wetlands and the name of the individual reserve.
- Hides are to be constructed of woven natural materials, including any approaches which are exposed to view from the water. Floors and pathways will be of sawdust or sand.
- Sections of path that are to be used as weed and fire barriers may be installed prior to more overt encouragement of public access.
- Weed eradication will require professional involvement in some cases. Others may be undertaken by community groups including schools, all under the direction of an environmental scientist.
- Planting will also be directed by an environmental scientist and will adhere specifically to original vegetation associations unless particular functions cannot be fulfilled by those species.
- Grass area on west side of Bullcreek Reserve to act as buffer between residential edge and streamline vegetation, and to act as a fire break (in both directions).
- In the upper reaches of Bull's Creek there should be a power boat exclusion zone. The Swan River Trust has no authority to impose such a restriction but its act is up for review and the opportunity should be taken to amend it to enable the Trust to establish and police such zones.

0 20 40 100M

CONCEPT PLA

BULLCREE

AP

WESTERN PETALURA DRAGONFLY COLLECTION/OBSERVATION RECORD

Collector: Steven Bastick, CALM Volunteer, 538 Beach Rd, Hamersley, WA 6022. Phone 4474969

Date: Wednesday 21 December 1994, 10.30 - 3.00 pm

Site: Bull Creek

Collection: N/A

Details: No *P. hesperia* were sighted. It may appear that the population numbers at this site areextremely low. This decline in numbers from previous years could be explained by extensive urban development in the area.

Comments: Also no specimen were observed at the location that was previously pin-pointed by JAL Watson, adjacent to Rossmoyne Senior High School. A possible explanation for the lack of *P. hesperia* at this location could be that the area has recently been subject to fire.

Notes: From notes by Bastick (1994)

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Miss M. Hawkin (or Hawking)

Date: 10 November 1956

Site: Lesmurdie

Collection: Zoology Department, University of Western Australia (Paratype male)

Details: This paratype male specimen was found at Lesmurdie, 12-13 miles east south east of Perth. Only a single male specimen was obtained.
This is the original specimen described by Watson (1957). It was obtained in open fields adjacent to the boggy headwaters of Woodlupine Brook, Lesmurdie. Similar habitat to the Karragullen site where Watson found the holotype (Watson 1958).
At all three localities Watson (1958) found *P. hesperia* lives in association with other mud-dwelling Odinata: *Argiolestes pusillus* Tillyard, *Synthemis macrostigma occidentalis* Tillyard, *Orthetrum caledonicum* (Brauer) and *Nannophya dalei occidentalis* (Tillyard).

Comments:

Notes: From notes within Watson (1957) and Watson (1958)

WESTERN PETALURA DRAGONFLY OBSERVATION RECORD

Collector: Paul Brown, CALM Swan Region Kelmscott. Phone: 3905977
Steven Bastick, CALM Volunteer, 538 Beach Rd, Hamersley, WA 6022.
Phone 4474969

Date: Tuesday 20 December 1994, 12.30 - 1.30 pm.

Site: Lesmurdie

Collection: N/A

Details: The area surveyed on this day was the length of creek in Whistle Pipe Gully from Lesmurdie Falls to approximately 300 m upstream. The weather was hot and conditions good for *P. hesperia* sighting. This area is surrounded by urban area and is showing extensive signs of degradation in flora, fauna and water quality. No *P. hesparia* were sighted.

Comments: However other species of dragonflies were recorded and one specimen was captured. The first dragonfly seen possessed white wing tips a thin black abdomen with yellow bands and a brown head It was perched on a wild oat 30 cm above the ground 30 m west of the picnic site. The captured specimen is yet to be described.

Notes: From notes by Bastick (1994).

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Dr. J.A.L. (Tony) Watson, Zoology Department, University of W.A.

Date: 30 November 1957 (Paratype); 01 December 1957 (Holotype)

Site: South west of Karragullen

Collection: Western Australian Museum No. 1958-3 (Holotype male)
Zoology Department, University of Western Australia (Paratype male)

Details: This holotype and paratype male specimen found 1.75 miles south west of Karragullen and 13.5 miles south east of Perth. Grid reference 102294 on Kelmscott 1 mile per inch map.
At Karragullen the insects were found in a permanent, partially cleared, swamp bordering a spring. The cleared portion was under grass, with isolated patches of *Scirpus* and *Gahnia*, but the uncleared area supported dense thicket of the tea tree *Agonis*.
At all three localities Watson (1958) found *P. hesperia* lives in association with other mud-dwelling Odinata: *Argiolestes pusillus* Tillyard, *Synthemis macrostigma occidentalis* Tillyard, *Orthetrum caledonicum* (Brauer) and *Nannophya dalei occidentalis* (Tillyard).

Comments:

Notes: From notes within Watson (1958)

WESTERN PETALURA DRAGONFLY OBSERVATION RECORD

Collector: Magnus Peterson, private contractor associated with the W.A. Museum.

Date:

Site: Karragullen

Collection: N/A

Details: Magnus Peterson has visited this locality, but found that the streamside vegetation had been cleared for agriculture and that the population is unlikely to persist.

Comments:

Notes: From notes within Williams (1993).

WESTERN PETALURA DRAGONFLY OBSERVATION RECORD

Collector: Dr. Allen Davies

Date: 1990

Site: Manjedal Brook (Scout Camp)

Collection:

Details: Comparatively large numbers, about 20, were seen in 1990.

Comments:

Notes: From notes within Williams (1993).

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Dr. J.A.L. (Tony) Watson, Division of Entomology, CSIRO Canberra

Date:

Site: Manjedal Brook (Scout Camp)

Collection:

Details: Dr. Watson collected a single exuviae at this site in summer 1991.

Comments:

Notes: From notes within Williams (1993)

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Matthew R. Williams, CALM Science and Information Division, Como. Phone: 3340399

Date: 8 January 1993

Site: Manjedal Brook (Scout Camp)

Collection:

Details: Four specimens collected. Comparatively large numbers, about 20, were seen.

Comments:

Notes: From notes within Williams (1993)

Manjedal

Thesperia rate

① 7km+ Road on right

② +1·5km "

in to 1km

in original

ie 1 square

= 1km²

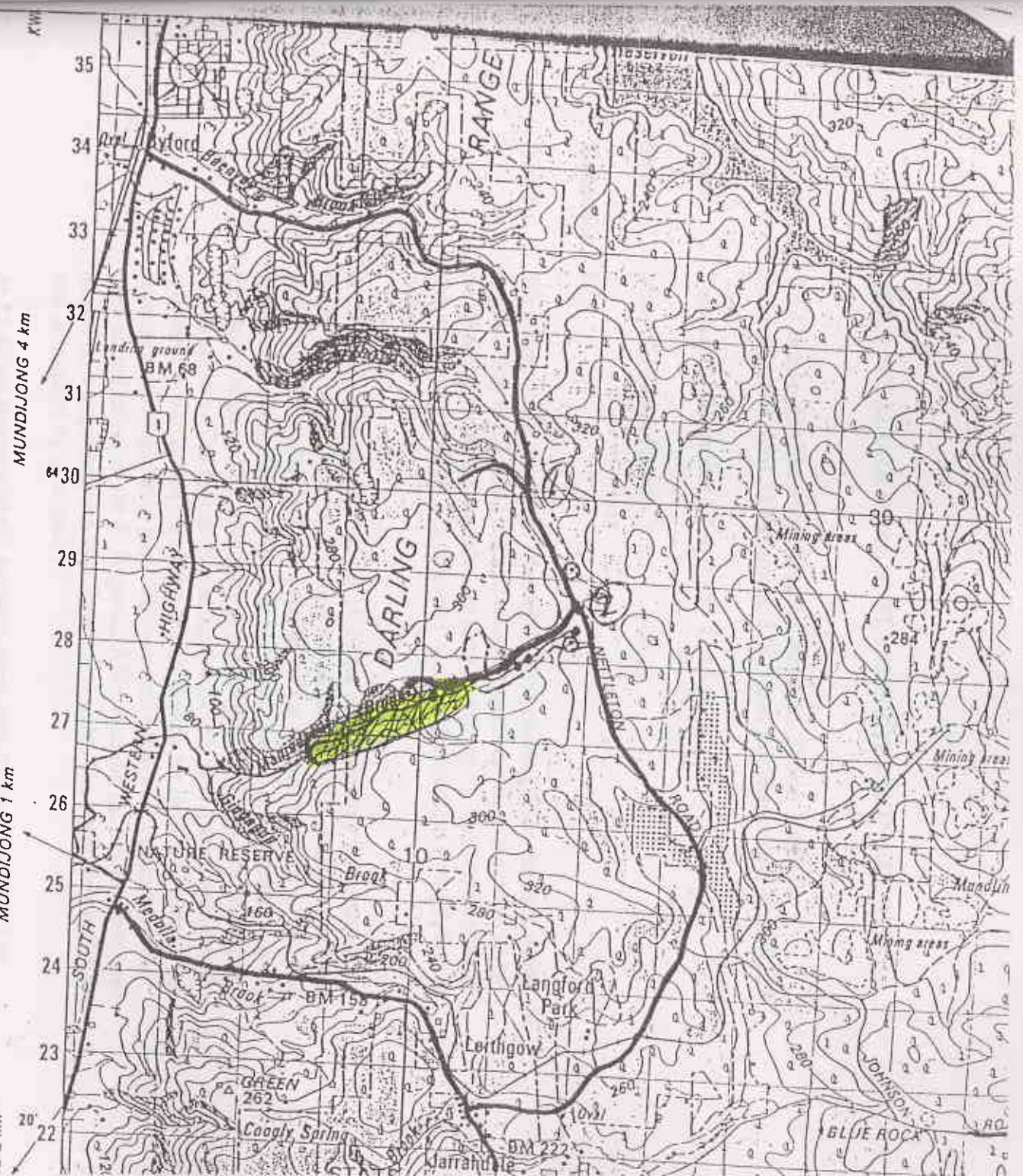
• Dam

⊙ Building

approx ~~Thesperia~~

a) where road to dam & BBQ site & camp crosses Manjedal brook

b) From dam, walk along track E to



WESTERN PETALURA DRAGONFLY OBSERVATION RECORD

Collector: Paul Brown, CALM Swan Region Kelmscott. Phone: 3905977
Steven Bastick, CALM Volunteer, 538 Beach Rd, Hamersley, WA 6022.

Date: Tuesday 20 December 1994, 9.15 - 11.15 am

Site: Manjedal Brook (Scout Camp)

Collection: N/A

Details: We surveyed the section of Mandejal Brook running from the dam where the road leading to the BBQ site and came cross the brook to the point where surrounding forest is succeeded by farmland (Map 1). The weather of this day was sunny hot (28 - 32 degrees C), dry and a medium strength breeze was present.

A possible sighting was made at 10.00 am approximately 20 m east of the flying fox cable. The exact location is indicated on Map 1 and is marked as sighting 1. The individual was perched on the vertical trunk of a blackbutt for approximately 10 minutes. The blackbutt was 50 cm diameter, 1 m from the waters edge and the dragonfly perched approximately 3 m above the waters surface. The specimen was seen to have a pale cross striping on the abdomen, however this may have been mistaken for light reflecting of the segmentation of the body parts. The size and behavioural characteristics were all indicative of the *P. hesperia*. After vacating the tree the specimen landed on a large reed and then flew out of sight. The vegetation in the area was dominated by specimen 1.

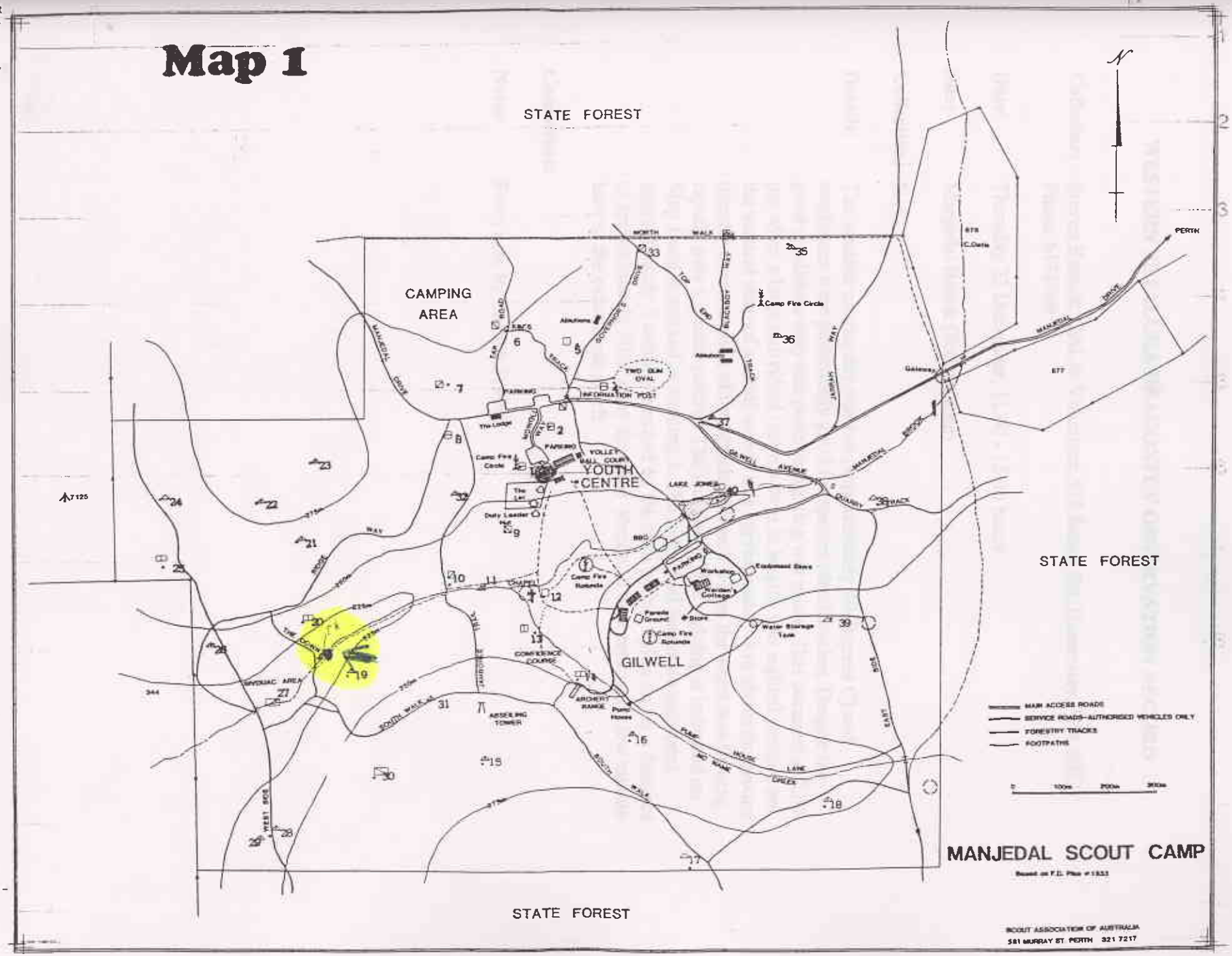
At 10.40 am two possible *P. hesperia* were seen flying together 2-3 m abovethe ground for about 20 seconds in an area 50 m east of the first sighting. The second site had similar vegetation to that of the first. As the two dragonflies where in flight 100% identification counld not be made. The exact location is given on Map 1 and is marked sighting 2.

Another species of dragonfly was also sighted on this day at 10.30 am. The individual had a light yellow body and tail tip. The leading edges of the wings were also yellow and the head and thorax a dulled yellow brown. It was spotted flying 25 - 50 m from the creeks edge on the Down Road. We believe it was not *P. hesperia.*

Comments: A second permanent stream 1.5 km north of Mandejal Brook appeared to have remnant vegetation that looked suitable for *Petalurus hesperia* habitat. However, only 1 km of creek line remained bushland between cleared private property blocks.

Notes: From note by Bastick (1994).

Map 1



1	Y	R
2		R S
3	R	B
4		B S
5		B
6	Y	S
7	Y	B
8		K S
9	S	Y
10	B	Y
11	B	K
12		B
13	Y	K.
14	Y	R
15	G	Y
16	B	R
17		B
18	Y	B
19	Y	S
20	K	B
21	Y	S
22	R	B
23	B	K
24		B
25	K	R
26	S	Y
27	Y	R
28	R	K
29	K	Y
30	R	B
31	K	R
32	Y	K
33	Y	R
34	R	B
35	B	Y
36	Y	S
37	S	Y
38		R
39	Y	S
40	K	B

Colour Code :-
Y = Yellow
K = Khaki
R = Red
B = Blue
S = Silver or Grey

WESTERN PETALURA DRAGONFLY OBSERVATION RECORD

Collector: Steven Bastick, CALM Volunteer, 538 Beach Rd, Hamersley, WA 6022. Phone 4474969

Date: Thursday 22 December, 11.00 - 15.00 hours

Site: Manjedal Brook (Scout Camp)

Collection: N/A

Details: The weather on this day was hot (approximately 40 degrees C) and conditions were particularly good for species identification. Despite the good conditions only one positive sighting was made. This occurred at 2.00 pm when a large individual (approx 9cm in length) was sighted perched on the vertical stem of a small woody tree approximately 2 m above the ground directly over a section of the Mandejal Brook where the water was flowing rapidly over a granite outcrop The location of this sighting is indicated on Map 1 and is marked as sighting 3. The individual was male and spent approximately 5 minutes perched on the stem before flying on for a distance of approximately 30m away from the stream. It then returned a few minute later to the exact same perch.

Comments:

Notes: From note by Bastick (1994).

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Jan C. Taylor

Date: 5 January 1993 - Single specimen collected

Site: East of Alcoa alumina refinery near South Danalup Dam

Collection:

Details: From the Pinjarra Alumina Refinery Road, branching up the scarp along North Spur Road. Turn north up Scarp Road for about 2.5 km to where it crosses the fast flowing clear stream (Boomer Brook, tributery of Dardanup River). About 20 adults.

Comments: Also observed adults at this site on 16 December 1992 although he indicated that they were less plentiful on the first visit that the second.

Notes: From letter from Jan Taylor dated 7 January 1993 and notes within Williams (1993)

1 Gold Mine Hill

Gold Mine Hill gives sweeping views over the coastal plain towards Ma[illegible]rah, but is perhaps better known locally as the site of North Dandalup's last gold rush. Mine shafts and diggings can still be found in the undergrowth surrounding the picnic area, and chunks of quartz quarried by the miners are strewn over the ground. No gold was found.

2 Whittaker's Scarp Mill

This old millsite five kilometres from North Dandalup on Whittaker Road provides an open area suitable for camping.

3 Oakley Dam

Originally built in 1939 to provide water for the steam locomotives at Pinjarra, Oakley Dam [illegible] the western [illegible] the Darling Scarp. The dam overlooks the [illegible] Alumina Refinery [illegible] gives a panoramic view of the coastal plain. There [illegible] areas and [illegible] the dam site.

4 South Dandalup Dam

South Dandalup Dam supplies domestic water to Perth, and has the largest capacity in the Water Authority system.

A picnic area with barbecues, a lookout and a walk track near the dam wall are provided and maintained by the Water Authority.

5 Dwellingup

The major forest town in the northern jarrah forest, Dwellingup was first established in the latter years of the nineteenth century as a timber milling town. Nearly all the original buildings were destroyed in a fierce bushfire which swept through the area in 1961, leaving only the hotel and a few other houses unscathed.

Dwellingup is still the centre of the timber industry in this area but is gradually assuming importance as a stop-over for travellers enroute to the forest recreation areas in the Lane Poole Reserve and surrounding district.

6 Scarp Lookout

A shaded parking area, tables and barbecues are set on the edge of the Darling Scarp. From the lookout the forested slopes of the scarp descend to the coastal plain and the farming country b[illegible].

7 Scarp Pool

Scarp Pool is a popular picnic and swimming area designed for day-use only. A [illegible] several barbecues and tables is located [illegible] over[illegible] the Murray River. Walk tracks lead down to the swimming hole, and a canoe launching area is provided near the lower car park. The roads leading to [illegible] are steep and should be negotiated with care.

8 Baden Powell

[illegible] Powell is divided into two sections, one for camping and one for day-use. There are tables and barbecues in the shade on the river bank overlooking [illegible]. Steps down the steep bank have been provided for swimmers. [illegible] camping area is situated [illegible].

9 Charlie's Flat

[illegible] bays are provided on a one-way [illegible] to each bay is [illegible] site, barbecue and table, surrounded by vegetation and secluded from [illegible]. The tent sites are shaded by tall trees and shrubs, and those on the [illegible] side overlook the steep banks of the Murray River. Toilets are [illegible] near the access road.

10 Island Pool

[illegible] Pool is a day-use area. Parking spots [illegible] the shade [illegible] the river [illegible] is perfect for swimming. Barbecues and tables are sited on the [illegible] with an attractive view [illegible] walk trail leads up the [illegible] to a scenic lookout.

11 Tony's Bend

[illegible] Bend is a campsite designed for individual tents. Bays are provided on a [illegible] road, each with its own tent site, fireplace and table.

12 Nanga Mill

[illegible] Mill was once the site of a jarrah sawmill [illegible] down in the 196[illegible]. The remains of the log landing platform and the workers' houses can [illegible] seen. Toilets, fireplaces and tables are located beneath tall pines and [illegible] plenty of dead wood in the surrounding forest for cooking fires. [illegible] Brook flows down into the Murray River, not far from the campsites, and [illegible] northern side an adventure playground [illegible] leads through the forest [illegible].

13 Yarragil

[illegible] overlooking the Murray River, shaded by tall trees and ideal for [illegible] canoes.

14 Nanga Townsite

[illegible] townsite is half a kilometre west of Nanga Mill. The area is open and [illegible] for the most part, with clumps of young marri and jarrah shading parts [illegible] area. The site is recommended for group camping. Fireplaces, tables and [illegible] are provided. A forest walk trail leaves the campsite and meanders up [illegible] the jarrah forest for two kilometres until it joins Nanga Road.

15 The Stringers

[illegible] and tables are situated in shaded areas near the parking bays, and [illegible] are provided on site. A series of broad steps leads 25 metres down the slopes of the river banks to a canoe launching pad. A trail leads along the [illegible] to various swimming holes.

WESTERN PETALURA DRAGONFLY COLLECTION RECORD

Collector: Jan C. Taylor

Date: 7 December 1994

Site: Logue Brook Dam

Collection: N/A

Details: Site is inland from Yarloop, not far from Logue Brook Dam. It is where the tributary of the Harvey River crosses the Nanga Road, some 1.5 km north of the junction with Willowdale Road and 2.2 km south of Driver Road. CALM Murray 1:50,000 plan, reference 63DL, adjioning ref tree 4.

Appears a fairly typical forest stream without any obvious extensive spring-fed boggy area, although the flow east is impeded by granite near the surface where the road crosses. The dragonflies are typically difficult to see until I got my eye in and could pick them up settling on vertical woody stems and small tree trunks in open areas. I found 4-5 *P. hesperia* altogether. the dense growth near the stream has tube like mammal tracks - quokkas or bandicoots.

Comments: J. Taylor first observed adult *P. hesperia* at this site in December 1988. However could not remember exactly its location until he relocated it on this visit. He indicates that he "missed it before because the vegetation had grown up so much."

Notes: From letter by Jan Taylor of 8 December 1994.

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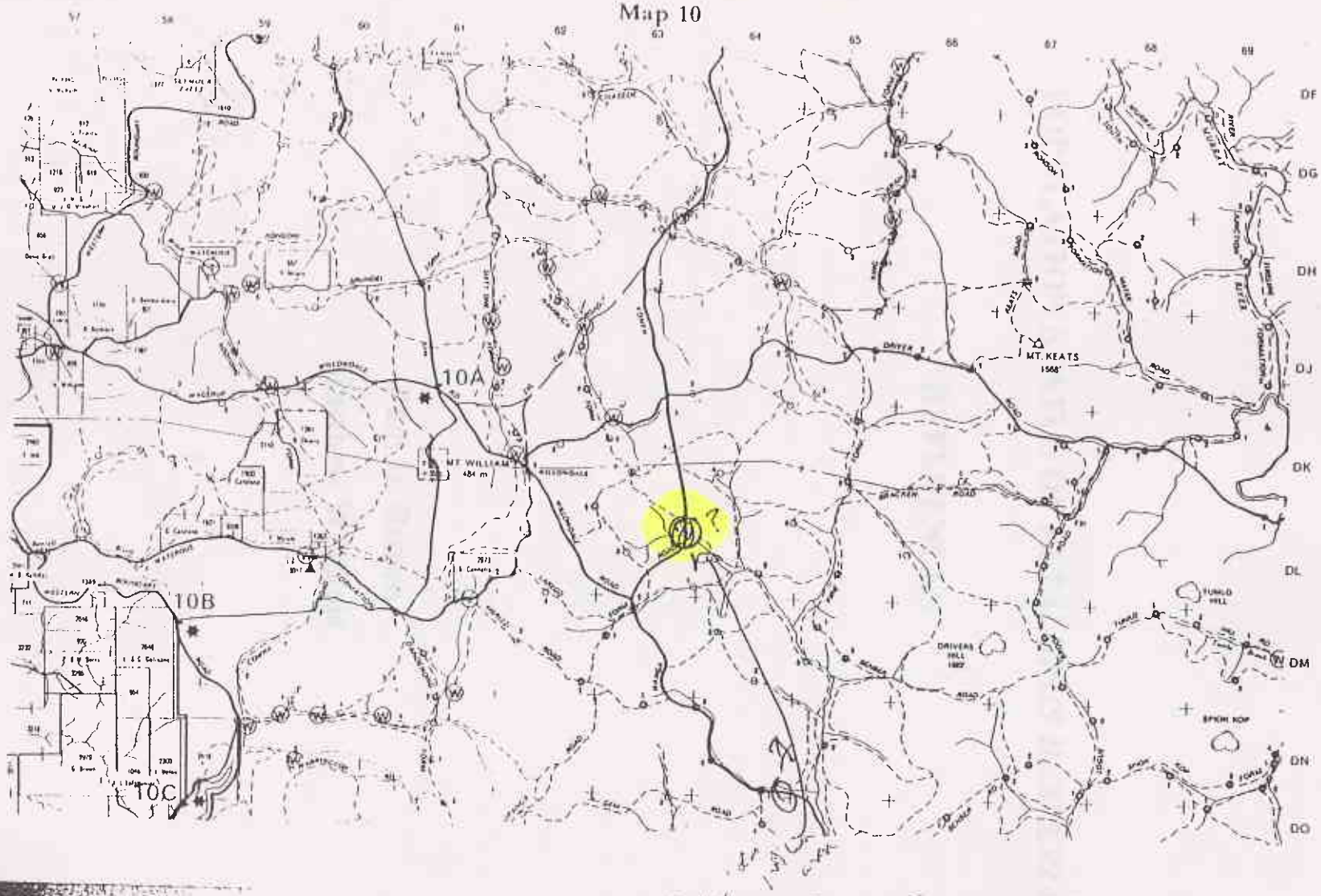
Map 10



Petalura site - first seen Dec 1988
- still present 7.12.94
J Taylor

POPULATION STATUS OF *PETALURUS HESPERIA*

REFERENCES

Paul H. Brown

Matthew Williams

Department of Conservation and Land Management, Perth

8 Circe Circle
Dalkeith
Western Australia 6009

Tel: 386 1633

Dear Matthew,

7th. January 1993

PETALURA HESPERIA

I went out on 16th December intending to visit the area where I had found *Petalura* in 1988. Instead I found another place where they occur and I went there again on 5th January. I thought you might be interested to see it if you have not seen many of there dragonflies before – they are plentiful now, and easy to see on a hot still day. I saw about 20, two pairs in copulation. It was midday and they were more easily scared than before, but still not seen much in flight - most seen settled in the typical manner first. There is a small dam and pool of water where two settled on a stick in the middle and others flew and dipped in the water. They appear to be breeding in a spring-soaked swamp with abundant *Agonis* south of the road, and a small area adjoining the road on the other side, although I did not find any pupal cases. Few other dragonflies were in evidense but I saw one *Synthemis macrostigma* and one *Nannophya dalei*. I collected one specimen of *Petalura*, if you are interested.

The best way to get there is from the Pinjarra Alumina refinery road, branching up the scarp along North Spur Road. Turn north up Scarp Road for about 2.5 km. to where it crosses a fast-flowing, clear stream.

I spent the rest of the day looking at other possible sites, but did not find any more *Petalura*. I was also hoping to relocate my previous site, also without success. (I had remembered it as near Logie Brook Dam, but only because that is where I started the search. Thinking more about it, I believe it was north of Dwellingup, and probably not far from the above site – I hope it is not under a dam or in a bauxite mine. I made a note at the time, but have not found that either - one day it will come back to me!)

Hope this is of use to you.

With best wishes.

Jan Taylor

Jan Taylor

1 Gold Mine Hill

Gold Mine Hill gives sweeping views over the coastal plain towards Me[illegible]rah but is perhaps better known locally as the site of North Dandalup's last gold rush. Mine shafts and diggings can still be found in the undergrowth surrounding the picnic area, and chunks of quartz quarried by the miners are strewn over the ground. No gold was found.

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This old millsite, five kilometres from North Dandalup on Whittaker Road provides an open area suitable for camping.

3 Oakley Dam

Originally built in 1939 to provide water for the steam locomotives at Pinjarra, [illegible] on the western edge of the Darling Scarp. The dam overlooks [illegible] Alumina Refinery, and gives a panoramic view of the coastal plain. [illegible] area and lookout near the dam site.

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A picnic area with barbecues, a lookout and a walk track near the dam wall are provided and maintained by the Water Authority.

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6 Scarp Lookout

A shaded parking area, tables and barbecues are set on the edge of the Darling [illegible]. From the lookout the forested slopes of the scarp descend to the coastal [illegible] and the farming [illegible].

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Scarp Pool is a popular picnic and swimming area designed for day-use only. A [illegible] near several barbecues and tables is located [illegible] overlooking the Murray River. Walk tracks lead down to the swimming hole, and a [illegible] area is provided near the lower car park. The [illegible] leading to [illegible] steep and should be negotiated with care.

8 Baden Powell

Baden Powell is divided into two sections, one for camping and one for day-use. [illegible] are tables and barbecues in [illegible] on the river bank overlooking [illegible] pool. Steps down the steep banks [illegible] for swimming. [illegible] situated in the [illegible].

9 Charlie's Flat

[illegible] car bays are provided on a one-way access road. Next to each bay is [illegible] site, barbecue and table, surrounded by vegetation, and secluded from [illegible]. The tent sites are shaded by tall trees and shrubs, and those on the [illegible] hand side overlook the steep banks of the Murray River. Toilets are [illegible] the access road.

10 Island Pool

[illegible] Pool is a day-use area. Parking [illegible] in the shade overlook the river and [illegible] pool is perfect for swimming. Barbecues and tables [illegible] off the side [illegible] with an attractive view [illegible] pool. A [illegible] trail leads up the [illegible] a scenic lookout.

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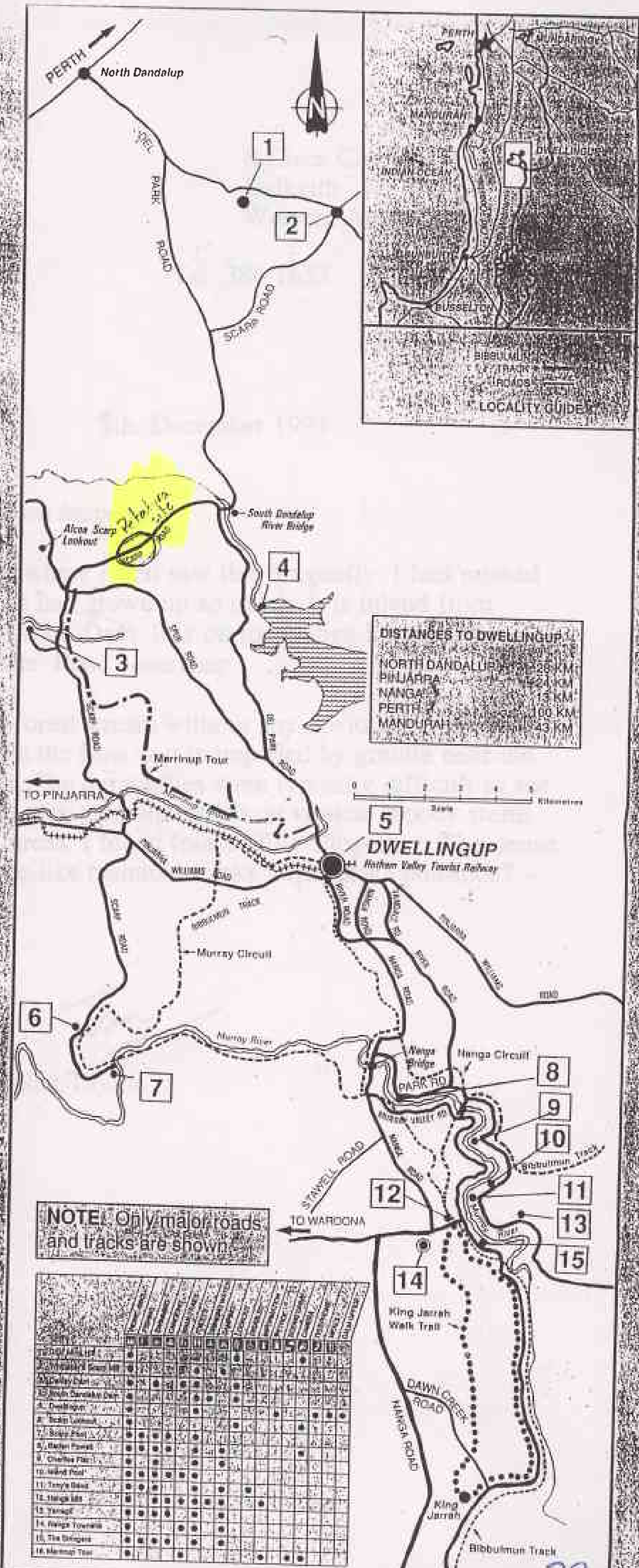

8 Circe Circle
Dalkeith
Western Australia 6009

Tel: 386 1633

Matthew Williams,
CALM.

8th. December 1993

Dear Matthew,

Petalura hesperia

I have re-found the area where I first saw this dragonfly. I had missed it before because the vegetation had grown up so much. It is inland from Yarloop, not far from Logue Brook Dam. It is on the Nanga Road, north of the junction with the Willowdale Road – see map.

It seems a fairly typical forest stream without any obvious extensive spring-fed boggy area, although the flow east is impeded by granite near the surface where the road crosses. The dragonflies were typically difficult to see until I got my eye in and could pick them up settled on vertical woody stems and small tree-trunks in open areas. I found four or five altogether. The dense growth near the stream has tube-like mammal tracks – quokkas? potoroos? – probably bandicoots.

With best wishes.

Jan

Jan Taylor.

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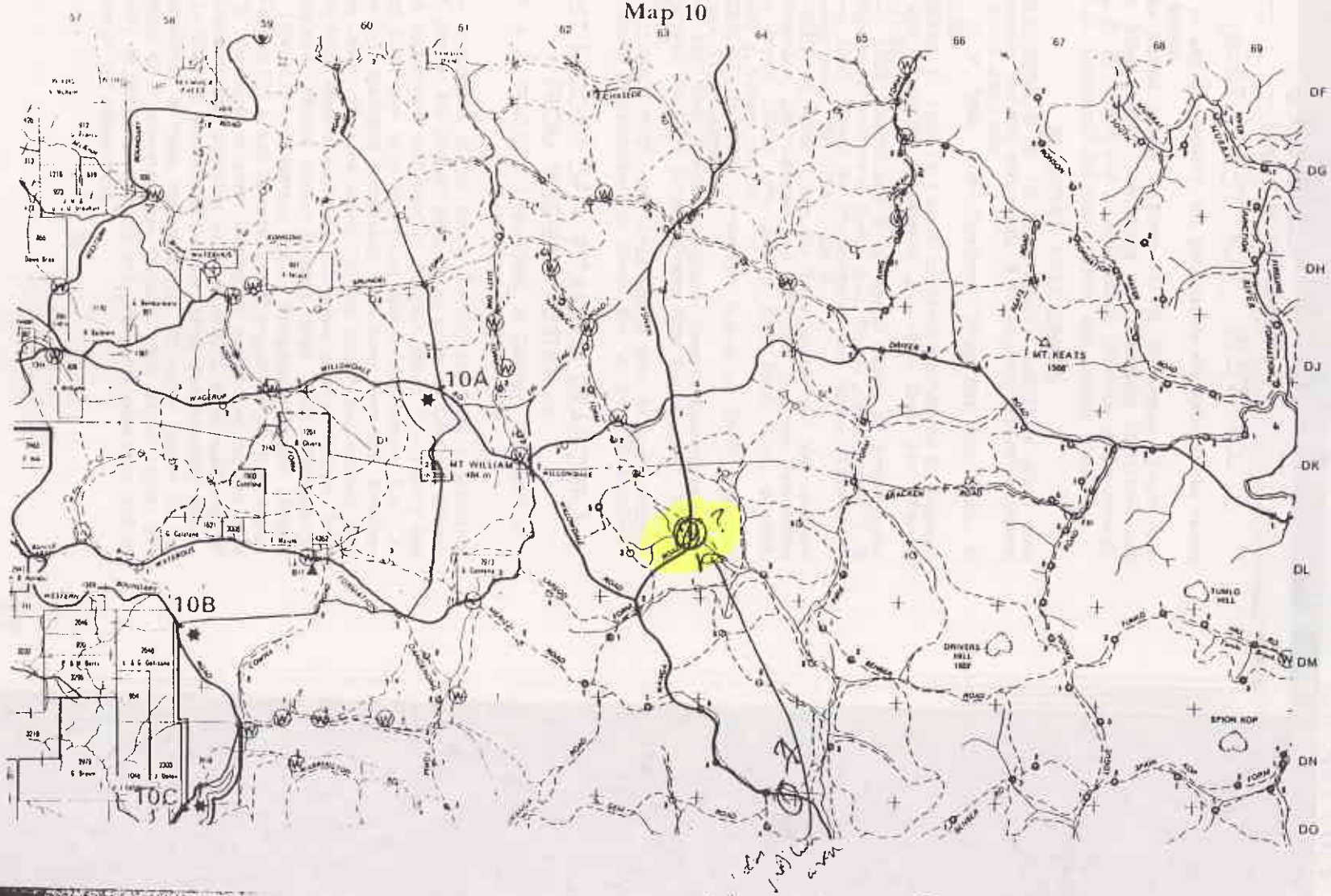

Petalura site - first seen Dec 1988
- still present 7·12·94
J Taylor

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taken in any one locality, the projapygids are some of the rarest of all insects.

The author wishes to thank Mr. H. Womersley (South Australian Museum) for identifying the specimens illustrated and Messrs. D. H. Wilson and L. A. Marshall (Division of Entomology, C.S.I.R.O., Canberra) for photographic and process work.

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FIRST RECORD OF A PETALURID DRAGONFLY FROM WESTERN AUSTRALIA

By J. A. L. WATSON, Department of Zoology, University of Western Australia.

The dragonflies of the family Petaluridae form a primitive, distinct, and at the present time, relict group of Odonata. Plentiful and apparently dominant in Jurassic times, the family has dwindled until now only nine living species are known. Eight of these, with a scattered distribution, have been described: *Petalura gigantea* Leach; *P. ingentissima* Tillyard, and *P. pulcherrima* Tillyard, all from eastern Australia: *Uropetala carovei* (White), from New Zealand: *Phenes raptor* Rambur, from Chile: *Tachopteryx thoreyi* (Hagen), from eastern U.S.A.; *Tanypteryx hageni* (Selys), from Western U.S.A. and Canada, and *T. pryeri* (Selys), from Japan.

It is, therefore, of great interest to report the capture of a hitherto undescribed petalurid at Lesmurdie, 12 miles south-east of Perth, by Miss M. Hawkin in October, 1956. Unfortunately only a single specimen, a male, was obtained. It comes closest to the descriptions of *P. gigantea* (see Tillyard, 1908: Fraser, 1933) differing only in details of thoracic and abdominal coloration and in the shape of the appendages.

Petalurids are readily recognizable in the field by several characteristics:

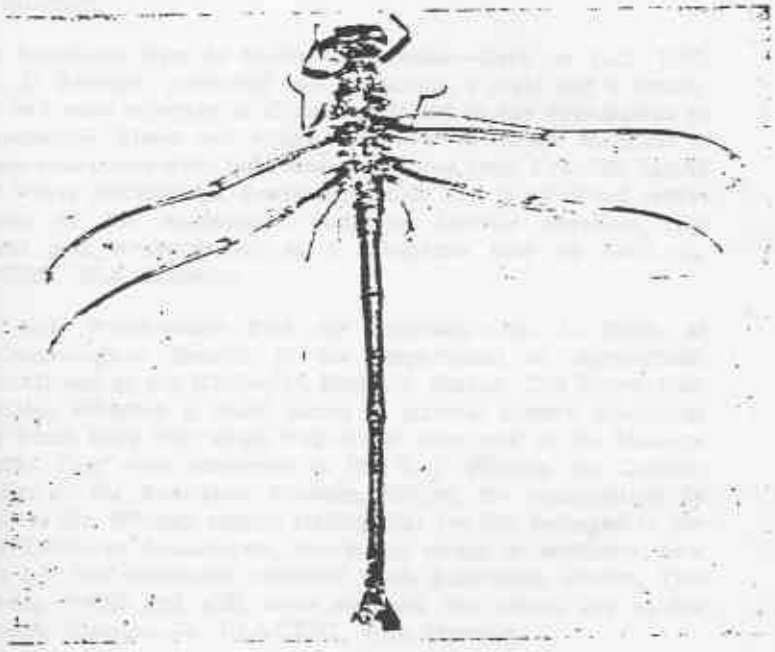
i. Their large size. The specimen from Lesmurdie is 3½ in. long and 4½ in. across the wings, distinctly greater in size than the common large dragonfly, *Anax papuensis* (Burmeister).

ii. The eyes are separated, i.e., do not meet in the mid-line.

iii. The pterostigma (dark spot near the wingtip) is very long and narrow.

iv. In the male, the terminal appendages are large and leaf-like, unlike those of any other Odonata. Further, the hind-wings are strongly angulated at the base.

v. The known petalurid larvae are semi-aquatic, living in burrows in peaty swamps and spring bogs. When mature, they are 1½-2 in. long, and climb from their burrows on to reeds, on which they emerge. The most likely breeding places of the new species would appear to be the swampy headwaters of the smaller streams flowing through the Darling scarp, the type of locality in which Quokkas were recently rediscovered (Barker *et al.*, 1957). Tillyard (1908) showed that *Petalura gigantea* was common only near its breeding sites, and that there was little tendency for the adults to disperse. Similar behaviour may reasonably be expected from the western form, so that in localities where



Petalura sp., from Lesmurdie; 9/10 nat. size.

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numbers of adults are observed, a search should be made for exuviae.

A full description of this new species will be published later. Meanwhile, any specimens or sight records would be of great value to the author.

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FROM FIELD AND STUDY

Diamond Dove Near Woodanilling.—Additional to the records of the Diamond Dove *(Geopelia cuneata)* recently reported from the South-west (*W.A. Nat.*, 6 (1): 24), early in February, 1957, I saw one bird seven miles east of Woodanilling.

—V. F. McDOUGALL, Nyabing.

A Further Record of *Pseudemydura umbrina*.—Another specimen of the rare Swan River tortoise, *Pseudemydura umbrina* (*W. Aust. Nat.*, 4: 125; 5: 44) has been received at the Western Australian Museum. It was found in a drain at the side of a road at Upper Swan by Ted Exell on August 30, 1956.—. L. GLAUERT, W.A. Museum.

A Bandicoot New to Western Australia.—Early in July, 1957, Mr. V. N. Serventy presented two bandicoots, a male and a female, which had been collected at Christmas Island in the Archipelago of the Recherche. These two animals prove to be almost identical in all their characters with the *Isoodon nauticus* from Franklin Island in the Nuyts Archipelago, South Australia. This is an island representative of the widespread mainland *Isoodon obesulus* (the Quenda) and is recognised as a subspecies only by Tate.—L. GLAUERT, W.A. Museum.

A New Fresh-water Fish for Australia.—Mr. L. Koch, of the Entomological Branch of the Department of Agriculture, while stationed at the Kimberley Research Station, Ord River, East Kimberley, collected a small series of natural history specimens among which were four small fresh-water soles new to the Museum collection. They were forwarded to Mr. G. P. Whitley, the Curator of Fishes at the Australian Museum, Sydney, for examination. In due course Mr. Whitley replied stating that the fish belonged to the species *Liachirus klunzingeri*, inhabiting rivers of southern New Guinea but not previously reported from Australian waters. Two specimens, P4050 and 4051 were retained, the others are in the Australian Museum.—L. GLAUERT, W.A. Museum.

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From

THE PROCEEDINGS OF THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Series B. TAXONOMY

Vol. 27, Parts 7-8, August 29th, 1958.

The Royal Entomological Society of London,
41, Queen's Gate, S.W.7

PRINTED BY ADLARD & SON LTD., BARTHOLOMEW PRESS, DORKING.

A NEW SPECIES OF *PETALURA* LEACH (ODONATA) FROM WESTERN AUSTRALIA

By J. A. L. Watson

(Zoology Department, University of Western Australia)

[Communicated by Dr. E. P. Hodgkin]

The discovery in Western Australia of the first specimen of a new *Petalura* was reported recently (Watson, 1957). Subsequently, series of mature and newly emerged adults of both sexes and many exuviae were collected in two additional localities in the vicinity of Perth. These form the basis of the description of the new species, which may be called

Petalura hesperia sp. n.

(Derived from the Greek ἑσπερος—western)

These descriptions were prepared from live material. The terminology is that of Chao (1953).

Male.—Length 89–99 mm.

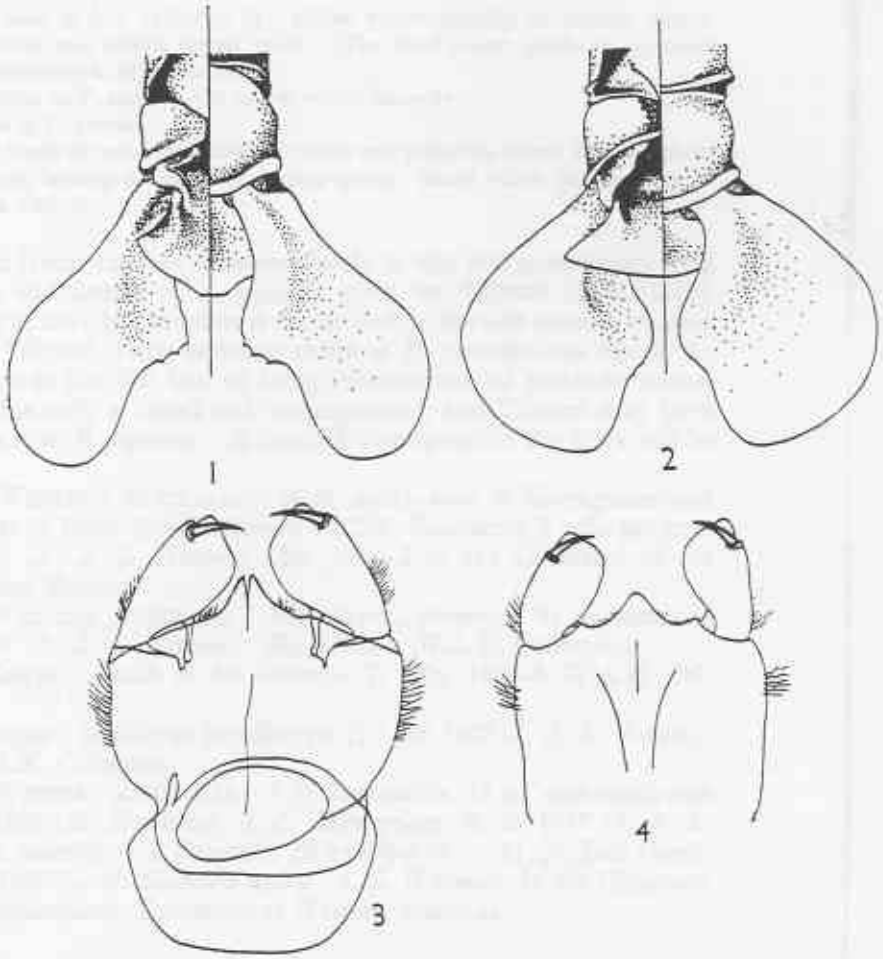
Head : vertex and occiput black, downy ; a pair of yellow spots behind ocelli and also on rear of occiput ; postocciput yellow above ; frons yellow-cream, bordered behind with blackish-brown and with fine black dorsolateral spots ; postclypeus yellow-cream, bordered below with black : anteclypeus black ; labrum pale yellow, with black-brown lower border ; mandible black, pale yellow laterally ; labium pale yellowish-brown ; genae and postgenae black, yellow stripe bordering posterior margin of eye ; eye deep grey in life, red-brown in dried specimens.

Thorax downy, covered with fine pruinescence. Prothorax dark brown, pale edge to anterior lobe, small yellow nodule on episternum. Synthorax : anepisterna and epimera pale yellowish-brown, merging into dusky brown on edges and in sutures ; katepisterna dark brown, touched yellowish. Legs black, stout ; coxae each bearing a small yellow mark laterally. Wings : fore wing 51–55 mm., hind wing 49–53 mm.; similar to *P. gigantea* but membrane darkly pigmented along veins at base of wing, small patch of brown at nodus ; subtriangle of fore wing 3–6 celled, triangle of fore wing 3–4 celled ; nodal index :

$$\frac{9\text{–}12 : 17\text{–}19}{9\text{–}11 : 13\text{–}15} \qquad \frac{16\text{–}19 : 8\text{–}11}{14\text{–}16 : 8\text{–}12}$$

Abdomen : length 66–75 mm.: thick at base, segments 4–10 more or less cylindrical ; lightly pruinescent, more densely so on segments 2–3 and 9. Segment 1 dark brown, hairy ; small lateral yellowish-brown patches ; narrow dorsal line or spot on basal third. Segment 2 dark brown above, shading into yellow-brown laterally ; auricle yellowish, posterior to auricle dark brown ; narrow mid-dorsal yellow line, posterior transverse carina variably touched with yellow ; accessory genitalia similar to *P. gigantea*. Segment 3 brown above ; laterally a yellowish mark reaching back past supplementary transverse carina ; dorsal stripe and posterior transverse carina as 2. Segment 4 as 3, but lateral yellowish patch narrower. Segment 5 as 4, but yellow patch reduced to dull spot astride supplementary transverse carina, or absent ; segments 6–7 as 5, yellow patch absent. Segment 8 black, yellow dorsal stripe continuous or broken, reaching only to middle of segment, posterior transverse carina variably touched with yellow. Segments 9–10 black, posterior transverse carina as 8 ; yellow in extreme angle of tergite 10.

Appendages (fig. 1): superior black, petaloid, ± 7 mm. long, 3·5 mm. broad, inner and apical borders crenulate; large inferior spine at extreme base. Inferior broader than long; black tipped yellow ventrally; basal half of dorsal surface black, distal yellow; lateral spine black.



FIGS. 1–4.—(1–2) Male appendages, dorsal and ventral aspects of (1) *Petalura hesperia* sp. n. (holotype); (2) *P. gigantea* Leach. (3–4) Labium of last instar male larva of (3) *P. hesperia* sp. n. (paratype); (4) *P. gigantea* Leach (*after* Tillyard, 1909).

FEMALE.—Length 82–96 mm.

Head and *thorax* as in male. Wings: similar to male; fore wing 53–58 mm., hind wing 51–56 mm., anal border rounded; nodal index:

$$\frac{9\text{–}10:\ 20}{11\ :\ 15\text{–}17} \qquad \frac{14\text{–}16:\ 10\text{–}11}{18\text{–}20:\ 9\text{–}10}$$

Abdomen: stout, slightly tapering, pruinose. Segment 1 as male. Segment 2 as male, lacking auricles but with yellow stripe laterally, tapering to posterior. Segments 3–7 as male. Segments 8–10 short, dark brown above, yellow dorsal stripe absent; posterior

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transverse carina black in S. 9, yellow in 10; diffuse yellow dorsally on sutures. Supra-anal plate and inferior anal lamina tipped yellow. (The small yellow marks on segments 8–10 may be inconspicuous in dried material.)

Ovipositor: similar to *P. gigantea* but valves yellow laterally.

Appendages: as in *P. gigantea.*

Newly emerged forms of both sexes have the yellow and yellowish-brown areas brighter, dark brown eyes and, lacking pruinescence, appear glossy. Small yellow patches may be present laterally on Abd. 6.

Larva: final larval exuviae correlate closely in size and morphology with the descriptions and figures of *P. gigantea* given by Tillyard (1909, 1911). However, the tip of the labial mentum is deeply cleft in the new species, whereas it is figured by Tillyard (1909) as being entire in *P. gigantea* (see figs. 3, 4). Wolfe (1953) regards the cleft lobe as being characteristic of petalurid larvae. In *P. hesperia*, the cleft is closed and inconspicuous, and Tillyard may have failed to observe it in *P. gigantea*. A detailed description of the larva will be published later.

Holotype ♂, Western Australia: 1¾ m. south-west of Karragullen and 13½ m. south-east of Perth (Grid reference 102294, Kelmscott 1 mile per inch map), 1.xii.1957 (*J. A. L. Watson*). No. 1958–3 in the Collection of the Western Australian Museum.

Allotype ♀, Western Australia: Bull Creek, Riverton, 6½ m. south of Perth, 4.xii.1957 (*J. A. L. Watson*). No. 1958–4, W.A.M. Collection.

♂ *exuviae-allotype:* details as for allotype ♀. No. 1958–5, W.A.M. Collection.

♀ *exuviae-allotype:* locality as for allotype ♀, 7.xii.1957 (*J. A. L. Watson*). No. 1958–6, W.A.M. Collection.

Paratypes: Western Australia: 1 ♂, Lesmurdie, 13 m. east-south-east of Perth, x–xi.1956 (*M. Hawking*). 1 ♂, Karragullen, 30.xi.1957 (*J. A. L. Watson*). 4 ♂ (1 teneral), 1 ♀ (teneral), 20 exuviae (9 ♂, 11 ♀), Bull Creek, Riverton, 4.xii.1957 (*L. M. Saunders* and *J. A. L. Watson*). In the Collection of the Zoology Department, University of Western Australia.

Biology

The biology of *P. hesperia* appears to be similar to that of other petalurids, and more particularly that of *P. gigantea*. The original specimen was obtained in open fields adjacent to the boggy headwaters of Woodlupine Brook and, at Karragullen, the insects were found in a similar habitat, a permanent, partially cleared, swamp bordering a spring. The cleared portion was under grass, with isolated patches of *Scirpus* and *Gahnia*, but the uncleared area supported dense thicket of the tea tree *Agonis*. At Bull Creek, *P. hesperia* breeds in swampy ground alongside the creek itself. The swamp is densely vegetated with *Lepidosperma*, *Gahnia*, *Cladium* and other rushes under a broken tree cover of *Melaleuca*, *Agonis* and *Eucalyptus*, and contains a black peaty mud which is kept wet throughout the year by seepage from the adjacent hill slopes. The larvae form burrows in the mud and exuviae have been collected from the vegetation surrounding these, from ground level up to heights of 15 feet on the tree trunks. In the three localities, *P. hesperia* lives in association with other mud-dwelling Odonata: *Argiolestes pusillus* Tillyard, *Synthemis macrostigma*

occidentalis Tillyard, *Orthetrum caledonicum* (Brauer) and *Nannophya dalei occidentalis* (Tillyard).

Discussion and Diagnosis

Three species of the archaic Australian genus *Petalura* have been described previously, and descriptions or redescriptions of these may be found in Tillyard (1908, 1913) and Fraser (1933). *P. gigantea* Leach is known from the Blue Mountains, New South Wales, while *P. ingentissima* Tillyard and *P. pulcherrima* Tillyard are reported only from northern Queensland. *P. hesperia* may be distinguished from the two Queensland species by its smaller size and by the absence of yellow stripes on the thorax and yellow annulations on the abdomen. On morphological criteria it appears to be most closely allied to *P. gigantea* and comparative data on the two species are summarised in the table below. The information on *P. gigantea* is taken from Tillyard (1908, 1909, 1911) and from a specimen No. 6143 in the Collection of the Western Australian Museum, locality " Blue Mountains, N.S.W.", 16.xii.1908 (*R. J. Tillyard*).

Diagnosis of Petalura hesperia *sp. n. and* P. gigantea *Leach*

	P. hesperia	*P. gigantea*
Length	Male, 89–99 mm. Female, 82–96 mm.	Male, 87–97 mm. Female, 82–96 mm.
Postclypeus	Yellow, edged brown-black	Brown-black.
Prothorax	Posterior lobe blackish	Posterior lobe blackish; small yellow spot on posterior border.
Synthorax	Pale yellow-brown, dusky in sutures and on katepisterna	Dark brown, yellow stripes alongside dorsal carina, on mesepimeron and metepimeron.
Wings	Dusky membrane along veins at base in male; spot at nodus	No darkening at base of veins in male; no spot at nodus.
Abdomen	Yellow laterally only to Abd. 4 or 5. Abd. 9 black	Yellow laterally to Abd. 10. Abd. 9 yellow above.
Male appendages	Fig. 1	Fig. 2.
Distribution	Lesmurdie, Karragullen, Bull Creek, Western Australia	Blue Mountains and their southern and coastal spurs, New South Wales. Stradbroke Island, Queensland.
Habitat	Muddy or peaty swamps along or at head of streams; larvae in burrows among roots	" Tea tree " swamps at head of creeks; larvae in burrows in wet mud and vegetation; " summer dry ".
Labium of larva	Tip of mentum cleft (fig. 3)	Tip of mentum entire ? (fig. 4).

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Summary

A fourth species of the archaic Australian genus *Petalura* is described. This new species, the first recorded from Western Australia, appears on morphological criteria to be most closely allied to *P. gigantea* Leach from New South Wales. The known biology is also similar to that of *P. gigantea*.

Acknowledgments

The author wishes to thank Dr. E. P. Hodgkin (University of Western Australia) for supervision of this work, and Dr. W. D. L. Ride (Western Australian Museum) for making available the specimen of *P. gigantea*. Receipt of a C.S.I.R.O. Honours Studentship and a research grant from the University of Western Australia is gratefully acknowledged.

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PETALURIDS MOST PRIMITIVE LIVING DRAGONFLIES

J.A.L. WATSON

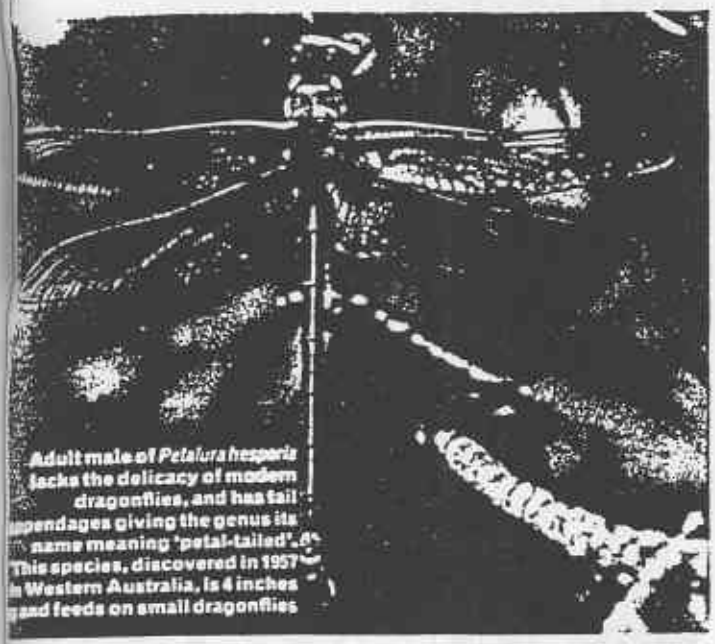
AUSTRALIA'S primitive fauna has long been of special interest to biologists. The two most well-known groups are the monotremes (the egg-laying mammals, the platypus and echidna) and the marsupials (kangaroo, possum, and others). These 'primitive' mammals, however, are not the only unique members of Australia's isolated fauna. Within many other groups, such as the birds, reptiles, fishes, frogs, and insects, there are species that belong to genera, families, or orders that are extinct or nearly so elsewhere, and are as remarkable in their own way as the mammals.

Among the insects, such a relict group is the family Petaluridae, a distinct family of rugged and primitive dragonflies. The fossil wings and bodies of dragonflies preserved in the slates at Solnhofen in Bavaria show us that petalurids closely similar to living forms were plentiful in Jurassic times, the period of the giant reptiles some 150 million years ago. Palaeontologists have recognised several species from Solnhofen alone, and, judging from the abundance of the family in the fossil remains, petalurids may have been the dominant dragonflies of the time. Since the Jurassic, however, more 'modern' dragonflies have arisen and the petalurids have dwindled so that, of the 1,400 or so species of living dragonflies, only 9 are petalurids. These few survivors have a scattered distribution, as do so many relict groups, but over half of them live in Australia or New Zealand; there are 4 species of *Petalura* in Australia, *Uropetala carovei* with two subspecies in New Zealand, *Phenes raptor* in Chile, *Tachopteryx thoreyi* in the eastern United States, and 2 species of *Tanypteryx*, one in the mountains on the Pacific side of North America and one in Japan. Europe, which once supported a rich fauna, is deserted of petalurids.

Why the name *Petalura*? Leach, who described the genus in 1815, coined the name from the Greek words *petalos*, meaning outspread or flat, and *ura*, meaning a tail, alluding to the large, leaflike appendages on the end of the abdomen in the male. Not all species have these well developed, but they were present in the Jurassic *Mesuropetala* and remain large in *Petalura* and *Uropetala*. As the *Petalura* was one of the largest dragonflies Leach had seen he chose for it the specific name *gigantea*. During the 19th century further species, both living and fossil, came to light so that by 1900, six living petalurids were known. Between 1908 and 1921, Tillyard described an additional two species of *Petalura* from Queensland and a new form, now recognised as a subspecies of *Uropetala carovei*, from New Zealand. Then, in 1957, yet another species of *Petalura* was discovered, this time in Western Australia, and was described in the following year as *Petalura hesperia*, the western *Petalura*. It is possible—even probable—that further species await discovery; the first specimen of *Petalura hesperia* was collected on a farm near Perth, the Western Australian capital, and I subsequently discovered colonies of the species as little as 6 miles from the centre of the city!

Despite its name, *Petalura gigantea* is not the largest petalurid; *Petalura ingentissima* from Queensland is larger, and is in fact the bulkiest living dragonfly—the body is some 5 inches long and the wingspan often exceeds 6 inches. The Jurassic petalurids were about the same size, but they were still small, when compared with some of the earlier fossil dragonflies. The largest of these, *Meganeura monyi* from Carboniferous times, some 250,000,000 years ago, had a wingspan of 27 inches.

The archaic and rough-hewn appearance is added to by the colour and proportions of the body. With the exception of *Tanypteryx*, all petalurids are dully coloured, patterned



Adult male of *Petalura hesperia* lacks the delicacy of modern dragonflies, and has tail appendages giving the genus its name meaning 'petal-tailed'. This species, discovered in 1957 in Western Australia, is 4 inches and feeds on small dragonflies

Today only nine out of the 1,400 species of dragonflies in existence are petalurids, yet according to the fossil record, some 150 million years ago they were the most abundant dragonflies. The peculiarities of this primitive family and the adaptations that have enabled a few species to survive scattered in remote parts of the world are described by J. A. L. WATSON

in grey, brown, and dull yellow, and the pattern is often obscured by a whitish deposit of wax on the cuticle. The head appears small, for the eyes do not meet at the mid-dorsal line, unlike the large, globular eyes of higher dragonflies. The thorax is compact, but the legs do not point far forwards; in most dragonflies, the thorax is greatly skewed, so that the legs point forward for catching insects in flight. The wings are almost unpigmented, but the venation is very dense and net-like and its details are highly inconstant—both archaic features. The abdomen is stout and almost cylindrical, lacking a pronounced taper behind the second segment, so that it also lacks the delicacy characteristic of other dragonflies.

All adult dragonflies feed on flying insects, but the petalurid does not generally hawk for them. Instead, it perches on stones, logs, or tree trunks, waiting for insects to fly nearby; then it flies swiftly to intercept, returning with its prey, often to the same perch. Many sorts of insects fall victim to petalurids, even other dragonflies; thus *Petalura hesperia*, a species up to 4 inches long, feeds on small dragonflies such as *Austrogomphus*, which have a wingspan of just over 2 inches, but cannot take the larger and faster *Hemianax papuensis*.

How, then, if petalurids are so much less advanced than other dragonflies, have they survived since the Jurassic? An answer may be found in the biology of the larvae.

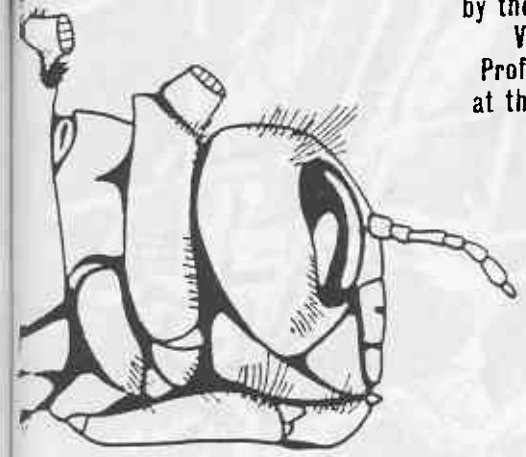
The larvae of most dragonflies live in open bodies of fresh water—streams, rivers, lakes, and ponds. Their respiratory systems, however, indicate that they must have evolved from terrestrial ancestors, which, like most terrestrial insects, breathed through a series of paired apertures (spiracles) on the thorax and abdomen. In present-day larvae, these spiracles persist, but they are not generally functional; the larva breathes instead by means of gills in the rectum. Yet if the larvae of some species are deprived of dissolved oxygen, they may come to the surface and breathe air either through the first thoracic spiracles or with the rectal chamber, using it as a lung. Tillyard has also shown that the utilisation of still waters, in which the oxygen tension may be low, has required the evolution of gills far more complex and efficient than those possessed by more primitive larvae dwelling in cold streams, in which the oxygen tension is always high.

We argue, then, that the evolution of dragonfly larvae involved a progressive change from air-breathing in a damp habitat to an aquatic life with rectal gills. We might therefore expect primitive dragonfly larvae to lead semi-aquatic lives, perhaps in cold, boggy places.

This is, in fact, exactly where the larval petalurids live. Far from inhabiting open water they burrow into the mud in spring-fed bogs and in swamps along the sides of cold streams. The burrows open on to 'dry' ground, but they extend down to below the water table.

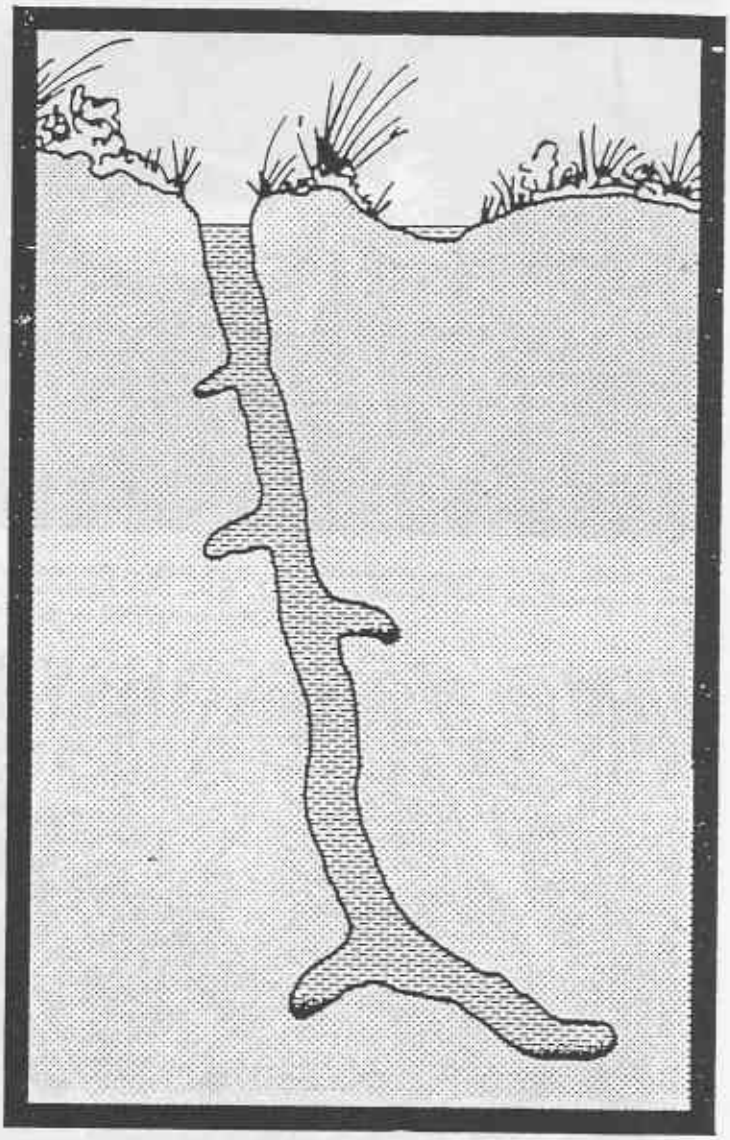
The larva, like the adult, is a bulky, ungainly creature, and is a pale cream colour. The legs and the mouthparts, however, are darkened and strong, for both are used in burrowing, the broad palps of the labium serving to push dirt from the burrow as well as to feed. Again like the adults, the larvae are predatory creatures. At least in *Tanypteryx* and *Uropetala*, they come to the top of the burrow and wait until smaller insects or spiders stray within the range of the labial palps, and *Uropetala* may also wander some distance from the mouth of the burrow. Not all species necessarily feed on other arthropods, for the gut contents of larval *Petalura hesperia* may contain large quantities of earthworms. The larvae feed mostly at night, and probably detect their prey by tactile means —perhaps by the long antennae. */continued overleaf*

Photographs and diagrams by the author, who is Visiting Assistant Professor of Biology at the Developmental Biology Centre, Cleveland, Ohio



ead of *Petalura* larva showing
werful mouthparts and long
tennae, for detecting insect
d earthworm prey when feeding at
e mouth of its burrow

alura habitat: a seepage overgrown with reeds, saw grass, and
perbark trees; at Bull Creek, near Perth

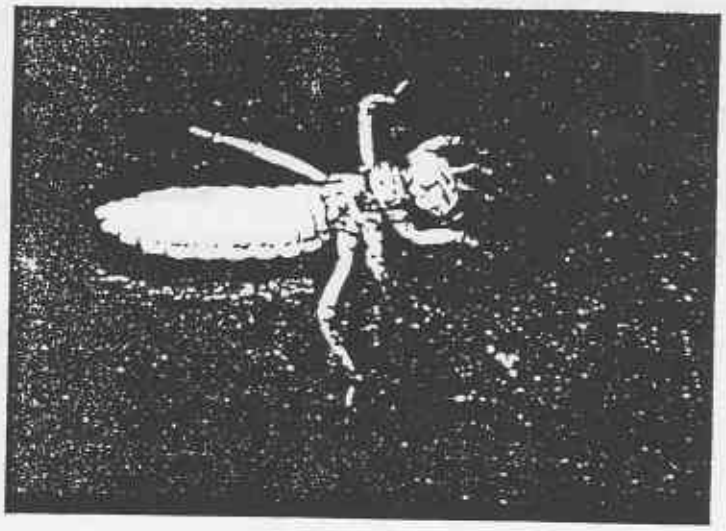


Petalurid burrow is 2 feet deep and underwater. Side-chambers are occupied successively as the larva grows

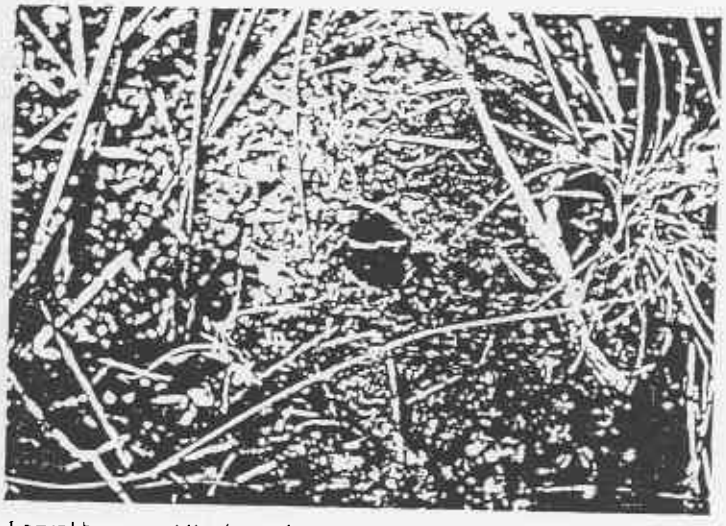
This semi-aquatic habit, and the wanderings in moist correlate well with the structure of the respiratory stem. The larvae have rectal gills, but the surface area these is small and the rectum appears to function both a gill and as a lung. We may suppose that this, too, presents a very primitive state, a state which is a half- house in the evolution of the aquatic dragonfly larva. How long does the larval life last? It seems that it lasts ger than in any other dragonfly, with the possible ception of the Japanese *Epiophlebia*. The researches Wolfe on *Uropetala* indicate a larval life of 5 or 6 years! e female deposits her eggs in tussocks or moss, and newly hatched larva builds a tiny burrow nearby. As larva grows, it enlarges the burrow, and the burrow of nature larva may be an inch or more in diameter and extend several feet into the ground; the burrow of *Petalura ingentissima* must be considerably larger. When the time comes for the adult to emerge, the mud-encrusted larva climbs some adjacent vegetation, and transforms just as in other dragonflies.

In contrast to the long larval life, the adult life is quite short. We can judge this most easily by observing small, isolated populations. Thus, in one population of *Petalura hesperia*, the adults started emerging during the second half of November, at the beginning of the Australian summer; sexually mature males and females were present by the end of the first week in December, and eggs were being laid; and by the New Year the adults had virtually disappeared. One must conclude that the adults live only 4 to 6 weeks.

y larval skin of *Petalura* clinging to vegetation. Larvae may x years, adults for six weeks



Petalura larva, dug from its burrow, is nearly 1 inch long, and ungainly like the adult. Legs and mouthparts are darkened and strong for burrowing and feeding



Larval burrow at the foot of a saw grass tussock; modern dragonfly larvae live in open water

e biology of petalurids makes it difficult to estimate abundance. First of all, their habitats are often ered and restricted in area, difficult of access and lt to discover. Secondly, the long larval life means e numbers of adults are not related to the numbers preceding year, but to those of 5 or 6 years before, one location adults may be abundant in one year and absent the next. The short adult season must also ne time for counting the adults. The discovery of *a hesperia* emphasises the situations to which these ities may lead. The best index of abundance is ore the number of larvae, but we cannot measure by counting burrows, for many burrowing crayfish similar habitats; and digging out the burrows is ous and unrewarding work. There is, however, no reason to suppose that any of the 9 species is in danger, the bogs that they inhabit being of little potential use to man. Even where such bogs have been converted to grazing, the larvae often survive in the seepages—the first known larva of *Tachopteryx* was collected in a cow field in Pennsylvania, and the first adults of *Petalura hesperia* came from similar locations in Western Australia.

Thus it seems that while the larvae of 'modern' dragonflies evolved from their ancestral marshy habitats to a life in open waters, the petalurids were left as a relic which took to burrowing, went underground—and so a few species survived. These living fossils have made their archaic habitat a refuge; and in Australia and New Zealand, isolated since late Mesozoic times, this refuge seems to have been especially secure.

Conservation status of *Petalura hesperia* Watson in Western Australia

Dr Matthew R. Williams
Science and Information Division
January 1993

Summary

This report outlines the current distribution and conservation status of *P. hesperia*, and makes some recommendations for preservation, management and further study of the species.

Introduction

The petalurids are a small relict family of dragonflies. Of the ten species of petalurid dragonflies worldwide, four occur within Australia. *Petalura hesperia* is the sole representative of the family in Western Australia.

All the petalurids require specialised breeding areas which by their very nature are restricted in extent. In addition, the adults are usually sedentary and hence the colonies are very localised. Thus all the species including *P. hesperia* are regarded as being rare.

Of the four Australian species, only *P. gigantea* has been closely studied. Taxonomically this species is very similar to *P. hesperia*, and observations by Tony Watson, Magnus Peterson and Jan Taylor indicate that the biology and ecology of the two species may be quite similar. In order to breed, *P. gigantea* requires fast flowing, permanent streams with beds suitable for the larvae to burrow into. In south western Australia similar conditions are usually restricted to the headwaters of permanent streams. The recorded distribution of adults and the single locality where a number of exuvae have been observed (Bull Creek) support this hypothesis.

Methods

There is little published information on the status of *P. hesperia*. In order to determine the conservation status of *P. hesperia*, a number of people were approached, and asked to provide the following information:

* Distributional data, from specimens held or from personal observations;

* Information or comments regarding the conservation status of extant populations of *P. hesperia*;

* Perceived priorities for preservation of populations (i.e. which populations are at greatest risk, which are most secure, and which are the highest priority for preservation);

* Any management practices seen as relevant to successful management, and any priorities seen for research into management of the species.

The following people were approached:

* Magnus Peterson, a private contractor associated with the W.A. Museum (WAM), who has collected information on the distribution of dragonflies, including *P. hesperia*, in Western Australia. Magnus has also monitored the Bull Creek population and searched for other populations of *P. hesperia*;

* Dr. J. A. L. (Tony) Watson, Division of Entomology, CSIRO Canberra, who described the species;

* Jan Taylor, an amateur interested in photographing dragonflies;

* Dr. Terry Houston, curator of entomology, WAM; and

* Members of the W.A. Insect Study Society (WAISS) were asked at a general meeting to provide any information that they had concerning sightings or distributional information on *P. hesperia*.

In addition, the WAM, Dept. of Agriculture and CALM collections, and Tony Watson's original description of the species, were examined and label information recorded.

Results

Because the adults are sedentary and the populations local, observed localities for adults almost certainly indicate nearby breeding locations. On this basis, known distributional data for *P. hesperia* is tabulated below and summarized in figure 1.

Fig. 1. Distribution of *Petalura hesperia* Watson in Western Australia.

Specimens held in the WAM, Department of Agriculture and CALM, or referred to in the original description, bear the following data:

BULL CREEK AREA:

BULL CREEK:

4 December 1957 (LM Saunders and JAL Watson)
(6 adults, 20 exuvae, including allotype female)
10 December 1965 (JAL Watson) (3 adults, 2 exuvae)
14 December 1965 (JAL Watson) (4 adults, 3 exuvae)
18 December 1965 (JAL Watson) (5 adults)
8 January 1966 (L O'Halloran) (2)
12 December 1991 (TE Burbidge) (1)

ROSSMOYNE:

28 December 1970 (L McKay) (1)
4 January 1970 (RJ McKay) (1)*
* ?Possibly mis-labelled and should be 4 Jan 1971?

LESMURDIE:

October-November 1956 (M Hawking) (Paratype)

KARRAGULLEN:

1 and 3/4 MILES SW OF KARRAGULLEN:
30 November 1957 (JAL Watson) (1) (Paratype)
1 December 1957 (JAL Watson) (1) (Holotype)

MANJEDAL BROOK:

MANJEDAL CAMP:
12 December 1965 (JAL Watson) (1)
8 January 1993 (MR Williams) (4)

OTHER AREAS:

QUILICUP*:
28 January 1966 (GH Teale) (1)
* There is no such locality as "Quilicup" in Western Australia: Magnus Peterson believes that the intended locality is Quilergup, near Jarrahwood, south of the Capel River.

KELMSCOTT:
1 December 1987 (S Williams) (1)

SOUTH DANDALUP DAM:
30 January 1975 (SJ Curry) (1)

Near SOUTH DANDALUP R., E of ALCOA alumina refinery:
5 January 1993 (J Taylor) (1)

5th. January 1993. J.C. Taylor
East of Alcoa Alumina Refinery at Pinjarra on Scarp Road, 2.5km North of North Spur Rd.

NORTH BANNISTER:
15 December 1975 (L O'Halloran) (1)

Observational data for additional localities, specimens collected but held elsewhere, adults observed by people sufficiently acquainted with the species to provide a positive identification, and observations relevant to the above localities (the bulk of this information has been provided by Magnus Peterson):

✓ Near SERPENTINE DAM and Near MOUNT COOK (M Peterson)

Near HARVEY DAM (M Peterson)

✓ TURTLE BROOK, near Canning Dam (M Peterson)

✓ MUNDAY BROOK, near Canning Mills (M Peterson)

✓ Near LOGUE BROOK DAM (J Taylor, M Peterson)
(Jan Taylor is now unsure of whether he has in fact seen specimens at this location)

✓ NANGA BROOK, near Waroona Dam (M Peterson)

Two members of the WAISS believed that they had seen large dragonflies: Peter Ray had observed a large, vertically perching dragonfly at his home in Mahogany Creek on a few occasions; however, he did not recall observing the specimen in sufficient detail to be sure it was a petalurid. Another member had observed large dragonflies in Admiral Road, Bedfordale, below Wungong Dam. However, in the absence of specimens from these sites, these records must be treated cautiously. Both people have been asked to attempt to capture or photograph any further specimens they observe at these sites.

Both Dr. Terry Houston and Jan Taylor know only of the records from what were the four original localities (viz. Bull Creek, Manjedal Brook, Lesmurdie and Karragullen) where specimens had been collected.

Status of known populations

The continued existence of at least nine distinct populations of *P. hesperia* is known or can be inferred from observations. These are listed below from north to south, together with an estimate of their size and viability:

Lesmurdie
Whether the population recorded from Whistlepipe gully still persists is unknown. However, there is insufficient data to conclude that it does not and it must be presumed to be extant. The creek running through the gully arises in urban Lesmurdie and passes through Regional Open Space before returning to urban areas in Forrestfield. Like Bull Creek it is threatened by urbanisation and consequent effects on water quality.

Bull Creek
This is the only site for which the precise breeding location (adjacent to Rossmoyne Senior High School) is known. This is also a large population, based both on the number of specimens known from the area and on the experience of observers familiar with other populations. It is atypical, being a coastal plain site. However, being surrounded by urbanisation means that it is also the site most under threat.

Karragullen
M Peterson has visited this locality, but found that the streamside vegetation had been cleared for agriculture and that the population is unlikely to persist.

Munday Brook
This site is adjacent to Karragullen and so far as is known is still extant, although it may be under threat from clearing for agriculture.

near Canning Dam
See below.

Manjedal Brook
Adults have been collected or observed on a number of occasions, the latest in 1993. Dr. Tony Watson collected a single exuvae at this site in summer 1991. Comparatively large numbers, about 20, were seen both in 1990 (by Dr. Allen Davies) and in 1993 (by M. Williams). This population appears to be both large and secure.

Serpentine Dam/ Mount Cook
See below.

Near South Dandalup Dam
Adults have been observed by Jan Taylor in December 1992 and January 1993, and a single specimen collected. About 20 were seen. This population appears to be both large and secure.

Waroona Dam
See below.

Logue Brook Dam/ Harvey Dam
See below.

Adults have been observed by M Peterson at each of the dams mentioned above. Presumably, one or more populations exist in the headwaters of streams above the dams. Current management of the catchment areas for each dam make all of these (presumed) populations secure.

"Quilicup" =?Quilgerup
This locality, if correct, would represent a considerable southward extension of the range of *P. hesperia*. However, further information is needed to confirm its existence.

Discussion

P. hesperia has an extensive though disjoint distribution along the Darling scarp between Perth and Harvey, and possibly occurs further south. Given that the dragonfly is known to be rare, local and sedentary, and hence difficult to locate, it is likely that further populations exist at localities interspersing those recorded here. Genetic interchange between populations is probably extremely low, and long term survival of the species may depend upon maintaining a chain of populations rather than preserving isolated populations. Unbiased estimates of the relative sizes of extant populations are currently impossible because of a lack of any systematic censusing.

There is no evidence nor has anyone suggested, that *P. hesperia* is in general decline, and any known reductions are attributable to habitat destruction through urbanisation or agriculture. However, no systematic population monitoring is currently conducted, and although there appears to be no cause for concern, it would be prudent to obtain better information regarding the number, distribution, size and extent of populations.

Recommendation 1: Consideration be given to establishing a project to map and census the distribution of *P. hesperia* in the south west.

Recommendation 2: In the absence of a strategy to preserve the species, priority should be given to protection of the northernmost populations near Perth, since these are under the most imminent threat.

There is no evidence that CALM's current management practices are anything but conducive to this (or any other) dragonfly's continued survival. Hence, it is possible that research into *P. hesperia* might not be seen as a high priority for internal CRF funding. However, because of its size (it is one of the largest species of dragonflies in the world) and its taxonomic status, potential exists to use *P. hesperia* as a flagship species for other dragonflies. Such a project also has the potential to increase CALM's public image by showing that it is beginning to give greater attention to the conservation of invertebrates.

Recommendation 3: External funding should be sought for any research project into *P. hesperia*.

Recommendation 4: Any project to study *P. hesperia* should consider other species of dragonflies or other taxa deemed worthy of attention, which occur in similar habitats or areas.

Recommendation 5: Consideration should be given to the use of volunteers in any such projects.

By CALM's criteria for the declaration of endangered fauna, *P. hesperia* may qualify for listing under criteria ii)(c) and ii)(d) (i.e. dependent on restricted habitats; and very uncommon, even if widespread). However, it is not under imminent threat from any source, and the Bull Creek site is already listed in the System Six report.

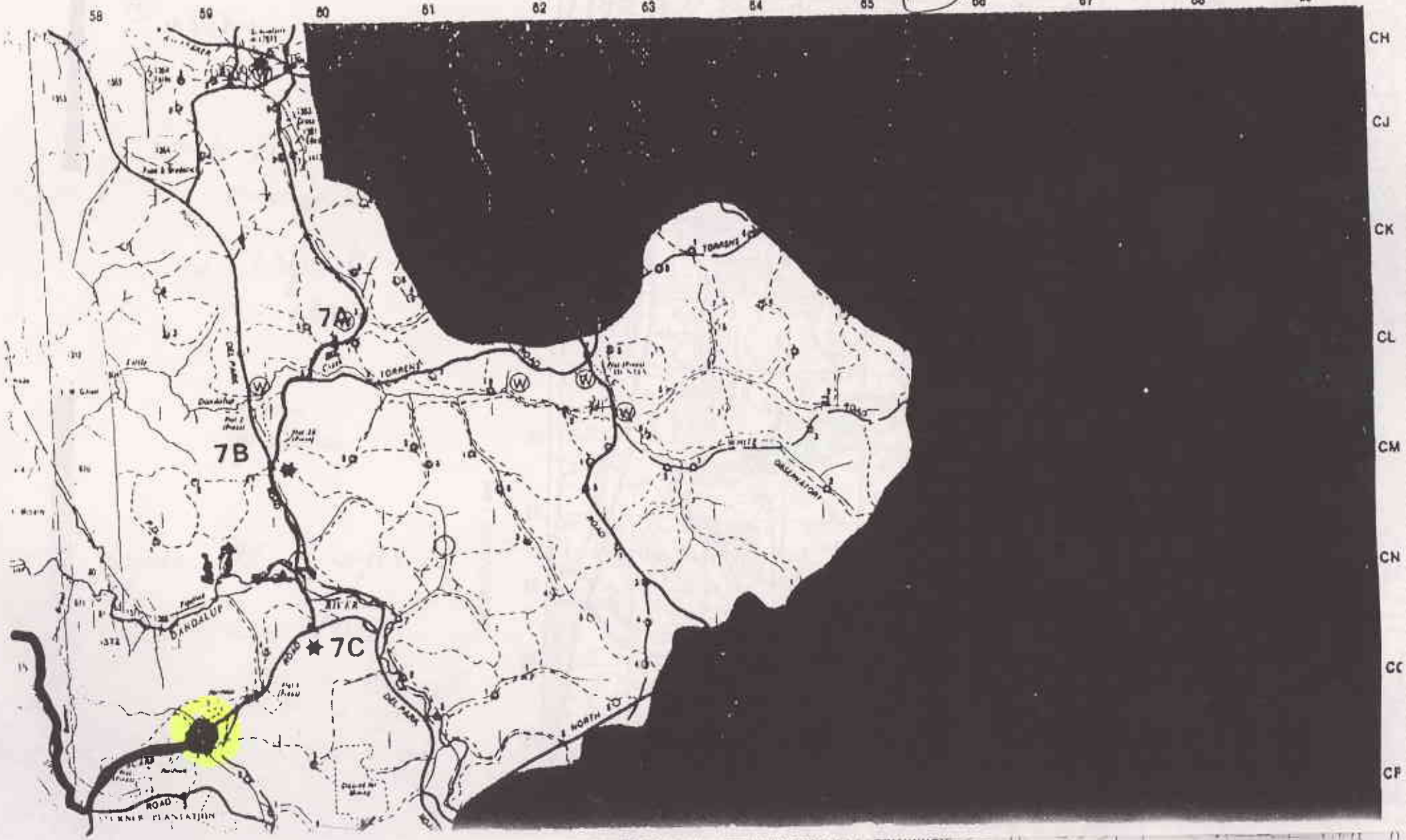
Recommendation 5: P. hesperia be proposed for listing as endangered fauna because of its limited distribution, restricted habitat requirements, and vulnerability to disturbance.

Spring-fed swamps

poo' stream

petroleum seen over shaded area

Map 7



49

Mungedal

Phesperia site

① 7km+ Road on right

② +1.5km "

in to 1km

in original

ie 1 square

= 1km²

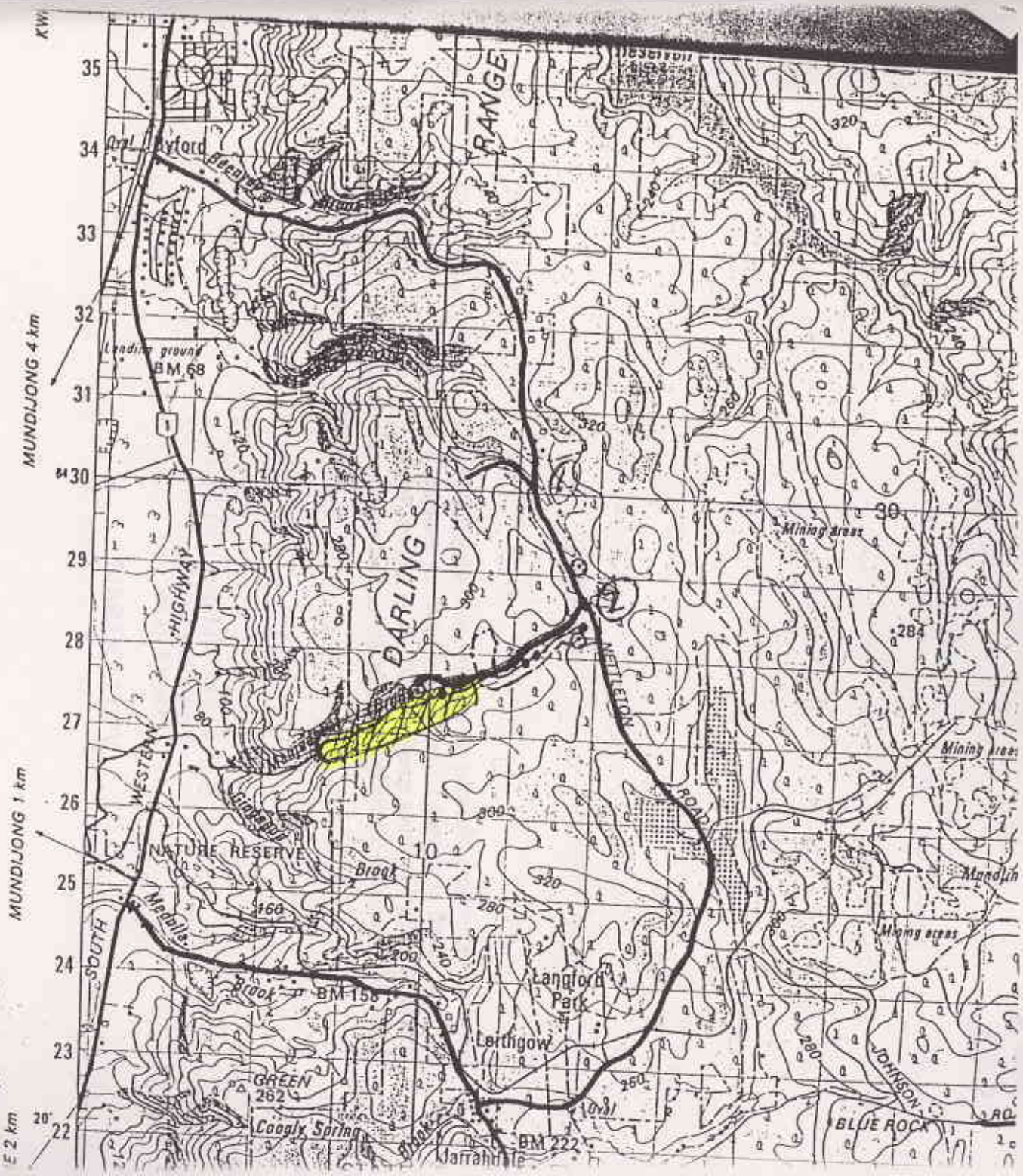
• Dam

⊙ Building

approx. //// P. hesperia

a) where road to dam & BBQ site & camp crosses Mungedal brook

b) From dam, walk along track E to



AIRE ØØ2

Matt -
herewith the Petalura article
submitted to Landscope.
For your info
Andrew
14/4/94

SYNOPSIS

The Western Petalura, *Petalura hesperia* is one of only ten petalurid dragonflies surviving to this day. *P. hesperia* is confined to Western Australia where it is found near the headwaters of a few fresh-water streams in the Darling Scarp south of Perth. Its habits, specialised breeding requirements and conservation status are briefly discussed. The adult and larval stages are illustrated.

WESTERN PETALURA - ANCIENT RELICT OF THE JARRAH FOREST

By Andrew A.E. Williams and Matthew R. Williams

Since European settlement over 200 years ago, Australia has become famous for the uniqueness of its bird, mammal and reptile faunas. Images of kangaroos, koalas, frill-necked lizards, lyre birds and platypuses abound in books and on film. Less well known however are some of the extraordinary insects which inhabit our arid continent. One such insect is the western petalura, (*Petalura hesperia*) a giant dragonfly found in the south-west of Western Australia. It belongs to a primitive relict family of dragonflies, the Petaluridae. Fossil records indicate that petalurids not unlike those living now were plentiful some 150 million years ago. Only ten species exist today, and four of these occur in Australia. The other representatives come from New Zealand, Japan, Chile and North America. The generic name *Petalura* is derived from Greek and refers to the flat, petal-like tail appendages in the male. The specific name *hesperia* also comes from Greek and denotes 'western', a reference to its distribution in Australia.

The western petalura is by far the largest dragonfly in Western Australia, with a body length of 8 to 10 cm, and a wing-span exceeding 10 cm in some individuals. Though large

by modern day standards, it is dwarfed by *Meganeura monyi* the largest of the early fossil dragonflies, which had a wing-span of about 70 cm. Overall the western petalura's colouration is a sombre dull brown. Closer examination however, reveals that the frons and facial area, a mid-dorsal line along the abdomen and the leading edges to the wings are pale yellow. The wing membranes themselves are transparent, with the veins forming a dense and intricate reticulated pattern. The eyes are set wide apart unlike most of the other large Western Australian dragonflies whose eyes meet in the middle. (See Landscope 1986/87 Summer Edition). In the males the flat petal-like tail appendages are very distinctive.

Western petaluras can be seen on the wing from December to February. Compared with other Western Australian dragonflies they look huge, and in flight appear almost black. Their behaviour is also distinctive. Like other dragonflies, they are predators and feed on a variety of invertebrates. They are relatively slow fliers and generally adopt an ambush technique to secure their prey. Individuals perch on the trunks of trees alongside forest streams watching for insects to fly past. They then dart out from their vantage point to catch their prey, often returning to the same perch to feed.

The first specimen of this magnificent insect was collected near Lesmurdie by M. Hawkin in October 1956. Soon after its discovery, further searches by Tony Watson, then a student at the University of Western Australia, revealed local populations at nearby Karragullen, and at Bull Creek on the Swan Coastal Plain. In both cases the dragonflies were located near the headwaters of permanent fresh water streams. This was not entirely unexpected as other members of this relict family require similarly specialised breeding areas; their larvae live in burrows in boggy locations where there is a permanent supply of fresh running water. In south-western Australia similar conditions are found near the upper reaches of a few permanent streams within the jarrah forests of the Darling scarp south of Perth, and this is precisely where the western petalura has recently been found to occur. As with other Petalurids, the western petalura larvae excavate burrows in boggy situations alongside these streams. Burrows examined at Bull Creek by Tony Watson of CSIRO, Canberra, opened on to dry ground, but extended as much as 60 cm below the water table (Fig. 4). The larvae are therefore semi-aquatic. Like the adults they forage for live food which may include such items as earthworms. Small insects and arthropods which investigate the burrows would no doubt also be eaten. Little detailed information is presently available on their habits and life cycle, but it is quite possible that the larval development

could take several years, far longer than the few weeks spent as an adult.

As human populations expand, both urban and rural developments have put increasing pressure on the natural environment around Perth. Given that western petaluras are known to be rare, local and sedentary, concern for their long term survival resulted in the Department of Conservation and Land Management investigating the distribution and conservation status of the species. Not surprisingly these investigations confirmed that the petalura habitats closest to Perth were the most under threat. Bull Creek, the only known locality on the coastal plain, was most severely threatened from urban development. Fortunately however, other sites in forested areas to the south of Perth have now been identified where populations of western petaluras persist. These sites are on land managed by the Department of Conservation and Land Management. The greatest threat to these fragile habitats is decreasing water quality, and for this reason careful management must continue to ensure the survival of this truely wonderful relict from the prehistoric past.

Captions to illustrations:

Fig. 1
Petalura hesperia: MALE ADULT, LIFE SIZE.

Although rather subdued in coloration this dragonfly is the only one of the four Australian Petalura species to show colour tinting at the wing bases.

Fig. 2

Petalura hesperia: FULL GROWN LARVA, LIFE SIZE.

The larva is almost without pigment and takes on the colour of the substrate in which it has dug its burrow. It may take several years to reach full development.

Fig. 3
Petalura hesperia: EXUVIA CLINGING TO LOW VEGETATION.

The mud-encrusted final larval skin (exuvia) can be found clinging to vegetation above the burrow after the adult has emerged and flown away.

Fig. 4
Diagram of *Petalura hesperia* larval burrows.

Insert Box

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