DEPARTMENT OF FISHERIES AND WILDLIFE

Western Australian Wildlife Research Centre

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1 May 1984

DEPARTMENT OF FISHERIES AND WILDLIFE

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984 - 9.00 a.m.

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PROGRAMME

TUESDAY MAY 1 : WILDLIFE RESEARCH SEMINARS

0900-0940	Dr A.A. Burbidge
0940-1020	Mr N.L. McKenzie

MORNING TEA

1050-1130	Dr S.D. Hopper
1130-1155	Mrs A. Taylor
1155-1220	Mr M.A. Burgman

LUNCH

1320-1400	Mr A.J.M. Hopkins
1400-1440	Dr J.A. Friend

AFTERNOON TEA

1510-1550	Dr R.I.T. Prince
1550-1630	Dr J.E. Kinnear

REFRESHMENTS

WEDNESDAY MAY 2 : RESERVE MANAGEMENT PROGRESS REPORTS (0900-1140 HRS) AND DISCUSSION TOPICS (1140-1630 HRS)

0900-0910	Introduction - Jim Lane
0910-0930	Island Nature Reserves - Keith Morris
0930-0950	Pingelly Management Team - Ken Atkins
0950-1010	Katanning Management Team - Ken Wallace
1010-1030	Two Peoples Bay - Graeme Folley

MORNING TEA

1100-1120	Wanneroo Management Team - Gordon Graham
1120-1140	Management Planning - Sue Moore
1140-1230	Rural Information System Videos - Ian Crook/Sue Moore/ Paul Gioia and Discussion

LUNCH

1320-1400	Rehabilitation of Gravel Extraction Sites on Nature Reserves - Ken Atkins and Discussion
1400-1440	Recreational Pressures on Nature Reserves - Keith Morris (Island Reserves)/Ken Atkins (Wheatbelt Reserves) and Discussion

AFTERNOON TEA

1510-1550	Vegetation Survey as a Prelude to Management - Ken Wallace and Discussion
1550-1630	Monitoring, Why and How - Angas Hopkins/Jim Goodsell and Discussion

THURSDAY MAY 3 : RESERVE MANAGEMENT GUEST SPEAKERS (0900-1020 HRS) AND BRANCH DISCUSSION OF NEW DEPARTMENT FORMATION (1100-1630 HRS)

0900-0905	Introduction - Jim Lane
0905-0930	Dr Allan Purcell : Agriculture Department Veterinary Services
0930-0955	Mr Robert Powell : Public Open Space for Wildlife Conservation
0955-1020	Mr Doug Watkins : Benger Swamp Management

MORNING TEA

1100-1130	Progress and Proposed Departmental Structure - Andrew Burbidge
1130-1200	
1200-1230	Proposed Regional Structure - Jim Lane
	Management Planning - Sue Moore

LUNCH

1330-1400	
1400-1430	Radio Communications - Gordon Graham
	Data Processing - Jack Kinnear

AFTERNOON TEA

1500-1630	
	Discussion - Andrew Burbidge

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CHIEF RESEARCH OFFICER'S REPORT

ANDREW A. BURBIDGE

CHIEF RESEARCH OFFICER'S REPORT

Department of Natural Land Management

Undoubtedly the major event of the past year has been the Government's decision to split the Department of Fisheries and Wildlife and place the Wildlife Branches in a new Department of Natural Land Management with the National Parks Authority and the Forests Department.

The Task Force set up by the Premier has argued that amalgamation will lead to more effective protection and management of the State's natural lands, including nature reserves, and believed that wildlife conservation should be included in this new Department. Some points in the Task Force's Report which are of particular relevance to the Wildlife Research Branch include:

1. The proposed appointment of an Assistant Director Research to direct and coordinate activities of the various research groups, and channel research findings to the policy forming levels of the Department.

2. Acceptance that "the Wildlife Research Branch of the Department of Fisheries and Wildlife represents the major existing resource of scientific research capacity available to service natural land management in Western Australia".

3. Adoption of the public participation management planning process developed by this Branch for all land to be controlled by the new Department.

4. Recommendations for an immediate reinforcement of the wildlife research group by recruitment of research biologists and technicians so it can service the expanded land management planning process.

5. Identification of the need for additional staff and resources in the wildlife and national park areas, but also recognition that additional management inputs in the absence of a better understanding of natural ecosystems could easily do more harm than good. While applauding this concept I believe there is a demonstrated need for more management staff and resources for nature reserves now.

There is no doubt that the amalgamation will have a major effect on this Branch. The uncertainty of future roles and relationships has already affected staff morale to a small degree and it is desirable that everyone knows where they stand as soon as possible.

In early March I was appointed the Department's representative on the "Core Group" which is coordinating legislation and administrative arrangements for the new Department and I will endeavour to ensure that the arrangements and

legislation are the best possible for both wildlife conservation and existing wildlife staff.

Several other Inquiries have had an impact on the Branch during the past year. The two major ones are:

Aboriginal Land Inquiry

The terms of reference of this Inquiry ensure that the question of the future ownership and control of nature reserves, particularly those in the more remote parts of the State, be considered by the Commissioner. I coordinated the preparation of a submission by the Department and took part in discussions with other conservation agencies and the conservation movement. On 27 February I appeared before the Inquiry to support the written submission and comment on the Discussion Paper prepared by the Commissioner. It is clear that the Commissioner agrees with the basic proposition that we have put forward - that the National Park and Nature Reserve system remain and that procedures for joint ownership and management with the traditional users of these lands be worked out.

Agricultural Land Release Review

The Cabinet Committee appointed to carry out this Review set up a Working Party to conduct investigations and advise it on new procedures. I was appointed to the Working Party and have helped write a draft report for the Committee. I also prepared the Department's submission to the Review Committee. This work has taken up a considerable portion of my time.

Some notable highlights of the past year include:

Extensions to the Wildlife Research Centre

It is a pleasure to record that funds were provided during the 1983/84 financial year to construct the extensions which had been planned for some time. The Hon. Minister for Works, Mr. K. McIver, M.L.A. visited the Wildlife Research Centre during August 1983 and was able to see for himself the crowded conditions under which staff have been working. I would like to extend my thanks to Mr McIver and officers of his Department for their consideration and every assistance. The extensions should be ready for occupation by Christmas 1984.

Grant Monies

The Wildlife Research Centre has continued to attract grants for special projects and these grants have had a major impact on our activities. Current grants include:

i) Australian Biological Resources Study

Flora survey of the mallee belt on the inland margins of farms between Ravensthorpe and Cape Arid National

Park. Supervisor: Dr S.D. Hopper, Consultant: Mr M.A. Burgman.

ii) Australian Biological Resources Study

Banksia Atlas Project. Supervisor: Dr S.D. Hopper, Research Officer (temporary): Mrs A. Taylor.

iii) Australian Heritage Commission

Rare flora of the Western Australian Wheatbelt. Supervisor: Dr S.D. Hopper, Research Officer (temporary): Mrs S.A. Patrick.

iv) World Wildlife Fund Australia

Captive breeding of the Numbat. Supervisor: Dr J.A. Friend, Technical Officer (temporary) : Mr R. Whitford.

v) Australian National Parks and Wildlife Service

Biological Survey of the Nullarbor Plain (joint project with South Australian Department of Environment and Planning). Supervisor: Mr N.L. McKenzie, Research Officer (temporary): Dr B. Downing.

vi) Australian National Parks and Wildlife Service

Conservation Status of W.A. plant species listed in CITES (Convention on International Trade in Endangered Species). Supervisor: Dr S.D. Hopper, Research Officer: Miss J. Mutter.

vii) Australian National Parks and Wildlife Service

Management of Bernier Island Nature Reserve (Goat control). Supervisor: Mr K.D. Morris.

A major initiative in wildlife conservation occurred during the year when the Commonwealth made money available under the States Assistance Programme through the Australian National Parks and Wildlife Service.

Computing Staff

We were fortunate to receive in the 1983 Budget an allocation of two new staff items for computing. This was particularly timely because otherwise the split in the Department would have left wildlife with no computing staff at all. Unfortunately at the time of writing these items have not yet been advertised.

Changes in Staff

Since the 1983 Research and Management Seminar we have seen some changes in staff. The major change has been the promotion of Dr Ian Crook to the new position of Assistant

Director Wildlife. Since he joined the Branch as our first Reserve Management Officer Planning, and more recently in the position of Chief Reserve Management Officer, Ian has made major contributions to our work. He will probably be remembered most for the development of our management planning process - a process which will now be adopted for all land controlled by the new Department, but he has made many other, often innovative, contributions. I wish him well in the future.

The position of Chief Reserve Management Officer has been filled by Jim Lane and the decision was taken to change the duties of his previous position to a Botanist to support the Biological Survey Programme. We were fortunate to be able to appoint a very experienced botanist, Greg Keighery, to this position and I welcome him to the Wildlife Research Centre. The recent resignation of Ken Cashin from the Survey Unit will enable us to provide Greg with technical assistance in the future.

The Future

Few, if any, of us were in favour of the splitting of our current Department and amalgamation of wildlife with other agencies to form a new Department. However, now that the decision has been taken by Government I'm sure that I speak for all of us when I say that we will endeavour to make the new Department, the best nature conservation agency in Australia. We should look to the amalgamation as an opportunity to improve flora and fauna research and management throughout the State. Doubtless there will be some difficult decisions which will have to be made and it seems likely that some of the staff who currently work in the Wildlife Research Branch will become associated with other sections of the new Department. Our loss will be the other Sections' gain, but we will all still be in the same, if larger, organisation.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

A.A. Burbidge

RESEARCH PROJECTS

1. SHORT-NECKED TORTOISE (Pseudemydura umbrina)

1.1 Objectives

To monitor the populations on Twin Swamps and Ellen Brook Nature Reserve. To develop techniques for captive breeding.

1.2 Procedures

Visits were made to both Nature Reserves at frequent intervals during Winter and Spring. Tortoises were captured by hand. Data on sex, age, size, growth and location were entered in a card index. Population numbers are estimated using the Jolly-Seber Model and the Manley and Parr method, and a minimum number is calculated from mark and recapture data.

A captive population comprising animals from Perth Zoo and wild-caught animals from Twin Swamps Nature Reserve has been established.

1.3 Results

1.3.1 Twin Swamps Nature Reserve

This population is considered non-viable and is almost extinct. One animal captured in 1983 was transferred to the captive colony.

1.3.2 Ellen Brook Nature Reserve

Four animals were captured in 1983. Population estimates continue to indicate a fairly stable population of ca 15 to 30 tortoises. Recruitment occurs in most years.

1.3.3 Captive Breeding

Only one of the 1980 hatchlings remains alive but it is not growing. Various treatments have been tried to trigger growth, so far without success.

No eggs were obtained during 1982 or 1983. The reasons for this are not known.

1.4 Publications 1983/84

Nil.

1.5 Publications 1984/85

My article "The Western Swamp Tortoise - A very rare Australian", published in Australian Natural History in 1983 will be reprinted in a forthcoming book, Edited by Michael Archer and Georgina Clayton titled 'Vertebrate Zoogeography and Evolution in Australia' (Hesperian Press :

Perth).

2. DESERT WILDLIFE

2.1 Objectives

To document the status of rare mammals in the deserts. To document the flora and fauna of existing and proposed nature reserves in Western Australian deserts.

2.2 Procedures

A field trip during 1983 enabled further data to be collected on the distribution of Sminthopsis longicaudata in the Gibson Desert. Visits were also made to Aboriginal Communities in Western Australia, the Northern Territory and South Australia, and to the Conservation Commission of the Northern Territory headquarters at Alice Springs to plan work under the World Wildlife Fund Australia grant to study the conservation status of the Dalgyte or Bilby, Macrotis lagotis. Later Technical Officer Phil Fuller accompanied Richard Southgate, CCNT biologist employed under the WWFA grant, on a trip through central Australia seeking information on the whereabouts of Dalgyte colonies, and on other desert mammals. Richard Southgate visited the WAWRC in February 1984 to collate Western Australian information on Dalgyte distribution.

2.3 Results

A colony of Sminthopsis longicaudata was located in the Clutterbuck Hills (Patar). Much information on past and present distributions and biology of desert mammals has been acquired from Aboriginal people.

2.4 Proposals for 1984/85

Further field work is proposed with Richard Southgate in the Kimberley and Pilbara. An expedition is proposed to examine the conservation status of the declared rare animal Ctenopharus yinnietharra.

2.5 Publications 1983/84

Burbidge, A.A. 1983. Amphibians and Reptiles. In Burbidge A.A. and McKenzie N.L. (Eds). The Wildlife of the Great Sandy Desert, Western Australia. Wildl. Res. Bull. West. Aust. No. 12.

Burbidge, A.A., McKenzie, N.L. and Start, A.N. 1983. Conclusions and Recommendations. In Burbidge A.A. and McKenzie N.L. (Eds). The Wildlife of the Great Sandy Desert, Western Australia. Wildl. Res. Bull. West. Aust. No. 12.

McKenzie, N.L., Burbidge, A.A., George, A.S. and Mitchell, A.S. Environment. In Burbidge A.A. and McKenzie N.L. (Eds). The Wildlife of the Great Sandy Desert,

Western Australia. Wildl. Res. Bull. West. Aust. No. 12.

2.6 Publications 1984/85

Burbidge, A.A. and Fuller, P.J. Finding out about desert mammals. SWANS.

3. BIOLOGICAL SURVEY OF THE EASTERN GOLDFIELDS

See Mr McKenzie's paper for details of project.

3.1 Publications 1984/85

Biological Surveys Committee, Western Australia (in press). The Biological survey of the Eastern Goldfields of Western Australia. Part I. Introduction and Methods. Rec. West. Aust. Mus. Suppl.

4. OTHER BIOLOGICAL SURVEYS

I am involved in field work during the Biological Survey of the Nullarbor Plain (see Mr McKenzie's paper). Data from the work in the Buccaneer Archipelago in 1982 are still to be written up. Data from surveys of Cooloomia Nature Reserve and a proposed reserve near Jibberding are also still to be written up. A report on Salisbury Island is complete and awaiting funds for publication.

5. EGGSHELL THINNING

No further progress to report.

6. REVISION OF BEAUFORTIA R.BR.

Field work during Spring and Summer 1983 was concentrated in the wheatbelt and the Darling Range. During this time special searches were made for two rare species - B. purpurea which is found on and just above the Darling Scarp near Perth, and an undescribed species which occurs on laterite hill tops in the Beverley and Corrigin areas. Field work during 1984 will be mainly in the northern sandplains. This project is programmed for completion in 1989.

7. RAT ERADICATION ON ISLAND NATURE RESERVES

Responsibility for these programmes has been passed to Keith Morris, but my Technical Officer, Phil Fuller, will continue to be involved in the work.

8. MANAGEMENT PLANS

8.1 Objectives

When possible, to provide assistance in the preparation of Draft Management Plans for Nature Reserves, especially where I have been heavily involved in management in the

past.

8.2 Publications 1984/85

Burbidge, A.A. and Folley, G.L. Past management of Two Peoples Bay Nature Reserve. In : Two Peoples Bay Nature Reserve. West. Aust. Nat. Reserve Manage. Plan Series.

COMMITTEES

I am a member of the following committees:

1 Bush Fires Board.

2 W.A.W.A. Reserves Committee.

3 W.A.W.A. Rare and Endangered Fauna Committee.

4 CONCOM Working Group on Endangered Fauna.

5 CONCOM Working Group on Crocodiles.

6 Biological Surveys Committee (Chairman).

7 Working Group on Land Releases (EPA).

8 Agricultural Land Release Review Working Party.

9 Editorial Advisory Committee, Australian Wildlife Research.

10 National Conservation Strategy for Australia, DCE Working Group.

11 Policy Advisory Committee, Master of Natural Resources Management, University of Western Australia.

12 Wildlife Publications Committee.

ADMINISTRATION

Administration of the Wildlife Research Centre, the provision of advice to Head Office, other Government Departments and the public, and Committee work, accounted for about 90% of my time last year. This is far too high a proportion and I look forward to more time being available for research and writing once the new Department is operative and the various Inquiries are complete.

GENERAL

"The Complete Book of Australian Mammals", edited by Ron Strahan, was published during 1983. I wrote the accounts of the following species: Onycholgalea lunata, Lagorchestes hirsutus, L. conspicillatus, Bettongia lesueur, Wyulda squamicaudata, Perameles bougainville and Sminthopsis longicaudata.

I am currently co-editing, with R.W.G. Jenkins of the Australian National Parks and Wildlife Service, a forthcoming CONCOM publication on Endangered Vertebrates of Australia.

I have written the captions and provided scientific advice for two fauna posters - one already published on Mammals of the South-west and one in preparation on Endangered Animals.

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N.L. McKenzie

1. BIOLOGICAL SURVEY - DESERTS

1.1 Objectives

Improve knowledge of the habitats, distributions and conservation status of desert wildlife from which the reserve system proposed by CTRC (1974) can be assessed and where necessary additional reserves delineated.

1.2 Procedures

Organise and undertake biological surveys in desert regions. Review relevant available data in the collections of Australian Museums. This is a continuation of previous work.

The Australian National Parks and Wildlife Service (ANPWS) provided funds for a joint W.A.-S.A. survey of the Nullarbor Plain in December 1983. It was agreed that survey staff from the W.A. Wildlife Research Centre would be responsible for design of the survey and for the preparation of sampling quadrats throughout the Nullarbor. Staff from the South Australian Department of Environment and Planning employed four temporary field assistants (two for Western Australia) and, through their computing facility, were responsible for data storage and manipulation. Both states would field survey teams to carry out the actual sampling and an interim report would be prepared by 30 June 1984. The Western Australian contingent would be provided with funds to employ a co-ordinating biologist.

1.3 Results and Conclusions

1.3.1 The Nullarbor survey is a standardized site-specific sampling program for vegetation and vertebrates carried out over an interval of time sufficiently brief to justify the assumption that all quadrats are sampled simultaneously. The aim is to collect baseline data of a type allowing direct ecological comparisons between all sampled sites and amenable to monitoring programs. The sites sampled (quadrats) are selected to represent the geographic extent of the Nullarbor (Eucla Botanical District and Nullarbor Environmental Association) and to sample as much of the biological diversity of this district as available resources permit.

The size of quadrats is 2 km x 2 km. The large size of the quadrats in comparison with those adopted for the survey of the Eastern Goldfields (BSCWA 1984) was considered necessary to offset the relatively low productivity and standing biomass of Nullarbor communities.

Patchiness is apparent in many Nullarbor Land Units at

a very fine scale so it is anticipated that quadrats of the above size will often encompass a mozaic of several patch-types. The survey strategy demands that vertebrates and vegetation sampling within the quadrat recognises their patchiness and that all observations are related to a particular patch-type thereby providing assemblage data.

Data derived from the above strategy of sampling is amenable to the following forms of presentation, comparisons, and analyses.

Plant, mammal, bird, reptile and amphibian species lists for the Nullarbor district based on

1) the result of this study

2) previous museum and herbarium records including the RAOU Bird Atlas

3) literature records.

A statement of the biological resources of the Nullarbor in relation to the biotic components of adjacent natural districts.

Patterns of species distribution within the Nullarbor will be examined in relation to influence of surface-type, climatic gradients and proximity of adjacent districts.

The influence of surface type, climatic gradients and geographical proximity on assemblage composition will be examined using similarity coefficients. Dendograms will be used to illustrate these relationships and relate assemblages to a lesser number of community types.

Principal Component analyses will be undertaken on the assemblage data looking for predictions of community and assemblage richness, presence of individual species of interest and related matters in terms of biophysical environmental descriptors.

Species accumulation curves will be plotted to give some indication of the completeness of the assemblage inventories made during the autumn field programme.

Reserve design/strategy considerations were completed in January 1984 and the co-ordinating botanist appointed, somewhat belatedly, at the beginning of February. Eighty-five quadrats were selected and established (a total of 1 200 pit traps) to represent the variety of Nullarbor surfaces and provide geographical coverage of the Plain. Fieldwork associated with this phase of the study lasted from 5 February to 30 March 1984. However, most of the Western Australian personnel were withdrawn from the

field on 4 March so that the sampling trip could be organized and undertaken at the earliest possible date; night time temperatures on the Nullarbor in late autumn become too low for nocturnal vertebrates to be efficiently sampled. The field survey commenced on 26 March.

1.3.2 A biological survey of the Mandora Salt Marsh area was undertaken in August 1983. It involved seven days of sampling at eight sites. The array of dune, sandplain, saltmarsh, undulating calcrete plain and alluvial plain vegetations typical of the western edge of the Great Sandy Desert were sampled.

The peat pile at Mandora Swamp referred to in the 1983 review was cored to provide material for radio-carbon dating. It was found to have a continuous profile with no sandy bands apparent. The bottom of the pile, where it interfaced with dune sand, was dated at 8 500 $\pm$ 1 000 radio carbon years. This result was consistent with those found at Dragon Tree Soak and confirmed that the Dragon Tree Soak conclusions (mentioned in the 1983 review) could not be explained by some local geomorphic effect, but represented a regional change in groundwater levels. A duplicate core is currently being dated.

1.3.3 A consultancy was let to Dr Peter Helman to investigate the status of Ghost Bats in the Gibson Desert and Warburton District of Western Australia while he was in Central Australia carrying out similar work for the Northern Territory and South Australian Governments. A report was received in December 1983 evidencing a decline in Central Australian Ghost Bat populations similar to that found for many other desert mammals of equivalent size. The consultancy cost $600.

1.4 Proposals and Recommendations

An interim report on results of the Nullarbor survey is to be prepared for ANPWS by June 30. An application for further funds (so that the sampling can be repeated in September/October when assemblages are expected to be richer in species) has been submitted to ANPWS.

If survey data is to provide a baseline statement of what lived where in the Nullarbor in 1984, and indicate the general species-habitat relationships basic to reserve system design, the sampling strategy must encompass the dynamic aspects of communities. Especially important is the influence of seasonal fluctuations.

To address seasonal variation all quadrats must be re-sampled, at least at the opposite end of the year - spring 1984. A further six months will not only improve the assemblage inventories, but will also allow more confident generalizations about the Nullarbor District as a

whole particularly in relation to researching species and areas of special conservation significance.

At the same time the sites on existing and proposed reserves will be permanently marked, standard photo points established, and the pit traps permanently capped so that there is provision for future monitoring.

As time permits, the survey data from Mandora will be compiled as a Departmental report and reserve acquisition recommendations made covering the mouth of the Mandora Palaeoriver and representing the western edge of the Great Sandy Desert. A further visit may be required to sample uplands of the western Ankatell Ridge and near Radi Hills. As for the Mandora survey reported herein, this will be fitted in during multi-purpose trips made to tropical areas of W.A. from time to time.

1.5 Publications 1983/84

McKenzie, N.L., Burbidge, A.A., George, A.S. and Mitchell, A.S. "Environment". and

McKenzie, N.L. and Youngson, W.K. "Mammals". and

Burbidge, A.A., McKenzie, N.L. and Start, A.N. "Conclusions and Recommendations"

IN

Burbidge, A.A. and McKenzie, N.L. (Eds.) (1983). "Wildlife of the Great Sandy Desert". Wildl. Res. Bull. West. Aust. No. 12.

1.6 Publications 1984/85

Report to ANPWS on Biological Survey of the Nullarbor Plain.
Wyrwoll, K.H., McKenzie, N.L. and Petersen, B. (in prep). "A Holocene date for the end of the last arid phase in north-western Australia".

2. BIOLOGICAL SURVEY - EASTERN GOLDFIELDS

2.1 Objectives

In conjunction with the organizations represented on the Biological Survey Committee to design, organize and undertake a biological survey of C.T.R.C. System 11 (Eastern Goldfields, W.A.) with emphasis on the more southern portions. The main objectives are:

1. Conduct a quantitative survey of the vegetation at selected sites to document structure and species composition. This information will be used to provide habitat data for fauna collections and observations and to re-define existing vegetation maps.

2. Observe, and collect where necessary, vertebrate animals at selected sample sites to provide information on distribution, habitat utilization, temporal fluctuations in abundance, and taxonomy.

3. Using data gathered, reassess the conservation requirements of the system.

2.2 Procedure

As discussed in the 1978 research seminar, the Goldfields have been divided into twelve cells with the W.A. Wildlife Research Centre being responsible for surveying six and the W.A. Museum undertaking the survey of the remaining six. The three-year field program was listed in the 1979 research seminar.

2.3 Results and Conclusions

The analysis of the Cell 6 results continued with an examination of the effectiveness of the techniques of sampling applied to the Goldfields vertebrates in the context of:

a) Actually providing a sufficiently complete inventory of the vertebrate assemblage at sampled sites to distinguish assemblages belonging to different communities from those belonging to the same community.

b) Providing a data base that meets the theoretical requirements of monitoring (long-term management needs) and reserve system design.

The results of this analysis were presented at a workshop on biological survey techniques held in Adelaide (see 8.4). In December 1983, a written version of the paper was submitted for publication as part of the proceedings of the workshop.

2.4 Publications 1983/84

Baverstock, P.R., Adams, M., Archer, M., McKenzie, N.L. and How, R.A. (1983). "An Electrophoretic Study of Species Boundaries within the Marsupial Genus Ningaui". Aust. J. Zool. **31**, 381-92.

2.5 Publications 1984/85

Biological Survey Committee (in press). "The Biological survey of the Eastern Goldfields of Western Australia". I. - Introduction and Methods. Rec. West. Aust. Mus. Suppl. Ser.

McKenzie, N.L. (in press). "Biological surveys for nature conservation by the Western Australian Department of Fisheries and Wildlife - a current view". Proceedings of the Workshop on Survey Methods for Nature

Conservation, Adelaide, 1983.

McKenzie, N.L. and Milewski (in prep). "The biological survey of the Eastern Goldfields". VI. - The Kalgoorlie-Kurnalpie Cell.

3. BIOLOGICAL SURVEY - KIMBERLEY

3.1 Objectives

Improve knowledge of the habitats, distributions and conservation status of Kimberley wildlife to provide a basis for reserve acquisition recommendations and to identify areas of particular conservation concern.

3.2 Procedures

i) Organise and undertake biological surveys in the Kimberley.

ii) Encourage, edit contributions to, and write survey publications on Kimberley wildlife, thereby promoting study of plant and animal groups in the Kimberley by government organizations.

iii) Undertake survey work and write papers relevant to Kimberley mammals, especially their biogeography and taxonomy, where these are relevant to conservation needs.

3.3 Results and Conclusions

The results of the Buccaneer Archipelago survey remain to be compiled. A poster on results of the survey was presented in Darwin during May 1983 at the Ecological Society of Australia symposium on the "Ecology of the Wet-Dry Tropics" (see 8.1).

3.4 Recommendations and Proposals

No Kimberley field survey work is proposed during 1984/85. However, a broad-scale inspection of Kimberley communities is proposed in late 1984 with the following objectives:

1. To familiarize staff from the reserve management section with problems confronting conservation measures (especially our reserves) in the region.

2. To investigate the feasibility of low-key management strategies in the Kimberley. Personal contact with people managing pastoral leases adjacent to our reserves informing them about the reserves is one example. Another is the use of aerial survey techniques to assess and monitor damage to reserves caused by frequent burning and grazing by cattle. An immediate need is to document cattle damage along the eastern side of the Prince Regent Nature Reserve.

3. To undertake an aerial search of the Edgar Ranges, and suitable sites nearby, for additional populations of Pandanus spiralis var. flammeus. Is it really rare and endangered?

4. Using the drilling rig, purchased with Commonwealth funds for the Nullarbor survey, to penetrate the sand layer under Mandora Soak looking for additional peat strata (see 1.3.2).

3.5 Publications 1983/84

McKenzie, N.L. and Kenneally, K.F. "Background and Environment". and

McKenzie, N.L. "Mammals". and

McKenzie, N.L. "Conclusions and Recommendations".

IN

McKenzie, N.L. (Ed.) (1983). "Wildlife of the Dampier Peninsula, South-west Kimberley, Western Australia". Wildl. Res. Bull. West. Aust. No. 11, 1-83.

4. OTHER SURVEYS

4.1 Objectives

To broaden the input of survey into Departmental activities and encourage a standardized approach to survey designs.

4.2 Procedures

To provide advice on design philosophies and techniques in biological survey. To take a collaborative field involvement in survey work of other sections when necessary and as staff commitments permit.

4.3 Results and Conclusions

The Salisbury Island survey (discussed by A.A. Burbidge) and sampling work being undertaken on reserves in the western wheatbelt (discussed by S. Moore) are examples.

5. ECOLOGICAL STUDIES - MANGROVE BAT COMMUNITIES

5.1 Objectives

A long term study, the first step of which is an inventory of the species richness of bats in the different mangrove communities along the W.A. coastline. The project aims to inventory bats occurring in each block of mangroves.

5.2 Procedure

By relating the environmental situation and observed behaviour of each bat recorded with the flight characteristics

of its wings (aspect ratio calculations based on wing bone measurements), to document species structure of bat communities in mangroves. In effect, I am trying to separate the species within each such fauna in terms of ecological niche parameters related to differences in the functional requirements of their food hunting.

5.3. Results and Conclusions

The first paper, reporting the results of work in the three Kimberley mangrove sub-districts, has been submitted for publication; results were presented at the E.S.A. Symposium on the "Ecology of the Wet-Dry Tropics" held in Darwin during May 1983 (see 8.2).

5.4 Recommendations and Proposals

Further fieldwork is required before the data from the Pilbara and Carnarvon Districts can be analysed. This will be carried out as opportunity presents during other work.

5.5 Publications 1984/85

McKenzie, N.L. and Rolfe, J.K. (in prep). "Guild structure of mangrove bats in the Kimberley, Western Australia".

6. CHIROPTERAN STUDIES - MORMOPTERUS TAXONOMY

6.1. Objective

To review the taxonomy and distribution of Tadarida (Mormopterus) in Western Australia.

6.2 Procedure

Morphometric and anatomical examination of available specimens; comparison with material from elsewhere in Australia. Use of enzyme electrophoresis to cross-check morphometric and anatomical conclusions. A hobby project involving about two weeks work per year.

6.3. Results and Conclusions

Morphometric analysis yielded four main groups within Australian Mormopterus. An appraisal of Glans Penis anatomy of 80 male specimens resulted in further sub-division - eight species groups can now be distinguished within Australian Mormopterus. These correspond to eight species groups distinguished independently by Peter Baverstock using electrophoretic material.

Four of the species occur in Western Australia.

6.4 Recommendations and Proposals

A classification is being undertaken of the remaining 200 specimens (o and ^{o}) measured to determine the cranial and external measures that best distinguish the eight species

groups. Depending on the outcome of this analysis, a poster on Taxonomy of Australian Mormopterus will be presented at the joint American-Australian Mammal Society meeting in Sydney in July 1984.

6.5 Proposed Publication

Taxonomy and Distribution of Australian Mormopterus (Chiroptera : Molossidae).

7. COMMITTEES AND WORKING GROUPS

Biological Survey Committee - the System 11 study is the current project.

Department of Conservation and Environment study on the future of the Bungle-Bungle area.

8. SEMINARS, WORKSHOPS, PUBLIC RELATIONS, EXTENSION

8.1 Wildlife and Biogeography of the Buccaneer Archipelago in a Late Quaternary context. E.S.A. Symposium Poster, Darwin, by K.F. Kenneally and N.L. McKenzie.

The Buccaneer Archipelago straddles the mouth of King Sound on the North Kimberley coast and comprises numerous islands, islets and rocks lying between lat. 15°50'S and lat. 16°20'S and between long. 123°15'E and long. 123°47'E.

The islands lie within the Kimberley Basin, an area dominated by Proterozoic sandstones. Their rugged geomorphology reflects this relationship.

Surveys throughout medium and high rainfall areas elsewhere in the Kimberley Basin and of medium and low rainfall areas in the Canning Basin to the south provide a basis for biogeographical interpretation of the wildlife of the archipelago.

The biogeographic affinities of the Buccaneer Archipelago are consistent with the current view of late quaternary changes in sea level and climate. Based on a time depth curve and the present bathymetry of King Sound, most of the islands would have been isolated between 9 500 and 11 000 years BP. These islands support a mesic wildlife including a proportion of species today restricted to high rainfall parts of the Kimberley.

8.2 Community Structure of Mangrove Bats of the insectivorous foraging guild. E.S.A. Symposium talk, Darwin, by N.L. McKenzie.

A guild of insectivorous bats was inventoried in two of the four tropical mangrove biogeographical districts recognised in Western Australia by Semenuik et al. (1978).

Using flight morphology as an index of potential foraging niche, the species composition of each mangrove district was compared with the pool of potential colonizers (the array of additional bat species known from the adjacent terrestrial district). The flight morphologies of co-existing species were dissimilar. In both districts, the flight morphologies of nearly all potential colonizers overlapped with at least one mangrove bat species.

Four flight zones (foraging microhabitats) were arbitrarily distinguished within the mangal in terms of their relative obstruction to direct flight: high over stand, close over canopy, beside stand and under canopy. All zones were occupied by at least one bat species; each species was found to favour one zone. Field observations indicated that two of these zones should have been further sub-divided.

8.3 Patterns of vertebrate decline in Western Australia ANZAAS talk June 1983 by A.A. Burbidge and N.L. McKenzie. See A.A. Burbidge Review.

8.4 Biological surveys for nature conservation by the Western Australian Department of Fisheries and Wildlife - a current view. Workshop on Survey Methods for Nature Conservation talk, Adelaide, by N.L. McKenzie.

The biological survey activities of the Western Australian Department of Fisheries and Wildlife include a program to assess and improve the coverage of the State's nature reserve system. This programme is based on a district by district biological survey of plants and vertebrates.

Two main strategies have been adopted. In one, species are documented in terms of land units distinguished using generalized descriptions of vegetation, geomorphology and surface-type; internal heterogeneity is not quantified. In the other strategy, sampling is confined to particular sites, each of which is carefully described using an array of environmental descriptors. The merits of the two are discussed.

An approach combining both strategies has been adopted in the recent Great Sandy Desert and Eastern Goldfields surveys. These surveys are described. Some preliminary analyses of the Goldfields data are included.

8.5 A talk on the reserve system and mammal conservation problems was given to Muresk Agricultural College students in March 1984.

8.6 Other Publications

The Complete Book of Australian Mammals by R. Strahan (Ed.) was published in 1983. A number of species accounts and advice on species distributions were contributed (see 1983 Review).

McKenzie, N.L. (1983). "Bats - A part of our disappearing heritage". SWANS 13(3), 3-7.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

S.D. Hopper

1. ATLAS OF THE W.A. FLORA - PILOT PROJECT

1.1 Objectives

To initiate a volunteer-participant atlas project aimed at recording the present distribution and abundance of Western Australian orchids (162 spp.) and kangaroo paws (12 spp.). To develop an interactive computerized data base system which allows for the retrieval and manipulation of the biogeographical information to serve departmental responsibilities in wildflower conservation. To assess the value of extending the atlas project to other plant groups on completion of the pilot scheme.

1.2 Procedures

Activity this past year has included:

a) continued development by Mr Paul Gioia of computer programs that allow mapping of species' distribution data on the minicomputer screen; the current system now allows for a linear scale (in km), major town names and national park/nature reserve boundaries to be automatically plotted;

b) continued soliciting of sight records on the distribution of orchids from members of the W.A. Native Orchid Study and Conservation Group;

c) the preparation of two interim series of distribution maps showing orchid sight records that were on computer file as at August 1983 and April 1984;

d) the development by Mr Gioia of a kangaroo paw mapping system as part of the pilot rural joint project run by LISAC using Intergraph and Vax equipment (this involved an 8 month secondment);

e) the preparation of the manuscript of a colour book on orchids of Perth that will serve as a guide to identification in future Atlas work;

f) an application for funding for a national Banksia Atlas was made to A.B.R.S.

1.3 Results

Figure 1 gives examples of interim orchid maps produced for contributors to the Atlas Pilot Project. Mr Gioia's programming efforts have produced an efficient and sophisticated system for handling Atlas data in an interactive graphics environment.

The following table summarises progress in contributions to the Orchid Atlas Pilot Project as reflected in the three

FIGURE 1

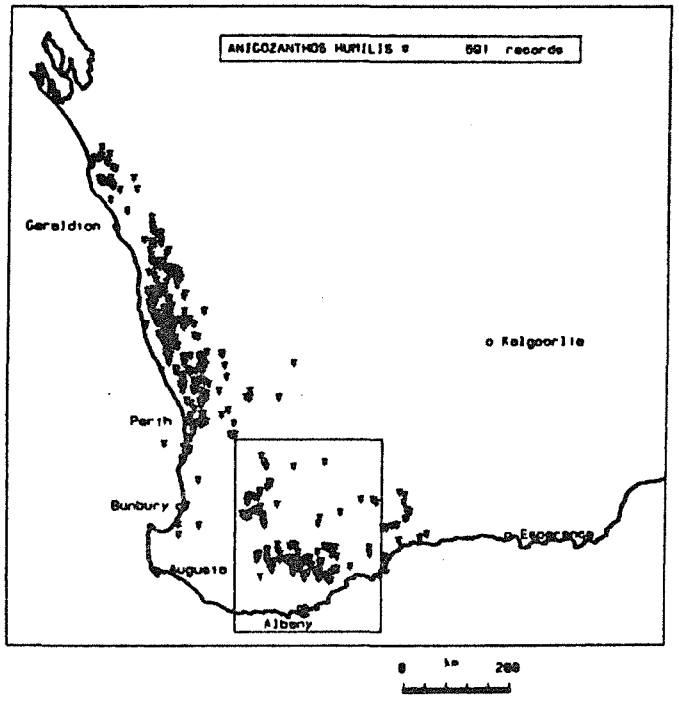
FLORAPLOT

A Department of Fisheries and Wildlife
LAND INFORMATION SYSTEM PROJECT,
forming part of the Atlas of Western
Australian Flora Pilot Project.

Funded by the Australian Biological
Resources Study and the Department of
Fisheries and Wildlife

08-APR-84

PLOT SPECIFICATIONS



National park & nature reserve
boundaries as at 30/6/82. Digitised
from 1:1000000 & 1:3000000 maps
from Lands & Surveys' State Modified
Polyconic series and reprojected.

Map data courtesy Lands & Surveys Dept.
Albers + Area Proj. Std Par 17 30', 31 30'
C. Mer 121 E. Prod. by Maproj
(Hutchinson,1980) on Clarke's 1858 Spheroid

FLORAPLOT

A Department of Fisheries and Wildlife
LAND INFORMATION SYSTEM PROJECT,
forming part of the Atlas of Western
Australian Flora Pilot Project.

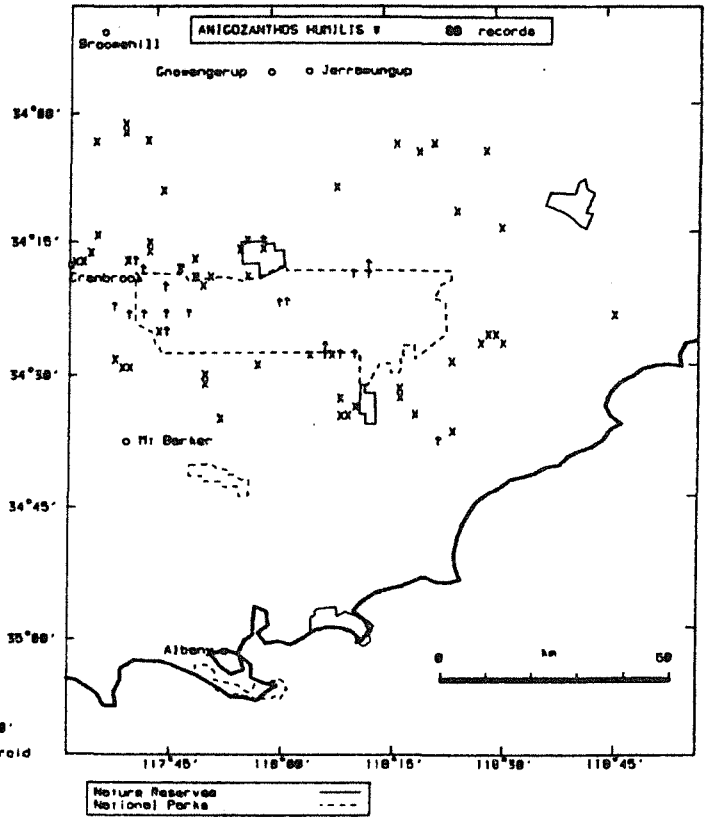
Funded by the Australian Biological
Resources Study and the Department of
Fisheries and Wildlife

08-APR-84

PLOT SPECIFICATIONS

Reserve Status :

A Class †
B Class †
C Class †
Unspecified X



National park & nature reserve
boundaries as at 30/6/82. Digitised
from 1:1000000 & 1:3000000 maps
from Lands & Surveys' State Modified
Polyconic series and reprojected.

Map data courtesy Lands & Surveys Dept.
Albers + Area Proj. Std Par 17 30', 31 30'
C. Mer 121 E. Prod. by Maproj
(Hutchinson,1980) on Clarke's 1858 Spheroid

series of interim maps produced so far.

	Series 1 Aug. 1982	Series 2 Aug. 1983	Series 3 April 1984
No. of contributors	4	13	19
No. of sight record sheets	127	230	635
No. of sight records	868	1 136	n.a.
No. of species observed	85	97	c. 150

As predicted last year, the production of interim maps for contributors has instilled a great deal of interest in the pilot project.

The manuscript for the book on orchids of Perth has been shelved awaiting completion of taxonomic research on spider orchids and hammer orchids.

A.B.R.S. granted $32 500 for the first year of a proposed three year national Banksia atlas program. Mrs Anne Taylor was appointed in February 1984 as a research officer to coordinate this project, and discusses the Banksia Atlas separately in this publication.

Mr Gioia's eight month secondment to work on the LISAC Rural Joint Project provided valuable experience with the Intergraph computer system and in working with personnel from other government departments. However, his thorough analysis of the system showed that its inflexibility in certain areas rendered it unsuitable in a research environment. He recommended against basing the Banksia Atlas on the Vax Intergraph system. With the acquisition of a few small items of hardware, the Tektronix-Cyber system developed for the Atlas Pilot Project will handle the Banksia Atlas efficiently.

1.4 Conclusions

The Atlas Pilot Project has been successful thus far. It has established the importance of a number of key elements if success is to be achieved. Examples include an efficient interactive computing system, the production of interim maps for contributors so that they can see the results of their labours, and the need for a minimum of two staff members to run the project - a coordinator and a computer programmer. The pilot project has also generated useful experience for research and programming staff in having to deal with the computing bureaucracy in government. And lastly, the pilot project has achieved one of its major aims in convincing A.B.R.S. that the Wildlife Research Centre has sufficient competence in the field to now run the national Banksia Atlas.

1.5 Proposals for 1984/85

Continue the orchid atlas for one more year, and prepare a book thereafter. Write up reports on the kangaroo paw pilot project and the computer system FLORAPLOT as

departmental publications. Place research data on the system for rare plants and for eucalypts. Seek funds from A.B.R.S. for the second year of the Banksia Atlas.

1.6 Publications 1983/84

Hopper, S.D. (1983). (Ed.) Orchids. Interim Map Series 2. Atlas of the Western Australian Flora. Pilot Project. Mimeographed Report. (Dept. Fish. Wildl. : Perth.)

Hopper, S.D. (1984). (Ed.) Orchids. Interim Map Series 3. Atlas of the Western Australian Flora. Pilot Project. Mimeographed Report. (Dept. Fish. Wildl. : Perth.)

1.7 Proposed Publications 1984/85

Brown, A.P. and Hopper, S.D. Orchids of Perth.

Gioia, P. Floraplot - A computer-based data management and graphic display system.

Hopper, S.D., Gioia, P. and Hall, N. A computer graphics study of the distribution and conservation status of kangaroo paws and related plants.

2. LICENSING AND MANAGEMENT OF THE WILDFLOWER INDUSTRY

2.1 Objectives

To advise on the effective management of the wildflower industry. To undertake research on aspects of the industry that effect the conservation status of wildflowers.

2.2 Procedures

Incoming pickers' returns were sorted chronologically and stored. Recommended changes to the Wildlife Conservation Act were discussed with senior staff but have yet to be implemented. An application was made to the Australian National Parks and Wildlife Service for funds to employ a Temporary Research Officer to document the reservation status of and harvesting techniques used on W.A. species listed on Appendix II of CITES. Advice on W.A. flora was given through the CONCOM Working Group on Endangered Flora to the Australian delegation to the 1983 meeting of CITES at Botswana.

2.3 Results

The Botswana CITES meeting rejected half the commercially-used W.A. taxa recommended for deletion from Appendix II. A.N.P.W.S. granted $15 000 for the first six months' appointment of the Temporary Research Officer. Ms Julie Mutter was appointed to this position in February 1984. To date she has collated available information in the literature and on departmental files regarding the occurrence of Appendix II species on some 500 national parks and nature reserves.

2.4 Conclusions

None.

2.5 Proposals for 1984/85

Await proposed changes to legislation and the licensing system. Complete the project on the reservation status and harvesting of CITES Appendix II plants. Seek new staff appointments to work on the wildflower industry.

2.6 Publications 1983/84

Nil.

2.7 Publications proposed 1984/85

Mutter, J. and Hopper, S.D. The reservation status of and harvesting techniques used on heavily exploited commercial Western Australian wildflowers.

3. CONSERVATION STATUS AND BIOLOGY OF RARE SPECIES

3.1 Objectives

To investigate the systematics, distribution and reproductive biology of rare plant species and undertake effective programmes of reserve acquisition and management for their conservation. To supervise contractual work aimed at surveying rare plants.

To recommend additions and deletions to the list of taxa gazetted as rare under the Wildlife Conservation Act. To prepare publications on the State's rare flora.

3.2 Procedures

Information on rare species was obtained through literature searches, consultation with local botanists, active field programmes, and through the letting of consultancies for surveys of particular species. Attempts to acquire reserves for rare plants were continued. A major effort to prepare material for publication was undertaken. Applications for grants for research on rare plants were made to the Australian Heritage Commission and to the Australian Biological Resources Study.

3.3 Results

(a) Systematics

A large proportion of research time was allocated to systematic studies on rare flora these past 12 months. Field work, herbarium studies and preparation of manuscripts were undertaken to clarify the status of rare flora in the genera Eucalyptus, Conostylis, Anigozanthos, Blancoa, Drakaea and Caladenia. Projects nearing completion include

revisions of Drakaea, Conostylis, Blancoa and Anigozanthos, papers describing new rare taxa among eucalypts of the Mt Lesueur and Stirling Range regions, and in Caladenia species in the Perth Flora region.

Progeny trials and electrophoretic analyses suggest that five of the six Stirling Range eucalypts previously regarded as new species are hybrid in origin. The genetics of this remarkable group of mallees is the subject of current investigation.

Highlights in 1983 field work included the discovery of a number of new eucalypt taxa in collaboration with M.I.H. Brooker, and several new taxa of spider orchids in collaboration with A.P. Brown.

(b) Survey

Largely through the labours of consultants and wildlife officers, survey information on rare plants was obtained from herbarium records and through field work. The projects undertaken varied from general collations of existing data on rare and geographically restricted plants through to detailed searches for individual species.

S. van Leeuwen, as part of a W.A.I.T. Biology Work Experience Project, collated published literature, photographs, herbarium records and drew maps for geographically restricted plants of the Pilbara region. He presented the following summary:

> "From this study 64 plant species have been identified as being rare or restricted to the Pilbara, Fortescue Botanical District. Of these 64, nine can be classified as being rare, 20 as having a very restricted geographical range, 22 as having a restricted geographical range and 28 as occurring in a conservation reserve. The inclusion of other species, both described and undescribed, to this list could be made possible through future taxonomic work on species of the area such as the Euphorbias, Goodenias and the Acacias as well as more intensive field surveys and studies related to the flora."

M.A. Burgman completed the first year of a two year study of virgin mallee vegetation between Ravensthorpe and Cape Arid. His comprehensive interim report was summarised as follows:

> "The Australian Biological Resources Study provided funds in 1983 for a botanical survey of potential agricultural land in the Roe Botanical District, to be administered by the Western Australian Wildlife Research Centre.
>
> A total of 2 250 km of roads, survey lines and tracks were surveyed to ensure adequate sampling of all soil and vegetation types. Some 1 915 plant specimens were

collected and 820 different vascular plant taxa were identified. Voucher specimens for all taxa were prepared for incorporation into the Western Australian Herbarium (PERTH). Dwarf shrub species comprised 45% of the species list. A total of 154 taxa (18.8% of the total) were undescribed or of uncertain taxonomic status. The major families collected were Myrtaceae, Leguminosae and Proteaceae and the major genera were Acacia, Eucalyptus, Melaleuca and Grevillea. The distribution of species of the genera Eucalyptus and Banksia, two dominant structural groups, were mapped. It was estimated tentatively that 70-80% of the flora of the area was collected. The level of invasion of exotic plants is low (2.6% of total taxa). The district has a strong biogeographic relationship with southern South Australia (26% of total identified taxa also occur in South Australia).

There were 95 taxa collected in 1983 that are rare, geographically restricted or poorly known. Of these, 21 require immediate survey to determine their conservation status. Rare or restricted plants make up 11% of the flora list. This necessarily excludes all undetermined collections and the proportion that rare plants make of the complete flora will be higher than 11%.

Indices of rarity, threat and disturbance were proposed to assist in the survey of rare plants. The indices provide a method of determining the relative degree of rarity of different species. Values of the indices for different taxa, when considered together, will facilitate the objective estimation of conservation priorities and aid the administration of limited resources by establishing priorities for effort based on the different threat faced by different species. An example of the use of the indices using variants of Eucalyptus diptera Andrews complex shows that there is no severe threat to this species from current proposed agricultural development.

Two trial nested plots were surveyed. The resulting species-area curves suggest that an optimal sampling area for ecological studies may be about 200 m^2.

The biogeography of the Roe District was briefly reviewed. A study of one taxon, Boronia inornata Turcz., reflects the relationship of the district with southern south Australia and provides an example of speciation events in the study area.

It is recommended that in 1984, current reserves be surveyed, rare flora be surveyed in detail, the flora inventory be expanded with special attention paid to the ephemerals and to non-flowering taxa, and that an ecological survey be undertaken to identify areas of species richness and endemism."

Mrs S.J. Patrick, now on staff as a Temporary Research Officer on funds provided by the Australian Heritage Commission, completed a survey during October-November 1983 for six rare species in the York area. Her report is in preparation.

Mrs Patrick worked primarily in 1983 on preparing a report on presumed extinct and very rare plants of the wheatbelt. After conducting a literature search and consulting with field botanists and taxonomists, 43 plants are now known to be possibly extinct, 42 are very rare, 6 are known from only one large population, and 14 are known to be widespread but in very small local populations.

Wildlife officers in the Department have responded positively to an increased number of request for inspection and further survey of rare or geographically restricted plants. Many significant discoveries were made, including the rediscovery of the presumed extinct plants Hemigenia viscida and Acacia vassalii by Wongan Hills D.W.O. P. Roberts.

c) Reserve acquisition and management

Reserve proposals were prepared for several areas of land to conserve rare plants. Liaison with Reserve Management Officers was maintained, particularly in relation to threats to rare plants posed by firebreak construction.

A proposed realignment to Formby South Road through Stirling Range National Park was inspected with the engineer in charge and the realignment was moved to avoid destruction of some rare eucalypt hybrids.

d) Administration and legislation

Advice was given on a number of applications to take gazetted rare plants. Administrative arrangements to notify landowners of the presence of gazetted rare plants on their properties were initiated for numerous species.

Research on additions and deletions to the gazetted rare flora was undertaken and recommendations will be made.

Liaison occurred with several other departments with an interest in land on which rare species occur. The Mines Department, Main Roads Department, Forests Department and National Parks Authority have all made internal administrative arrangements to better handle notification about rare flora sites.

As mentioned previously, the involvement of wildlife officers in the administration of rare flora matters has increased considerably this past year. This system works well, giving farmers and government agencies a local contact person to deal with in relation to rare flora in country districts.

A meeting of the CONCOM Working Group on Endangered Flora was attended in Hobart in March 1984. The resources needed to adequately conserve Australia's endangered flora were estimated at this meeting. The W.A. Wheatbelt was regarded by all delegates as a region of national importance that deserves urgent attention to conserve its rare flora.

e) Extension and publicity

Assistance was provided in the preparation of a colour poster on rare flora. Articles on flora conservation were prepared for SWANS. A number of talks were given to amateur and scientific bodies interested in rare plants.

3.4 Conclusions

None.

3.5 Proposals for 1983/84

The above programs will continue as discussed below. However, I see a need to initiate a fresh study like that recently completed on Eucalyptus caesia so that the administration and management of a few of the gazetted rare species can occur from an informed biological viewpoint. It is therefore proposed that new programs commence aimed at:

(i) developing laboratory facilities and expertise in electrophoretic analyses of allozyme variation;

(ii) investigating the reproductive biology of selected rare plants in considerable detail.

Surveys of rare and poorly known species will continue, primarily by consultants, with an emphasis on land under consideration for release for agriculture.

The Australian Heritage Commission has awarded a further grant of $11 000 for a survey of rare wheatbelt plants. A major thrust will be made on this project, and on the A.B.R.S. funded survey of the mallee region.

Consultant S. van Leeuwen will complete a report on available information on rare and restricted plants of the Kimberley. Librarian E. Laczo will complete a similar report for the W.A. Deserts as part of a project for a W.A.I.T. postgraduate course.

Information on locations of rare plants will be accessed onto computer files developed for the Flora Atlas Pilot Project.

The survey of rare eucalypts, banksias and other plants on existing nature reserves will be continued.

Wildlife Officers interested in surveys of rare plants will be given every assistance possible.

Taxonomic work on rare Conostylis, Anigozanthos, Caladenia and Drakaea will continue.

A taxonomic study of rare acacias related to Acacia myrtifolia will be continued in collaboration with B.R. Maslin.

Taxonomic studies of rare eucalypts will be continued in collaboration with M.I.H. Brooker.

Work on the proposed book on rare W.A. flora will commence.

3.6 Publications 1983/84

Hopper, S.D. (1983). Applied plant systematics : case studies in the conservation of rare Western Australian flora. Australian Systematic Botany Society Newsletter 35, 1-6.

Hopper, S.D. (1983). New wildflowers from the Wongan Hills Wildlife District. SWANS 13(1), 10-14.

Hopper, S.D. (1983). Grants aid flora surveys in the wheatbelt and its margins. SWANS 13(1), 20-25.

Hopper, S.D. (1983). Rare flora of the Mount Lesueur area. SWANS 13(3), 14-16.

Hopper, S.D., Campbell, N.A. and Caputi, N. (1984). Geographical variation in fruits, leaves and buds of Eucalyptus caesia. Nuytsia (in press).

Hopper, S.D. and Muir, B.G. (1984). Conservation of the kwongan. In J.S. Pate and J.S. Beard (eds). Kwongan - Plant Life of the Sandplain. (Univ. W.A. Press, Nedlands) pp. 253-266. (In press).

3.7 Publications proposed 1984/85

Bird pollination of Eucalyptus caesia.

Geographical variation and conservation status of Mottlecah Eucalyptus macrocarpa and E. macrocarpa x pyriformis hybrids - coauthored with T. Fetherstonhaugh and N. Caputi.

Eucalyptus carnabyi - rare hybrid or relict species?

Conservation status of the Kalbarri catspaw Anigozanthos kalbarriensis.

New eucalypts from the Mt Lesueur region and the Stirling Range - coauthored with M.I.H. Brooker.

Revisions of Drakaea, Conostylis, Blancoa and Anigozanthos.

Some new and reinstated taxa in Caladenia (Orchidaceae).

4. RESERVE SURVEY, ACQUISITION AND MANAGEMENT

4.1 Objectives

To contribute botanical expertise in reserve survey, acquisition and management on an *ad hoc* basis.

4.2 Procedures

Proposed reserves were visited when requested by the C.R.O. or opportunity allowed, and recommendations made regarding acquisition and management.

4.3 Results

Over the past year several reserves or proposed reserves were surveyed or visited and relevant notes entered on departmental files.

4.4 Proposals for 1984/85

Contribute towards Sue Moore's biological survey of Chiddarcooping Hill Nature Reserve.

Make plant collections from other granite rock nature reserves.

Continue the survey of the eucalypts and banksias in the Stirling Range National Park and adjacent nature reserves.

Prepare for publication results of the biological survey of Cooloomia Nature Reserve.

Continue other surveys on an *ad hoc* basis.

4.5 Conclusions

None.

4.6. Publications 1983/84

Nil.

4.7 Publications proposed 1984/85

A biological survey of Cooloomia Nature Reserve - co-authored with A.A. Burbidge, P.J. Fuller and J. Rolfe.

Banksias and eucalypts - a pilot study of the distribution and habitats of flora on Two Peoples Bay Nature Reserve -coauthored with G.L. Folley.

Eucalypts of Stirling Range National Park.

5. BIOLOGY OF KANGAROO PAWS AND CONOSTYLIS

5.1 Objectives

To collate and prepare for publication studies conducted on the kangaroo paws and Conostylis. To continue observations on pollination on an ad hoc basis. To undertake a detailed study of the systematics of Conostylis

5.2 Procedures

Standard data analysis, literature research, herbarium studies and writing manuscripts. Limited field surveys were also conducted. Preparation of the Flora of Australia treatment of Anigozanthos, Conostylis, Blancoa and Macropidia commenced.

5.3 Results

None.

5.4 Conclusions

Nil.

5.5 Proposals for 1984/85

Write papers and continue field observations as time, inclination and opportunity allow. Complete descriptions of all Conostylis, Anigozanthos, Blancoa and Macropidia species for the Flora of Australia treatment.

Commence work on a field guide to the kangaroo paws and related plants.

5.6 Publications 1983/84

Nil.

5.7 Publications proposed 1984/85

Flora of Australia treatments of Anigozanthos, Conostylis, Blancoa and Macropidia.

6. POLLINATION ECOLOGY OF THE AUSTRALIAN FLORA

6.1 Objectives

To develop an understanding of Australian plant-pollinator relationships, particularly those involving birds and small mammals. To explore the significance of pollination studies in conserving rare plants.

6.2 Procedures

Pollination observations were made on an ad hoc basis in conjunction with field work. Methods were mainly observational, but also may have included capturing pollinators and checking for pollen loads, measuring nectar volume and nectar concentration, and examining related features of the reproductive biology of plants under study.

A literature search was continued for observations of vertebrates feeding at flowers of W.A. plants.

6.3 Results

Further original observations of honeyeaters and honey possums feeding on flowers were made. These, together with published observations and numerous personally communicated records from interested colleagues have been collated in draft form for a proposed departmental report. A.H. Burbidge spent a few days at the Wildlife Research Centre in March finalising this report.

6.4 Conclusions

None.

6.5 Proposals for 1984/85

Dr Robert Wyatt from the Department of Botany, University of Athens, Georgia, U.S.A. arrived in Perth in March to commence a year's sabbatical research on pollination of granite rock plants in the wheatbelt. He is based at the Wildlife Research Centre. Some collaborative research will be undertaken with him.

6.6 Publications 1983/84

Nil.

6.7 Proposed publications 1984/85

A checklist of observations of vertebrates feeding at flowers and on fruit of Western Australian plants - coauthored with Allan Burbidge.

Evolutionary responses of Western Australian plants to nectarivorous birds - co-authored with Allan Burbidge.

Mechanical and temporal controls of flower opening in *Banksia* - coauthored with V. Turner.

Pollination ecology of *Grevillea petrophiloides* coauthored with I. & G. Crook.

7. EVOLUTION AND BIOGEOGRAPHY OF THE AUSTRALIAN FLORA

7.1 Objectives

To develop an understanding of evolutionary processes and biogeographical principles in the Australian flora.

7.2 Procedures

Literature review and analysis, writing manuscripts, *ad hoc* field work.

7.3 Results

None.

7.4 Conclusions

None.

7.5 Proposals for 1984/85

Continue work on the phytogeography of Australian acacias and eucalypts.

7.6. Publications 1983/84

Nil.

7.7 Proposed Publications 1984/85

None.

COMMITTEES

1. W.A.W.A. Flora Committee.

2. Technical Advisory Committee to the Road Verges Conservation Committee.

3. Convening Committee, Perth Chapter, Australian Systematic Botany Society.

4. CONCOM Working Group on endangered flora.

5. Advisory Committee for the Bachelor of Applied Science (Biology) course, W.A.I.T.

6. Supervisory committees for M.A. Burgman's Ph.D. thesis project (U.W.A.), and for two W.A.I.T. MSc Biology projects.

7. Research Committee, Australian Orchid Foundation.

Committee work this past year involved 10% of my time.

ADMINISTRATION

Administrative work related to flora conservation and to research undertaken by the six professional Research Officers/consultants and the Technical Officer under my supervision has involved 40% of my time.

SEMINARS

1. A bird pollination trilogy ANZAAS, Perth (May 1983).

2. Some new monocalypts (Eucalyptus) from south-western Australia. ANZAAS, Perth (May 1983).

3. Botany Course, Eyre Bird Observatory (10-16 July

1983).

5. New spider orchids in south-west Western Australia. W.A. Native Orchid Study and Conservation Group, Perth (Sept. 1983).

6. The eucalypts of southern W.A. Wildflower Society, Perth (14 Feb. 1984).

7. New spider orchids and hammer orchids from W.A. S.A. Branch, Native Orchid Society of Australia, Adelaide (2 March 1984).

8. Conservation of southern W.A. eucalypts. W.A. Tree Society, Perth (29 March 1984).

9. Flora conservation research. Bunbury Technical College (17 April 1984).

10. Common trees of the south-west. W.A. Native Orchid Study and Conservation Group (18 April 1984).

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

A. Taylor

RESEARCH PROJECTS

1. BANKSIA ATLAS

1.1 Objectives

To co-ordinate a computer based national Banksia Atlas program based on sight records supplied by volunteer contributors over the next 3 years (1984-86).

1.2 Procedures

During the 6 weeks I have been working on the project my activities have included:

i) Drawing up of the sight record sheet (see fig. 1) and recording instructions for efficient use by amateur Atlas contributors.

ii) Development of a Banksia Atlas "Kit" for contributors, to include: introductory letter; photocopy of an article written for SWANS vol. 14 no 1. 1984; sight record sheets; set of computer codes; set of instructions for completing a sight record sheet; supplementary field guide; field notebook; recommendation on field guides to be used and note on recent name changes in the genus Banksia; map of state showing nature reserves/national parks (whenever possible).

iii) Initial contact made with members of the Society for Growing Australian Plants (SGAP) Australia-wide by means of an article in their national newsletter.

iv) The testing of the Banksia Atlas "Kit" by volunteers from the SGAP.

v) Preparation of the manuscript for a supplementary field guide on the 24 new Banksia species and 13 new varieties not previously covered in Holliday and Watton's Field Guide to Banksias (the recommended field guide). Illustrations for the field guide have been prepared by Mrs Sue Patrick.

vi) Discussions with Mr Roger Jaensch, project co-ordinator of the South West Waterbird Project on organisational aspects of running a volunteer program, namely: design of record sheets; provision of field guides; need for and establishment of regional co-ordinators; design and frequency of newsletter; breakdown of project into manageable time scales; publicity; recruitment (and training) of volunteers; personal interactions with contributors.

vii) Initial discussions with Dr S.D. Hopper and Mr M. Taylor concerning the production of an audio-visual on the Banksia Atlas, comparable to the wetlands/waterbird a.v. produced during 1983. A production of this nature would be of considerable assistance in

recruitment of contributors Australia-wide.

viii) Communications with the National Parks and Wildlife Service and the Lands and Surveys Department in each state regarding the availability of suitable maps for use by Atlas contributors, i.e. showing the boundaries of national parks, nature reserves, and local authorities.

1.3 Results

The trial of the Banksia Atlas "Kit" is underway and I am awaiting feedback from the volunteers.

1.4 Publications: 1983/84

Taylor, A., (1984). Banksia Atlas Initiated, SWANS (in press).

1.5 Proposals for 1984/85

i) After modifications, submit the components of the Banksia Atlas "Kit" for printing.

ii) Recruiting of volunteers. Initially this is likely to concentrate on W.A. and on the members of clubs such as the Wildflower Society, National Parks and Reserves Association (WANPARA), Natural History Society, Gould League, Country Woman's Association. Considerable country travel is envisaged. The feasibility of participation from schools will be investigated.

iii) Organise field trips both to areas where rare or endangered Banksias are thought to occur and to remote areas which would otherwise probably not be covered. Volunteers will be encouraged to participate on many of these trips.

iv) Organise identification workshops if such a need is expressed.

v) Prepare quarterly newsletter and interim maps for distribution to contributors.

BANKSIA ATLAS – SIGHT RECORD SHEET

observer [R C] | Date of observation Yr Mn Dy | Locality number for day

Use BLOCK LETTERS to fill in blank boxes ☐ inserting one letter per space.
Shaded boxes ▩ are "for office use only."
On dashed lines ------ use own handwriting.
If in doubt about a record, leave space blank.
Write zero as "Ø", seven as "7", letter i as "I", letter z as "Z"

Map used and scale ----------

LOCALITY

[G D] latitude ° ' " | longitude ° ' " | Resolution code | Altitude code | Shire code | Shire name ----------

Straight line distance from nearest place (Km) (last digit ↓) | Direction from nearest place (↑first letter)

Nearest named place [N P]

Further details of location [L O]

[P R] Reserve or National Park? Y=yes N=no | Reserve/Park name. ---------- | Reserve number | Reserve class

HABITAT

[L F] Within 2km of coast? Y=yes N=no | landform code | Aspect of Slope (XXX=no slope) (first letter →)

[S V] Surface soil code | Soil colour code | Vegetation structure code | Vegetation restricted to road verge Y=yes N=no

If "X" (=other) recorded for any of above, please specify

[R F] Signs of recent fire? Y=yes N=no | If yes, approx. number of months ago. (Ø = less than 1 month) ← (last digit)

Dominant species at record locality ------

BANKSIAS PRESENT

[B S] ← Number of Banksia species at this locality

	Name	Species code	Shrub (S) or Tree (T)	Average height in metres (last digit ↓)	Population code	Flower code	New shoot growth? Y=yes N=no	Response to fire code	Pollinator code	Specify Name of pollinator if Known +
[D B]	----------									----------
[O B]	----------									----------
[O B]	----------									----------
[O B]	----------									----------
[O B]	----------									----------
[O B]	----------									----------

Additional remarks ----------

[D T]

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

A.J.M. Hopkins

SUMMARY

The highlight of the past year was a 14 week visit to Cambridge (UK) to study regeneration mechanisms in Australian sclerophyllous vegetation. Several other institutions were visited at the same time. Most of the existing field programmes continued with further sampling and analysis of results. A number of papers were completed; included are the Middle Island chapters and this proposed Bulletin now awaits final editing before going to press. Several initiatives were undertaken: an experimental fire at Tutanning, a study of fine scale pattern in shrub-dominated vegetation and a study of the biogeography of Dryandra with particular emphasis on the Northern Sandplains (Irwin District). For the forthcoming year, work will continue on the existing long-term projects with special emphasis being placed on the production of the Two Peoples Bay Management Plan. Three new programmes are proposed: the setting up of a network of monitoring sites and establishment of the associated data bank, a study of variation in certain vegetation characteristics along a rainfall gradient through the Wheatbelt, and a modified programme of research in the Archipelago of the Recherche.

RESEARCH PROJECTS

FIRE ECOLOGICAL STUDIES

1. MODELLING

1.1 Objectives

To develop an array of ecosystem and land-use modelling strategies for use in reserve management decision making and in research.

1.2 Procedures

The development of PREPLAN (Pristine Environment Planning Language and Simulator) has been discussed in past years. Recent work has been directed towards improving the data base using Geographic Information System technology at ESRI Australia Ltd. The new resource inventory is now complete and work is currently underway to integrate this with the other PREPLAN components. The resource inventory is being reformatted for incorporation in the Rural Land Information System.

Development of resource inventories for the Two Peoples Bay Nature Reserve and the proposed Mt Lesueur Nature Reserve is proceeding slowly with the assistance of the Australian Survey Office. It is anticipated that a version of PREPLAN will be operational for these two areas within 3-5 years.

In July 1982, Dr H.H. Shugart (Oak Ridge National Laboratory, Tennessee) visited the WAWRC to discuss a proposal for modelling plant succession in Western

Australian plant communities. It is proposed to develop a model based on JABOWA for a species-rich shrub dominated community at Tutanning as a pilot project. Collection and analysis of suitable data is proceeding.

1.3, 1.4 Results and Conclusions

The value of this deductive approach to the study of change in, and effects of management decisions on, complex ecosystems have been elaborated in previous years. The approach is complementary to the inductive approach based on direct observation and measurement.

1.5 Proposals for 1984/85

Work on refinement of the Tutanning PREPLAN will continue as time permits. Results of observations on the experimental fire at Tutanning will be incorporated and some data will be utilized for validation of the model.

1.6 Publications 1983/84

Kessell, S.R., Good, R.B. & Hopkins, A.J.M. (in press). The implementation of two new resource management information systems in Australia. Environ. Manage.

1.7 Publications 1984/85

A paper is being presented at ANZAAS (Canberra, May 1984) on this work.

2. CENTRAL WHEATBELT STUDIES (TUTANNING, BOYAGIN, DRYANDRA).

2.1 Objectives

To develop a knowledge and understanding of patterns and processes in vegetation in this area, particularly in relation to fire.

2.2 Procedures

Historical and field environmental data have been collected and collated. A permanent systematic grid of 316 points has been established at Tutanning for sampling and long-term monitoring.

A block in the centre of Tutanning Nature Reserve is scheduled to be burnt in Autumn 1984. At the time of writing the experimental fire has been deferred for two weeks pending appropriate weather conditions. The block to be burnt has been sampled in detail prior to the fire and regeneration quadrats established.

Two new studies were established at Tutanning in the past year. One, on the growth and flowering patterns of Xanthorrhoea reflexa is designed to collect data that would validate (or otherwise) estimates of fire histories using

this species and the Lamont, Downes and Fox technique. The second study, of pattern in a shrub community, is to provide further insight into mechanisms influencing community dynamics. Locations of all individuals of all species have been mapped in a 64 m^2 area. Data await analysis.

2.3, 2.4 Results and Conclusions

Field sampling has been completed and grid data are gradually being compiled. A separate study of the shrublands has highlighted the floristic importance of this vegetation type and has shown that species-richness declines little with increasing time since fire (at least to age 50 years).

2.5 Proposals for 1984/85

Compilation and analysis of grid data will continue. Analysis of results from the pattern study will commence in May 1984. Study of regeneration plots will begin with detailed sampling in September-October 1984.

2.6 Publications 1983/84

Some of the data from the grid sampling have been incorporated in the paper listed in 2.

2.7 Publications 1984/85

Hopkins, A.J.M., Burbidge, A.A. & Brown, J.M. Tutannning Nature Reserve I. History, environment and results of some preliminary studies. Dept. Fish. Wildl. West. Aust. Report. (carried forward).

3. TWO PEOPLES BAY

3.1 Objective

To study the processes and time scales of regeneration on south coast kwongan vegetation after fire.

3.2 Procedures

Two study plots have been established, sampled, burnt and resampled over a 7 year period.

3.3, 3.4 Results and Conclusions

Preliminary data were presented in the seminar document last year. The ready regeneration of many species by resprouting, particularly in the absence of grazing, makes the area fire-prone before some important seed regenerating species reach reproductive maturity. This poses some major management problems. Further, recent sampling suggests that the fires have promoted some floristic change that may be regarded as undesirable.

3.5 Proposals for 1984/85

Analysis of results will continue.

3.6 Publications for 1983/84

Nil.

3.7 Publications 1984/85

A management planning document is currently being prepared and publication of the Draft is scheduled for late 1984. The document will include a chapter on fire as well as chapters on the flora and vegetation.

4. MIDDLE ISLAND, RECHERCHE ARCHIPELAGO

4.1 Objectives

To monitor the regeneration of the vegetation after fire and to study the development and maintenance of vegetation in the absence of fire.

4.2 Procedures

A set of 36 permanent quadrats was established in 1973 in the area burnt in the 1972/73 fire. These have been sampled 6 times in the 10 year period of the study. Plots were established in the then-unburnt portion of the island's vegetation in 1976 to study regeneration mechanisms operative in the absence of fire. A fire in January 1977 consumed the vegetation of much of this unburnt section of the island including some monitoring sites set up in conjunction with the unburnt vegetation study plots. These monitoring sites have now been resampled three times.

4.3, 4.4 Results and Conclusions

Detailed results of all investigations are included in the publication that is now in final stages of editing. As a result of all the work on Middle Island, it is now the best known island of the Archipelago; the value of the data base will be discussed at the seminar. In terms of regeneration, the 1972/73 areas are proceeding well but return to the pre-fire structure is still many years off being achieved. Of particular significance is the importance of the seed regeneration mode on Middle Island. At many mainland sites studied, about 70% of species are reported to have regenerated by resprouting from below ground parts (lignotubers, rootstocks, rhizomes etc). In contrast, only a few of the species in Middle Island quadrats resprouted to any extent and seedlings of those species were also prominent. Interpretations of the difference will be elaborated at the Seminar.

4.5 Proposals for 1984/85

A trip to Middle Island is scheduled for October/November 1984 for the purpose of monitoring the regeneration quadrats.

Results of the work on Middle Island have suggested two further lines of investigation that would be worthwhile pursuing:

a) The biogeographic implications of variations in relative importance of major plant families on islands of the Archipelago; the relationships of these variations to such things as palaeoclimate (at time of isolation) and patterns of differentiation.

b) The evolutionary significance of the reduced degree of resprouting on islands relative to mainland sites especially in relation to possible effects of Aboriginal man and fires on the mainland.

It is proposed that these two topics be researched further by extending the studies in the Archipelago over the next 5 years to 5 or 6 of the other islands of the group.

4.6 Publications 1983/84

Nil.

4.7 Publications 1984/85

Hopkins, A.J.M. (editor). Results of Studies on Middle Island (Recherche Archipelago), Western Australia. Wildl. Res. Bull. West. Aust. No. 13 (carried over from 1983/84).

This publication is now in the final stage of editing.

5. OTHER

5.1 Objectives

To examine population structure and reproductive strategies of important plant species in relation to fire. To examine the effects of fire on structural and successional patterns in vegetation.

5.2 Procedures

Sampling of the two Eneabba study sites (discussed last year) has been completed and papers are being prepared for publication.

5.3, 5.4 Results and Conclusions

Virtually the complete range of possible regeneration strategies are developed in Eneabba vegetation. These include patch regeneration (reported for tropical rain forest), the slow trickle regeneration and pulse regeneration (after fire or major disturbance).

5.5 Proposals for 1984/85

Data will be prepared for publication.

5.6 Publications for 1983/84

Bell, D.J., Hopkins, A.J.M. & Pate, J.A. Fire in the kwongan. pp 178-204 (1984). In J.S. Pate & J.S. Beard (eds). Kwongan - Plant Life of the Sandplain. Univ. of W.A. Press.

5.7 Publications for 1984/85

Griffin, E.A. and Hopkins, A.J.M. The dynamics of long unburnt vegetation at Eneabba, Western Australia I and II (carried over from 1983/4).

REGENERATION STUDIES

6. ENEABBA RESERVES

6.1 Objectives

To develop an understanding of the ecology of the Eneabba area to ensure appropriate land-use management, particularly in relation to the various mining activities in the area.

6.2 Procedures

Studies undertaken to date are:

1. Ecological survey of the mineral sand mining area at Eneabba.

2. Effects of cutting native vegetation for use in rehabilitation as brush material.

3. Rehabilitation after sand mining (analysis of results of the Allied Eneabba S.E. Factorial experiment).

4. Regional variation in kwongan on lateritic uplands.

5. Detailed ecological survey of the Mt Lesueur - Cockleshell Gully area.

6. Biogeography of Dryandra particularly in relation to the Irwin Botanical District (Northern Sandplains).

6.3, 6.4 Results and Conclusions

The results of studies 1-5 have already been discussed and have been included in publications or draft manuscripts. The major studies have shown that the Eneabba - Mt Lesueur area is of considerable biogeographic importance, being central to a node of floristic richness and having numerous endemics restricted to it. The study of Dryandra was initiated to further investigate this feature. Results are

still being compiled and analysed.

6.5 Proposals for 1984/85

Analysis of results and preparation of publications on this work will continue. Some further detailed field work on the Dryandra project may be necessary and a proposal for external funding for that is being prepared.

Because of the land-use conflicts associated with the Mt Lesueur area, and its importance to nature conservation, it seems desirable to develop a management plan as soon as possible after the reserve is gazetted. Work has begun on compiling the necessary information for such a plan; this will continue over the next 2 years with the co-operation of the Australian Surveys Office and CRAE and using Mr E.A. Griffin as a consultant.

6.6 Publications for 1983/84

Griffin, E.A., Hopkins, A.J.M. & Hnatiuk, R.J. (1983). Regional variation in mediterranean-type shrublands near Eneabba, south-western Australia. Vegetatio, **52** : 103-127.

Hopkins, A.J.M., Keighery, G.J. & Marchant, N.G. (1983). Species-rich uplands in south-western Australia. Proc. Ecol. Soc. Aust. **12** : 15-26

Hopkins, A.J.M. (1983). A new reserve for the Mt Lesueur area. SWANS **13**(3) 10-13

6.7 Publications for 1984/85

Griffin, E.A. & Hopkins, A.J.M. The flora and vegetation of Mt Lesueur area, Western Australia J. Roy Soc. West. Aust. (in press).

Black, R.F., Elkington, J., Griffin, E.A. & Hopkins, A.J.M. Techniques for rehabilitation after heavy mineral sand mining at Eneabba, Western Australia. Reclam. Reveg. Res.

7. BARROW ISLAND

No work was undertaken at Barrow Island over the past year.

8. TUTANNING

8.1 Objectives

To examine appropriate methods for revegetating disused farmland in the central wheatbelt.

8.2 Procedures

This is a collaborative study with Dr Peter Farrington (CSIRO Groundwater). Details are given in previous years

papers.

8.3, 8.4 Results and Conclusions

Nil yet.

8.5 Proposals for 1984/85

Dr Farrington will continue to have major responsibility for this work; the commitment of WAWRC staff is small.

8.6, 8.7 Publications 1983/84

Nil.

RESERVE ADEQUACY

9. TUTANNING NATURE RESERVE - EDGE EFFECT

No action has been taken in the past 12 months. Data from the Grid samples will be analysed as appropriate.

10. EUCALYPTUS FORRESTIANA

10.1 Objectives

To examine the distribution of Eucalyptus forrestiana and make appropriate recommendations for reserves, particularly in the light of EPA Red Book 1 Recommendation 3-9.

10.2 Procedures

Existing and proposed reserves have been surveyed by vehicle and on foot and populations of the species estimated.

10.3, 10.4 Results and Conclusions

A report on the work has been prepared for the EPA.

10.5 Proposals for 1984/85

This study is completed.

10.6, 10.7 Publications

Nil.

11. MONITORING PROGRAMME

11.1 Objectives

To develop methodologies for, and to establish, a programme of long term monitoring suitable for use on all natural areas for recording the changes occurring in the biota, either as a result of the passage of time or after disturbance.

11.2 Procedures

A pilot project has been set up by Mr J.T. Goodsell involving 8 study areas at Clackline Nature Reserve. The results of this project are currently being assessed.

11.3, 11.4 Results and Conclusions

There is a clear need for a scientifically based vegetation monitoring programme to provide the proper basis for future management decisions. Suitable methods, involving permanently marked quadrats and transects and measures of canopy cover of all plant species, have been selected. A number of approaches to designing a network of monitoring sites have been outlined; it remains to select one or more of these and to make the commitment to the programme.

11.5 Proposals for 1984/85

In the event of agreement being reached on the future directions for this programme, it is proposed to begin establishing monitoring quadrats in selected Nature Reserves and National Parks in the next year.

11.6 Publications

Nil.

12. RAINFALL GRADIENTS AND VEGETATION CHARACTERISTICS

12.1 Objectives

To study patterns of species richness, life form and beta diversity along a rainfall gradient in south-western Australia.

12.2, 12.3 Procedures, Proposals for 1984/85

In the first instance this study will focus on patterns in shrub dominated communities on lateritic soils. Sites are being selected on Nature Reserves and National Parks from Boyagin to Lake Cronin, south to Frank Hann and Dongolocking. Nested quadrats will be set up in May 1984 and field sampling will take place in September-October 1984.

13. OTHER

Two papers on kwongan have been written. The first (on the flora) deals with some aspects of diversity in this vegetation type and addresses the questions of stability/ resilience. The second describes the heterogeneous nature of kwongan and discussed possible causes, significance and implication (particularly for reservation).

Lamont, B.B., Hopkins, A.J.M. & Hnatiuk, R.J. (1984). The flora-composition diversity and origins. pp 27-50. In J.S. Pate & J.S. Beard (eds) Kwongan - Plant Life of the Sandplain. Univ. of W.A. Press.

Hopkins, A.J.M. & Griffin, E.A. (1984). Floristic patterns. pp 69-83. In J.S. Pate & J.S. Beard (eds) Kwongan - Plant Life of the Sandplain. Univ. of W.A. Press.

MISCELLANEOUS

A number of minor projects are continued as time permits. Work on the compilation of data from surveys of the Buccaneer Archipelago and Salisbury Island (Recherche Archipelago) has continued.

A period of fourteen weeks, comprising 9 weeks of accumulated annual leave and 5 weeks of working time, was spent overseas. The majority of that time was spent working with Dr P.J. Grubb, Botany School, University of Cambridge, on regeneration mechanisms in Australian sclerophyllous vegetation types. In addition, visits were made to Sheffield University (Professor J.P. Grime), University of Utrecht, The Netherlands (Dr J. de Smidt) and Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier, France (Dr L. Trabaud). Various meetings and seminars were attended. The trip was both useful and stimulating and the contacts made should contribute to the international reputation of the WAWRC.

SEMINARS, WORKSHOPS, PUBLIC RELATIONS

During the visit overseas, seminars were given at Universities of Cambridge and Utrecht. One talk has been given to conservation groups concerned with fire management in natural lands of Western Australia. Advice has been provided to a number of Departments, Authorities, Local Governments and individuals on problems of fire management and rehabilitation.

COMMITTEES

1. Mineral Sands Agreements (Eneabba) Rehabilitation Co-ordinating Committee (DRD).

2. W.A. Wildlife Authority Flora Committee.

3. Technical Committee on environmental Problems associated with Underground Water Extraction (PWD-MWA).

4. ANZAAS. Section 12. Steering Committee for 1983 Congress.

5. 4th International Conference on Mediterranean Ecosystems for Perth August 1984. Organising Committee and four subcommittees.

6. Ecological Society of Australia. Council.

7. Australian Heritage Commission. Steering Committee for WA Projects Officer working on natural areas

Hopkins, A.J.M. & Griffin, E.A. (1984). Floristic patterns. pp 69-83. In J.S. Pate & J.S. Beard (eds) Kwongan - Plant Life of the Sandplain. Univ. of W.A. Press.

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7. Australian Heritage Commission. Steering Committee for WA Projects Officer working on natural areas

listings (Conservation Council).

8. CONCOM/CSIRO Working Group on Mallee Conservation.

Commitment to committee work, administration, and to the provision of advice within the Department has involved about 25% of time. Of this, the major time consuming issue continues to be mining (including court cases) and rehabilitation.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

J.A. Friend

SUMMARY

Field work relating to description of the ecology of the numbat at Dryandra is now largely complete, and during 1984/85 writing up of results will commence. Knowledge gained up to this stage is now being used to investigate the need for and design of appropriate management practices. Meanwhile, the numbat captive breeding project has commenced, following the granting of funds by World Wildlife Fund Australia in October 1983.

1. NUMBAT: SURVEY OF DISTRIBUTION AND DESCRIPTION OF HABITAT

1.1 Objectives

To provide information on the status of the species and to help define numbat habitat.

1.2 At Dryandra

1.2.1 Procedures

i) Driven surveys for sightings

ii) Surveys on foot, recording diggings of numbats, and collecting scats.

1.2.2 Results

These activities were continued at a reduced level in 1983/84, with the addition of some data which supported last year's conclusions. However, an important new finding resulting from these methods as well as from radio-tracking studies is the large extent to which the mallet plantations at Dryandra are used by numbats (see 4.3).

1.2.3 Proposals for 1984/85

i) Driven surveys will be recommenced later in 1984 to assess the effects of predator baiting on numbat populations (see 3.4).

ii) Further surveys on foot will also be undertaken by personnel referred to in 1.3.4. This should allow an assessment of the total inhabited range of the numbat at Dryandra.

1.3 Elsewhere in the South-West

1.3.1 Procedures

Survey on foot, searching for diggings and scats.

Interviews with local people, proposed publicity in local press.

1.3.2 Results

The only survey carried out outside Dryandra during 1983/84 was at Dragon Rocks Nature Reserve in May 1983, when areas of mallet and salmon gum woodland were searched (8 person-days). No signs of numbats were found.

1.3.4 Conclusions

The numbat population on Dragon Rocks N.R., reported in the early 1970s, appears to be extinct.

1.3.5 Proposals for 1984/85

A grant of $5,000 from a private donor for use in numbat research and conservation will be used partly to employ a zoologist to continue this survey work in the south-west. Surveys will be concentrated in uncleared land previously known to support numbat populations and also in the vicinity of recently reported, but as yet unverified sightings.

1.4 The arid zone

1.4.1 Background

The results of investigations into the status and aspects of the biology of the eastern form of the numbat, mentioned in last year's document, were reported in a paper delivered at the 53rd ANZAAS Congress in Perth, May 1983.

1.4.2 Proposals for 1984/85

An article presenting results of investigations into the status and biology of the eastern form of the numbat will be prepared for publication.

2. NUMBAT: FACTORS AFFECTING ASPECTS OF HABITAT

2.1 Objectives

To distinguish environmental influence affecting the availability of food and shelter for numbats.

2.2 Procedures

Fire effects on termites and logs

- monitoring short-term effects in areas to be burnt, examined before and after fire and monitored subsequently for 1-2 years.
- comparison of similar areas with different fire histories to elucidate long-term effects.

Effects of climate on termites.

- manipulation of climate in a small area of forest by watering on several occasions during summer drought to

simulate rainfall. Comparison of termite abundance in numbat feeding zone in watered and unwatered areas.

2.3 Results

An area of natural woodland at Dryandra is to be burnt in April or early May 1984. Three resident numbats have been been captured and fitted with radio transmitters, allowing their home ranges to be determined. Termite abundance in similar plots in the burn area and in a control area has been measured, as well as hollow log abundance. The behaviour of the numbats during and after the fire may now be monitored; changes in termite and log abundance will also be measured.

2.4 Proposals for 1984/85

To monitor the effects of this autumn fire during the next year; to repeat the procedure during a spring burn in a nearby area. Forests Department officers responsible for the management of Dryandra Forest have given their full support to this project.

If time permits, the watering project will be carried out over the summer of 1984/85.

3. NUMBAT: EFFECT OF INTRODUCED PREDATORS ON POPULATIONS

3.1 Objectives

To determine whether the presence of introduced predators, particularly the fox, reduces numbat population numbers.

3.2 Procedures

i) Reduction of predator numbers in an experimental area by baiting, using 1080 over a period of 2-3 years. Monitoring of numbers of numbats in this and a control area by driven surveys.

ii) Survey of forest areas for fox dens, firstly to assess differential occupation in baited and unbaited areas, and secondly to identify prey items from skeletal remains.

3.3 Results and Conclusions

i) Baiting has been carried out at intervals of 3-4 weeks for 20 months, involving a considerable amount of effort, considering other work in progress. Poisoned foxes were found regularly in the baited area during the first 6-8 months but are now found less frequently. An assessment of the effect on the numbat population has not yet been made.

ii) 18 person-days were spent searching for fox dens in Dryandra Forest, but only 6 dens were found, all deserted. 53 identifiable bones were found, most of

which belonged to sheep, rabbits or cats. Four bones were of native mammals; tammar, woylie, brush wallaby and an unidentified smaller marsupial. All bones found belonged to individuals larger than numbats. It is possible that animals of numbat size or smaller, are eaten without leaving skeletal remains at the den in this fashion. This evidence therefore sheds no light on the question of fox predation on numbats.

3.4 Proposals for 1984/85

i) A series of driven surveys will be carried out in September-November 1984. These will be designed to compare frequencies of sightings in the baited and unbaited areas with those found in September-November 1981 before baiting commenced.

ii) Searching for fox dens will continue as time permits.

iii) A reasonable number of numbats are now fitted with operating radio transmitters (12 at time of writing). If significant predation is occurring it is hoped that evidence will be gained from this source.

4. NUMBAT: STUDIES OF INDIVIDUALS AND POPULATIONS

4.1 Objectives

To study aspects of the numbat's ecology relevant to management of the species.

4.2 Procedure

Radio-tracking and observation of individual numbats in Dryandra Forest.

4.3 Results

The development of more powerful and more durable radio-collars this year has considerably enhanced the acquisition of information from radio-tracking. Firstly, it has enabled the accumulation of a relatively large number of marked animals, greatly increasing the return of information on long-term movements, reproduction, and eventually, mortality. Secondly, it has made possible the tracking of juveniles as they dispersed from their mother's home range.

Four juvenile numbats belonging to three litters were fitted with collars in spring 1983. One of these young was taken by a raptor in the Little Eagle-Brown Goshawk size range. Another radio collar was found discarded 5 km from the "nursery" area of its former wearer. The other two numbats are still fitted with collars, occupying new home ranges, both established within a week of leaving their "nursery" areas. One is 15 km away, the other 4 km away from its area of origin.

The other major development relating to radio-tracking is a computer program (written by Norm Hall of the W.A. Marine Research Labs.), compatible with the Tektronix system, which accepts field tracking data and accumulates the time, in minutes, spent by an animal in each square of an arbitrary grid. This will allow the clear graphic representation of large amounts of radio-tracking data. In addition, most areas in which numbats have been tracked have now been surveyed on a similar grid for various habitat attributes - dominant tree species, tree density, log density, litter cover and shrub cover. Together with other information collected on the same grid system, values of these attributes may be compared by multi-variate techniques with the numbats' use of the areas. By this method, it is hoped to identify the habitat attributes, individually or in combination, which have most influence on numbat activity.

Seven of the 12 numbats fitted with transmitters at present are living in mallet plantations. These areas are structurally very different from the Eucalyptus wandoo - Gastrolobium microcarpum association which is preferred habitat in the natural areas of Dryandra. Log abundance, shrub cover, canopy cover and litter thickness all differ greatly from the wandoo areas. It is hoped that the analyses which can now be performed will identify some features which will explain this distribution.

4.4 Proposals for 1984/85

i) Analysis of movement and habitat data, and preparation of publication.

ii) Further monitoring of dispersal of young numbats from their mothers' home ranges.

4.5 Publications 1983/84

Friend, J.A. and Burrows, R.G. (1983). Bringing up young numbats. SWANS 13(1) : 3-9.

Friend, J.A. and Kinnear, J.E. (1983). Numbat Myrmecobius fasciatus. In R. Strahan (ed.). The Complete Book of Australian Mammals. Angus and Robertson, Sydney, p.85.

5. NUMBAT: SEASONAL FEEDING DIFFERENCES

5.1 Objectives

To investigate variation in numbat feeding patterns between seasons.

5.2 Procedures

i) Collection of scats from individual numbats at different times; analysis of scat composition; identification of insect remains.

ii) Recording signs of feeding by individual numbats.

5.3 Results

Little was accomplished in this area in 1983/84 beyond manual sorting of numbat scats.

5.4 Proposals for 1984/85

Attempts will be made to design a mechanised method for breaking up scats and separating insect remains from other material. This will considerably speed up the acquisition of these data.

5.5 Publication 1983/84

Fain, A. and Friend, J.A. (1984). Two new acarid hypopi (Acari, Astigmata) from the faeces of the numbat Myrmecobius fasciatus. Waterhouse (Marsupialia, Myrmecobiidae). Records of the Western Australian Museum 11(2) : 101-108.

6. NUMBAT: RELATIONSHIP OF NUMBAT ACTIVITY TO TERMITE ACTIVITY

6.1 Background

The numbat is the only fully and exclusively diurnal marsupial and this feature has been attributed to its specialised diet. The diel activity of termites in the numbat feeding zone was monitored for comparison with numbat activity data already accumulated.

6.2 Procedure

Sampling of termites in the upper 3 cm of soil at 3-4 hour intervals during a summer day.

6.3 Results and Conclusions

Termite activity (measured by the number of galleries containing termites which were breached in 100 m of trench dug out each sampling time) was found to match numbat activity at various times of day at this time of year (February). Numbats enter logs and become inactive during most of the afternoon in summer. Termites disappear from the upper soil galleries during this time. Temperature data collected during sampling indicate that the movement of termites out of these galleries is to escape high temperatures. The lack of termites in these galleries at night has been attributed to their tendency to aggregate in the nest, maintaining the nursery temperature at a steady level despite the drop in ambient temperature.

6.4 Proposals for 1984/85

Repeat 24 hour sampling during winter, when numbat activity

is compressed into a few hours in the middle of the day.

Prepare a publication describing these findings.

7. TRANSLOCATION OF NUMBATS TO AREAS OF FORMER OCCURRENCE

7.1 Objectives

To re-establish numbats in apparently suitable forested areas which previously supported populations.

7.2 Procedure

Capture of numbats from populated areas; release of animals fitted with transmitters in suitable patches of bushland; monitoring their survival and establishment.

This project is dependent on the availability of suitable animals. If Dryandra is to be the source of numbats for this project, it would only go ahead if the survey planned for September-November (section 1.2.3) indicates a significant increase in numbers since 1981.

8. ESTABLISHMENT OF CAPTIVE BREEDING COLONY OF NUMBATS AT WOODVALE

8.1 Objectives

i) To establish a colony of numbats in captivity at W.A. Wildlife Research Centre.

ii) To provide conditions conducive to breeding.

iii) To formulate an artificial food for numbats so that provision of live termites is not necessary for their survival and breeding.

iv) To increase knowledge of numbat biology by observation of captive animals.

8.2 Procedures

In October 1983 World Wildlife Fund Australia granted $57 500 to the Department over two years to support this project. In December Mr Dick Whitford was appointed as a Technical Officer to maintain the colony. At the time of writing, two compounds have been built and procedures established to provide captive numbats with live termites. We are now in a position to receive the first numbats.

8.3 Proposals for 1984/85

It is hoped that at least one female with young, and one or two other animals will be captured and placed in the compounds well before the young detach from the mother's teats in July. From that stage it is envisaged that attempts will be made to wean some animals off termites and onto a diet more easily provided.

OTHER PROJECTS

9. TAXONOMY AND ZOOGEOGRAPHY OF AUSTRALIAN LANDHOPPERS (TERRESTRIAL AMPHIPODA)

9.1 Objectives

Description of new species; revision of group at generic level; drawing zoogeographic conclusions.

9.2 Procedures

Collection of specimens; examination of these and museum collections; drawing and description; application of classical and numerical taxonomic concepts.

9.3 Results

Very little time has been devoted to this project this year; completion of Tasmanian paper draws closer.

9.4 Proposals for 1984/85

Completion and submission of paper on taxonomy and zoogeography of Tasmanian landhoppers.

9.5 Proposed Publications 1984/85

Friend, J.A. and Lam, P.K.S. Occurrence of the terrestrial amphipod Talitroides topitotum (Burt) on Hong Kong Island. Manuscript submitted to Acta Zootaxonomica Sinica.

Friend, J.A. Tasmanian terrestrial amphidpoda (Talitridae) (Manuscript under revision).

10. ECOLOGY OF THE WESTERN BARRED BANDICOOT

10.1 Objectives

To investigate aspects of the ecology of Perameles bougainville on Dorre Island.

10.2 Procedure

Visit Dorre Island for 10 days in May 1984. Collect scats and likely food items for identification; radio-tracking of individuals to discover home range, activity patterns and shelter sites; collect other information as appropriate.

Peter Brown, who is working on the Eastern Barred Bandicoot, and John Seebeck (both from Fisheries and Wildlife Division, Victoria) will be present.

SEMINARS AND PUBLIC RELATIONS

"The numbat (Myrmecobius fasciatus) in the arid zone".

Paper presented at session on Biology and Conservation of Arid Zone Vertebrates, 53rd ANZAAS Congress, Perth May 19 1983.

Talk on numbat research to the Kwinana - Rockingham - Medina Branch of the W.A. Naturalists' Club, 16 September 1983.

Talk on numbats to the Orienteering Association of W.A., 30 October 1983.

"Research on the biology of the numbat: a basis for conservation and management of an endangered species". Zoology Department Seminar, University of Western Australia, 6 October 1983.

"Movement patterns of juvenile numbats Myrmecobius fasciatus" Paper presented to the Australian Mammal Society's Scientific Meeting, Armidale, N.S.W. 1 December 1983.

Talk on numbats and termites to the Taxonomy Group, CSIRO Division of Entomology, Canberra 5 December 1983.

Work experience students:

One student from Carmel College was engaged from 22-26 August 1983.

Two students from WAIT School of Biology were engaged from 16 January - 10 February 1984.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

R.I.T. Prince

1. RED KANGAROO MANAGEMENT (Also including EUROS)

1.1 Objectives

To maintain up to date information on the harvested kangaroo stocks and to improve knowledge of the exploitation system and its impact on the kangaroos.

1.2 Procedures

Commercial shooting data obtained from shooter's returns (Form 3) are processed via standard EDP programme. Summarized data are obtained in the form of tables and graphs.

Additional information aiding understanding of this situation is sought where possible.

1.3 Results

Changes required to transfer initial responsibility for updating of harvest monitoring records to the established data base at Head Office were progressively implemented during 1983. Assistance with editing of new data records being accessed was provided to me through to late 1983. The need to maintain the integrity and reliability of information being added to the data base was recognized but the necessary checks could not all be done with respect to the new 1983 records. The need to ensure the validity of the information being stored in this data base remains a problem for future users and those now responsible for the system.

A review of the Department's role in kangaroo management initiated following Dr Crook's appointment as Assistant Director Wildlife, required a substantial input during the latter part of 1983. This included a review of shooter's performance records and implementation of relicensing of shooters for 1984.

Further input to the process of gaining approval for continuation of the State's kangaroo management programmes pursuant to the new Wildlife Protection (Regulation of Exports and Imports) Act 1982 was required through March 1984.

The 1983 Red Kangaroo harvest accounted for c. 160 000 animals. The excess of this harvest above the approved 1983 commercial quota of 140 000 for Western Australia has rekindled the debate in this State on the rationale for and scope of management programmes involving commercial use of kangaroos.

Recensus of the Western Australian Red Kangaroo stocks is now a pressing need and is being planned.

1.4 Conclusions

Authorities responsible for wildlife conservation must continue to be involved in kangaroo management issues. The public debate in this area is in part based on moral/ethical questions, but there is a deficiency in factual information pertaining to the situations in which practical management measures can be, or are required and initiated. We can and ought to continue to contribute such information.

Recensus of the Western Australian kangaroo populations should be expedited.

1.5 Programme for 1984/85

Completion of the supplementary report on Red Kangaroo harvesting and management for the 1980-1982 triennium.

Preparation of a paper comparing the demands placed on rangeland ecosystems by domestic livestock and red kangaroos as producers of animal products and potential competitors.

1.6 Publications 1983/84

Manuscripts of:

Exploitation of Kangaroos and Wallabies in Western Australia I - A review to 1970, with special emphasis on the Red and Western Grey Kangaroos.

and

Exploitation of Kangaroos and Wallabies in Western Australia II - Exploitation and management of the Red Kangaroo : 1970-1979.

were approved for publication in December 1983. Submission to the printers is delayed pending reformatting of the text.

1.7 Publications 1984/85

Exploitation and Management of Kangaroos and Wallabies in Western Australia III - Exploitation and Management of the Red Kangaroo : 1980-1982.

Domestic Livestock and Kangaroos on Rangelands in Western Australia : A Comparison.

2. OTHER KANGAROO MANAGEMENT PROGRAMMES

2.1 Report

All research input into these programmes has been terminated. No publishable material has been generated.

3. DORRE ISLAND STUDIES

3.1 Report

Work on this monitoring project is to be reactivated in conjunction with Mr Goodsell. A request for needed rephotography of the island and the established monitoring sites has been submitted to the Lands Department. Detailed mapping of the island vegetation as noted in the 1981 report will be the first task.

4. BANDED HARE WALLABY - DIRK HARTOG ISLAND

4.1 Objectives

To attempt re-establishment of the species on Dirk Hartog Island. To obtain further information about the species and its biology.

4.2 Procedures

A further attempt at direct introduction of Dorre Island adults to the Dirk Hartog Island experimental area is to be tried.

The original field release enclosure is to be repaired. A second larger enclosure will be constructed nearby, and the vegetation adjacent to these enclosures will be protected from grazing by sheep and goats by construction of a surrounding electric fence.

Following completion of the construction work required, the two enclosures will be stocked with a total of c. 20 new adult wallabies. From this point the field release programme will be similar to that followed previously through 1977-78 and thence through to late 1980.

4.3 Results

Materials for fence construction needed as outlined above and in the 1983 report have been purchased. Work planned through 1983 could not be proceeded with.

4.4 Conclusions

Implementation of this work requires access to more technical assistance than could be obtained through 1983. Work planned for 1983 should however be attempted this year.

4.5 Programme 1984/85

May-June 1983	- review situation Dirk Hartog Island.
July-August 1984	- erect new fencing Dirk Hartog Island and stock enclosures with new wallabies from Dorre Island.

November 1984 - check status of experimental group.

March 1985 - ditto.

4.6 Publications 1983/84

Nil.

4.7 Publications 1984/85

Revise and complete unfinished manuscripts dealing with initial work on this programme.

5. DUGONG

5.1 Report

Coastal surveillance logs for northern Western Australian waters forwarded to the Department have been examined and dugong sighting reports extracted.

Professor P.K. Anderson paid two further short visits to Shark Bay in May-June 1983 and again in September 1983 in the course of his research programme.

Accounts of killer whale attacks on dugong in Shark Bay were received mid 1983. Further information concerning these reports was sought and obtained. A paper reporting this episode has been prepared and is being submitted to J. Mammalogy.

Growth in public concern about possible adverse changes in the impact of Aboriginal hunting on northern dugong populations has added impetus to previous attempts to further our direct involvement in research investigations in this area. Funding for a preliminary investigation appears likely to be provided by ANPWS in the near future.

5.2 Results

The occurrence of killer whale predation in Shark Bay has highlighted a need to take such episodic natural mortality into account in further work.

The need for more knowledge of the dugong stocks in northern Western Australia has been highlighted.

5.3 Programme 1984/85

Pursue contacts with coastal Kimberley Aboriginal communities to ascertain their involvement with dugong and possible impact on local populations with a view to achieving agreement on acceptable management.

Do preliminary reconnaissance survey work on Kimberley coasts using coastal surveillance assistance and some special purpose charter flying funded by ANPWS to locate areas of possible major significance to dugong and assist

in the design of a future more extensive practical programme to document distribution and abundance of Kimberley dugong populations.

Maintain contact with the Shark Bay situation.

5.4 Publications 1983/84

Anderson, P.K. and Prince, R.I.T. Predation on Dugongs : Attacks by Killer Whales. J. Mammalogy (Being submitted).

5.5 Publications 1984/85

None planned.

SEMINARS, EXTENSION, PUBLIC RELATIONS, ETC. 1983/84

Input into Departmental review of Kangaroo Management (see 1).

Programme 1984/85

Attend and deliver paper at Ruminant Physiology Conference, Perth, 7-10 May 1984.

COMMITTEES

1. Kangaroo Management Advisory Committee.

2. Coordinating Committee (APB, Animal Health-Agriculture, Fisheries and Wildlife).

3. Technical Sub-Committee (Coordinating Committee) to consider Holdings of Fauna and Exotic Animals.

Membership of these committees is being dropped.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

J.E. Kinnear

RESEARCH PROJECTS

1. DAMPIER ARCHIPELAGO PROJECT

1.1 Preamble

The rock wallaby species Petrogale rothschildi is found on 3 islands in the archipelago: this species has been studied for a variety of reasons as described at previous seminars. A final field trip was made in August 1983; data analyses are nearly complete and the project will be submitted for publication this year.

1.2 Objectives

A. To complete vegetation surveys on Enderby and West Lewis Islands.

B. To harvest vegetation from post-fire exclosures.

C. To trap the wallaby population resident on the burnt area.

D. To search W. Lewis Island for rock wallabies released in 1982.

1.3 Results

Points A, B, C, will be discussed at the seminar.

D. The rock wallabies were located and the indications were that most had survived; the sand plains were not utilized; these results will be interpreted at the seminar.

1.4 Conclusions

To be discussed at the seminar.

2. DEPUCH ISLAND

2.1 Preamble

Depuch Island was surveyed by a W.A. Museum party in 1962 and reported the presence of the rock wallaby species P. lateralis coexisting with the fox. In 1982 we visited the island briefly and recorded only the fox.

In May 1983, the island was surveyed intensively for a longer period.

2.2 Objectives

To confirm the presence or absence of P. lateralis.

2.3 Methods

By helicopter

2.4 Results and Conclusions

P. lateralis is extinct on Depuch Island. The fox still persists.

2.5 Proposals

Some will be discussed at the seminar.

3. VISIT TO WOODSTOCK STATION

3.1 Preamble

Little is known about the Rothschild's rock wallaby on the mainland; in 1982 a population was found on Woodstock Station and in November 1983 some exploratory surveys were made to assess the status the species.

3.2 Results

Several populations were found: in general all were small consisting of only 2-3 animals; grazing was confined to the vegetation near the rock pile; this pattern is similar to wheatbelt populations of P. lateralis.

Some effects of indiscriminate burning will be illustrated.

3.3 Proposals 1984

Additional studies are needed to complete the assessment of the species status. It is clear that some management is necessary on Woodstock especially with respect to the use of fire.

4. WHEATBELT ROCK WALLABY PROJECT

4.1 Preamble

Five populations of rock wallabies still persist on a group of granite outcrops south of Kellerberrin and these populations have been under study since 1978. Some of the populations are considered to be close to extinction and all population densities are considered to be below the carrying capacity of the habitat. A number of factors have been tested in an attempt to account for the above situation and most have been eliminated as single major causes; one factor, predation by foxes/feral cats, has been under test in a controlled field experiment for the past 2 years; data from this important experiment is, at this writing, being collected and still requires processing and interpretation. The project will be reviewed and discussed in detail at the seminar; at this stage the results imply that there is a predation effect which interacts with environmental factors.

Other aspects have proceeded as planned and are briefly described below.

4.2 Quurekin Rock population (Langdon property)

This population was last trapped in 1980 when we caught 7; in August 1983 we caught 5. This population was known to consist of at least 16 wallabys in 1978; no attempts at predator control have been made. Foxes and feral cats are numerous.

4.3 Tutakin Reserve

Records indicate that this rock carried a widespread population in 1969-70: in 1978 we failed to locate any wallabies and we therefore concluded that the population was extinct. In 1983, R. Bromilow rediscovered a small population; trapping revealed that there were about 7-10 animals.

Of significance, was the nature of the rocky habitat as it was similar to other sites in that it afforded good shelter from potential predators with food nearby.

4.4 Baiting Trials

An important result this year was the finding that foxes will readily take baited eggs; this is of some significance as eggs are ideal for baiting during the wet season when the problem of bait potency is suspect. When track counts were resumed in the spring, the counts were the lowest ever; these findings will be briefly discussed at the seminar.

4.5 Fox Dispersal

For 3 successive years we have noted that fox activity increases early in the new year; intensive baiting has been necessary at this time and the early results led us to believe that bait rejection may be a factor. While this factor cannot be ruled out entirely we now realize that the increase in fox activity is due to dispersal presumably by new recruits; we now know that baiting is effective and that the sustained activity is due to new invaders. This finding has management implications.

4.6 The Predator Control Experiment

The available information will be presented and interpreted at the seminar.

5. PROPOSALS 1984/85

The results to date imply that predation is a factor which interacts with environmental variables. In view of these findings, it does not seem unreasonable to infer that other populations of small macropods may be similarily affected. It is therefore proposed to examine the status of some of

the surviving macropod populations persisting in the southern regions of the state with the predation factor in mind. Some of the populations under consideration are rock wallabies in the Murchison Gorge in Kalbarri National Park, tammars on Tutanning and Boyagin Reserves, and on some sites in the Jerramungup Shire.

6. PUBLICATIONS 1983/84

Friend, J.A. & Kinnear, J.E. (1983). Numbat. In "Complete book of Australian Mammals". Ed. by R. Strahan, Angus & Robertson; U.K.

Kinnear, J.E., Onus, M. & Bromilow, R. (1984). Foxes, Feral cats, and Rock Wallabies. SWANS (in press).

Kinnear, J.E. (1984). Ecological Concepts and Pregastric Fermentation. To be delivered at a Symposium in May 1984.

COMMITTEES

Feral Cats

Feral Pigs

Computer Users (Research)

Data Processing Working Group for the new Department of Natural Land Management.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

G.J. Keighery

1. BIOLOGICAL SURVEY - NULLARBOR

1.1 Objectives

Improve knowledge of the habitats, distributions and conservation status of desert wildlife from which the reserve system proposed by CTRC (1974) can be assessed and where necessary additional reserves delineated.

1.2 Procedures

Organise and undertake biological surveys in desert regions. Review relevant available data in the collections of Australian Museums. This is a continuation of previous work.

The Australian National Parks and Wildlife Service (ANPWS) provided funds for a joint W.A.-S.A. survey of the Nullarbor Plain in December 1983. It was agreed that survey staff from the W.A. Wildlife Research Centre would be responsible for design of the survey and for the preparation of sampling quadrats throughout the Nullarbor. Staff from the South Australian Department of Environment and Planning employed four temporary field assistants (two for Western Australia) and, through their computing facility, were responsible for data storage and manipulation. Both states would field survey teams to carry out the actual sampling and an interim report would be prepared by 30 June 1984. The Western Australian contingent would be provided with funds to employ a co-ordinating biologist.

Review relevant data in collections at PERTH, especially with regard to possible Nullarbor endemic species or taxa at range ends. Update species' lists from A.M. Baird's collections at Forrest (UWA), and Eyre.

1.3 Results and Conclusions

None at present.

2. BIOLOGICAL SURVEY - STIRLING RANGE AND ENVIRONS

2.1 Objectives

Improve knowledge of flora of Stirling Range National Park and region.

2.2 Procedures

Survey of Stirling Range National Park for species list. Identification and mapping of endemics. Survey flora of surrounding bushland isolates for lists, possible rare flora and occurrence of supposed "endemics". Ad hoc observations on biology of endemic flora.

2.3 Results and Conclusions

Current flora list stands at 903 species, with 58-61 endemics.

2.4 Proposals for 1984/85

Continue collections in wildfire areas for new records, regeneration of *Darwinia* species. Check A.S. Weston collections from range. Survey further bushland regions, especially Green Ranges. Undertake analysis of raciation of *Oxylobium* species in the range, and map forms.

2.5 Publications

Keighery, G.J. (1983). New Species from the Stirling Range of Western Australia. Bot. Jahrb. Syst. 104 : 177-182

2.6 Proposed Publications 1984/85

Marchant, N.G. and Keighery, G.J. A Taximetric Study of the Mountain Bells (*Darwinia* species : Myrtaceae) from the Stirling Range of Western Australia.

Keighery, G.J. Notes on the biology of *Rumicastrum Chaemacladum* (Diels) Ulb (Portulaccaceae); a recently rediscovered genus.

Keighery, G.J. An Annotated Checklist of the Flora of the Stirling Range National Park.

3. BIOLOGICAL SURVEY - DARLING SCARP

3.1 Objectives

Liaise with Western Australian Naturalists' Club who are proposing to undertake a survey of the Scarp. Develop an understanding of the flora and reserve needs of this region.

3.2 Procedures

Carry out field surveys of selected areas along Darling Scarp.

3.3 Results

None.

3.4 Conclusions

None.

4. REVISION OF DESCRIPTIVE CATALOGUE OF WESTERN AUSTRALIAN PLANTS

4.1 Objectives

Revise Descriptive Catalogue, Layman's cheap ready reference to Western Australian Flora.

4.2 Procedures

Obtain data from herbarium specimens, collate into standard format. A consultant Ms A. Coates is currently obtaining this information on an Australian Biological Resources Study Grant.

4.3 Results and Conclusions

First draft to Canberra by 1-7-1984. Publication by Society for Growing Australian Plants during 1984/1985.

4.4 Information on distribution of species being used for Nullarbor Survey, Stirling Ranges and Darling Scarp Surveys.

5. SYSTEMATICS AND BIOLOGY OF WESTERN AUSTRALIAN FLORA

5.1

Collate and prepare for publication previous studies conducted on the biology and systematics of Western Australian Flora. Continue biology observations as time permits. Complete systematic studies on Liliaceae, Apiaceae and Myrtaceae.

5.2 Procedures

Standard taxonomic field and herbarium studies. Field, glasshouse studies on biological aspects.

5.3 Results and Conclusions

Revision of Chamelaucium (with N.G. Marchant) in press. Actinodium, studies completed awaiting types. Pileanthus, all taxa illustrated. Studies on Darwinia continuing.

Liliaceae, Laxmannia being written for Flora of Australia.

5.4 Proposals

Continue studies as time allows, prepare for publication.

5.5 Publications 1983/84

Systematics

Keighery, G.J. A Review of the Genus Burchardia (Liliaceae) in Western Australia. Nuytsia (in press).

Keighery, G.J. (1984). Arnocrinum gracillimum (Liliaceae: Johnsonieae) sp. nov. Nuytsia (in press).

Keighery, G.J. (1984). The Johnsonieae (Liliaceae): Biology and Composition. Flora (in press).

Keighery, G.J. (1984). Chromosome Numbers in Australian Liliaceae. Feddes Repp. (in press).

Keighery, G.J. (1984). Cytogeography of Sowerbaea laxiflora Lindl (Liliaceae : Johnsonieae) Flora (in press).

Keighery, G.J. (1984). A New Genus of Gyrostemonaceae from Western Australia Bot. Jahrbr. Syst. (in press).

Keighery, G.J. and Marchant, N.G. (1985). A revision of the genus Chamelaucium (Myrtaceae) Nuytsia (in press).

Biology

Keighery, G.J. (1984). Sex Ratios in Cratystylis S. Moore (Asteraceae) Flora (in press).

Keighery, G.J. (1984). Bud autogamy in Orobanche L. (Orobanchaceae) West. Aust. Naturalist (in press).

Keighery, G.J. (1984). Insect Pollination in the Cyperaceae. West. Aust. Naturalist (in press).

Keighery, G.J. (1984). Breeding Systems of the Western Australian Flora III Aizoaceae West. Aust. Naturalist (in press).

Keighery, G.J. (1984). Pollination of Jansonia Formosa (Fabaceae). West. Aust. Naturalist (in press).

6. EXTENSION AND PUBLICITY

Assistance in identifying material was given to several country wildflower shows. Material on native plants was provided to Society for Growing Australian Plants publication : Australian Plants and to the Western Australian Nutgrowers Association. A photographic index is being prepared of all Western Australian Proteaceae, to compliment similar studies in Eastern Australia for a book on Australian Proteaceae to be ready in 1989.

6.1 Proposals for 1984/85

Continue photographic index.

Country flower displays and liaison with Australian Plants, as time allows.

6.2 Publications 1983/84

Keighery, G.J. (1984). Eremosyne Australian Plants (in press).

Keighery, G.J. (1984). Endemics of the Porongurup Range. Aust. Plants (in press).

Keighery, G.J. (1985). Colour variation in Kennedia

nigricans R.Br. Aust. Plants (in press).

Keighery, G.J. and Dixon, I.R. (1984). Western Australian Santalaceae, and their potential as nut crops. A.C.O.N.T.A.C. West Symposium Cornucopia Press; Nedlands (in press).

Keighery, G.J. and Dixon, I.R. (1984). Western Australian Terminalia species. A.C.O.N.T.A.C. West Symposium. Cornucopia Press; Nedlands. (in press).

Keighery, G.J. and Dixon, I.R. (1984). Western Australian Primelea species Aust. Plants (in press).

Keighery, G.J. (1985). Leptospermum and allies in Western Australia. Aust. Plants (in press).

COMMITTEES

1. Vice President, Western Australian Wildflower Society.

2. Member, Council, Royal Society of Western Australia.

3. Delegate, Horticultural Council of Western Australia.

4. Australasian Editor, International Association of Plant Taxonomy Chromosome Numbers Working Group.

Committee work is almost entirely outside office hours.

4a Publications

Goldblatt, P.(Chief Ed.) 1984 Index to Plant Chromosome Numbers 1979-1981. Monographs in systematic Botany 8. 427 pp.

New Names and Changes in Western Australian Plants W.A.W.S. Newsletter (ca 4 pages per quarter, at present rate).

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

J.A.K. Lane

1. WETLAND NATURE RESERVES (WNRs) : MONITORING OF WATER DEPTH AND QUALITY

1.1 Objectives

Routine monitoring of water depth and water quality of selected WNRs in the south-west of the State assists in:

i) annual evaluation of conditions for waterfowl breeding

ii) prediction of summer conditions for waterfowl

iii) determination of seasonal, annual and longer-term variations in water depth and quality - important aspects of the condition of WNRs.

iv) management of particular WNRs e.g. Lakes Beverley, Chittering, Nonalling, Byenup, Tordit Garrup, Poorginup and Chandala.

1.2 Procedures

i) Gauge Installation : This was completed in 1982/83. The total number of gauged wetlands is now 119. 100 of these are WNRs vested in W.A.W.A.

ii) Monitoring : Depth and salinity have been monitored by Research Staff at two-monthly intervals since November 1978. Regular monitoring of pH commenced January 1982. West Australian Field and Game Association members have assisted in monitoring since January 1980.

1.3 Results

All data are now on computer and available on request in either tabular or graphical form.

1.4 Conclusions

In conjunction with rainfall statistics, results obtained from the monitoring programme provide a sound basis for season-to-season comparisons of conditions for waterfowl breeding, and for prediction of conditions likely to prevail during impending duck-shooting seasons. (See Research Project 3.7).

The data gathered continue to be of considerable assistance in dealing with management problems which have hydrological components, that is, proposals which may effect water quality or quantity of specific wetlands.

Monitoring of wetland condition during the "Waterbird Usage" project (Research Project 2) is also provided for by the present programme.

1.5 Proposals for 1984/85

Two-monthly monitoring of all gauged wetlands by Research Staff and W.A.F.G.A. members will continue until May 1985. From that date onwards only selected key wetlands will continue to be monitored at two-monthly intervals. The remainder will be checked in July, September and November each year to provide a basis for duck-shooting season decisions.

1.6 Publications 1983/84

None.

1.7 Publications 1984/85

The 1983 and 1984 "Reviews of Rainfall and Wetlands in the South West of Western Australia" will be published during 1984/85.

2. WETLAND NATURE RESERVES : SURVEY OF WATERBIRD USAGE

2.1 Objectives

i) to provide information on waterbird usage to assist in the management of WNRs and in the resolution of conflicts between different uses.

ii) to assess the role and importance of the WNR system in the conservation of waterbird populations

iii) to provide appropriate experience for future monitoring of waterbird abundance.

2.2 Procedures

The Royal Australasian Ornithologists Union has been commissioned to undertake this 4 year field study which began in April 1981. Total funding for the project is $134 500; $71 300 from the Wildlife Conservation Trust Fund (duck-shooters' licence fees) and $63 200 from Consolidated Revenue. The RAOU has appointed a full-time Project Coordinator, Mr Roger Jaensch, who has two main roles; to recruit, train and coordinate a team of amateur observers, and to design, test and report on census techniques. A more complete account of procedures is contained in the April 1981 Research Seminar paper.

2.3 Results

Some 112 wetlands within 68 WNR's were being regularly monitored for waterbird usage at 31/12/83. Twenty-two important wetlands require observers for the 1984-85 waterbird season; these are being sought in early 1984.

100 observers were actively censusing waterbirds for the Project at 31/12/83: 58 of these were based at non-metro locations. These figures have stabilized over the year 1983 due to roughly equal recruitment and loss of contributors (mostly lost because of changes in work

commitments).

The RAOU continues to receive strong support from members of the Field and Game Association of W.A. who regularly monitor ten wetlands.

To 31 January 1984, 1 973 data sheets had been processed. These represent 1 746 waterbird surveys and cover 205 wetlands (within 122 WNR's). Some observers have been particularly diligent. One has sent in more than 150 sheets, another 120 sheets, while four have completed 50 to 70 sheets. Feedback by personal contact during field trips and at RAOU meetings has continued, while articles in W.A. Bird Notes and the National RAOU Newsletter have been printed regularly. The former publication is largely funded by the Waterbird Project and has been well received throughout Australia.

The Field Officer has undertaken major field trips to different sectors of the South-West and Eucla Divisions every two months. These have facilitated training and feedback for participants and have been directed at wetlands with access and/or coverage problems, poorly-recorded species and breeding species. The high water-levels in wheatbelt and coastal plain wetlands in spring 1983 necessitated extra excursions to assist local observers in covering 'expanded' wetlands.

One of the special activities organised in 1983 was a crake and rail trapping exercise at Thomsons Lake. This yielded more than 30 birds of four species and provided insight into crake/rail status and abundance as well as giving breeding records (runners caught). Reports of the exercise in the National RAOU Newsletter generated quite a deal of interest in the technique.

In March, the Field Officer studied wetlands and waterbirds in the North-East Kimberley. This work provided experience with Black and Little Bitterns. It also improved knowledge of census methods and difficulties in tropical wetlands.

Breeding by Little Bitterns, Pacific Herons, crakes and Freckled Ducks was pursued in spring. Special efforts were made at reserves with management conflicts, especially Beverley Lakes and the Lake Muir complex. Knowledge of these two complexes is now greatly improved.
Some particularly noteworthy findings have been

1. A flock of more than 500 Freckled Ducks at Toolibin Lake.

2. A flock of 182 Great Egrets at the Harvey Estuary.

3. First recorded breeding by the Glossy Ibis in the South-West at Chandala Lake (second W.A. breeding locality?).

4. First recorded breeding by Gull-billed Terns in the

South-West at Hinds Lake.

5. Many 'new' breeding localities for the Pacific Heron.

6. Breeding by Freckled Ducks at Toolibin Lake, Benger Swamp and Crackers Swamp.

7. Breeding colonies of Little Bitterns at Jandabup Lake and Yarnup Lagoon (19 nests - one of the largest known colonies in Australia).

2.4 Proposals for 1984/85

One of the principle objectives in early 1984 will be recruiting of additional observers in preparation for concerted, highly co-ordinated waterbird surveys from June 1984 to May 1985 (end of fieldwork).

The Field Officer will be increasingly involved in writing of articles resulting from data collected.

During March and April, the Field Officer will be studying bird research organisations, waterbird census projects and management of waterbird reserves in Japan, Great Britain and the Netherlands. He will also represent the RAOU at the I.U.C.N. "Convention on Wetlands of International Importance, especially to Waterbirds", in the Netherlands.

3. WETLANDS : OTHER STUDIES AND MANAGEMENT PROJECTS

Waterbird Research Staff were involved in a number of other research and management projects during 1983/84.

3.1 Lake Chittering

The "check structure" (adjustable-height weir) on the outlet from Lake Chittering continues to require frequent checking and adjustment (by Technical Officer Don Munro) during winter and spring each year in order to fill the lake without flooding the adjoining landholders' properties. Since the check structure was installed in April 1977 it has been possible to hold water right through summer, despite the low rainfalls of recent years. Lake Chittering is therefore a most valuable breeding and summer refuge area for waterbirds.

3.2 Lakes Byenup, Poorginup, Tordit-Garrup (Lake Muir Wetland Nature Reserve).

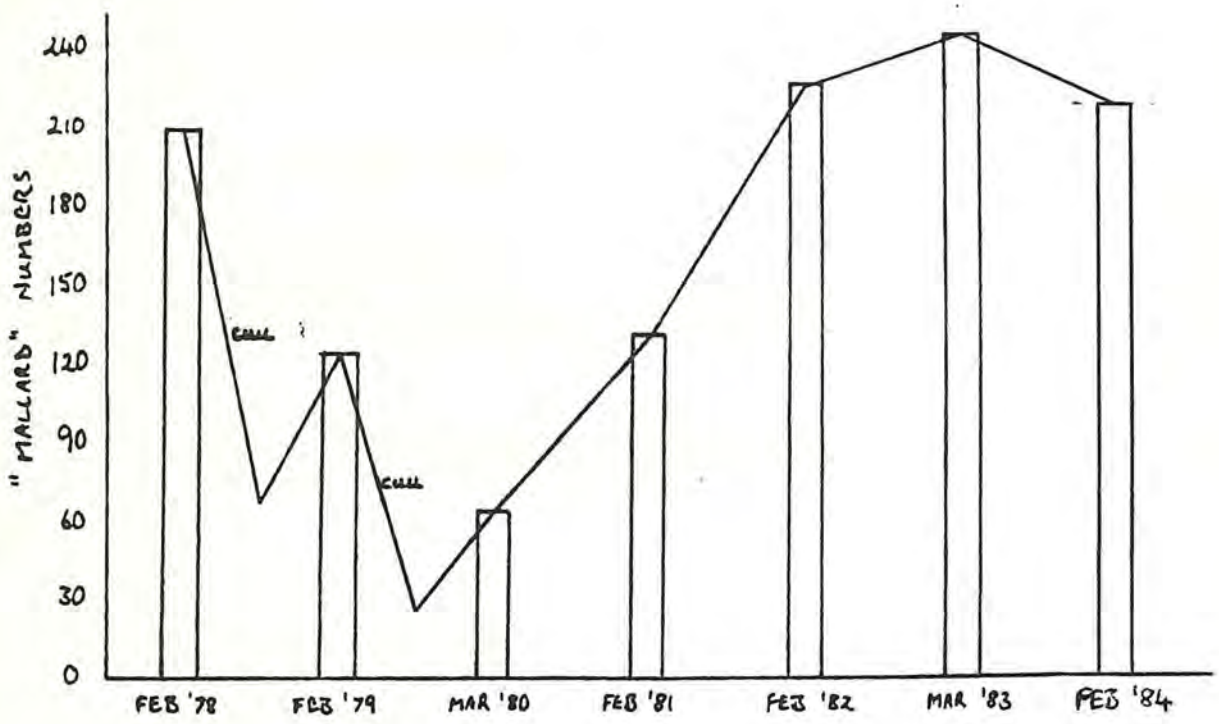
Mines Department require regular monitoring of water depth, salinity and pH of the above lakes prior to mining for peat. This monitoring has been carried out by D. Munro since April 1977 and is now being performed as part of the wetland monitoring programme (Research Project 1).

3.3 Feral Ducks and Geese

The last cull of feral ducks and geese on metropolitan

lakes by Departmental staff (D. Munro) was in 1979. From February 1983 to February 1984 feral "mallard" (i.e. Anas platyrhynchos - derived domestic ducks) fell from 252 to 214, muscovy rose from 17 to 34 and geese fell from 27 to 8. The decrease in mallard numbers has probably been due to the efforts of private citizens who have been encouraged, and in two cases authorized, to remove these birds.

An assessment of the risk in terms of gene flow which the feral "mallard" population poses to native Black Duck (A. superciliosa) populations was suggested to the University of W.A. Zoology Department as a 1983 Honours project and was taken up by Ms M. Silbertstein. Ms Silberstein's findings have yet to be carefully considered or acted upon.



3.4 Australian Wader Studies

Technical Officer Grant Pearson assisted members of the Australian Wader Study Group in planning and equipping the November'84 expedition to the north-west. More than 500 000 waders were counted and 3 500 of these were banded and colour-dyed. In February 1984 Pearson undertook an aerial survey of the north-west coast as part of a national wader count. 400 000 birds were counted; 50 000 of these were at Shark Bay, adding another site of international importance to the list of migratory wader habitats in Australia.

In October 1983, J. Lane and G. Pearson led a one-week course on wader identification, trapping and banding at Eyre Bird Observatory. A similar course will be held in

October 1984.

3.5 Wetland Nature Reserves : Card Index and Photographic Library

The card index of administrative information concerning the 250 -odd Wetland Nature Reserves in the southern half of W.A. was up-dated during 1983/84, as was the aerial photographic library (Lands and Surveys Dept. 9" x 9" prints - 1 : 40 000). These continue to be useful in dealing with the many queries which arise each year concerning WNRs and their management. A system for digitizing the wetland area of WNR's is now in use.

3.6 Duck-Shooting Seasons : Opening Day Bag-check Data

Bag-check data for all shooting seasons since 1972 are being re-worked for publication. No further progress was made during 1984/85.

3.7 Determination of Annual Duck-Shooting Seasons

Decisions concerning duck seasons in the south-west of the State (i.e. the South West and Eucla Land Divisions) are based on annual assessments of conditions for waterfowl breeding. These assessments are based on rainfall data, and on water-depth data derived from the WNR monitoring programme.

Due to a substantial improvement in conditions in 1983 a full shooting season was declared for the summer of 1983/84.

3.8 Wetland Creation

No further progress was made during 1983/84 with the proposal to create new wetlands by damming old drainage lines (salt lake chains) of the wheatbelt. A start on this project is now awaiting an assessment of waterbird usage of the Beverley Lakes WNR, as part of the larger assessment of usage of all WAWA-vested WNRs (Research Project 2).

3.9 Benger Swamp

Since 1972 the Department has purchased approx. 85% of Benger Swamp (Harvey). Benger used to be the State's main potato-growing area, however, rising costs during the 1960's made this an unprofitable activity. Typha orientalis is rapidly invading those areas which are no longer cultivated. This and other problems have necessitated the appointment of a consultant, Mr D. Watkins, 6 months per year for three years to study the present situation, liaise with landholders and advise the Department on management. Mr Watkins began his appointment in December 1982 and is supervised by J. Lane.

COMMITTEES

I am a member of the following committees:

1. Bird Committee of W.A.W.A.

2. Standing Working Group on Birds of the Council of Nature Conservation Ministers. (Corresponding member only).

3. Wetland Advisory Committee of the Environmental Protection Authority. (Didn't meet during 1983/84).

4. Research Committee of the Royal Australasian Ornithologists Union.

5. Regional Organization Working Group for the Department of Natural Land Management.

In August 1983 I moved from the position of Research Officer to Chief Reserve Management Officer whilst still retaining overall responsibility for waterbird matters (research and management). This arrangement has necessitated Waterbird Research continuing on an "existing programmes" basis, with few new initiatives. It has also resulted in increased work loads and responsibilties for Technical Officers Don Munro and Grant Pearson. These they have carried most ably. It is to be hoped that the proposed formation of a Department of Natural Land Management with increased staffing in the areas of wildlife research and management will result in an early improvement in this situation.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

CHIEF RESERVE MANAGEMENT OFFICER'S REPORT

J.A.K. LANE

The past year has been one of considerable change for the Nature Reserve Management Section.

STAFF

On the staffing side 1983 saw the promotion of Chief Reserve Management Officer Ian Crook to the newly-created position of Assistant Director Wildlife, my promotion from Research Officer Waterbirds to CRMO, Ken Wallace's move from the position of Pingelly Reserve Management Officer to Katanning RMO, Malcolm Graham's promotion from Pingelly Reserve Management Assistant to Katanning Reserves Officer, Ken Atkins' appointment to the staff as Pingelly RMO and Jason Calvert's appointment to the Wanneroo-based Management Team.

ORGANIZATION

On the organizational side 1983 saw the Interim and Final Reports of the Task Force on Land Management in Western Australia and the Government's adoption in principle of the Task Force's proposal for the formation of a new Department of Natural Land Management comprising the Forests Department, the National Parks Authority and the wildlife element of the Department of Fisheries and Wildlife. Implementation of this proposal will have a substantial impact on the staff and workings of the Nature Reserve Management Section since it will involve the formation of a single management unit to care for all Nature Reserves, National Parks, State Forest, unvested reserves and Vacant Crown Land in Western Australia. Thus Nature Reserve Management will cease to have a separate identity as of July 1st, 1984.

In view of the imminent dissolution of the Nature Reserve Management Section I believe it is most appropriate for me to use this opportunity to record two of the most striking impressions which I have gained during my short period as CRMO.

PERFORMANCE

The first concerns the staff of the Management Section. Over the past 9 months or so I have been greatly impressed by the professionalism, diligence and dedication of all members of the Management staff from senior professional to "temporary" fire crew. Few organizations in this country could boast such an able, enthusiastic and hard working team. Their performance is of course largely attributable to their personal qualities, however, in my view it has also been attributable to the very strong sense of purpose and direction of the group and to the high levels of responsibility carried by each officer. The job ahead of us will be to ensure that absorption of these staff into a much larger organization with a multitude of roles will not result in a diminution of these senses of purpose, direction and responsibility.

PRESSURES

The second most-striking impression which I have gained over the past 9 months concerns the nature and magnitude of the task we face in protecting the State's Nature Reserve system.

The immediate pressures on Nature Reserves seem endless. Pressure to burn on short rotation to minimize fuel levels; pressure to allow mining for gravel, sand, limestone, limesands, mineral sands, gypsum, peat and diatomaceous earth; pressure for increased recreational access and facilities, both terrestrial and aquatic; pressure for land for service facilities such as roads, drains, powerlines, communication lines and radio-communication towers; pressures to permit insecticide spraying for nuisance insect control; not to mention illegal rubbish dumping, beanstick cutting, salt diversion works or the pressures exerted by foxes, cats, rabbits, rats, pigs, goats, sheep and cattle or weed invasion, herbicide and fertilizer drift or nutrient runoff. The most important lesson that I have learnt, or at least had reinforced, during my period as CRMO is that the Department's ability to resist these pressures depends not on the strength of its legislation but on the level of community support for the retention and protection of these natural areas. Without strong community support the Department is, in the final analysis, virtually powerless to prevent the natural areas with which it is entrusted from being burnt, bulldozed, mined, poisoned, rubbished or otherwise used and abused to death since any decision which the Department may take to prevent such depredations can be democratically overuled by the Minister, Government or Parliament of the day, ie by the elected representatives of the community we serve.

If the community is to support the retention and protection of natural areas then these areas must be seen by the community to be worthy of protection, ie to be of value. Right at the heart of most of the problems which confront us is the fact that most Nature Reserves are seen by the local community to be areas of no value, areas of land for which no use has yet been found, areas of useless bush. Viewed in the long term, if our Department (either new or old) is to achieve any more than simply legitimize the progressive destruction of most of the State's Nature Reserve system it simply must be able to intensify its efforts to produce a substantial improvement in the attitude of the Western Australian community, and particularly the rural community, towards the protection of these areas.

MANAGEMENT CAPABILITY

How is this improvement to be achieved? Well it is not helped by the complete absence of management capability throughout most of the State. Lack of management presence simply serves to reinforce the community's attitude that Nature Reserves are valueless. After all, if they did have

value wouldn't it be reasonable to expect somebody to be putting some effort into looking after them? A continuation of this Department's programme for the establishment of a network of regionally based management teams is obviously required.

APPRECIATION OF VALUE

Also required is the documentation of the flora and fauna of these Reserves. How can the value of a Nature Reserve be expounded or appreciated when that value is simply not known? There is a desperate need for further biological survey of existing as well as proposed Reserves and for the dissemination of this information to the local community in an easily appreciable form.

COMMUNITY INVOLVEMENT

A third urgent requirement is for community involvement. With involvement comes interest, appreciation and commitment. An excellent opportunity for involvement is provided by the need for documentation of the flora and fauna. This documentation can often be carried out by interested locals under skilled leadership. Alternatively locals may assist in survey or monitoring work performed by professional staff. The management planning process developed by Ian Crook with its commitment to public participation in the draft and other stages provides perhaps the best opportunity for community involvement in Nature Reserve management. It is essential that this initiative be vigorously pursued by the new Department.

FINALLY

These then, are the steps which are required for Western Australia's Nature Reserves to be valued by the community. Until these Reserves are genuinely appreciated, particularly by local communities, we the custodians will be achieving little more than fighting a rearguard action, retreating in the face of alternative uses, documenting the destruction. If the new Department of Natural Land Management is to live up to its promise of greater security for the Nature Reserves of this State it will have to produce additional resources for these essential areas.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

K.D. Morris

ISLAND NATURE RESERVE MANAGEMENT

1. DAMPIER ARCHIPELAGO DRAFT MANAGEMENT PLAN

Preparation of the DMP for the island nature reserves in the Dampier Archipelago is progressing well and it is planned to submit the DMP in April/May 1985.

1.1 Island Status

In August 1983, the islands of the Dampier Archipelago were again visited by the Minister for the Environment in response to requests from the public for shack type development on some of the islands. In the resulting submission to cabinet, recommendations were made that all of East and West Lewis Islands were to be made recreation reserves, and that Whalers Bay, Malus Island was to be retained as a recreation reserve. These were the areas where most shack development had already occurred. All the other recreation reserves, ie those on Rosemary, Angel, and Delambre Islands were to be cancelled and returned to the adjoining nature reserve.

It was also recommended that the unvested status of the many smaller islands in the archipelago (Eaglehawk, Egret, Kendrew, Brigadier, Lady Nora, Tozer, Wilcox and Conzinc Islands, and Millers, Nelson and Bare Rocks, and Elphick Nob) be changed, and that they be incorporated into C Class nature reserve 36913.

These recommendations were approved on August 29, 1983, however as yet no gazettal action has occurred. Despite this, leases for shack building on West Lewis Island are presently being issued.

1.2 Biological Survey and Research

The majority of work for the DMP has centered on undertaking biological surveys of the islands, and supervising research into specific aspects of the fauna utilising the islands. I believe, that in addition to the DMP for the Dampier Archipelago nature reserves, a Wildlife Research Bulletin should also be produced to fully document the wildlife of the Dampier Archipelago.

1.2.1 Fauna Lists

a) Mammals

Eight native mammal species are known from the island. This includes a bat *Eptesicus pumilus*.

Rattus tunneyi has been shown to have a wider distribution than previously thought and has been recorded on most islands with sand plain habitat. This year I am supervising a Zoology honours degree student, Peter Cale, who will be attempting to determine the reasons for the distribution of *Rattus tunneyi* on Enderby Island and *Pseudomys hermannsburgensis*

on Rosemary Island.

Tracks of the water rat Hydromys chrysogaster have been found on Collier Rocks, and on the Burrup Peninsular.

The fox Vulpes vulpes is now found on most, if not all the islands immediately adjacent to and to the north of, the Burrup Peninsular. Remains of the sheep Ovis aries have been found on West Lewis Island, remnants from the many pastoral leases on the island around the turn of the century. I do not believe any still exist on the island.

Five species of marine mammal have been recorded from the waters of the Dampier Archipelago. In July/August 1983 I undertook eight hours of aerial survey for the W.A. Museum to determine the extent of use of the Dampier Archipelago by the Humpback Whale. A total of 17 whales were seen, many with calves.

b) Birds

One hundred and six (106) species of bird have been recorded from the islands and waters between. This includes 75 non passerine and 31 passerines. Sixteen species have been recorded breeding on the islands.

c) Reptiles

Thirty nine (39) species of terrestial reptile and two species of sea snake have been recorded from the Dampier Archipelago. Our knowledge of the herpetofauna of many of the smaller islands was greatly increased following a zoology honours project undertaken by Garry Connell in 1983. This study, and other biological survey work, have added 11 species of terrestial reptile to the list obtained by Burbidge and Prince (1972). Of considerable interest was the record of two varanids V. gouldi and V. tristis on Conzinc Island, of only 11ha in area.

Four species of turtle are now known to breed on the island, these being the Green, Hawksbill, Loggerhead and Flatback Turtle. Regular aerial surveys of the Dampier Archipelago have been undertaken since February 1983 to determine the extent of turtle usage of the island beaches, and ground surveys have been conducted to determine species' breeding distribution.

d) Amphibians

The rockholes on the islands have only contained water once since I began working on the islands, and that was early 1984 following tropical cyclones Bobby and Chloe. A collection of adult frogs and tadpoles was made, but have yet to be identified. I believe they are not either Cyclorana cultripes, or Litoria rubella, the species recorded earlier from the archipelago.

e) Invertebrates

Opportunistic collections of invertebrates are being made, including intertidal molluscs, terrestial crustaceans, and invertebrates from the rock holes containing water.

1.2.2 Vegetation and Fire History

Opportunistic collections of the flora of the Dampier Archipelago have been and will continue to be made, with specimens being lodged in the Pilbara Regional Herbarium, Karratha, and the W.A. Herbarium, Perth.

A vegetation map for the islands will also be prepared.

The earliest aerial photographs available for the Dampier Archipelago (1957) show no fire scars, nor do the 1972 series.

In November 1979, the majority of Angel Island was burnt, after stranded fishermen lit a signal fire to attract attention. Regeneration now appears to be complete.

In October 1982, a lightning strike was believed to have started a fire which burnt the eastern two thirds of Legendre Island (VCL). Following a very dry summer 1982/83 no regeneration was apparent. However the 100 mm of rain received since January 1, 1984 has enabled some regeneration to now occur.

A rain gauge is now located permanently at the Enderby Island shack.

1.3 Public Utilisation

The beaches of the island nature reserves are used by the residents of Dampier, Karratha, Roebourne and Wickham for day tripping and camping. The majority of shacks are located on recreation reserve or proposed recreation reserve. Excluding the departmental shack, two shacks are also still erected on nature reserves. The owners of one of these, on Goodwyn Island are presently being prosecuted by the department for erecting a structure on a nature reserve in 1981. The other, on Enderby Island was erected prior to gazettal as a nature reserve, and the owners have now accepted an alternative site on Malus Island and will be shifting shortly. Three other shacks exist on the recreation reserve on Delambre Island which will become nature reserve when the proposed gazettal occurs.

Estimates of public usage of the islands are obtained by boat and camping counts during aerial surveys over long weekends and normal weekends. These also provide some indication of what beaches are preferred.

With the provision of recreation reserves in the Dampier Archipelago, I cannot see that shack development should be permitted on nature reserves. However, camping on a restricted basis, and on nominated beaches, is acceptable.

Delambre Island is used almost exclusively by the public from Wickham and Roebourne and camping activities on this island should be allowed to continue. Norbill Bay on Rosemary Island is also very popular camping site and is suitable for this purpose as few turtles use this beach. Camping could possibly also be permitted in the bays on the north of Rosemary Island, however public access should be totally excluded from the beaches on the west of Rosemary Island. In view of the nature of the vegetation, and the rainfall pattern, I believe open fires on the nature reserves should be prohibited.

In August 1983, cabinet approved the recommendation by the Minister for the Environment that the Nor West Game Fishing Club's present lease on Rosemary Island be renewed. Discussions have been held with the club's president on restricting the use of the tractor to the well site and lease area only.

Efforts have been made, through the press, to inform the public of the reserve status and conservation values of the islands.

1.4 Other Aspects of the Dampier Archipelago

1.4.1 Aboriginal Sites

The locations of midden and rock etching sites have been recorded for islands in the Dampier Archipelago. A proper survey of these sites should be undertaken by the W.A. Museum.

1.4.2 Historic Sites

A detailed survey of historic sites in the Dampier Archipelago was undertaken in 1979 by Jack MacIlroy for the Australian Heritage Commission. The history of the wreckage of a USAF Catalina flying boat on Enderby Island has now also been determined with the assistance of the Air Force Association.

1.5 Island Nature reserve Management

1.5.1 Signs

Because of the amount of public utilisation of the nature reserves, it will be necessary to erect signs on beaches informing the public of the island status, and of the regulations applying to the use of the nature reserve. To cover all nature reserves in the archipelago, 32 signs will be required. Approval has to be obtained from the Hampton Harbour Boat and Sailing Club to erect an information board at the boat club ramp and approaches are being made to the Shire of Roebourne to erect similar signs at the public ramp.

1.5.2 Pest Species Control

a) Fox (Vulpes vulpes)

It is proposed to conduct an aerial baiting programme using 1080/meat baits to control the foxes on the islands to the north of the Burrup Peninsula. Woodside Petroleum is also anxious to control the foxes on the Burrup Peninsula, and some joint programme will probably be undertaken.

APB has indicated that it would be possible through size of bait and dose of 1080, to conduct this baiting without harmful effect to the native cat (Dasyurus hallucatus) or birds of prey.

b) Prickly Pear (Opuntia sp)

The APB and DCE are currently undertaking a programme to eradicate the Prickly Pear on East and West Lewis Island using Cochineal and Cactoblastis beetles. These will also be used on Enderby Island to eliminate the small growth of Prickly Pear near the shack.

2. BARROW ISLAND - RATTUS RATTUS ERADICATION FROM ADJACENT ISLANDS

Boomerang, (April 1983) Double and Pascoe (October 1983) Islands have now been baited with Pindone and oats following the standard baiting pattern of bait stations every 50 m with one station in the middle. Recent inspection of these islands (March 1984) found no signs of Rattus.

Following a preliminary inspection of Boodie Island a proposal was submitted for the eradication of Rattus on Boodie Island, while not affecting the Bettongia lesueur population, in October 1984. Briefly, this involves physically excluding Bettongia from the bait stations while allowing access for the Rattus. Because of the nature of pindone action, and of the behaviour of Bettongia, secondary poisoning is also unlikely. Vitamin K could be used as a pindone antidote if necessary.

Rattus rattus also occur on Middle Island with the Golden Bandicoot Isoodon auratus. A proposal will be prepared to eradicate the Rattus without harming the Isoodon population. This will be formulated following the Boodie Island exercise.

3. BERNIER ISLAND - FERAL GOAT ERADICATION

ANPWS funds have been allocated to eradicate the feral goat population from Bernier Island. A helicopter and APB shooter have been obtained for this operation which will take place 14-26 May 1984. A preliminary inspection of the island was made in February 1984 to obtain some estimate of population size and distribution on the island. A base site was also selected.

The Department of Agriculture wish to muster the goats

prior to the shooting operation and I have suggested they do this 2-3 weeks prior to our arrival.

4. BEDOUT ISLAND - RECOLONIZATION BY RATTUS

Rattus rattus have apparently recolonized Bedout Island, despite an intensive poisoning campaign in September 1981.

It has been proposed to visit the island in July 1984 to assess population numbers and to bait again in September/October 1984.

5. MUIRON ISLANDS

These were visited in October 1983 with ADW and DWO to assess and discuss the proposed use of the island by a local charter operator for overnight camping. Comment was later made on WAWA approval for the charter operator to conduct overnight camping excursions to South Muiron Island.

These islands, and others in the vicinity are coming under increased recreational pressure and management plans for their use should be prepared as soon as possible.

6. MONTE BELLO ISLANDS

These were visited in May 1983 with personnel from the Australian Radiation Laboratories.

Fauna lists were compiled during the visit, and five species of bird not previously recorded were observed. Mus musculus were also recorded for the first time.

7. THEVENARD ISLAND AND THE MARY ANNE GROUP

An aerial survey of the islands between Dampier and Onslow was conducted in December 1983.

Steamboat Island is presently visited by a marine charter based in Dampier and it is their desire to obtain aproval to erect chalets on this island. The airstrip on Sholl Island, constructed by the manager of Mardie Station, appears to be now unusable. A recent fire on the island has removed much of the vegetation and the sand has become unstable.

There was evidence of camping on many of the islands.

A landing was made on Thevenard Island, and the Mackeral Island resort inspected. The Tamarisk trees are still present, as are three palm trees in the excavated waterhole. These should be removed and natural species from the adjacent mainland used for providing shade around the chalets.

8. MUNGAROONA RANGE NATURE RESERVE

Mungaroona Range nature reserve was inspected aerially and on the ground in June 1983. Initially it was proposed to conduct a complete biological survey using WRC personnel in March/April 1984, however this was deferred.

Approximately 5,000 ha of vacant crown land adjacent to the SE boundary of the reserve is presently being considered for release as pastoral land. This would be a valuable addition to the nature reserve as it includes riverine flats which are not included in the present nature reserve.

COURSES AND MEETINGS ATTENDED, PUBLICATIONS

ANZAAS, Perth, May 1983 - paper presented on "The status of the rodent genus Pseudomys in the arid zone".

Attended the Eyre Bird Observatory in November 1983 - shore bird course.

Paper to be published in WA Naturalist. "Taking of fish by a Whistling Kite in the Pilbara, WA".

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

K.J. Atkins

1. FIRE

1.1 Firebreak Design and Construction

Firebreak construction and expansion work has been undertaken on Tutanning, Dragon Rocks and Dunn Rock (external) Nature Reserves. Work is programmed for the immediate future on upgrading some sections of firebreaks on Boyagin Nature Reserve, and with constructing firebreaks around the central Dobaderry Nature Reserve.

A contract vegetation survey of the Dobaderry Nature Reserves is nearly completed and this will be used for designing the internal firebreak system. Another contract vegetation survey of Dunn Rock Nature Reserve will be completed by the end of this financial year, and will also be used for internal firebreak design.

Proposed work for the 1984/85 financial year includes further construction work on the Dragon Rocks and Dunn Rock (external) Nature Reserves, plus new firebreak construction on internal breaks for Dunn Rock Nature Reserve and Mooradung Nature Reserve.

1.2 Firebreak Maintenance

The length of firebreaks is unchanged from last year, being 743 km of external breaks and 271 km of internal breaks. Fifty four reserves (four of which are encompassed in larger reserves) are firebreaked. The firebreak maintenance organized by the Pingelly Reserve Management Team has been reduced slightly with the formation of the Katanning Management Team.

The late break of season last year, and the protracted clearing burn period this year resulting from the unseasonal weather, has resulted in minimal herbicide work on firebreaks. Some erosion control work using rocks has been tried at Tutanning Nature Reserve.

1.3 Fire Control

One hundred and eighty nine manhours have been spent by Departmental personnel in the Pingelly District attending burns. This has been for six clearing burns, one clover burn and one wildfire adjoining reserves. Six other clearing burns and one clover burn in the east of the District were adjoining Reserves but were not attended by Departmental personnel. This was due to either lack of notification on the specific day, or conflicting priorities with other prescribed burns.

No areas of Nature Reserves were burnt during any burns, with the exception of several minor hopovers which were rapidly extinguished, usually by our Departmental personnel. At these fires however several areas of privately owned bush were burnt which shows the value of having Departmental personnel attending these burns.

There is one grass burn still planned for adjacent to a Nature Reserve (as at April 2). Two prescribed burns are also planned for on Nature Reserves, one a fuel reduction buffer burn, and one a research burn at Tutanning Nature Reserve.

2. BIOLOGICAL SURVEY

2.1 Proposed Nature Reserves

During the year nine reserves or areas of bushland have been inspected as potential Nature Reserves. Five of these were or will be recommended. Five other reserves were surveyed in conjunction with other purposes.

2.2 Vesting of Nature Reserves

Six un-vested Nature Reserves have been surveyed and five have or will be recommended for vesting in the Western Australian Wildlife Authority.

2.3 Contract Surveys

As mentioned above, two contract vegetation surveys have been commissioned. These are for the Dobaderry Nature Reserves, and the Dunn Rock Nature Reserve. The results of these surveys will provide information on fragile vegetation areas, low fuel areas, and lightly vegetated areas, all of which will assist in designing the internal firebreaks for these reserves. The surveys will also provide the basic botanical data for these reserves, and hence for the surrounding area which will assist future vegetation work on nearby Nature Reserves.

2.4 Tutanning Nature Reserve

The six permanent pit trap lines at Tutanning have been regularly monitored with a store of data, especially from recaptured dunnarts (Sminthopsis), being accumulated. Of note was the capture of a honey possum last November.

3. RESEARCH

There has been little time for independant research activities. The Pingelly Team has however provided assistance to research personnel from the Department, plus others including CSIRO.

Flora taxonomy has been undertaken as an aid to vegetation surveys and Nature Reserve flora species lists. The Pingelly herbarium contains 1 378 specimens representing 760 species. Plant identifications done for other officers include 130 specimens for the District Wildlife Officer.

4. REHABILITATION

Work on rehabilitating gravel/sand pits on Nature Reserves

has been undertaken. Of specific note was the rehabilitation of five gravel pits in the Kulin Shire, by the Shire using Department of Conservation and Environment funds. These pits totalled nearly 12 ha. A photographic record was taken of this work, and it shall be used to produce a report which can in turn be used to help explain to other Shires the approach to be taken in rehabilitating these pits. Several Shires have been approached concerning rehabilitation work and the reaction to rehabilitating active pits has been favourable. The problem remains with old disused pits.

A Botany Department, University of Western Australia student group will be doing a study on Hopkins Nature Reserve in the Kulin Shire in June. This study will aim at surveying the reserve and analysing the natural regeneration of the gravel/sand pits on it. The results will be used to help formulate rehabilitation practices on Wheatbelt reserves. This work is being funded by the Department of Conservation and Environment, with further funds being available for more rehabilitation work later in the year.

5. VERMIN CONTROL

The major lakes systems in the Narrogin and Beverley/Quairading/ Brookton Shires were inspected for vermin control work in association with the APB. Other reserves with vermin problems have also been inspected. This activity is a consequence of the new payment system with the APB which therefore requires greater control and coordination by our Department.

6. GENERAL MANAGEMENT ACTIVITIES

General management activities undertaken by the Pingelly Reserves Management Team include:

i) Nature Reserve inspection for firebreak maintenance, rubbish dumping, gravel/sand mining, rare flora etc.,

ii) production and improvement of fire access maps for each Nature Reserve,

iii) general maintenance activities, especially with regards firebreaks,

iv) Liaison and meetings with Shires, other Government Departments and specific bodies such as tourist organizations to maintain a status of understanding of our role and aims.

7. PINGELLY RESERVE MANAGEMENT AREA

Total Area PRMA	4 893 584 ha
No. Reserves	270
Area Reserved	180 491.8 ha
Average Reserve Size	668.5 ha
Medium Reserve Size	179.4 ha
% Total Area Reserved	3.7%
% of Reserves Vested WAWA	70.7%
% of Reserved Area Vested in WAWA	90.9%

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

K.J. Wallace

KATANNING RESERVE MANAGEMENT TEAM

As a result of a report written by Dr A.A. Burbidge and Senior Technical Officer T. Evans in 1976 (Department of Fisheries and Wildlife Report No 23), the Cabinet of the day endorsed a proposal to establish reserve management teams in Pingelly, Katanning and Wongan Hills. Following the establishment of the Pingelly Management Team in 1978 no further funds were allocated to complete the initial system of management teams.

Recognising the high importance of rural based management teams and given that no new funds were available, the Department converted two items to management positions to enable a reserve management team to be established at Katanning. These new items were filled in 1983 by Reserve Management Officer K. Wallace (previously Reserve Management Officer at Pingelly) and Reserves Officer M. Graham (previously Reserve Management Assistant at Pingelly). Both officers commenced duties as the Katanning Reserve Management Team (KRMT) during October 1983.

As the Two Peoples Bay Nature Reserve lies within the Katanning Management District the Reserves Officer based at the Bay has been included within the KRMT. The team has also been fortunate to have the services of Ms A. Napier as a temporary, Reserve Management Assistant for several months.

The Katanning Management District includes 18 Local Authorities and one Town Authority (Appendix 1). General data on the reserves in the District is given in Appendix 2.

With the exception of the officer based at Two Peoples Bay Nature Reserve, the personnel of the KRMT are presently based at the Wildlife Research Centre. However as soon as office facilities are available the KRMT personnel in Perth will move to Katanning. It is anticipated that the shift to Katanning will occur during late May 1984.

While based in Perth the KRMT has expanded its efforts in three general areas. These are:

1. dealing with urgent management problems as they arise;

2. monitoring or increasing the level of ongoing activities such as firebreak maintenance;

3. gathering data and equipment which will be required by the KRMT in Katanning.

The following is a general account of the work of the KRMT since its establishment.

1. FIRE

1.1 Firebreak Construction

To the present date (March 30) the only new firebreaks programmed for the current year are 4.7 km at Lake Muir and buffer strips at Lake Unicup, East Brook and East Pinticup/Cobertup.

Firebreak construction has been, of necessity, limited by budgetary constraints and the work required to establish a new team.

Budget proposals for the 1984/85 financial year make provision for the construction and upgrading of firebreaks at Sheepwash Creek Nature Reserve as a matter of priority. Provision has also been made for survey work by consultants to be carried out on important nature reserves. This work will provide a sound basis for the design and construction of new firebreak systems.

The programme for 1984/85 may require re-assessment pending the outcome of current proposals for the amalgamation of this Department within the proposed Land Management Department.

1.2 Firebreak Maintenance

Approximately 1,170 km of firebreaks on 68 nature reserves are managed by the KRMT.

During the 1983/84 financial year aproximately 800 km of firebreaks on 44 nature reserves were included in the Annual Maintenance Programme.

1.3 Fire Control

1.3.1 Wildfires

Since the establishment of the KRMT in October 1983 to the present date (March 30) there have been five wildfires on reserves within the Katanning District. These fires involved Katanning District personnel for the equivalent of 25½ man/days, plus a heavy involvement by Wanneroo personnel and District Wildlife Officers.

In addition Katanning personnel assisted at four wildfires in the Wanneroo Management District for the equivalent of 11 man/days and at a National Park in the Avon Valley for the equivalent of 3 man/days.

1.3.2 Prescribed Burns (non-Departmental)

To the present date (March 30) Katanning staff have attended five burns on private property adjoining nature reserves. Three of these burns were in the Katanning District and two in the Wanneroo District. A total of 7 man/days were involved in this aspect of fire control.

1.3.3 Prescribed Burns (Nature Reserves)

The programme for April/May, 1984 is for the burning of three buffer strips in the Shire of Cranbrook and two block burns in the Shire of Manjimup. One buffer strip burn is also planned for a nature reserve in the Shire of Albany.

2. BIOLOGICAL SURVEY

2.1 Proposed Nature Reserves

Since October 1983 two areas of bushland have been surveyed. One area was recommended as a nature reserve and the other for inclusion into an existing nature reserve.

2.2 Nature Reserves

Data has been collected on a number of nature reserves on an opportunistic basis.

4. CONSULTANCIES

Two contracts for consultancy work have been let during the present financial year. These have included a contract for vegetation surveys of the Lake Unicup, Kulunilup and Yarnup Nature Reserves; and a contract for providing data sheets and criteria for assessing Phytophtora cinnamomi on nature reserves.

5. GENERAL MANAGEMENT ACTIVITIES

A wide range of general management activities have been undertaken on nature reserves by the Katanning Team. They have included:

1. examination of a proposal to mine on a nature reserve;

2. inspection of nature reserves;

3. production of base maps for nature reserves;

4. liaison with the Agriculture Protection Board to control declared animals and plants on nature reserves.

3. TWO PEOPLES BAY NATURE RESERVE

Apart from carying out the general management duties associated with running the Two Peoples Bay Nature Reserve, Reserves Officer G. Folley has again been deeply involved in translocation work with the Noisy Scrub-bird (Atrichornis clamosus). This successful project has received wide media coverage and it will be the subject of a special report. No further translocations will be attempted during 1984/85.

Work at Two Peoples Bay Nature Reserve during 1984/85 will be directed towards consolidating the advances of the last few years.

For some time a number of people have been working on a

bulletin which will include biophysical information and a history of the reserve. It is intended that this bulletin will be completed during 1984/85 and that work on a management plan will begin.

6. OTHER ACTIVITIES

Until the KRMT is established in Katanning little effort will be made in the public relations and education sphere. However during the past year I again gave a lecture at an Advanced School of the Bush Fires Board.

During March 1984 I toured parts of the south-west with members of both a House of Representatives Standing Committee and a Select Committee of the Legislative Assembly. Both committees were examining aspects of bush fires, the former in relation to environmental impacts and the latter with respect to fire control.

APPENDIX 1

Local Authorities in Katanning Management District

Albany
Boyup Brook
Broomhill
Cranbrook
Denmark
Dumbleyung
Gnowangerup
Jerramungup
Katanning
Kent
Kojonup
Manjimup
Plantagenet
Ravensthorpe
Tambellup
Wagin
West Arthur
Woodanilling

Town of Albany

Totals:

Shires
18

Towns
1

APPENDIX 2

Katanning Management District - General Reserve Data

Reserve Data as at 30/3/84

Total Number of Reserves including Unvested Nature Reserves	292
Total Area of Nature Reserves	approx. 234 465.84 ha*
Average Size	802.965 ha
Size Range of Reserves	0.2342 ha-94 170.3799 ha.
Total Reserves Vested in WAWA	198

*Figure includes all of Lake Magenta. It does not include the unsurveyed Doubtful Islands and is inaccurate for 5 reserves which are part of other management districts.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

WILDLIFE RESEARCH AND MANAGEMENT SEMINAR

1-3 May 1984

S.A. Moore

1. MANAGEMENT PLANNING

1.2 Objectives

To produce management plans for individual nature reserves of high importance and for groups of nature reserves of a similar type, or in the same local area.

To produce "model" plans illustrating the different approaches to management planning and the inherent flexibility of the planning process.

To maintain the high degree of community involvement in nature reserve planning.

1.2 Procedures

Work has proceeded on plans for both individual, and groups of reserves over the last year. These plans will further extend the range of "models", or approaches, to management planning.

The concept of model plans is one of the philosophies which has guided management planning from its outset in this Department. The first two plans produced, for Moondyne and Thomsons Lake Nature Reserves, were for high priority metropolitan areas. However, this is the only similarity between these two nature reserves. Moondyne is a relatively large, undisturbed reserve on the Darling Scarp, while Thomsons Lake, a freshwater wetland on the coastal plain, is subject to increasing pressures from its suburban surroundings.

Further variations on the single reserve model are the plans for Lake Magenta, a large undisturbed wheatbelt nature reserve and the proposed plan for Chiddarcooping, a large undisturbed granite rock reserve in the north-eastern wheatbelt. The range of models also includes a number of different approaches to planning for groups of reserves. Group models have covered nature reserves in the Shire of Serpentine-Jarrahdale (a near-Metropolitan Shire), the southern half of the Shire of Dandaragan (part of the northern sandplains) and the Shire of Toodyay (an old, well established agricultural district, with strong community interest in "their" nature reserves).

Community involvement is an integral part of the planning process, and is encouraged in a number of ways. In the initial stages of planning, the Local Government Authority, local community groups, and often reserve neighbours, are consulted. A draft is prepared and this is circulated to other government departments, tertiary institutions, community groups, local government authorities and reserve neighbours. Notices are placed in local papers, advising of the availability of the document and the 3 month submission period. Submissions are collated into an audit,

which is distributed, with the final plan, to those people who submitted comments. In some cases the draft plan is released at a public meeting held at the regional centre of the local government authority concerned.

1.3 Results

The following management plans are at the stage detailed below:

Management Plan No.	Plan Name	Stage
5	Nature Reserves of the Shire of Dandaragan, Volume 1	Audit of Submissions published Final Plan in Press
6	Nature Reserves of the Shire of Toodyay	Draft Plan in Press
7	Nature Reserves of the Shire of Wyalkatchem	Draft Plan in final stages of preparation

1.4 Proposals

The following year should see the completion, at least to the draft stage, of the following management plans:

Nature Reserves of the Shires of York-Northam

Field surveys are continuing, including the establishment of a long term monitoring trapping program (see section 5).

Chiddarcooping Nature Reserve

Work continues in this area, accompanied by the realisation of the importance of a detailed vegetation survey upon which management decisions can be based.

Nature Reserves of the Perth Metropolitan Region

This plan is in the very early stages and it is hoped to develop a high degree of community involvement in the pre-planning stages.

1.5 Publications

Crook, I.G., Williams, A.A.E., Chatfield, G.R. and Moore, S.A. (1984). Nature Reserves of the Shire of Dandaragan, Volume 1. West. Aust. Nat. Reserve Manage. Plan No. 5 (Dept of Fish. and Wildl. : Perth).

Moore, S.A. and Ramsden, T.J. (1983). Nature Reserves of the Shire of Dandaragan, Volume 1. West. Aust. Nat. Reserve Manage. Plan No. 5 (Audit of Public Submissions) (Dept. of Fish. and Wildl. : Perth).

Moore, S.A., Crook, I.G., Williams, A.A.E. and Chatfield, G.R. (1983). Nature Reserves of the Shire of Toodyay. West. Aust. Nat. Reserve Manage. Plan No. 6 (Draft) (Dept. of Fish. and Wildl. : Perth). "Prepublication copy - not for public release".

Moore, S.A., Crook, I.G., Williams, A.A.E. and Chatfield, G.R. (1984). "Nature Reserves of the Shire of Toodyay. West. Aust. Nat. Reserve Manage. Plan No. 6 (Draft). (Dept. of Fish. and Wildl. : Perth).

1.6 Future Publications

Management plans at various stages of the planning process for those reserves covered in Section 1.4, will be published over the following year.

2. NATURE RESERVE MANAGEMENT INFORMATION SYSTEM

2.1 Objective

To continue to develop an easily accessible system for the storage and retrieval of data pertinent to reserve management, in particular fire protection.

2.2 Procedure

Following the completion of a report by Brett Tannahill, which detailed the establishment of a reserve management information system, a functional system has been developing. Individual files for reserves have been established, incorporating administrative information, data on flora, fauna, fire history, pests, human usage and fire suppression. The fire suppression information incorporates reserve location and access maps, plus any other information pertinent to fire protection. The relevant aerial photographs are also included in the reserve file.

2.3 Results

Complete files for individual reserves are gradually accruing, due primarily to the hard work of Natalie Taylor.

Most of the information contained is suitable for direct transfer to a computerised data storage, manipulation and retrieval system.

2.4 Conclusions

The benefits of a functional reserve management information system to research and reserve management alike, are obvious.

2.5 Proposals

The following year will see the continuing collection and collation of reserve information.

2.6 Publications

None

3. RURAL INFORMATION SYSTEM (RIS) JOINT PROJECT

3.1 Objectives

To use the available technology to enter, store and manipulate reserve management information, and to test the suitability of this technology for these tasks.

3.2 Procedure

The project extended well beyond the proposed deadline of August 1983 to November of the same year. By this date all reserve management and flora atlas information had been entered, manipulated and used for display purposes.

3.3 Results

All data was entered successfully, although this was time consuming due to system problems. Output or products obtained are as follows:

Lake Magenta

All the reports were fire management/protection orientated; the only exception being an administrative report. These products are considered to be representative of other reserve management data which in future could be utilised in a similar manner. A brief listing of the products follows:

*Fire protection plan
*Fire history map and report
*Vegetation Map
*Soils Map
*Land Clearing Map
*Reserve Administration Report
*Firebreak Details Report
*Firebreak Maintenance Report
*Fence Report
*Water Source Report
*Reserve Access Report

Western Australian (Flora Atlas)

Maps showing the distribution of flora were produced with the inclusion of information previously unavailable.

The products were:

*State coast/local government authority map
*The above, plus any combination of 200 species of wildflower.
*The above, plus rainfall isohyets
*The above, plus major towns in W.A.

*For the south-west of W.A., all of the above
*Sight observation record summary report
*Detailed sight observation record report
*Flowering occurrence report

3.4 Conclusions

The RIS project has indicated the benefits of having rapidly, easily accessible information both within, and between government departments. However, while acknowledging that the Intergraph system is near the front of the technological market in graphic data base systems, certain charateristics of the system cause inconvenience in an operational research and management situation. The main characteristic which leads to unsuitability is the rigidity of the data base. This means that all expected outputs must be fully stipulated from the outset of the project. This is not possible in a reserve management environment where ad hoc enquiries and variable output requirements are the norm.

3.5 Proposals

Although formal involvement in the RIS project is finished, the Department is still involved in the Rural Special Interest Group (SIG Rural) and in LISSC cadastral data entry.

3.6 Publications

Crook, I., Gioia, P. and Moore, S. (1983). "SIG-Rural joint project - Participants Report - Department of Fisheries and Wildlife in LISAC SIG Rural Joint Project February-November 1983 . Technical Report (LISSC : Perth).

4. MANAGEMENT OF METROPOLITAN NATURE RESERVES

4.1 Objectives

To work closely with the local community, primarily through local community groups and Councils, to encourage an appreciation of the conservation values of reserves in the Metropolitan area.

To emphasise the importance of nature conservation (through nature conservation in the metropolitan area) to the community at large.

4.2 Procedure

The first formal step towards achieving these objectives was made on 20 September 1983 when a one-day seminar on the management of small bush areas in the Perth metropolitan region was held.

As part of the ongoing management considerations for the metropolitan nature reserves, a management plan is in the

early stages (see section 1.4).

4.3 Results and Conclusions

The seminar brought together government departments, local government authorities, tertiary institutions and community groups to listen to 22 speakers. The speakers highlighted the problems of fire and weed control, the need for survey and planning, and for a continuing management input, if management for nature conservation in the urban environment is to be successful.

The need for a similar seminar dealing solely with the problem of weeds was emphasised by many speakers during the course of the seminar.

4.4 Proposals

One of the most important outcomes of the seminar was the realisation, by many people, of the availability of this Department as an advisory organisation. In the following year advice regarding the management of urban bush areas, will continue to be given to interested members of the community.

4.5 Publications

Moore, S.A. (1984) (ed). "The Management of Small Bush Areas in the Perth Metropolitan Region: Proceedings of a Conference held on 20 September 1983 by the Department of Fisheries and Wildlife (Fish. and Wildl. : Perth).

5. MONITORING

5.1 Objectives

To establish, as part of ongoing management planning, a series of permanent traplines on a group of nature reserves. This will provide initial data for management planning, and also long term data as part of a monitoring program.

5.2 Procedure

Traplines have been constructed on 3 of the 4 larger (118-459 ha) nature reserves in the Shires of York and Northam. Traplines will be in place on the fourth reserve by spring of this year.

5.3 Results

None.

5.4 Proposals

The traplines will be regularly "opened" so that the small mammal, reptile and amphibian populations of these 4 nature

reserves can be monitored. An integral part of this program is the compilation of species lists, not only for the trapped fauna, but for the observed fauna (particularly birds) as well.

SEMINARS, WORKSHOPS AND CONFERENCES

The following meetings were attended:

*53rd ANZAAS Congress, Perth, 16-20 May, 1983
*Workshop on Survey Methods for Nature Conservation, Adelaide, 31 August-2 September, 1983
*Environmental Survey of Australia Workshop, Adelaide, 21-22 November, 1983 (paper presented)
*Australian Mammal Society Possum and Glider Symposium and General Scientific Meeting, Armidale (NSW) 28 November-2 December, 1983 (paper presented)

mgt small bush areas –

Publications

Chilcott, M.J., Moore, S.A. and Hume, I.D. (1983). Effects of Water Restriction on Nitrogen Metabolism and Urea Recyling in the Tammar Wallaby (Macropus eugenii) and the Red-necked Pademelon (Thylogale thetis). Submitted to Comp. Physiol.

PUBLIC RELATIONS

Worked in an advisory role, with Department of Conservation and Environment and Lands and Surveys, in discussions and field resolution of the route of the proposed Southern Ocean East Road in the Shire of Ravensthorpe.

Continuing advice given to the Shire of Wanneroo, regarding the survey and management needs of Marangaroo Reserve.

Accompanied 2 representatives of the W.A. Wildlife Authority on a field trip to Chiddarcooping Nature Reserve for discussions with the Shire of Westonia regarding the advisability of routing a road through the western part of the reserve.

COMMITTEES

RIS Joint Project - Group Leader
Working Group on the Preparation of Management Plans
Apiary Site Allocation Committee