065257

DEPARTMENT OF FISHERIES AND WILDLIFE

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL 1980. 9 A.M.

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PROGRAMME

9.00 a.m.	MR. J.A.K. LANE
9.35 a.m.	MR. N.L. McKENZIE
10.10 a.m.	MORNING TEA
10.40 a.m.	MR. A.J.M. HOPKINS
11.15 a.m.	DR. J.E. KINNEAR
11.50 a.m.	DR. S.D. HOPPER
12.25 p.m.	LUNCH
2.00 p.m.	DR. I.G. CROOK
2.35 p.m.	MR. J.T. GOODSELL
3.10 p.m.	AFTERNOON TEA
3.30 p.m.	MR. K.J. WALLACE
4.05 p.m.	DR. A.A. BURBIDGE
4.40 p.m.	CLOSE
	DRINKS WILL BE SERVED.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL 1980.

JIM LANE.

Monitoring of Depth and Salinity of Wetland Nature Reserves.

1.1. Objectives.

Routine monitoring of the depth and salinity of selected Wetland Nature Reserves in the south-west of the state will assist in

i) the annual evaluation of conditions for waterfowl breeding.

ii) the prediction of summer conditions

iii) the determination of annual and long-term variations in water depth and salinity - important aspects of the condition of WNRs.

iv) the development of a salinity and water-permanence classification system for WNRs.

v) the determination of salinity tolerances and preferences of various species of waterbirds for breeding and other purposes

vi) the determination of salinity and depth tolerances of other aquatic fauna and flora.

vii) the management of particular WNRs eg Lakes Chittering, Nonalling, Byenup, Tordit Garrup, Poorginup, Chandala and Benger.

1.2. Procedures.

i) Gauge Installation: 41 depth-gauges (staffs) were installed during 1979/80, bringing the total number of gauged wetlands to 68. 63 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.

W.A. Field and Game Association members have provided some assistance in monitoring since January 1980.

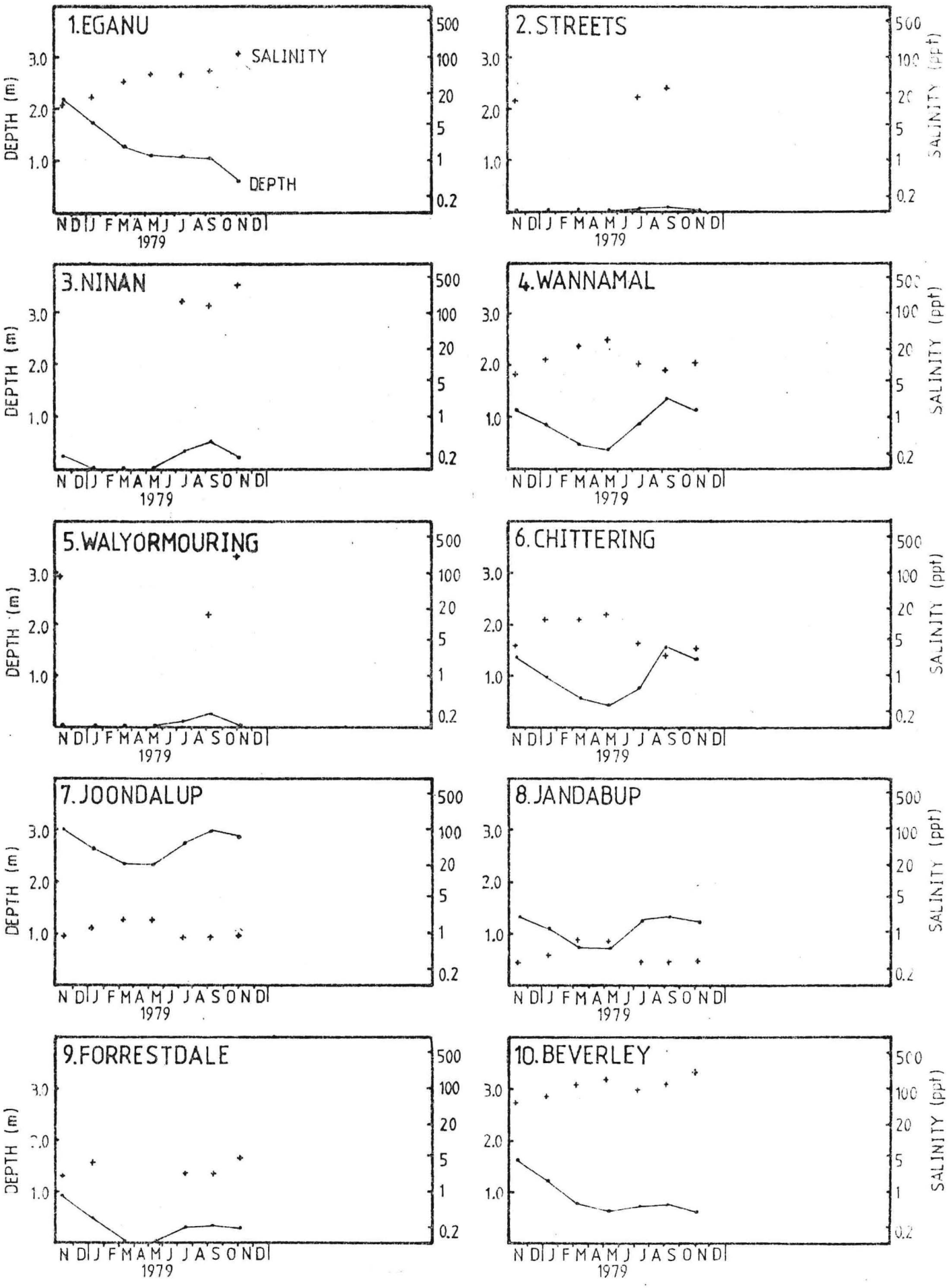
1.3. Results.

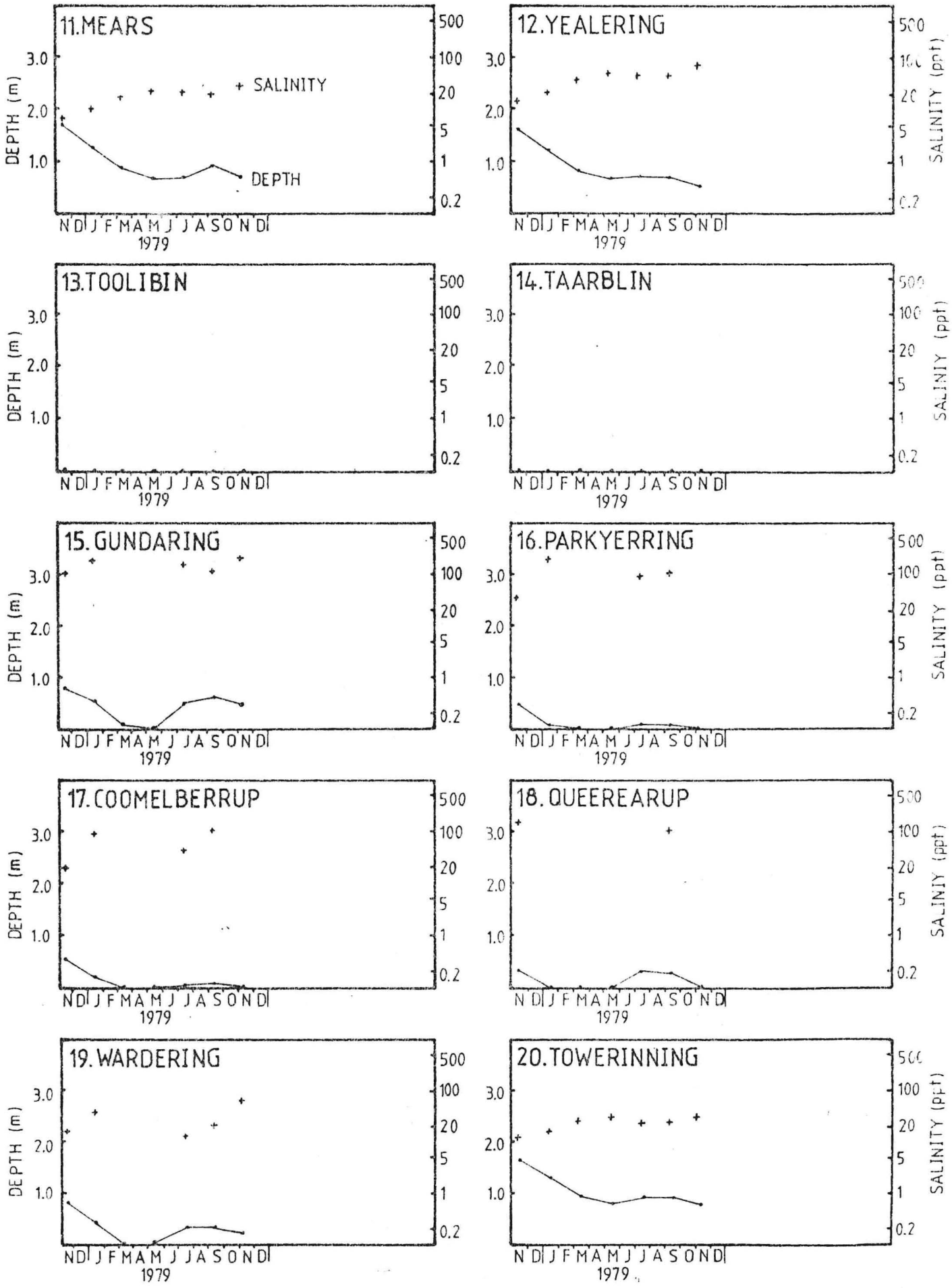
See figures 1-24 for a sample of results.

1.4. Conclusions.

In conjunction with rainfall statistics, results obtained from two-monthly monitoring of WNRs 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. In past years the WAFGA has frequently disputed the Department's subjective assessment of wetland conditions. WAFGA has welcomed the Departments recent efforts to assess conditions more objectively, and in 1979 the Departments assessment was not disputed, despite the recommendation for a "No Season".

The data gathered will also provide a sound basis for the development of a meaningful salinity classification for WNRs, and for other wetlands of the south-west (See Research Project 2.)


1.EGANU
SALINITY
DEPTH
2.STREETS
3.NINAN
4.WANNAMAL
5.WALYORMOURING
6.CHITTERING
7.JOONDALUP
8.JANDABUP
9.FORRESTDALE
10.BEVERLEY
DEPTH (m)
SALINITY (ppt)
3.0
2.0
1.0
500
100
20
5
1
0.2
N D J F M A M J J A S O N D
1979


11.MEARS
12.YEALERING
13.TOOLIBIN
14.TAARBLIN
15.GUNDARING
16.PARKYERRING
17.COOMELBERRUP
18.QUEEREARUP
19.WARDERING
20.TOWERINNING
DEPTH (m)
SALINITY (ppt)
SALINITY
DEPTH
3.0
2.0
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500
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20
5
1
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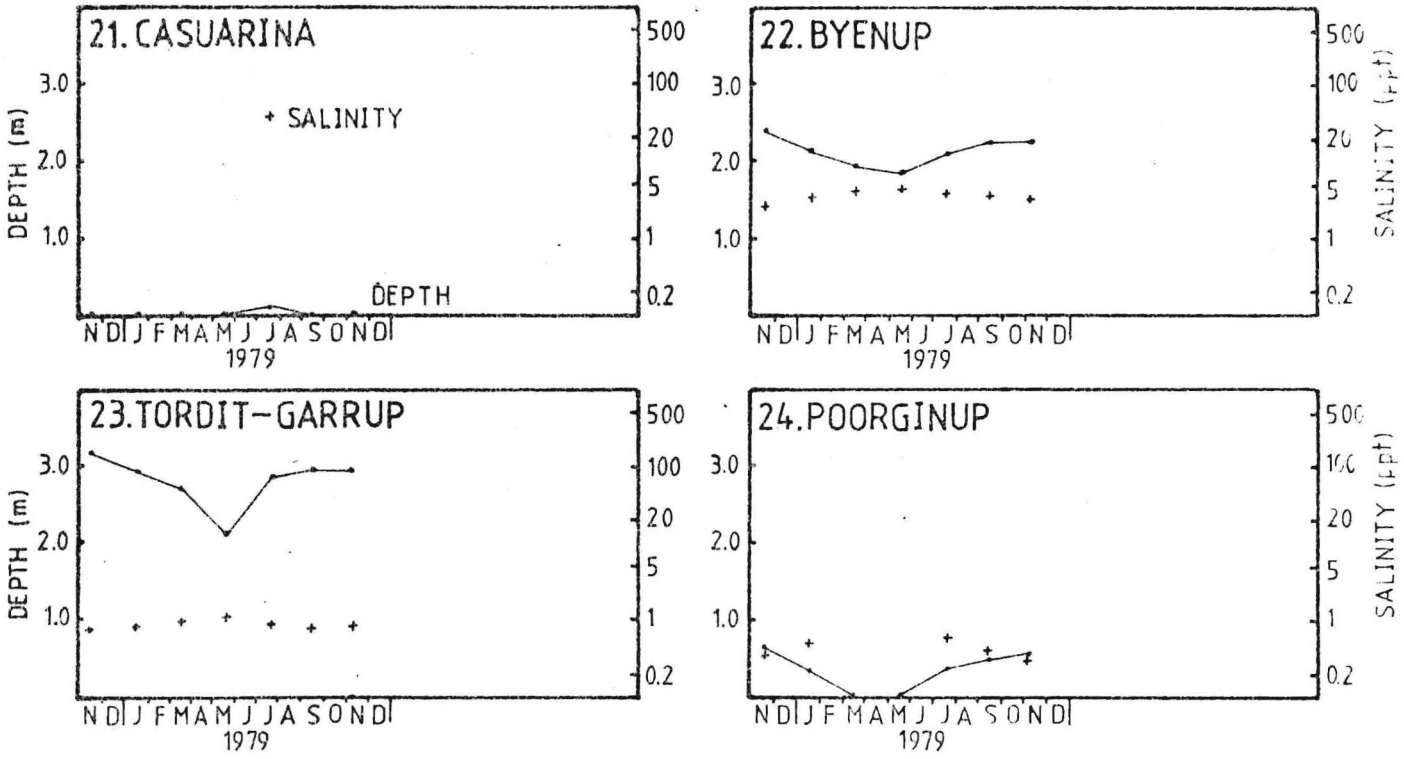
N D J F M A M J J A S O N D J
1979


21. CASUARINA
+ SALINITY
DEPTH
DEPTH (m)
3.0
2.0
1.0
500
100
20
5
1
0.2
N D J F M A M J J A S O N D J
1979
22. BYENUP
SALINITY (ppt)
23. TORDIT-GARRUP
24. POORGINUP

1.5. Proposals for 1980/81

During 1980 it is proposed to install depth gauges on a further 20-25 WAWA-vested WNRs in the south-west of the state. This will complete the gauge-installation programme. Two-monthly monitoring of water and salinity levels by Research Staff and WAFGA members will continue until November 1980. Monitoring frequency will then be reduced to bi-annual checks (September and November) of all gauged wetlands by Research Staff, plus two-monthly checks on depth of selected wetlands (approximately 15-20) by DWOs and RMOs (pending CWO approval), and additional, opportunistic data-gathering by DWOs, RMOs, Research Staff and WAFGA members.

1.6. Publications 1979/80 Nil

1.7. Publications for 1980/81 Two short papers concerning annual assessment of wetland condition will be published.

2. Wetland Nature Reserves:

2.1. Objectives.

Continuing studies on WNRs of the south-west of the state have the following principal objectives.

i) To determine the total area of wetland reserved under the WNR system. (Each WNR may include both wetland and "dryland". Although the total area of each WNR is known, the proportion which is wetland is not known)

ii) To develop a salinity and water-permanence classification system for WNRs and to classify each WNR accordingly

iii) To determine (albeit imprecisely) the "representativeness" of the WNR system as a matter of some urgency. Obvious gaps in representation can thus be identified and priorities for acquisition can be established.

iv) To assess waterbird usage of WNRs and, as far as practicable, to determine the role of the WNR system in the maintenance of waterbird populations of the south-west. This project might well be undertaken as part of the proposed RAOU National Waterbird Survey.

2.2. Procedures.

i) The boundaries of wetlands contained within each WNR are being determined from 1:40,000 B & W aerial photography, with field inspections (ground or aerial) where necessary. A digitising computer will be used to calculate the area of wetland reserved.

ii) Salinity and water-permanence data are obtained through the WNR monitoring programme (Project 1) and during brief inspections of non-gauged WNRs.

iii) Waterbird species, breeding-species and abundance are also determined during brief inspections, and dominant plant species are recorded. This information, together with salinity and water-permanence data, from the basis for assessing the "representiveness" of the WNR system.

2.3. Results.

i) Determination of the area of wetland included in WNRs has recently commenced. No data are available.

ii) The WNR monitoring programme (Project 1) has provided salinity and water permanence data on 63 of the c 250 WNRs of the south-west. (see 1.3). Brief inspections have provided limited data on a further 57 WNRs.

iii) Waterbird usage data have been obtained (either by brief inspection, or by detailed survey) from approximately 90 WNRs. Usage of Lake Forrestdale and Lake Jandabup has been assessed at two-monthly intervals since August 1979.

2.5. Proposals for 1980/81

i) The total area of wetland reserved under the WNR system will be determined during 1980/81.

ii) A salinity and water-permanence classification system will be produced during 1980/81 and each WNR will be classified accordingly.

iii) Further familiarization surveys of WNRs vested in WAWA will continue. Data obtained during these surveys will be used in the classification referred to above, and in the compilation of preliminary waterbir species and breeding-species lists.

iv) Further discussions will be held with the RAOU concerning that organisation's possible role in assessing waterbird usage of WNR's and monitoring waterbird populations of the south-west (particularly ducks).

2.6. Publications 1979/80

No publication. A map of WNRs of the south-west of the state has been produced.

2.7. Publication for 1980/81

3. Feral Duck and Goose Control

3.1. Objectives

i) To monitor the numbers of feral ducks and geese on lakes and rivers of the south-west of W.A.

ii) To control these populations at as low a level as possible, as efficiently as possible.

3.2. Procedures

i) Perth Metropolitan Area: Feral duck and goose populations on 71 wetlands from Yanchep to Rockingham have been surveyed during February or March each year since 1978. Attempts have been made to reduce these populations by trapping and shooting.

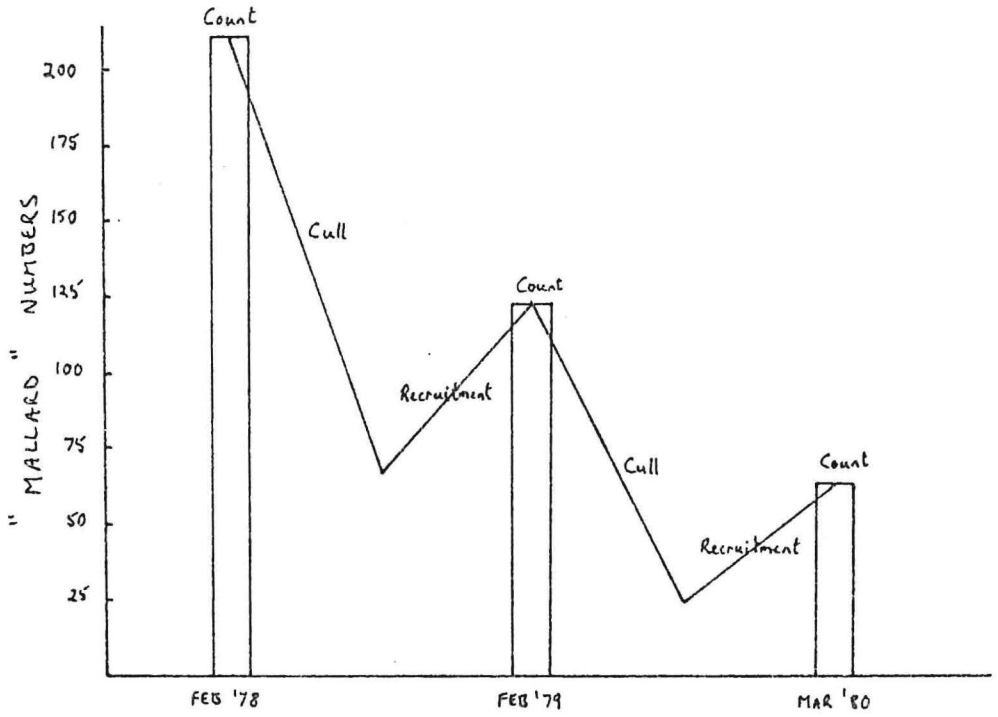
ii) Remainder of the South-West. During 1979, District Wildlife Officers were asked to advise on numbers of feral ducks and geese in their districts.

3.3. Results

i) Perth Metro Area:

Since February 1978, feral "mallard " numbers have been reduced from 209 to 63.

Muscovy from 16 to 7, and Geese from 25 to 18.



ii) Remainder of South-West; During 1979, District Wildlife Officers reported a total of 31 "mallards" in country areas. Removal of these birds is under way.

3.4. Conclusions.

i) Perth Metro Area:

Following culling, the metro area "mallard" population increased by 83% in 1978 and 162% in 1979. Recruitment is due to breeding activity and to dumping of additional birds on the wetlands. Continual culling will therefore be necessary to maintain the population at an "acceptable" level.

ii) Remainder of S.W.

Feral duck and goose numbers in the remainder of the south-west are apparently quite low. These birds can be removed with little difficulty by DWO's. No special eradication programme is required.

3.5. Proposals for 1980/81

i) Perth Metro Area: Further trapping and shooting will be undertaken during 1980. A follow-up census will be made in February 1981.

ii) Remainder of South-West:

Further surveys of feral ducks and geese in country areas are not proposed. District Wildlife Officers will be requested to remove feral birds wherever and whenever they are encountered.

ADVICE AND COMMITTEE WORK

During 1979/80 approximately 40% of my time was spent on advice and committee work.

I am a member or deputy of the following committees:

1. Bird Committee of the Western Australian Wildlife Authority.
2. Standing Working Group on Birds of the Council of Nature Conservation Ministers. (Doesn't meet)
3. Peel Inlet Management Authority (Deputy).
4. Planning Committee of the Peel Inlet Management Authority (Deputy).
5. Wetlands Advisory Committee of the Environmental Protection Authority.
6. Lake Joondalup Regional Open Space Technical Advisory Committee.

WESTERN AUSTRALIAN WILDLIFE RESEARCH

RESEARCH CENTRE

RESEARCH PROGRAMME SEMINAR

N.L. McKENZIE.

11 APRIL, 1980.

RESEARCH PROJECTS

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

Organize and undertake biological surveys in desert regions. Review relevant available data in the collection of the Western Australian Museum. This is a continuation of previous work.

1.3. Results and Conclusions

The second Desert Bulletin is now published.

In April-May 1979 a major biological survey of the Great Sandy Desert was undertaken. Collections of plants, mammals, bird data, and reptiles were made from the range of major environmental mosaics represented in the desert. To this end, sixty three sample sites were selected, described and sampled during the course of the work, an average of seven near each of the nine campsites chosen.

The survey was carried out by two teams, one concentrating on north-eastern and central parts of the desert and the other in its southern and north-western sectors. A rich flora and fauna were recorded, including new species of plants and reptiles and extensions of the known ranges of a variety of plant and vertebrate species. Notable

mammal records include *Antechinus rosamondiae*, *Planigale ingrami* and *Pseudomys forresti*. The pit-drift fence technique described in the 1979 research seminar proved its efficiency as a method of recording both reptiles and small mammals in desert as well as semi-arid environments.

Evidence of medium-sized mammals, such as those now rare or extinct in the more southern deserts, again proved scarce. A sighting and scats of a Hare-wallaby were recorded near Lake Gregory, and tracks and scats of a small macropod and/or bandicoot were recorded on the Ankatell Ridge. Surveys aimed at clarifying the status of such species in Western Australia's arid zone are a matter of urgency.

A Bulletin on the wildlife of the Great Sandy Desert is currently in preparation; the necessary reserves have been delineated by the principal authors. The publication on the McLarty Hills/Dragon Tree Soak trip mentioned in the 1979 review will be incorporated in this Bulletin.

1.4. Recommendations and Proposals for 1980/81

During late 1979 and early 1980 there was again substantial rainfall in the Great Sandy Desert so a re-visit to our Ankatell Ridge site in the Great Sandy Desert has been programmed to follow-up the evidence of bandicoots and to see if, with the third successive year of good rainfall, any different mammals (hopefully the larger species with a longer breed-up period) can be recorded. It was only after good seasons in 1930/31 that Lipfert recorded the larger species now considered endangered.

1.5. Publications 1979/80.

1. McKenzie, N.L. and Burbidge, A.A. (Editors) 1979 "The Wildlife of some existing and proposed nature reserves in the Little Sandy Gibson and Great Victoria Deserts, Western Australia". Wildl. Res. Bull. West. Aust. No. 8, 1-36.

2. Burbidge, A.A. and McKenzie, N.L. (1979). "Environment" In McKenzie, N.L. and Burbidge, A.A. A.A. (Eds). Wildl. Res. Bull. West. Aust. No. 8, 7-15.

3. McKenzie, N.L., Youngson, W.K., Chapman, A. and Burbidge, A.A. (1979) "Mammals". In McKenzie, N.L. and Burbidge, A.A. (Eds). Wildl. Res. Bull. West. Aust. No. 8, 16-21.

4. Burbidge, A.A. and McKenzie, N.L. (1979) "Conclusions". In McKenzie, N.L. and Burbidge, A.A. (Eds.). Wildl. Res. Bull. West. Aust. No. 8, 34-36.

1.6. Proposed Publications.

McKenzie, N.L. and Youngson W.K. (in prep). "Mammals". In Burbidge, A.A. and McKenzie, N.L. (Eds). "Wildlife of the Great Sandy Desert and adjacent sites". Wildl. Res. Bull. West. Aust.

2. Biological Survey - Kimberley

2.1. 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 conservational concern.

2.2. Procedures

(i) Organise and undertake biological surveys in the Kimberley.

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

(iii) Undertake survey work and write survey papers on Kimberley mammals.

2.3. Results and Conclusions

The Bulletins on the Edgar Ranges Area and Dampier Peninsula are still in preparation pending completion of the botanical and insect sections. Introductory, physical environment, mammal, bird and reptile papers are completed for both Bulletins. A paper titled "Mammals of the Phanerozoic South-west Kimberley - Biogeography and Recent Changes" has been completed and is ready to be submitted for publication in a Journal. Mammal species inventories of the main biogeographical areas in the far north of Western Australia are presented. The mammal fauna of the Phanerozoic South-west Kimberley reflects the area's intermediate climate, its geographical location between, and its geomorphic continuity with, both the sub-humid North Kimberley and the arid Great Sandy Desert.

The fauna of the East Kimberley is a depauperate selection of North Kimberley species, with a few special arid zone inclusions, and reflects the influence of the area's drier climate on its geomorphological kinship to the North Kimberley; the presence of its arid zone component can be explained in terms of its widespread dry alluvial surfaces.

Insufficient is known about mammals in the medium rainfall Hall's Creek area, between the North Kimberley and the Tanami Desert (Fig. 1), for meaningful discussion. Survey work is needed in this area.

Available sub-fossil material suggests a middle Holocene period of higher rainfall in the Phanerozoic South-west Kimberley during which a number of high rainfall mammal species, that are today restricted to the north-western Kimberley, were present. They disappeared during ensuing drier climatic conditions, well before the advent of a pastoral industry about 90 years ago; a number of medium-sized mammal species (0.5 to 4 kg) have declined or become extinct in the area since then. All species of small and large mammals recorded since earliest European settlement have persisted, apparently in good numbers.

A specific problem in the South-west Kimberley mammal work was the identification of bats belonging to the Genus *Nycticeius*. To achieve a satisfactory determination, a review of Western Australian *Nycticeius* specimens was undertaken and a brief publication is being prepared.

A progress statement on the need for and conclusions of this review has been submitted to "Bat Research News".

2.4. Recommendations and Proposals for 1980/81

No field work is programmed in the Kimberley in 1980/81.

2.5. Publications 1979/80

McKenzie, N.L. and Rolfe, J.K. (1979). "A Further Mangrove Kingfisher record from Western Australia." W.A. Nat., 14 (6), p. 159.

2.6. Proposed Publications

McKenzie, N.L. (ed.) (in prep.). "Wildlife of the Edgar Range area, south-west Kimberley, Western Australia." Wildl. Res. Bull. West. Aust.

McKenzie, N.L. (ed.) (in prep.). "Wildlife of the Dampier Peninsula, Western Australia". Wildl. Res. Bull. West. Aust.

McKenzie, N.L. (in prep). "Mammals of the Phanerozoic South-west Kimberley - Biogeography and Recent Changes".

McKenzie, N.L. and Caputi, N. (in prep.). "Taxonomy of *Nycticeius* in Western Australia.

Kitchener, D.J., Keller, L.E, Chapman, A., McKenzie, N.L., Start, A.N. and Kenneally, K.F. (in press). "Observations on Mammals of the Mitchell Plateau Area". Rec. West. Aust. Mus.

3. Biological Survey - C.T.R.C. System 11 (Goldfields).

3.1. 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 and temporal fluctuations in abundance.

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

3.2. 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.

3.3. Results and Conclusions.

All cells in the region have now been visited once. Voluminous inventory and environmental data have been collected which detail the area as a biogeographical interface. Compilation and analysis of data for publication is pending finalisation of the Kimberley and Desert survey publications.

3.4. Recommendations

An ongoing survey program with two more years to run.

3.5. Publications 1979/80

Nil.

3.6. Proposed Publications

Detailed in the 1978 Research Seminar.

4. Chiropteran Studies - Taxonomy of *Mormopterus*

4.1. Objective

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

4.2. Procedure

Morphometric examination of available specimens; comparison with material from elsewhere in Australia.

During the year, series were collected at Point Samson, Cape Keraudren, Kalgoorlie, Kurnalpie, Coolgardie, the Jilbadgie Nature Reserve and the Rudall River National Park.

4.3. Results and Conclusions

Pattern of Morphological forms remains little changed from the 1979 research review although samples are now larger.

4.4. Recommendations

On-going program as further specimens become available from areas where this species is yet poorly collected (e.g. Pilbara, N.W. Kimberley), as a result of biological survey work or from other sources.

4.5. Publications 1979/80

Nil.

4.6. Proposed Publication

McKenzie, N.L. and Caputi, N. (in prep).
"The Taxonomy and distribution of *Mormopterus* in Australia."

5. Chiropteran Studies - Mangrove Bats

5.1. Objectives

A long term ecological study, the first step of which is on inventory of the species richness of bats in the different mangrove blocks along the W.A. coastline. The project aims to inventory the bats occurring in each block of mangroves and, by combining the results from blocks within each mangrove biogeographical region (as defined in Semeniuk *et al* 1978, "Mangroves of Western Australia." Handbook No. 12, W.A. Naturalists' Club, Perth.) recognise characteristic bat faunas.

By correlating 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), it is hoped to ~~look at the~~ document species structure of bat communities in mangroves. In effect, I am trying to separate the species within each su fauna in terms of ecological niche parameters related to differences in the functional requirements of their food hunting.

5.2. Procedure

During Long Service Leave in 1979, bats were collected from mangrove swamps at Giralea Bay, Point Samson, Karratha, Cape Keraudren and West of Wyndham. A further trip to Gales Bay, Point Samson and Cape Keraudren was undertaken by one of my staff in March 1980. This study is carried out as time and other programs permit.

5.3. Results and Conclusions

Seventeen different mangrove blocks have now been visited and four blocks revisited on two or more occasions. In all, seventeen different bat species have been for 36 nights effort.

Overall the inventory has not improved with the extra effort although greater consistency in species composition has been achieved between blocks in the same biogeographical regions of Western Australia.

5.4. Recommendations

Field work to continue as other programs permit, publication of inventory results when satisfactory.

5.5. Publications 1979/80

Nil.

5.6. Proposed Publications

The first will be a paper on the distribution of bat species in mangrove communities along the western coast of Australia.

COMMITTEES

1. W.A. Wildlife Authority Reserves Committee
2. Biological Survey Committee
3. Peter Gowland Steering Committee

The work involved about 5% of my time during 1979/80

SEMINARS, WORKSHOPS, PUBLIC RELATIONS, EXTENSION

A chapter titled "Biological Survey and Acquisition of Nature Reserves" was written as a contribution to a book on Nature Conservation in Western Australia. Three other chapters, "The Kinds of Conservation Reserves", "Primitive Area Reserves", and "The Vertebrate Fauna" are in various stages of preparation.

As regional editor (Western Australia) of "Bat Research News", I have prepared a report on current Chiropteran research being undertaken in Western Australia.

A contribution was also made to:-

Hopper, S.D. Burbidge, A.A., Hopkins, A.J.M., Kinnear, J.E, Lane, J.A.K., McKenzie, N.L. and Prince, R.I.T. (1979). "Establishment and Management of Nature Reserves for threatened vertebrates in Western Australia. In: "A vanishing heritage: the problem of endangered species and their habitat." (Nature Conservation Council: Wellington).

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMME SEMINAR

A.J.M. HOPKINS

11 APRIL, 1980.

SUMMARY

Substantial headway has been made with three major projects in the past year: The work at Eneabba has been written up for publication, manuscripts on the work on Middle Island (*Recherche Archipelago*) are virtually complete, and a predictive land-use model was constructed for Tutanning Reserve. Other field programmes at Two Peoples Bay and in the Eneabba - Mt Leseur area continued.

During the coming year, work at Tutanning and Mt Leseur will be consolidated and the preparation of some material for publication is anticipated. A further harvest at Two Peoples Bay is programmed and the Middle Island study plots will also be sampled.

RESEARCH PROJECTS

A. Fire Ecology Studies

1. Modelling

1.1. Objectives

To examine the possibility of the use of various modelling strategies for the simulation of the long term effects of various management strategies on the biota of reserves - and to highlight further research needs. To adapt the predictive gradient modelling approach of Kessell (U.S.A.) to Western Australian conditions.

1.2. Procedures

A simple model was developed in 1976/77 to simulate effects of various fire regimes on a Tutanning-like model reserve. This provided some indication of optimum regimes and highlighted further research needs. Collection of appropriate field data from Tutanning Reserve commenced in 1977.

Dr Stephen Kessell (of Montana USA) was invited to Western Australia to collaborate in the preparation of a predictive land-use model or 'Gradient model' Dr Kessell visited this research institution for a total of 5 weeks in October - November 1979 and during this time we were able to construct a very basic system for Tutanning using existing field data, Forest Department fire tables and programmes prepared by Dr Kessell for a similar modelling project in Kosciusko National Park.

1.3. Results.

The very basic system incorporates resource inventory information (e.g. elevation, slope, aspect, topography, soils, fire history etc) with results of vegetation and litter and fire fuels studies. Vegetation and fuels can be predicted at any specified site within the reserve. Fire behaviour can be predicted under prevailing meteorological conditions. The results were presented at a workshop held at WAWRC in November 1979.

1.4. Conclusions.

The values of the gradient modelling approach to land-use management and of the model as a research tool have been clearly demonstrated.

1.5. Proposals for 1980/81

A large proportion of the resource inventory work remains to be done. Further vegetation data will enhance the quality of the model. There is some potential for the incorporation of results from Dr Kitchener's Wheatbelt Fauna Survey into the existing model and this will be investigated as time permits. The development of a Plant Succession Model, which will be basically for research purposes, will also be investigated.

1.6. Publications-1979-80.

Nil

1.7. Publications 1980/81

A joint publication with Dr Kessell on the results of the Tutanning work is proposed.

2. Wheatbelt Field Studies (Tutanning, Boyagin, Dryandra S.F.)

2.1. Objectives

To develop a knowledge and understanding of the patterns and processes of regeneration of the central wheatbelt vegetation following fire.

2.2. Procedures

As a pre-requisition to the comprehensive ecological studies planned, a thorough background of general environmental information is being compiled from diverse field and documentary sources. A variety of ecological techniques will then be used to elucidate differences between similar areas with different fire histories, etc. to study successional processes.

2.3. Results

Tutanning. Resource inventory work has continued with sampling at the 316 grid points. About half the points have been comprehensively sampled (relative importance values, all species + structural information) and these data were utilized in the development of the gradient model. Much of the other data on Tutanning Reserve, particularly the fire history information, were also consolidated and used for the modelling projec Monthly collection of litter samples continued up to December 1979 when this project was taken over by Ms Anne Petch, CSIRO Division of Land Resources Management.

An automatic weather station has been established at Tutanning in conjunction with the Public Works Department and utilizing some of the equipment previously borrowed from CSIRO Division of Wildlife Research

Boyagin and Dryandra S.F. No work was undertaken in these areas in 1979/80.

2.4. Conclusions

None at present.

2.5. Proposals for 1979/80

Collection of resource inventory information will continu

2.6. Publication 1978/79

Nil.

2.7. Publications 1979/80

Hopkins, A.J.M. & Burbidge, A.A. Tutanning Nature Reserve I History, Environment and Results of some Preliminary Biological Studies. Dept. Fish. Wildl. W.A. Rept. (carried over from 1979/80.)

Hopkins, A.J.M., Monk, D. & Robinson, C.J. Population Structure Analyses of some Central Wheatbelt Plant Species (carried over from 1979/80.)

3. Two Peoples Bay

3.1. Objectives

To study the processes and time scales of regeneration of south coast heath vegetation following fire.

3.2. Procedures

As for 2.2. above, collection and collation of background information is a necessary pre-requisite to detailed ecological studies. This process is continuing.

A625m^2 plot was established in September 1976. Sets of sub-plots were harvested then, and immediately after a controlled fire, and 1, 2 and 3 years later. Harvested plant material is sorted by species and oven dry weights determined. A second plot 425m^2 was established in February 1979 and sampled in a similar way.

3.3. Results

Material from harvests has now been dried and weighed. Data are presently being worked up.

3.4. Conclusions

Nil.

3.5. Proposals for 1980/81

Further sets of sub-plots will be harvested in 1979.

3.6., 3.7. Publications for 1978/80

This study is programmed to last 12-15 years. Results will be reviewed after 5 years.

4. Middle Island (*Recherche Archipelago*)

4.1. Objectives

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

4.2. Procedures

A set of permanent quadrats was established in the 1972/73 burn area in 1973. These have been sampled 5 times in 6 years. Sections of the then unburnt portion of the island were sampled during the 1976 visit. A fire in January 1977 consumed the vegetation of much of this unburnt section including some of the

unburnt vegetation monitoring sites. These sites were resampled in November 1978 and notes made on general damage and regeneration in the area.

4.3. Results

The results of all work on Middle Island are currently being prepared for publication. A talk was given at the Ecological Society Open Forum (Brisbane, May 1979) on the major findings from this study.

4.4. Conclusions

To be included in the publication.

4.5. Proposals for 1980/81

Sampling of all study plots on the island is programmed for November 1980. A concerted effort will be made to complete preparation of the publication.

4.6. Publications for 1979/80

Nil.

4.7. Publications for 1980/81

Hopkins, A.J.M. (Editor). Results of Studies on Middle Island (*Recherche Archipelago*). Wildl. Res. Bull West. Aust. (carried over from 1979/80).

5. Other.

5.1. Objectives

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

5.2. Procedures

Lake King - 90 mile Tanks. A relict of prefire woodland vegetation, surrounded by post-fire mallee-heath vegetation was located about 2 km E. of 90 mile Tanks. The vegetation was sampled along a transect passing from the mallee-heath

through the woodland and into the mallee-heath.

5.3. Results.

To be presented.

5.4. Conclusions

The results show clearly that a single fire can cause substantial structural changes to vegetation. Some implications of this will be discussed.

5.5. Proposals for 1979/80

Further one-off studies of this nature will be carried out as the opportunities exist.

5.6. Publications for 1979/80

Hopkins A.J.M. and Robinson C.J. (in press) Fire induced structural change in a Western Australian Woodland. *Aust. J. Ecol*

5.7. Publications for 1980/81

Nil.

B. Regeneration Studies

6. Eneabba Reserves

6.1. Objectives

To develop an understanding of the plant ecology in the Eneabba area to ensure appropriate management in the various sandmining companies' rehabilitation programmes.

6.2. Procedures

A ca 20 km^2 area of kwongan (sclerophyllous shrubland) vegetation was surveyed by Dr R.J. Hnatiuk and myself in September 1977. Results of this survey have been written up for publication.

A contract was let to Mr E.A. Griffin in 1978 for some further work in the Eneabba area. Reports on this work have been drafted.

A further contract was let to Mr Griffin for a major study of the vegetation in the Mt Lesueur - Cockleshell Gully area. This contract was for 12 months work in the 1979/80 financial year. Results are presently being analysed.

6.3. Results

The findings of the major Eneabba as incorporated in the reports include: a) small but distinctive suits of species characterised a gradient in soils from lateritic gravels through deep sands to clayey winter-wet depressions, b) about 75% of the species encountered (429 total, 338 at study sites) were either widespread or uncommon, c) species richness was greatest in a zone of apparent overlap between the lateritic group of species and those of the deep sand areas, d) physiognomic classifications of the vegetation did not closely parallel those based on floristics, e) distribution of 4 rare or poorly known species were mapped. Work on the effects of brush harvesting of the vegetation (to provide material for rehabilitation) showed some deleterious effects of the practice (i.e. loss of species).

The study of the vegetation of lateritic uplands in the Eneabba area (with E.A. Griffin) highlighted the great variation in vegetation on an apparently uniform substrate. Extra data from the most recent sampling (Mr Lesueur area) have now been incorporated into this study and the whole data set is presently being re-analysed.

6.4. Conclusions

The studies have highlighted the botanical importance of the Eneabba - Mt Lesueur area.

6.5. Proposals for 1979/81

A further small contract will be let to finalise this work.

6.6. Publications for 1979/80

The following two papers have been completed ready for publication:

Hopkins A.J.M. and Hnatiuk R.J. An ecological survey of the kwongan south of Eneabba. Wildl. Res. Bull West. Aust.

Hnatiuk R.J. and Hopkins A.J.M. An ecological analysis of kwongan south of Eneabba, Western Australia for *Aust. J. Ecol.*

6.7. Publications for 1980/81

Griffin E.A. and Hopkins A.J.M. Short-term effects of brush harvesting on the Eneabba kwongan. Dept. Fish. Wildl. W.A. Rept.

Griffin E.A. Hnatiuk R.J. and Hopkins A.J.M. Variation in the vegetation of lateritic uplands in the Eneabba area.

It is probable that some of the work in the Mt Lesueur - Cockleshell Gully area will be ready for publication within the next 12 months.

7. Barrow Island

7.1. Objectives

To monitor the regeneration of vegetation following disturbance (major earthworks and fire).

7.2. Procedures

Permanent sampling sites were established in 1973 by Dr N. Marchant (W.A. Herbarium). Further sites were established in 1975. Sites are monitored approximately biennially.

7.3. 7.4. Results and Conclusions

Nil.

7.5. Proposals for 1979/80

A visit is planned for 1980.

7.6. 7.7. Publications for 1978/80

Nil.

8. Tutanning

8.1. Objectives

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

8.2. Procedures

Mr Peter Farrington (CSIRO Division of Land Resources Management) has become involved in this study in the past 12 months and is to assume major responsibility for it. An appropriate programme of research is now being developed. This programme will include three main lines of inquiry:

i) old-field succession (natural regeneration)

ii) autecology of major habitat species

iii) field techniques for rehabilitation.

8.3. 8.4. Results and Conclusions

Nil

8.5. Proposals for 1980/81

Research work is to be undertaken largely by Mr Farrington with a small amount of involvement by staff of this institution.

8.6. 8.7. Publications for 1979/81

Nil.

9. Other

Woodvale. A programme for the rehabilitation of a *ca.* 0.6 ha area at the Wildlife Research Centre, disturbed during the laying of a sewerage main was prepared and largely implemented in 1978. Transplants were set out before winter 1979. Results are being monitored.

East Wallaby Island. A disused and eroding airstrip has been stablilised using a variety of mesh fences erected in 1978. The island was visited again in 1979 and some repairs effected. Early results of this work are promising.

Two Peoples Bay. A plan for rehabilitation of some eroding visitor walking tracks was devised. Materials were supplied to the Management Officer but it is not known if the work has yet been effected.

C. Reserve Adequacy

10. Tutanning Reserve - Edge Effect

10.1. Objectives

To monitor the long-term changes in the reserve associated with edge deterioration, weed invasion, etc.

10.2. Procedure

This monitoring programme is incorporated within the existing one outlined in Item 2, involving regular sampling of the 316 systematic grid points. Weed invasion following control burns is also being monitored.

10.3. Results

About 20 species of introduced plants have been collected to date. These are most common on the edges of the reserve, but some individuals have been noted germinating from seed in kangaroo faeces well within the reserve. A similar association between the activities of kangaroos and the presence of a ruderal flora has also been noted during the Eneabba Study.

10.4. Conclusions

Nil.

10.5. Proposal for 1979/80.

Monitoring of grid points is to continue.

10.6. 10.7. Publication for 1978/80

Nil.

11. Eucalyptus forrestiana.

11.1. Objective

To examine the distribution of *Eucalyptus forrestiana* in relation to proposed and existing reserves in the Truslove area, pursuant to E.P.A. recommendation 3-9, Red Book 1.

11.2. Procedure

Reserves are traversed by vehicle and on foot and populations of *E. forrestiana* estimated.

11.3. Results

Twenty seven reserves have been surveyed.

11.4. Conclusions

Material which has been collected suggests that *Eucalyptus forrestiana* sub sp. *dolichorynoha* may not be a good sub species. Substantial populations

of *E. forrestiana* are present on existing reserves over a wide distributional range.

11.5. Proposals for 1980/81

Mr Chris Robinson (now with Kings Park and Botanic Gardens) is to assume responsibility for this study.

11.6. Publications 1979/80

Nil.

11.7. Publications 1980/81

A report will be submitted to the E.P.A. Some results may be submitted for publication.

D. Miscellaneous

The first of two articles on Western Australian heathlands has been published:

George A.S, Hopkins A.J.M. and Marchant N.G. (1979). The Heathlands of Western Australia. In R.L. Specht (editor) Ecosystems of the World Vol 9A. Heathlands and Related Shrublands Elsevier, Amsterdam.

A paper on the effects of drought on the vegetation at Eneabba has been submitted to Aust. J. Bot :
Hnatiuk R.J. and Hopkins A.J.M. Western Australian Species-Rich Kwongan Affected by Drought.

Work on three small projects on mangroves continued:

i) The population dynamics of the Mangroves of Anglesea Island (Bubury)

ii) The conservation of mangrove communities in Australia.

iii) The rehabilitation of mangroves in S.E. Queensland.

SEMINARS, WORKSHOPS, PUBLIC RELATIONS

Talks were given at the Ecological Society of Aust. Open

Forum, the Symposium on the Biology of Native Australian Plants, the Bush Fires Board Advanced Fire School and at Murdoch University. A Wildlife Authority inspection of the Eneabba sand-mines was organised and a trip to Esperance was undertaken for the opening of the public walking tracks at Cape Le Grande National Park.
A half-day workshop on 'Gradient Modeling and its applications in Australia' was organised as a culmination of the visit of Dr Kessell in November 1979.

COMMITTEES

1. Mineral Sands Agreements (Eneabba) Rehabilitation Co-ordinating Committee (DID).
2. W.A. Wildlife Authority, Flora Committee.
3. CONCOM Working Group on Endangered Flora.
4. Technical Committee on Environmental Problems Associated with Underground Water Extraction (P.W.D.).

Commitment to Committee work and to the provision of advice within the Department is 20-25% of time. Of this the major time consuming issue continues to be mining and rehabilitation in the Eneabba area.

WESTERN AUSTRALIAN WILDLIFE

RESEARCH CENTRE

RESEARCH PROGRAMME SEMINAR

11 APRIL 1980

J. E. KINNEAR.

RESEARCH PROJECTS.

1. NUMBAT - population survey.

1.1. Objectives.

(i) To survey the preferred habitat of the Numbat in order to determine the present abundance of the species.

1.2. Procedures.

(i) Surveys on foot, bicycle, vehicle.

(2) Investigations of reported sightings.

1.3. Results.

The Numbat population has declined to a very low level. Full details are available in the report written by the survey team.

1.4. Proposals 1980/81 - to be discussed.

2. Dorre Island - macropodid nutritional studies and metabolic studies.

2.1. Objectives:

(i) To establish and document the ruminant - like properties of the Western and Banded hare wallabies and the Boodie rat.

(ii) to collect data on the nutritional niche of each species.

2.2. Results.

(i) as expected, all three species are clearly ruminant - like

(ii) there are appreciable differences in their stomach anatomy which is consistent with niche theory

(iii) Studies on the dietary preferences and differences are incomplete at this point.

2.3. Publications - the study will be published

2.4. Proposals 1980/81 Bernier Island

(i) To compare the diets of the 3 species on Bernier Island with the Dorre Island populations

(ii) To determine the nutritional niche overlap between goats and the 3 macropodid sps.

2.5. Metabolic Studies on the Boodie and Woylie

Standard metabolic techniques are being used to document the energy metabolism and insensible water loss of these 2 sps at the Zoology Dept., UWA, in collaboration with J. Shield.

This work will be completed in April 1980 and will be published.

3. Rock Wallaby Project - Dampier Archipelago

3.1. Objectives:

(i) To document and assess the status of Rothchild's rock wallaby on islands in the Dampier Archipelago.

(ii) To compare the abundance of Wallabies on an island that is alleged to carry exotic predators with those islands that are predator free.

(iii) To collect basic information on the biology and ecology of the species.

3.2. Procedures

(i) Trapping - on Enderby Island
(ii) Scat collections, plant reference collections
(iii) Transects on foot - on Enderby and Dolphin

3.3. Results: Enderby Island - predator free

On Enderby, 131 rock wallabies were sighted; they are readily observed and for this reason useful indices of relative abundance are calculable. These will be presented and discussed.

Dolphin Island - has predators

In five days only 3 rock wallabies were sighted. Euros were sighted, but were not numerous.

Trapping - easily trapped; animals in good condition with females carrying pouched young of varying sizes.

Food - mainly grasses.

3.4. Conclusions: The island with predators has very few rock wallabies; cause and effect? The euro? - competition? Habitat differences? These questions cannot be answered at this stage.

3.5. Publications - none planned at this stage

3.6. Proposals 1980/81

(i) further research on Enderby with emphasis on the sand-plain habitat on which mining leases are held.

(ii) Survey of Rosemary Island

(iii) more survey work on Dolphin

4.0 Wheatbelt Rock Wallabies

Preamble

Formerly abundant and widespread in the wheatbelt, *Petrogale sp.* is now only found on 5 rocky outcrops south and SE of Kellerberrin, Since 1968, 2 populations have become extinct and the persisting populations are small; a reasonable population estimate for the whole area about 100 animals.

4.1. Objectives:

(i) to try and determine the causes of the decline

(ii) to draft a management plan for the species of this objective proves to be feasible and realistic.

4.2. Working hypotheses

(i) disease

(ii) environmental factors e.g. drought with its associated nutritional and water stresses; shelter.

(iii) predation by foxes and feral cats

(iv) genetic factors

4.3. Methods

(i) routine techniques commonly used in macropodid research.

(ii) predation factor - an experimental situation will be described

(iii) Genetic Variability of the populations - by electrophoresis.

4.4. Results.

(i) disease - no evidence of disease
Salmonellosis - negative
Toxoplasmosis - negative

likewise for predators except for 1 cat which was positive for salmonella

(ii) Data on population estimates, body condition etc is obtained by trapping. As this writing data is being collected and will be discussed in detail at the seminar.

(iii) Genetic variability - the population is severely inbred.

The implications of this finding will be discussed.

(iv) Some very limited data on the home range of predators will be described.

4.5. Publications none planned at this stage.

4.6. Proposed studies for 1980/81

(i) the study is to continue

(ii) A search will be made for suitable populations of rock wallabies with the ultimate aim of introducing some variability into the population. This is a long term project that will have to be carefully worked out.

5.0 Committees - Feral cats

Feral pig control committee.

6.0 Publications -

2 papers were published in 1979

2 are in preparation.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL 1980

S.D. HOPPER

CONTENTS

RESEARCH PROJECTS

1. COMMERCIALLY EXPLOITED WESTERN AUSTRALIAN PLANTS - CENSUS AND ATLAS

1.1. Objectives

To determine which native plant species are commercially exploited for seed, cut flowers or the nursery trade. To establish a data base of locality, habitat and flowering season records from specimens housed in the Western Australian Herbarium. To map the geographical distribution of each species. To determine which commercially exploited species are possibly rare and/or endangered. To publish the results as a preliminary aid to wildlife officers in policing the wildflower industry.

1.2. Procedures

Over the past year a survey of businesses involved in the wildflower trade has continued to ensure that the census of exploited species is comprehensive and up to date. The tabulation of label details on herbarium specimens is complete. Each species is now mapped on a 1^{o} latitude x 1.5^{o} longitude grid system covering the whole state. Data on rare and endangered species have been extracted from available publications.

1.3. Results

A departmental report on this project is currently in press.

Updated figures on the number of commercially exploited species are given in Table 1. Of the 1 119 species known to have been exploited during 1977-79, 146 were sold as cut plants, 624 as nursery plants and 881 as seeds.

An analysis of the distribution of the commercially exploited flora has shown that areas around Perth and Albany are particularly rich in species used in the wildflower trade (Fig. 1).

Approximately 200 exploited species are rare, geographically restricted or poorly collected and are in need of further study to assess their conservation status.

TABLE 1. SYNOPSIS OF THE UTILIZATION OF THE WESTERN AUSTRALIAN FLORA IN THE WILDFLOWER INDUSTRY

	Number of Species Commercially Exploited				
	Cut Plant	Nursery	Seed	Total	Total Flora (Approx.)
Pteridophyta	1	7	0	7	55
Gymnospermae	3	9	14	15	15
Monocotyledonae	27	26	42	67	1300
Dicotyledonae	115	582	825	1030	6000
TOTAL	146	624	881	1119	7400

1.4. Conclusions

As above

1.5. Proposals for 1980/81.

On proclamation of the amended Wildlife Conservation Act and the subsequent institution of a returns system for wildflower pickers it will be possible to obtain a more comprehensive picture of the species being exploited. Analysis of incoming returns is therefore proposed for the coming year.

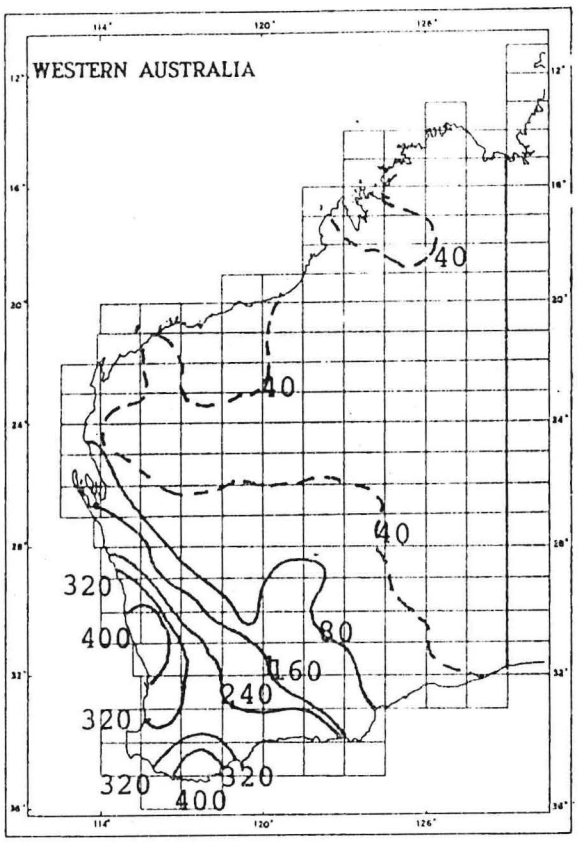
Additionally, studies on selected exploited species that appear to be rare will commence.

1.6. Publications 1979/80.

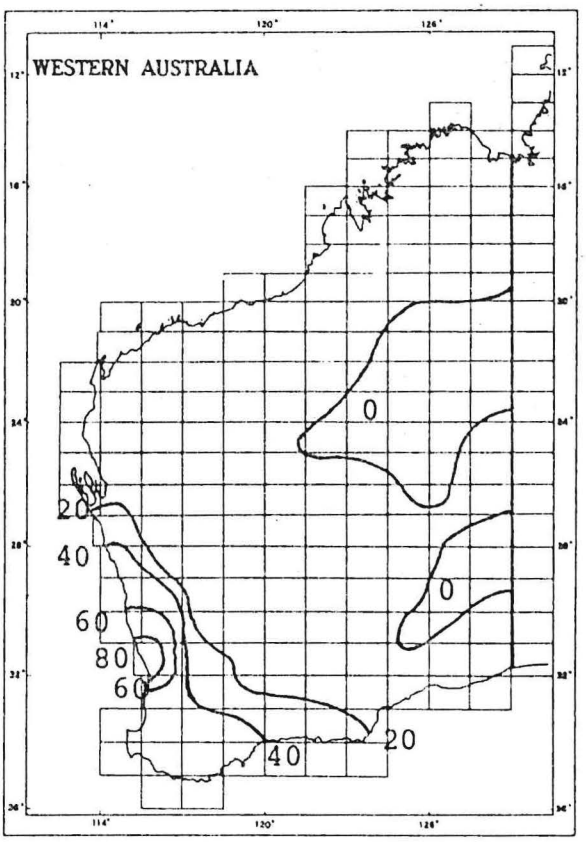
Rye, B.L., Hopper, S.D. and Watson, L.E. (1980). Commercially exploited vascular plants native in Western Australia : census, atlas and preliminary assessment of conservation status. *Dept. Fish. Wildl. West. Aust. Rept.* No. 40, in press.

1.7. Proposed publications 1980/81.

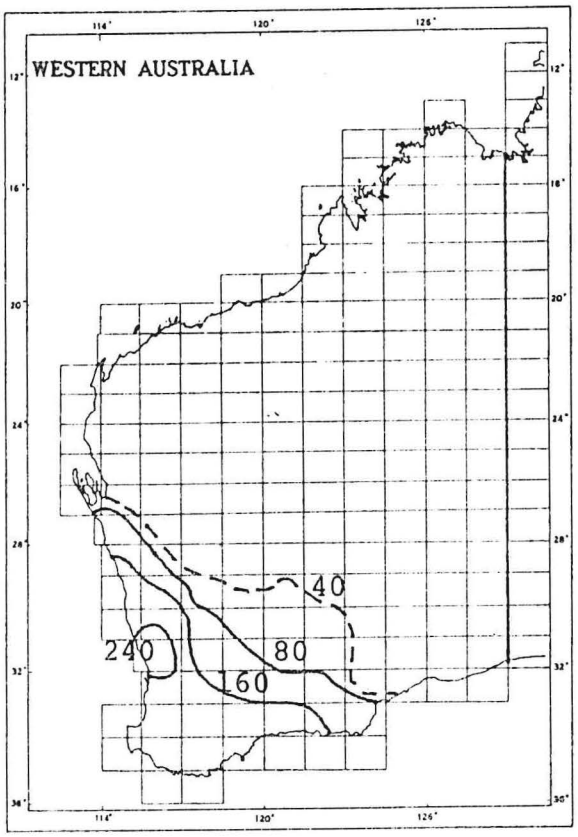
A chapter on commercial exploitation of wildflowers for the proposed W.A.W.R.C. book on Nature Conservation in Western Australia.



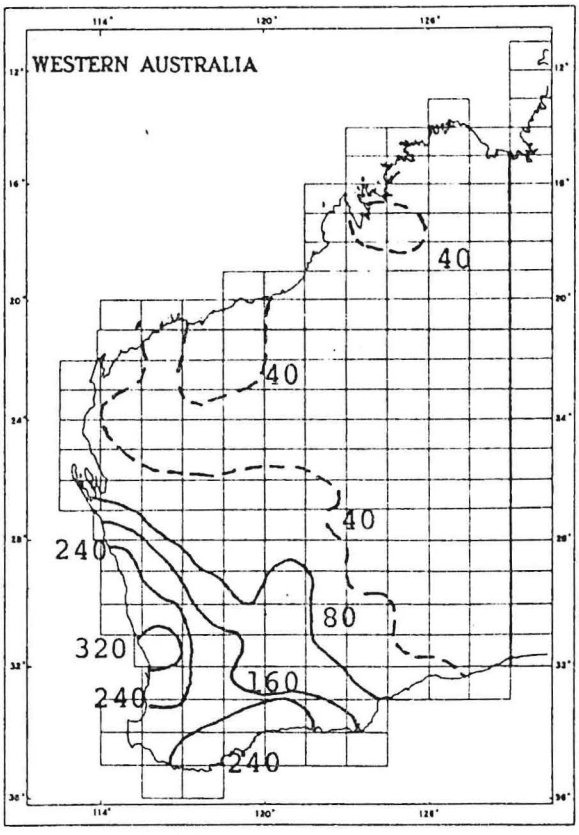
TOTAL EXPLOITED FLORA
(1119 species)
isoflor interval 80



CUT PLANT TRADE
(146 species)
isoflor interval 20



NURSERY TRADE
(624 species)
isoflor interval 80



SEED TRADE
(881 species)
isoflor interval 80

Figure 1. Isoflor Maps of the Commercially Exploited Flora.

2. ATLAS OF THE W.A. FLORA - PILOT PROGRAMME

2.1. Objectives

To initiate a volunteer—participant atlas programme aimed at recording the present distribution and abundance of Western Australian banksias (46 spp.), kangaroo paws (12 spp.) and orchids (130 spp.). To develop field recording sheets which are efficient to use, provide the information required for the atlas, and are suitable for direct transcription for computer storage. To collaborate with N. Hall, N. Caputi and I. Crook in developing 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 programme to other plant groups on completion of the pilot scheme.

2.2. Procedures

Over the past year a three stage proposal for the Atlas Scheme has developed. The first stage entails accessing my own field observations on the distribution of kangaroo paws and their relatives into a computerized data base, and the development of programmes to manipulate these data. The second stage will involve volunteer amateur participants in mapping banksias, orchids, and kangaroo paws. The third stage is envisaged to expand the Atlas project to other groups of W.A. plants such as the eucalypts.

2.3. Results

Thus far, recording sheets for my field observations have been designed, offset printed, and are now being used to access the information. At the same time, Waterman's computing staff are developing the appropriate computer programmes.

2.4. Conclusions

None as yet.

2.5. Proposals for 1980/81.

Complete the accession of my field observations and collaborate with Mr Hall and his colleagues in development of computer routines. It is anticipated that this stage of the project will be finished by about June.

Thereafter, it is proposed that administrative procedures be developed to launch the volunteer participant study. This will entail further design of field sheets, production of instruction booklets, and preparation of a submission to the Computing Policy Committee. It is hoped that this second stage in the Atlas Project will start by spring.

2.6. Publications 1979/80.

Nil.

2.7. Proposed Publications 1980/81.

Nil.

3. LICENSING AND MANAGEMENT OF THE WILDFLOWER INDUSTRY

3.1. Objectives

To devise license and return forms which will facilitate the effective management of the wildflower industry. To assist administrative staff in assessing license applications and the quality of subsequent return forms. To develop, in collaboration with Waterman's computing staff, a means of processing license and return forms on computer.

To compile a list of species to be gazetted as rare under the amended Wildlife Conservation Act.

3.2. Procedures

After obtaining background information on the wildflower industry and familiarization with administrative and computing procedures involved in other management areas (e.g. kangaroo shooting), suggestions on the design of license and return forms were made to administrative staff.

A list of species to be gazetted as rare was obtained through an analysis of available publications on rare plants and through consultation with local professional botanists.

3.3. Results

The license and return forms have now been produced in collaboration with Mr B. Martin (S.C. Flora).

For the purposes of gazetting rare species, the following classification has been proposed.

1. Believed extinct:
   Self explanatory.

2. Very rare:
   Taxa whose known wild populations contain less than a few hundred reproducing plants.

3. Rare:
   Taxa whose known wild populations contain less than a few thousand but more than a few hundred reproducing plants.

4. Common and widespread but in need of special protection:
   Taxa whose known wild populations contain more than a few thousand reproducing plants and whose maximum geographical range exceeds 150 km that are in need of special protection (e.g. due to heavy commercial exploitation).

5. Very restricted distribution, locally abundant:
   Taxa whose known wild populations contain more than a few thousand reproducing plants but whose maximum geographical range is less than 50 km.

6. Restricted distribution, locally abundant:
   Taxa whose known wild populations contain more than a few thousand reproducing plants but whose maximum geographical range is between 50 and 150 km.

7. Indeterminate
   Taxa whose abundance and distribution are uncertain but for which there is some evidence that they may be classified in one of the above categories when further information is available.

At present, a list of 45 Very Rare species, 56 Rare species, and 1 species In Need of Special Protection is being considered by members of the Wildlife Authority's Flora Committee for gazettal as rare species.

3.4. Conclusions

None

3.5. Proposals for 1980/81

The return form system will be closely monitored and updated where necessary. It is hoped that information on returns will be computerized to facilitate retrieval of statistics, but this will depend on the availability of time and staff.

The list of species to be gazetted as rare will be under constant review as new information becomes available.

3.6. Publications 1979/80

Nil.

3.7. Publications proposed 1980/81

Nil.

4. CONSERVATION STATUS AND BIOLOGY OF RARE SPECIES

4.1. Objectives

To investigate the systematics, distribution and reproductive biology of rare plant species and undertake effective programmes of reserve acquisiton and management for their conservation.

4.2. 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.

A filing system on rare species was developed to facilitate rapid retrieval of the available information.

4.3. Results

In 1979, two publications appeared dealing with rare Western Australian plants. "Australian Plants at Risk" (*Aust. Natl. Pks. Wildl. Serv. Occ. Pap.* No. 3), by W. Hartley and J. Leigh, listed 936 W.A. species as being rare or endangered. "Poorly Collected and Presumably Rare Vascular Plants of Western Australia". (Kings Park Res. Notes No. 5), by N.G. Marchant and G.J. Keighery, listed 124 species as rare, and a total of 2022 species as being rare, restricted or poorly collected (1544 were placed in the latter category).

Both these publications indicate the magnitude of the problem of rare species in W.A. and both highlight the need for systematic biological surveys on rare taxa.

The approach adopted thus far in coming to terms with the rare species problem has been largely one of data collation. Moreover, field surveys on selected species were continued and expanded over the past year. These species included *Eucalyptus caesia*,

E. crucis, E. pendens, E. exilis, E. johnsoniana, E. roycei, Anigozanthos kalbarriensis, Grevillea rogersoniana, Newcastelia chrysophylla, undescribed species of *Banksia, Conostylis, Calothamnus* and *Verticordia, Eremaea purpurea, Banksia goodii, Lambertia rariflora, Rhizanthella gardneri* and several tuberous geophytes.

A number of these species are turning out to be locally common and geographically restricted rather than rare. However, a nucleus of rare and endangered species has emerged in light of these surveys (e.g. *Eucalyptus johnsoniana*).

Studies on geographical variation in *Eucalyptus caesia* have been illuminating. Although now known from several widely scattered granite rocks in the central wheatbelt, and most populations appear to be morphologically uniform (the large and small forms are now recognised as distinct subspecies), an analysis of enzyme variation has demonstrated that each population has a unique genetic makeup. This implies that if the gene pools of W.A. species that have insular population structures are to be conserved, then the majority of populations of each species will need to be protected by reservation. The situation in species with more continuous distributions appears to allow for the inclusion of fewer populations in reserves from the viewpoint of conserving gene pools.

4.4. Conclusions

Now that the magnitude and approximate limits of the rare species problem have been defined, detailed surveys and biological studies on particular species have commenced. Work on rare species is seen as a major priority for the next few years at least.

4.5. Proposals for 1980/81.

To facilitate public awareness of rare and restricted species, a series of leaflets is proposed, each one illustrating a taxon which is either gazetted as rare or is known to be geographically restricted.

The letting of consultancies for surveys of rare plants has been productive thus far and will be continued. This entails some supervisory and editorial involvement.

Several field trips will be undertaken to investigate the status of rare species as time and priorities allow.

4.6. Publications 1979/80

Hopper, S.D. (1979). Threatened vascular plants in Western Australia. In Anon, ed. "A Vanishing Heritage : the problem of endangered species and their habitat". Nature Conservation Council, Wellington.

Hopper, S.D., Burbidge, A.A., Hopkins, A.J.M., Kinnear, J.E., Lane, J.A.K., McKenzie, N.L., and Prince, R.I.T. (1979). Establishment and management of nature reserves for threatened vertebrates in Western Australia. In Anon, ed., "A Vanishing Heritage : the problem of endangered species and their habitat." Nature Conservation Council, Wellington.

4.7. Proposed publications 1980/81

The first few leaflets on Rare Western Australian Plants - co-authored with B.L. Rye.

Geographical variation in *Eucalyptus caesia* - co-authored with N. Campbell and N. Caputi.

New subspecies in two Western Australian eucalypts - co-authored with M.I.H. Brooker.

A chapter on rare plants and another on nature reserves for rare species (co-authored with Dr Burbidge) for the proposed W.A.W.R.C. book on Nature Conservation in Western Australia.

5. RESERVE SURVEY, ACQUISITION AND MANAGEMENT

5.1. Objectives

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

5.2. Procedures

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

5.3. Results

Over the past year the following reserves or proposed reserves have been surveyed or visited.

Boyagin Nature Reserve - 25.4.79, 16 & 17.5.79, 30.5.79, 4.9.79, 2.1.80.

Chiddarcooping Hill Nature Reserve and the proposed Chutawalakin Hill Nature Reserve - 5-9.6.79, 30.7.79-1.8.79, 24-25.8.79.

Queen Victoria Rock Nature Reserve - 5 & 6.6.79.

Avon Nature Reserve - 27.7.79.

Proposed Cheyne Beach Nature Reserve - 20-28.11.79.

Mount Manypeaks Nature Reserve - 24.11.79

Mount Caroline Nature Reserve - 9.6.79, 30.7.79, 6-8.10.79, 7.1.80.

Billyacatting Nature Reserve - 25.8.79.

Kalbarri National Park and Reserve 36127 - 10-21.9.79, 24-29.3.80.

Peak Charles National Park - 28.9.79.

Vacant Crown Land north of the Arrowsmith River - 13-15.11.79.

Millbrook Nature Reserve - 28.11.79, 6.2.80.

Proposed Mt. Lesueur Nature Reserve - 3.1.80, 5 & 6.3.80.

Bobakine Hills proposed reserve - 23.1.80.

Clackline Nature Reserve - 13.2.80.

Two Peoples Bay Nature Reserve - 30.1.80 - 9.2.80.

Most of these areas were found to have outstanding value for flora conservation. Reports on several of the surveys were written and submitted to Dr Burbidge for consideration.

In addition to preliminary survey work, a project aimed at mapping the flora on Two Peoples Bay Nature Reserve on a 500 m^2 grid system was initiated. Banksias and eucalypts are being mapped in this initial project.

5.5. Proposals for 1980/81.

Continue surveys on an *ad hoc* basis. Complete the mapping of banksias and eucalypts at Two Peoples Bay Nature Reserve. Initiate a similar project on Millbrook Nature Reserve.

5.6. Publications 1979/80

Nil.

5.7. Proposed Publications 1980/81

A biological survey of Nature Reserve 36127, Kalbarri National Park, and adjacent areas - coauthored with A.A. Burbidge, P.J. Fuller and J.K. Rolfe.

Distribution of banksias and eucalypts on Two Peoples Bay Nature Reserve - co-authored with G. Folley.

A pit trap survey of small mammals and reptiles at Two Peoples Bay Nature Reserve - coauthored with T. Fetherstonehaugh.

6. BIOLOGY OF KANGAROO PAWS AND *CONOSTYLIS*

6.1. 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*.

6.2. Procedures

Stnadard data analysis, literature research, herbarium studies and writing manuscripts. Limited field surveys were also conducted.

6.3. Results

Three brief papers dealing with the horticulture, hybridization and taxonomy of the kangaroo paws were written and published in the journal *Australian Plants*.

A paper on experimental hybridization in the Kangaroo paws was written and submitted to the *Australian Journal of Botany*.

A survey of the distribution of *Anigozanthos kalbarriensis* in Kalbarri National Park was undertaken. Opportunistic field and observations on several species of kangaroo paws and *Conostylis* were made in the course of routine field work on other projects.

A paper describing *Conostylis neocymosa* sp. nov. was rewritten and submitted to the journal *Botaniska Notiser*.

In preparation for a taxonomic revision of *Conostylis*, label details on the *ca.* 3 000 specimens in the Western Australian Herbarium were transcribed and distribution maps were compiled for all species.

6.4. Conclusions

None.

6.5. Proposals for 1980/81

Write papers and continue field observations as time, inclination and opportunity allow. Prepare descriptions of all *Conostylis* species for the taxonomic revision. Undertake a study of the pollination of *Conostylis androstemma*.

6.6. Publications 1979/80

Hopper, S.D. (1978). Speciation in the Kangaroo Paws of South-western Australia (*Anigozanthos* and *Macropidia* : Haemodoraceae). Ph.D. thesis, University of Western Australia, submitted November 1978, accepted June 1979.

Hopper, S.D. (1979). Hybridizing *Anigozanthos*. *Australian Plants* 10, pp. 211-217.

Hopper, S.D. (1979). Developments in the taxonomy of the kangaroo paws. *Australian Plants* 10, pp. 229-237.

Hopper, S.D. (1980). *Conostylis neocymosa* sp. nov. (Haemodoraceae) from south western Australia. *Botaniska Notiser*, in press.

Hopper, S.D. (1980). Experimental hybridization in the kangaroo paws (*Anigozanthos* and *Macropidia*, Haemodoraceae). *Australian Journal of Botany*, in review.

Dixon, B., and Hopper, S. (1980). Growing kangaroo paws and related species. *Australian Plants* 10, pp.199-211.

6.7. Proposed publications for 1980/81.

A revision of the genus *Conostylis*.

7. POLLINATION ECOLOGY OF THE AUSTRALIAN FLORA

7.1. 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.

7.2. 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 undertaken for observations of vertebrates feeding at flowers of W.A. plants.

7.3. Results

A substantial number of 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 study of the comparative feeding ecology of nectarivorous birds and mammals at Cheyne Beach was undertaken with Dr Burbidge while trying to trap Dibblers. This study established that contrary to popular belief, honey possums *(Tarsipes spencerae)* are not strictly nocturnal. They will feed in full daylight when it's cloudy and cool. Consequently, it was possible to actually observe free-living animals feed on Banksia and eucalypt flowers and obtain data directly comparable to that obtained in standard honeyeater studies. These data are not yet analysed.

7.4. Conclusions

None.

7.5. Proposals for 1980/81.

To continue *ad hoc* observations. To commence a study of the comparative pollination ecology of *Banksia* species on Two Peoples Bay and Millbrook Nature Reserves.

7.6. Publications 1979/80

Hopper, S.D. (1979). Bird and mammal pollination in straight-styled and hook-styled Banksias (Proteaceae). Abstracts Symp. Biol. Native Aust. Plants, pg. 36 (Perth, West. Aust.)

Hopper, S.D. (1980). Bird and mammal pollen vectors in *Banksia* communities at Cheyne Beach, Western Australia. *Australian Journal of Botany*, in press.

Hopper, S.D. (1980). Pollination of the rainforest tree *Syzygium tierneyanum* (Myrtaceae) at Kuranda, northern Queensland. *Australian Journal of Botany*, in press.

Hopper, S.D. (1980). Pollen and nectar feeding by Purple-crowned Lorikeets on *Eucalyptus occidentalis*. *Emu*, in press.

Hopper, S.D. (1980). Pollen loads on honeyeaters in a *Grevillea rogersoniana* thicket south of Shark Bay. *Western Australian Naturalist*, in press.

7.7. Proposed publications 1980/81.

A checklist of observations of vertebrates feeding at flowers and on fruits of Western Australian plants - co-authored with Allan Burbidge.

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

Comparative feeding ecology of nectarivorous birds and mammals at Cheyne Beach, Western Australia - co-authored with Dr Andrew Burbidge.

8. EVOLUTIONARY BIOLOGY OF THE AUSTRALIAN FLORA

8.1. Objectives

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

8.2. Procedures

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

8.3. Results

This past year has seen the publication of a review paper on speciation in the Western Australian flora. In addition, a review of speciation in the Australian flora as a whole was prepared in collaboration with Dr S.H. James and presented at the Symposium on the Biology of Australian Native Plants held in August 1979.

8.4. Conclusions

None

8.5. Proposals for 1980/81

To continue writing up publications on previous work as time and opportunity allow.

8.6. Publications 1979/80

Hopper, S.D. (1979). Biogeographical aspects of speciation in the south-west Australian flora. *Annual Review of Ecology and Systematics* 10, pp. 399-422.

8.7. Proposed publications 1980/81

Speciation in the Australian flora - co-authored with S.H. James.

Natural hybridization in the spider orchids *(Caladenia)* of south-west Australia (possibly to be deferred to 1981/82).

A chapter on the composition and origins of the W.A. flora for the proposed W.A.W.R.C. book on Nature Conservation in Western Australia.

COMMITTEES

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

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

3. Organising committee for the sequicentennial celebration conference on the "Biology of Australian Native Plants".

4. Convenor, Perth Chapter, Australian Systematic Botany Society.

5. Council Member, Royal Society of Western Australia.

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

SEMINARS, SYMPOSIUM POSTERS, PUBLIC RELATIONS

1. Bird and Mammal pollination in straight-styled and hook-styled banksias (Proteaceae) - August 7, 1979. 11.55 a.m. Symposium on the Biology of Australian Native Plants, University of Western Australia.

2. Speciation in Australian Plants - co-authored with, and presented by, Dr S.H. James, August 10, 1979. 9.00 a.m. Symposium on the Biology of Australian Native Plants, University of Western Australia.

3. Flora conservation in Western Australia - poster, co-authored with A.J.M. Hopkins. Symposium on the Biology of Australian Native Plants, University of Western Australia.

4. Phytogeographical aspects of speciation in the south-west Australian flora - November 12, 1979. 12.15 p.m. Australian Systematic Botany Society, Kings Park Administration Building.

5. Adaptations of south-west Australian plants to vertebrate pollinators - March 17, 1980. 4.00 p.m. Botany Department, University of Western Australia.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL, 1980.

I. G. CROOK.

RESEARCH & MANAGEMENT PROJECTS.

1. Development of Management Principles and Guidelines.

1.1. Preamble.

The Nature Reserves of Western Australia have had a wide variety of origins over a considerable period of time. Remarkable progress has been made, particularly during the past 20 years, both to increase the value of the Reserves by new acquisitions, and, most recently, to draw all the Reserves together into a single system, both in concept and in their administration. Originally "inter-Departmental" in character, these initiatives have been continued by the Western Australian Wildlife Authority and the Department of Fisheries & Wildlife in the development of policies and facilities for reserve management.

1.2. Objectives.

As a means of further strengthening the unity of the Nature Reserve system, conceptually, in its administration and in the eyes of the public, to set down guidelines for management of the system as a whole.

1.3. Procedures & Proposals for 1980-81

Management of Nature Reserves may be either "biological" management of species or ecosystems or management in relation to people - "use and protection" management.

During 1980-81 it is proposed to write a "draft" set of guidelines for management of Nature Reserves in relation to people.

The purpose of publishing the guidelines in a draft form is to provide the public and all interested parties with opportunities to participate in what is essentially part of the management planning process.

1.4. Publication for 1980-81

"The Protection and Use of Nature Reserves", a publication in the style of the "Draft Management Plan" series, will be published during 1980-81, to introduce the proposed management guidelines and to invite comments from the public on their provisions.

2. MANAGEMENT PLANS AND THE PLANNING PROCESS.

2.1. Objectives.

- To establish a process for planning the management of Nature Reserves and groups of Nature Reserves.
- To prepare a series of management plans as "models" with the dual aim of testing the planning process and of providing guides for Reserve Management Officers to follow in writing management plan for Reserves in their districts.

2.2. Procedures.

Local community involvement, consultation and other forms of participation in planning provide the means for testing and integrating the economic and social objectives of the community with the ecological objectives of Nature Reserves. Community involvement in planning also safe-guards against poor decisions and is a most valuable means of educating public and planners alike of the importance and problems of conservation on the one hand and concerns of the broader community on the other.

Participation can build public confidence and improve the public's understanding of management objectives. It is particularly important in the rural communities in which the great majority of Nature Reserves are situated.

Public involvement in the planning process should ideally, be at all stages from policy making to reserve plan formulation and review.

It is possible to lay down procedures in detail by which this can be achieved, but attaining the ideal of maximum community involvement is not always so easy. It would be better for the present to leave as many avenues as possible open, and, over a period of experience, assess which are the most used.

A planning procedure has been adopted initially, consisting of consultation with interested parties leading to production of a draft management plan followed by a period for public submissions, revision of the plan, review by the Wildlife Authority and adoption of the plan by the Minister. The management plans will conform to the requirements of Section 12D of the Wildlife Conservation Act and Section 34 (1a) of the Bush Fires Act.

Management plans are prepared firstly for selected individual Nature Reserves of particular importance, including some of those Classified under Section 12A of the Wildlife Conservation Act, and secondly for all Reserves in particular local authority districts. Examples of draft management plan of each type are available.

Management plans of the latter type (Shire plans) have the advantages of placing Reserves in some sort of regional context and of facilitating comparisons with some of their neighbours. There are also obvious administrative advantages of choosing local authority districts as a basis for this regional planning approach. These offset to some degree the shortcomings in an ecological or biogeographical sense of the arbitrary boundaries imposed.

2.3. Publications for 1979/80.

Crook, I.G. & T. Evans (1980) "Draft Management Plan No. 1: "Avon Valley" Nature Reserve - Class A Reserve No. 30191. "Department of Fisheries & Wildlife, Perth.

Crook, I.G. & T. Evans (1980) "Draft Management Plan No. 2. Thompson Lake Nature Reserve - A Class Reserve No. 15556". Department of Fisheries & Wildlife, Perth.

Crook, I.G. (1980) "Draft Management Plan No. 3: Nature Reserves of the Shire of Serpentine - Jarrahdale. Department of Fisheries & Wildlife, Perth.

2.4. Publications for 1980-81.

Management plans for the Nature Reserves in the Shires of Albany, Bruce Rock and Dandaragan are in preparation as is one for the offshore island Reserves between Dongara and Warnbro Sound. Management plans are also in preparation for several individual Reserves including Two Peoples Bay and Hermite Island.

3. DEVELOPMENT OF A RESERVES DATA BASE.

3.1. Preamble

At present information about Nature Reserves is held on Cadastral maps, Reserves files and a variety of published and unpublished reports and papers. As they are prepared, management plans will summarise this information and provide references to it. These data are an essential basis to management and often include valuable historical perspectives on individual Reserves. For the present, however, both access and the task of updating the data base can be time consuming, and it would probably not be difficult to find management decisions which may have been different if all the relevant data had been more easily available at the time they were made.

3.2. Objective.

To establish a computer facility for the storage and processing of administrative, scientific and management data about Nature Reserves.

3.3. Procedures.

In co-operation with the Data Processing Section at the Watermans Marine Laboratory the feasibility of various approaches to a data base involving large frame or mini-computers or both is being assessed.

3.4. Publication.

None and none envisaged at this stage.

COMMITTEES

Bush Fires Board (Deputy to Dr. Burbidge).

SEMINARS.

None.

WESTERN AUSTRALIAN WILDLIFE RESEARCH

RESEARCH CENTRE

RESEARCH PROGRAMME SEMINAR

11 APRIL, 1980

J. T. GOODSELL.

MANAGEMENT PROJECTS

1. Land use problems associated with Nature Reserves, (approximately 50% of time).

1.1. Objectives.

To investigate and report on varieties of problems associated with Nature Reserves.

To liaise with interested parties e.g. Local and members of the public.

1.2. Procedure.

(1) An *ad hoc* approach has been the basis for dealing with the following:

- Woody Island
Recherche Archipelago:
Recreational use.

- Goonaring and Belaring Springs Nature Reserves:
Management and enlargement.

- Bruce Rock Shire:
Rehabilitation of existing rubbish tip on a Nature Reserve.

- Barbalin and Wildhorse Swamp Nature Reserves:
Relocation of incorrectly sited fenceline.

- Lake Dumbleyung:
Recreational use and management.

- Lake Towerinning Nature Reserve:
Investigation of a proposal by West Arthur Shire Council to direct a stream into the lake.

- Lake Booragoon Reserve:
  Liaison with Melville City Council in relation to artificial charging of the lake with water over summer.

2. On going projects:

- Lake Magenta Nature Reserve: Liaison with Shire of Kent re construction of a 30 km road through the reserve.

  Benger Swamp :
  Since 1974, 82% of this formerly privately owned 600 ha ephemeral swamp has been purchased to become a wetland nursery. Limited water supplies preclude the possibility that all of the swamp can be maintained as a permanent summer refuge.

1.3. Proposals for 1980/81

I will continue to be involved in some of the above projects and others that may be referred to me from time to time.

2. Feasibility Study - Rehabilitation of Northern Arthur River Wetlands (approximately .50% of time).

2.1. Objectives

To rehabilitate lakes and foreshores of the Arthur River, and to improve its wildlife carrying capacity, water quality and wildlife value of the Arthur River System.

To preserve Lake Toolibin (sited in the northern Arthur River) as a freshwater lake.

2.2. Procedure

The problem has been examined by a committee formed in 1977 that comprises representatives from the Departments of Public Works, Mines, Forests, Agriculture, and Fisheries and Wildlife.

Initial attention has focussed on Lake Toolibin (an ephemeral lake) where hydrological monitoring equipment has been installed for the purpose of developing a hydromineral budget for the lake. Unfortunately development of such a budget has been delayed because there have been a series of dry years since the equipment's installation.

Contouring an area of 30 km^2 around the lake has been completed by the Department of Lands and Surveys. Both these data, and underground water bore data are being used to compile the configuration of the underground water table. Such information is relevant to the development of strategies aimed at preventing the rise of saline underground water (29,000 ppm) and its subsequent intrusion into Lake Toolibin.

Bushland use of underground water can maintain a lowered water table. Therefore, 335 ha of once privately owned bushland that surrounds the lake was purchased to prevent the water table's rise. This strategy's success has been maintained, there has been no rise of underground water levels.

Maintenance of appropriate water qualities at Lake Toolibin is necessary because the lake is a wetland nursery where freshwater invertebrates provide a protein source for breeding waterbirds. Thus, it is also important to have some knowledge of the tolerances of freshwater invertebrates to the marginal water qualities experienced at Lake Toolibin. To initiate the gain of such knowledge, osmoregulation curves have been compiled for the freshwater crayfish: Koonac (*Cherax plebejus pressii*), and Marron (*C. Tenuimanus*). The curve of the Common Gilgie (*C. Quinquecarinatus*) has also been commenced. Such curves have been compiled to assess the limits to survival imposed by water quality. The animals under investigation have been acclimated to a range of ambient salinities, and in an effort to survive they adjust the osmotic concentration of their blood so that it remains above the osmotic concentration of the ambient medium. In each animal's case the blood exhibits a range of low to high values that are compatible with life. After acclimation has been attained, a comparison has been made of the osmotic concentration of the blood with that of the ambient medium. The curve thus derived shows the range of ambient salinities in which animals can live normally. Consequently, the curves are being used as indicators of desirable water qualities required within the northern Arthur River system.

2.3. Proposals for 1980/1981

(1) Vegetation underground water and surface water will be monitored.

When the lake fills, a hydromineral budget will be developed.

(2) In conjunction with (1) I will continue to investigate the effects of water quality on selected freshwater invertebrates.

3. Publications 1979/80.

None

4. Publications 1980/1981

Papers on osmoregulation by the freshwater crayfish Koonac, Marron, Yabbie and Gilgie are being prepared.

5. Committees

Northern Arthur River Wetlands Rehabilitation Committee.

Advisory Committee - Diploma of Natural Resources (W.A.I.T.).

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL 1980

K. J. WALLACE.

MANAGEMENT OPERATIONS

1. Fire

1.1. Firebreak Design and Construction

During the present financial year 63 km of firebreaks have been constructed. The major element of the program for the coming financial year will be the design and construction of firebreaks on the Dragon Rocks Nature Reserve.

1.2. Firebreak Maintenance

The Pingelly Reserve Management Team (PRMT) carried out firebreak maintenance on four Nature Reserves and organised maintenance work on a further thirty-three Nature Reserves in 1979. The latter figure is approximately double that for 1978.

1.3. Fire Control

Within the 1979/80 fire season the PRMT has attended two wildfires on Nature Reserves. A number of clearing burns adjacent to Nature Reserves have been attended during the present Restricted Fire Season.

1.4. Prescribed Burning

One of the "buffer strips" on the Boyagin Nature Reserve was burnt in April, 1979. Another Buffer Strip will be burnt in April or May, 1980. The PRMT also assisted with several prescribed burns undertaken by the Perth Management Team.

2. Biological Survey

2.1. Proposed Nature Reserves

Ten areas of bushland have been surveyed up to and including March 10, 1980. Of this number eight have been recommended either for inclusion into adjoining Nature Reserves or for creation as new Nature Reserves. Two proposals are at present being given further consideration.

2.2. Vesting of Nature Reserves

Four Nature Reserves were surveyed and recommended for vesting in the Western Australian Wildlife Authority.

2.3. Boyagin Nature Reserve

H. Butler carried out a ten day survey of the fauna of Boyagin Nature Reserve in early 1972, however no other survey work has been undertaken on this important Reserve. A survey of both the flora and fauna of Boyagin Reserve has recently been initiated by the PRMT, and it is anticipated that this survey will continue throughout 1980. Two species of marsupial, *Sminthopsis murina* and *Phascogale calura* that have not previously been recorded on the Boyagin Nature Reserve have been trapped on the Reserve by the PRMT.

2.4. General Survey

Records of the flora and fauna occurring on Nature Reserves in the Pingelly Management District have been collected throughout the year on an opportunistic basis.

3. Research

Apart from some liaison with Research Officers from this Department, and Officers from C.S.I.R.O., the PRMT has had little involvement with research work during 1979.

4. General Management Activities.

4.1. Examination of Requests for Excision from Nature Reserves

4.2. Inspection of Nature Reserves

4.3. Recommendation with Regard to Specific Requests

Examples of this type of work include recommendation concerning requests to remove gravel from Nature Reserves, and a recommendation with regard to the proposed construction of a dam on a Nature Reserve.

4.4. General Maintenance and Other Activities

5. Operations Manual

During the past year a number of chapters for the Operations Manual have been written to the "final draft" level, and it is anticipated that a final draft of the Manual will be completed by the end of 1980.

6. Public Relations and Education

During the past twelve months an address was presented to the Lion's Club, Williams and on several occasions the PRMT has been involved with school excursions to the Tutanning Nature Reserve. It is planned to increase the amount of time spent on public relations and education in the next twelve months.

General Data - Reserves in the Pingelly Management District

Total Number of Nature Reserves 247 (236)*

Total Area of Nature Reserves 142, 577 ha (107,365)

Average Size of Nature Reserves 577ha (455)

Median Size of Nature Reserves 127 ha (116)

Range in Size of Nature Reserves 0.5ha - 32,097ha

In a number of instances reserves are located across the boundary separating adjoining, management districts. Where these reserves are currently managed by the PRMT, the total area of these reserves has been included in the above figures with the exception of the Lake Magenta Nature Reserve. A number of reserves occurring outside the Pingelly Management District are at present managed by the PRMT, but these have not been included in the above figures.

*Figures in brackets represent the equivalent data as at March, 1979.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMMES SEMINAR

11 APRIL 1980

A. A. BURBIDGE.

...

RESEARCH PROJECTS

Short-necked Tortoise (*Pseudemydura umbrina*)

1.1. Objectives.

To monitor the populations of Ellen Brook and Twin Swamps Nature Reserves. To gather data on growth recruitment, mortality and longevity. To make and enact recommendations aimed at ensuing the persistance of the species.

1.2. Procedures.

Visits were made to both Nature Reserves at frequent intervals during winter and spring. Tortoises were captured in pit traps and caught by hand. Data on sex, size, weight, growth rates and location are entered in a card index and the animal released.

Population numbers are estimated by the Jolly-Seber Model and the Manley and Parr method. A minimum number is calculated from mark and recapture data. One adult female from Twin Swamps and three from Perth Zoo were kept in the laboratory and radiographed for eggs during spring 1979. One hatchling taken from Ellen Brook was held in the laboratory.

1.3. Results.

1.3.1. Twin Swamps Nature Reserve Population estimates.

See Table 1. The 1978 estimates are slightly above those for 1977 but this is an artefact of sampling success rather than a reflection of actual recruitment. The 1979 sample size of 6 included 4 adults and no unmarked animals.

TABLE 1 . POPULATION ESTIMATES, TSNR.

YEAR	NUMBER CAUGHT	MINIMUM NUMBER	JOLLY-SEBER ESTIMATED POPULATION	JOLLY-SEBER 95% CONFIDENCE LIMITS	JOLLY-SEBER ADJUSTED 95% LIMITS*	MANLEY & PARR ESTIMATED POPULATION
1963	1	51	-	-	-	-
1964	4	73	- †	-	-	280
1965	9	95	5	0-18	-	270
1966	66	100	119	0-244	100-244	124
1967	26	73	156	60-252	73-252	165
1968	17	59	54	34-74	59-74	65
1969	8	58	62	25-99	58-99	88
1970	26	56	62	42-82	56-82	69
1971	27	49	49	33-64	49-64	67
1972	15	37	43	22-65	37-65	56
1973	13	30	34	15-54	30-54	50
1974	8	25	72	0-171	25-171	76
1975	8	20	23	7-39	20-39	27
1976	3	17	17	4-31	17-31	17
1977	9	17	17	6-28	17-28	23
1978	9	13	21	0-45	13-45	27
1979	6	6	-	-	-	-

† 1963, 64 combined in Jolly-Seber calculations

* Lower limit adjusted to minimum number.

TABLE 2. POPULATION ESTIMATES, EBNR.

YEAR	NUMBER CAUGHT	MINIMUM NUMBER	JOLLY-SEBER ESTIMATED POPULATION	JOLLY-SEBER 95% CONFIDENCE LIMITS	JOLLY-SEBER ADJUSTED 95% LIMITS*	MANLEY & PARR ESTIMATED POPULATION
1963	4	16	-	-	-	-
1964	10	16	21	0-51	16-51	41
1965	2	11	27	0-67	11-67	0
1966	3	9	4	0-9	9	9
1967	2	11	18	0-43	11-43	0
1968	5	12	9	5-13	12-13	17
1969	1	10	5	3-7	10	10
1970	2	11	23	0-57	11-57	0
1971	0	11	-	-	-	0
1972	6	12	11	3-12	12	13
1973	0	14	-	-	-	0
1974	2	15	11	0-26	15-26	28
1975	3	14	12	0-24	14-24	20
1976	9	13	24	1-47	13-47	16
1977	3	9	9	3-15	9-15	9
1978	8	10	18	0-45	10-45	24
1979	3	3	-	-	-	-

* Lower limit adjusted to minimum number

1.3.2. Ellen Brook Nature Reserve.

See Table 2. The 1978 estimate is well above that of 1977, again reflecting better sampling success. 1979 sample was only 3.

1.3.3. Artificed breeding.

Three Zoo females and one wild caught female were kept through the egglaying season. Only one, a zoo animal, produced eggs. These were laid following the injection of hormones and are being incubated. Two of the three eggs were fertile but both of these have cracked during incubation and it is by no means certain that they will hatch.

1.4. Conclusions.

The low numbers in the wild continue to give cause for concern.

1.5. Proposals for 1980/81

Monitoring will be continued. Artificial breeding will be continued using both zoo and wild caught females.

1.6. Publications 1979/80. - Nil.

1.7. Publications 1980/81 - A paper titled "The Ecology of the Western Swamp Tortoise *Pseudemydura umbrina* (Testudines Chelidae) has been submitted to Australian Wildlife Research.

2. Saltwater Crocodile

No further work has been carried out.

3. Barrow Island

No work during 1979/80. A visit of inspection is programmed for the 1980/81 summer.

4. Desert Wildlife - joint project with N.L. McKenzie

4.1. Objectives.

To document the flora and fauna of existing and proposed Nature Reserves in the deserts of Western Australia.

To delineate and propose Nature Reserves in the Great Sandy Desert. To investigate the status of rare mammals.

4.2. Procedure

A four week field trip was made in the Great Sandy Desert during May and June 1979. Standard biological survey techniques were employed to survey mammals, birds, reptiles and frogs. The Lake Gregory area was also inspected in response to an E.P.A. Red Book recommendation.

4.3. Results.

Being written up. Boundaries of proposed Nature Reserves have been delineated. Hare-wallabies were located at Lake Gregory.

4.4. Conclusions.

Nature Reserves can be set aside to include the full range of environments and species in the Great Sandy Desert except the Permian Sandstones of the South Esk Tableland which are totally included in an Aboriginal Reserve.

4.5. Proposals for 1980/81

A field trip to Lake Gregory Area (Tanami Desert) is planned for May-June 1980 to investigate the situation regarding Hare-wallabies. The return trip will be via the Northern Territory, where I will examine N.T. Parks and Wildlife Commission projects on Hare-wallabies and the Dalgyte, and Warburton where meetings will be held between Government Officers and the local people to discuss the proposed Baker Lake Nature Reserve in the Gibson Desert.

4.6. Publication 1979/80.

Burbidge, A.A. and Fuller P.J. (1979) 'Mammals of the Warburton Region, Western Australia. Rec. West. Aust.Mus. 8, 57-73.

4.7. Publications 1980/81

"Amphibia are Reptiles". In Great Sandy Desert Bulletin.

A paper on Hare wallabies will be written if warranted.

5. Re-introduction of Banded Hare-wallaby to Dirk Hartog Island.

See Dr Prince's paper

6. Biological Survey

6.1. Objectives.

Conduct biological surveys as recommended in the E.P.A. Red Book. Co-ordinate and assist with surveys carried out under the auspices of the Biological Surveys Committee. Examine Nature Reserves.

6.2. Procedure

Standard techniques (see Mr. N.L. McKenzie's paper) were applied doing a visit in July 1979 to cell 3 of the "Biological Survey of the Eastern Goldfields". The Cooloomia Nature Reserve, between Kalbarri and Shark Bay, was examined with Dr. S.D. Hopper in March 1980.

6.3. Results and Conclusions.

None as yet.

6.4. Proposals for 1980/81.

A further visit will be made to Goldfields Cell 3 in September/October 1980. A visit to the Nullabor Plain area to document mammal distribution will be made if rainfall in the area is adequate.

6.5. Publications 1979/80.

Burbidge, A.A., Fuller P.J. and Cashin K. (1980). "The wildlife of the proposed Toolonga Nature Reserve, Shark Bay Shire, Western Australia." Dept. Fish. Wildl. West. Aust. Rept. No. 39.

6.6. Publications 1980/81

None proposed.

7. Bird observations.

Historical and recent records were submitted to the RAOU Bird Atlas as before. Counts of birds at Lake Joondalup and at the Wildlife Research Centre were continued as time permitted.

8. Eggshell thinning.

8.1. Objectives.

Following work on the Peregrine Falcon (which was

published by P. Olsen of C.S.I.R.O. Division of Wildlife Research without acknowledgement) it is proposed to extend the work to a variety of raptores and some owls.

8.2. Procedure.

Technical Officer P.J. Fuller has measured and weighed eggs in all W.A. collections. These data are being analysed.

8.3. Results and Conclusions.

None as yet.

8.4. Proposals for 1980/81

None

8.5. Publications 1979/80.

None.

8.6. Publications 1980/81

Mr Fuller will co-author a paper on the results of this work Australia-wide.

9. Islands between Lancelin and Dongara (joint project with Dr. I. Crook.)

9.1. Objectives.

To document the fauna of these islands, especially sea birds, and to prepare a management plan for the island Nature Reserves.

9.2. Procedure.

Following the 1977/78 work further field work was carried out in 1979 to fill gaps in the available information.

9.3. Results and Conclusions.

Sufficient data are available from most islands for the development of a management plan. Further information is desirable on sea bird colonies, especially Silver Gulls.

9.4. Proposals for 1980/81

As for 1979/80.

9.5. Publication 1979/80

Nil.

9.6. Publication 1980/81

Nil.

10. Conservation of the Dibbler (Antechinus apicalis)

10.1. Objectives.

To establish the status of the Dibbler.

10.2. Procedure.

Intensive trapping, using a variety of traps, was carried out at Cheyne Beach in November 1979.

10.3. Results.

No Dibblers were collected. Other species trapped included Honey Possums, Common Dunnart, Southern Bush Rat, House Mouse, Short-nosed Bandicoot and a variety of frogs and reptiles.

10.4. Conclusions.

Results indicate that Dibbler numbers are very low at Cheyne Beach. Under these circumstances further work aimed at improving trapping techniques is not warranted.

10.5. Proposals for 1980/81

None.

10. 6. Publications 1979/80

None.

10.7. Publications 1980/81

I am co-authoring a paper on Honey Possums with Dr. Hopper - data on this species was collected while attempting to trap Dibblers.

11. Marine Turtle Nesting Sites.

11.1. Objectives.

To identify important nesting sites of the four species of marine turtle which breed in W.A. To recommend conservation measures for these sites if necessary.

11.2. Procedure.

Aerial surveys from Shark Bay northwards will be carried out using techniques developed by the Queensland National Parks and Wildlife Service.

11.3. Results.

Nil.

11.4. Conclusions.

Nil.

11.5. Publications.

Nil.

12. Revision of Beaufortia

A revision of the Myrtaceous genus Beaufortia is proposed over the next 3 to 5 years.

SEMINARS AND PUBLIC RELATIONS.

During the past year I gave the following seminars and talks.

1. The Biological Survey of the Eastern Goldfields. RAOU Congress, Kalgoorlie, August 1979.
2. The imminent extinction of the Short-necked Tortoise? Seminar at Zoology Department, University of Western Australia, October 1979.
3. Biological Survey and the Conservation of Desert Ecosystens. Opening address at W.A.I.T. Biology Enrichment Programme, February 1980.
4. Fire Policy of W.A. Wildlife Authority, Bush Fires Board Advanced Fire School. February 1980.

With my wife I published a pamphlet on the Self Guiding Nature Trail at Two Peoples Bay.

COMMITTEES.

I am a member of the following committees:

1. Bush Fires Board
2. Conservation and Environment Council (Deputy).
2. National Parks Authority (Deputy).
4. Peel Inlet Management Authority.
5. PIMA Planning Committee.
6. W.A. Wildlife Authority Reserves Committee.
7. System 6 Parks and Reserves Committee.
8. CONCOM *ad hoc* Working Group on rare fauna.
9. Biological Surveys Committee (Chairman).
10. CONCOM Working Group on the management of threatened Vestebrates.

11. W.A.W.A. Committee on rare fauna.

12. Policy Advisory Committee, M. Nat. Res. Mgmt., U.W.A.

13. Working Group on Land Releases (EPA)

14. Editorial Advisory Committee. *Aust. Wildl. Res.*

15. Dampier Archipelago Recreation Reserves Advisory Board.

16. Lake Joondalup Management Committee (MRPA).

Committees account for approx. 25% of my time.

ADMINISTRATION

Administration of the Wildlife Research Centre and the provision of advice to Head Office, other Government Departments and the public accounts for about 35% of my time.

WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

RESEARCH PROGRAMME SEMINAR

11 APRIL 1980

R.I.T. PRINCE

RESEARCH PROJECTS

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.

1.2. Procedures

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

Further information on past exploitation has been obtained from search of archives and other similar records. These data have been examined using the multiple regression technique in order to derive predictive equations based on previous weather patterns and other relevant data.

1.3. Results

Summary data on current harvests are available on call.

Predictive equations which give good fit to previous hunting data have been obtained. Extrapolation of these equations into present times also provides predicted average harvest levels similar to those obtained in Western Australia over the past 5-6 years, i.e. in the range 100-150 000 per annum.

1.4. Conclusions

The direct information obtained from shooters allows for a consistent interpretation of events over the period of record as far as patterning in these data is concerned. Comparison of current indices of catch/unit effort with previously recorded values and associated harvest levels poses problems.

Multiple regression equations fitted to relevant data show that catch/unit effort indices are influenced mostly by factors affecting shooter performance e.g., accessibility of kangaroos for shooting and the degree of choice available to the shooter. However, rainfall approximately 2 years previously also has an effect. This latter relationship most probably reflects recruitment to stocks.

Thus, short term changes (i.e. 1-2 years) in the harvest rate mainly reflects factors affecting shooting performance rather than the size of the kangaroo stocks. But continuation of hunting over a longer period should eventually reflect depletion of stocks unless successful recruitment is occurring.

Harvest data for the last 3 years show a pattern suggesting population decline after an extended period of drought. We have the direct harvest data and the suggested harvest levels but do not yet have any data on the relationship of these to field population size in any area. This information appears most necessary as a check on the assumptions underlying the management of these kangaroo stocks in recent times and as a basis for decisions in the future. The practical problems in obtaining other supporting data referred to last year remain.

1.5. Programme for 1980/81

Harvest data collected via shooters returns will be treated as previously. The Technical Officer will continue with the programme of maintaining direct contact with the shooters.

The need for further knowledge of population size has always been apparent. It is now most important that this information be obtained. Discussions previously had indicated a probable cost of $20-30 thousand dollars for a statistically sound census of the exploited red kangaroo stocks. Further correspondence with Dr Graeme Coughley, formerly of Sydney University and now at C.S.I.R.O. Division of Wildlife Research, has confirmed this estimate and pointed out the fact that an adequate "whole state" census can be done for approximately the same price as a more limited census of part of the stocks, due to differences in sampling intensity required.

Financing of the exercise has been the main stumbling block in the way of progress in the past few years. This obstacle remains insofar as the Fisheries and Wildlife Wildlife Research Budget is concerned. Two main alternatives to financing are available:

a) a joint exercise funded by Fisheries and Wildlife, APB and Rangelands;

b) external funding.

Dr Coughley has, with my concurrence, recently made application to the Rural Credit Authority to see if an externally funded project can be undertaken. Results of this application may not be known till October-November 1980. It therefore seems prudent to further consider alternative a) above in order to cover possible rejection of the application to Rural Credits. Some recent preliminary discussion on this topic has been had with Mr C.D. Gooding of APB. The need for this project was also discussed with Messrs A.J. Oliver, D.G. Wilcox and N.G. Hall, in October 1979.

1.6. Publications 1979/80

None completed.

Two major reviews are still in preparation as follows:

a) "Exploitation of Kangaroos and Wallabies (F. Macropodidae) in Western Australia. A review to 1970, with special emphasis on the Red and Western Grey Kangaroos."

Draft text for amendment.

b) "Exploitation and Management of Kangaroos in Western Australia 1970-1979".

Advanced draft stage.

An abstract titled "Exploitation and Management of Kangaroos in Western Australia" has been accepted by the organizers of the Worldwide Furbearer Conference as the basis for a paper to be presented at the Conference later in the year.

1.7. Publications 1980/81.

The two reviews above will be completed. These will be Departmental Bulletins.

The paper to be presented to the Worldwide Furbearer Conference will be published in one volume of the two volumes, Proceedings of the Conference.

2. Western Grey Kangaroo Management

2.1. Objectives

To gain knowledge of the management situation.

2.2. Procedures

Research investigation during 1979-80 was confined to search of archives and other records of previous harvests in conjunction with the work on the Red Kangaroo. Multiple regression has been used in interpreting these data.

2.3. Results

A predictive equation giving good fit to the previous hunting data has been obtained.

Extrapolation of this equation to the present time also tracks the average trend in harvest in recent times. This trend is downwards.

2.4. Conclusions

Western Grey Kangaroo stocks in the south west will continue to be reduced in total numbers as long as further farmland development proceeds. In the meantime, kangaroos displaced by this land clearing will continue to be available for commercial harvest. This component of the grey kangaroo surplus can however be expected to decline in size as farmland development pushes further into less favourable habitat.

A further surplus will also continue to be produced at the boundary between established farmland and areas of natural habitat such as Nature Reserves, National Parks, State Forests, etc. The total numbers available from this situation may be relatively low, i.e. possibly 10 000 per annum or less.

2.5. Programme 1980/81

Direct involvement has been suspended. Ongoing research conducted by Dr G.W. Arnold and colleagues of C.S.I.R.O. continues to provide insights into the biology of this species.

2.6. Publications 1979/80

Nil: refer 1.6.

2.7. Publications 1980/81

See under 1.7.

3. Sandy or Agile Wallaby

Programme not proceeded with.

4. Skull Collections - Western Grey and Red Kangaroos.

No further work done during 1979/80. The situation remains the same as last year.

5. Dorre Island Studies.

5.1. Objectives

The objectives of this work are to study the post fire succession following the 1973 fire, and the interaction between the flora and fauna with a view to better future management of this important nature reserve.

5.2. Procedures

Marked transects and series of plots and exclosures were established at several locations on the island late 1973, in order to monitor the changes in the vegetation and assess the possible impact of grazing by wallabies.

These have been revisited four times to date.

The fifth visit during August 1978 was concentrated on animal trapping and survey in the vicinity of White Beach. The information sought was required to supplement the very limited information previously obtained on the first visit in 1973. This work was combined with the attempts to capture further female Banded Hare Wallabies *(Lagostrophus fasciatus)* for transfer to the experimental group on Dirk Hartog I (see Item 6).

5.3. Results

No further data obtained during 1979/80.

5.4. Conclusions

Indications are that succession will be a relatively slow process in this environment, although a few species of plants seem to have reached peak abundance within 2 years of the burn, and to have once again

declined to minor components of the vegetation. *Scaevola crassifolia* stands also appear to have thinned out in the past year, and there is now evidence of germination and development of species thought typical of the former vegetation beneath these stands of *Scaevola*.

A transient response in increased abundance within two years post fire has also previously been observed for the Ashy-grey Mouse *(Pseudomys albocinereus)*.

Changes in abundance of the four marsupials appear to have been related to the post fire vegetation structure e.g. presence or absence of relict cover stands for the Banded Hare Wallaby, and the shelter requirements of the species. These responses also appear to be longer lasting than those of the Ashy-grey Mouse.

5.5. Programme 1980/81

Field work in suspense.

5.6. Publications 1979/80

Nil. Minimal progress was made with the vegetation work to the end of 1979.

5.7. Publications 1980/81

Further work on the vegetation data is now proceeding. It is hoped that more substantial progress will be made this year.

6. Banded Hare Wallaby - Dirk Hartog Island.

6.1. Objectives

To attempt re-establishment of the species on Dirk Hartog Island. To obtain further information on breeding patterns and growth rate of young, and if the project appears to be succeeding it is also anticipated that further progress will be amenable to research on the dynamics of reinvasion.

This is a joint project with Dr A.A. Burbidge.

6.2. Procedures

The general outline of the project has been given previously.

A trapping programme to check on dispersal and

survival of the animals in the release group was carried out in June 1979, in conjunction with work on the Dugong project.

6.3. Results

The June 1979 trapping programme showed that at least 13 of the 21 individuals present in the group on release in September 1978 had survived. The presence of several additional individuals outside of the area trapped also appeared likely on the results of search for tracks and other signs of occupancy. The area occupied by the group at this time had expanded to approximately 18 ha (cf. the original 4 ha within the enclosure). The major direction of dispersal was downwind i.e., north-eastward from the enclosure but several animals were also utilizing a limited area on the south side of the enclosure.

Multiple capture data (and further observations of the condition of some of the males trapped) showed that individuals were moving about over distances of 200 m or more. The limited data suggested that there was no difference between the sexes in this respect.

Cat tracks were observed within the area occupied by the wallabies. 4 of the trapped animals were juveniles in September 1978, so survival of young animals appears possible despite potential cat predation. Several small near full size pouch young were also present in the population at this time, but no newly independent young had yet been raised due to the shortness of the intervening period.

The question of successful recruitment under free ranging conditions in the presence of cats thus remains open.

6.4. Conclusions

The project is proceeding according to plan, and satisfactory progress continues to be made.

6.5. Programme 1980/81

A further intensive trapping programme is needed primarily to check survival and recruitment over the past year.

Further review of the project will be made after this work.

6.6. Publications 1979/80

Nil. Held up by delay in getting further blood typing results.

6.7. Publications 1980/81

Progress report on project to date.

7. Dugong

7.1. Objectives

1. To gain knowledge of abundance and dispersal of these animals along the Western Australian coast.
2. To ascertain how local populations behave, and utilize their environment.
3. To generate outside interest in, and if possible attract, further research involvement in such studies.
4. To use such information in planning management for conservation.

7.2. Procedures

General information on dispersal and abundance is being gathered by aerial survey. Work to date has been done in conjunction with the Pelican research programme, and confined to the coastline between Shark Bay and Port Hedland.

Further detailed knowledge has also been obtained from Shark Bay as a result of a short field investigation during June 1978, and liaison with commercial fishermen based at Denham. Assistance in this work has been provided by Mr Derek Blackman, the local Fisheries Inspector.

7.3. Results

A further aerial survey of Shark Bay was carried out on April 16, 1979, following passage of the tropical cyclone "Hazel" through the Bay. No evidence of cyclone induced mortality was seen. Three hundred and sixty-three dugong were sighted during this survey, being the highest total recorded prior to Professor Anderson's work during June-July 1979, when a maximum of nearly 500 dugong was recorded on one survey flight.

Financial support for this work was obtained from Esso. Alcoa also provided a 4-wheel drive vehicle for use on Dirk Hartog Island during the project.

A documentary dealing with Shark Bay dugong was filmed by the ABC-TV Wildlife Unit. A thirty-minute programme is being produced. The National Geographic Magazine also commissioned a photographic project by Ben Cropp with Professor Anderson writing a supporting feature.

7.4. Conclusions

Shark Bay appears to contain possibly the largest single dugong population presently known, and offers one of the best opportunities for research. Further interest can therefore be expected, despite the fact that recent experience has shown how difficult this may prove.

Comments previously made concerning Exmouth Gulf and other areas along the northern coasts still apply.

7.5. Programme 1980/81

Information is being sought on dugong occurrence in northern waters.

7.6. Publications 1979/80

Prince, R.I.T., Anderson, P.K. and Blackman, D. (in press). "Status and Distribution of Dugong In Western Australia".

Proceedings of Dugong Workshop, Townsville, May 1979.

Prince, R.I.T., Anderson, P.K. and Blackman, D. Observations on the Status and Behaviour of Dugong *(Dugong dugon)* in Western Australian Waters (in prep.).

Revision of MS needed to account for April, 1979 survey data. To be submitted to "Biological Conservation".

SEMINARS, EXTENSION, PUBLIC RELATIONS, ETC. 1979/80

ANPWS Dugong Workshop - Townsville - May 1979 - data presented by P.K. Anderson.

Talk to W.A. Naturalists Club on Dugong - October 1979.

1980-81.

Presentation of Paper on Kangaroo Management - Worldwide Furbearer Conference, Maryland, U.S.A. - August 1980.

COMMITTEES

Kangaroo Management Advisory Committee
Coordinating Committee (APB, Animal Health-Agriculture, Fisheries and Wildlife)
Technical Sub-Committee to consider Holdings of Fauna and Exotic Animals (Coordinating Committee).