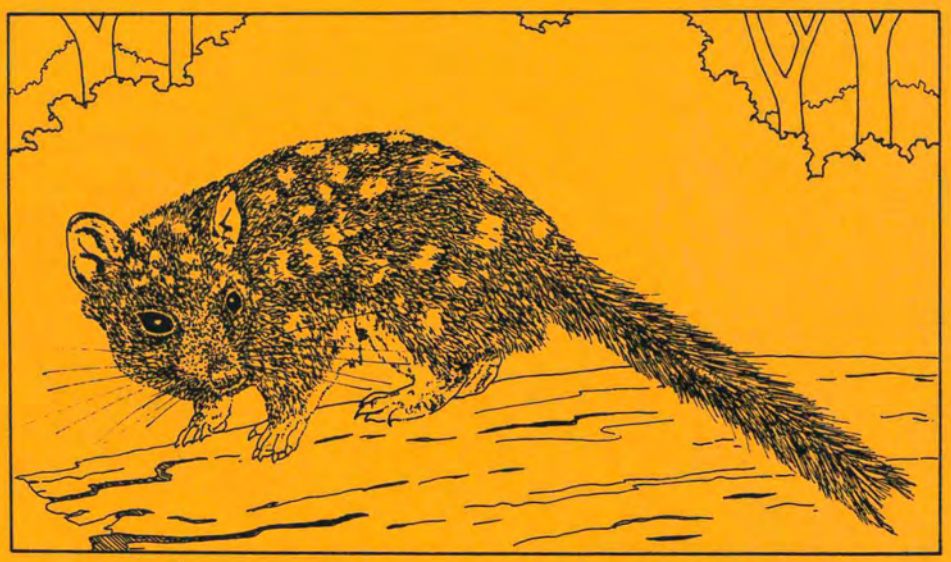
WILDLIFE RESEARCH BRANCH



SUMMARY OF RESEARCH
1986-1987

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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WILDLIFE RESEARCH BRANCH

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RESEARCH SUMMARY

1986-1987

ANDREW A. BURBIDGE

DISTRIBUTION OF DESERT MAMMALS

Staff: A.A. Burbidge and P.J. Fuller.

Objectives: To document the past and present distribution and status of desert mammals. To elucidate priorities for future research and management programs.

Date Commenced: Initial work 1976. This program commenced 1983.

Proposed Date of Completion: Field work completed, writing up 1986.

Work Already Carried Out: A series of field trips have been made to various parts of the western deserts of Western Australia, north-western South Australia and south-western Northern Territory. Aboriginal communities were visited and discussions held with older community members with the aid of puppet skins of the species which occur or occurred in the area. Distributions have been mapped with the aid of the FLORAPLOT routines in use at WAWRC. A paper is in preparation jointly with Dr K.A. Johnson and Mr R. Southgate of the Conservation Commission, Northern Territory. This research has resulted in a much better understanding of past and present mammal distributions and has enabled the decline of many of the species to be dated much more accurately than in the past.

Proposed Work Program 1986/87: Completion of paper should be during 1986.

RARE AND ENDANGERED VERTEBRATES

Staff: A.A. Burbidge.

Objectives: To identify which species of vertebrates are rare and/or endangered. To review the Western Australian official list of rare and endangered species, and through the CONCOM Working Group on Endangered Fauna, the Australian list. To publish information on endangered species. To advise on research priorities. To carry out preliminary surveys of possibly endangered species and to arrange for biological studies by the Department and other agencies.

Date Commenced: 1968.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Numerous field trips, often in conjunction with other work, have been made to collect data on endangered vertebrates. Periodic reviews have been made of the Western Australian and Australian official lists of endangered fauna. A variety of studies have been initiated, including those on the Numbat, Black-flanked Rock-wallaby, Western Swamp Tortoise, Woylie, Long-tailed Dunnart, Dibbler, Noisy Scrub-bird and Ground Parrot.

During June 1986 an intensive helicopter assisted search was conducted for rare mammals in the Great Sandy Desert.

Proposed Work Program 1986/87: This work will continue as time permits.

PATTERNS OF DECLINE IN THE WESTERN AUSTRALIAN MAMMAL FAUNA

Staff: A.A. Burbidge and N.L. McKenzie.

Objectives: To seek patterns in the decline of the mammals in Western Australia which might reveal the major causes of the decline and enable it to be halted or reversed.

Date Commenced: 1983.

Proposed Date of Completion: 1986.

Work Already Carried Out: A paper presented at the 1983 ANZAAS Congress showed that it was possible to show relationships between the decline of the mammals and factors such as size, geographical distribution and habitat. Decline was independent of phylogeny, ability to fly or food. These data are being refined and worked up into a major paper.

Proposed Work Program 1986/87: Continuation of paper preparation which will be completed during 1986.

REVISION OF *BEAUFORTIA* R.BR. AND *REGELIA* SCHAU.

Staff: A.A. Burbidge and P.J. Fuller.

Objectives: Prepare generic taxonomic revisions. Document distribution and conservation status and make recommendations for conservation programs where necessary. Write up for publication in 'The Flora of Australia'.

Date Commenced: 1980.

Proposed Date of Completion: 1988/89.

Work Already Carried Out: Extensive collections have been made of the described species of *Beaufortia*. Three undescribed species and one subspecies have been identified. Distributions are now well documented. Two species are considered to be rare and possibly endangered and detailed examination of one of these, *B. purpurea*, has commenced. Work on *Regelia* is at an early stage.

Proposed Work Program 1986/87: Further field work on the *Beaufortia interstans* complex is needed, and will take place in early summer 1986. Distribution maps for all species will be prepared using the FLORAPLOT routines. Initial examination of the distribution of *Regelia* spp. will take place as time permits.

WESTERN SWAMP TORTOISE

Staff: A.A. Burbidge and P.J. Fuller.

Objectives: To monitor the population of the Western Swamp (or Short-necked) Tortoise at Twin Swamps and Ellen Brook Nature Reserves. To develop techniques for captive breeding.

Date Commenced: 1963 (while at Zoology Department, University of Western Australia).

Proposed Date of Completion: Ongoing.

Work Already Carried out: Natural history, biology and ecology are now well understood and the information has been published. Decline in the wild has been due to a combination of drought, marginal habitat and fox predation. The population on Twin Swamps Nature Reserve is effectively extinct. The population in the Ellen Brook Nature Reserve is maintaining itself at about 25-30 animals.

Captive breeding experiments have been underway since 1979. Techniques for egg letdown and incubation have been perfected but few eggs have been obtained from the 3 captive females (more since 1981) and hatchling survival has been low.

There is little doubt that the Western Swamp Tortoise is the most endangered vertebrate in Western Australia. Prospects for its survival are not good.

Proposed Work Program 1986/87: Wild populations will be monitored as before. The captive population will be maintained with some variation in conditions with the aim of eventually meeting the correct combination of conditions for egg production.

NOISY SCRUB-BIRD MANAGEMENT PLAN

Staff: A.A. Burbidge and A.V. Danks.

Objectives: To ensure the persistence of the Noisy Scrub-bird (*Atrichornis clamosus*).

Date Commenced: Pilot study on translocation 1983. This program 1985.

Proposed Date of Completion: 1986.

Work Already Carried Out: Following detailed biological studies of the Noisy Scrub-bird by CSIRO Division of Wildlife and Rangelands Research a Draft Management Plan for the species was prepared in 1984 and published in early 1985. The plan proposed a series of translocations of the species commencing in 1985.

Proposed Work Program 1986/87: The 1986 translocation, aimed at establishing a population in the Walpole-Nornalup National Park, is underway. Detailed investigations of other possible release sites will be carried out. The program will be handed over to the new Reserve Management Officer at Two Peoples Bay in 1986/87.

OFFSHORE ISLANDS SURVEY - LANCELIN TO DONGARA - BIRDS AND MAMMALS

Staff: P.J. Fuller and A.A. Burbidge.

Objectives: To provide information on birds, especially breeding seabirds, and mammals for the preparation of a management plan.

Date Commenced: 1979.

Proposed Date of Completion: 1986.

Work Already Carried Out: A series of surveys were made of various island groups during the summers of 1979/80 and 1980/81. Some work was carried out during holiday periods and long weekends to assess impact by visitors. Additional surveys were conducted in association with other CALM staff in 1985.

Proposed Work Program 1986/87: Preparation of sections on birds and mammals for proposed Technical Report.

BARROW ISLAND - FAUNA MONITORING

Staff: A.A. Burbidge.

Objectives: To monitor the effects of an oil field on the fauna of Barrow Island.

Date Commenced: 1969.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Regular, usually biannual, visits are made to Barrow Island and an examination is made of oil field developments since the previous visit. Regular spotlight transects are made inside and outside the oil field and turtle breeding beaches checked.

Proposed Work Program 1986/87: Next visit in February/March 1987.

SALT-WATER CROCODILE NUMBERS IN WESTERN AUSTRALIA

Staff: A.A. Burbidge and P.J. Fuller.

Objectives: Make estimate of the numbers and distribution of *Crocodylus porosus* in Western Australia. Make recommendations for management.

Date Commenced: 1976.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Counts were made of salt-water crocodiles in about half the tidal river systems in the Kimberley in 1977 and 1978. This work was done in conjunction with Professor H. Messel of the University of Sydney and the results were published in Department of Fisheries and Wildlife Reports No 24 (1977) and 34 (1979). A.A. Burbidge represents Western Australia on the CONCOM Working Group on Crocodiles and attended a conference on Crocodile Management in Darwin in January 1985. A paper was presented on Crocodile Management in Western Australia which will be published in the proceedings.

Proposed Work Program 1986/87: Planning is well advanced for a further count to take place in conjunction with the University of Sydney during July and August 1986. This work will be published during 1987.

RESEARCH SUMMARY

1986-1987

ALLAN BURBIDGE

BIOLOGICAL SURVEY OF CONSERVATION RESERVES

Staff: A.H. Burbidge and L.J. Boscacci.

Objectives: To carry out biological surveys in selected existing and proposed reserves, as well as in other specific areas in which the Department of Conservation and Land Management has responsibilities. The purpose of these surveys is to provide biological data of value both to management planners and to a long-term monitoring program.

Date Commenced: August 1985.

Proposed Date of Completion: Ongoing; sections will be written up as data become available.

Work Already Carried Out: Interaction with other research sections in the Department and with Planning Branch is continuing.

Where possible, site-specific assemblage data are collected for vascular plants and vertebrate animals. Several surveys, of varying degrees of complexity, have already been carried out in the southern part of the state:

1. Manjimup area: Assessment of the conservation value of six blocks proposed for release for agriculture. Results of this survey were written up and ready for publication in March 1986.

2. Southern Beekeepers Reserve: Assessment of the conservation value of a presently unvested reserve, together with an assessment of possible management problems which may be encountered if the area is vested as a conservation reserve. A report, presently in draft form, will be completed by July 1986.

3. Nullarbor Ground Truth Survey: Field work carried out in October 1985 in conjunction with N.L. McKenzie and G.J. Keighery.

4. Proposed Boonanarring Nature Reserve: Preliminary survey carried out in March 1986. Field data are still being processed (May 1986).

Proposed Work Program 1986/87:

1. Further writing up of work already done, specially Boonanarring survey.

2. Continuing interaction with other research groups and users of biological survey data.

3. Small scale surveys in selected existing and proposed reserves and other areas of the Department of Conservation and Land Management responsibility. To some extent this is interactive with short term needs of other sections of the Department.

4. Contribute to vertebrate survey aspects of a broad scale biological survey of the Irwin/Carnarvon region (in conjunction with N.L. McKenzie and G.J. Keighery).

5. Minor involvement in Nullarbor Ground Truth Survey (in conjunction with N.L. McKenzie and G.J. Keighery).

SAMPLING SMALL GROUND DWELLING VERTEBRATES

Staff: A.H. Burbidge and L.J. Boscacci

Objectives: Field testing and evaluation of various pitfall sampling techniques for use in broad scale biological surveys.

Date Commenced: February 1986.

Proposed Date of Completion: Ongoing; sections will be written up as data become available.

Work Already Carried Out: Initial testing of effects of pit line length and sampling strategy has been carried out near Gingin. Preliminary results have been of interest, but show that much more work is needed.

Proposed Work Program 1986/87: Testing of sampling strategies as well as work on various aspects of pit and drift-fence design. Where possible, such testing will be incorporated into normal survey work (see above).

GROUND PARROT CONSERVATION

Staff: A.H. Burbidge and L.J. Boscacci

Objectives: To determine the fine scale habitat requirements of the Ground Parrot, *Pezoporus wallicus*, so as to facilitate conservation and management of this rare and declining species.

Date Commenced: October 1985.

Proposed Date of Completion: Pilot project to be completed in 1986/87; action after this will depend on initial results.

Work Already Carried Out: Literature survey and preliminary vegetation sampling.

Proposed Work Program 1986/87: A small pilot project will be aimed at locating and tracking individual birds in order to determine the vegetetation types being used. Preliminary

data will be used to plan methods of analysis and to refine field methods.

BIOGEOGRAPHY AND TAXONOMY OF CREEPING TRIGGERPLANTS

Staff: A.H. Burbidge.

Objectives: To document biogeographic patterns in triggerplants (*Stylidium*).

To prepare a taxonomic revision of the creeping triggerplants and assess the conservation status of each taxon, specially those which are poorly known or of restricted occurrence.

Date Commenced: 1975 (while at University of Western Australia).

Proposed Date of Completion: 1986/87 (if time available).

Work Already Carried Out: All species of *Stylidium* have been mapped, with greatest effort being put into those species occurring in south-western Australia. Most type collections have been examined for the creeping triggerplants. Draft manuscrips have been prepared.

Proposed Work Program 1986/87: As opportunity permits, examine the few herbarium specimens not yet seen, and finalize manuscripts.

A CHECKLIST OF OBSERVATIONS OF VERTEBRATES FEEDING ON ON FLOWERS AND FRUITS OF W.A. PLANTS

Staff: A.H. Burbidge and S.D. Hopper.

Objectives: To collate published and unpublished site-specific observations of birds and mammals feeding on nectar, pollen and fruits of Western Australian plants. To analyse the data for major trends, and prepare the study for publication.

Date Commenced: 1978.

Proposed Date of Completion: 1986.

Work Already Carried Out: The study is finished and the manuscript awaits final editing prior to submission for publication.

Proposed Work Program 1986/87: Complete editing and submit for publication as a departmental report.

RESEARCH SUMMARY

1986-1987

MIKE CHOO

COMPUTING'S ROLE IN WILDLIFE RESEARCH

Staff: H.C. Choo and P. Gioia and S. Talip (Trainee).

Objectives: To provide Research personnel with facilities and expertise to support the functions of the Division in the most efficient manner.

Date Commenced: Initial Developments - 1970
Consultant Engaged - 1982
Permanent Positions - 1984

Proposed Date of Completion: Ongoing - though various project phases will be developed according to specified schedules.

Work Already Carried Out: Work commenced in the 70's with the initial development of the Kangaroo Returns system, and has since been extended to cover the following:

Population Estimates	-	1978
Flora Atlas	-	1981
Animal Ecology	-	1982
Kangaroo Logbook	-	1980
Vegetation Survey	-	1980
Wetland Monitoring	-	1980
Numbat Tracking	-	1983
Taxonomic Analyses	-	1985
Word Processing	-	1985
Biological Survey	-	1986
Statistical Analyses	-	1986

Since the review in November 1984 and the subsequent development of the Research computing strategy, a more organised approach has been adopted. Phase one of this approach dealt with providing computing facilities to all research personnel, increasing the level of computing literacy and rationalising on the use of both computer

hardware and software. This was acheived in the 1985/86 financial year with introduction of the following:

1. Hardware

- Access to the LISSC VAX was established and systems developed on the VAX in readiness for installation of a VAX at CALM and the eventual migration of systems from the CYBER.
- Introduction of one dozen micro computers at CALM - Woodvale, and one at Karratha.
- Introduction of a high quality graphics plotter at Woodvale.
- Introduction of field data recorders (Huskey) for field data capture.

2. Software

Assess to the installation of specialised softwares to cater for the specific functions of Research. These include:

- Taxonomic softwares (NTP & TAXON)
- Statistical Analysis softwares (SAS & SPSS)
- Database Management software (dBASEIII & dBASEII)
- Spreadsheet Softwares (LOTUS & SUPERCALC)
- Word Processing software (DISPLAYWRITE/3)

3. Communications

Establishment of communications between hardwares (between PC's, host, W/P w/station, E.F. Data Recorders & Graphics Plotter) and between softwares (between dBASE, SAS, SUPERCALC, LOTUS & DISPLAYWRITE).

Proposed Work Program 1986/87:

1. Document Processing

Establish communications between the DISPLAYWRITER at CALM - Woodvale and the DISPLAYWRITER at Publications.

Continue to reduce W/processing bottleneck by providing researchers with better facilities and by replacing the obsolete Remington workstation with an up to date word processor.

2. Data Collection & Management
   Automate the date collection process by using electronic field data recorders and providing the interface from these to other computers for further processing and analyses.
3. Geographical Information Systems
   Identify and specify requirements for Geographical Information Systems.

4. Data Analyses and Reporting. Install packages, and continue to develop and implement systems to provide research staff with the ability to perform all required forms of analysis and to generate reports.

5. Support. Provide ongoing support (ie. operations, maintenance and enhancements) for systems already implemented.

6. Education and Training. Provide and coordinate education, familiarisation and training of research staff in the use of computing facilities.

7. Computer Products Evaluation. To continue evaluation of computer hardware and software to identify and select system/s which best suit our long term requirements.

8. Inter/Intra Government Communications. Continue liaison with other government departments on direct access to information stored within the respective computers, and to establish electronic mailing facilities.

RESEARCH SUMMARY

1986-1987

DAVID COATES

CONSERVATION GENETICS OF RARE FLORA

Staff: D.J. Coates and R.E. Sokolowski.

Objectives: To determine patterns of genetic variability in species of rare flora using allozyme techniques. To assess the long-term genetic viability of rare plant populations and where necessary develop suitable genetic management strategies to ensure their conservation. To determine which populations of rare flora should have the highest priority in conservation management programs.

Date Commenced: March 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Material suitable for allozyme studies has been collected from populations of *Acacia anomala* and *Kennedia glabrata* and population genetic studies initiated.

Proposed Work Program 1986/87: Collection of material for allozyme studies from populations of the following species of gazetted rare flora.

Aponogeton hexatepalus, Banksia goodii, Darwinia carnea, Eucalyptus steedmanii, Eremophila microtheca, Lambertia rariflora, Leucopogon obtectus, Stylidium coroniforme, Stylidium expeditionis

Initiate population genetic studies on these species.

GENETIC SYSTEMS OF RARE FLORA

Staff: D.J. Coates and R.E. Sokolowski

Objectives: To develop an understanding of mating systems and chromosome characteristics and their effects on levels of genetic variability within populations of species of rare flora. To use this information in the development of genetic management programs for the conservation of rare flora.

Date Commenced: 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Collation of information presently available on mating systems and chromosome studies on species of gazetted rare flora.

Proposed Work Program 1986/87: Begin crossing experiments on selected species of rare flora. Where feasible collect sufficient seed material for mating system studies using allozyme techniques. Initiate these studies on selected rare species. Collect cytological material for chromosome studies on rare flora.

LIFE HISTORY AND ECO-GEOGRAPHIC STUDIES OF RARE FLORA

Staff: D.J. Coates, S.D. Hopper, R.E. sokolowski, A. Brown and other Departmental staff.

Objectives: To provide life history and ecological data necessary for the development of management programs and the conservation of populations of rare flora.

Date Commenced: 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Preliminary eco-geographic data are already available on all gazetted rare species and are being continually updated by both research and operations staff of the Department.

Proposed Work Program 1986/87: Set up permanent quadrats on populations of selected species of rare flora. Begin long-term monitoring of populations to determine life history and ecological parameters.

GERM PLASM STORAGE PROGRAM FOR RARE, ENDANGERED AND RAPIDLY DECLINING FLORA

Staff: D.J. Coates, S.D. Hopper, R.E. Sokolowski and A. Brown.

Objectives: To develop and coordinate seed and tissue storage facilities for rare, endangered and rapidly declining flora. To coordinate and carry out research on their germination and propagation and ensure the conservation of adequate genetic resources of those species.

Date Commenced: 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: None.

Proposed Work Program 1986/87: To initiate a program for the storage of seed from rare, endangered and rapidly declining species using facilities currently available within the Department. Develop a collaborative program involving Departmental and Kings Park staff aimed at the propagation of those species.

GENETIC DIVERSITY AND THE BREEDING SYSTEM IN KARRI

Staff: D.J. Coates, S.D. Hopper, R.E. Sokolowski

Objectives: To determine levels of genetic variability within stands and across the geographic range of Karri. To investigate the mating system and the proportion of heterozygous genotypes expected under normal pollination conditions. To determine whether heterozygous genotypes have the highest fitness and result in the best timber trees and to provide advice on the management, regeneration and conservation of Karri.

Date Commenced: April 1986.

Proposed Date of Completion: 1987.

Work Already Carried Out: Germinated Karri seed has been assayed for 15 different iso-enzyme systems indicating that genetic information will be available from 23 different gene loci of which 8 are polymorphic.

Proposed Work Program 1986/87: Using allozyme techniques, carry out genetic variability studies on seed material collected from 12 different populations of Karri, including the three known outliers. Determine the rate of outcrossing of seed progeny from selected trees.

DETERMINATION OF THE HYRBID STATUS OF SOME GAZETTED RARE FLORA

Staff: D.J. Coates and S.D. Hopper.

Objectives: To investigate the status of certain species of rare flora currently thought to be of hybrid origin, by using electrophoretic techniques. To re-assess the conservation status of taxa confirmed to be hybrids.

Date Commenced: 1986.

Proposed Date of Completion: 1988.

Work Already Carried Out: Morphological studies indicate that 14 presently gazetted or proposed gazetted rare species may be of hybrid origin.

Proposed Work Program 1986/87: Collection of material from the presumed hyrbids and their putative parental taxa for allozyme studies. Initiate allozyme studies to confirm their hybrid status.

CONSERVATION STATUS AND GENETIC VARIABILITY IN SIX COMMERCIALLY EXPLOITED, GEOGRAPHICALLY RESTRICTED AND DIEBACK SUSCEPTIBLE SPECIES

Staff: D.J. Coates and R.E. Sokolowski.

Objectives: To determine patterns of genetic variability using allozyme techniques and the conservation status of the following species; *Andersonia simplex, Banksia coccinea, B. burdetti, B. hookerana, Boronia megastigma* (not dieback susceptible), *Dryandra polycephala.*

Date Commenced: 1986.

Proposed Date of Completion: 1990

Work Already Carried Out: None.

Proposed Work Program 1986/87: Survey and collect material for allozyme studies from populations of *Banksia coccinea* and *Boronia megastigma.* Commence allozyme studies on both species.

CONSERVATION STATUS AND GENETIC VARIABILITY IN FOUR DOMINANT BUT RAPIDLY DECLINING SPECIES

Staff: D.J. Coates and R.E. Sokolowski.

Objectives: To determine patterns of genetic variability, carry out eco-geographic studies and determine the conservation status of; *Eucalyptus loxophleba* (York gum), *Eucalyptus gomphocephala* (Tuart), *Banksia speciosa*, *Callitris preissii*.

Date Commenced: 1986.

Proposed Date of Completion: 1991.

Work Already Carried Out: None.

Proposed Work Program 1986/87: Survey and collect material for allozyme studies from populations of Tuart and *Banksia speciosa*.

PHYLOGENETIC AND BREEDING SYSTEM STUDIES IN THE GENUS *EREMAEA*

Staff: D.J. Coates and R. Hnatiuk (Bureau of Flora and Fauna, Canberra).

Objectives: To determine the number of taxa within the genus, their phylogenetic relationships and investigate their breeding systems. To document their conservation status and where necessary make recommendations concerning their conservation and management.

Date Commenced: 1984.

Proposed Date of Completion: 1988.

Work Already Carried Out: Allozyme studies on all known taxa within the genus have been completed and indicate six distinct taxa with a further nine forming three discrete groups. At present the status of taxa within each of the three groups is unclear and requires further population studies. These are presently underway.

Proposed Work Program 1986/87: Complete surveys and allozyme studies of populations of all known taxa within the genus.

HYBRIDIZATION AND GENE EXCHANGE IN A CONTACT ZONE BETWEEN *STYLIDIUM AFFINE* AND *STYLIDIUM CARICIFOLIUM*

Staff: D.J. Coates.

Objectives: To investigate the extent of hybridization and introgression in a contact zone between the chromosomally distinct species *S. affine* and *S. caricifolium*.

Date Commenced: 1975.

Proposed Date of Completion: 1989.

Work Already Carried Out: Chromosome, morphometric and breeding system studies have been carried out on both species and on intermediate forms within the contact zone. These studies are covered in two publications in the Australian Journal of Botany. Further surveys have been carried out to collect material for allozyme studies.

Proposed Work Program 1986/87: Continue surveys of populations within the zone of overlap and collect material for allozyme studies. Initiate allozyme studies to investigate levels of gene exchange between the species.

ESTABLISHMENT OF FIELD HERBARIA IN ALL REGIONAL AND DISTRICT OFFICES AND ALL RANGER STATIONS

Staff: R.E.S. Sokolowski.

Objectives: To assist relevant officers in the establishment of system-card based field herbaria and to offer *ad hoc* support in their continued maintenance.

Date Commenced: 1983.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: This system has been introduced to all District Wildlife Officers and is now fully operational. Estimates and material lists have now been submitted for the further establishment of field herbaria by CALM staff involved in Flora Conservation within the Management Regions.

Proposed Work Program 1986/87: One or two days will be spent at each regional, district office or ranger station setting up the equipment and undertaking field training in collecting techniques, specimen preparation and handling and their dispatch to the W.A. Herbarium.

RESEARCH SUMMARY

1986-1987

GORDON FRIEND

SAMPLING METHODOLOGY - PITFALL TRAPPING

Staff: G.R. Friend and D.S. Mitchell.

Objectives: To test the relative efficiency and practicality of a range of pitfall/drift fence designs for sampling (a) reptiles and amphibians, and (b) litter-dwelling invertebrates.

Date Commenced: 1985.

Proposed Date of Completion: Mid 1987.

Work Already Carried Out: Opportunistic work has been carried out on the Woodvale Nature Reserve since October 1985. Various spatial arrays of small vertebrate pitfall traps in combination with different lengths of drift fence have been tested. Invertebrate pitfall traps have also been tested with several lengths of drift fence (clear perspex).

Proposed Work Program 1986/87: Although some trends are emerging, much more data are needed to provide conclusive results for survey design. Further tests will be conducted throughout 1986 and early 1987 to provide a full range of seasons.

FIRE ECOLOGY - TUTANNING AREA

Staff: G.R. Friend, D.S. Mitchell, A.J.M. Hopkins and J.M. Brown.

Objectives: To examine the effects of fire on herpetofaunal communities, with particular emphasis on changes in abundance trends, species richness and composition, succession, and the role of fire in creating or altering habitat patchiness (eg. ecotones). This work complements the fire ecology program on vegetation at Tutanning carried

out by A.J.M. Hopkins and J.M. Brown. Studies on invertebrates will commence at a later date (late 1987?).

Date Commenced: Mid 1986.

Proposed Date of Completion: Long-term. Initial 12 months data to be assessed in mid 1987. Overall program should be reassessed in 1990.

Work Already Carried Out: Research proposal prepared and discussed at workshop, early 1986. Four grids established at Tutanning during April-May 1986.

Proposed Work Program 1986/87: Sampling of herpetofauna at six-weekly intervals on two study sites on Tutanning will proceed from June 1986 to June 1987. These data will then be assessed to determine biologically optimal times for further sampling, and to pinpoint species or species groups for longer-term study. Burning of selected areas is proposed for early 1989.

FIRE ECOLOGY - KELLERBERRIN AREA

Staff: G.R. Friend, D.S. Mitchell - in co-operation with G.T. Smith and R.J. Hobbs (CSIRO Wildlife & Rangelands Research).

Objectives: To examine the effects of fire on invertebrate fauna of the litter and low vegetation strata. Particular emphasis will be placed on the effects of burning a substantial portion of a relatively small, isolated reserve (CSIRO personnel will be studying herpetofauna and vegetation).

Date Commenced: Mid 1986.

Proposed Date of Completion: Initial 12 months data to be assessed in mid 1987. Overall program should be reassessed in 1990.

Work Already Carried Out: Research proposal prepared and discussed early 1986. Four grids established in conjunction with CSIRO staff in May 1986.

Proposed Work Program 1986/87: Invertebrate sampling at 2-monthly intervals on Durokoppin and East Yorkrakine Reserves will proceed from June 1986 to June 1987. These data will then be assessed to determine biologically optimal times for further sampling, and to pinpoint a limited number of species groups for longer-term study. Burning is scheduled for March/April 1988.

FIRE ECOLOGY - PERUP MANAGEMENT PRIORITY AREA

Staff: G.R. Friend, D.S. Mitchell - in co-operation with N. Burrows and other staff from Manjimup Research Office.

Objectives: To examine the effects of various fire regimes on invertebrate communities inhabiting leaf litter. Particular emphasis will centre on comparing spring and autumn burns, and on comparing the resilience of the litter fauna in mesic (Perup Jarrah/Wandoo forest) and semi-arid (wheatbelt woodlands and shrublands) environments.

Date Commenced: Spring 1986

Proposed Date of Completion: Long-term. Program should be reassessed in 1991

Work Already Carried Out: Research proposal prepared and discussed early 1986.

Proposed Work Program 1986/87: Sampling of litter invertebrates using pitfall traps will commence in late 1986 on three treatment areas (unburnt "control"; spring fuel reduction burn every six years; autumn fuel reduction burn every six years). As sampling and analysis proceeds a limited number of species groups will be selected for longer-term studies.

NICHE RELATIONSHIPS OF SMALL LIZARDS

Staff: G.R. Friend, D.S. Mitchell - in conjunction with related studies by N.L. McKenzie and A.H. Burbidge.

Objectives: To examine community boundaries and patterns in the structure (niche spacing and species composition) of communities of small lizards across geographical space and through time. The effects of certain categories of disturbance (e.g. fire) on niche relationships of different species along resource axes will be examined. Most emphasis will be on the insectivorous guild.

Date Commenced: Mid 1986 as part of Tutanning Fire Ecology Program.

Proposed Date of Completion: 1990

Work Already Carried Out: Study grids established at Tutanning during April-May 1986.

Proposed Work Program 1986/87: Information on species composition, microhabitat use, activity patterns and diet of small lizards will be collected during the fire ecology studies at Tutanning. Trapping and searching will be carried out at six weekly intervals for the initial twelve months and probably at longer intervals thereafter.

RESEARCH SUMMARY

1986-1987

TONY FRIEND

NUMBAT : STUDIES OF INDIVIDUALS AND POPULATIONS

Staff: J.A. Friend.

Objectives: To study the ecology of the Numbat as a basis for the management of the species.

Date Commenced: 1981.

Proposed Date of Completion: Field work 1986. Lab work and writing up 1986-87.

Work Already Carried Out: A large amount of information has been collected, mostly at Dryandra Forest, but most is awaiting analysis. This information includes data on:

a) home range size;
b) interactions of individuals;
c) intensity of use of habitat;
d) definition of habitat, by radio-tracking and by recording sightings;
e) seasonal variation in diet;
f) life history, longevity, seasonal apsect of breeding, dispersal of young, relationship of life history to habitat use.

Proposed Work Program 1986/87: During 1986/87, the remaining field work will be largely completed, if technical assistance is available. This includes mapping areas of numbat movement (marked at present by flagging tape), keeping tabs on numbats currently fitted with transmitters, and collecting data on marked logs and burrows used by numbats. The need for radio-collared numbats as a source for translocation animals (see later project) will allow further information to be collected this year.

Laboratory work to be done during 1986/87 includes the sorting and identification of termite remains in a large number of scats collected during the study. With technical

assistance this could be completed by the end of 1988. The data from radio-tracking are largely still in a raw state, but this analysis will be completed in 1986/87 given technical assistance and sufficient access to the Tektronix 4054. Maps displaying these movements will then be drafted, commencing late in 1986/87.

NUMBAT : SURVEY OF DISTRIBUTION AND DESCRIPTION OF HABITAT

Staff: J.A. Friend.

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

Date Commenced: 1981.

Proposed Date of Completion: 1986.

Work Already Carried Out: Most data have already been collected, by canvassing for reports of numbat sightings, interviewing members of the public and following up reports with inspection of sites of possible numbat occurrence. This information has been collated. A consultant was employed to carry out an intensive survey of the Jandakot area, and found evidence that numbats exist there at low density.

Proposed Work Program 1986/87: An article on the distribution of the numbat in the SW will be written up during 1986/87.

NUMBAT : FACTORS AFFECTING ASPECTS OF HABITAT

Staff: J.A. Friend.

Objectives: To distinguish environmental influences affecting the availability of food and shelter for numbats.

Date Commenced: 1981.

Proposed Date of Completion: 1987.

Work Already Carried Out: This falls into two areas as follows:

a) Predictable factors - variation of termite availability with forest type, season and time of day. Variation of log availability with forest type. Field work completed, most data analysed.

b) Unpredictable factors - variation of termite availability with climate, variation of log and termite availability with fire frequency and intensity. Climate work has not yet commenced. Two fires have been monitored (April and October 1985), and immediate changes in log and termite abundance recorded.

Proposed Work Program 1986/87: Recovery after the 1985 experimental fires will be monitored during the next 1½ years.

NUMBAT : CAPTIVE BREEDING

(Initially funded by World Wildlife Fund Australia)

Staff: J.A. Friend and R.W. Whitford.

Objectives: To breed numbats in captivity and to develop an artificial diet for numbats.

Date Commenced: 1984.

Proposed Date of Completion: 1986.

Work Already Carried Out: Two numbats were brought into captivity from the wild, a male and a female with young. The young were weaned onto termites, then all but the adult female transferred to an artificial diet previously used for young echidnas. The original female and the two young females have mated with the adult male and all have produced young. In late 1985, two males were released at Boyagin Nature Reserve and have adapted to the wild (both are still alive in April 1986).

Proposed Work Program 1986/87: It is intended that the fourteen captive animals will be transferred to zoos during the second half of 1986. Research on optimum conditions for breeding and on diet will be continued in association with other institutions, particularly Perth Zoo.

NUMBAT : TRANSLOCATION TO AREAS OF FORMER HABITAT
(Funded by World Wildlife Fund Australia)

Staff: J.A. Friend, Neil Thomas and Bruce Turner.

Objectives: To develop techniques for translocating wild numbats, and to release captive bred numbats. To use these techniques to re-establish populations in areas of former occurrence.

Date Commenced: 1985.

Proposed Date of Completion: 1987.

Work Already Carried Out: Fifteen animals were moved from Dryandra Forest to Boyagin Nature Reserve in November and December 1985, and two males from the captive colony at Woodvale were released with them. All were fitted with radio-transmitters to enable their progress to be monitored. Rates of survival have been as high as those found at Dryandra, and all females which have been checked have

produced young since their translocation. Fox control using 1080 has been carried out on Boyagin Nature Reserve since October.

Proposed Work Program 1986/87: The Boyagin population will be monitored and may be supplemented by a further translocation group in November 1986. The main activity will be the attempted establishment of a further population in a large eastern wheatbelt nature reserve (probably Karroun Hill Nature Reserve) which previously supported numbats. WWFA funding for this project ends in March 1987. This will mean that the lack of technical support may prevent monitoring necessary to gain full benefit from this Program.

ECOLOGY OF THE WESTERN BARRED BANDICOOT

Staff: J.A. Friend.

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

Date Commenced: To be commenced in June 1986.

Proposed Date of Completion: 1987.

Work Already Carried Out: No field work has yet been performed.

Proposed Work Program 1986/87: An initial field trip is planned to Dorre Island in June 1986. Bandicoots will be trapped and breeding data collected, and some animals fitted with transmitters. Radio-tracking techniques will be used to collect habitat usage data; scats and potential food items will be collected for analysis of diet. A follow-up visit to the island in August 1986 will allow the assessment

of mortality factors by tracing the fate of radio-collared animals.

TAXONOMY AND ZOOGEOGRAPHY OF AUSTRALIAN LANDHOPPERS (CRUSTACEA : AMPHIPODA)

Staff: J.A. Friend.

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

Date Commenced: 1981 (at WAWRC).

Proposed Date of Completion: Indefinite.

Work Already Carried Out: An article describing five new species (2 from W.A.) was published in 1982. Collections have been made in Western Australia in preparation for another paper on the W.A. species. Drawings of W.A. species were made during a visit to the Australian Museum in 1986, and collections of Victorian species made on a field trip funded by the Museum.

Proposed Work Program 1986/87: The article on landhoppers of Western Australia will be completed during 1986/87. This may involve further collecting in the south-west of the State.

RESEARCH SUMMARY

1986-1987

STUART HALSE

HERDSMAN LAKE : SITUATION REPORT

Staff: S.A. Halse.

Objectives: To document the current situation at Herdsman Lake and indicate its conservation and recreational values as well as likely problems with management of the lake.

Date Commenced: August 1985.

Date of Completion: September 1985.

WATERBIRDS OF LAKE TOOLIBIN

Staff: S.A. Halse.

Objectives: To provide information on waterbird usage of Lake Toolibin (near Narrogin) and attempt to predict the effect of it becoming saline on use by waterbirds as part of the Northern Arthur River Wetlands Rehabilitation Committee's report.

Date Commenced: October 1985.

Date of Completion: December 1985.

Work Carried Out: Data from the RAOU South-west Waterbird Survey was used to indicate the extent of waterbird usage of Lake Toolibin. Data from the Wetland Monitoring Programme together with breeding records throughout the south-west, were used to examine the effect of salinity in a wetland on its use for breeding by various species.

WETLANDS OF INTERNATIONAL IMPORTANCE

Staff: S.A. Halse.

Objectives: To compile a list of wetlands to be nominated as Wetlands of International Importance (under the RAMSAR Treaty) by Western Australia.

Date Commenced: February 1986.

Date Completed: April 1986.

Work Carried Out: A list of 10 wetlands was compiled and submitted to the Policy Directorate.

FACTORS AFFECTING WATERBIRD USAGE OF WETLANDS

Staff: S.A. Halse, J.A.K. Lane and R.P. Jaensch.

Objectives: To analyse data collected during the RAOU South-west Waterbird Survey (see p.see page 97 old report) in conjunction with that from the Wetland Monitoring Programme (see p.see 95 old report) and some habitat measurements to determine what factors influence use of a wetland by waterbirds.

Date Commenced: April 1986.

Proposed Date of Completion: July 1986.

Work Already Carried Out: A preliminary analysis has been carried out and written up in manuscript form. However, more elaborate analysis seems warranted.

Proposed Work Program 1986/87: A copy of the RAOU data will be transferred to the Wildlife Research computer and clustering analysis and various other multivariate techniques will be used to analyse it.

EFFECT OF SALINITY ON USAGE OF WETLANDS BY DUCKS

Staff: S.A. Halse.

Objectives: To examine the effect of comparatively low levels of salinity in wetlands on breeding by various species of duck and the effect of high levels on the usefulness of wetlands as drought-refuges.

Date Commenced: July 1986.

Proposed Date of Completion: 1988.

Work Already Carried Out: None.

Proposed Work Program 1986/87: As far as breeding is concerned work will be concentrated on determining its prevalence in saline areas, the species involved, the role of vegetation in providing nesting cover and the importance of freshwater seepages and other sources of freshwater for successful raising of young.

In highly saline areas used as drought-refuges, patterns of drinking and the diet of birds will be examined to determine whether they are using freshwater and to gain some idea of salt-loads incurred.

INVERTEBRATE SPECIES ASSEMBLAGES IN WETLANDS

Staff: S.A. Halse.

Objectives: To document invertebrate faunal assemblages of a number of wetlands, especially in the wheatbelt, to determine the effect of increasing salinity in individual lakes on their invertebrate fauna and also to gain some idea of the conservation status of the wheatbelt region's freshwater invertebrate fauna as a whole.

Date Commenced: July 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: None.

Proposed Work Program 1986/87: To carry out surveys in conjunction with the duck program and as the opportunity arises, identify animals collected or send samples to specialist taxonomists for identification.

ANALYSIS OF DUCK-BANDING DATA

Staff: S.A. Halse and temporary research officer.

Objectives: To analyse the data gathered during the Department's duck-banding programs between 1952-65 and 1968-74.

Date Commenced: October 1986 (subject to funds being available).

Proposed Date of Completion: June 1987.

Work Already Carried Out: Other Departmental staff have computerised the data collected during 20 years of duck-banding.

Proposed Work Program 1986/87: To analyse the data for Pacific Black Duck and Grey Teal to show extent of seasonal movements, annual survival, seasonal patterns of weight change and, if possible, daily shooting mortality at Moora during the hunting season.

BIOLOGY OF CAPE BARREN GEESE

Staff: S.A. Halse.

Objectives: To examine the effect of isolation and small population size on genetic systems of Cape Barren Geese and gather information on their population biology.

Date Commenced: July 1986.

Proposed Date of Completion: Ongoing

Work Already Carried Out: None

Proposed Work Program 1986/87: To collect blood samples for electrophoresis, estimate population sizes on different islands and choose sites for further study.

RESEARCH SUMMARY

1986-1987

ANGAS HOPKINS

THEORY OF RESERVE MANAGEMENT PLANNING AND IMPLEMENTATION

Staff: A.J.M. Hopkins in collaboration with planning staff.

Objectives: To further develop the intellectual basis for management planning in Western Australia.

Date Commenced: 1985.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: In the past year, work on this project has proceeded along three lines. Firstly, a paper which dealt with integration of research, planning and management functions and with experimental management and planning for that was presented at the Busselton Remnants Workshop. Secondly, arrangements were made for Dr Richard Davis (CSIRO Division of Water and Land Resources) to come to Perth for discussions on ADAPT and EXPERT Systems and the application of these to land management and planning. Thirdly, development of appropriate Geographic Information Systems (GISs) as research tools has continued.

Proposed Work Program 1986/87: A collaborative project with Dr Davis is planned. Development of GISs will continue.

A SYSTEM OF MONITORING FOR CONSERVATION RESERVES IN WESTERN AUSTRALIA

Staff: A.J.M. Hopkins, J.M. Brown, E.A. Griffin (Consultant) and J.T. Goodsell (to January 1986).

Ojectives: To establish a system of permanently marked sites for use in monitoring long-term changes in vegetation composition and structure (in the first instance).

Date Commenced: 1976.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: A system of permanent monitoring posts was established at Tutanning Nature Reserves in 1976. Subsequent survey work in the south-west has concentrated on use of permanent plots. In 1983 the promotion project was expanded and taken on by Mr Goodsell. A flexible but multi-level system of monitoring based on initial recording of all biophysical attributes of a site was developed and tested at Clackline Nature Reserve. In 1984 plots were established in a range of *Eucalyptus loxophloeba - Acacia acuminata* communities running from Pingelly to east of Hyden. The program has been evaluated internally and is now being written up as a Technical Report to permit wider application and evaluation.

Proposed Work Program 86/87: It is proposed to publish the Technical Report and to run a workshop to evaluate response to the proposed methodology and to develop a program for its application. The computer system for dealing with the data is also being developed.

PATTERNS OF GROWTH AND FLOWERING OF *XANTHORRHOEA*

Staff: J.M. Brown and A.J.M. Hopkins.

Objectives: To further validate the work of Lamont, Downes & Fox in order to provide a sound basis for pre-European fire history estimation using *Xanthorrhoea*.

Date Commenced: 1982.

Proposed Date of Completion: To be reassessed in 1986/87.

Work Already Carried Out: Studies of leaf production, senescence and flowering have been conducted on *X. reflexa*

at Tutanning since 1983. Samples of old *X. reflexa* have been collected and prepared for analysis.

Proposed Work Program 1986/87: Results of work so far will be analysed and the program reviewed.

A FUNCTIONAL LIFE FORM CLASSIFICATION FOR THE SPECIES-RICH KWONGAN VEGETATION OF WESTERN AUSTRALIA

Staff: P.J. Grubb (Cambridge, U.K.) and A.J.M. Hopkins.

Objectives: To develop a classification for species that will enhance insight into the mechanisms of co-habitation on species-rich vegetation.

Date Commenced: 1984.

Proposed Date of Completion: 1986/87.

Work Already Carried Out: Field work was undertaken in September-October 1984 and a preliminary working classification developed.

Proposed Work Program 1986/87: Further field work is required to test and refine the working classification developed so far. It is proposed that this should be undertaken late in 1986.

ANALYSIS OF FINE SCALE PATTERN IN SPECIES-RICH SHRUB DOMINATED PLANT COMMUNITIES

Staff: A.J.M. Hopkins, J.M. Brown, E.A. Griffin (Consultant) L. Olsvig-Whittaker (Israel) and G. Eiten (Brasil).

Objectives: To identify relationships between individual plants and their neighbours and microsite features and between individuals of the same species.

Date Commenced: 1982.

Proposed Date of Completion: To be reassessed in 1987.

Work Already Carried Out: Field work has been completed at two sites, Tutanning and Mt Lesueur, using three different sampling techniques. Some very preliminary analyses have been done. A new analytical methodology is currently being developed.

Proposed Work Program 1986/87: Work on the new analytical method and subsequent data treatment will continue as time permits.

THE IDENTIFICATION OF MAJOR ENVIRONMENTAL GRADIENTS IN SOUTH-WESTERN AUSTRALIA

Staff: J.M. Brown, A.J.M. Hopkins, J.T. Goodsell (to January 1986), E.A. Griffin and D. Mitchell (to July 1985).

Objectives: To identify major environmental gradients for the purpose of interpreting and understanding large scale patterns floristic and vegetation and to provide some basis for ascribing management priorities for reserves.

Date Commenced: 1980.

Proposed Date of Completion: Study 1 complete, Study 2, late 1986.

Work Already Carried Out: A major survey of shrub vegetation on laterite in the Jurien-Three Springs region revealed the importance of climate gradients in that area

(Study 1). The present study involves shrub dominated communities from Boyagin to Lake Cronin, south to Frank Hann and Dongalocking. Field sampling has been completed and data are currently being analysed.

Proposed Work Program 1986/87: Results of the study will be analysed and written up for publication.

DISTRIBUTION AND ECOLOGY OF DRYANDRA (PROTEACEAE)

Staff: A.J.M. Hopkins and E.A. Griffin (Consultant).

Objectives: To map the complete distribution of all species in this endemic genus and analyse these in relation to climate and soil patterns.

Date Commenced: 1984.

Proposed Date of Completion: 1987.

Work Already Carried Out: Distribution data from all herbarium records and from a thorough survey of the area Moore River to Kalbarri have been compiled in a format for the Australian Biogeographic Information System. (ABRS is funding ongoing data collection for all other genera in the Proteaceae except *Banksia* and *Grevillea*). Data are being analysed in conjunction with climate, soils, geology, landforms information.

Proposed Work Program 1986/87: Data capture will be completed during 1986. Analyses of data will continue as time permits with a view to publication in 1986/87.

THE RELATIONSHIP BETWEEN CLIMATIC AND EDAPHIC FACTORS AND THE DISTRIBUTION OF PLANT SPECIES IN SOUTH-WESTERN AUSTRALIA

Staff: A.J.M. Hopkins, J.M. Brown and E.A. Griffin (Consultant).

Date Commenced: 1976.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: A detailed study of a 20 km² area south of Eneabba was followed up by a regional study (Jurien - Three Springs) of a single vegetation type (heath) on a single soil type (laterite) and a further detailed study in the Mt Lesueur-Cockelshell Gully area (with some support from CRA Exploration). Results from this last survey are now being analysed. A systematic grid of 316 sampling points has been established at Tutanning - these have all been sampled but data await analysis. Further regional survey is being undertaken in conjunction with the monitoring and gradients projects.

Proposed Work Program 1986/87: Work will continue on analysis and preparation of reports for publication. Field sampling for a new project in the Kellerberrin area, to be conducted in conjunction with CSIRO personnel, is proposed for spring 1986.

REGENERATION STUDIES - BARROW ISLAND

Staff: A.J.M. Hopkins.

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

Date Commenced: 1975.

Proposed Date of Completion: To be assessed.

Work Already Carried Out: Study sites have been laid out in areas that have been affected by a variety of disturbance types. These have been assessed twice. Some additional data were gathered in November 1985 during the CONCOM Island Workshop.

Proposed Work Program 1986/87: This program is in abeyance owing to pressure of other work and will be resurrected as time permits. Workshop.

REGENERATION STUDIES - ENEABBA RESERVES

Staff: A.J.M. Hopkins and E.A. Griffin (consultant).

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

Date Commenced: 1977.

Work Already Carried Out:

1. Ecological survey of the mineral sand mining area at Eneabba.
2. Effects of cutting native vegetation for use in rehabiliation as brush material.
3. Rehabilitation after sand mining (analysis of results of the Allied Eneabba S.E. Factorial experiment). A draft report on this work has been prepared.

Proposed Work Program 1986/87: A report on the S.E. Factoral Experiment will be prepared for publication.

REGENERATION STUDIES - TUTANNING

Staff: A.J.M. Hopkins and P. Farrington (CSIRO).

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

Date Commenced: 1980.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Three avenues of investigation have been pursued: (i) a study of the soil-borne seed bank in the farmed areas; (ii) an investigation of seed dispersal into cleared areas from adjacent native vegetation and (iii) regeneration from seed and seedlings with various soil surface treatments.

Proposed Work Program 1986/87: Results of the above studies will be worked up for publication as time permits.

FIRE ECOLOGY

Staff: A.J.M. Hopkins, E.A. Griffin and N. Burrows.

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

Date Commenced: 1977.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: The first study at a woodland site E of Lake King has been published. Field work has been completed on a further two sites, a *Banksia* woodland and

Jacksonia tall shrubland, at Eneabba. Data have been compiled and analysed and one paper has been drafted.

Proposed Work Program 1986/87: Papers on the two Eneabba studies will be completed. Some preliminary discussions with Mr Neil Burrows (Manjimup) suggest the possibilities of collaborative studies in State Forest. This will be developed and implemented as appropriate.

FIRE ECOLOGY - MT LESUEUR

Staff: A.J.M. Hopkins and E.A. Griffin (Consultant).

Objectives: To monitor the regeneration of vegetation in the Irwin Botanical District (northern sandplains) and of selected species (including gazetted rare flora) after fire.

Date Commenced: 1985.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: In May 1985 an existing study area with over 300 fixed study plots was burnt by a combination of wildfire and back burns. In September/November 1985 some 50 of the study sites were selected for further study and were assessed.

Proposed Work Program 1986/87: The monitoring sites will be assessed in spring 1986 and results of the first 18 months regeneration will be evaluated.

FIRE ECOLOGY - MIDDLE ISLAND (RECHERCHE ARCHIPELAGO)

Staff: A.J.M. Hopkins, J.M. Brown, A.S. Weston and M.E. Trudgen (consultants).

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

Date Commenced: 1973.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Over the past 12 years, a comprehensive inventory of the island's resources has been compiled (flora, fauna, vegetation, history, physiography and visitors' use). The 36 study quadrats in the 1972/73 fire area have been sampled seven times. Studies have also been conducted on the dynamics of the unburnt vegetation (estimated to be 170 years since fire). The work has been written up for publication.

Proposed Work Program 1986/87: A further sampling trip is proposed for the coming year. A program involving visits to other selected islands in the Archipelago is tentatively scheduled for May 1987. Particular attention will be paid to the relative proportions of seed regenerators to resproutors in the vascular flora of the islands in relation to times of isolation from the mainland.

FIRE ECOLOGY - MODELLING

Staff: A.J.M. Hopkins plus collators overseas and interstate.

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

Date Commenced: 1979.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: A PREPLAN (Pristine Environment Planning Language and Simulator) system was developed for Tutanning Nature Reserve in 1979. This system is now being upgraded particularly by the use of new Geographic Information System technology. At the same time the data bases for the Two Peoples Bay Nature Reserve and the Mt Lesueur area are being developed. Observation from an experimental fire at Tutanning in 1985 will be used to test the Tutanning PREPLAN system. A fire fuels sampling program has been initiated to provide a data base to assess fire behaviour models. This sampling program uses the methodologies developed for semi-arid woodland, shrublands and mallee communities by officers of the S.A. Department of Environment and Planning.

Proposed Work Program 1986/87: The collection of fire fuels data will continue. Data bases for Tutanning, Two Peoples Bay and Mt Lesueur will be completed and a new, upgraded PREPLAN System implemented as far as computer facilities permit.

FIRE ECOLOGY - TUTANNING NATURE RESERVE

Staff: A.J.M. Hopkins and J.M. Brown (in collaboration with G.R. Friend).

Objectives: To study fire behaviour, effects of fire on, and rates of regeneration of a variety of structural and floristic types of vegetation.

Date Commenced: 1981.

Proposed Date of Completion: To be reassessed in 1995.

Work Already Carried Out: Twenty paired quadrats and 15 single quadrats were established and comprehensively sampled in 1981 in a block programmed to be burnt in autumn 1982.

This block was burnt in April 1985. Following the fire, one quadrat in each pair was fenced off to limit grazing. Plots were resampled in Spring 1985 and Autumn 1986.

Proposed Work Program 1986/87: Field sampling will continue.

FIRE ECOLOGY - TWO PEOPLES BAY

Staff: A.J.M. Hopkins and J.M. Brown.

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

Date Commenced: 1976.

Proposed Date of Completion: 1996.

Work Already Carried Out: Two study plots were established in closed heath vegetation. Both were sampled (species composition, number of individuals, cover, structural characteristics and biomass). The first plot was burnt in September 1976, the second in February 1979. Plots have been resampled at intervals of 0, 1, 2, 3, 5 and 7 years after the fire. Harvested material has been dried and weighed and data compiled. In addition, at Year 5, quadrats outside the grazing exclosure were harvested to ascertain the impact of kangaroo grazing on post-fire regeneration. Results of all the sampling so far have been entered into the computer and have been analysed in a preliminary way. Some results have been incorporated in the Two Peoples Bay Bulletin.

Proposed Work Program 1986/87: A further period of sampling is scheduled for October 1986.

RESEARCH SUMMARY

1986-1987

STEPHEN HOPPER

ADMINISTRATION AND MANAGEMENT OF DECLARED RARE FLORA

Staff: S.D. Hopper, D.J. Coates, R.E. Sokolowski, A.P. Brown, Senior Clerk Flora and other operations staff.

Objectives: To provide advice, research data, liaise with government departments and the public, and to initiate surveys, reserve acquisition, oversee departmental correspondence and liaise with the Senior Clerk Flora, wildlife officers and operations personnel to ensure effective implementation of Section 23F of the Wildlife Conservation Act.

Date Commenced: Research - September 1977, administration 1980.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Locations of declared rare flora are established by a continuing program of surveys undertaken by research staff, wildlife officers and other operations staff, consultant botanists supervised by S.D. Hopper and, on an *ad hoc* basis, by members of the Australian professional botanical community in the course of systematic or ecological research. Research staff collate locational information and, through the Senior Clerk Flora, set up a departmental file on each species, request follow up surveys by Wildlife Officers where necessary, establish ownership of the land involved, and ensure that official notification about the rare flora and legal responsibilities associated with its protection is hand delivered by a Wildlife Officer to the owner. Various avenues of protection are explored, including purchase of the land as a nature reserve, fencing to prevent grazing by stock, cessation of destructive activities such as sand or gravel mining etc, and propagation of species. District Wildlife Officers and other Departmental staff routinely monitor known populations of rare flora, and regular reports are sent via the Chief

Wildlife Officer and Senior Clerk Flora to research staff. Applications to damage or destroy rare flora for industrial development, prescribed burning, mining, horticultural or scientific research etc. are routinely sent to research staff for advice. Requests for information on rare flora by mineral exploration companies, local authorities, consultant botanists working on E.R.M.P.s and government officers are processed by research staff and the Senior Clerk Flora.

A major proportion of the teams' work this past year has been devoted towards reviewing the past five years' management of rare flora, and towards developing a policy document on conservation of rare flora by CALM.

Proposed Work Program 1986/87: To continue as above. Establishment of a computerized rare flora data base is proposed. Subject to funds becoming available, a program of fencing of rare flora on private property will be implemented. Establishment of artificially propagated rare flora in the wild will be attempted for the first time.

ADDITIONS AND DELETIONS TO THE DECLARED RARE FLORA

Staff: S.D. Hopper and S.J. Patrick (consultant botanist).

Objectives: To undertake and collate research on the conservation status of plants considered for addition and deletion to the schedule of declared rare flora.

Date Commenced: September 1977.

Proposed Date of Completion: Ongoing. Current revision of schedule by Mrs Patrick - May 1986.

Work Already Carried Out: This is summarized in Department of Fisheries and Wildlife Report Nos 42 and 53 entitled "A Guide to the Gazetted Rare Flora of Western Australia" and

".... ibid : Supplement 1". Taxonomic and ecological literature and findings of active field workers are routinely examined for possible taxa of interest. Field surveys are undertaken or initiated and supervised in the manner described for the previous project. Survey data are then collated and a proposal for addition, deletion or no action is prepared for consideration by senior staff and the Minister for formal gazettal. Currently, data have been considered on several hundred taxa that have been proposed for consideration for gazettal as rare flora. A revised schedule listing 300+ taxa is in the hands of the Policy Directorate.

Proposed Work Program 1986/87: Ongoing monitoring of the schedule of rare flora will continue.

BRYOPHYTES AND LICHENS - NEED FOR GAZETTAL AS PROTECTED FLORA

Staff: S.D. Hopper, Dr R. Wyatt and Dr. A. Stoneburner (University of Georgia, U.S.A.).

Objectives: To collate available information and add to knowledge of Western Australia's bryophytes (mosses and liverworts) and lichens so that a case can be made for including them in the schedule of protected flora as defined in the Wildlife Conservation Act.

Date Commenced: March 1984.

Proposed Date of Completion: December 1986.

Work Already Carried Out: Knowledge of the State's lichens has been summarised by Richardson, R.M., & Richardson, D.H.S. (1982). A systematic list with distributions of the lichen species of Western Australia, based on collections in

the Western Australian Herbarium. West. Aust. Herb. Res. Notes 7 : 17-29.

Dr Wyatt and Dr Stoneburner spent six months on sabbatical in W.A. in 1984 as visiting scientists to the Wildlife Research Centre. Extensive bryophyte collections were made throughout the south-west, focusing on nature reserves and national parks. In addition, collections were made by S.D.H. of bryophytes in the Gibson and Great Victoria Deserts. All material in the Western Australian Herbarium and Herbarium of the Botany Department, University of Western Australia, was examined and curated by Drs Wyatt and Stoneburner. A checklist of the bryophytes of Western Australia is in preparation. A proposal to have bryophytes and thallophytes declared as protected flora is in the hands of the Director, Nature Conservation.

Proposed Work Program 1986/87: Completion of the checklist of W.A. bryophytes. Short notes on the bryophtes of Rottnest Island and the Gibson and Great Victoria Deserts will be prepared for publication.

PRESUMED EXTINCT AND VERY RARE WHEATBELT PLANTS

Staff: S.J. Patrick (Temporary Research Officer) and S.D. Hopper.

Objectives: To collate available published and herbarium information, to prepare line drawings and draft text for a publication on the subject.

Date Commenced: January 1984.

Proposed Date of Completion: December 1986.

Work Already Carried Out: Literature and herbarium work (including a two week study of type specimens at the

National Herbarium, Melbourne) is complete. Drawings of most taxa are finished. Many taxonomic problems were encountered and most resolved by consultation with relevant botanists. A manuscript is in preparation. An unpublished report providing all literature and herbarium data on each taxon is finished.

Proposed Work Program 1986/87: Finalize manuscript and submit it for publication. Distribute the report to departmental staff in wheat-growing districts to encourage the rediscovery of presumed extinct taxa.

DATA BASE ON RARE AND GEOGRAPHICALLY RESTRICTED PLANTS OF WESTERN AUSTRALIA

Staff: S.D. Hopper and various consultant botanists.

Objectives: To collate into unpublished departmental reports all available literature and herbarium data on geographically restricted plants of the State on a regional basis. To thus provide a data base for planning detailed regional surveys of rare plants, and for rapid retrieval of available information on the rare and restricted plants of regions of the State. To place the data base on computer and coordinate future surveys of rare flora.

Date Commenced: 1982.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Unpublished reports have been completed on all regions of the State except the Goldfields and the Stirling Range. Grant applications to secure funding for computerizing the data base were made.

Proposed Work Program 1986/87: Subject to the availability of funds, a botanical consultant will be hired to prepare a

report on the Goldfields. Another consultant will be appointed to coordinate the computerization of the data base.

LICENSING AND MANAGEMENT OF THE WILDFLOWER INDUSTRY

Staff: S.D. Hopper, D.J. Coates, A.P. Brown and R.E. Sokolowski.

Objectives: To advise and undertake research on the licensing and effective management of the wildflower industry.

Date Commenced: 1977.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: This is summarized in the following two publications.

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, 1-307.

Burgman, M.A., & Hopper, S.D. (1982). The Western Australian wildflower industry 1980/81. Dept. Fish. Wildl. West. Aust. Rept No. 53, 1-217.

Advice on licenses is routinely provided to the Senior Clerk Flora. There is a clear need to amend legislation so that wholesalers have to be licensed and submit returns of flora traded. Attendance at the 1985 Buenos Aires meeting of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) led to the successful removal

of all remaining heavily traded W.A. wildflowers from Appendix II of the Convention.

Proposed Work Program 1986/87: Prepare submissions to senior staff for proposed changes to legislation. Continue routine advice. Seek new staff appointments to work on the wildflower industry. Prepare for the Australian National Parks and Wildlife Service a booklet on W.A. plants listed on CITES.

Proposed Work Program 1986/87: See report through to publication.

RESERVATION STATUS OF COMMERCIALLY EXPLOITED FLORA

Staff: J. Mutter (Temporary Research Officer) and S.D. Hopper.

Objectives: To establish the reservation status of Western Australian plant species exploited in the wildflower trade, particularly those included on Appendix II of CITES or identified as being at risk.

Date Commenced: February 1984.

Proposed Date of Completion: 1986.

Work Already Carried out: Project completed, and an unpublished report is available. A draft departmental report was completed on this and the following project by A. Napier and is currently with Information Branch.

HARVESTING TECHNIQUES USED IN THE WILDFLOWER TRADE

Staff: A. Napier (Temporary Research Officer) and S.D. Hopper.

Objectives: To gain information on harvesting techniques and make recommendations for further study on species at risk and on management of commerical picking.

Date Commenced: May 1984.

Proposed Date of Completion: December 1985.

Work Already Carried Out: Two unpublished reports on short-term studies have been completed, and their results prepared for publication in a single departmental report by A. Napier.

Proposed Work Program 1986/87: See report through to publication. Consider changes to conditions on commercial picking licenses in light of recommendations made.

CONSERVATION OF TWO KANGAROO PAW SPECIES

Staff: E. Brown and H. Runciman (M.App.Sc. W.A.I.T. students), supervised by Dr B. Collins, Dr B. Lamont and S.D. Hopper.

Objectives: To determine factors influencing natural pollination, seed set and recruitment in black kangaroo paws *Macropidia fuliginosa* and yellow kangaroo paws *Anigozanthos pulcherrimus*. To assess the impact on these processes of commercial flower and seed harvesting.

Date Commenced: March 1986

Proposed Date of Completion: March 1988.

Work Already Carried Out: A grant of $24 900 for the first year of the project was awarded by the Australian National Parks and Wildlife Service under the States Assistance Grants Scheme. The students have conducted preliminary literature and field surveys.

Proposed Work Program 1986/87: Commence major studies of pollination, seed set, seed germination and use of the species in the wildflower trade.

REVIEW OF RARE FLORA CONSERVATION IN WESTERN AUSTRALIA

Staff: S.D. Hopper and S.J. Patrick.

Objectives: To prepare for publication a book that summarizes approaches to flora conservation in Western Australia and provides a colour guide to those taxa declared as rare flora. To use results of the review to plan future flora conservation research.

Date Commenced: 1978.

Proposed Date of Completion: 1987/88.

Work Already Carried Out: Two papers covering general aspects of this field have been published to date:

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

Hopper, S.D., and Muir, B.G. (1984). Conservation of the Kwongan. In J.S. Pate and J.S. Beard (eds), "Kwongan, Plant Life of the Sandplain", University of Western Australia Press, Nedlands.

Research on several other projects will contribute data to the proposed review.

Proposed Work Program 1986/87: Draft text of selected chapters of book, and complete photographic coverage of all declared rare taxa.

FLORA POSTERS, LEAFLETS, MAGAZINE ARTICLES AND PUBLIC LECTURES

Staff: S.D. Hopper A.P. Brown and Information Branch Staff.

Objectives: To convey flora research results and the need for flora conservation to the general public through the use of colour posters, leaflets, magazine articles and public lectures.

Date Commenced: 1977.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Two flora posters, eight leaflets on rare flora, and several magazine articles have been published. A number of public lectures and field courses have been given. A guide to the orchids of the Stirling Range National Park has been drafted.

Proposed Work Program 1986/87: Continue as above.

FLORA SURVEY OF SELECTED CROWN LANDS

Staff: S.D. Hopper and A.P. Brown.

Objectives: To undertake general collections and prepare flora lists for selected Crown lands such as poorly known

nature reserves or national parks, or areas of Crown land proposed for acquisition as reserves.

Date Commenced: 1978.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Collections completed and reasonable flora lists collated for Eyre, Mt Augustus, the proposed Mt Adams Nature Reserve and part of the proposed Edgar Range Nature Reserve. A detailed survey of banksias and eucalypts on Two Peoples Bay Nature Reserve has been drafted with G. Folley for publication in the forthcoming management plan.

Proposed Work Program 1986/87: Prepare lists for Eyre and Mt Augustus for publication. Commence general collections for selected granite rocks throughout the south-west.

BIOLOGICAL SURVEY OF COOLOOMIA NATURE RESERVE

Staff: S.D. Hopper, A.A. Burbidge and P.J. Fuller.

Objectives: To survey the flora and fauna of Cooloomia Nature Reserve (S of Shark Bay) and prepare a report for publication.

Date Commenced: 1979.

Proposed Date of Completion: 1986/87.

Work Already Carried Out: Full surveys undertaken in September 1979, March 1980, and subsequent flora collections in August 1984. Preliminary lists collated. Most herbarium work finished. Most fauna data collated.

Proposed Work Program 1986/87: Complete data analysis and draft report.

ATLAS OF THE W.A. FLORA - PILOT PROJECT (ORCHIDS)

Staff: S.D. Hopper, A.P. Brown, P. Gioia, S.J. Patrick (consultant artist).

Objectives: To conduct a volunteer-participant pilot atlas project aimed at recording the distribution of W.A. orchids. To develop an interactive computerized data base system that allows for the retrieval and manipulation of the biogeographical information to serve departmental responsibilities in wildflower conservation.

Date Commenced: Initial concept - 1978; first contributions sought - 1981.

Proposed Date of Completion: Closing date for final contributions - 1 July 1985. Publication of Orchid Atlas - 1986/87.

Work Already Carried Out: Computer programming over several years has led to the development of a sophisticated interactive graphics display system (FLORAPLOT) without parallel in Australia. Several thousand orchid sight records have been contributed by some 30 selected members of the W.A. Native Orchid Study and Conservation Group who were invited to participate in the pilot project. Line drawings of almost all known W.A. orchids have been completed by Mrs S. Patrick in preparation for publication of the Orchid Atlas.

Proposed Work Program 1986/87: Analyse data statistically and prepare publication quality computer maps of all orchids for the Atlas. Draft text and complete illustrations. Submit the Atlas for publication.

NATIVE TREES AND TALL SHRUBS OF PERTH - GUIDE AND ATLAS

Staff: R.J. Powell (Senior Clerk Reserves), S.D. Hopper and S.J. Patrick (consultant artist).

Objectives: To prepare an illustrated guide to the identification of native trees and tall shrubs (3 m), of Perth, and to use this as a basis for a mapping program involving metropolitan schools and other interest groups.

Date Commenced: 1984.

Proposed Date of Completion: Guide - 1988; atlas project - 1990.

Work Already Carried Out: Line drawings of almost all trees and shrubs are complete, as is photographic coverage of most.

Proposed Work Program 1986/87: Complete photographic coverage. Initiate drafting of text.

POLLINATION OF WESTERN AUSTRALIAN TERRESTRIAL ORCHIDS

Staff: S.D. Hopper, A.P. Brown and A.G. Wells (consultant photographer).

Objectives: Conduct field work and prepare for publication a colour book on the various pollination modes of W.A. terestrial orchids.

Date Commenced: June 1985.

Proposed Date of Completion: December 1987.

Work Already Carried Out: Photography completed. Pollinators identified. Preliminary contact with a publisher has been made.

Proposed Work Program 1986/87: The manuscript will be drafted and submitted for publication.

ORCHIDS OF METROPOLITAN PERTH

Staff: A.P. Brown, S.D. Hopper and S.J. Patrick (consultant artist).

Objectives: Prepare for publication a colour book on the biology and identification of Perth's 100+ orchids.

Date Commenced: 1982.

Proposed Date of Completion: 1987.

Work Already Carried Out: Most of the text has been drafted, all drawings are complete, and most colour photos are in hand.

Proposed Work Program 1986/87: Completion of the book has been deferred until taxonomic studies of several problem genera are finalized. Once manuscripts on the latter are submitted for publication, work on the book will recommence.

A REVISION OF *CALADENIA*, *DRAKAEA* AND ALLIED GENERA OF ORCHIDACEAE IN WESTERN AUSTRALIA

Staff: S.D. Hopper, A.P. Brown and S.J. Patrick (consultant artist).

Objectives: Conduct field and herbarium surveys to enable preparation of a formal taxonomic revision of this group of terrestrial orchids, focusing especially on rare taxa.

Date Commenced: 1982.

Proposed Date of Completion: 1987.

Work Already Carried Out: With considerable assistance from members of the W.A. Native Orchid Study and Conservation Group, field studies and collections have been made of all known taxa in this group of about 90 species. A number of new taxa will be named as a result of the study. Several of these are rare and threatened. Drawings of all are complete. Descriptions of some have been drafted.

Proposed Work Program 1986/87: Complete descriptions and field work, and submit a manuscript for publication in Nuytsia.

GENERIC RELATIONSHIPS AND EVOLUTION OF *CALADENIA, CHLORAEA* AND ALLIED ORCHIDS

Staff: S.D. Hopper and M.A. Burgman (consultant botanist).

Objectives: To revise the tribal and subtribal classification of this Australasian-South American group of orchids from an evolutionary (cladistic) perspective. Part of a series of studies in preparation for forthcoming books on W.A. orchids.

Date Commenced: April 1985.

Proposed Date of Completion: 1987.

Work Already Carried Out: Field work, literature search, herbarium studies, preliminary data collation and computer analysis completed. A draft manuscript is in hand.

Proposed Work Program 1986/87: Finalize the study for publication.

A REVISION OF *EUCALYPTUS WANDOO* AND ALLIED SPECIES (*EUCALYPTUS* SERIES *SUBCORNUTAE*)

Staff: M.I.H. Brooker (CSIRO, Forest Research), S.D. Hopper, M.A. Burgman (consultant botanist) and S.J. Patrick (consultant artist).

Objectives: To conduct fieldwork and herbarium studies on the *Subcornutae* and prepare a taxonomic revision for publication. To investigate evolutionary relationships in the group using numerical cladistic and phenetic techniques and submit the results for publication.

Date Commenced: November 1981.

Proposed Date of Completion: 1987.

Work Already Carried Out: Several collecting trips throughout the south-west have been completed and two new rare species discovered. Material (including types) in all major Australian herbaria has been examined. Seed lots of all of the 25 taxa involved have been germinated and raised in glasshouses at CSIRO. The taxonomic revision is in first draft. Work on the cladistic study by M.A. Burgman commenced in June 1985.

Proposed Work Program 1986/87: Complete final draft of taxonomic revision and submit for publication in *Nuytsia*. Prepare cladistic study for publication.

TAXONOMY OF NEW WESTERN AUSTRALIAN EUCALYPTS

Staff: M.I.H. Brooker (CSIRO, Forest Research), S.D. Hopper and S.J. Patrick (consultant artist).

Objectives: To conduct field and herbarium surveys of W.A. eucalypts aimed at discovering or relocating and formally naming new taxa.

Date Commenced: 1978.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Several surveys have been undertaken in the south-west, goldfields and southern desert regions. In many instances, these surveys have been the first for the region concentrating solely on eucalypts. As a consequence, in excess of 50 new taxa have been discovered. It is evident that most groups of W.A. eucalypts require taxonomic revision. Besides the existence of many new taxa, the project has shown that names of such common mallees as *E. foecunda* and *E. redunca* have been misapplied. A combination of careful field observation, examination of types, growing of seedlings, and the investigation of a range of new characters of the seed, leaf and bud have resolved several previously confused groups into well-defined taxa.

Proposed Work Program 1986/87: Prepare for publication in one paper the description of the majority of new taxa now known. Continue collaborative field, herbarium and glasshouse studies. Extend field surveys to the eastern Great Victoria Desert, the Pilbara and, possibly, to the Great Sandy Desert.

GENETIC VARIATION IN OUTLYING POPULATIONS OF JARRAH AND IN COEXISTING ALLIED RARE SPECIES

Staff: S.D. Hopper, G.F. Moran (CSIRO, Forest Research, Canberra) and A.H.D. Brown (CSIRO, Plant Industry, Canberra).

Objectives: To assay genetic variation using allozyme markers in outlying jarrah populations at Mt Lesueur and Jilakin Rock, and in four rare allied species in the Mt Lesueur region. To test the suitability of allozyme assay as a technique for determining which populations of declared rare eucalypts should have highest priority in conservation management such as fencing or land purchase. To determine whether general principles for the conservation of the gene pools of eucalypts may be derived by allozyme assay of selected species.

Date Commenced: October 1984.

Proposed Date of Completion: 1987.

Work Already Carried Out: Allozyme assays of populations of *E. marginata, E. pendens, E. johnsoniana, E. suberea, E. lateritica,* and *E. exilis* are complete. Data are partly collated. A paper has been drafted.

Proposed Work Program 1986/87: Data analysis and preparation of results for publication, subject to other work commitments of Dr Moran.

BIRD POLLINATION, NECTAR FLOW AND THE MATING SYSTEM OF *EUCALYPTUS CAESIA*

Staff: S.D. Hopper, R. Wyatt (University of Georgia, USA), and G.F. Moran (CSIRO, Forest Research, Canberra).

Objectives: To document variation in bird pollinators over several years and across the geographical range of *E. caesia*. To study patterns of nectar flow and correlated bird feeding behaviour in the two subspecies. To document outcrossing rates and their variation within and between populations using allozyme markers.

Date Commenced: 1978.

Proposed Date of Completion: 1986.

Work Already Carried Out: All field work, allozyme assays and most data analysis completed.

Proposed Work Program 1986/87: Complete data analysis and write up the work for publication.

CONSERVATION STATUS, MORPHOMETRICS AND ALLOZYME VARIATION IN *EUCALYPTUS MACROPCARPA* AND ALLIED SPECIES

Staff: S.D. Hopper, Y. Fripp (Latrobe University), T.J. Fetherstonhaugh (Consultant Botanist) and N. Caputi (W.A. Marine Research Laboratories)

Objectives: To document patterns of genetic variation in these eucalypts using allozyme and morphometric techniques, and to assess the adequacy of the reservation of their gene pools in conservation reserves.

Date Commenced: Field work and morphometrics - 1979; allozymes - 1984.

Proposed Date of Completion: 1987.

Work Already Carried Out: Field surveys and morphometric analyses completed. Preparation for publication is well advanced. Allozyme survey by Dr Fripp is still underway.

Proposed Work Program 1986/87: Complete draft and submit morphometric study for publication. Likewise for allozyme survey should Dr Fripp's commitments allow.

REPRODUCTIVE BIOLOGY AND MANAGEMENT OF *EUCALYPTUS RHODANTHA*

Staff: J. Sampson and S.H. James (University of Western Australia), B. Collins and S. McNee (W.A.I.T.) S.D. Hopper.

Objectives: To document patterns of gene flow and establish minimum viable effective population size in this rare eucalypt. To investigate pollination, seed set and natural recruitment with a view to supplementary management if required.

Date Commenced: April 1985.

Proposed Date of Completion: J. Sampson's Ph.D program - April 1988. S. McNee's Dip. Nat. Resources - December 1986.

Work Already Carried Out: Field surveys and mapping of known populations completed in 1982.

Proposed Work Program 1986/87: My involvement will be limited to cosupervising the two students, a few days' field work with them, and expediting the administration of the department's consultancies that are funding the research.

A CLADISTIC STUDY OF RELATIONSHIPS AMONG WESTERN AUSTRALIAN MONOCALYPTS

Staff: P. Ladiges (Melbourne University), C.J. Humphries (British Museum), S.D. Hopper and M.I.H. Brooker (CSIRO Forest Research)

Objectives: To investigate evolutionary relationships of the *c.*30 W.A. monocalypts, a group that includes jarrah and several declared rare mallees, using computer-based cladistic analyses of adult, seedling and seed characters.

Date Commenced: 1982.

Proposed Date of Completion: 1987.

Work Already Carried Out: Field, herbarium and glasshouse studies complete. Data matrix collated. Dr Ladiges has analysed data and prepared a paper for publication.

Proposed Work Program 1986/87: See the project through to publication.

PATTERNS OF LEAF VENATION AND OIL GLANDS IN WESTERN AUSTRALIAN EUCALYPTS

Staff: M.I.H. Brooker (CSIRO Forest Research) and S.D. Hopper.

Objectives: To photographically document transmitted sunlight images of adult leaves and assess the resultant patterns of ventation and oil glands as useful characters for identification and classification of W.A. eucalypts.

Date Commenced: 1982.

Proposed Date of Completion: 1987.

Work Already Carried Out: Photographs from one or more populations of all known W.A. taxa have been taken. Preliminary analysis indicate useful distinctions between species (e.g. *E. marginata* and *E. staeri*) as well as uniformity in certain higher groups (e.g. the bloodwoods).

Proposed Work Program 1986/87: Obtain black and white prints of representative photographs of all taxa. Continue analysis of patterns. Commence drafting paper for publication.

NATURAL HYBRIDIZATION IN W.A. MONOCALYPTS, WITH PARTICULAR REFERENCE TO THE STIRLING RANGE

Staff: S.D. Hopper, G.F. Moran (CSIRO Forest Research, Canberra) and M.I.H. Brooker (CSIRO Forest Research Wembley).

Objectives: Investigate putative hybrids in W.A. monocalypts (jarrah and allied mallees) using morphometric, allozyme and progency trial assays. Prepare results for publication.

Date Commenced: 1976.

Proposed Date of Completion: 1987/88.

Work Already Carried Out: Morphometric, allozyme and progeny trial assays on all known hybrids are complete. The Stirling Range contains a remarkable array of monocalypt hybrids.

Proposed Work Program 1986/87: Commence data analysis.

A GUIDE TO THE EUCALYPTS OF THE STIRLING RANGE

Staff: S.D. Hopper and A.P. Brown.

Objectives: To prepare a booklet on the eucalypts of the Stirling Range with introductory text on classification and biology, and a systematic description with illustrations of each species and hybrid.

Date Commenced: 1982.

Proposed Date of Completion: 1988.

Work Already Carried Out: Field work involving traverses on most firebreaks and the ascent on foot of several peaks. Taxonomic research on several unnamed species and hybrids is ongoing with M.I.H. Brooker.

Proposed Work Program 1986/867: Finalize taxonomic studies. continue field surveys.

EUCALYPTUS CARNABYI - RARE HYBRID OR RELICT SPECIES?

Staff: S.D. Hopper.

Objectives: To investigate morphometric relationships, progeny variation and the reproductive biology of the gazetted rare plant *E. carnabyi* and test Pryor and Johnson's hypothesis that it is a rare hybrid of *E. macrocarpa* and *E. drummondii*.

Date Commenced: 1978.

Proposed Date of Completion: 1987.

Work Already Carried Out: Field studies, progeny trials, morphometric analysis and sterility estimation complete. The accumulated evidence favours the hybrid hypothesis.

Proposed Work Program 1986/87: Draft a paper for publication.

EUCALYPTS OF THE GREAT VICTORIA DESERT

Staff: S.D. Hopper and A.P. Brown.

Objectives: To take advantage of recently made mineral exploration tracks and survey new areas of the Great Victoria Desert for eucalypts. To prepare for publication a paper on the results of the survey which will describe and map each species and consider the adequacy of its representation on existing conservation reserves.

Date Commenced: 1984.

Proposed Date of Completion: 1988.

Work Already Carried Out: Two trips traversing the desert, one of which focused on Queen Victoria Springs Nature Reserve, were completed in 1984. One new species (allied to York Gum *E. loxophleba*) was discovered, and the known range of several undescribed species was extended. The surveys confirmed the discovery by Kalgoorlie CALM staff of *E. pimpiniana* (previously known only from South Australia) S of Lake Minigwal. They also showed that *E. angulosa* var. *ceratocorys*, previously known only north of Kalgoorlie, was common on dunes in and near Queen Victoria Spring Nature Reserve.

Proposed Work Program 1986/87: A survey of the SE and E end of the Great Victoria Desert will be carried out.

FLORA OF AUSTRALIA TREATMENT OF *ANIGOZANTHOS*, *MACROPIDIA*, *BLANCOA* AND *CONOSTYLIS* (HAEMODORACEAE)

Staff: S.D. Hopper and S.J. Patrick (consultant artist).

Objectives: To prepare descriptions, maps and illustrations of all taxa of kangaroo paws and related plants for publication in a forthcoming volume of the "Flora of Australia".

Date Commenced: Field work - 1973, manuscript 1984.

Proposed Date of Completion: 1987.

Work Already Carried Out: Field and herbarium studies completed. Manuscript for *Anigozanthos* and *Macropidia* submitted for publication. Treatment of *Conostylis* (including the description of c. 20 new taxa) in preparation. Drawings complete.

Proposed Work Program 1986/87: Finish manuscript on *Conostylis* and submit for publication.

BIOLOGY AND CONSERVATION OF KANGAROO PAWS AND CONOSTYLIS

Staff: S.D. Hopper.

Objectives: To collate and prepare for publication studies conducted on the biology and conservation of kangaroo paws and *Conostylis*.

Date Commenced: 1973.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Several papers have been published, principally in the Australian Journal of Botany.

Data on natural hybridization and a chromosome number survey are analysed.

Proposed Work Program 1986/87: Draft papers on the above as time allows. Commence collation of material for a proposed field guide to kangaroo paws and related plants.

POLLINATION ECOLOGY OF THE AUSTRALIAN FLORA

Staff: S.D. Hopper.

Objectives: To develop an understanding of Australian plant-pollinator relationships, particularly those involving birds and small mammals. To explore the significance of pollination studies to the conservation of plants.

Date Commenced: 1976.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Several papers on pollination have been published. Field work completed on as yet unpublished studies of honeyeaters feeding on *Grevillea petrophiloides*, pollinator-triggered anthesis of *Banksia* flowers (with V. Turner, A.N.U.), bird pollination of *Oreocallis pinnata* in SE Queensland rainforests, and lorikeets feeding on eucalypt flowers.

Proposed Work Program 1986/87: Continue pollination observations on an *ad hoc* basis in conjunction with other field work. Prepare material for publication as time allows.

RESEARCH SUMMARY

1986-1987

GREG KEIGHERY

BIOLOGICAL SURVEY OF THE NULLARBOR PLAIN - FLORA

Staff: G.J. Keighery and B. Downing. A.C. Robinson and P. Canty of South Australian Department of Environment and Planning are co-investigators.

Objectives: Computer based inventory and survey of flora of Nullarbor Plain and surrounds (Eucla basin). Document past collections, elucidate conservation priorities, obtain ecological data base for current flora.

Date Commenced: 1984.

Proposed Date of Completion: Report ?July 1986.

Work Already Carried Out: Two major field trips of 4 separate parties to 16 campsites (83 quadrats) undertaken in April and September 1984. Preliminary report to Commonwealth, June 1984. Vegetation chapter drafted.

Proposed Work Program 1986/87: Sampling undertaken at Toolinna Cove in 1985. Paper on *Santalum* drafted.

CENSUS OF AUSTRALIAN PLANTS

Staff: G.J. Keighery (R.J. Hnatiuk of Bureau of Flora and Fauna is Co-ordinator).

Objectives: Compile list of all native and naturalized flora (with distribution per phytogeographical region for Western Australia). W.A. data contributor.

Date Commenced: March 1984.

Proposed Date of Completion: January 1985.

Work Already Carried Out: Completed.

Proposed Work Program 1986/87: To be published by Australian Biological Resources Study (A.B.R.S.) in 1985/86 (still in press).

INDEX TO PLANT CHROMOSOME NUMBERS

Staff: G.J. Keighery.

Objectives: Worldwide listing of plant chromosome numbers from literature. Australasian/Pacific editor.

Date Commenced: Continuing project.

Proposed Date of Completion: Continuing Project.

Work Already Carried Out: Publications:

Index to Plant Chromosome Numbers 1975 - 1978. Monographs in Systematic Botany 3. Missouri Botanic Garden. 1983.

Index to Plant Chromosome Numbers, 1979-1981. Monographs in Systematic Botany 8. Missouri Botanic Garden. 1984.

Index to Plant Chromosome Numbers, 1982-1983. Monographs in Systematic Botany (1985).

FLORA LISTS FOR RESERVES IN TOODYAY/YORK/NORTHAM SHIRES

Staff: G.J. Keighery and J.J. Alford.

Objectives: To compile species lists (flora) for management plans of these reserves. To obtain data on rare flora.

Date Commenced: June 1984.

Proposed Date of Completion: May 1986.

Work Already Carried Out: Flora list obtained for Wongamine Nature Reserve, now in management plan. Collections undertaken on Goonaring Nature Reserve. First survey undertaken on Clackline, Mokine, Wambyn and St Ronan's Nature Reserves.

Significant new records which were obtained in many reserves will enable better planning of same. Most reserves contain 250 - 300 species of flowering plant compared to 70 - 100 currently listed. Preliminary list incorporated for draft plan.

Proposed Work Program 1986/87: Complete flora lists for York/Northam reserves and send to Planning Branch. Detailed report on rare or unusual flora of these reserves prepared for Northern Forests Region.

OFFSHORE ISLANDS SURVEY : LANCELIN TO DONGARA - FLORA

Staff: G.J. Keighery and J.J. Alford.

Objectives: Data base for management plans (vegetation map; floristics, monitoring sites).

Date Commenced: May 1985.

Proposed Date of Completion: June 1986.

Work Already Carried Out: Survey carried out October, December 1985.

Proposed Work Program 1986/87: Material being identified, data being collated.

CHECKLIST OF FLORA OF STIRLING RANGE (AND ENVIRONS)

Staff: G.J. Keighery.

Objectives: Compile annotated checklist of native and naturalized flora of Stirling Range National Park. Map endemic flora. Study aspects of systematics and biology of endemic flora. Check surrounding uplands for similar flora.

Date Commenced: 1977 (while at Kings Park Board).

Proposed Date of Completion: 1988.

Work Already Carried Out: Checklist now at 940 species. Currently 61 known endemics. Several new endemics described. Article on *Darwinia* species published in Landscope during June. Taximetric study of *Darwinia* species completed; awaiting return of co-author (N.G. Marchant) from overseas study tour.

Proposed Work Program 1986/87: Survey will be completed during transfer to South Coast Region in 1986

CONSERVATION, ECOLOGY, BIOLOGY OF WESTERN AUSTRALIAN TREMANDRACEAE

Staff: J.J. Alford and G.J. Keighery.

Objectives: Computer based flora survey teaching model to utilize data entry, analysis and standard field search techniques, on a small but poorly understood group.

Date Commenced: 1984.

Proposed Date of Completion: 1989.

Work Already Carried Out: Data sheets obtained on all known taxa from Herbarium, literature searches and colleagues. Data being entered on data base.

Proposed Work Program 1986/87: Attempt to relocate *Tetratheca deltoidea*, a species known only from near Mt Caroline, last collected in mid 19th Centuary. Obtain population information on *Tetratheca retrorsa*, a species currently known only from Tutanning and Wongan Hills.

GARDEN ESCAPES, NATURALIZED FLORA OF WESTERN AUSTRALIA

Staff: G.J. Keighery.

Objectives: Document current status of supposed naturalized species of Liliaceae and Fabaceae, obtain data on previously unrecorded naturalized taxa. Develop expertise in identification of possibly harmful weeds and their biology; advise on control.

Date Commenced: 1977 (while at Kings Park Board).

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Study undertaken on forms of Pampas Grass (*Cortaderia* spp) naturalized in Western Australia, and a Landnote article has been prepared on this subject. A Landnote article has been submitted on Pepper Trees (*Schinus molle*) and Pine Plantations.

Information on the occurrence of African Boxthorn (*Lycium ferrocissimum*) on the island nature reserves near Leeman provided to Greenough Region, and on *Moraea fugax* on St Ronan's to Northern Forests Region.

An occurrence of Skeleton Weed (*Chondrilla juncea*) on Marmion Avenue was reported to the Agriculture Protection Board.

Proposed Work Program 1986/87: Continuing study as opportunities arise.

SYSTEMATICS OF WESTERN AUSTRALIA FLORA

Staff: G.J. Keighery (some with N.G. Marchant).

Objectives: Taxonomic revisions of selected genera of Western Australian native flora.

Date Commenced: 1976 (while at Kings Park Board).

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Flora of Australian treatments prepared for *Arnocrinum, Hensmania, Johnsonia, Hodgsoniola, Laxmannia* and *Stawellia* (Liliaceae) in press. Revisions of Western Australia *Burchardia* (Liliaceae) and *Chamelaucium* (Myrtaceae) in press. New genera of Gyrostemonaceae and Myrtaceae described. Tribal limits of Western Australia Liliaceae re-defined. Generic treatment of Dasypogonaceae prepared (with H.T. Clifford).

Proposed Work Program 1986/87: Description of new species of *Darwinia* from Busselton/Augusta region (m/s prepared). Complete revisions of *Balaustion, Actinodium* and *Myrtella* (Myrtaceae).

BIOLOGY OF WESTERN AUSTRALIAN PLANTS

Staff: G.J. Keighery.

Objectives: Develop an understanding about the biology (habitats, distribution, pollination and breeding systems) of the Western Australian flora. Collate and prepare material for publication, especially of a "popular" or "semi-popular" nature. Increase knowledge of the natural history of W.A. plants.

Date Commenced: 1975 (while at Kings Park Board).

Proposed Date of Completion: Ongoing.

Work Already Carried Out: A number of papers, reports (and pers. comm. in taxonomic, ecological and horticultural texts) and public seminars have been written and given over the years on this general subject.

Proposed Work Program 1986/87: Continue public seminars, advice, articles in W.A. Wildflower Society Newsletter and Australian Plants. Prepare invited major review on the Pollination and Breeding Systems of Australian Legumes for book Biology of Legumes. Prepare contributed paper on Phytogeography and Conservation of Western Australian Legumes for same volume. Continue ad-hoc observations on biology of native flora.

SOUTH COAST DIEBACK COMMITTEE

Staff: G.J. Keighery.

Objectives: Contribute botanical expertise to departmental Committee on protection of South Coast region from dieback (*Phytophthora cinnamomi*) disease. Prepare regional and specific management plans for region.

Date Commenced: 1985.

Proposed Date of Completion: 1986.

Work Already Carried Out: Survey report on dieback in Cape Arid National Park and other areas of concern (with A. Brandis, T. Hill and J. Tippett).

Dieback briefing papers on possible effects on members of the plant groups : Monocotyledons, Proteaceae and Epacridaceae.

Draft South Coast Dieback Protection Plan prepared (Dieback Committee).

Dieback hygiene manual, sampling manual for dieback proposed (Dieback Committee).

A table on Protection Status and Vegetation Types in the South Coast Region prepared (with J. Tippett).

Vegetation data for Cape Le Grand National Park collated for Management Plan.

Proposed Work Program 1986/87: Lake Magenta Dieback Survey (April 1986).

Continue liaison for specific management plans.

Completion of Stirling Range Survey, and other areas near Albany during transfer to South Coast Region in 1986.

RESERVE SURVEY

Staff: G.J. Keighery and J.J. Alford.

Objectives: Undertake vegetation mapping and species lists of poorly known nature reserves, or areas which could be acquired for nature conservation. Liaise with amateur bodies, planning branch and regions for areas of greatest need.

Date Commenced: 1985.

Work Already Carried Out: Vegetation map, flora list prepared for Forrestdale Lake Management Plan (now published as in draft plan).

Species list for Wongamine Nature Reserve included in management plan.

Flora lists (and subsequent action needed) prepared for 25583 (Kalgan Plains Rd.); 23321 (Fish Rd.). A similar report was prepared for 800 (Townsite), and 27607 (recreation) at Kamballup.

Material for reports on reserves; 30809 (Woodvale); 2547 (Harvey); 826 and 5644 (both in York-Northam Shire) has been obtained.

A survey of the Dongolocking Nature Reserves was undertaken with the Western Australian Wildflower Society to improve the current species list for these reserves.

The Kemerton Smelter Site was surveyed under a consultancy let by the Department under this branch's supervision.

Floristic data was obtained on the proposed Boonanarring Brook Reserve (C9, of C.T.R.C. report).

Proposed Work Program 1986/87: Compile reports on reserves 2547, 826 and 5644 for relevant files.

Continue survey of Boonanarring Brook.

Commence survey of Dryandra/Highbury forest, timber and nature reserves for Wheatbelt region.

RESEARCH SUMMARY

1986-1987

JACK KINNEAR

FIRE ECOLOGY OF THE TUTANNING WOYLIE

Staff: J.E. Kinnear and M. Onus.

Objectives: To carry out studies on the fire ecology of the woylie persisting in Tutanning Nature Reserve for the purpose of formulating management plans for the species.

Date Commenced: Initial work 1978. Project in abeyance since 1979. Project suspended because of low population numbers making study impractical.

Proposed Date of Completion: Open - dependent on population recovery.

Work Already Carried Out: Very low catch-per-unit-effort for woylies was indicative of low population densities. The cause of the decline was unknown. It is now believed that predation by foxes may have been a significant factor in causing the decline. A fox control program was implemented in 1984 and the population is being monitored.

Proposed Work Program 1986/87: Population surveys annually.

THE WOYLIE AND FLUORACETATE (1080)

Staff: J.E. Kinnear and M. Onus.

Objectives: The woylie is remarkably tolerant to the poison "1080" which is produced by many plants on Tutanning Reserve. It has been suggested that woylies, therefore, have acquired resistance to 1080 to enable them to eat plant materials containing 1080. An effort was made to test this hypothesis.

Date Commenced: 1979.

Proposed Date of Completion: Open.

Work Already Carried Out: The known detoxification metabolism of 1080 involves removal of the fluorine from fluoracetate. The fate of the fluoride is subject to two competitive processes - urinary excretion or uptake by the skeleton. Given this situation, then, one should expect woylie bone to contain high levels of fluorine if they ingest 1080 in their diet.

Analysis of woylie skeletal materials was negative for high F levels.

Proposed Work Program 1986/87: Further attempts to define the diet of woylies in Tutanning will be made when the population increases.

BIOLOGY AND ECOLOGY OF WHEATBELT ROCK WALLABIES

Staff: J.E. Kinnear and M. Onus.

Objectives: To carry out studies on surviving rock wallaby (RW) populations with the purpose of formulating a management plan for region.

Date Commenced: Late 1978.

Proposed Date of Completion: Ceased data collection on biology of species 1980. Continued studies on the predation ecology to present.

Work Already Carried Out: Standard collections of data on life history, reproduction, etc, were made. The populations were small and recruitment was low despite the fact that most females were carrying pouched young. It was concluded that, in the long term, survival prospects were poor, but the reasons for this were not self-evident.

Proposed Work Program 1986/87: Work to be published in association with predation ecology study.

POPULATION GENETICS OF ROCK WALLABIES

Staff: J.E. Kinnear, M. Onus, R. Bromilow, MacQuarie University Staff

Objectives: To collect data on the genetic variability of rock wallaby populations.

Date Commenced: 1979.

Proposed Date of Completion: 1980.

Work Already Carried Out: Blood samples were analysed electrophoretically. There was no detectable variation within and between populations. Implications: all populations are severely inbred.

Proposed Work Program 1986/87: Dependent on availability of external funding.

ECOLOGY OF PREDATION BY THE FOX ON WALLABIES

Staff: J.E. Kinnear, M. Onus and R. Bromilow.

Objectives: To experimentally test the hypothesis that fox predation represents a serious threat to surviving species of medium sized marsupials.

Date Commenced: 1982.

Proposed Date of Completion: 1986.

Work Already Carried Out: The wheatbelt rock wallaby populations were used as experimental populations. Two populations were used as control populations (i.e. no treatment), and two other colonies were used as experimental populations. A census of all populations was made in March 1982 and a fox control program was implemented on the reserves carrying the experimental Rock Wallaby populations - Nangeen Hill and Mt Caroline. After two years of fox control, a census of an experimental population (Nangeen Hill) and a control population (Sales' Rock) was made. The results were: on Nangeen Hill following two years of fox control, the population almost doubled, while the population subject to no fox control showed no significant increases in Rock Wallaby numbers.

All populations were intensively trapped over the period March-May 1986. The results were consistent with the previous census made in 1984. Populations afforded protection from fox predation increased significantly while populations not protected did not.

Conclusions: The evidence collected strongly supports the working hypothesis that the fox is a major threat to long term survival of wheatbelt rock wallaby populations. It is likely this conclusion holds over a wider area and extends to other macropodid species as well.

Proposed Work Program 1986/87: Fox control to continue at the management level. Project to be written up.

ECOLOGY OF PREDATION: SURVEY STUDIES

Staff: J.E. Kinnear and M. Onus.

Objectives: To locate and survey mammal populations subject to fox predation, and to appraise and assess the need for protection.

To compare the ecology of populations not subject to predation with populations subject to predation.

Date Commenced: 1980.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Populations on islands and the mainland have been investigated and compared. Significant differences in behaviour and ecology have been noted. This work complements and is consistent with the findings of the wheatbelt predation study. A population was located in the Calvert Ranges. This population will serve as benchmark for ecological studies relating to the fragmentation problem in the settled areas of the State.

Proposed Work Program 1986/87: More surveys.

DAMPIER ARCHIPELAGO : HABITAT REQUIREMENTS OF ROTHSCHILDS' ROCK WALLABY

Staff: J.E. Kinnear, M. Onus and R. Sokolowski.

Objectives: Two islands in the archipelago support thriving populations of *Petrogale rothschildi* - a wallaby restricted to the Pilbara and East Gascoyne. Mining leases held by Hamersley Iron cover extensive areas of sand plain habitat on both islands; mining would destroy this habitat. The objective of this work was to assess the importance of the sandplain habitat to the Rock Wallaby populations.

Date Commenced: 1980.

Proposed Date of Completion: Field work completed 1984; write-up 1985/86.

Work Already Carried Out: The sandplain habitat was shown to be the principal source of food for the rock wallaby populations. Destruction of this habitat would drastically reduce the carrying capacity of the islands.

Proposed Work Program 1986/87: Writing up.

DAMPIER ARCHIPELAGO : FIRE ECOLOGY OF *P. ROTHSCHILDI*

Staff: J.E. Kinnear, M. Onus, and R. Sokolowski.

Objectives: To document the response of *P. rothschildi* to fire.

Date Commenced: 1981.

Proposed Date of Completion: 1984.

Work Already Carried Out: An experimental burn was successfully carried out. The area of the burn encompassed both shelter and feeding habitats. Studies of movement and behaviour of rock wallabies was facilitated by fitting some rock wallabies with radio transmitters. No fatalities were observed. Plant succession and recovery were monitored for three years. Rock wallabies affected the recovery on the sand plain. Much was learned about food preferences of rock wallabies from this experiment. The negative and positive aspects of fire are now better understood to a greater degree as a result of this work.

Proposed Work Program 1986/87: None, manuscript in preparation.

DAMPIER ARCHIPELAGO : TRANSLOCATION EXPERIMENTS USING ROCK WALLABIES

Staff: J.E. Kinnear and M. Onus.

Objectives: To release rock wallabies on an island in the archipelago and to observe and interpret the consequences.

Date Commenced: 1983.

Proposed Date of Completion: Open.

Work Already Carried Out: Fifteen rock wallabies were captured on Enderby Island and were released at an appropriate site on nearby West Lewis Island. Subsequent observations implied that most if not all survived. The rock wallabies are now widely dispersed, and do not feed on the nearby sandplain. The plant community on the W. Lewis sandplain has a low coefficient of similarity with Enderby sand plains. The experiment has been instructive in many ways, but most of all it has shown that the other islands in the archipelago cannot be used as substitutes or alternatives for Enderby and Rosemary Islands.

Proposed Work Program 1986/87: Field survey of population; manuscript in preparation.

EASTERN PILBARA ROCK WALLABIES - SURVEYS

Staff: J.E. Kinnear and M. Onus.

Objectives: To assess the status of mainland populations of *P. rothschildi* and to compare mainland populations with the island populations.

Date Commenced: 1983.

Proposed Date of Completion: 1987.

Work Already Carried Out: The distribution and abundance of this species is being mapped. On sites where the species is found the population density is invariably low. There are numerous sites where the habitat appears to be ideal for this species, but it is absent.

Several small populations have been found on Woodstock Station and data relevant to management is being collected.

Proposed Work Program 1986/87: To continue.

FIRE ECOLOGY IN THE EASTERN PILBARA

Staff: J.E. Kinnear and M. Onus.

Objectives: Indiscriminate burning in the Pilbara represents a grave threat to many wildlife species. Rock wallabies and dalgytes are particularly vulnerable to the misuse of fire. An example of misuse was evident on Woodstock Station, and an opportunity was taken to study and document the consequences of burning rock wallabies habitat indiscriminately.

Date Commenced: 1983.

Proposed Date of Completion: 1987, but dependent on vegetation regeneration.

Work Already Carried Out: Recovery and succession in the burned areas are being monitored jointly along with aspects of rock wallaby behaviour, and diet.

Proposed Work Program 1986/87: To continue.

DALGYTE BIOLOGY AND ECOLOGY

Staff: J.E. Kinnear and M. Onus.

Objectives: To carry out the required research on the dalgyte for the purpose of writing a management plan for the species.

Date Commenced: 1984.

Proposed Date of Completion: Open at this stage, and dependent on rate of essential data collection.

Work Already Carried Out: A dalgyte population was discovered on Hillside Station. This population was intensively surveyed and mapped; working from this site the region was systematically searched for more populations in 1984. This year (April) the survey continued and we have extended the range of colonies to Woodstock Station. Two colonies have been selected as subjects for more detailed studies.

Proposed Work Program 1986/87: Work to continue.

POPULATION GENETICS OF MAINLAND AND ISLAND MACROPODIDS

Staff: J.E. Kinnear, M. Onus, B. Bromilow and McQuarie University staff (pending).

Objectives: To evaluate the extent of genetics deterioration of mainland macropodid populations.

Date Commenced: Initial work 1980.

Proposed Date of Completion: Open.

Work Already Carried Out: Electrophoretic measurements on rock wallabies revealed little genetic variation. This implies severe inbreeding. It is proposed to compare island populations (which would serve as controls) with mainland conterparts for differences. Some genetic management may be in order.

Proposed Work Program 1986/87: Work to commence on the tammar if external funding available.

OPTIMIZATION OF FOX CONTROL IN W.A.

Staff: J.E. Kinnear, D. Algar, M. Onus, B. Bromilow, and T. Leftwich.

Objectives: To optimize existing methods of fox control on small and large nature reserves, National Parks and selected forested areas.

Date Commenced: Spring 1986, subject to funding.

Proposed Date of Completion: Open.

Work Already Carried Out: Studies will extend the research performed during the rock wallaby project.

Proposed Work Program 1986/87: Radiotelemtry studies of fox activity on and around reserves supporting vulnerable macropodid populations; bait preferences.

RESEARCH SUMMARY

1986-1987

JIM LANE

WATERBIRD CONSERVATION : GENERAL

Staff: J.A. Lane, D.R. Munro and G.B. Pearson

Activities

1. Provision of advice concerning management of duck hunting in Western Australia; i.e. determination of hunting seasons, game and protected species, bag limits, shooting areas, refuges etc.

2. Research relating to the management of duck hunting in W.A., eg. annual assessment of conditions (environmental) for waterfowl breeding, waterfowl population assessment, analysis of hunter success.

3. Liaison with pro-hunting, non-hunting and anti-hunting associations and individuals concerning management of duck hunting in W.A. eg. Western Australian Field and Game Association, Royal Australasian Ornithologists Union.

4. Provision of technical advice and comment to Environmental Protection Authority, Department of Conservation and Environment, State Planning Commission, Marine and Harbours and other State and Local Government bodies concerning potential impact of proposed developments involving wetlands, regardless of tenure. Advice on such matters may also be provided at times to other organizations and individuals such as environmental consultants, conservation groups and concerned members of the public. Areas of current involvement include the Busselton Wetlands (proposed canal developments) and Peel Inlet (channel dredging).

5. Participation in various inter-departmental committees concerning special management problems, eg. Northern Arthur River Wetlands Rehabilitation Committee

(salinisation of Lake Toolibin), Beverley Lakes Working Group (water level and salinity control), Mosquito Control Review Committee (mosquito control on Peel and Leschenault Inlets).

6. Involvement in acquisition and management of Wetland Nature Reserves and other areas of DCALM (wet)land. Areas of current involvement include Benger Swamp, Lakes Chittering, Carbul, Gidong and Kubitch and the Muir group of lakes.

7. Participation in preparation of Management Plans for Wetland Nature Reserves, e.g. Benger Swamp, Forrestdale Lake, Dumbleyung Lake.

8. Supervision of consultancies relating to specific management problems, eg. Benger Swamp management, Lake Forrestdale midge control.

9. Development and direction of waterbird and wetland related research programmes undertaken under contract by non-government volunteer organizations, eg. 1986-88 RAOU Waterbird Studies.

10. Provision of logistical support and technical advice for research programmes undertaken by volunteer waterbird/wetland groups, eg. North-West Wader Expeditions conducted by the Australian Wader Studies Group.

In addition to research/advice activities J. Lane is responsible for administration of the Wildlife Research Branch, D. Munro is the Branch Safety Officer and G. Pearson the Branch Plant (vehicles and equipment) Officer.

Research programs, current and proposed, undertaken or directed are as follows.

WETLAND MONITORING PROGRAM

Staff: D.R. Munro, J.A. Lane and G.B. Pearson.

Objectives: To monitor annual changes in water depth and quality of selected wetlands in the south-west of the State. Data obtained are used as a basis for determining duck-hunting seasons and in the management of wetlands.

Date Commenced: The first depth gauge was installed in 1977. Regular monitoring began in November 1978.

Proposed Date of Completion: September and November monitoring will continue each year as a basis for duck season determination.

Work Already Carried Out: Depth gauges have been installed on 124 wetlands from Dongara to Esperance. Water depth and salinity were monitored at two month intervals from November 1978 to May 1985 incl. and in September and November 1985.

In conjunction with rainfall statistics, results obtained from the monitoring program provide a sound basis for year to year comparisons of conditions for waterfowl breeding and for prediction of conditions likely to prevail during impending duck shooting seasons.

The data gathered continue to be of considerable assistance in dealing with management problems which have a hydrological component, eg. midge control at Forrestdale Lake.

Proposed Work Program 1986/87: Monitoring of 84 selected Wetlands will continue in September and November each year, as a basis for duck season decisions. More frequent monitoring of selected key wetlands, particularly those with management problems, eg. Lake Forrestdale, will be

undertaken as required. Volunteer assistance will be used where most efficient.

SOUTH-WEST WATERBIRD SURVEY: 1981-1986

Staff: R.P. Jaensch (RAOU), J.A. Lane and G.B. Pearson.

Objectives: To provide information on waterbird usage of Wetland Nature Reserves in order to facilitate their wise management. To assess the role and importance of the WNR system in the conservation of waterbird populations. To provide appropriate experience for future monitoring of waterbird abundance. This survey is seen by other States and the RAOU as a pilot project for a national waterbird survey.

Date Commenced: April 1981.

Proposed Date of Completion: August 1986.

Work Already Carried Out: The Royal Australasian Ornithologists Union (RAOU) was commissioned to undertake this four year field study. Total funding was $134 500; $71 300 from the Wildlife Conservation Trust Fund (duck-shooters' licence fees) and $63 200 from Consolidated Revenue. The RAOU appointed a full time Project Coordinator, Mr Roger Jaensch, to develop census procedures; recruit, train and coordinate a team of amateur observers; collate and analyse data obtained, and to prepare a final report.

Surveys of waterbird usage (species, numbers, breeding activity, areas utilized etc.) were conducted at frequent (two month or less) intervals from July 1981 to May 1985. Approximately 100 amateur observers were involved on a regular basis, surveying the wetlands of their choice. More than 200 Wetland Nature Reserves were visited.

The total number of waterbird species recorded was 97 with 49 recording breeding. The highest total count for any month was 122 000 in January 1983. The highest count for any one wetland was 41 000 at Peel Inlet. The highest species count was 69 at Alfred Cover and highest number of breeding species 22 at Lake Toolibin.

Proposed Work Program 1986/87: The last field survey was conducted in May 1985. Seven months full time and six months part time have been required to finalise the data base, analyse the data and prepare the final report.

A further two months will be required for editing prior to forwarding to CALM Information Branch for publication.

ANNUAL MONITORING OF WATERFOWL ABUNDANCE

Staff: R.P. Jaensch (RAOU), J.A. Lane, D.R. Munro and G.B Pearson.

Objectives: To monitor annual changes in the abundance and distribution of waterfowl, particularly game species of waterfowl, in Western Australia. To identify sites of importance for waterbirds.

Date Commenced: 1986

Proposed Date of Completion: Funded to 1988.

Work Already Carried Out: A pilot survey was undertaken in May 1986 and involved extensive ground counts (88 volunteers) complemented by 10 hours of aeriaL census (Munro and Pearson). More than 800 wetlands were surveyed and 84 000 ducks, 18 000 swans and 16 000 coots were counted. A preliminary report has been prepared.

Proposed Work Program 1986/87: A full report of the March 1986 pilot survey will be presented in 1986. The second survey will be conducted in March 1987.

ASSESSMENT OF WATERBIRD USAGE OF REMOTE WETLANDS OF PROBABLE INTERNATIONAL IMPORTANCE

Staff: R.P. Jaensch (RAOU) and D.R. Munro

Objectives: To determine conservation value of number of "remote" wetlands (i.e. wetlands outside the south-west of W.A.) thought to be of major importance for waterbirds. To identify sites which satisfy criteria for nomination as Wetlands of International Importance under the RAMSAR Convention.

Date Commenced: 1986

Proposed Date of Completion: Funded to 1988

Work Already Carried Out: Preliminary inspections of Lakes Argyle and Gregory were made by R. Jaensch in May 1986.

Proposed Work Program 1986/87: Thorough survey of the waterbird populations of Lakes Argyle and Gregory will be undertaken by R. Jaensch, D. Munro and ten volunteers in August 1986. Results will be presented in November 1986.

ROUTINE MONITORING OF WATERBIRD USAGE OF IMPORTANT THREATENED WETLANDS IN SOUTH-WESTERN AUSTRALIA

Staff: R.P. Jaensch (RAOU) and J.A. Lane.

Objectives: To regularly monitor waterbird usage of selected wetlands of south-western Australia which are known to be important for waterbird conservation and which are under threat. To thereby assist CALM in its efforts to protect these wetlands and to wisely manage them.

Date Commenced: 1986

Proposed Date of Completion: Funded to 1988.

Work Already Carried Out: Surveys of waterbird usage of 30 wetlands, 15 of which are both important waterbird sites and under threat, have been conducted (principally by volunteers) at two month intervals since January 1986. Important sites include Lakes Forrestdale, Thomsons and Joondalup, and the Vasse and Wonnerup Estuaries.

Proposed Work Program 1986/87: With additional volunteers the number of wetlands routinely monitored in 1986/87 will increase to 50, approximately 25 of which are both important and under threat. First report to be presented November 1987.

BREEDING STATUS OF THE GREAT EGRET

Staff: R.P. Jaensch (RAOU) and J.A. Lane

Objectives: To determine the breeding status (number of breeding colonies, size and locations) of the Great Egret (*Egretta alba*) in Western Australia. To develop methods of monitoring breeding success of this species.

Date Commenced: 1986

Proposed Date of Completion: Funded to 1988

Work Already Carried Out: None

Proposed Work Program 1986/87: Volunteers will be used to search for breeding colonies during 1986. Known colonies will be censused and attempts made to determine breeding success. Information will also be collected on other species which nest in association with the Great Egret, e.g. Little Egret *Egretta garzetta* and Yellow-billed Spoonbill *Platalea flavipes*.

WATERBIRD USAGE OF LAKE MUIR WETLANDS AND STATUS OF AUSTRALASIAN BITTERNS

Staff: R.P. Jaensch (RAOU)

Objectives: To obtain comprehensive information on waterbird usage of Byenup Lagoon. To gather detailed information concerning the habitat requirements of the Australasian Bittern (*Botaurus poiciloptilus*).

Date Commenced: 1986

Proposed Date of Completion: Funded to 1988

Work Already Carried Out: Periodic surveys of waterbird usage of Byenup Lagoon have continued since January 1986.

Proposed Work Program 1986/87: Surveys of waterbird usage will continue. Bittern studies will commence in Spring 1986.

RESEARCH SUMMARY

1986-1987

NORM McKENZIE

STRATEGIES AND DESIGNS FOR BIOLOGICAL SURVEY

Staff: N.L. McKenzie.

Objectives: To incorporate the results of contemporary ecological research into the design of our biological surveys so that the data base they provide can be used in monitoring change and provide a basis for management decisions for nature conservation such as those to optimise the persistence of species richness.

Date Commenced: This program commenced with the assessment of pit-fall traps at Dundas in 1977 and the design of the site-based survey of the Eastern Goldfields in 1978.

Proposed Date of Completion: Continuing.

Work Already Carried Out: An ongoing process of literature review, involving the assessment and adaption (through experimentation) of concepts and techniques. Two relevant publications were produced in 1984.

Current work involves the application ecological pattern analysis (NTP) to our most recent survey data base (from the Nullarbor) to examine problems in identifying biological gradients across a study area the size of a phytogeographic district given the vast differences in scale (longevity and mobility) perceived by, for example, bird and trees. Our object is to design a reserve system that represents the biota of the district giving equal consideration to a wide variety of species.

A field sampling trip to Cocklebiddy, Haig and Toolina Cove was carried out in October 1985 with three objectives:

i) to extend the Nullarbor data base geographically (Toolina Cove);

ii) to re-sample sites near Cocklebiddy one year after our previous sampling to look at year to year variation in composition of Nullarbor assemblages noting the locally unpredictable nature of Nullarbor climate;

iii) to look at quantifying patchiness within Nullarbor quadrats and its influence on interpretation of pattern in our supposedly homogeneous quadrats.

Proposed Work Program 1986/87: A discussion paper was written on the roles, strategies, philosophies, methodologies and resources of the WAWRC biological survey research unit and a program of surveys for 1986 and 1987 proposed and justified. Research needs in biological survey were also identified. A review of the role of our biological survey program in the context of various other CALM research, management and planning responsibilities was also undertaken and a workshop convened and presented on these subjects (in late April 1986), to the Department's executive and a cross-section of research staff of both CALM and its sister organisations.

BIOLOGICAL SURVEY - EASTERN GOLDFIELDS

Staff: N.L. McKenzie (five study areas), A.A. Burbidge (one study area), extra-Departmental members of the Biological Survey Committee (six study areas), and two consultant botanists.

Objectives: To design, organize and undertake a biological survey of C.T.R.C. System II (Eastern Goldfields, W.A.).

Date Commenced: Initial work 1977. This program commenced in late 1978.

Proposed Date of Completion: Field work 1982, writing 1986.

Work Already Carried Out: The field work was completed as programmed. Writing-up commenced in 1983 with identification and tabulation of the species recorded on quadrats in each Study Area. In 1983 I also did some preliminary analysis of the data from the Kalgoorlie-Kurnalpi study area to assess the adequacy of our sampling procedures. The jointly authored publication on methodology was published in 1984. The paper on the results of the Kalgoorlie-Kurnalpi Study Area is being typed. The results of the vertebrate surveys of three of my other four study areas are tabulated.

Direct transfer of the consultant botanist's computer files of southern cells in the study area was organised and the Kalgoorlie-Kurnalpi study area report brought to manuscript.

Design and installation on micro-computers of a data entry system for field data collected during surveys is being undertaken in conjunction with the Centre's computing staff. A master file of species codes is also being accessed to this system.

Proposed Work Program 1986/87: Preparation of publications on the Southern Cross-Coolgarie Study Area, and the Sandstone-Sir Samuel and Laverton-Leonora Study Areas is still continuing.

Entry of Eastern Goldifelds data onto computer to commence using commercial data entry facilities and a data base (Dbase III) system currently being designed at the WAWRC.

BIOLOGICAL SURVEY - NULLARBOR

Staff: N.L. McKenzie and extra-Departmentally, A.N. Robinson of the S.A. Department of Environment and Planning. Other staff from CALM involved in particular aspects: A.A. Burbidge, G. Keighery and L. Boscacci.

Objectives: Undertake a biological survey of the Nullarbor District of Australia to:

i) provide an inventory of the biological resources of the district in relation to the biota of adjacent natural districts;

ii) document patterns of species distribution within the district for a wide array of its biota (plants and vertebrates) and relate these to gradients in the physical environment. Thus derive an appraisal of reserve needs;

iii) provide a biological data base involving a selection of assemblages documented in terms of their species structure and precise location, that represents the biological diversity of the district. A data-base suitable for monitoring long-term changes in the species richness of the district.

Date Commenced: Conceived in November 1983. Funds were available by December 1983.

Proposed Date of Completion: A report was produced in July 1984 and a further Commonwealth Grant obtained to allow a second session of sampling. Deadline for the manuscript of the final report is 30 June 1985, though editing obligations continue until August 1986.

Work Already Carried Out: I designed the study and selected the 80 sample sites in January and February 1984. the sites were established (pit-traps drilled) in February and March. A computer-based data strange system was devised in March and the first sampling session undertaken between 27 March and 20 April. A report (McKenzie and Robinson 1984) was published in July 1984. A second session of sampling was undertaken between 17 September and 9 October 1984. Specimen determinations were completed and the entire data

base was entered into computer by February 1985. It was edited and analysed between March and May 1985.
Preparation of the biological papers for the report is our responsibility (CALM biological survey unit) and commenced in mid-May 1985.

Drafts of the Methods, Reptiles, Total data-set Analysis, and the Conclusions and Recommendations papers (by N.L. McKenzie), vegetation paper (by G. Keighery), mammals paper (by L. Boscacci), late Quaternary mammals paper (by A. Baynes), and birds paper (by A.A. Burbidge) were written during 1985 and accepted by early 1986. Scientific editing of all contributions (by A.C. Robinson and N.L. McKenzie) was in its final stages in May 1986.

A representative system of conservation reserves for the entire district was proposed and delineated and a variety of major disturbances identified. The native biological resources of the district were appraised in the context of conservation.

Proposed Work Program 1986/87: The South Australian Department of Environment and Planning will handle the layout and printing of the final report which will become available before the end of 1986.

In connection with the Biological Survey Strategy and Design project described earlier, a more detailed analysis of the Nullarbor Data Base is proposed for September 1986 (in conjunction with ecologists of the CSIRO Division of Water and Land Resources Canberra) to examine:

1) the predictive ability of data base of this type at our level of sampling intensity.

2) the patterns in the data base, more carefully.

A field trip is proposed in October 1986 to sample Nullarbor sites not previously sampled to compare actual assemblage composition with that predicted statistically from the data base. A ground-truthing exercise.

BIOLOGICAL SURVEY - DESERTS

Staff: N.L. McKenzie and A.A. Burbidge.

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.

Date Commenced: 1975, with work in the Great Victoria Desert, then the Gibson, Little Sandy and, from 1979, the Great Sandy Desert.

Proposed Date of Completion: Continuing.

Work Already Carried Out: Documented in publications in Wildl. Research Bull. West. Aust. between 1976 and 1983. Current work involves a survey of quadrats in the Mandora Salt Marsh/Radi Hills area with a view to delineating a nature reserve to represent the western edge of the Great Sandy Desert. This is a part-time study carried out as time allows. Field sampling in the salt marsh area was undertaken in August 1983 along with further investigations of the biogeographic and palaeoclimatic significance of the peat swamps associated with the Mandora palaeodrainage system.

Proposed Work Program 1986/87: The two week visit to the Mandora/Radi area previously proposed for late October 1985 (to sample upland surfaces of the Radi Hills and document further freshwater swamps in the palaeodrainage system) has

been deferred; instead a four day visit in May 1986 is planned, in conjunction with a visit to the south-eastern Great Sandy Desert to clarify the status of desert Ghost Bat populations.

BIOLOGICAL SURVEY - KIMBERLEY

Staff: N.L. McKenzie.

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

Date Commenced: 1971, with work on the Bonaparte Archipelago, Prince Regent Nature Reserve (1974), Drysdale River National Park (1975), Edgar Ranges (1976-1980), Dampier Peninsula (1977-1981), Mitchell Plateau (1977).

Proposed Date of Completion: Continuing.

Work Already Carried Out: Documented in publications in Wildl. Res. Bull. West. Aust. between 1975 and 1983. Vegetation, bird and bat survey-work in the Cambridge Gulf mangroves in 1983 led to recommendations to extend the Ord River Nature Reserve.

Proposed Work Program 1986/87: Work is suspended pending the outcome of the Bungle Bungle National Park issue.

BIOLOGICAL SURVEY - CARNARVON DISTRICT

Staff: N.L. McKenzie, G.J. Keighery, A.H. Burbidge.

Objectives:

1) Document the biological resources of the northern half of the Irwin and southern half of the Carnarvon Phytogeographic Districts.

2) Provide the first time-points for a site-specific ecological data base of the district.

Date Commenced: November 1986 provided funds become available from CALM and/or Commonwealth Government sources.

Proposed Date of Completion: Field work to be completed by December 1987.

Work Already Carried Out: Applications have been made for the necessary funding.

Proposed Work Program 1986/87:

BIOLOGICAL SURVEY - FITZGERALD RIVER NATIONAL PARK

Staff: N.L. McKenzie in conjunction with the two consultant biologists to the Fitzgerald River National Parks Association. A National Heritage Commission grant. Originally devised by B. Muir of the National Parks Authority that I was asked to take control of the project after CALM was created.

Objectives:

i) Inventory the vegetation and vertebrate fauna of the Fitzgerald River National Park and the significance of the Park to conservation;

ii) Document patterns of species distribution within the Park;

iii) Provide the first time-point in a site-based biological

data base suitable for monitoring long-term changes in the species richness of the Park's biota.

Date Commenced: Field work commences in July 1984.

Proposed Date of Completion: Programmed to finish in 1987.

Work Already Carried Out: In April 1984 the emphasis of the objectives was shifted, several new objectives defined, and the design extensively revised. Sampling is now complete for sites at the western end of the Park.

Proposed Work Program 1986/87: Provide logistical support to the consultants as agreed under previous arrangements - in the form of advice, loans of equipment and liaison with the State Heritage Committee - for sites at the eastern end of the Park.

BIOLOGICAL SURVEY - CAPE ARID

Staff: N.L. McKenzie, G.J. Keighery, A.H. Burbidge.

Objectives: As for Fitzgerald River National Park study.

Date Commenced: Early 1987, provided program allows.

Proposed Date of Completion: 1988, provided program allows.

Work Already Carried Out: Nil.

Proposed Work Program 1986/87: No formal details available.

BIOLOGICAL SURVEY - BUCCANEER ARCHIPELAGO

Staff: N.L. McKenzie, A.A. Burbidge, J.A.K. Lane, A.J. Hopkins and staff from the W.A. Herbarium.

Objectives: Document the conservation resources of the islands in the Archipelago.

Date Commenced: 1982.

Proposed Date of Completion: As program permits.

Work Already Carried Out: Field survey complete; specimens identified. A poster paper on the survey was presented (in September 1983) to the symposium in the Wet/Dry Tropics.

Proposed Work Program 1986/87: None. Data exists; to be written up as opportunity presents.

ECOLOGICAL STUDIES - MANGROVE BAT COMMUNITIES

Staff: N.L. McKenzie.

Objectives: The mangrove community is stable compared with most other natural communities in Western Australia. It is not subject to frequent catastropic disturbances such as fire. Cyclic fluctuations in temperature and humidity associated with diurnal and seasonal influences are minimised by marine influences. The mangel has characteristics of high resilience and persistence in species composition. This study seeks to examine two aspects of ecology fundamental to biological survey: (i) the relationship between stability and determinism in the species sturcture of communities (ii) the relationship between mobility and perceived patch-size of species with otherwise very similar life-history strategies that potentially belong to the same fuild. This study documents and analyses the species structure of guilds of obligate insectivorous bats that forage at night in stands of mangroves. An array of stands along the tropical coastline of Western Australia is being sampled.

Date Commenced: 1977.

Proposed Date of Completion: A part-time study as opportunity presents.

Work Already Carried Out: A publication on the results of work in stands of the coast of Kimberley is published (McKenzie & Rolfe 1986). Sampling of Pilbara stands is in collaboration with A.N. Start is well advanced. A paper on the results of this study was presented at the Fourth International Theriological Congress in Edmonton in August 1985.

Proposed Work Program 1986/87: Preparation of a paper on the results of the Pilbara work.

CHIROPTERAN STUDIES - *MORMOPTERUS* TAXONOMY

Staff: N.L. McKenzie (extra-departmental N. Caputi and P. Bavistock).

Objectives: To document species boundaries in Australian bats of the Genus *Mormopterus* and thereby maintain a knowledge of modern taxonomic techniques - electrophoress, classification analyses and anatomical characters important in taxonomy as opposed to ecology.

Date Commenced: 1978.

Proposed Date of Completion: Continuing as a hobby project.

Work Already Carried Out: The study is complete. I await an opportunity (time) to write the publication. Three new species for Western Australia are recognised.

Proposed Work Program 1986/87: Low priority.

RESEARCH SUMMARY

1986-1987

KEITH MORRIS

BIOLOGICAL SURVEY OF NW ISLAND NATURE RESERVES

Staff: K.D. Morris.

Objectives: To assess the conservation values of island nature reserves between Shark Bay and Port Hedland and provide biological and recreational use data for future management plans for these islands.

Date Commenced: Dampier Archipelago - November 1982. Islands between Exmouth-Dampier - 1984. Shark Bay Islands - 1986.

Proposed Date of Completion: Dampier Archipelago survey completed 1985. Islands between Exmouth-Dampier 1988. Shark Bay Islands 1989.

Work Already Carried Out: Biological survey of Dampier Archipelago has been completed and these data are now being incorporated into a management plan for the nature reserves. Preliminary biological and recreational use data of some of the islands between Exmouth and Dampier have also been obtained (Thevenard, Muiron, Serrurier Islands).

Proposed Work Program 1986/87: The draft management plan for Dampier Archipelago Nature Reserves has been completed. Preliminary survey of the Shark Bay Islands proposed for August 1986. Surveys of other NW islands will continue.

TURTLE UTILIZATION OF NW ISLANDS

Staff: K.D. Morris.

Objectives: To assess the importance of NW islands for turtle breeding, and to determine areas of potential conflict between this and recreational/industrial development. Monitor turtle nesting activity in areas

subject to disturbance. Initiate more detailed studies on the breeding biology of the four species utilizing NW islands.

Date Commenced: Studies on turtle utilization of islands in the Dampier Archipelago commenced in January 1983. A tagging program in the Dampier Archipelago and on Barrow Island will commence September 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Three years (1983-1985) aerial survey data on nesting in the Dampier Archipelago have been obtained. Some preliminary data on turtle breeding biology have also been obtained. Some information on turtle utilization of other NW islands has also been contained.

Proposed Work Program 1986/87: Continue aerial survey in Dampier Archipelago. Liaise with coastwatch regarding concentration of turtles. Initiate tagging program and studies on reproductive physiology in Dampier Archipelago.

FERAL ANIMAL CONTROL ON NW ISLAND NATURE RESERVES

Staff: K.D. Morris.

Objectives: To eradicate feral animals on islands between Shark Bay and Port Hedland, and to determine methods of selectively eradicating feral species in the presence of rare and endangered native species.

Date Commenced: April 1983.

Proposed Date of Completion: 1988, after which time other areas such as the Kimberley islands will be worked on. Some programs where total eradication is not possible will be ongoing.

Work Already Carried Out: Successful *Rattus* eradications have been conducted on Bedout, Boomerang, Double and Pascoe Islands. A goat eradication program on Bernier Island conducted in May 1984 also appears to be successful. The baiting of Boodie Island in 1985 was unsuccessful and will be repeated.

Proposed Work Program 1986/87: Continue to monitor the islands in the vicinity of Barrow Island for *Rattus*. Repeat *Rattus* eradication program on Boodie Island. Conduct another fox baiting program on islands in the Dampier Archipelago. Inspect Bernier Island (goats) and Bedout Island (*Rattus*) for feral animal activity.

RESEARCH SUMMARY

1986-1987

DAVID PEARSON

TRADITIONAL ABORIGINAL BURNING

Staff: D.J. Pearson and D.R. Grace.

Objectives: To investigate and record traditional Aboriginal philosophy and techniques of land management by fire and to assess their usefulness for the management of arid zone nature reserves.

Date Commenced: September 1985.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: One field trip to discuss traditional techniques and establish contacts at Cundeelee (now Coonana) Community. A second trip, taking four men from Coonana to Queen Victoria Spring Nature Reserve. Discussed our objectives, showed them large hot burns north of the Reserve and they stated the location of important sites and burials which should not be fired. Attended a three week course in the Western Desert Language at the Kalgoorlie College to permit better communication with the old people and to promote acceptance and trust from the desert communities.

Proposed Work Program 1986/87: Field trip to outstations, Warburton, Kintore and Wiluna in May 1986 to meet community leaders and establish contacts for future information gathering trips. Field trip planned for July 1986 to Urana outstation and the Great Victoria Desert Nature Reserve. Other trips planned later in the year to Coonana, Warburton, Cosmo-Newberry and Norseman.

ARID ZONE FIRE BEHAVIOUR

Staff: D.J. Pearson and D.R. Grace.

Objectives: To develop a predictive basis for future management burns in desert nature reserves.

Date Commenced: September 1985.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Literature review. Acquisition of equipment.

Proposed Work Program 1986/87: Experimental fires in Wanjarri, Queen Victoria Spring and Gibson Desert Nature Reserves. Ongoing modification of CSIRO/CCNT hummock grassland fire models using experimental results. Fire ecology conference in Alice Springs in May 1986.

IMPACT OF MANAGEMENT BURNS ON SMALL MAMMALS AND REPTILES

Staff: D.J. Pearson and D.R. Grace

Objectives: To monitor small mammal and reptile population responses to mosaic-burning in desert areas.

Date Commenced: September 1985

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Preliminary trapping in Wanjarri, Queen Victoria Spring, Plumridge Lakes and Neales Junction Nature Reserve. Pit trap design appraisal.

Proposed Work Program 1986/87: Establishment of control and burn plots in Wanjarri, Queen Victoria Spring and Gibson Desert Nature Reserves and commence trapping prior to small management burns.

ARID ZONE AERIAL BURNING

Staff: D.J. Pearson and D.R. Grace.

Objectives: To develop methodology and expertise in the aerial ignition of hummock grasslands to creat vegetation mosaics.

Date Commenced: May 1986.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Discussions with CALM staff associated with aerial burning.

Proposed Work Program 1986/87: Site selection and airstrip appraisal in May 1986. First flying operation in winter 1987.

ARID ZONE FIRE MONITORING

Staff: D.J. Pearson and D.R. Grace.

Objectives: To assess fire monitoring techniques, particularly Landsat imagery, in the planning of management burns.

Date Commenced: September 1985.

Proposed Date of Completion: Ongoing.

Work Already Carried Out: Landsat interpretation of burn patterns in the Great Sandy Desert. Ground truthing in June 1986.

Proposed Work Program 1986/87: Interpretation of Landsat imagery acquired after experimental ground and aerial burning operations.

RESEARCH SUMMARY

1986-1987

BOB PRINCE

BANDED HARE WALLABY - DIRK HARTOG ISLAND

Staff: R.I.T. Prince and technical help when available as can be arranged.

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

Date Commenced: The initial phase of this project was commenced in 1974 and ended in 1980. Capital items needed to revive the project and implement the second phase have been acquired since 1983.

Proposed Date of Completion: Five years from time of resumption of work for second phase. Problems due to lack of adequate transport for necessary gear and plant to the island and limited availability of technical assistance at the time required again prevented resumption of the proposed work program.

Work Already Carried Out: Initial phase of project demonstrating potential for successful re-introduction and planning and purchasing of materials required for second phase.

Proposed Work Program 1986/87: July-August 1986 - erect new fencing Dirk Hartog Island and stock enclosures with new wallabies from Dorre Island.
November 1986 - check status of experimental group.
March 1987 - check status of experimental group.

DORRE ISLAND STUDIES - FIRE ECOLOGY

Staff: R.I.T. Prince. See also K.D. Morris, J.A. Friend.

Objectives: To follow the regeneration of vegetation post-fire. To develop an understanding of the vegetation of the island, its development, and the effects of this on distribution of the vertebrate fauna.

Date Commenced: December 1973, following occurrence of a severe human-lit wildfire in October-November. Work on this project has been in suspense since 1978.

Proposed Date of Completion: Work to date has shown that re-establishment and development of vegetation on this island following disturbance is an exceedingly slow process. Resumption of required monitoring work and completion of outstanding analysis and reporting on results of previous visits could be envisaged for completion early 1988.

Work Already Carried Out: Visits to establish monitoring sites and record changes in vegetation on these sites, and to document the vegetation of the island have been undertaken previously on five separate occasions, *viz.*, December 1973, June 1974, October 1975, August 1977 and August 1978. Flora lists and preliminary vegetation analyses have been compiled, and map base sheets at 1 : 10 000 scale produced. Ongoing aerial photographic monitoring has also been maintained - last date of photography was 10 August 1984.

Proposed Work Program 1986/87: Dependent on resources.
See also, K.D. Morris.

DUGONG IN NORTHERN WESTERN AUSTRALIA

Staff: R.I.T. Prince and external colleagues.

Objectives: To determine abundance and seasonal changes in distribution of dugongs on the Western Australian coast. To determine factors affecting, or which have effected, local

populations of dugongs, and where human activity is involved, to establish a basis for effective management and education. To document the distribution of seagrasses and seagrass communities and determine their relative importance to dugong.

Date Commenced: Initial dugong surveys were made in February 1977. The present program commenced June 1984.

Proposed Date of Completion: The initial west Kimberley field work program has been completed. Initial contact with north Kimberley Aboriginal communities will be made May-June 1986.

Detailed surveys of the north and north west Kimberley coasts have yet to be done. This work will be postponed to a future date to allow concentrations through 1986/87 on development of management program aspects applicable to the Dampier Land area and the local Aboriginal communities, and extension of the general marine resources program in this area to focus on marine turtles through the coming year.

Work Already Carried Out: Aerial survey work in the Shark Bay-Exmouth Gulf area was last attempted in 1979. Reconnaissance survey of parts of the northern Western Australian coastline from Onslow to the W.A./N.T. border was done in July 1984. Through 1984, 1985 and to the present, more detailed work has been done in the Dampier Land area, supported by ANPWS funding. This has aimed at gaining a better understanding of the natural history of Dugongs and the seagrass resources on which they are dependent, increasing knowledge of Dugong abundance and distribution and of past and present impacts of human exploitation and related activities of these stocks, and establishing a firm basis for adequate management. Contact with Aboriginal communities and Dugong hunters required as a foundation for this latter objective has been established.

Proposed Work Program 1986/87: Maintain contact with Aboriginal communities and Dugong hunters in the Dampier Land area to facilitate development of an adequate harvest monitoring and biological specimen salvage program and continue working towards development of an appropriate management program. To be undertaken in parallel with marine turtle work.

CONSERVATION OF WESTERN AUSTRALIAN MARINE TURTLES

Staff: R.I.T. Prince and technical help in association with Kimberley Aboriginal communities (Kimberley area). For Pilbara area, see K.D. Morris.

Objectives: To obtain further information on occurrence of marine turtle nesting sites in the Kimberley area of Western Australia, and where necessary seek further reservations for Nature Conservation; to document patterns of use of apparently important rookery areas by the different species; to gather information on the movement and mortality patterns of the presumed migratory, exploited species; to develop an adequate harvest monitoring system to document impact of Aboriginal exploitation; to obtain other information relevant to conservation of marine turtles in Western Australia.

Date Commenced: Individual information on marine turtles in Western Australia has been obtained from a wide range of sources previously, including that gained from wildlife survey and management visits to offshore islands. Detailed research applicable to specific conservation issues affecting these turtles is long overdue. Some preliminary work has been done off the Pilbara coast since January 1983 (K.D. Morris). An integrated program is planned to commence in September 1986.

Proposed Date of Completion: Marine turtles are long lived animals with low rates of recruitment. An extended program will be necessary. Initial work should extend to 1990.

Work Already Carried Out: For background, see above. Contacts with Aboriginal communities have been established in course of ongoing Dugong program work and conservation issues and the need for co-operative work on marine turtle resources discussed.

Proposed Work Program 1986/87: Commence September-October 1986. Identify areas with significant aggregations of turtles, and where practicable commence tagging program aimed principally at Green and Hawksbill Turtles. Principal sites: Barrow and Lowendall Islands in south; Lacepede Islands and within King Sound, in north. Working through to December, flight surveillance program to identify possibly important nest sites off the northern Kimberley and document patterns of use on selected known rookeries off Pilbara and Kimberley coasts.

In addition to the above, promote documentation of turtle harvest by Aboriginal communities through this nesting season.

Through 1987, assess results of initial work and where necessary reassess directions. Work on development of tag recovery program and on aspects requiring international co-operation (Indonesian authorities, and operators of foreign fishing vessels off W.A. coast also).

Initial funding proposals submitted to ANPWS - States Assistance Program..

RESEARCH SUMMARY

1986-1987

MELODY SERENA

CORTICOSTEROID LEVELS IN THE CHUDITCH

Staff: Melody Serena, Todd Soderquist and Adrian Bradley (University of Western Australia).

Objectives: To investigate seasonal variation in the blood corticosteroid levels of male and female *Dasyurus geoffroii*. To relate such variation to seasonal stress and mortality.

Date Commenced: April, 1986.

Proposed Date of Completion:

Work Already Carried Out: Blood samples have been collected from live-trapped animals (belonging to a marked population subject to life history studies), and analyzed for hemoglobin content, differential white blood cell count, and plasma corticosteroids.

Proposed Work Program 1986/87: Continue collecting and analyzing blood samples at bimonthly intervals.

ECOLOGY OF THE CHUDITCH

Staff: Melody Serena, Todd Soderquist (visiting scientists) and A.A. Burbidge (co-ordination and advice).

Objectives: To document biology and ecology of *Dasyurus geoffroii* in the Darling Range, with special emphasis on the Lane-Poole Jarrah Reserve. To make recommendations to promote conservation of the species.

Date Commenced: July, 1985.

Proposed Date of Completion:

Work Already Carried Out: Live-trapping surveys have been conducted at a variety of locations in the northern jarrah forest. Information on reproduction, diet (from scats), and seasonal variation in body condition and weight have been collected by repeated live-trapping at two sites, in Batalling Forest Block and the Lane-Poole Reserve. Monitoring radio-collared animals on and adjacent to the Lane-Poole Reserves has provided information on den types, patterns of den use, home range size, and habitat use.

Proposed Work Program 1986/87: Continue Collecting information on breeding biology, diet, den use, home range, and habitat use. Mark a large sample of juveniles to obtain an estimate of the degree to which juveniles disperse from their natal areas. Monitor radio-collared juveniles to obtain data relevant to the timing, extent and direction of dispersal.

ECOLOGY OF WESTERN NATIVE-CAT

Staff: Dr Melody Serena, Todd Soderquist (visiting Scientists) and A.A. Burbidge (co-ordination and advice).

Objectives: To document biology and ecology of *Dasyurus geoffroii* in the Darling Range, and if possible elsewhere. To make recommendations to promote conservation of the species.

Date Commenced: July 1985.

Proposed Date of Completion: June 1987.

Work Already Carried Out: Background reading.

Proposed Work Program 1986/87: An intensive work-recapture and radio-tracking program will be carried out on a population in the Darling Range, probably near Boddington.

Data will be collected on food, population biology, reproduction and juvenile dispersal, and on the effects of management practices such as fire.

RESEARCH SUMMARY

1986-1987

ANNE TAYLOR

BANKSIA ATLAS

Staff: A. Taylor, P. Gioia, S.D. Hopper and S.J. Patrick (consultant artist).

Objectives: To co-ordinate a computer based national Banksia Atlas program based on sight records supplied by volunteer contributors over a three year period (1984-87).

Date Commenced: February 1984.

Proposed Date of Completion: February 1987.

Work Already Carried Out: A Banksia Atlas recording kit has been designed for distribution to volunteer contributors. The kit includes introductory letter, book of recording sheets, field notebook, instructions for completing a sight record sheet, and supplementary field guide. The project was officially launched in July 1984. At present, there are some 1 000 people enrolled throughout Australia. Publicity has been achieved through a series of illustrated talks and field trips in all States. In addition there have been newspaper and magazine articles and radio talks. An audio-visual has been produced, outlining the aims of the Atlas and providing a brief introduction to the genus *Banksia*. A 3 monthly newsletter is sent to all volunteers, and contact is also maintained through a voluntary co-ordinator in each State. Completed record sheets are checked for errors, and letters of acknowledgement sent to all first-time contributors. Records already received have been compiled into the first and second sets of Interim Distribution Maps using FLORAPLOT routines in use at WAWRC. The 8 000 or so record sheets already received have raised many new questions about the genus *Banksia*. For many species range extensions are becoming apparent. In Western Australia, two new *Banksia* species have been found. Northern New South Wales may have a new variety of *Banksia spinulosa*. Possible hybridisation amongst some of the

prostrate banksias is becoming increasingly apparent. There are many other lines of enquiry still to be explored.

Proposed Work Program 1986/87: Prior to the end of the recording phase (August 1986), the main emphasis will be on providing feedback to contributors, in the form of FLORAPLOT maps. These show where banksias are currently recorded. Contributors will be encouraged to search in 'blank' areas for new locations. An evaluation questionnaire has been sent to all volunteers. Results of this will appear in the final report. Between August 1986 and February 1987, a report on the project and a BANKSIA ATLAS will be produced.

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Taylor, A. (1984). Banksia Atlas Initiated. *SWANS* Vol. 14(1), 28-30.

SUMMARY OF AREAS OF ACTIVITY AND ADVICE

Andrew Burbidge B.Sc. (Hons), Ph.D. - Principal Research Officer

RESEARCH TOPICS

Population study and conservation of the Short-necked Tortoise.
Conservation of rare species of vertebrates, especially in the arid zone.
Barrow Island - comparison of animal numbers within and outside oilfield.
Biological Survey.
The Conservation Reserves System in Western Australia.
Crocodile numbers in the Kimberley.

AREAS OF INTEREST AND ADVICE

Mammals in general, especially conservation.
Australian Tortoises and Turtles.
Crocodile conservation.
Sea birds and protection of breeding sites.
Island biogeography, ecology and management.
Marine Turtle nesting sites.
Desert reptiles.
Rare and endangered species of fauna.

COMMITTEES

Bush Fires Board.
CONCOM Working Group on endangered fauna.
CONCOM Working Group on Crocodiles.
CONCOM Working Group on the Management of Endangered Vertebrates.
IUCN Species Survival Commission Australian Marsupials Specialist Group.
IUCN Species Survival Commission Freshwater Chelonian Specialist Group.
Biological Survey Committee (Chairman).
Policy Advisory Committee, Master of Natural Resources Management, University of W.A.
Working Group on Land Releases (Environmental Protection Authority).
Scientific Advisory Committee, World Wildlife Fund Australia.
CALM Computer Policy Committee
Division of Research and Planning Computer Users Committee, Chairman.
Kangaroo Management Advisory Committee

Allan H. Burbidge B.Sc. (Hons), P.h.D. - Research Officer

RESEARCH TOPICS

Biological survey for nature conservation.
Conservation of bird species and bird communities.
Biogeography and conservation of triggerplants (*Stylidium*).

AREAS OF INTEREST AND ADVICE

Biology and conservation of terrestrial birds, specially Ground Parrot and raptors.
Biology and conservation of triggerplants (*Stylidium*).

COMMITTEES

Western Australian Co-ordinator of Australasian Raptor Association.

Choo, H.C. B.Sc. (Hons), M.Sc. - Computer Systems Officer

COMPUTING PROJECTS

Under Development

Banksia Atlas (Plot and Reports)
Animal Ecology
Vegetation Survey
Biological Survey
Wetland Monitoring
Population Estimates
Wildlife General
Statistical Analysis Systems
Numerical and Taxonomic Analysis

Proposed 1986/87

Word Processing and its Interfaces
Statistical and Numerical Analysis
Species Distribution Atlas
Graphics
Automated Data Capture
Biological Survey
Animal Ecology
Vegetation Survey
Kangaroo returns - Redevelopment
Fire Ecology
Water Birds
Interface to Taxonomic Packages
Gazetted Rare Flora Database
Spread Sheet Applications (eg LOTUS 123)
Geographical Information Requirements - Evaluations and Communications

AREAS OF INTEREST AND ADVICE

Data Processing, Organization and Management
Analyses of Data
Development and Integration of Systems
Graphics
Geographical Information Systems
High Level Fourth Generation Language Applications
Computer Hardware/Software and Systems

COMMITTEES

CALM - Research and Planning Directorate Computer Users Committee.
SIGRURAL - Sub Committee for Data Custodianship

David J. Coates, B.Sc. (Hons), Ph.D. - Research Officer

RESEARCH TOPICS

Flora conservation genetics and genetic systems.
Rare flora - conservation status, eco-geography, life history, management, administration.
Evolutionary biology and systematics of triggerplants and *Eremaea*.
Karri population genetics and breeding systems.
Conservation of genetic resources.

AREAS OF INTEREST AND ADVICE

Genetic management of rare and endangered flora and fauna.
Plant and animal evolutionary biology, genetics and systematics.
Flora conservation and management.

COMMITTEES

None.

Gordon Friend, B.Sc. (Hons), Ph.D. - Research Officer

RESEARCH TOPICS

Role of fire in management of natural ecosystems, particularly conservation reserves in the wheatbelt.
Influence of fire on herpetofaunal and invertberate communities.
Life history of selected small vertebrates and invertebrates and influence of disturbance (especially fire).
Sampling methodologies for studying animal communities and populations.

AREAS OF INTEREST AND ADVICE

Effects of human-induced disturbance on faunal populations; particularly fire and forestry operations.

Structure and diversity of animal communities in relation to climate and vegetation.
Fauna/habitat relationships.
Management and faunal conservation in small nature reserves.
Sampling methodologies for faunal surveys.

COMMITTEES

Organising Committee - W.A. Fire Management Workshop 1986.
CALM/CSIRO Fire Liaison Committee.

Tony Friend B.Sc. (Hons), Ph.D. - Research Officer

RESEARCH TOPICS

Ecology and biology of the Numbat.
Conservation of the Numbat.
Captive breeding of Numbats.
Regulation of termite populations in forests.
Taxonomy, ecology and reproductive biology of terrestrial amphipods.
Ecology of the Western Barred Bandicoot.

AREAS OF INTEREST AND ADVICE

Conservation of invertebrates.
Forest invertebrates and fire.
Biogeography of Australian forest invertebrates.
Feeding in echidnas.

COMMITTEES

None.

Stuart Halse B.Sc. (Hons), Ph.D. - Research Officer

RESEARCH TOPICS

Effect of salinity on usage of wetlands by ducks.
Effect of salinity on composition of invertebrate fauna in wetlands.
Waterfowl population dynamics.
Biology of Cape Barren Geese.

AREAS OF INTEREST AND ADVICE

Avian reproductive biology.
Avian economic pests.
Management of wetlands.

Angas Hopkins B.Sc. (Hons) - Research Officer

RESEARCH TOPICS

Management of natural ecosystems - especially in relation to the use and effects of fire in conservation reserves.
Development of techniques for the rehabilitation of disturbed areas.
General ecological field studies - Eneabba, Mt Lesueur, Tutanning, Boyagin, Two Peoples Bay, Lake King and Esperance.
Rehabilitation of mined areas - Eneabba, Barrow Island, Woodvale, Mandurah.
Development of computer systems for integrating resource data on individual reserves together with fire behaviour tables to permit long term effects of management decision to be predicted.
Studies of regeneration following fire - Eneabba, Mt Lesueur, Tutanning, Two Peoples Bay, Lake King, Middle Island.
Revegetation of previously farmed land at Tutanning.
Species richness (especially in W.A. heathlands) and biogeographic implications.
Design of a conservation reserve system in relation to environmental gradients and design of individual reserves particularly in relation to degrading influences.
Effects of drought stress on native plant species.
Monitoring rates of change in natural communities of plants and animals.

AREA OF INTEREST AND ADVICE

Environmental Impact Assessment.
Heritage matters.
Mangroves, especially Anglesea Island (Bunbury).
Effects of Honey Bees on native plants.
Planning for management and actual management of National Parks, Nature Reserves, State Forests and other Crown lands.

COMMITTEES

Australian Heritage Commission (Part Time Commissioner).
Australian Heritage Commission - W.A. Natural Environment Evaluation Panel.
National Conservation Strategy for Australia, Interim Consultative Committee.
Mineral Sands Agreements : Rehabilitation Co-ordinating Committee.
Technical Committee on Environmental Problems associated with Underground Water Extraction.
CONCOM/CSIRO Mallee Conservation Working Group.
Ecological Society of Australia - Council.
W.A. Bush Fires Board (Deputy Member).
Various organizing committees for scientific meetings, seminars, workshops.

Stephen Hopper B.Sc. (Hons), Ph.D. - Research Officer

RESEARCH TOPICS, AREAS OF INTEREST AND ADVICE

Rare flora - conservation status, locations, identification, biology, administration, legislation, management.
Licensing and management of the wildflower industry.
Identification and biology of eucalypts, orchids, kangaroo paws and *Conostylis*.
Botanical consultants - supervision, project design, administration.
Impact of honey bees on native flora and fauna.
Pollination ecology (especially involving birds and mammals).
Community involvement in biological data gathering (eg Banksia Atlas).
Plant and animal systematics, genetics, evolutionary biology, biogeography.
Conservation of genetic resources.
Conveying flora conservation to the general public via the mass media, posters etc.
Scientific methodology, experimental design.

COMMITTEES

CONCOM Working Group on Endangered Flora.
CITES Plant Working Group.
IUCN Species Survival Commission Orchid Specialist Group.
Australian Orchid Foundation Research Committee.
Australian Flora Foundation Scientific Committee.
WAWA Flora Committee (current status unknown).
Technical Advisory Committee to the Road Verges Conservation Committee.
Advisory Committee for the Bachelor of Applied Science (Biology) course, W.A.I.T.
Supervisory committees for two Ph.D. students (U.W.A.) and three M.App.Sc. students (W.A.I.T.).

Greg Keighery B.Sc. (Hons) - Research Officer

RESEARCH TOPICS

Biological survey of existing and proposed reserves
- Nullarbor.
- Stirling Range and environs.
- Lancelin to Dongara islands.
- York/Northam nature reserves.

Systematics of Western Australian Flora.
Naturalized Flora of Western Australia.
Biology of Western Australian Flora.

AREAS OF INTEREST AND ADVICE

Poorly collected, rare flora.
Distribution of native, naturalized flora.
Public involvement in flora conservation (Vice President

W.A. Wildflower Society, Co-ordinator of plant study groups for Western Australia, provision of name changes of W.A. plants to newsletter).
Pollination native flora.

COMMITTEES

None.

Jack Kinnear B.Sc., M.Sc., Ph.D. - Research Officer

RESEARCH TOPICS

Ecology and management of marsupials.
Ecology of exotic predators with reference to their impact on wildlife.
Control of exotic predators.
Competition between feral species and native species.
Conservation Genetics: with special reference to the problems associated with small population size, habitat isolation and fragmentation.
Fire ecology and conservation.
Re-introduction of species to reserves.

AREAS OF INTEREST AND ADVICE

Kangaroo management.
Nutritional biology and ecology with special reference to herbivory.
Application of microcomputers to research.

COMMITTEES

Feral Cats - Biological Committee.
Feral Pigs - Control.
Computing - Wildlife Research Branch.
Computer Users Group - Division of Research and Planning.

Jim Lane B.Sc. - Senior Research Officer

RESEARCH TOPICS

Waterbird population and habitat assessment

AREAS OF INTEREST AND ADVICE

Conservation of waterbird populations and their habitats.
Management of waterfowl hunting.
Public attitudes to wildlife conservation.
Community involvement in wildlife conservation.
The role and structure of government.

COMMITTEES

CONCOM Working Group on International Treaties relating to

Migratory Birds and Wetlands of International importance.

Research Committee of the Royal Australasian Ornithologists Union.

Northern Arthur River Wetlands Rehabilitation Committee.

Beverley Lakes Working Group.

Norman McKenzie B.Sc. (Hons), M.Sc. - Research Officer

RESEARCH TOPICS

Biological survey for nature conservation.
- Design philosophies, strategies, data bases.
- CTRC System 11 (Eastern Goldfields).
- Nullarbor.
- Fitzgerald River National Park.
- Kimberley.
- Deserts.
- relevance in reserve system design.

Taxonomy of bats in the Genus *Mormopterus*.
Community Ecology of Animals.

AREAS OF INTEREST AND ADVICE

Mammals in general - distribution, taxonomy, conservation status.
Acquisition of Nature Reserves.
Biology, taxonomy and ecology of bats.
Mangrove communities in Western Australia - distribution, vertebrate fauna, conservation.
Application of biological survey data to wildlife management.
W.A. editor of "*Macroderma*".

COMMITTEES

Biological Surveys Committee.
DCE Working Group on the Bungle Bungle area.

Keith Morris B.Sc., M.Sc., - Research Officer, Islands

RESEARCH AND MANAGEMENT TOPICS

Management of Island Nature Reserves.
Biological Survey of North West Island Nature Reserves.
Preparation of Draft Management Plan for Dampier Archipelago Nature Reserves.
Turtle utilization of North West Islands.
Control of introduced plants and animals on Island Nature Reserves.
Assessment of recreation and oilfield activities on North West Islands.

Biology of vertebrate populations on islands.

AREAS OF INTEREST AND ADVICE

Conservation and biology of arid zone mammals.
Control of *Rattus rattus* and fox on islands.
Breeding biology of Turtles.
Sea bird nesting on islands.
Bird hazards to aircraft at aerodromes.
Aerial survey techniques.
Increasing public awareness of conservation reserves, especially islands.

COMMITTEES

Pilbara Regional Herbarium Management Committee.
Science and Technology Committee, Karratha College.

David Pearson B.A. (Hons) - Research Officer

RESEARCH TOPICS

Traditional Aboriginal Burning
Arid Zone Fire Behaviour
Impact of Management Burns on Small Mammals and Reptiles
Arid Zone Aerial Burning
Arid Zone Fire Monitoring

Bob Prince B.Sc. (Agric.) (Hons), Ph.D. - Research Officer

RESEARCH TOPICS

Dugongs - biology and management, traditional exploitation, seagrass resource base.
Dorre Island - Fire ecology - development of regenerating vegetation and its effects on distribution of the vertebrate fauna.
Banded Hare Wallaby - Dirk Hartog Island ecology in relation to reestablishment of the species on Dirk Hartog and general biology.
Marine mammals, and traditional fisheries - incidental to dugong and turtle work.
Marine turtles - surveys, management research, exploitation, general biology.
General aspects of land and wildlife management in relation to problem species.

AREAS OF INTEREST AND ADVICE

Land management, especially rangelands.
Traditional fisheries in relation to wildlife conservation.
Macropods in general.
General wildlife conservation and management problems.

COMMITTEES

Corresponding member, IUCN/SSC Sirenia Specialist Group.

Anne Taylor B.A. (Hons) M.Sc., - Research Officer, Banksia Atlas

RESEARCH TOPICS, AREAS OF INTEREST AND ADVICE

Banksias.
Community involvement in biological data gathering.
Community involvment in environmental issues.
Techniques of biological atlassing.
Extension and publicity of wildlife information.

COMMITTEES

W.A. Wildflower Society - Eastern Hills Branch. Institute of Horticulture - W.A. State Executive.