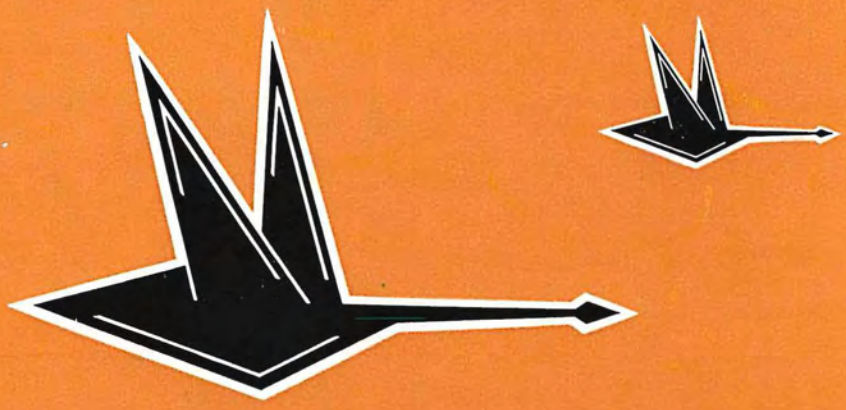
2(1)

WESTERN AUSTRALIA

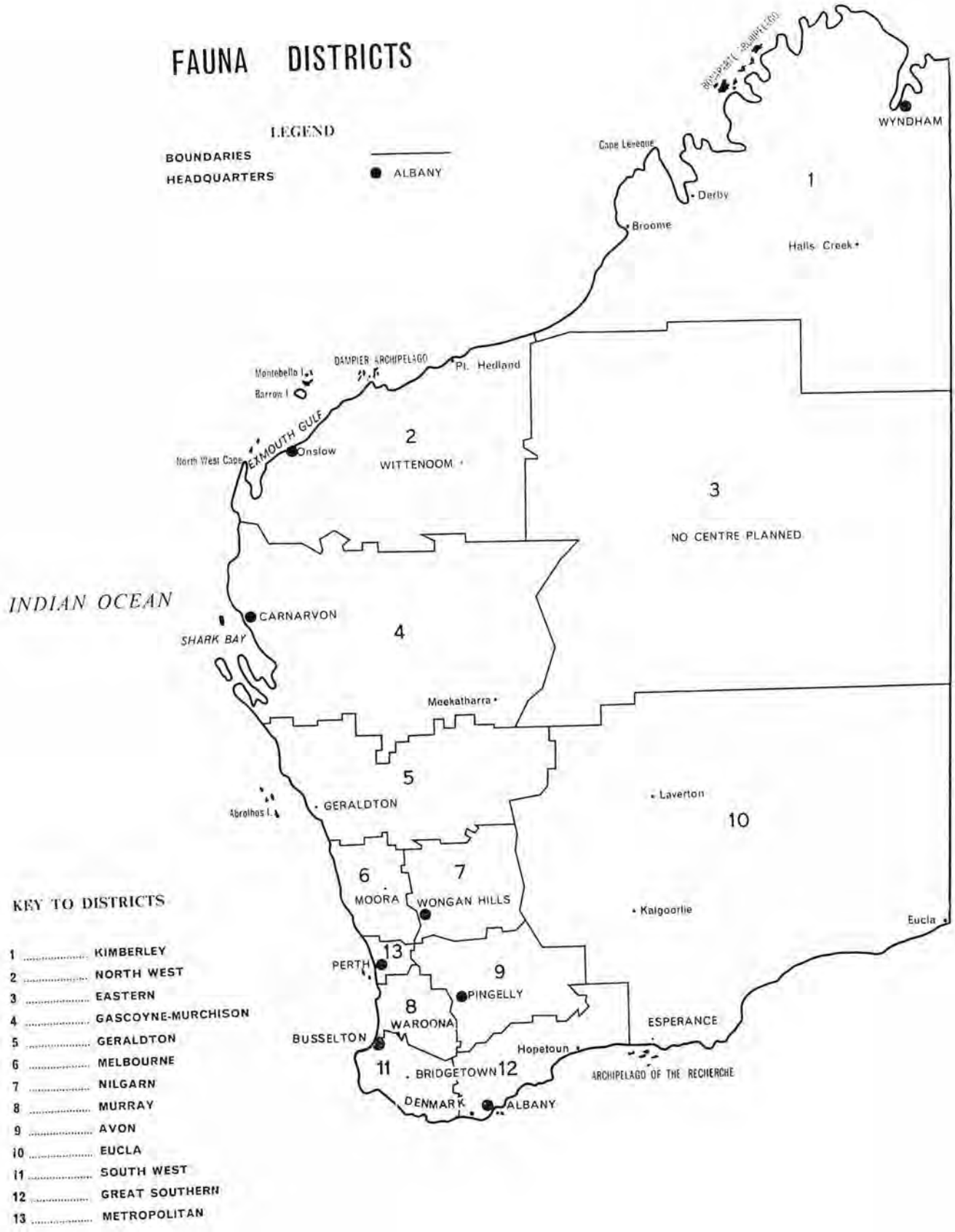


S.W.A.N.S.

State
Wildlife
Advisory
News
Service

Vol. 2 No. 1
Summer, 1971

FAUNA DISTRICTS



KEY TO DISTRICTS

1 ..... KIMBERLEY
2 ..... NORTH WEST
3 ..... EASTERN
4 ..... GASCOYNE-MURCHISON
5 ..... GERALDTON
6 ..... MELBOURNE
7 ..... NILGARN
8 ..... MURRAY
9 ..... AVON
10 ..... EUCLA
11 ..... SOUTH WEST
12 ..... GREAT SOUTHERN
13 ..... METROPOLITAN

S.W.A.N.S

Vol. 2 No. 1

SUMMER, 1971

Issued by direction of the Hon. R. Davies, M.L.A., Minister for Fisheries and Fauna.

Director of Fisheries and Fauna: B.K. Bowen, B.Sc.

Chief Warden of Fauna: H. B. Shugg, A.A.P.A.

The support of the public is an essential component in any conservation or reserve management programme—but an informed, educated public is needed to ensure its continuing success.

This publication is designed as a medium by which the various organisations, individuals, and wildlife management personnel may be kept informed of the work being carried out by this department; of departmental policies and directions; and for promoting a better understanding and appreciation of Western Australian wildlife and the role it plays in maintaining a suitable environment in which man can live.

S.W.A.N.S. is published quarterly at the conclusion of each season by:

Extension and Publicity Service,
Department of Fisheries and Fauna,
108 Adelaide Terrace,
Perth, Western Australia 6000.

Editor: A. C. Waldon, A.A.I.A. (Dip.)

Assistant Editor: J. J. Brennan.

Something to think about....

IN THE BEGINNING GOD CREATED . . .

God gave man "dominion over the fish of the sea, and the birds of the air, and over the cattle, and over all the earth."

Genesis 1:26

THEN MAN DESECRATED . . .

"And I brought you into a plentiful country, to eat its fruit, and its goodness, but when ye entered, ye defiled my land, and made mine heritage an abomination."

Jeremiah 2:7

IN THIS ISSUE . . . .

SUBMISSIONS TO THE WILDLIFE INQUIRY

In 1970 a House of Representatives Select Committee was appointed to inquire into and report on Wildlife Conservation in Australia.

The Committee was asked to report on the following:—

(a) The need for an urgent and comprehensive survey of wildlife populations including birds, mammals of the land and water, and reptiles, and their ecology to enable conservation measures to be effectively applied to threatened species;

(b) The adequacy of the several systems of national parks, reserves, etc., of the States and territories to ensure that at least the minimum areas of the major animal habitats and the wildlife of the continent are preserved, held securely, and are properly managed in the national interest;

(c) The effects of pollution and the widespread use of pesticides on wildlife population;

(d) The effect on the population of kangaroos of the trade in meat and hides and the effect of other industrial exploitation on wildlife;

(e) The need for international and interstate agreements for the effective conservation of migratory animals;

(f) The threat presented to wildlife by the large numbers of domestic animals gone wild, particularly in northern Australia; and

(g) The need for a Commonwealth wildlife conservation authority.

Under the chairmanship of Mr. E. C. M. Fox, M.P., the Select Committee visited Perth during February.

Submissions were made by the Department of Fisheries and Fauna, the Museum and a number of other organisations concerned with wildlife and conservation.

A resumé of the Department's submissions follow.

(a) THE NEED FOR A SURVEY

Dr. A. A. Burbidge, Senior Research Officer, who put the Department's submissions, said that the Department considered that there was a definite need for a wildlife survey not only of birds, mammals and reptiles (as indicated in the Committee's terms of reference) but also of amphibia, freshwater fish, invertebrate groups, and plants, as the aim of any conservation measure should be to preserve representative ecosystems, not just individual species.

It was indicated that a comprehensive survey would either confirm or disprove the present doubt regarding the rarity of some species and enable conservation measures to be directed toward threatened species.

Dr. Burbidge also pointed out that limited staff and finance prohibited the Department's research officers from undertaking extensive surveys of this type.

(b) THE ADEQUACY OF THE RESERVE SYSTEM

It was submitted that a reserve system should be adequate in two main ways:—

1. It should protect as wide a range of ecosystems as possible; and
2. The individual reserves should be of adequate size and should be managed so that the flora and fauna persist. The Department's aim in this direction has been to obtain representative areas of the primitive environment and its fauna and to retain a number of smaller reserves which permit the co-existence of native species and man.

The number of reserves set aside for the conservation of flora and fauna totalled 326, covering approximately 12 million acres (30/9/1970).

These areas have been tentatively classified into five groups:—

(1) **Primitive Areas**

These areas of bushland contain all the elements of the local flora and fauna and are considered large enough to maintain this variety with a minimum of management.

The major areas under this category comprise eight reserves totalling 11½ million acres.

(2) **Rare Species Reserves**

A. **Mainland Areas**

Contains rare or important species in a relatively small area of land

One of the gullies at Two Peoples Bay Wildlife Sanctuary (Rare Species Reserve) where the Noisy Scrub Bird is found.

which may not be entirely in its primitive state. Intensive management is necessary.

There are 11 main reserves totalling 37,000 acres.

B. **Offshore Islands**

These important areas contain rare or threatened species which have been isolated from the mainland and have generally been less affected by man or exotic fauna. Island reserves also act as refuges for marine fauna. Considerable surveillance and management needed.

The 27 island reserves have a total area of approximately 80,000 acres.

(3) **Local Bushland Reserves**

These areas have been set aside to provide breeding habitat and stopping places for a variety of local flora and fauna and to maintain the character of the particular area. These areas comprise 190 reserves.

(4) **Wetland Areas**

These are areas reserved for the conservation of waterfowl and associated flora and fauna. Shooting of game birds in season is permitted on some of these areas. There are 80 wetland reserves.

Dr. Burbidge told the Committee that the reserve system in Western Australia is incomplete and inadequate because of the lack of information on the indigenous flora and fauna, the unavailability of some areas to be reserved due to agricultural development, and because no reserve is secure from mining.

Photo by courtesy of "Sunday Independent".

(c) EFFECTS OF POLLUTION AND PESTICIDES

In Western Australia there are no available data on this problem, although the Department is designing a pesticides monitoring programme for fish and wildlife.

(d) COMMERCIALISATION OF FAUNA AND THE EFFECTS OF INDUSTRY

(1) **Kangaroos**

It was pointed out to the Select Committee that the effects of direct commercial exploitation are not necessarily the most important factors influencing survival, although extensive exploitation of insecure populations could affect chances of survival. The particular strategy of management for any species will depend on the situations involved, but the criterion of success in each case is identical, i.e. the survival of viable populations of the particular species. In a wider context, the aim of nature conservation is to ensure the preservation of viable populations of both plants and animals in their natural habitat, and management programmes which involve the direct exploitation of wildlife should also satisfy this aim. For these reasons exploitation should be assessed in relation to the conservation and management programmes for the particular species. From the viewpoint of resource analysis, wildlife populations have values in terms of retention of wilderness conditions, not only for the scientific value of these areas, but also for their contribution to the satisfaction of the moral and aesthetic desires of the general public. In addition to this, some species have a direct commercial value either for the sporting or commercial hunter.

The real problem in the conservation of kangaroos is not so much one of preservation, because these animals can survive in relatively disturbed situations, but one of optimisation of total value of a natural resource. In the appropriate situations, a controlled exploitation programme will realise part of the direct value of this resource but more importantly such a programme can help to re-

solve some of the major conflicts associated with populations on the open range and still lead to retention of these populations. In these circumstances controlled exploitation is a legitimate management practice available to Fauna Authorities.

Dr. Burbidge, in discussing the Western Australian kangaroo trade, summarised the position as follows: Uncontrolled exploitation of the different species of kangaroos would result in the reduction of the existing population to fugitive remnants on inaccessible, marginal areas of habitat, and the collapse of the kangaroo trade itself. Furthermore, it appears unlikely the removal of kangaroos in this way would appreciably affect the economic position of the pastoral industry and the loss of these species would represent the squandering of a national asset.

(2) Crocodiles

The committee was told that two species of crocodiles exist in the north of Western Australia. The freshwater crocodile is fully protected and, although it has never been the subject of an industry, a considerable amount of poaching has taken place. Poached skins are sold in Queensland where exploitation of crocodiles is not controlled. In the past the saltwater species was exploited but as a result of a report by Dr. H. R. Bustard of the Australian National University, this crocodile has also been protected. The Department visualises commercial farming in the future.

(3) Emus

An emu farming project is under way in Western Australia and, if successful, may become an important industry. All animals will be bred in captivity.

(4) Industrial Effects

Whether or not to permit mining on National Parks and Wildlife Sanctuaries is an area of some controversy at the moment.

The Department has presented its views on this problem to the Government appointed Committee of Enquiry into the Mining Act.

[The Department's submissions were reproduced in S.W.A.N.S. Vol. 1 No. 2 Spring 1970.]

(e) THE NEED FOR INTERNATIONAL AND INTERSTATE AGREEMENTS

(1) Migratory Species—International.

Dr. Burbidge said that very little information was available on possible problems relating to bird migration. The attention of the Committee was drawn to Resolution 7 of the 1970 Australian Fauna Authorities' Conference (AFAC). The Conference resolved to appoint a working party of three to attempt to define the problem and, if necessary, prepare terms of reference for a Committee to be formed by the AFAC.

(2) Migratory Species—Interstate.

It was stated that Western Australia had few problems in this regard due to its isolated position. One area of interest referred to however, is waterfowl conservation, particularly in the north of the State, which is at present being examined by the Australian Committee on Waterbirds, a Sub-committee of AFAC.

(3) Interstate Trade.

Problems may arise in the future, especially in relation to trade in kangaroo products, the Committee was told.

(f) FERAL DOMESTIC ANIMALS

It was pointed out to the Committee that little information is available on this topic. Attention of the Select Committee was drawn to Resolution 18 of the Australian Fauna Authorities' Conference.

The resolution pointed out that the Northern Territory and Kimberley area of Western Australia have high populations of feral domestic animals which are regarded as pests. Many of these animals have become established in wildlife sanctuaries and have contributed to the destruction of habitat.

AFAC therefore resolved that:

> "There is a need for research to be carried out in the North-West of Australia on the the effect of feral animals on indigenous species and their habitats."

(g) THE NEED FOR A COMMONWEALTH WILDLIFE CONSERVATION AUTHORITY

It was submitted that the conservation of flora and fauna is basically tied to the States since only they can control the reservation of land for this purpose. The Department, however, suggested to the Select Committee that the Commonwealth could assist in a number of ways:

(1) Control of import and export of fauna.

(2) Providing grants to the States for fauna conservation. Funds could be used to purchase private land for reserves. Money is also needed for research and management; this could be provided directly to the States or indirectly to C.S.I.R.O. and the Universities.

(3) Setting up a national biological survey to provide information necessary to reserve allocation and management.

(4) Supporting Legislation. This may be necessary in specific cases, e.g.: the movement of kangaroo products between States.

FORMER PASTORAL LEASE TO BE FAUNA SANCTUARY

Wanjarri Station.

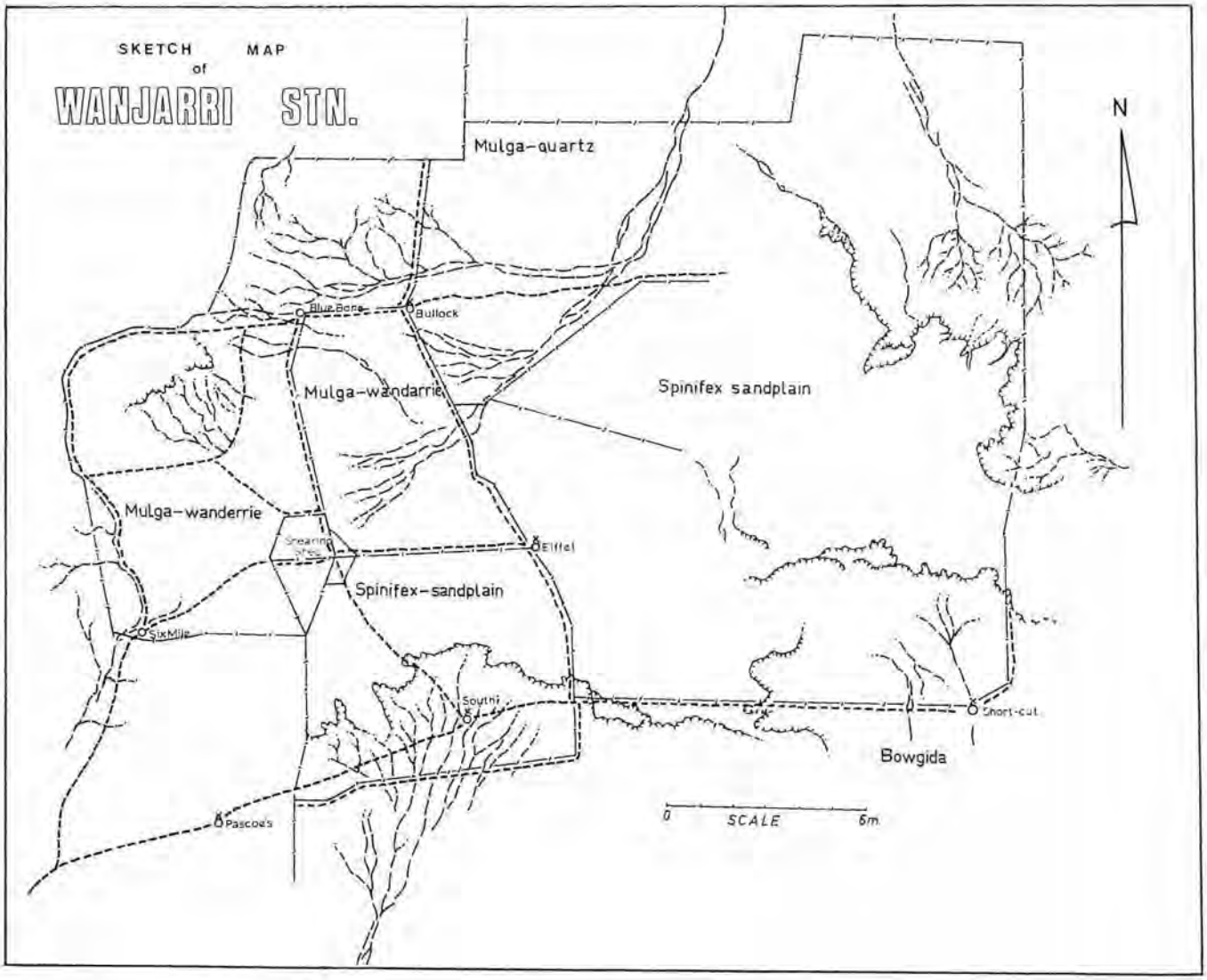
A former pastoral lease of about 132,000 acres situated in the Kathleen Valley south of Wiluna, is being purchased by the Department of Fisheries and Fauna as a sanctuary for flora and fauna.

In announcing the purchase in December the Minister for Fisheries and Fauna, the Hon. G. C. MacKinnon said that negotiations had been in hand since 1967 when the leaseholder, Mr. T. K. Moriarty, first offered the property as a fauna sanctuary.

When negotiations for the sale are completed, application will be made to the Lands and Surveys Department to have the area declared as an "A" Class Reserve vested in the Western Australian Wildlife Authority. Mr. MacKinnon said that the area had been inspected on several occasions by scientists from the Museum, University of W.A., C.S.I.R.O., the U.S. Museum of Natural History and the Royal Australian Ornithologists' Union. All were impressed with the quantity and quality of the fauna and flora in the area. Wanjarri has been the subject of separate reports by Dr. S. J. J. F. Davies, Officer in Charge of the W.A. Division of Wildlife Research, C.S.I.R.O., and Dr. A. A. Burbidge, Senior Research Officer, Fauna Branch, Department of Fisheries and Fauna. Extracts from these reports follow:

Landforms.

Wanjarri is made up of a series of peneplain scarps lying roughly in a NE/SW line. The laterite formations cover decomposed granite except in places where the granite is exposed as boulders or domes. Sandy soils predominate near the top of each scarp and grade into loamy soils at the base of the next. In the stony outwash plains fronting the breakaways, soils are generally shallow with textures ranging from gritty clay sands to small stones. Hard pan is common and where this occurs run-off conditions prevail.



Flora.

The scarps support a characteristic and rich vegetation which grows in sheltered indentations along the edge of the scarp. Notable plants are *Callitris, Calythrix, Dodonea* and *Scaevola.*

Spinafex *(Triodia)* associations cover the sand plains on the top of the scarps, sometimes with an overstorey of eucalypts and in some instances, a variety of Protaeceous shrubs (includes prickly-type shrubs e.g. *Banksia)* and *Acacias.* Marked short term changes can be induced in this type of vegetation by burning but fairly rapid regeneration does occur.

Mulga *(Acacia aneura)* dominates the loamy soils in association with wandarrie grass and/or bowgida *(Acacia linophylla)* on the sandier sites.

There are many dead mulgas and a variety of shrubs *(Eremophilia spp.)* wherever quartzite pebble-plains occur. The deterioration of mulga stands should not be over emphasised since mulga appears to grow in even-age stands and if one tree dies it is likely that its neighbours are also dying. Extensive regeneration is likely after a good season, if seed is available.

Small areas of almost pure bowgida sand plain are found in the south east and north west area of Wanjarri. Large accumulations of seed found under shrubs in the north west patch illustrate the vigour of the shrubs.

Only one creek lined with *Eucalyptus camaldulensis* occurs on Wanjarri, along the western boundary, but the trees are vigorous and apparently typical of the habitat.

Fauna

The area is rich in arid-zone fauna. Among the reptiles, lizards are well represented. The black, tree dwelling goanna *(varanus)* and the club-tailed gecko are notable. The range of available habitats suggests that Wanjarri contains a representative sample of arid-zone reptiles.

During the R.A.O.U. visit to Wanjarri between August 29 and September 5, 1970, 74 species of birds were recorded. Of these, 35 species were seen breeding, which illustrates the healthy state of the habitat and the relatively short nesting period in this environment.

Two particularly interesting species, the Mallee-Fowl and the Spotted Bower-bird, were the subject of special study during the excursion. In a systematic search of one area a mallee-fowl mound was located. Three bowers of the bower-bird were also located and birds were seen at four of the five mills, where a continuous watch was maintained. Bourke Parrots and Grey Honey-eaters, Central Australian species not known to be common anywhere, were frequent at Wanjarri, as were the interesting chat and wren-like birds of the family *Maluridae.*

Both Euros *(M. robustus)* and Red Kangaroos *(M. rufa)* occur at Wanjarri. Foxes, dingoes, rabbits, goats and camels have also been sighted or their presence inferred by fresh tracks. In the breakaways, stick nests of the type made by stick-nest rats *(Leporillus sp.)* have been found as well as echidna *(Tachyglossus aculeatus)* droppings. During the R.A.O.U. excursions some extensive warren systems were located in mallee scrub on the south of Wanjarri. Some of these were used by goannas *(Varanus)* but the possible existence of colonies of a middle-sized macropod or a bandicoot should not be excluded.

Fortunately, Wanjarri lies in a zone in which the range of bird species overlap and thus it has a richer avian fauna than most arid areas. Undoubtedly, the presence of spinifex sand plains is a significant factor in this richness and will probably enhance the number of species representing other groups of animals and plants.

CROCODILE TEARS

The poem "Plastic Autumn" which appeared in S.W.A.N.S. Vol. 1 No. 1 was written by Mrs. Jean R. Smith, a freelance journalist and conservationist from South Brighton, South Australia.

After seeing a photograph in the local newspaper Mrs. Smith was prompted into writing another poem entitled "Crocodile Tears" which she has kindly allowed us to reproduce.

The photograph pictured a group of young children with their noses pressed up against the window of a pet shop—they were staring longingly at a baby crocodile.

Crocodile Tears

When I outgrow aquariums
What will become of me?

A thousand dusty miles between
My tropic estuary,

Where warmer waters meet the sea
And crabs ascurrying
Dig their way to freedom,

While I peer through a glass
And hide my fears . . . .

Maybe some child, aweary of his toys
Will buy me. Take me home

And watch with merriment
His parents' horror.

They'll picnic by some rippling brook,
Then after barbecuing

Will gently place me in the stream.
Will they know what they're doing to me?

DID YOU REPORT IT?

Fauna Warden K. Morrison recently reported that a dead 20-foot whale was washed ashore near Fish Rock, Dunsborough.

In the local Press the whale was reported as a Finback Whale but a study of the photograph by Mr. J. Bannister, Curator of Mammals at the Museum, revealed that it was probably a Minke Whale—a close relative of the Finback.

The stranded whale at Busselton—identified by the Museum as a Minke Whale or Lesser Rorqual.

Although Mr. Morrison did not see the whale before it was buried he was informed that there were no signs of external injury, and no apparent reason for its fate.

A few weeks later another small whale, apparently sick, came into shallow waters between the two Busselton jetties and, after some hours, headed back into the open sea.

Once again Mr. Morrison was not informed of the whale's presence in the area and consequently he was unable to observe it or attempt any examination.

Although the two incidents were probably unrelated it is unfortunate that Mr. Morrison was not informed in time to carry out an examination of the whales.

From time to time the Department's inspectors and wardens do receive reports of strange or unusual sightings but all too often these sightings are reported long after any identification or examination can be attempted.

While inspectors and wardens make every endeavour to investigate any unusual sightings or happenings they must rely to a large extent on the co-operation and assistance of the general public to report these sightings as soon as possible.

Honorary Inspectors and Wardens, fishermen and others can play an important role in helping to determine the fate of many creatures washed up on our shores by making an immediate report to the Department's field staff or to the Museum.

Mr. J. Bannister of the West Australian Museum is anxious to receive information about stranded marine animals, particularly whales. Some species of whales are only known from records of stranded animals and there is always the chance of a rare find.

Mr. Bannister said that the Museum would make every endeavour to investigate all reports forwarded to them.

On the outside back page of this edition is a list of addresses and telephone numbers of the Department's Inspectors and Wardens.

CARE OF SICK OR INJURED FAUNA

The Fauna Conservation Act provides that wild native fauna should be protected and conserved. To this end, funds as approved by Parliament are allocated annually to the Department of Fisheries and Fauna. These funds are not unlimited and the Department must allocate them to those aspects of conservation and protection which its officers consider most important and urgent.

Except in the case of rare species, the caring for sick, injured and derelict individual animals cannot be said to be of first importance in the preservation of species. It must rank, for example, below such things as the acquisition, care and management of sanctuaries, the control of commercial exploitation and the research work necessary to show how best these things can be done.

There is no doubt, however, that care of unfortunate animals is a most laudable pursuit, nor that a large section of the public expects such a service to be available. To date it has been provided by volunteers who have devoted their own time and money to their self-imposed tasks. Two such persons are Mrs. A. B. Anderson, B.E.M., of Bicton, and Miss C. A. Nicholls, of Dalkeith, who have at great personal sacrifice of their own slender financial resources been active in this work for more than a decade.

The Department has encouraged the efforts of these people and provided them with some financial assistance. It has also published brochures on how to care for sick and injured fauna, and co-operated in their collection and ultimate release.

More recently the Government agreed to assist the R.S.P.C.A. with an initial grant of $4,000 to erect a treatment room, holding yards and cages so that they could provide skilled and humanitarian care for sick and injured wildlife on a long term basis. In addition the Government agreed to provide $1,500 each year towards running costs.

Unfortunately, after the R.S.P.C.A. had had the necessary plans drawn up for the extension of their premises at Belmont, the Society was refused

permission to proceed by the Shire of Belmont. Further representations have recently been made to the Shire, but the Council has remained adamant in its refusal to allow the Society to extend its premises.

The position now stands that the R.S.P.C.A. has regretfully had to refuse to accept responsibility for this laudable humane community service which would be best provided by a voluntary organisation with some government assistance.

Fauna Wardens Conferences

In the first edition of S.W.A.N.S., Honorary Fauna Wardens were invited to advise the Department of the day which they considered to be the most suitable for holding regional conferences.

The survey revealed that:

24 per cent. of Wardens preferred Fridays.

22 per cent. of Wardens were in favour of Saturdays, and

15 per cent. of Wardens indicated a preference for Sundays.

The highest percentage for any other day of the week was less than 10 per cent.

As a result of this survey the Department has decided to hold future conferences on the two most popular days depending, of course, on the facilities available at the time. Thanks are expressed to all those Wardens who assisted in the survey.

SHORT-NECKED TORTOISE

The 1970 Annual Report of the Zoological Gardens Board of W.A. contained the following report of successful breeding of the Short-necked Tortoise:—

> For the third time, the Short-necked Tortoises have bred, but for the first time, two clutches have hatched, indicating that two females bred. The broods consisted of four and three and both surfaced after very heavy falls of autumn rain, the first on 24-29 April and the second brood on 9-11 May.
>
> Hatchling Short-necked Tortoises climb like tree-frogs and before discovery, one of the brood of three had climbed from the pool of the adults into that occupied by yearling Western Long-necked Tortoises where its mutilated remains were found next day. The six survivors are doing well on a diet of water-fleas.

Correction SWANS Vol. 1 No. 2

In the submissions to the Committee of Inquiry into the Mining Act, which were published in S.W.A.N.S. Vol. 1 No. 2 Spring 1970, Item (1) (b) was reproduced on Page 23 under submissions made by Professor A. R. Main, Department of Zoology, University of Western Australia.

Item (1) (b) was, however, a submission by the Department and should have appeared in the Directors' submissions on Page 4.

FAUNA WARDEN—APPOINTMENTS

Baird, Lee Raymond.
Brown, Michael Jeffery.
Bruce, Barry Charles.
Faulkner, Geoffrey Basil.
Gibb, Walter Andrew.
Hawkins, Barry Leonard.
Kendrick, Ron Edward Phillip.
Kendrick, Robert William.
Lewis-Driver, Christopher.
Lilburne, Spencer James.
Lukies, Graeme Walter.
McKenzie, Norman Leslie.
McWhirter, Stephen Charles.
Marshall, Kevin James.
Moss, Leslie Roy.
Pedersen, Haakon.
Stickland, Peter James.
Van Roon, Johannes Christianus.
Kirk, Robert James.
Looby, John Grayden.

Gazetted 18 December, 1970.

HONORARY FAUNA WARDEN - APPOINTMENTS

Gloster, Gerald Fitz-Gerald.
Davies, Lester Lloyd.

Gazetted 13 November, 1970.

DISTRIBUTION OF S.W.A.N.S.

This journal is issued free of charge to various organisations and individuals associated with conservation and wildlife management.

If you are not receiving an individual copy and wish to do so, please write and request that your name and address be placed on the mailing list.

See publisher's note, column 1, page 3.

(EDITOR.)

ACF MEMBERSHIP DRIVE

Since the commencement of the Australian Conservation Foundation membership drive last June the total number of members in this State has increased fourfold making W.A. the fastest growing membership body in Australia.

When membership targets were alloted for each State, Western Australia had 100 members and was asked to recruit a further 150 supporters. In just over six months to the end of January this year, new membership had reached 442.

Throughout Australia, the total number of ordinary members in January, 1970, was 2,200. This figure has now climbed to over 5,000. A break-up of membership figures for each State is shown in the table below.

The A.C.F. is a non-profit, private organisation which was set up in 1965 to promote the understanding of conservation throughout Australia. Its methods are to act as a forum where people can analyse problems, formulate solutions and and spread the understanding of these issues by means of publications, press releases, seminars and direct influence.

Anyone interested in joining the Foundation should direct their enquiries to Brigadier C. M. L. Elliott of 1 Mosman Tce, Mosman Park—Tel. 31 3329.

ORDINARY MEMBERS

Membership	Australia	Queensland	New South Wales	Victoria	South Australia	Western Australia	Tasmania	Northern Territory	Australian Capital Territory	Territory of Papua-New Guinea
Existing Members, January, 1970	2,200	282	502	864	178	100	76	24	145	6
Target allotted for New Membership	3,500	400	1,000	1,000	400	250	120	100	200	30
New Members, January, 1971	2,948	211	608	995	334	442	116	57	177	8

DECLARATION AND AMENDMENT OF RESERVES

CHANGE OF PURPOSE :

Name	Reserve No.	Locality	Plan	Area	Previous Purpose	New Purpose	Vesting	Gazettal
——	C 27769	17 miles west of Katanning	Woodanilling 40, Sht. 3	97a. 2r.	Conservation of Flora and Fauna	Conservation of Flora and Fauna	W.A.W.L.A.	21/8/70
Woody Lake	A 15231	3 miles northeast of Esperance	423/80	About 375a	Conservation of Flora	Conservation of Flora and Fauna	W.A.W.L.A.	22/5/70
Blue Gum Swamp	C 25562	Melville	F 43–4, F 44–4	19a. 3r. 3p.	Recreation	Recreation and Conservation of Flora and Fauna	City of Melville	23/10/70
Jilbadgie Rocks	C 20262	14 miles west of Marvel Rock	23/80	About 2,500a.	Water	Conservation of Flora and Fauna	W.A.W.L.A.	18/9/70
Lake Varley	A 28014	Lake Varley	375/80	About 250a.	Conservation of Flora	Conservation of Flora and Fauna	W.A.W.L.A.	10/7/70
Warrinup Swamp	A 1931	15 miles west of Tenterden	444/80	640a.	Public Utility	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70
Rock Hole Dam	A 2079	14 miles west-northwest of Tenterden	444/80	635a. 3r. 36p.	Travellers and Stock	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70
West and Middle Islands (Lacepede Group)	C 7279	80 miles north of Broome	Pender 4 mile	Not surveyed	Public Utility	Conservation of Flora and Fauna		21/8/70
——	C 20231	12 miles southeast of Yuna	156/80, 161/80	3,624a. 2r. 6p.	Conservation of Flora	Conservation of Flora and Fauna		4/9/70
Goonaring Spring	C 659	10 miles southwest of Toodyay	Toodyay 40, Sht. 4	About 130a.	Resting Place for Travellers and Stock	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70
Belaring Spring	C 529	10 miles southwest of Toodyay	Toodyay 40, Sht. 4	98a. 2r. 6p.	Resting Place for Travellers and Stock	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70
Beaufort Bridge	C 1736	10 miles south of Arthur River	409/80	About 433a.	Stopping Place for Travellers and Stock	Water Supply and Conservation of Flora and Fauna	Minister for Water Supply	13/11/70

NEW RESERVES :

——	C 30526	15 miles east-northeast of Cranbrook	436/80	124a. 28p.	Vacant Crown Land	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70
——	C 30563	12 miles northeast of Wandering	379/80	443a. 3r. 18p.	Vacant Crown Land	Conservation of Flora and Fauna	W.A.W.L.A.	9/10/70
St. Ronan's Well	C 30591	10 miles west of York	2/80	292a. 22p.	Vacant Crown Land	Conservation of Flora and Fauna	W.A.W.L.A.	23/10/70

AMENDMENT OF AREA :

Name	Reserve No.	Locality	Plan	Previous Area	New Area	Vesting	Gazettal
Varley and Lucy Rocks	A 27927	Lake Hurlstone	375/80	About 5704a.	About 5,902a.	W.A.W.L.A.	28/8/70
Lake Pallarup	C 29860	12 miles south of Lake King	405/80	3,717a. 1r. 13p.	8,026a. 1r. 3p.	W.A.W.L.A.	30/10/70

VESTING OF RESERVES :

Name	Reserve No.	Locality	Plan	Area	Purpose	Previous Vesting	New Vesting	Gazettal
Lake Bryde	C 28667	20 miles northeast of Pingrup	407/80	324a. 2r. 4p.	Water, Picnic Ground and Conservation of Flora and Fauna	—	Minister for Water Supply	30/10/70
Nangeen Hill	C 23187	8 miles northwest of Kwolyin	4/80	About 436a.	Conservation of Flora and Fauna	—	W.A.W.L.A.	28/8/70
Jibberding	C 9935	15 miles East of Wubin	89/80	630a.	Conservation of Flora and Fauna	—	W.A.W.L.A.	20/3/70

LESCHENAULT INLET

DEVELOPMENT AND CONSERVATION

The southernmost waters of Leschenault Estuary which have been isolated from the rest of the Inlet by harbour development.

Leschenault Estuary and hinterland afford an excellent example of the complex problems involved in the multiple use of a very important estuary—problems common overseas but only now being fully realised in Australia.

Primary concern for the estuary is centred around two opposing interests; development and conservation. To the city dweller an area of protected water such as this provides for a variety of recreational activities; a safe area for boating and swimming, a perfect location for crabbing and fishing and an area of picturesque surroundings to enjoy or perhaps to photograph. To the fisherman it represents his source of income and livelihood; to the teacher it satisfies a practical teaching need in an area of diverse interest; and to the industrialist it can present a variety of uses.

Quite obviously these uses—urban, recreational and industrial—conflict with conservation; that is, maintaining the native state of the estuary. Inevitably, any development in a specific location on the estuary will result in localised or widespread destruction of habitat with a consequent deterioration of the natural state of the estuary as a whole.

The compromise between development and conservation must therefore seek to localise development in areas of minimal value to the conservation interest.

There is another aspect to the problem of development of the Leschenault Estuary. In the past, there has been a lack of unified approach; as is often the case, one group of interests tended to override the other and there was little or no consultation between these groups. Evidence of this may be found in the Report by the Senate Select Committee on Water Pollution. Referring to the disposal of La Porte effluent, the Committee Report stated: "This is a classic case of industrial pollution. When a new industry is to be established in the State, the Government and the enterpreneur are naturally concerned primarily with the economic success of the industry. The judgements made about the side effects of pollution often receive rather less detailed consideration."

To be effective, any plan for development and conservation should set out to achieve the best possible compromise between these opposing interests. Future planning should be undertaken on a unified basis with representation of all interests, and the major consideration of any development should recognize the tolerance limits of the estuary.

INTRODUCTION

Reproduced below is a summarised version of the Report on Leschenault Inlet by Dr N. Morrissy, Research Officer, Department of Fisheries and Fauna. The report which was compiled in September last year came about as a result of the urgent need of the Leschenault Estuary Conservation Committee to consider a proposed development in a relatively undisturbed section of the Estuary.

The Leschenault Estuary Conservation Committee was formed in 1965 to co-ordinate the activities of a number of authorities who have some interest in the Estuary and to consider such proposed developments. The Committee has representatives from nearby local authorities, Swan River Conservation Board, Town Planning Board, Public Works Department and Department of Fisheries and Fauna. Dr Morrissy's Report to the Committee describes the area and its present utilization, outlines the hydrological conditions and ecology of the estuary and discusses guidelines for future development.

UTILISATION

The study area, (Fig. 1) consisting of the estuary and environs appears to fall into four major categories and areas at present, with respect to human usage and modification versus the natural habitat.

Area A.

There are three situations:

(1) Koombana Bay, which offers protected recreational beaches and boating waters. The Bay is the site of the present Bunbury Harbour Wharves. It is also important as a crab habitat (see Fisheries and Fauna Journal F.I.N.S. Vol. 3 No. 1 March 1970). The feature reported in F.I.N.S. was part of a three year research programme by Mr T. Meagher. on crab populations in the Leschenault Inlet.

(2) This area comprises the former estuarine waters opposite Bunbury Town. The freshwaters draining into the inlet once gained access to the sea at the western end. This opening was plugged and a new opening was made opposite the Collie River mouth. With the new harbour development, the water of the Preston and Collie Rivers will not influence the waters of Area A which, therefore, can no longer be considered as estuarine.

A deep water channel runs along the southern foreshore and the northern foreshore is flat and swampy.

The semi-tropical mangrove *Abicennia marina* fringes the northern area and also the southern margin of the island whose eastern portion has now been banked for the harbour development. According to G. Smith of the Botany Department, University of Western Australia these mangroves exist in the inlet because of the high water temperatures and salinities which prevail for most of the year; it may be that the changes in water movement will no longer allow their con-

tinued existence. On the northern foreshore Cable (1956) Ltd. are filling some of the swamp with the waste soil from ilmenite extraction.

The man-made aesthetics of this area are rather poor. There is also considerable pollution of the waters with overflow from septic tanks.

(3) The new harbour-development waters and foreshores are, of course, a drastic alteration of the former habitat. There is some trepidation that crabs (juveniles) migrating into the enclosed waters may use the new opening as well as the customary one. If the juvenile crabs migrate into the harbour development waters they would be isolated from the major part of the estuary by the new plug. Much of the dredged material is being used to create the embankment opposite the power station and also to fill out the flats and adjacent bay. The salt marsh between the harbour and the main road appears to be dying.

The Preston River has been diverted to flow into Vittoria Bay from its former course from the main road to a confluence with the estuary close to the power station.

Area B.

This area is in a transient state of development with respect to housing and holiday facilities. East of the main road there is the growing Eaton Township south of the Collie River and Australind Township. The latter is apparently contained at present between the foreshore road, the La Porte factory, the Brunswick River and the northern divergence of the main road in a north-easterly direction over the north-south ridge.

In the area east of the road the important features are the picturesque lower reaches of the broad Collie River and the Tuart-forested slopes of the ridge.

The foreshore area west of the road between the Preston and Collie Rivers and facing Vittoria Bay is semi-rural, the edge of the water being sedge-lined and the land open except on the peninsula at the Collie River mouth. This foreshore is at present zoned open space for recreation, but it may be re-zoned industrial, with the reclamation of Vittoria Bay. Recreational facilities here consist of a boat launching ramp, speedway and caravan park. Further north lies the La Porte development.

Opposite Australind Townsite, housing development and a garage reduce the length of the foreshore available to the public by about half a mile. Elsewhere the sedge-lined foreshore between the water's edge and the road is only about 50 feet wide as compared with the 50 yards or so for about three quarters of a mile adjacent to Australind.

Just north of the housing development is the Paris Road boat-launching facility. The effect of removing the sedges from the waters edge adjacent to the ramp has been to promote shoreline erosion. The deepwater channel across the shallow water flats may provide cover for large fish e.g. Kingfish or Tailor which prey on small juvenile fish growing in the estuary.

The foreshore in this area, and also in Area C, is much used in the summer months by people who wade the shallow waters for crabs. On one Sunday the district fisheries inspector at Bunbury estimated that there were 2,500 people on the foreshore, about one third of whom were wading for crabs. This shallow water of 1-2 ft. in depth extends out for several hundred yards from most of the eastern foreshore. Camping is prohibited along the foreshore and alternative facilities are almost non-existent.

The western shoreline is less suitable for wading being boggy and access by land is difficult.

Area C.

At present this area can be classed as rural cattle grazing land with some large areas of virgin scrub forest. The north-south ridge is well clothed with Tuart forest. There are a few farm houses east of the old coast road.

The sedge-lined foreshore is mostly narrow, about 50 feet, the exceptions being at the wooded promontories in the central area. The northern area is a sedge swamp and at the top of the inlet the land is open for cattle grazing.

It seems likely that housing will extend northwards into this area. The land is freehold and tenure includes the foreshore in the central area where there is a group of old shacks. Freshwater drainage channels off the ridge occur across this area north of and including the central promontories. Peppermints and paperbarks occur on the promontories and line the roads. A large freshwater drainage channel enters the head of the estuary and there are also freshwater pools in this locality.

Area D.

This extensive area of coastal dunes is affected only by cattle grazing, which is probably limited, and, in one locality, by La Porte effluent.

For the most part, it is well forested with Tuarts on the eastern slopes except for the flatter land at Waterloo Head. Freshwater seepage occurs from the dunes. Kangaroo or wallaby tracks are common in this area.

As shown in Fig. 1 the inefficient disposal of La Porte effluent has resulted in:

(1) Killing of Tuarts and other trees over a considerable area.

(2) Limited direct leakage of effluent into the inlet foreshore.

(3) Pollution of the ocean and beach.

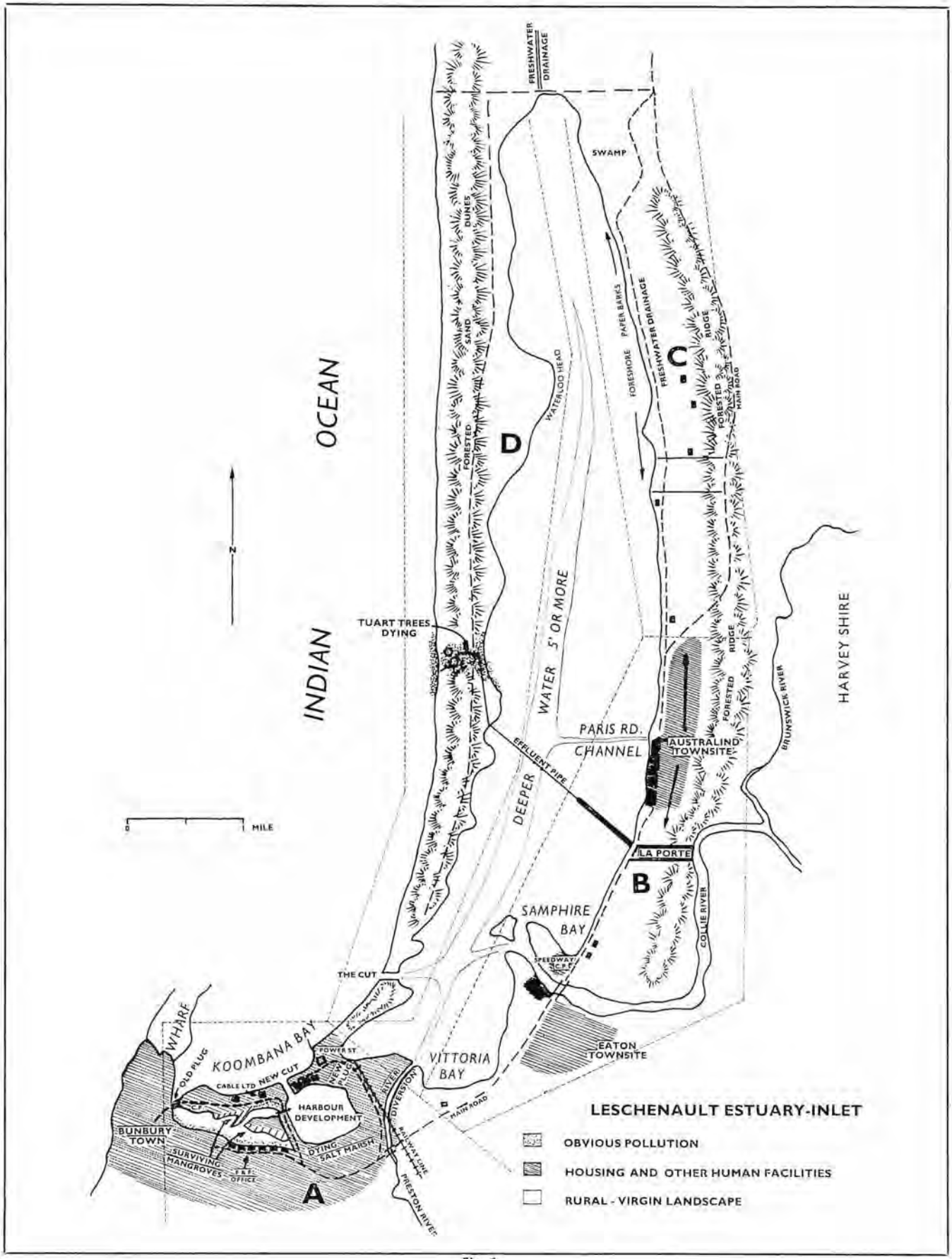

FRESHWATER DRAINAGE
SWAMP
DUNES
SAND
FORESTED
RIDGE
FORESHORE
PAPER BARKS
FRESHWATER DRAINAGE
C
D
WATERLOO HEAD
MAIN ROAD
OCEAN
INDIAN
N
TUART TREES DYING
WATER 5' OR MORE
DEEPER
PARIS RD.
CHANNEL
AUSTRALIND TOWNSITE
EFFLUENT PIPE
BRUNSWICK RIVER
HARVEY SHIRE
0
MILE
LA PORTE
B
SAMPHIRE BAY
COLLIE RIVER
THE CUT
WHARF
OLD PLUG
KOOMBANA BAY
POWER ST
CABLE LTD
NEW CUT
HARBOUR DEVELOPMENT
VITTORIA BAY
EATON TOWNSITE
DIVERSION
MAIN ROAD
BUNBURY TOWN
SURVIVING MANGROVES
DYING SALT MARSH
P.W.D. OFFICE
A
RAILWAY LINE
PRESTON RIVER
LESCHENAULT ESTUARY-INLET
OBVIOUS POLLUTION
HOUSING AND OTHER HUMAN FACILITIES
RURAL - VIRGIN LANDSCAPE

Fig. 1

The effluent settling ponds no longer work since an impervious layer of precipitate on the bottom has prevented filtration through the sand. The effluent appears to flow straight through the one pond in use down to the beach producing the characteristic red-brown stain in the ocean for several hundred yards along the beach. Sand dunes in this area are also stained.

The effluent disposal site was apparently placed in one of several large "blowouts" through the dunes. The killing of the forest and other vegetation adjacent to the blowout by pollution may lead to further wind induced erosion (in a wind-induced South West/North East line) with disastrous consequences if the effluent-caked sand is swept into the inlet.

HYDROLOGY

The estuary is approximately 12 square miles in extent. Except for a central north-south channel it is very shallow averaging 1-2 feet in depth with the deeper water up to 6 feet in depth. In its present state, and former natural state, the estuary has a very constricted and unusual ocean entrance.

Because of its shallowness, and despite the small tidal variation, up to 45% of ocean exchange can occur.

Water temperatures average 13-14°C in winter (ocean 16-17°C) and 25°C (ocean 20-22°C) in summer. There is a large diurnal variation in temperature from mid-winter to mid-summer increasing in degree towards the head of the estuary.

The salinity decreases from south to north during winter due to northern freshwater drainage and the dilution from the Collie and Preston Rivers extends only to about the La Porte pipeline.

In summer the salinity may reach 45% at the head of the estuary while remaining at seawater values (33%) at the southern end.

There is a large diurnal flux in oxygen content due to filamentous algae photosynthesis and respiration and overnight cooling and daytime heating. One hundred percent saturation daytime values in summer may fall to 35% saturation on the western shoreline and 60% on the eastern shoreline (where algae is not prevalent.)

The turbidity of the estuary varies widely from place to place; the northern parts being clear and the southern usually turbid due either to mud disturbance or unicellular algae.

Dr Hodgkin of the University of W.A. has pointed out that the Swan, Peel and Leschenault Estuaries differ greatly in many features—size, tidal exchange, dilution by drainage, depth, temperature, etc . . . . . Peel and Leschenault being similar because they are both shallow and highly productive—unlike the Swan.

FLORA AND FAUNA

Aquatic Life

Dense blooms of both attached filamentous algae and unicellular algae are characteristic of this warm, shallow and therefore highly productive estuary.

Benthos (particularly amphipods and polychaete worms) and plankton are very abundant.

Netting and inspection of the shallow water shows that the estuary is an extremely important nursery area for breeding and for juvenile fish. Species are blue manna crabs *(Portunas pelagicus)*, King George Whiting *(Sillaginodes punctatus)*, Yellow-finned Whiting *(Sillago schomburgkii)*, Cobbler *(Cnidoglanis macrocephalus)*, Sand Mullet *(Myxus elongatus)*, Yellow-eye Mullet *(Aldrichetta forsteri)*, Bony Herring *(Fluvialosa vlaminghi)*, Smelt *(Craterocethalus sp.)*, and Black Bream *(Mylio butcheri)*. Greasy-back Prawns occur infrequently.

Although there are 18 licensed professional fishermen in the Bunbury-Harvey area, only 7 fish consistently. Talks with these fishermen revealed that the highly seasonal incidence of maturing fish, the nuisance of meshing crabs in summer, and the depressed state of fish prices does not allow full-time fishing. There does, however, seem to be plenty of scope for amateur fishing.

Birdlife

Mr T. Riggert, of the Department of Fisheries and Fauna Research Section has pointed out that coastal inlets and estuaries are of minimal value for large-scale breeding of ducks. Estuaries are, however, very important as summer refuges for ducks when inland waters dry up. The ducks can feed on filamentous algae, etc. in brackish water but require freshwater soakages and springs for drinking water (at night).

These requirements of ducks are well met by conditions in the top end of the estuary where some breeding occurs. In these summer shallow water habitats ducks require protection from excessive disturbance (as produced by human shoreline activity, shooting and power boating.) The estuary is frequented by Black Swans, particularly in the north-west corner and Vittoria Bay area where there are mud banks.

Dr D. L. Serventy could not give a complete summary of the wildlife on the estuary but he thought that the avi-fauna would be substantially similar to that of Peel Inlet. Dr Serventy also said that the area appears to be a very important feeding ground for the northern migrants of waders which breed in Siberia. He added that the development of the Swan River Estuary has decreased the extent of their feeding grounds in that area.

In December, Mr J. Lane of the Department's Fauna Research Section, conducted two, four-day surveys of the birdlife of Leschenault Inlet. The survey did not include the area of new harbour development because of the drastic alterations to the waters and foreshores. The remainder of the inlet comprised four distinct waterbird habitats.

(1) **East Shore.**

On the sand flats of the eastern shore large numbers of Swans were observed feeding along

Aerial photograph of the study area taken from 20,000 ft. in January, 1966.

with White Egrets and Pelicans. On the sedge-lined foreshore only three species of wading birds (Greenshank, Grey Plover and Bar-tailed Godwit) were seen.

Scattered groups of Mountain Ducks were also seen feeding on the shallow flats of the eastern shore.

(2) **Head of the Inlet.**

The flats in this area consist of thick black mud and since public access is difficult, the head of the inlet forms a suitable refuge for ducks and swans. Large numbers of Mountain Duck, Black Duck, Grey Teal and Wood Duck were observed. These flats are also favoured as a feeding ground for White-headed Stilt, White Egret and White-faced Heron.

(3) **West Shore.**

The western shoreline supports an abundance of estuarine fish and as such the shallows provide important feeding grounds for Crested and Caspian Terns, White-faced Heron, White Egret, Swans and Pelicans.

Very few wading birds frequent this area.

(4) **Collie River Delta.**

The sandflats formed at the mouth of the Collie River are important resting grounds for Cormorants, Pelicans and Swans. The delta flats are also feeding areas for wading birds—Bar-tailed Godwit, Greenshank, Grey Plover, Red-necked Avocet, Little Stint and White-headed Stilt, Swans, Pelicans, Cormorants and Terns feed in the adjacent deeper water, and Pelicans, Cormorants, Terns, Egrets, Herons and Darters feed along the edges of the Collie River.

Mr Lane has concluded from his observations that Leschenault Estuary compares less favourably with the Swan River, Peel Inlet, and Harvey Estuary for species diversity and, in relation to bird numbers, Leschenault carries substantially less birds than Peel Inlet and Harvey Estuary. Mr Lane believes that representative areas of each of the four waterbird habitats will have to be retained to ensure the continued residence of the 25 species of birds recorded.

Foreshore.

It is fairly obvious that the marginal fringe of sedges on the perimeter of most of the estuary plays an important part in preventing shoreline erosion. If this feature is removed, the often limited width of foreshore will be further reduced.

Tuart Forest.

Mr G. Smith of the Botany Department, University of Western Australia points out that Tuarts have a restricted formation as a narrow strip along the coast on limestone soils. Mr Smith also points out that most flora and fauna reserves occur well inland from the coast and that there is a great practical teaching need for areas of natural biological interest close to coastal towns, such as Bunbury.

DISCUSSION AND RECOMMENDATIONS.

The following guidelines for the future development and conservation are made with regard to specific features and areas, and as an entity.

Area A.

The emphasis in this area of intensive housing and industrial development should be on attaining a higher standard of man-made aesthetics on the inlet foreshores. Special attention should be given to preserving the unique mangrove and in controlling aqueous pollution.

Areas B and C

(1) **Areas east of the Main Road (B) and the Old Coast Road (C).**

As well as promoting high grade housing and landscaping, attention should be given to providing attractive and spacious camping areas and facilities along the road.

(2) **Foreshore.**

Only a small fraction of the total perimeter of the Estuary is attractive, undeveloped and also accessible. This area is confined to the eastern foreshore.

This foreshore constitutes the primary location of public attraction to the estuary, most importantly, crabbing. The location of housing or shacks benefits very few people while decreasing both the scenic attraction and length of foreshore available to the public.

It should be pointed out that people are drawn to the area almost solely by its natural assets. Housing and unattractive facilities, particularly in Area C, should be restricted to the eastern side of the road. Some effects of the development of this area of the estuary would be to encroach on the refuge areas of ducks by more intensive boating activities and by human activity near the freshwater soakage.

Power boating may adversely affect the productivity of these clear shallow waters by increasing turbidity.

There is also a very bad mosquito problem towards the northern end of the estuary. Solutions to this problem, such as drainage of freshwater pools or spraying with insecticides, would disrupt or destroy the area as a duck refuge and nursery area for juvenile fish.

Area D.

This area is very important from a conservation point of view as a potential "A" Class Reserve. The northern part of the estuary should also be given protection for wildfowl refuge.

In summary the four areas A to D appear to offer excellent prospects for a planned compromise between future development on the estuary and conservation. Because of the manner in which development has extended out from Bunbury an ideal opportunity exists at this time to provide suitable areas for tourism, recreation and preservation of the natural habitat.

FAUNA CONSERVATION REGULATIONS

New regulations controlling the commercial exploitation of kangaroos came into operation on 18th November, last year. All kangaroo carcasses and skins must now have a tag attached before they can be consigned for sale.

A limited number of shooters have each been licensed to take a quota of 4,000 red kangaroos or euros per year. Departmental biologists have recommended these restrictions in order to preserve viable populations of these kangaroos. These restrictions will limit the commercial take of red kangaroos and euros to about 250,000 per year.

In February, licensed shooters were issued with one-third of their tag allocation.

Leaseholders who have considerable trouble with large numbers of red kangaroos and euros causing damage will be issued with a limited number of tags. The only persons who may take these animals are the property owner or a person nominated by him and approved by the Department. It is not necessary for a property owner to obtain permission to shoot red kangaroos or euros (on his property) in those areas of the State where an open season has been declared. However, should they wish to sell skins, they would need to apply for an appropriate number of tags.

There is to be no commercial exploitation of grey kangaroos except in cases where animals must be destroyed because of the amount of damage caused. In these circumstances, the sale of carcasses will be permitted and special tags will be made available.

Tags for red kangaroos and euros are yellow and cost ten cents each. Grey kangaroo skins or carcasses must have white tags attached and these cost twenty cents each.

The tags must be attached in either of the two positions indicated at point A in the sketch. They have ridges which pass through a clip and lock into place. Unless it is cut the tag cannot be

The new kangaroo tag.

removed from the carcass. The only persons permitted to cut the tag from the skin are tannery operators and Departmental wardens.

Other restrictions relating to the kangaroo industry include:—

- All chillers must be licensed.
- Licenses have been introduced for pet meat processors.
- Skin dealers must take out licenses.
- A comprehensive system of returns has been introduced.

OTHER REGULATIONS

Other regulations provide for the control, by license, of the following activities:—

- The destruction of dangerous fauna.
- Taking protected fauna causing damage to property.
- Taking avian fauna for sale.
- Keeping fauna in captivity.
- Dealing in avian fauna.
- Farming fauna for sale and keeping fauna for commercial display.
- Taking and keeping fauna for educational purposes.
- Taking fauna for scientific studies.
- Exporting fauna.
- Importing Australian and exotic fauna.
- Taking game (ducks and quail).
- Marking or banding fauna for research purposes.

Regulations relating to the keeping of fauna in captivity have been expanded and include the following provisions:—

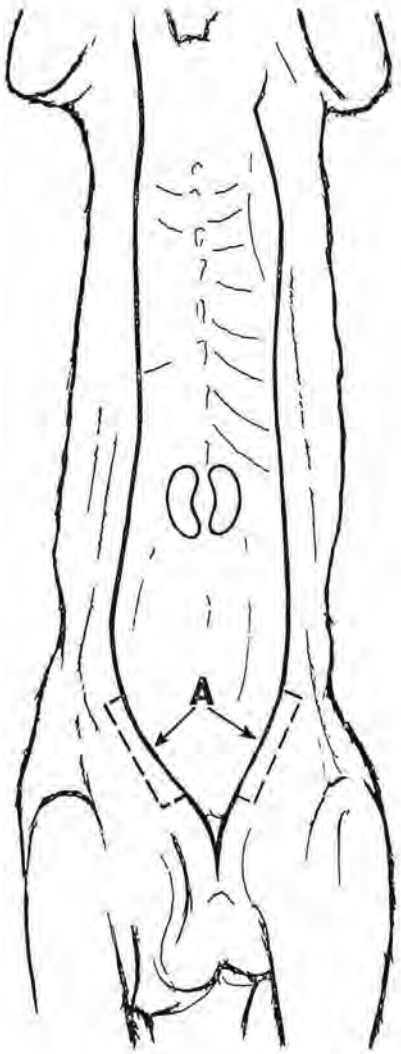
- Any person who has 10 or more unprotected birds or any protected bird in captivity must be the holder of the appropriate license.
- Birds' wings must not be clipped or pinioned except with permission of the Chief Warden of Fauna.
- Detailed specifications for the keeping of caged birds in captivity.

Under certain circumstances, special permission will be granted to persons wishing to keep waterfowl in captivity.

The regulations relating to Honorary Wardens are reproduced in full below:—

Regulation 41. (1) An honorary warden may—

(a) take possession and control of any fauna which the honorary warden believes, on reasonable grounds, to have been involved in the commission of an offence and deliver the fauna to a member of the Police Force or to any person appointed in writing by the Minister for the purpose to be dealt with according to law, or if the fauna is alive, he may release the fauna in a suitable place in the wild;



(b) take possession and control of any weapon, instrument, illegal device or other thing or means which the honorary warden believes, on reasonable grounds, has been used, is being used, or is about to be used, by a person in the commission of an offence, and deliver it as soon as is reasonably possible into the custody of a member of the Police Force to be dealt with according to law.

(2) When an honorary warden suspects, on reasonable grounds, that a person is committing or has committed an offence against the Act or these regulations, he may require the person to give him the person's name and address.

(3) An honorary warden may require any person to produce any license issued to him under these regulations.

continued on page 23

KANGAROOS

A QUESTION AND ANSWER FEATURE ON SOME CONTENTIOUS ISSUES.

Q Have the kangaroos benefited from increased food and water supplies through the development of the pastoral area?

A The distribution of the animal population was governed by the availability of water although the native vegitation had a wider distribution than the kangaroo. With the extension of water supplies for pastoral use a greater range of distribution of the animals was possible because of the availability of additional food supplies.

Q Are there many more kangaroos now than before the white man arrived?

A It would appear that the population has increased but not in those areas where the animals previously occurred. Prior to the coming of the white man only a limited area was available with adequate water supplies. The development of a pastoral industry over a much greater area of the State has provided the necessary water supplies, and in doing so it has opened up additional areas for the kangaroo population to utilise.

Q Are kangaroos competing with sheep and cattle for the same food?

A From studies previously carried out it appears that **some** foods eaten by kangaroos are common to sheep and at some periods of the year certain foods are more common than others. In general there is not a great deal to suggest that a pastoralist would be any better off if there were no kangaroos on his property; because of the different diet of sheep and kangaroos there is only limited competition for food.

Q Is it reasonable to expect co-existence of sheep and kangaroos in the pastoral areas?

A Since the distribution of the red kangaroo population is co-incident with the better pastoral areas of the State, eradication of the animals in that region would result in virtual extinction of the species. In present circumstances co-existence of "reds" and sheep must therefore be permitted if the species is to be maintained.

Q Are kangaroos animals that may be farmed?

A In general they would not be easily domesticated as cattle and sheep have been. If they were farmed on the same basis as other domestic animals it would no doubt incorporate all the problems and undesirable features of other farming industries—particularly that of trying to carry more stock than was ecologically desirable. These animals have not had

the benefit of selection for commercially desirable characteristics and the productivity would at this stage be very low. Selective breeding over an extensive period might be needed to increase the carcass weight and quality of fur etc.

Q How long does it take for a female kangaroo to reach sexual maturity?

A In captive animals and animals enjoying excellent conditions in their natural state, some may reach sexual maturity at the age of 1½ years. However, under normal field conditions this maturity is not reached until an average of 20-22 months. Under adverse conditions such as in time of drought maturity may be delayed until 3½-4 years of age. Depending upon conditions, the age of sexual maturity would therefore be somewhere between 2-4 years. Conditions prevailing in normal years might be termed "average" and maturity would then be reached around 2½-3 years of age.

Q What is the expected life span of a female kangaroo?

A In unexploited populations the average age of adults is approximately 6½-7 years although the majority of animals of the adult section would be much younger than this. Under normal conditions the average reproductive life of a healthy female kangaroo attaining adulthood would be about 4 years. However, it is probable that only about 85% of the females would be capable of reproducing.

Q Under ideal conditions how many joeys could a female produce in one year?

A Under ideal conditions, assuming that each mating was successful, that the joey survived a full pouch life and that there was a successful post partum mating the female could theoretically produce about 1¾ joeys per year. Taking into account mortality, availability of food, disease and other influencing factors, a female might be expected to produce one joey per year. Since approximately 50% of all joeys born die before reaching one year of age the actual recruitment rate into the adult population is about .6. With a reproductive life of 3 years the female would only be producing 1.8 joeys which would reach adulthood and this is barely a replacement rate. If the productive life was 4 years the female would produce 2.4 joeys—a slight excess over replacement.

Q What is the mortality rate of joeys in the pouch?

A In the first month of pouch life the mortality rate is up to 5% (per month). The rate increases as the joey ages and by the last month the rate can be 50% or more. The higher rate at the latter stage of pouch life is due to joey leaving the pouch for periods when it then becomes easy prey or can be abandoned by the mother in time of danger etc.
In a case of extreme drought it was found in the Eastern Greys that no joeys survived for a period of twelve months.

Q Is it true that kangaroos can breed like flies when seasons are good again after a period of drought?

A The reproductive success of kangaroos can change according to the conditions outlined in the above answers. It is obvious therefore that with one joey being produced each year the term "breeding like flies" is a fallacy.
As pointed out earlier, in time of drought there can be practically no breeding and the mortality of adults during such a period is much higher too. Therefore at the end of a drought there would be less adults to breed and less joeys entering the adult stage.
To illustrate this point let us take an example of a population of 100 adult kangaroos (50 males and 50 females) under "average" and extreme drought conditions. Allowing for normal mortality we could expect, at the end of the twelve months for there to be left an adult population of 40 males and 40 females. The females —at a maximum rate—could have produced approximately 30 joeys thereby making the total population 40 males and 40 females and 30 joeys = 110.
During a period of drought (with high mortality) the original population of 100 would have been reduced to probably about 30 males and 30 females or less and, even allowing for the birth of say 5 joeys the population could be reduced to only 65. Thus the breeding following a severe drought could only come from a reduced adult population with a period of two years when there would be very few joeys reaching adulthood—only those from pre-drought period—and even these latter animals may not have reached sexual maturity because of the drought conditions.

Q Reports from pastoral areas in the North-West indicate that some pastoralists may have a continuing kangaroo problem, some a seasonal problem and others, no problem at all. Why is this so?

A The pastoral leases are comprised of vastly different types of habitat. Those in marginal areas would support only small populations while those in good areas may carry large numbers of animals

at all times. Other areas are more variable and therefore would sustain varying population levels from year to year.

Q It is alleged that the kangaroo could never be shot out or become extinct. Is this likely to be true?

A The possibility of a sole cause of extinction is most unlikely. Over exploitation by professional shooters, followed with further exploitation by itinerant shooters (if allowed) could reduce the population to such an extent that it would be more vulnerable to other mortality factors such as droughts or human interference. However, with controlled shooting by professional operators only—as now exists—there is no likelihood of the kangaroo population being "shot out".

Q If shooters tend to operate from made tracks is it not likely that thousands of kangaroos could remain untouched in the more inaccessible and isolated country?

A The professional shooters certainly use the made tracks in travelling to and from their various shooting areas but the actual shooting takes place beyond those tracks. Shooters of red kangaroos tend to favour the better pastoral areas which are more accessible but this in fact is the habitat of the "red."
There may be small, isolated pockets of pastoral country which are economically inaccessible but the population on the majority of these areas in the pastoral lands, will still become exposed at some time.
Fugitive populations in these inaccessible areas would be very small and therefore more likely to become extinct by chance.

Q Does there have to be a minimum number in a population for it to be viable?

A There are certain biological criteria which suggest that kangaroo populations need to be of a minimum size to enable them to survive. The smaller the population, the less chance there is of survival. Without Government intervention and the protection offered by the regulations it could have been possible for the red kangaroo population of the pastoral areas to have been depleted to a few isolated pockets, thereby endangering the chance of survival.

Q It has been said that professional shooters tend to take only the bigger male kangaroos. Is this so?

A Since less than 10% of the total kangaroo population is made up of older and bigger males it would be uneconomic for a shooter to take these animals only.
Shooting does alter the age structure in that it crops off the older and larger animals but these are only a small fraction of the population. Some of the older animals may in any case be considered expendible since by virtue of their age they are not contributing greatly to the reproduction of the species.
If shooting is to be continued as an economic proposition the shooter must take all sizes offering. When the older animals have been taken the next age class becomes the prime target—probably with a preference for the males which offer the greater carcass weight.

Q Some pastoralists and shooters say that females out-number the males in the natural populations. How does this relate to the two previous questions?

A The mortality rate of adult males is slightly higher than females (normal throughout the animal kingdom). The sex ratio at birth is 50 : 50 for kangaroos but over the life span the ratio changes slightly in favour of the female.
Because of a preference for the larger male animal shooting tends to increase the ratio of females in the adult population.

Q Is the spelling of (a) overhunted regions and (b) the inspection of properties before issuing permits specifying the numbers of kangaroos that can be taken off them as outlined in the N.S.W. management programme (A.C.F. Occasional Publication No. 4 The Commercial Hunting of Kangaroos) a practical basis for conservation measures?

A (a) Shooting generally removes the excess number of animals. If overshooting takes place and more than the excess is taken some respite is necessary to allow the population to build up again. Some over-exploitation of populations must occur if the industry is to remain an economic proposition. However, from the returns submitted by shooters and processors it will be possible to determine when a particular area is being exploited at an excessive rate and steps can be taken to curtail further shooting until the population has again built up.
(b) The inspection of properties to determine the numbers of kangaroos which may be taken is biologically unrealistic, costly and impractical. While it may be necessary to census populations in order to adjust cropping rations to productivity

the management unit will comprise of a local population. Local populations of red kangaroos in particular do not necessarily coincide with individual property boundaries and in this case it is both unnecessary and a waste of manpower to attempt to individually assess numbers within the confines of each property.
The population will be monitored from a combination of the data supplied by shooters' returns and occasional aerial surveys of field populations.

Q Is the present kangaroo management plan flexible enough to deal with drastic fluctuations in the total populations?

A Previous answers have shown that there can be no dramatic upward fluctuations in the kangaroo population—it can only **decrease** dramatically as a result of drought etc. The present management plan can however be modified to re-arrange quotas and curtail shooting if it is considered essential for the preservation or control of the kangaroo population.

Q Is it true that the bulk of grey kangaroo populations are in the forests and that only a small proportion would be exposed to destruction on farms?

A There are only some 4 million acres of forests in the South West of the state but the range of the grey kangaroo extends far beyond this.
Therefore only a small proportion of the populations are found in the forest areas although the density of animals may be slightly higher in that region.

Q What is the value of the provision of special reserves for kangaroos and the allowing of an "open go" by shooters on those outside reserves?

A In the case of red kangaroos there is no suitable areas available large enough to sustain a reasonable population.
Any areas which could be set aside and which could sustain red kangaroo populations are already committed as they are the better pastoral areas. In order to maintain the red kangaroo population it is necessary to compromise over the use of the land by pastoralists and kangaroos.
In the case of the grey kangaroo it is a question of availability of suitable areas and size. Most reserves would not support a large enough population which would remain viable over the long term; only small populations could be supported in perpetuity and, in the majority of such reserves, the boundary area is high in proportion to the total area enclosed. Therefore virtually all of the animals would become exposed off the reserve which would cease to be a sanctuary both from a biological and practical point of view.
With the movement of kangaroos off the reserve they would be exposed to shooting pressure and the reserve population would eventually become depleted to a level which could not sustain future populations.

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continued from page 19

(4) A person shall not—

(a) refuse to produce any license issued to him pursuant to the provisions of the Act or these regulations when required to do so by an honorary warden;

(b) refuse to state his name and address when lawfully required to do so by an honorary warden;

(c) state a false name or address to any honorary warden when lawfully required by an honorary warden to give his name and address;

(d) use abusive language to an honorary warden; or

(e) wilfully mislead, hinder, assault, resist or obstruct, incite or encourage any other person to mislead, hinder, assault, resist or obstruct, any person in any particular way likely to affect the discharge of that person's duty pursuant to the provisions of the Act or these regulations.

A number of other regulations were introduced relating to the control of sanctuaries, illegal means and devices, prohibited imports, game species, marking of fauna, releasing animals and the inspection of premises by Departmental Wardens.

Honorary Wardens or other interested persons should contact the Department for further information on the new fauna regulations.

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(EDITOR.)

DEPARTMENT OF FISHERIES AND FAUNA
DISTRICT OFFICES

FAUNA

Metropolitan:
233 Adelaide Terrace.
Tel. 23 4312

Albany:
"Campion House,"
63 Serpentine Road.
Tel. 41 4111

†**Busselton:**
89 Reynolds Street.
Tel. 509.

†**Carnarvon:**
16 Robinson Street.
Tel. 41 1185

†**Onslow:**
Old P.W.D. Building.

Pingelly:
Park Street.
Tel. 273

Wongan Hills:
Fenton Street.
Tel. 232

†**Wyndham:**
Lot 1215,
Delamere Road.

† May also be consulted on Fisheries.

FISHERIES

Perth:
Ellam Street,
Victoria Park.
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Stirling Street.
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Carnarvon Street,
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Tel. 21 1187

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*Geraldton:
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*Jurien Bay:
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*Lancelin:
Bootoo Street.
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*Mandurah:
Leslie Street.
Tel. 35 1240

*Shark Bay:
Knight Terrace,
Denham.
Tel. 10

* May also be consulted on Fauna.

METROPOLITAN AFTER-HOURS NUMBERS

FAUNA

R. MARSHALL, Warden—8 3127
S. BOWLER, Senior Warden—64 4137
T. EVANS, Fire Control—60 5694

FISHERIES

M. CRAWFORD, Inspector—3 6719
E. FORSTER, Inspector—6 2532
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N. McLAUGHLIN, Chief Inspector—49 1072
J. ROBINS, Developmental Research Officer—
31 4701
C. S. SEABROOK, Master, R.V. Flinders—31 1224

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