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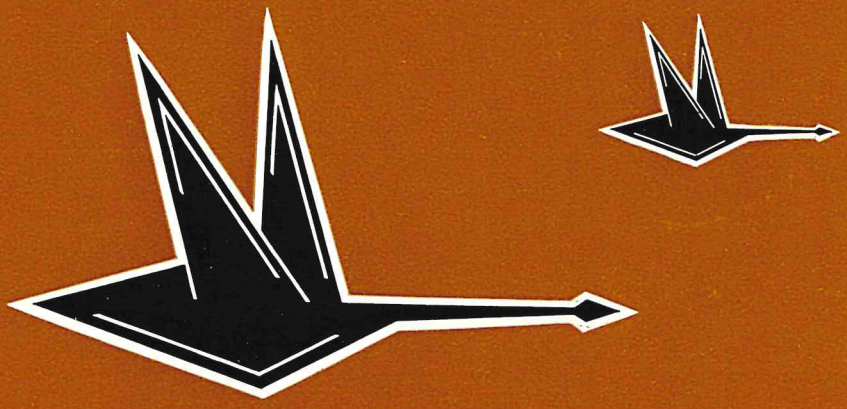
WESTERN AUSTRALIA

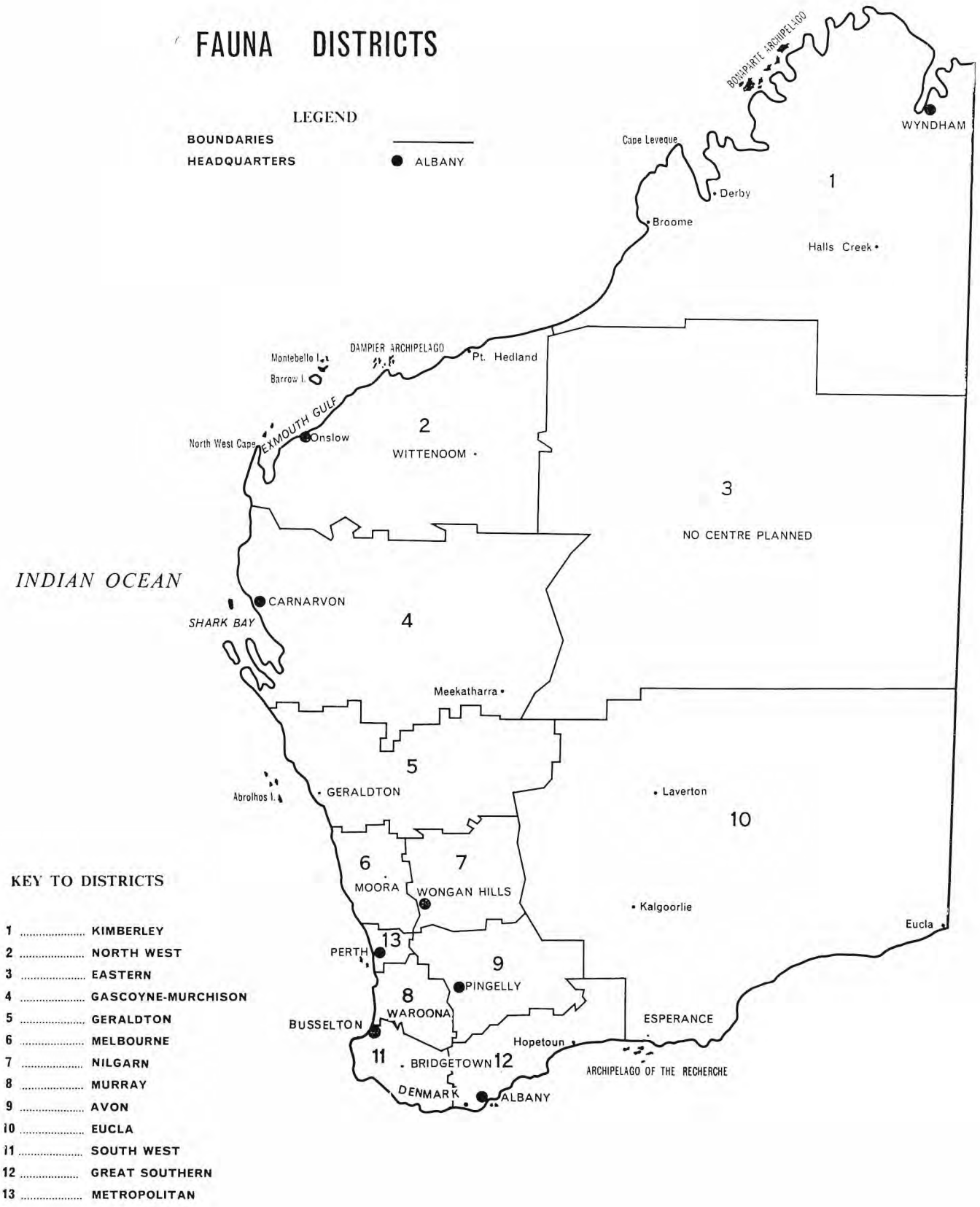


S.W.A.N.S.

State
Wildlife
Advisory
News
Service

Vol. 2 No. 2
Autumn, 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. 2

AUTUMN, 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., A.F.A.I.M.

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.

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

Assistant Editor: J. J. Brennan.

Something to think about....

Resolutions carried at the XVth World Conference International Council for Bird Preservation (see feature page 34) urged nations to introduce restrictions on the import and export of birds in order to protect endangered species.

Western Australia already has legislation whereby the export of fauna or parts of fauna, whether dead or alive, and the import of fauna into W.A. is either prohibited or allowed only under license.

Other States have similar restrictions, while the Commonwealth Government applies an embargo on the export of indigenous Australian fauna overseas, and exercises strict control over the import of animals into Australia.

Illegal trafficking in fauna (particularly birds) between some overseas countries is big business and, no doubt, as some species of our wildlife become even more rare the rackets will spread to Australia.

Firm action must therefore be taken at the first sign of illegal trafficking. It is the responsibility of each and everyone of us to report immediately any incident of illegal import or export of fauna. Failure to do so will only encourage the activity and allow it to consolidate and develop to a stage when it will be difficult—if not impossible—to eliminate.

Unconfirmed reports have already been heard of illegal export of birds from W.A. but until some evidence of this can be produced the Department of Fisheries and Fauna is powerless to act. Can you help?

IN THIS ISSUE....

GREY KANGAROO MANAGEMENT PROGRAMME

Prior to European settlement in Western Australia the range of the grey kangaroo extended throughout the south-west and southern areas of the State.

Since that time, however, the spread of agriculture in the south-west land division has removed approximately 50 million acres from a total of 63 million acres of prime natural habitat. Reduced populations of grey kangaroos still survive in this region but the unavoidable conflict between primary producers and the animals remains.

In conjunction with the Agriculture Protection Board the Department of Fisheries and Fauna has formulated a management plan designed to ensure the long-term survival of the grey kangaroo. At the same time it will allow the landholder to protect his crops from damage caused by these animals.

Details of the management programme follow:

LIMITED OPEN SEASON AREAS

The following procedure will apply in the Shires shown in Appendix A.

Where Sale of Skins or Carcasses is not intended:

1. A landholder may, on cleared areas of his property, and at a point where damage is occurring, destroy the grey kangaroos causing damage.

(A damage license must be held before shooting in areas of virgin freehold or leasehold land or land held under pastoral or grazing lease.)

2. Forthwith, the landholder must notify the nearest Departmental Warden of Fauna that he has commenced shooting.

3. The landholder may continue shooting until the warden arrives, so long as the damage continues.

4. The warden will inspect the property as soon as convenient and assess the justification for shooting.

5. In the event of the shooting not being justified, the warden may issue the landholder with a notice prohibiting further shooting without first obtaining a damage license.

Where Landholder Wishes to Sell Skins or Carcasses:

1. A landholder may, on cleared areas of his property, and at a point where damage is occurring, destroy the grey kangaroos causing the damage.

(A damage license must be held before shooting in areas of virgin freehold or leasehold land or land held under pastoral or grazing leases.)

2. Forthwith, the landholder must notify the nearest Departmental Warden of Fauna that he has commenced shooting.

3. The landholder may continue shooting until the warden arrives so long as the damage continues, but he must retain for biological research purposes, the skulls of all grey kangaroos which he intends to market.

4. The warden will inspect the property as soon as convenient and assess the justification for shooting.

5. The warden may issue a license with tags to be affixed to the skins and carcasses of all or part of the take, if he considers the shooting was warranted. The issue of tags may take place during, or at the expiration, of the license.

6. If further management control of the population is necessary the warden may issue a license to take a specified number of grey kangaroos during a specified period.

7. The warden will issue tags to cover the number stated on the license.

8. The landholder will be required by the warden to retain the skulls of all grey kangaroos shot, for subsequent collection for biological research purposes.

9. In the event of the shooting not being justified, the warden may issue the landholder with a notice prohibiting further shooting without first obtaining a damage license.

10. In the event of a dispute arising regarding issue of tags, number of grey kangaroos taken, or justification for shooting, the farmer shall have a right of appeal to the Minister for Fisheries and Fauna.

OTHER AREAS

Damage Licenses:

In all areas where grey kangaroos exist (except those listed in Appendix "A") landholders must apply for a damage permit before destroying any grey kangaroos.

In the event of a damage permit being issued, the Warden will issue sufficient tags to cover the number of grey kangaroos stated on the license should the landholder wish to sell the skins or carcasses. The issue of tags may take place during, or at the expiration of the license. The landholder will be required by the warden to retain the skulls of all grey kangaroos shot for subsequent collection for biological research purposes.

Eastern Goldfields (Yilgarn, Coolgardie, Boulder and Dundas Shires):

The area embracing the pastoral portions of these Shires presents some difficulty because of unresolved differences of opinion as to the numbers of grey kangaroos. For the time being, until further information is available, these Shires will be treated as areas where a damage license is required before shooting commences.

Management or Cropping Procedure:

In areas where grey kangaroo numbers have built up to troublesome proportions, the Department of Fisheries and Fauna will carry out a programme of management or cropping, based on the employment of Departmental staff or licensed shooters under contract.

Appeal Procedure:

In the event of a landholder and the Fauna Warden being unable to reach agreement, the Warden will consult the Regional Vermin Control Officer for his advice. The Warden will then make his final decision. Should the landholder still feel that he has cause to disagree with the Warden's assessment, he may appeal to the Minister for Fisheries and Fauna.

APPENDIX "A"

Limited Open Season Areas

Areas of Freehold or leasehold occupied land actively farmed in the undermentioned Shires.

Northampton
Chapman Valley
Mullewa
Greenough
Irwin
Mingenew
Morawa
Three Springs
Perenjori
Carnamah
Coorow
Dandaragan
Dalwallinu
Koorda
Mount Marshall
Westonia
Yilgarn
Narembeen
Kondinin
Kulin
Dundas
Lake Grace
Nyabing-Pingrup
Gnowangerup
Ravensthorpe
Esperance
Tambellup
Cranbrook
Plantagenet
Albany
Denmark
Kojonup
Manjimup
Bridgetown-Greenbushes
Upper Blackwood
Nannup
Augusta-Margaret River
Donnybrook-Balingup
West Arthur
Williams
Boddington
Wandering
Mukinbudin

That part of the Shire of Merredin east of the Vermin Fence.

QUEENSLAND APPOINTS FIRST FAUNA RANGERS

The appointment of Queensland's first two fauna rangers was announced by the Minister for Primary Industries (Hon. J. A. Row, M.L.A.) on March 4, 1971.

Mr. Row said the new officers were Mr. C. G. Wilkinson of Buderim, and Mr. I. R. Bradshaw of Brian Pastures Pasture Research Station, Gayndah.

Mr. Wilkinson held a Diploma in Agriculture and Mr. Bradshaw, a Beef Cattle Husbandry Branch field assistant at the Station, held a Diploma in Animal Husbandry.

The Officers would work under the immediate supervision of the Department's Fauna Officer, Mr. C. Roff, and would be given full authority under the Fauna Conservation Act and the Native Plants Protection Act.

Their duties, following intensive in-service training, would relate to the conservation of fauna and flora, including the supervision of the kangaroo skin and meat industry, commercial bird trapping and trade, zoos and other fauna premises and the many Queensland sanctuaries. They would also check on the exploitation of native plants and undertake field fauna surveys. The rangers would also liaise with ex-officio fauna officers such as police officers and officers of the Department of Primary Industries and the Lands and Forestry Departments, and with honorary flora and fauna protectors, and undertake extension activities with farmers' groups and natural science organisations.

It was proposed that although one officer would be stationed at Rockhampton and one in Brisbane, they would travel widely in the course of their duties.

Mr. Row said: "It is expected that these rangers will play an important role in the conservation of the State's wildlife. Their work will be watched closely, and if it is successful, the appointment of additional rangers will be considered".

NEW FELLOW OF R.A.O.U.

Mr. Angus Robinson of Coolup has been elected a Fellow of the Royal Australian Ornithologists' Union.

Founded in 1901 the R.A.O.U. is one of Australia's oldest bird protection societies. Its aims are to promote the study of ornithology and to preserve and protect any fauna, especially in Australia, New Guinea, New Zealand, etc.

Mr. Robinson is a member of the W.A. Wild Life Authority and also served for several years on the Fauna Protection Advisory Committee which preceded the Authority.

Spraying cotton crop with insecticide—Ord River

I.U.C.N. POLICY ON THE USE OF PESTICIDES

Reproduced below is a statement of the views of the I.U.C.N. Commission's Ecology Committee on ecological effects of chemical control. The comments in italics under each of the points raised by the I.U.C.N. indicate the pesticide situation in Western Australia.

The International Union for Conservation of Nature and Natural Resources (I.U.C.N.) is fully aware of the problems of agriculture and public health in a world with a rapidly growing population. It is accepted that no-one should oppose any well-considered attempt to increase the production of the necessary food, or to achieve the elimination of vectors of disease.

It is equally obvious that the use of pesticides is one of the means by which food production can be increased, and the I.U.C.N. wishes to be clear on the point that it is not opposed to the principle of using pesticides when it is the appropriate means according to present knowledge.

The I.U.C.N. emphasises the necessity of taking into account the following matters when pesticide applications are planned:—

(a) Before control is attempted it should be firmly established that the organism to be attacked is indeed doing damage of economic significance. The I.U.C.N. distinguishes different categories of social need for pest control. They are:—

(1) The abatement of a nuisance;

(2) the reduction of an agricultural or forest pest; and

(3) the elimination of a vector of human disease.

The degree of upset of ecological processes which may be temporarily permissible would vary with the particular objective and the social values and mores of the particular place.

[*In Western Australia, as elsewhere, there have been two generations of pest control:*

(1) The use of old-type chemicals such as lead arsenate; and

(2) the more recent use of complex organic compounds such as chlorinated-hydrocarbons and organophosphates.

Looking to the future, indications are that a type of integrated biological and chemical pest control will be the third generation of pest abatement techniques.

The projected aims of researchers to "manage" pests will result in the use of viruses, bacteria, chemo sterilants; of sterile males, sex attractants, and more resistant varieties of crops.

At present in Western Australia, growers generally seem to be ignorant of the difference between animals that are and are not causing damage of economic significance. There is also a tendency on the part of pesticide users to over-spray—"just in case". Orchardists, for example, spray as an insurance against attacks of light-brown apple moth which is an outbreak species and not an annual problem in every district; while potato growers over-spray (using D.D.T. and other persistent insecticides) against potato tuber moth.

These problems in pest control clearly indicate that there is a need for more grower education in Western Australia.]

(b) Ecological effects must always be considered in any assessment. Very stable, persistent pesticides have been used for many years but the situation has been greatly aggravated by their increased use and the greater use of aircraft, high pressure spraying, etc. Therefore, ecological effects have extended far beyond the target areas.

[*There has been a tendency in Australia to overlook the wider effects of certain pesticides. This has not always been the fault of the user because insufficient information is available on the repercussions of particular chemicals on the environment.*]

(c) There is a trend toward unnecessary clean farming and the establishment of monoculture on large areas. These factors, together with the unnecessary demand — largely established by advertisers — for completely unblemished fruit and vegetables, often lead to the extravagant use of pesticides. This has repercussions both within crop ecosystems and outside them, yet the economic gains, particularly in the long term, are open to question.

[*Researchers believe that there is no need for completely unblemished crops provided that: (1) there is no harm to the consumer, and (2) it tastes as it should. Most people would agree that slightly blemished fruit would be more acceptable than fruit contaminated with a persistent pesticide, or a reduction of environmental diversity caused by over-spraying.*

On the domestic side, there has been a trend toward "unnecessarily clean" lawns in Western Australia through the use of fertilizers containing pesticides. It has been reported that the pesticide (chlordane) kills bird life. In circumstances where lawns are attacked by pests such as lawn beetles, control can be justified, but the use of such products as a preventive measure is open on question and indicates a lack of appreciation of ecological side-effects.

Research has shown that monoculture on large areas (e.g., wheat farming in Western Australia) increases pest control problems and that the more diverse the farming the more damped are the oscillations of pest insects.]

(d) It is accepted that with present knowledge, chemical control is often the only feasible method. Pesticides have the very great advantage of giving results immediately and these can be very spectacular. However, the responsibility of the agricultural adviser must go further than the immediate result. In the long term, pesticides may increase problems rather than reduce them. With this in mind careful consideration must be given to the other solutions of the problem, such as cultural methods and the development of resistant varieties of crops and animals. Biological control, though not so spectacular and not as effective immediately, may eventually be a more economical way of improving the production of food in certain situations. In other cases, biological and chemical control may be combined in integrated control programmes which avoid loss of predators while reducing numbers of the pest.

[*In Western Australia, integrated biological control programmes are still in the developmental stage and it would be unrealistic (and impossible) to prevent farmers from using chemical control methods. There is a definite need, however, for agricultural advisers, manufacturers and researchers to educate growers in the safe use of pesticides, rates and times of application, and possible side effects.*

Research by C.S.I.R.O. scientists in W.A. is being conducted into the use of a virus to control the potato tuber moth and, although complete data are unavailable, present indications are encouraging. In the Eastern States, C.S.I.R.O. scientists are also conducting tests with virus chemo-sterilants and sex attractants.]

(e) When control by a chemical is undertaken, the pesticide should be applied at the minimum rate which will ensure effective control. There is a common tendency to use insecticides at excessive rates because it is hoped much better results will be obtained. This practice obviously increases considerably the danger to beneficial insects and other wildlife.

[*Application of excessive rates of pesticides has been shown to be no more effective in controlling pests than the rates recommended by manufacturers or agricultural advisers. Also, the excessive use of certain types of chemicals often has the adverse effect of harming beneficial insects and other wildlife, such as predators of the target species.*]

(f) The pesticide should be applied only at such places where control is necessary. Special dangers result from aerial spraying; not only does drift occur, especially when it is windy, but also volatilisation can be much greater.

[*It is evident in Western Australia that aerial spraying of small farm areas has affected adjacent areas through wind drift. In more recent times, however, farmers have become more aware of the dangers of aerial spraying and are more careful to protect wildlife and insects such as bees.*]

(g) The pesticide should be applied at such a time that maximum effect on the pest can be expected with a minimum of danger to non-target species. For example, to protect bees, crops should not be sprayed when flowers are open.

[*It is obviously most desirable for pesticides to be applied at the correct time and although this has only recently been realised, users are becoming increasingly aware of this fact.*]

(h) Whenever possible, the most specific pesticide should be used; for example, in some systems, organophosphorus insecticides kill aphid pests without harming their predators.

Fruit fly spraying on South West orchard

[*As already indicated there has been a tendency by apple growers to spray for light-brown apple moth even in years when outbreaks do not occur and the moth is not damaging. In some instances certain pesticides have destroyed non-target species (e.g., predators) and growers have found themselves on a pesticide treadmill.*

There is a need for more specific pesticides to be developed; many pesticides in common usage today kill a wide range of insects on the crop. These broad spectrum, mostly persistent pesticides also alter populations of soil animals which have a very important role as modifiers of the rate at which dead plant material is broken down into plant nutrients.]

(i) Some uses of a pesticide can be far more hazardous to wildlife than others, for example, the use of certain organochlorine insecticides as cereal seed dressings is far more hazardous to birds and mammals than is the use of the same material as plant dips.

Recently, there have been new developments which should be considered and programmes should be constantly reviewed.

The use of virus, of bacteria and bacterial toxins and of fungus diseases of insects, chemical and other sterilants and specific sex attractants is very promising. Some spectacular results have been achieved by the use of insect predators and parasites of pest insects, and in some cases this has led to solving rather difficult problems of integrated pest control. Also, we wish to emphasise again the use of cultural controls of insects, and the development of pest resistant varieties of plants as this shows great promise. The great advantages of these are obvious but development is still at an early stage. It should be underlined that these methods possibly used in combination with very low concentrations of synthetic insecticides, or in an integrated biological and chemical control, open a way for control of pests with slight disturbance of ecosystems within the agricultural area and without it having repercussions on both biological control and the ecosystems of the area thus treated. This will also safeguard non-target species. Such conservative use will also help guard the public health.

Disposal of pesticides should be in such a way that rivers and parks, and other natural environments are not contaminated.

Continuous research should be conducted to gather the needed knowledge to permit more and more enlightened pest control. All segments of society, including the manufacturer of pesticides, should support such research. Concerted efforts to educate salesmen, contractors, retailers and, above all, users, about the proper use of pesticides, must be made.

These principles should be continuously reviewed and changed as necessary.

[*Clearly, manufacturers, agricultural advisers, scientists, farmers and other users are not sufficiently aware of the possible repercussions of using a particular chemical. It is easy to criticise manufacturers for their failure to determine the full effects of their product before marketing, but the problem is not that simple. What is needed is intensified research into insect control, and more general education of the public. This education could be a part of the school curriculum and should go hand in hand with environmental education.*]

ANTI-LITTER CAMPAIGN

A six-week anti-litter campaign was launched in April by the Premier Mr. Tonkin on behalf of the Keep Australia Beautiful Council.

The cost of the campaign ($16,000) was met by the mass media and industry in Western Australia.

In conjunction with the K.A.B.C. campaign the police mounted an intensive blitz on motorists who threw litter from cars.

Mr. Eddy Tamlin, Executive Director of the Keep Australia Beautiful Council (W.A.), pointed out that the Road Traffic Regulations provided a $20 fine for throwing any item from a vehicle and that under the Health Act offenders could be fined $40 plus costs. Mr. Tamlin added that a section in the Local Government Act provided a penalty of $200 for littering public places.

Regulations under the Fauna Conservation Act provide a penalty of $200 for depositing litter on Fauna Reserves.

LACEPEDE ISLANDS REPORT

In 1801, the captain of a French vessel sailing up the north-west coast of Western Australia named a small group of islands near Broome after the French naturalist Lacepede.

One hundred and sixty-nine years later, two islands in the group, West Island and Middle Island, were set aside as sanctuaries for the conservation of flora and fauna.

In July, 1970, a Departmental patrol vessel, *P.V. Dampier,* crewed by Mr. E. J. Little (skipper) and Fisheries Inspector J. Harman, visited the north-western-most island in the Lacepede group.

Skipper E. J. Little and Inspector J. Harman aboard the "P.V. Dampier"

Mr. Little reported the following observations during their inspection:—

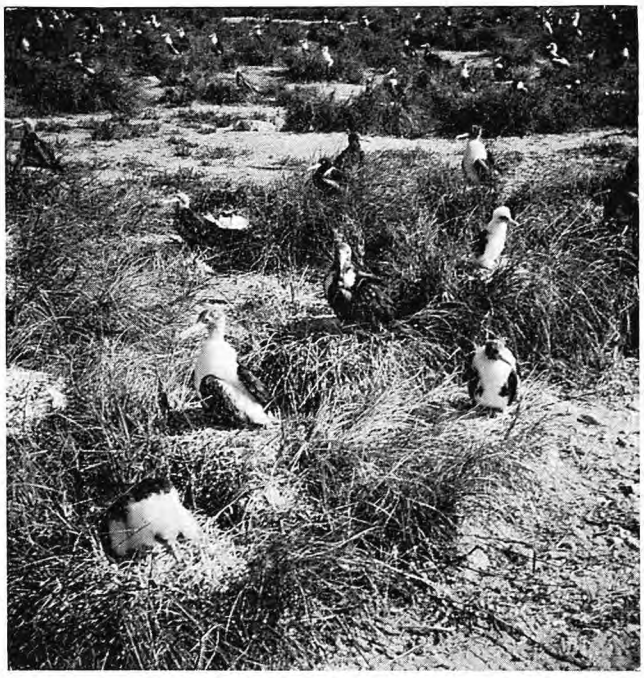
> "On the first day a low tide allowed us to concentrate mainly on the shallows and reefs on the south side of the island. We observed an abundance of Green Turtles, many of which were trapped in shallow holes on the dry reef. We had previously observed dozens of turtles in the shallows off the edge of the reef. Also worthy of note were the numerous large clams, some of which measured 30 inches across.
>
> As the tide rose we made our way ashore and headed toward an abandoned campsite. While walking in the direction of the camp we were impressed by an amazing sight. There were, conservatively speaking, thousands of nesting Brown Gannets, which we subsequently learned, use the island as a breeding site. The young, covered in white down, were taller than their parents and as we walked through them they barely parted—in fact many stood their ground and squawked disapproval.

The immature birds were in various stages of development; some almost ready to fly; some with only tail and wing feathers; others a ball of white fluff and some newly hatched and without a single feather. Inspector Harman saw an albino Gannet—the bird was ready to fly, complete with all feathers.

The nests were shallow depressions in the ground and some were covered with seaweed and small sticks. Most nests had two eggs in them. During our inspection of the young and the nests, hundreds of adult Gannets wheeled overhead and, needless to say, we caught a fair amount of their "bombardment".

Man has left his mark on the island. At the abandoned campsite we found a quantity of tinned and packaged food left in the tent, together with bedding and cooking utensils. Outside the tent, tin cans, cartons and similar debris was strewn around. On the northern side of the island, about 400 yards from the camp, we found four 44-gallon drums of petrol and more food supplies. There was also an 80 foot wireless mast near the camp.

The following day Inspector Harman and I carried out a survey of the island. As mentioned, we found Brown Gannets nesting everywhere. We also located a colony of 1,000 to 2,000 nesting Lesser Frigate Birds. Their nests were built on small bushes about 12 inches high and the young were in various stages of development. These immature birds, colourful with their scrawny necks and hooked



A colony of nesting Lesser Frigate Birds

beaks, resembled vultures perched on their nests. As we walked through the colony some of the birds clicked their beaks to show their disapproval of our intrusion.

On one of the beaches we observed a large flock of Fairy Terns but there was no sign of nesting.

Other birds observed were: Sooty Oyster Catcher, Dotterel, Blue Reef Heron, Large Pied Cormorant, Small Black Cormorant and Silver Gull.

Before we went to the island we were told that large numbers of rats have been seen on the beaches after turtle eggs. We did not actually see any rats on the beaches, or elsewhere, but there was evidence of their presence around the campsite.

Finally, worthy of note, was a port-type structure which we believe was used by guano diggers."

[According to Serventy and Whittell ("Birds of Western Australia") the Brown Gannet was the main guano producer of the former extensive deposits on the Lacepede Islands. Exploitation of the deposits began without the cognisance of the colony administrators until 1876. By 1879, about 37,000 tons of guano had been raised and the deposits were virtually exhausted.]

SUGGESTED READING

Several of our readers have requested that a list of suggested reading on wildlife and the environment be included in each edition of S.W.A.N.S.

In future issues we will publish a list of book titles, journals, etc., on topics covering plants, animals and the environment.

The titles suggested will, in most cases, be for the amateur or untrained person seeking a better understanding of our wildlife and its ecology.

BIRDS

"Birds of Western Australia"—Serventy, D. L. and Whittell, H. M.

"A Field Guide to Australian Birds"—Slater, P.

MAMMALS

"A Guide to the Native Mammals of Australia"—Ride, W. D. L.

"Furred Animals of Australia"—Troughton, E.

ENVIRONMENT

"A Continent in Danger"—Serventy, Vincent.

"Between Wodjil and Tor"—Main, Barbara York.

MISCELLANEOUS

"The Western Australian Naturalist"—Journal of the Western Australian Naturalists Club, Naturalists Hall, 63-65 Meriwa Street, Nedlands.

"Wildlife in Australia"—Journal of the Wildlife Preservation Society of Queensland, Subscription $1.60 W.P.S.Q. Box 2030, G.P.O. Brisbane, Qld. 4001.

XV WORLD CONFERENCE, ICBP

The October/December 1970 issue of the IUCN Bulletin contained a review of the resolutions adopted at the XV World Conference of the International Council for Bird Preservation held last September in the Netherlands.

Representatives were present from national sections of 31 nations and the International Wildfowl Research Bureau, as well as UNESCO, Council of Europe, IUCN, IBP, WWF, Conseil International de la Chasse, and observers from three nations.

Fifteen resolutions were adopted by the Council; however, some of these referred to situations in specific countries (other than Australia) and for this reason only the relevant resolutions have been reproduced below.

Resolution 1 (a), dealing with pesticides, reaffirms recommendations of two previous ICBP World Conferences, and urges: the prohibition of manufacture, use or sale of persistent pesticides; their replacement by non-persistent and more selective compounds; the keeping of statistics on commerce in pesticides; the proper labelling, directions for use, and notice of hazards; encouragement of biological control methods.

Resolution 1 (b) urges that the Governments of all countries immediately prohibit the exportation of pesticides which are banned in their own countries and the importation of pesticides banned in the country of origin.

Resolution 1 (c) recommends

(i) That the United Nations require its agencies to make adequate biological study of the long term effects of pesticides and herbicides on the environment before their use is recommended or financed; and that the Secretary General of the United Nations request reports by all United Nations agencies concerning their policies and practices with respect to pesticides;

(ii) That all National Sections urge their national delegations to the United Nations, ECOSOC, FAO, UNDP, WHO and to UNESCO to oppose the undertaking or financing of programmes involving the use of pesticides or herbicides without adequate biological study of their long term effects on the environment and that they particularly oppose the use in such programmes of persistent and cumulative pesticides, and that they should review current programmes in the light of the above recommendation.

Resolution 1 (d) urges that the Food and Agriculture Organization recommend application and treatment by rodenticides only in such manner that birds of prey and other animals feeding on pest rodents are not poisoned through the food chain and that other birds are not attracted to poisoned bait.

Resolution 2 (a), citing the usefulness of birds of prey and noting their alarming decline, recommends the complete prohibition of the killing, importation, exportation, transit, purchase, sale, keeping and use for sporting or financial ends (including public exhibition) of all birds of prey and owls except by license granted by the competent authority after consultation with specialised scientific authorities and societies for the protection of nature;

recommends that the governments, conservation organizations and educational institutions of the world undertake or expand educational programmes on behalf of the birds of prey;

recommends the International Association of Falconry and Conservation of Birds of Prey and International Union of Directory of Zoological Gardens and National Federations and Associations of Zoological Gardens to recommend that their members avoid acquiring the rarer species except for research by recognised scientific bodies on the conditions necessary for breeding birds of prey and owls in captivity.

Resolution 2 (b) recommends to all governments that they immediately afford complete protection to the Peregrine Falcon and its eggs including the prohibition of importation or exportation of live birds or their eggs for any purpose.

Resolution 9 urges restrictions on traffic in endangered bird species and their skins or parts, and further recommends that the importation of living wild birds be restricted to named places of entry, and that containers be labelled with common and scientific names and the number of birds contained.

Resolution 10 urges museums and other institutions refrain from acquiring newly collected skins of endangered bird species, and that a committee be set up to integrate specimens and data needs.

Resolution 11 urges Governments of all countries:

(i) to prohibit the taking of wild birds' eggs and to cease issuing permits to take the eggs of wild birds for private collections;

(ii) to cancel such permits now in existence, and to issue permits for the taking of the eggs of wild birds only as a part of bona-fide research and other scientific projects sponsored by established scientific institutions.

Resolution 15 recommends that the Governments of the world and their agencies, national and international, recognise that the major direct or indirect cause of environmental pollution and deterioration is the rate of increase of human population.

Six recommendations were also adopted. Number 2 is reprinted in full:

noting with growing alarm the evidence of increasing pressure on many seabirds throughout the world, especially as a result of pollution due to oil and to many toxic substances including pesticides, PCB's and heavy metals and especially mercury;

and considering that seabirds are not only of interest and value in themselves but are also indicators of damage to and contamination of the marine environment which is of vital importance in a period of explosive population growth;

recommends all National Sections to collect and evaluate information on the subject and press their Governments:

(i) to encourage and sponsor research into seabird populations and their ecology; and

(ii) to take urgent steps to contain these threats as they are identified.

LIBERATIONS OF TROUT FRY

A limited supply of fry from the depleted W.A. brood stock was augmented by fry from N.S.W. (100,000 ova) and Victoria (50,000 ova). These were released in:

Waroona Dam	12,000
Harvey River	8,000
Murray River System	45,000
Warren River System	34,000
Donnelly River System	30,000
Experimental places	10,000
Total	139,000

The fry were liberated by the Departmental Officer stationed at Pemberton, G. Cassells, a departure from previous years when anglers did this work.

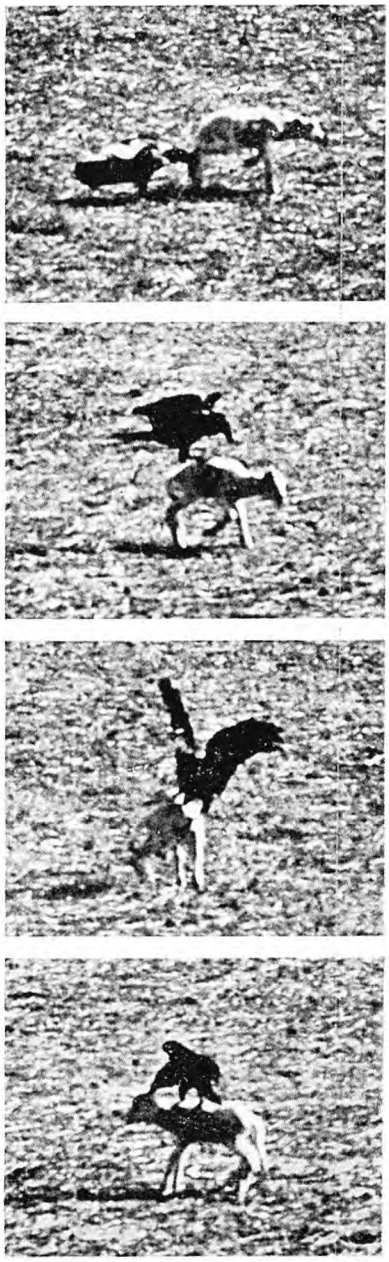
KANGAROO PETITIONS

The following report from the "Sydney Morning Herald" indicates how strongly some Australians feel about conservation of the kangaroo—

"During the year [1970] electors presented 495 petitions to Parliament; more than double the previous record of 226 in 1901, the first year of Federation.

"Kangaroos were the subject of 126 petitions. The next most popular subjects were pensions—86; censorship—63, and education—62."

CROW PREDATION NOT SIGNIFICANT IN LAMB MORTALITY



Successive photos of raven attack on 11½-hour old lamb. This "ride" lasted 45 seconds before the lamb sheltered with a ewe, not its mother. When examined later no wounds were found

This is a summary of an article by Ian Rowley, Division of Wildlife Research C.S.I.R.O. Canberra, which appeared in the December, 1969 (Vol. 14 No. 2) edition of C.S.I.R.O. Wildlife Research.

1. INTRODUCTION

Corvids of one sort or another occur throughout Australia. They are all black birds of medium to large size, commonly known as crows, but more correctly there are five species—three ravens and two crows. The Australian raven (*Corvus coronoides*), the forest raven (*Corvus tasmanicus*), and the little raven (*Corvus mellori*) occur mainly in the temperate region. The Australian crow (*Corvus orru*) and the little crow (*Corvus bennetti*) occur in the tropics and the arid interior. Since sheep are run virtually throughout Australia, they come into contact with all five species somewhere in their range as shown in Fig. 1.

All corvids are opportunistic scavengers that feed from a succession of natural sources as seasons change; carrion feeding and predation on birds, mammals and reptiles occurs as opportunities arise. Dead lambs and afterbirth discarded by a ewe provide attractive food for corvids, and since one in every five lambs born dies within a few days, it is inevitable that corvids will concentrate around lambing paddocks. In fact, few healthy lambs are killed by corvids, but many sick animals are finished off by them. This distinction is not readily appreciated by most farmers, in whose minds corvids and dead lambs are firmly linked as cause and effect.

The purpose of this investigation was to assess lamb mortality due to corvids and to describe the conditions under which it occurs. The work was almost exclusively concerned with two of the ravens, *Corvus coronoides* and *Corvus mellori*.

2. METHODS

The study of ravens amongst lambing flocks was confined to South-Eastern Australia, and approached in four ways:—

(a) Investigation of *Corvus* ecology.

(b) Direct observation of lambing flocks.

(c) Post-mortem analysis of dead lambs.

(d) Experiments in aviaries.

(a) *Corvus Ecology*

Two study areas used are relevant to this report; Geary's Gap, N.S.W. (solely *Corvus coronoides*) and Toganmain Station, N.S.W. (both *Corvus coronoides* and *Corvus mellori*).

(i) Geary's Gap

This study area was thirty square miles of Southern Tablelands sheep country, 20 miles north

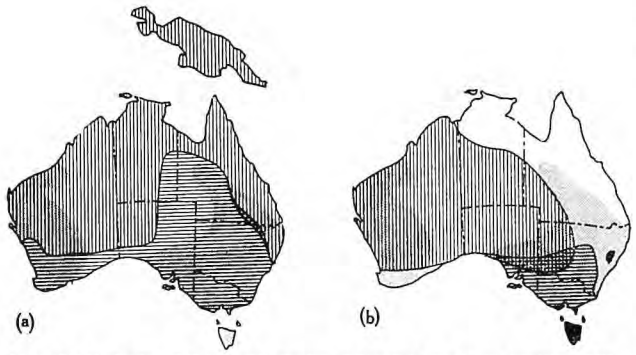


Fig. 1.—(*a*) Distribution of *C. coronoides* (horizontal hatching) and *C. orru* (vertical hatching) compared with that of sheep farming (stippling). (*b*) Distribution of *C. mellori* (horizontal hatching), *C. bennetti* (vertical hatching), and *C. tasmanicus* (black) compared with that of sheep farming (stippling).

of Canberra. At least one member of every pair of corvids in the area was banded to enable recognition up to a distance of a quarter of a mile. Nesting was followed for five seasons, many young were colour-banded and the movements of all birds closely tracked. Over 100 hours of observations were made on the lambing flocks.

(ii) Toganmain Station

This study area was a well-managed property of 100,000 acres, carrying about one sheep to every three acres. Observations were made both during the birds' breeding season and during lambing time. 2,176 ravens were banded, and subsequent recoveries led to an understanding of nomadic and local movements.

(b) *Direct Observation of Lambing Flocks*

Observation was carried out through binoculars from hides, blinds, or observation posts at Toganmain Station, Minnipa Research Centre, S.A. and Roma, Queensland.

(i) Toganmain—Observations were made over four seasons on two unshepherded flocks, each of about 400 animals. An observation post was established overlooking the only watering place and most lambs were born in this vicinity.

(ii) Minnipa Research Centre—Observations were carried out in enclosures for 20 days on a selected group of ewes on the point of lambing. Through most of the day more than 50 corvids were present in and around the lambing flocks.

(iii) Roma—Observations were carried out over 5 days on a small flock.

(c) *Post-mortem Analysis of Dead Lambs*

Collections of dead lambs were chilled and forwarded to Sydney for analysis.

(d) *Aviary Experiments*

Four aviaries averaging 50 sq. ft. in area were stocked with pairs of *Corvus* who were presented with an intact lamb carcass (pairs were used to reproduce the competitive situation which usually arises in the field). The time which elapsed before the eyeball of the lamb was removed was measured for each bird and a maximum of three tests per day every other day were made on each bird to ensure they did not become satiated with meat.

3. RESULTS

(a) *Corvus Ecology*

(i) Geary's Gap—Sixty pairs of *Corvus coronoides* were studied, and it was found that they seldom left their territories, which they patrolled several times a day. They rapidly located any new source of food (e.g., dead or dying animals) and were quick to respond to any departure from the normal pattern of farm operations, whether it was a basket of eggs left carelessly on a gatepost, a "cast" ewe lying upside down, or the fact that the farmer was carrying a rifle instead of a stick. Banding showed that the young raven is nomadic in nature from 6 months (when they leave their parents), and do not settle in one district until they are about 3 years old. It was flocks of these nomadic birds which were mainly present among lambing flocks.

(ii) Toganmain—Observations showed that *Corvus mellori* live as a flock and, except when engaged in yearly nesting activities, will move considerable distances foraging for food.

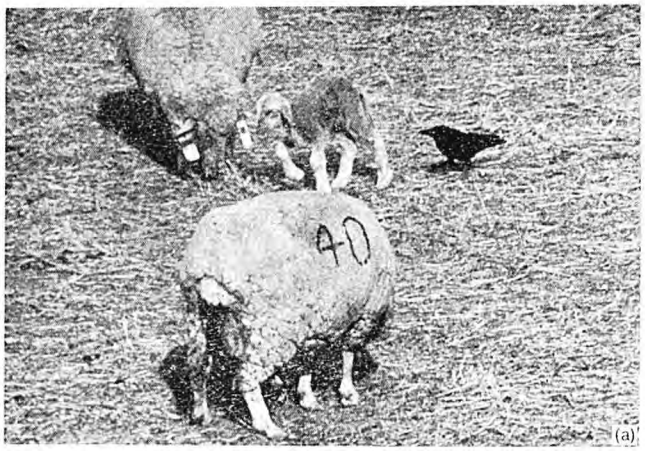
(b) *Direct observation*

(i) Toganmain—Two flocks of ewes were observed over a total of 32 days spread over four lambing seasons. Although *Corvus mellori* outnumbered *Corvus coronoides* by about five to one, the former were never seen to attack lambs, but fed on insects, seeds and carrion. In 361 hours of observation, no instance of successful predation was seen. *Corvus coronoides* did occasionally attack lambs that appeared weak, but in all cases were repelled by the defending ewe, and no attacks were made on lost lambs which became bogged down in the mud of the dam. Both species avidly ate afterbirth and carrion and when competition arose *Corvus coronoides* always conquered *Corvus mellori*. Consequently *Corvus coronoides* spent far more time feeding on carcases than did other species.

Under these conditions of minimal interference and the complete absence of any form of shepherding, flocks of Merino ewes average 80% of lambs marked to ewes mustered at marking time. Examination of the ewes at marking suggested that about 17% of the ewes had not born a lamb recently (as might be expected at a spring mating). Under these circumstances, predation seems of little importance, and it is unlikely that any change in management practice would significantly reduce the lamb losses.

(ii) Minnipa—In 1966 and 1967 lamb mortality was not heavy. In 1966, five lambs died from 44 ewes, while in 1967, 49 out of 424 lambs died. Despite large numbers of corvids present and the absence of any disturbance throughout most of the day, predation was not responsible for the loss of one healthy lamb.

The lack of effective predation by corvids on the lambs at Minnipa is interesting because ample opportunity for attack existed. Twenty-seven lambs were born in daylight, of which four births were twin deliveries. No damage was caused prior to the actual dropping of the lambs because the ewes circled away from the ravens. After birth, while the ewe was still resting, single ravens would dash in and take beakfuls of membrane and attendant fluids adhering to the new born coat, but no noticeably damaging attacks were made at the lamb's orifices, and once the ewe recovered she butted off the intruding ravens. With twin births, the first lamb born was undefended for up to half an hour, but in no instance was any damage noticed. Ravens made several attacks at the afterbirth membranes unshed by the ewes and fed extensively on these and faeces passed by the lambs. This often took the form of an attack on the anus of the lamb but, unless the lamb was starving and unable to run off, no extensive wounding was observed.



(a)

(b)

(a) While sleeping, lamb 47 was probed in the anal region by a raven. This healthy lamb jumped up and moved away

(b) *Corvus coronoides* holding the tail of a lamb in its bill. This lamb appears unconcerned but frequently such a lamb runs off with the raven holding on. As in (a) this approach probably enables ravens to distinguish between sick and healthy lambs

At Minnipa the only bird capable of damaging a healthy lamb was the large Australian raven *Corvus coronoides*. Its greater weight, longer reach, larger bill and extreme agility often enabled it to maintain a grip on a running lamb and continue to peck. Possibly because of the tough skin and tightly curled birth coat, no attack of this nature resulted in serious damage.

(iii) Roma—A feature of the attacks here was the concentration on the umbilical cord and the breech. The Southern Queensland raven appears larger than average (particularly its bill) and this, combined with the larger orifices and sensitive skins of the Border Leicester lambs at Roma, probably accounted for the injuries observed. The combination of sensitive skin and large-billed raven is not lethal by itself, but when infection with *Clostridium* spp. occurs, deaths become more frequent. The owner studied 44 new born lambs that had been recently picked by ravens without receiving major wounds. He injected half with antibiotics and left half untreated. Seven of the untreated lambs died, but none of the treated ones.

(c) *Post Mortem Examination of Dead Lambs*

In 1962, all dead lambs from four flocks at Geary's Gap were sent to Sydney for examination. Differences in the severity of predation were comparable to the circumstances on the property. The heaviest predation was noted in the flock which lambed in July, a full month ahead of the other three. Twelve of the dead lambs were healthy and viable apart from the damage caused by the predator. However, this is not a large loss from 700 ewes. Predation was not so effective in the other three flocks which were of similar size.

A mild winter in 1963 resulted in healthier lambs and this was reflected in the improved figures both for the number of healthy lambs killed and the number of dying lambs finished off. In 1965, a dry summer prevented hay reserves from being replenished; newly sown pastures failed to establish themselves and established swards failed to grow after a poor autumn rainfall. This situation led to a drop of weak lambs and a correspondingly large number failed to survive.

(d) *Aviary Experiments*

Experiments with lamb carcasses showed that the large species of corvids were much quicker at removing eyes than the small ones. *Corvus coronoides* and *Corvus tasmanicus* were extremely competent at removing eyes. Both species had long massive bills and this together with their powerful feet enables them to take a firm grip on the lamb and to deliver a powerful thrust generally sufficiently strong enough to burst the eyeball. Four methods of attack were observed:

(i) Picking—raising the beak about 6 inches and driving at the target with considerable force.

(ii) Pecking—relatively harmless and lacking the force of "picking".
(iii) Beaking—removing the flesh by pinching and tearing.
(iv) Spreading—widening the orifices by opening the beak inside the aperture.

Observations indicated that the smaller ravens are never serious predators of young lambs as in all cases they experienced difficulty in causing extensive damage except after prolonged exploratory delving.

4. SUMMARY

The results of the observations suggest that excessive predation is closely linked with mismanagement. When a farmer lambs out of phase with his neighbours he may attract abnormal numbers of birds; the available supply of carrion may be inadequate to satisfy all, and some may turn to predation on live lambs instead of the carrion which originally drew them. Mismanagement by over or under-feeding pregnant ewes, inadequate provision of shelter or insufficient supervision may result in large numbers of starving lambs. Ravens can easily finish these off, but such attacks do not represent a further financial loss to the farmer as these lambs would die anyway. The surveys made show that there are two periods of a lamb's life when it is particularly vulnerable to corvid attack.

(i) During or immediately after birth—Birth is quick for a single lamb of average weight (c. 8 lb), normally presented, and an experienced mother recovers rapidly and actively defends her offspring. However, with larger lambs, extensive exposure during birth and physical damage leading to weakness, creates a condition where predatory attacks are likely. Over-feeding of the ewe during pregnancy is usually responsible for large lambs. Maiden ewes are often severely shocked by birth and are either physically exhausted or will actually desert their offspring leaving them open to attack. Finally the first born lamb of twins is inevitably left defenceless while the second twin is born; twins are generally smaller than other lambs and consequently weaker.

(ii) During the moribund state preceding death from other causes—Starvation is the commonest single cause of lamb mortality in Australia, and may proceed for three or four days before the lamb dies. The decline is magnified under unfavourable climatic conditions and when shelter is inadequate, and in this situation, the lamb is often deserted by the ewe.

To summarise, long and difficult births, twin births, weakness and desertion are the main circumstances that will expose lambs to attack by corvids. Observations suggest that the great majority of normal healthy lambs are not in danger of serious wounding by corvids, due to their agility and tough skin, to vigorous maternal defence and to the size disparity between victim and attacker.

The real causes of predation by corvids on young lambs demands more fundamental remedies than attemps at intensive elimination. Most methods of control such as scaring, shooting, trapping, and blasting at roosts are inadequate, and only poisoning on a large scale can be highly effective. This however has its drawbacks, as baits can remain toxic for many weeks and be transported by birds beyond the owners' property. More recently, the introduction of organic insecticides has provided some readily available chemicals, very toxic to birds, who die in such a way that other birds are not alarmed. Resultant widespread destruction of corvids could therefore take place, but this may have the effect of drastically reducing the main natural remover of carrion and lead to an increase in the breeding of flies. This could give rise to greater losses of stock due to fly-strike than are commonly caused by raven predation.

EAGLE v. BUSTARD

A Wedge-tailed Eagle was reported as having killed a young bustard (wild turkey) near Mallina Station in the North West. The attack was observed by Mr. R. F. Dear, the Department's Fauna Warden at Onslow.

Wedge-tailed Eagle (*Aquila audax*)

While on patrol Mr. Dear saw two young bustards which were obviously distressed. He pulled up some distance away to try and determine the cause of the birds' agitation. However, as the two birds moved to take off, one was struck down and killed by the eagle.

This was the first time Mr. Dear had observed such an attack but he believes it is probably a common occurrence which is mostly unobserved.

Our Diminishing Heritage

THE AUSTRALIAN BUSTARD (Wild Turkey) has vanished from most of the agricultural lands of the South West.

Like his overseas relatives the shy and wary Australian Bustard has been driven from his breeding areas by the spread of agriculture. His numbers have also been reduced by a considerable amount of illicit shooting which takes place every year.

Although fully protected by law for more than 30 years, this splendid bird is still found on the table as an occasional Sunday dish.

The unfortunate Bustard has many enemies including foxes and Wedge-tailed Eagles which attack and kill the young. Crows and ravens are known to take eggs. Man, however, is by far his worst enemy.

Despite the fact that it is an extremely timorous bird, and is difficult to approach on foot, the shooter may get within point-blank range from a car with disastrous consequences for the Bustard.

Evidence from other countries shows conclusively that these species are unable to withstand shooting pressure. The Great Bustard which used to live in Britain, ceased to breed about 1830 in the face of excessive hunting. Overhunting has also reduced their range in India and Africa, and in Western Europe, the bird is almost non-existent.

A similar situation exists in Australia where the species is believed to be extinct in Victoria and is rare in New South Wales and South Australia.

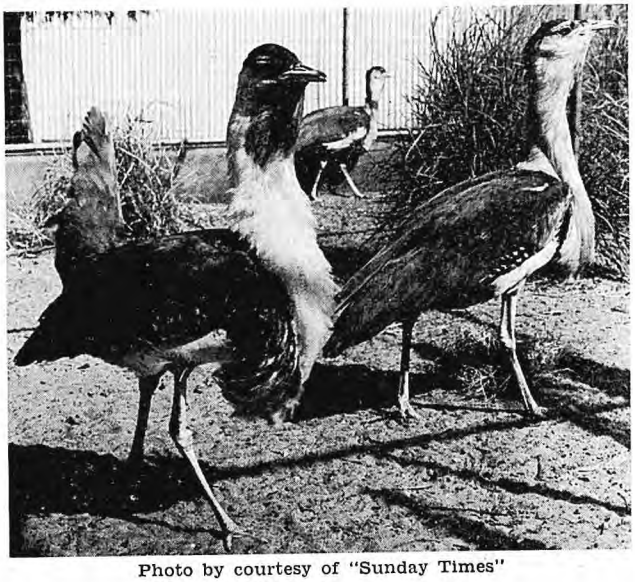


Photo by courtesy of "Sunday Times"

Another contributing factor in the world-wide decline in the Bustard's numbers is its slow rate of breeding. Females do not lay eggs until about four years of age and the male is not sexually mature until six or seven.

The nesting season of the Bustard is from July to November; the female lays one egg (sometimes two) on bare ground usually close to low scrub. The egg is light olive-green, marked with irregular blotches and streaks of olive-brown.

When first hatched the young are covered with mottled brown and black down and they leave the egg-site soon after hatching.

When protection of the Bustard was first sought, one of the prime considerations was its value as an insect suppressor. According to "Birds of Western Australia" (Serventy and Whittell, 1967) the food of the Bustard is mainly grasses, seeds and fruits of native plants, varied with mice, crickets, beetles and grasshoppers. The crop of one bird examined contained 150 caterpillars, 60 ground weevils (50 of which were an inch in length) and 35 millipedes.

Apart from being a big eater the Australian Bustard is one of the largest terrestrial flying birds in the world. Males are 43-45 inches in length with a 6 ft. 3 in. to 7 ft. wing span; the female averages 30-33 inches in length with a wing span of 5 ft. 5 in. to 5 ft. 9 in. Males range from 14 to 18 pounds in weight, and are occasionally heavier—the heaviest known being a Victorian bird which weighed in at 32 lb! Females normally weigh 10 to 14 pounds.

The Bustard's tail, back and wings are dark brown with light brown markings. On the wing coverts there is a black patch patterned with white. The crown of the head and crest-like nape feathers are black. The abdomen is white and the legs are yellowish or cream coloured.

In recent times mining development has opened the back country making the breeding areas of the Bustard more accessible to shooters. Reports from Honorary Wardens and other sources indicate that this bird is being hunted near mining centres in the North West. The inevitable result of this illegal activity will be the reduction of their range even further until only isolated populations struggle for survival.

While maximum publicity and legislation (a fine of up to $400) are directed towards the protection of these magnificent birds, little else may be done to improve their perilous state without a complete change of attitude among some sections of our community.

AUSTRALIAN BUSTARD

Eupodotis australis

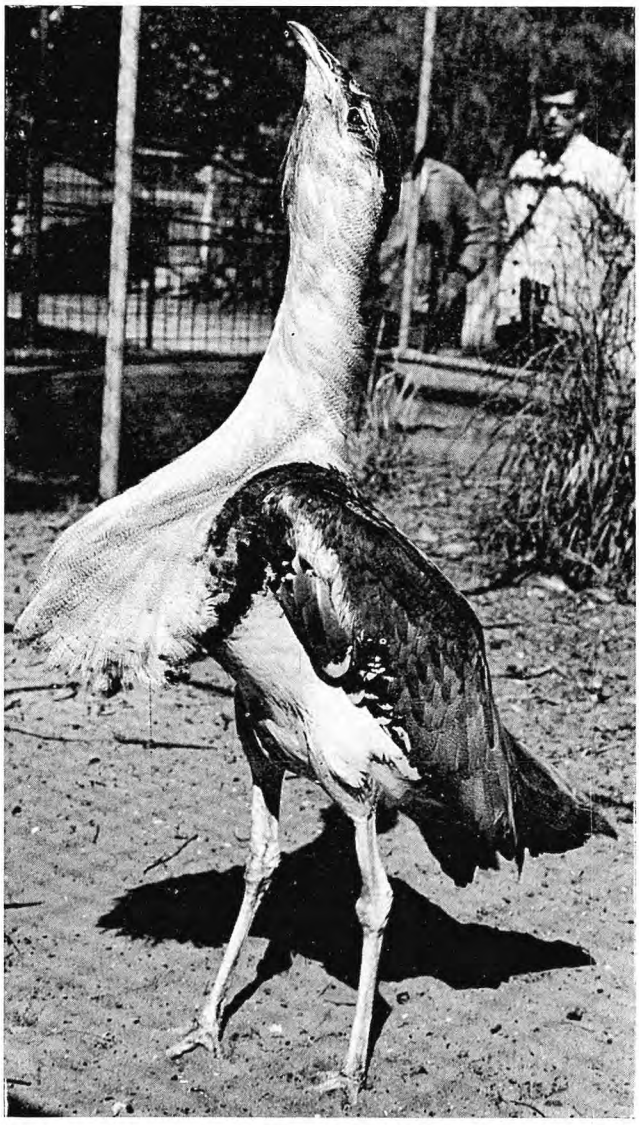


Photo by courtesy of "Sunday Times"

DISTRIBUTION:

Nomadic birds likely to be found all over the State in open country, particularly in areas where recent rains have fallen and insect populations are high.

Now rare in the South-West of W.A.

LOOKS:

Wing, tail and back—dark brown with light brown markings.

Crown of head and crest-like nape feathers—black.

Foreneck—greyish-white.

Abdomen—White.

Iris—white.

Beak—dull-white to brown.

Legs—Yellowish or cream-coloured.

WING SPAN:

Male—6 ft. 3 in. to 7 ft.

Female—5 ft. 5 in. to 5 ft. 9in.

LENGTH:

Male—43 to 45 inches.

Female—30 to 33 inches.

WEIGHT:

Male—14 to 18 lb. (occasionally heavier).

Female—10 to 14 lb.

NESTING:

Nesting season from July to November. Female lays 1 egg on bare ground usually close to low scrub. Egg measures 75-81 x 52-55 mm and is light olive-brown. When first hatched the young are covered with mottled brown and black down and they leave the egg-site soon after hatching.

DIET:

Consists mainly of grass, seeds, and the fruits of native plants. The diet is varied with crickets, beetles, grasshoppers, mice and sometimes young birds.

HUMAN ECOLOGY-WHAT DOES IT MEAN?

By R. O. Slatyer, Professor of Biology, Research School of Biological Sciences, Australian National University, Canberra.

Ecology is the study of organisms in relation to their environment; it deals with the environmental requirements of single species and with whole populations or communities, with the way in which organisms influence, and are influenced by their environment, and with the way in which organisms interact with one another.

Man is an organism, so human ecology is concerned with man in relation to other organisms and to his environment. Because of the complexity of the human environment, which is so strongly influenced by man's own actions, human ecology has many facets, and individual anthropologists, sociologists, and psychologists, as well as economists and biologists, have distinctive views as to what human ecology means.

In this article I wish to discuss first some general ecological principles and phenomena, then to look at man in relation to the ecosystems he occupies and which sustain him, and finally to point out the changes which are needed in his attitude to the environment in the interests of his long-term well-being as a species. To me this is the overview of what human ecology really means.

Ecology and environment

A primary feature of life on earth is that organisms do not exist in isolation; instead, the entire biosphere is composed of a range of ecosystems, each of which contains a number of species and a number of micro-environments, with each species tending to utilise and occupy an environmental niche more effectively than its competitors, and the whole assemblage of species tending to cohabit in a manner that provides a high degree of internal self-regulation. A forest, or a lake, provides examples of typical ecosystems, but the scale can vary widely. The entire biosphere constitutes the earth's ecosystem.

A primary feature of an ecosystem is that it tends towards self-regulation. Solar energy is absorbed by the green plants to provide, through photosynthesis, the basic energy input. Plants also absorb water and mineral nutrients from the soil. The plant components thus produced are then passed through a food chain, in which the initial products are eaten by herbivores, herbivores by carnivores, carnivores by other carnivores, and so on until decomposer organisms return the organic wastes and the remnants of the organisms in the food chain to the soil, in a form that enables their re-absorption by the green plants.

In most natural ecosystems, therefore, there tends to be no net production—in the human sense of a net harvest of materials. The solar energy absorbed and stored by the green plants is gradually consumed by metabolism through the food chain and dissipated as heat. Thus there is a flow of energy through an ecosystem, starting from solar energy, passing through successive forms of chemical energy—at each stage some energy being lost as heat—until it is all dissipated. Associated with this flow of energy is a cycling of nutrients through food chains so that the ecosystem as a whole tends to be balanced and self-contained.

The stability of an ecosystem, its ability to adapt to invasion or catastrophe without major change, is largely a matter of its diversity. In turn, this is largely a matter of the rate of nutrient cycling, or the rate of energy flow. An ecosystem with little diversity is vulnerable to invasion and, especially if energy flow is slow, is often unable to adapt to the change, at least without a period of marked instability. The successful invasion of Australia by rabbits is a good example of limited species diversity in Australian ecosystems. The ability of rabbits to compete favourably with other herbivores for forage, and the absence of effective predators, meant that the rabbit numbers increased dramatically until in many areas competition for food, between rabbits themselves, was the main factor limiting their numbers. The successful invasion of Queensland pastures by prickly pear is another example of ineffective competition and the absence of suitable animals in the food chain to consume it. Fortunately, the absence of predators of the insect *Cactoblastis,* introduced to control prickly pear, meant that this insect could control it effectively and the existing ecosystems, perhaps enlarged by these two species alone forming another loop in the food chain, returned to a degree of stability.

The most impressive examples of potentially unstable communities ripe for invasion by other species, are agricultural crops, where a single species may be grown over thousands of square miles. The opportunities for invasion by "weed", "pest", and "disease" species—all words of modern man's vocabulary—are tremendous.

Management of an ecosystem, "management" is another such word, in such a sense of increasing the numbers of one or a group of species within it, and perhaps in removing them from the ecosystem so that there is a net yield, need not disturb internal self-regulation. The primary need is to ensure that nutrients continue to be recycled, that other important organisms are not adversely affected, and that there is sufficient diversity in species composition to prevent the community from becoming unstable.

Man and environment

Let us now look at man's impact on the environment to see how he had adjusted ecologically to the biosphere in which he evolved. To my mind, it is easiest to do this by looking at man in three stages of his cultural evolution—man the hunter-gatherer, man the herder-cultivator, and man the technologist.

When man first appeared, of the order of a million or so years ago—a very brief time in geological time—the earth contained many of the species of plants and animals which exist today, most of the climates which exist today, and many of today's topographic features. Although the distribution of climates and the location of shorelines have changed, the range of ecological situations available for life has not changed to a pronounced degree. In many regions the first men enjoyed the same weather, breathed the same kind of air, and ate the same kind of animals as did Neanderthal man only a few tens of thousands of years ago, or today's huntsmen-campers in areas remote from industrial centres.

The place of early man in the ecosystems he occupied was a relatively passive one until his first deliberate activities in cultivation and animal herding. The first men preyed on, and were preyed on by, other animals. They gathered plant foods when and where they were available. They were, in all respects part of the natural food chain of the ecosystems they lived in; the changes they were able to make to their immediate ecosystems were probably of minor significance.

Gradually man's hunting and gathering skills increased with the use of crude tools, and with the development of different strategies and procedures. Fire was undoubtedly an important factor in this regard and was his only real instrument of environmental manipulation. The deliberate use of fire enabled man to increase primary productivity by keeping vegetation communities in a relatively productive sub-climax condition. It also encouraged the concentration of food animals on fresh vegetative regrowth, discouraged their concentration on burnt areas, and destroyed the cover offered to predatory animals.

The activities of the Australian Aborigine, prior to European colonization of Australia, in many respects epitomized the life of man the hunter-gatherer. If aborigines could not be seen, evidence of their previous presence at any location was meagre and short-lived. In most respects they were as well adjusted to the natural environment as were the animals and plants they consumed.

Man the hunter-gatherer really lived his natural ecological role. Admirable though this was in the sense of permitting nature's overall fulfilment, it clearly left man vulnerable as a species. So it was that man the farmer gradually emerged.

Those of us who admire the noble savage must conclude that life since the emergence of agriculture has been one long downhill slide—from fun to work. Whether or not one agrees with this view, the fact is that as man's hunting-gathering activities gradually became those of herding and cultivating, and he became a farmer, he began a commitment from which there was no escape.

As we have seen, the numbers of any species in an ecosystem will tend to rise if it is protected from its competitors. Man the herder-cultivator sought to ensure his own survival by protecting his food supplies—the plants and animals he wished to consume—from competition and predation, and by deliberately cultivating them. In ecological terms, he sought to maximize the energy flow passing through himself by maximising the energy flow passing through the species directly ahead of him in the food chain.

Because he was also able to protect himself against predation his numbers increased, and immediately his dependence on the managed ecosystems increased further. There was no going back. Not only did he become dependent on agriculture, but his increasing numbers started a demand-supply spiral which meant that continually he had to attempt to increase both the area under cultivation and the yield of any one area.

Furthermore, the more specialized his agriculture became—that is, the more he attempted to reduce the number of species in his managed ecosystems—the more unstable they tended to become. The tendency for undesirable species to invade his farms increased, the removal of existing vegetation exposed his lands to erosion, and this factor combined with the removal of nutrients from his ecosystems without replacement, began to reduce their productive potential.

Although some specific ecosystems were badly damaged (for example, those on the fringes of the Sahara where herding of goats caused almost completely new, and much less productive ecosystems to be established), man's activities, in most cases, were still of little consequence to

the biosphere as a whole. Not only was his capacity for major change limited by his muscle power and that of his domesticated animals, but his numbers were still so small that there was always more land over the next hill or in the next valley.

Man the herder-cultivator was therefore able, if not to live an ecological role as fully as man the hunter, at least to avoid his large-scale environmental change, although his low numbers were the main factor responsible. Even so, he barely managed to match food production against increasing numbers, as periodic famine in peasant agricultural systems, even today, testifies; thus in ecological terms, he was stretching the capacity of his ecosystems.

The story of man the technologist is, in most respects, simply an extension of man the farmer. However, with the industrial revolution, man's ability to harness power to his needs meant that the impact of his activities on the environment increased tremendously.

To my mind, this impact has two main, closely linked, aspects. The first has been the dramatic and continuing increase in man's numbers as his capacity to manipulate agricultural ecosystems for food production, and his control over human disease, have increased. The second has been the development of a great diversity of human activities, human demands, and human products. Thus not only has population itself increased rapidly, but the demands for each human being for factors other than basic food needs have also been increased. Man the technologist expects, not merely to survive, but to enjoy a socio-economic infrastructure which provides transportation, education, housing, recreational space, and many other cultural facets.

To satisfy these desires and needs, man has affected the environment both directly and indirectly. In a direct sense, his mechanical activity—in constructing cities, highways, and dams, and in soil cultivation and mining—is the most striking and obvious. Indirectly though the other products of modern technology are also of great importance as agents of change.

In these activities, man the technologist has attempted to ignore the capacities and characteristics of his ecosystems. The agricultural ecosystems in which he produces his food have been still further removed from stability. He has loaded them with the products of chemical technology, thinking only of maximizing food yield from a few species. In the process, the nutrient and non-nutrient chemicals (fertilisers, pesticides, weedicides) which he had added have had repercussions far beyond the ecosystems to which they were applied.

In the ecosystems in which man has built his cities he has also added vast quantities of nutrient and non-nutrient compounds—both domestic and industrial wastes. These, too, have affected regions far greater than the areas where they were dumped.

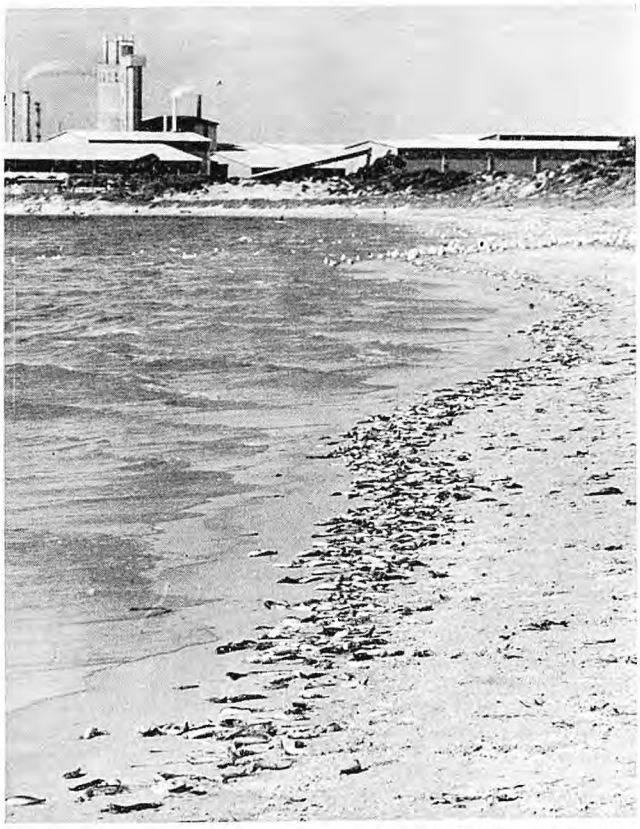


Photo by courtesy W.A. Newspapers

Dead fish line the shore in an area where man is making dramatic changes to the natural environment

The impact of these changes on the environment as a whole is now beginning to be appreciated. Ever since his appearance on earth, man has attempted to exploit his local environment for his own ends. In a sense, all organisms have done this, whether deliberately or not. As long as man used natural methods and the power of his own metabolism for this exploitation, and as long as his numbers were low, there was little likelihood of the changes he induced affecting more than his immediate environment—and his early attempts at exploitation were still essentially conservative, in the sense that they preserved the basic diversity and character of the environment. Now, however, the situation has gone full circle; man is so abundant and so powerful that he is changing the properties of the entire biosphere. The rate of change is far greater than occurred even during the great transitions from one geological epoch to another. Clearly this trend must be reversed.

Ecology and Man

What are the solutions to this collision course between man's numbers and demands on the one hand, and his environment on the other?

It is clear that the goal of "the greatest good for the greatest number" is impossible to achieve. Despite the bliss that this phrase may conjure up in some people's minds, even man cannot

maximise for both of these factors at once. Ecologically, it is probable he cannot maximise for either, unless "the greatest good" is identified with conservation of man as a species. But our present numbers, our present technology, and our present attitudes are not consistent with this goal.

What is really required is nothing less than a change in our basic philosophy of life—from an attitude to our environment which regards it as a resource to be exploited for short-term personal, regional, or national gain, to an attitude of living ecologically in a way that is essentially conservative of the environment.

Man the technologist must therefore become man the ecologist; not the same ecologist as man the hunter-gatherer, but rather one who can use the tremendous intelligence, experience, and power at his command to live in harmony with, rather than oppose, the natural workings of the biosphere. To my mind the human ecology, which spans the whole range of human activities should have at its core the study of man in relation to the biosphere, with a view to developing ecological guidelines for his future well-being.

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A.C.F. FORMS WESTERN CHAPTER

At a recent meeting of the Australian Conservation Foundation Executive in Sydney it was resolved that W.A. members be granted permission to form a local chapter—the first of its kind in Australia.

To be known as the Western Chapter the local body will be of great benefit to Western Australian members. One of the main advantages will be that in the future, when a member brings a conservation problem to the Foundation, a group from the local chapter can quickly assemble all available information on that issue and pass it to the central Executive which can then reach a well-informed and unbiased decision on the best course of action.

Other direct benefits for members will be organised lectures and seminars by local and visiting experts. To provide closer contact between members and office-bearers, the Chapter will, from time to time, hold meetings.

The Chapter will also be responsible for promoting the general objectives of the Foundation on maintaining quality of the environment. A further function of the Chapter will be to seek new members.

Western Australia is the fastest growing membership body in Australia. With only 100 members in January 1970 this figure has now climbed to 475. Total members throughout Australia is approaching 6,000.

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 spread the understanding of these issues by means of publications, press releases, seminars and direct influence.

The Foundation has already been actively involved in many of the major conservation issues in W.A. including; Cockburn Sound, the Fitzgerald River, etc., and has made submissions to the Committee of Inquiry into the Mining Act and to the Select Committee on Wildlife Conservation.

The A.C.F. is controlled by an executive of scientific and business people who are backed up by a council elected by members from all States and the A.C.T. The Governor General, Sir Paul Hasluck, is its Patron and Sir Garfield Barwick, Chief Justice of Australia, its President.

LITTER POLLUTION - RETURNABLE BOTTLES

The Reuters Environment Service News Sheet of May 6, 1971, carries a report that Carlton and United Breweries Limited had announced that the Company would eliminate non-returnable bottles from its marketable range of products in Victoria. The Company announced at a press conference on May 6 that it had ceased production of "stubbies" on May 3, 1971, and would replace them with a taller, slimmer, 13-ounce half-bottle which would be reusable. The Company's assistant general manager, Mr. L. J. Jordan, said that the Company had been studying the ecological problems of non-returnable bottles throughout the world for the last three-and-a-half years.

Readers with long memories may recall that the Chief Warden of Fauna, Mr. H. B. Shugg, drew attention to the problems caused by non-returnable containers in an A.B.C. "Country Hour" talk in 1968. His comments were reproduced in the Fauna Bulletin, September 1968, Vol. 2 No. 3. A recent issue of the Magazine "Environment" also has drawn attention to the extensive increase in the use of disposable containers and it is possible that non-degradable containers will submerge the civilised world unless the rate of increase is reduced or their use abandoned. As Mr. Shugg pointed out three years ago, the only

effective measure is to make them economically undesirable or, preferably, economically returnable. He suggested that it would be a relatively simple matter to impose a special tax on all non-returnable containers and packages. This tax would have a double effect. Firstly it would make disposable containers dearer and their contents would be less attractive to the consumer. Secondly, the tax would provide funds for distribution to local authorities to meet the costs of keeping the countryside clean.

Carlton and United Breweries Limited say that they will watch the effect of eliminating "stubbies" from their distribution in Victoria and see how other States re-act to the Victorian situation.

DECLARATION AND AMENDMENT OF RESERVES

NEW RESERVES

Name	Res. No.	Locality	Plan	Area	Previous Use	Purpose	Vesting	Gazettal
Gingilup Swamp	30626	15 miles east of Augusta	441/80	693a. 3r. 11p.	....	Conservation of Flora & Fauna	....	30-9-70
Tenterden	A30774	Tenterden Townsite	445/80	abt. 200a.	....	Conservation of Flora & Fauna	W.A.W.L.A.	12-2-71
Killarney	30791	2 miles South-West of Upper Kalgan	451/80	7a.	....	Conservation of Flora & Fauna	....	26-2-71

CHANGE OF PURPOSE

Name	Res. No.	Locality	Plan	Area	Previous Purpose	New Purpose	Vesting	Gazettal
Nallan	9169	12 miles North of Cue	221/80	353a.	Water	Water and Conservation of Flora & Fauna	Minister for Water Supplies S. & D.	4-12-70
	A.12590	6 miles south-east of Gnowangerup	436/80	Abt. 126a.	Resting Place and Protection of Flora	Conservation of Flora & Fauna	W.A.W.L.A.	12-2-71
Yornaning	21230	5 miles North of Cuballing	378/80	160a.	Timber	Conservation of Flora & Fauna	W.A.W.L.A.	26-3-71
	16226	6 miles South West of Nyabing	417/80	30a.	Ballast Pit	Conservation of Flora & Fauna	....	5-3-71
Mistaken Island	144	Frenchman Bay—Albany	457/80	Not surveyed	Acclimatization Purposes	Conservation of Flora & Fauna	W.A.W.L.A.	7-5-71

AMENDMENT OF AREA

Name	Res No.	Locality	Plan	Previous Area	New Area	Purpose	Vesting	Gazettal
Lake Powell (Grasmere)	25809	Elleker	457/80	abt. 458a.	abt 460a.	Conservation of Flora & Fauna	....	26-2-71
Coblinine Flats	A25133	6 miles South of Dumbleyung	408/80	abt 174a.	409a. 2r. 37p.	Conservation of Flora & Fauna	W.A.W.L.A.	5-3-71
Kulunilup Lake	26677	17 miles North West of Rocky Gully	443/80	1,092a. 1r. 24p.	1,512a. 1r. 22p.	Conservation of Flora & Fauna	W.A.W.L.A.	8-4-71
Coblinine Flats	A25136	10 miles North East of Katanning	417/80	abt. 4,016a.	abt. 4,558a. 1r. 33p.	Conservation of Flora & Fauna	W.A.W.L.A.	23-4-71

VESTING OF RESERVES

Name	Res No.	Locality	Plan	Area	Purpose	Previous Vesting	New Vesting	Gazettal
	17746	5 miles north-east of Kununoppin	34/80	5,102a.	Catchment area & Conservation of Flora & Fauna	....	Minister for Water Supplies Sewerage and Drainage	3-2-71

89074/5/71—1750

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