The Management of the Emu *Dromaius novaehollandiae* in Western Australia

BY

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I—INTRODUCTION

At the request of the Minister for Fisheries and Wildlife a committee was formed to ascertain the present status and management policies for the emu in Western Australia. Members of the "Emu Committee" consisted of Delegates from the Agriculture Protection Board, C.S.I.R.O. Wildlife Research and the Department of Fisheries and Wildlife.

In the past 50 years, since emus were first listed as vermin, many changes have occurred in land development, agriculture practices, and public attitudes which have had a direct bearing on the emu population within this State. In addition, extensive research by C.S.I.R.O. Wildlife Research and the Agriculture Protection Board (A.P.B.) have greatly contributed to a better understanding of this species' general biology, annual migrations, feeding habits and population fluctuations. It is the intention of the Committee to gather and collate all of the available information from its numerous sources so as to clarify the progression of events that have led to the present policies and attitudes on emu management within this State.

The following paper is divided into four major sections as follows: History of Emu Control and Management, Research, Deliberations of the Emu Committee and General Discussion. Throughout the Committee's deliberations it has endeavoured to gather information from as wide a spectrum of people as practical. In short, the Committee made a conscious effort to ensure that the information gathered and expressed here within, is representative of the present situation which now exists in the State.

It is appreciated that the recommendations or policies formulated in this report may need to be reconsidered in light of new scientific information, changing environs or flluctuations in numbers of the emu populations.

The prime objective of the Committee will be to rationalise our present situation so that policies can be formulated that would act as a foundation for future management programmes for emus in Western Australia.

II—HISTORY OF EMU CONTROL AND MANAGEMENT

Protection for emus in Western Australia was first specifically set out in the second schedule of the Game Act of 1874. In this schedule it states that it is an offence to kill emus from 1st day of June to the 30th day of September in any year with a penalty not to exceed the sum of forty shillings in addition to the sum of five shillings for each bird. In the Game Act of 1912, the terms of protection for emus became more general and were covered in paragraph (c) of Section 6 where it states "that any bird or animal indigenous to Western Australia shall be at all times strictly preserved, either generally throughout the State or in any one or more portions thereof". The legislative protection afforded to emus by these early legislative acts leaves little doubt that emus were given consideration by the early settlers and protected during their breeding season.

The Vermin Act was originally passed through State Parliament in 1918 but it was not until 6 August, 1922 that the emu was first listed as vermin. The listing of emus as vermin emanated from complaints by farmers in the Upper Chapman district where severe damage to wheat crops was caused by emus. The adjacent districts of Northampton and Mingenew were next with a request to have emus listed as vermin and by mid 1923 so many districts applied to have emus listed as vermin that the protection for emus under the Game Act was removed north of Latitude 30° South.

The only record kept of the numbers of emus destroyed during this early period was the total amount of money paid per annum as bonuses for emu beaks. When converting the total sum into individual emus killed it is evident that very large numbers were taken. In fact, during the latter half of 1928, 3 000 to 4 000 emus were destroyed in the Ajana district alone.

To help relieve the problem of emus invading the Northampton district from the Northern pastoral areas the Department of Agriculture erected a fence which is now known as the No. 3 Vermin Proof Fence, (Figure 1). This installation proved to be most successful but the next major invasion occurred in the North Eastern wheatbelt area around Campion, Bullfinch and Walgoolan. Farmers in their panic persuaded the Commonwealth and State Governments to beocme involved in the infamous "Emu War" of November 1932.

The Northampton district suffered several major invasions of emus commencing in 1935. During the first invasion, 28 577 birds were destroyed on the south side of the fence while 57 034 were destroyed from August to January on the north side of the No. 3 fence. In 1936, another invasion occurred and bonus payments were made on 15 521 emu beaks.

The Department of Agriculture published in its journal in June 1941 a paper entitled "Destruction of Emus" by Mr. A. Arnold, Chief Inspector of Rabbits. He states "that in the years 1936-1937 in areas north of Northampton and in the eastern wheatbelt beyond Merredin there were unprecedented numbers. A bonus was offered for their destruction resulting in over 72 000 being destroyed".

The pest problems associated with emus in the northern wheatbelt areas were not as severe in the more southern areas of the State. In fact, many naturalists were making their sentiments known to Parliament that emus should be given protection in areas where they were not causing agriculture damage. A similar sentiment towards emus was expressed in a letter written by the Chief Guardian

Figure 1. Vermin Proof Fences, Perth—Kalgoorlie and Great Southern Railways.

of Game in July, 1943 to the Minister for the North-West expressing dismay at the chaotic situation which now exists—"Emus have been declared vermin in so many districts that we who administer the conservation law—The Game Act—have virtually lost control, as the issue of a proclamation under the Vermin Act makes it practically obligatory on the Vermin Boards to destroy all vermin within their respective districts".

In 1943, the Government switched its tactics on emu destruction by offering to local vermin boards, free ammunition rather than bonuses. This resulted in districts having organized emu hunts using motor vehicles. During the latter part of 1943 the last single declaration was made for a shire to declare emus vermin as a move was made to the State Government to have emus declared vermin throughout the State. The declaration was resisted by the Government previously but it now seemed that the problem was of such magnitude that the Government had little choice but to agree. The proclamation was gazetted in 1944.

Pressure by naturalists and the majority of the district Vermin Boards themselves succeeded in having the anomaly rectified in 1947, when the emu was restored to the protected list in the lower south-west corner of the State. The Chief Guardian of Game wrote on the 19th November, 1948 that the proclamation declaring emus vermin was revoked on account of the relatively small damage being done in the south western portion of Western Australia. However, elsewhere bonus payments were made at the rate of one shilling (10 cents) per head and between the years of 1945-1960, bonuses were paid on 284 724 emu beaks.

The area designated as having emus protected can be defined as all that country to the South and West of the Perth-Kalgoorlie and Great Southern Railway lines. Also included in the protected area were all those shires which had an appreciable portion of their district within the protected area. This had the effect of extending the total protected area farther than was originally intended. Occasionally within this area, protection has been lifted at the request of the shire when emus have become numerous and troublesome. Shires which have consistently requested an open season in their districts are Greenbushes, Bridgetown, Collie, Nannup, Donnybrook and Gingin.

Emu bonus payments paid during the years of 1961 to 1973 showed that a total of 52 515 birds were killed inside the Vermin Proof Fences while 109 838 were killed outside. These figures cannot be relied upon as being totally correct as often birds killed outside of the fence were brought inside and turned in for bonus payments. Tables 1 and 2 give the total number of emus killed each year from 1960 to 1973 both inside and outside of the Vermin Proof Fence respectively.

The Department of Fisheries and Wildlife has in the main concentrated its efforts on emu management in the protected area of the lower South-West. Within this area there have been numerous complaints from shires which contain large tracts of State Forests, State Reserves or Vacant Crown Land concerning damage by emus to cereal crops, pastures and fences. The Department of Fisheries and Wildlife, in conjunction with the A.P.B., has when necessary assisted farmers who were having problems with large groups of emus. In 1962, Mr. Long of the A.P.B. and Mr. Bowler of the Department of Fisheries and Wildlife carried out a survey on emu damage on the property of Mr. R. J. Hebb of Collie. Mr. Hebb reported that flocks of 50 to 60 emus were feeding on his lupin crop. Mr. Long found that Strychnine was most effective in killing emus on Mr. Hebb's property after a short period of free feeding with grain was carried out.

In 1964 a second emu survey was carried out by the Department of Fisheries and Wildlife in the shires of Albany, Plantagenet, West Arthur, Cranbrook, Manjimup, Denmark, Upper Blackwood, Woodanilling and Kojonup. The survey was designed to question persons within the shire who were closely associated with the land to establish emu numbers and their pest potential. Upon concluding the survey, a system of damage permits was made available to farmers. It was felt that this system of emu control and management would not be abused as no commercial utilization of emus for pet food would be allowed. Also from the survey the Department recommended that the Shires of Bridgetown, Collie, Donnybrook, Gingin, Greenbushes and Nannup be opened on a damage permit basis which became effective on the 7th August, 1964.

The 1967 amendment to the Fauna Conservation Act gave this Act equality with the Vermin Act. Thus, a situation existed bringing the Legislative Acts into direct conflict. The Fauna Conservation Act protected emus throughout the State while under the Vermin Act, emus were declared vermin in certain areas and had to be destroyed.

In May, 1968 an extensive survey was carried out again for seventeen shires within the protected area of the lower South-West. The survey was to find out if there had been any change in the status of emus since the 1964 survey. The report of the survey recommended that the Shire of Bridgetown should be closed to shooting and that the Shire of Cranbrook would be open to shooting with the appropriate damage licences. These recommendations were accepted and gazetted on 19th September, 1969. Resulting from the survey and legislative changes, much of the emu problem with regards to commercialisation of skins and carcasses was resolved. The Supervising Warden, Mr. Bowler, inspected the major processing plants in the lower South-West in June, 1971 and found that only two carcasses of emus had been processed during the past twelve months. A check of the Department's records showed that only four persons held damage licences and twenty-four requests for licences were pending.

The Farmers' Union and the Pastoralists and Graziers' Association requested the Department to review its system of issuing damage licences in July, 1971. This request was forwarded to the bird committee of the Western Australian Wildlife Authority and a committee was formed with representatives of the A.P.B., C.S.I.R.O. Wildlife Research and the Department of Fisheries and Wildlife on 6th September, 1971. This committee was to review the status of the emu in Western Australia and in particular the lower South-West and report its findings to the Director of the Fisheries and Wildlife Department.

TABLE 1.

EMU BONUS PAYMENTS SHIRES INSIDE THE FENCE SYSTEM

Shires	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73
GNOWANGERUP	....	....	8	....	....	....	....	....	....	....	....	....	....
LAKE GRACE	104	284	213	161	159	232	120	111	146	....	....	89	....
NYABING/PINGRUP	15	51	16	12	....	16	21	61	7	36	....	....	....
TAMBELLUP	....	....	....	....	....	....	....	....	....	....	....	....	....
KOORDA	204	487	189	59	402	77	66	10	....	326	69	....	....
TRAYNING	83	20	....	48	98	....	46	17	....	....	....	....	....
KULIN	....	....	106	5	....	75	19	....	....	51	....	90	59
MERREDIN	326	642	98	122	527	16	31	21	74	198	79	....	....
MUKINBUDIN*	1 311	1 788	845	462	697	916	691	787	583	2 602	485	472	337
NAREMBEEN	248	263	223	153	213	161	166	195	....	416	62	....	31
NUNGARIN	....	....	....	13	....	....	....	....	....	....	....	....	....
TOODYAY	6	20	9	9	2	....	....	....	....	....	....	....	....
WESTONIA*	305	2 097	784	677	1 582	328	344	489	315	1 115	111	80	140
YORK	....	....	....	....	....	....	4	....	....	....	....	....	....
CARNAMAH	260	168	....	25	....	40	7	138	170	72	....	....	....
CHITTERING	....	....	5	....	3	....	....	4	....	....	....	....	....
COOROW	....	....	....	132	74	172	....	221	44	971	71	70	....
DANDARAGAN	42	62	121	63	76	84	22	208	6	35	121	27	....
GREENOUGH	265	303	343	244	485	149	332	270	174	193	128	23	54
GINGIN	53	118	26	70	79	15	126	71	89	108	31	77	72
IRWIN	154	79	58	37	79	150	7	193	53	42	6	....	26
MINGENEW	90	....	217	408	181	....	558	212	333	364	127	173	40
MOORA	32	78	69	30	12	54	59	....	165	70	31	....	16
MORAWA	492	554	775	211	505	243	65	35	291	167	711	283	263
THREE SPRINGS	266	....	74	128	134	124	59	87	27	....	74	....	155
CHAPMAN VALLEY*	218	340	633	261	343	416	406	691	214	1 145	170	240	55
VICTORIA PLAINS	81	122	19	71	78	39	40	134	54	....	26	16	....
TOTALS	4 556	7 476	4 831	3 401	5 739	3 162	3 189	4 315	2 745	7 911	2 302	1 640	1 248

*Shooting has taken place on the outside of the fence. Claims probably presented to inside Shires for bonus payments.

TOTAL 52 515

TABLE 2.

EMU BONUS PAYMENTS SHIRES OUTSIDE THE FENCE SYSTEM

SHIRES	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73
KONDININ	75	229	172	151	127	82	112	191	157	....	117	68	58
MT. MARSHALL	439	756	359	36	557	154	252	131	461	309	639	102	113
DALWALLINU	833	1 505	298	694	1 022	368	122	305	187	63	46	53	10
NORTHAMPTON	783	2 252	1 004	1 831	1 888	1 244	2 102	2 245	740	2 710	1 678	175	503
PERENJORI	187	1 672	815	282	1 359	1 034	267	1 778	185	1 921	526	251	440
EASTERN GOLDFIELDS DIVISION	689	1 748	1 817	2 339	2 462	1 863	2 055	2 781	2 061	3 980	3 129	1 106	1 655
CENTRAL DIVISION	1 819	3 822	2 630	1 780	3 120	3 310	1 456	2 565	847	7 079	4 407	600	516
NORTH WEST DIVISION	188	240	206	68	542	82	68	104	30	20	184	....	....
PILBARA DIVISION	268	839	343	640	682	341	309	502	550	486	205	13	7
TOTALS	5 281	13 063	7 644	7 881	11 759	8 478	6 743	10 602	5 218	16 568	10 931	2 368	3 302

TOTAL 109 838

III—RESEARCH

One of the earliest papers on emu control in Western Australia was written by Mr. A. Arnold, Chief Inspector of Rabbits for the Department of Agriculture in June, 1941 and suggests that the first line of defence against emus invading properties is *adequate* fencing. This point is most significant as 80 per cent of the 72 000 emus killed were on the outside of the rabbit proof fence, indicating the efficiency of fencing in keeping the emus out of certain areas. In addition he added "those emus that succeed in getting through can then be killed if a determined attitude to eradicate them instead of one of tolerance is shown. The rifle is very effective where they are confined to paddocks by fencing". Other control methods mentioned in the paper were pits and enclosures, poisoning of food and poisoning of water.

The initial studies by the Department of Agriculture (Agriculture Protection Board) were carried out by Long (1959) and Gooding and Long (1959) in the Northern wheatbelt area between Geraldton and Northampton near Nanson. This work was orientated towards emu control and investigations centred around breeding behaviour, feeding habits, extent of range and damage caused by emus to pasture, crops and fencing. Gooding and Long (1961) described in detail, poisons and poisoning methods which have proved successful during field trials. Also described by Long (1963) is the time of year when poisoning is most effective which is May to August before natural grasses and crops start to ripen and food is scarce forcing emus to feed on grain baits. There appears to be little doubt from this research work that emus can be effectively controlled by poisons such as Strychnine, Arsenic and Cyanide.

Estimates of damage caused by emus were assessed by Gooding and Long (unpublished) and a figure of $16 to $28 per bird per year was derived. This figure, as pointed out in the paper can only be regarded as a rough estimate due to the large number of variables in trying to establish what is truly emu damage and what damage may have been caused to crops from other sources. From the analysis of emu faecal samples Long (1965) established that cereal grain was consumed readily when available with 63·2 per cent of samples analysed containing cereal grains.

Dr. Davies of the C.S.I.R.O. Wildlife Research, Western Australia, commenced work on emus in the winter of 1959 in the Murchison area. This study was an endeavour to predict when the large movements of emus might occur and how many birds might be involved in any particular year. The project commenced with a survey to find a study area where birds could be readily observed and captured for marking. It was decided that Mileura Station, 161 km west of Meekatharra, best suited the proposed project and the area of research would extend north of the No. 3 Vermin Proof Fence into the pastoral country. The four main aspects of research on emus by Davies (1968) were food requirements, movements, reproduction and behaviour.

It was found that emus were herbaceous, feeding largely on the seeds, fruits and flowers of shrubs and the young green growth and flowers of herbs and grasses. Grasshoppers and beetles were also taken when they were abundant. The importance of specific types of food such as the mature pods of wattle (*Acacia sentis*) and their relationship to successful breeding in emus has been observed during the study. The controlling factor in the food reproduction cycle in the Upper Murchison area has been a wet period which accounts for more than 15 mm of rain falling. This amount is sufficient to cause run-off and to recharge the water storages of the minor water courses. Within these creeks the principal food production occurs. It has been suggested by Davies (per comm) that the amount of available for each year in the water courses cannot sustain the large population of emus which are breeding up on the man-made permanent water points; therefore, over-production and over-population of emus forces them to migrate from the pastoral areas in search of food.

The study of emu movements was made by counts along the No. 2 and 3 Vermin Proof Fences (see Figure 1) initially by Landrover and later by a light aircraft. In addition to these surveys it was possible to band 150 birds in 1969. Basically the information gained from the observations was that the movement of emus cannot be considered to be as regular as at one time thought. Generally, but not always, emus move South in July, August and September and move North in December, January and February. Banding studies show that emus in the pastoral country were able to move vast distances and therefore the population of this area must be considered as one unit. Even though there is no comparable data for the agricultural areas, i.e. emus inside the Vermin Proof Fences, it is very likely that the same mobility is characteristic of the emus in the agricultural and lower South-Western districts. It is also noteworthy that none of the forty bands recovered from the one hundred-and-fifty banded were found within the Vermin Proof Fences, indicating that these fences are indeed effective in keeping emus out of the agricultural area. See Figure 2 for movements of banded emus and location of Vermin Proof Fences.

In looking at emu densities it was found through aerial surveys of 1 214 hectares of pastoral and desert country that the bulk of the emu population lives on pastoral leases and only an insignificant fraction of it lives on the desert type areas, Davies (1969). It seems that emu production in the pastoral areas is tied to food availability. With clearing of large tracts of land, heavy grazing by livestock, and additional watering points emu populations have increased enormously. Although, it is extremely difficult to obtain accurate information about the distribution of emus prior to the development of the pastoral industry it is noted that large migrations of emus were not witnessed in the last century.

Behaviour studies on emus at Mileura are just beginning and certain ideas have been put forward by Davies (per comm) as to the initiation, orientation and termination of emu migration. It is felt that orientation of migration could be towards heavy cloud banks while the stimulation to initiate and terminate the migration is far from being understood. Although food does not appear to be the total stimulus for migration, it is a fact that many of the movements appear to take

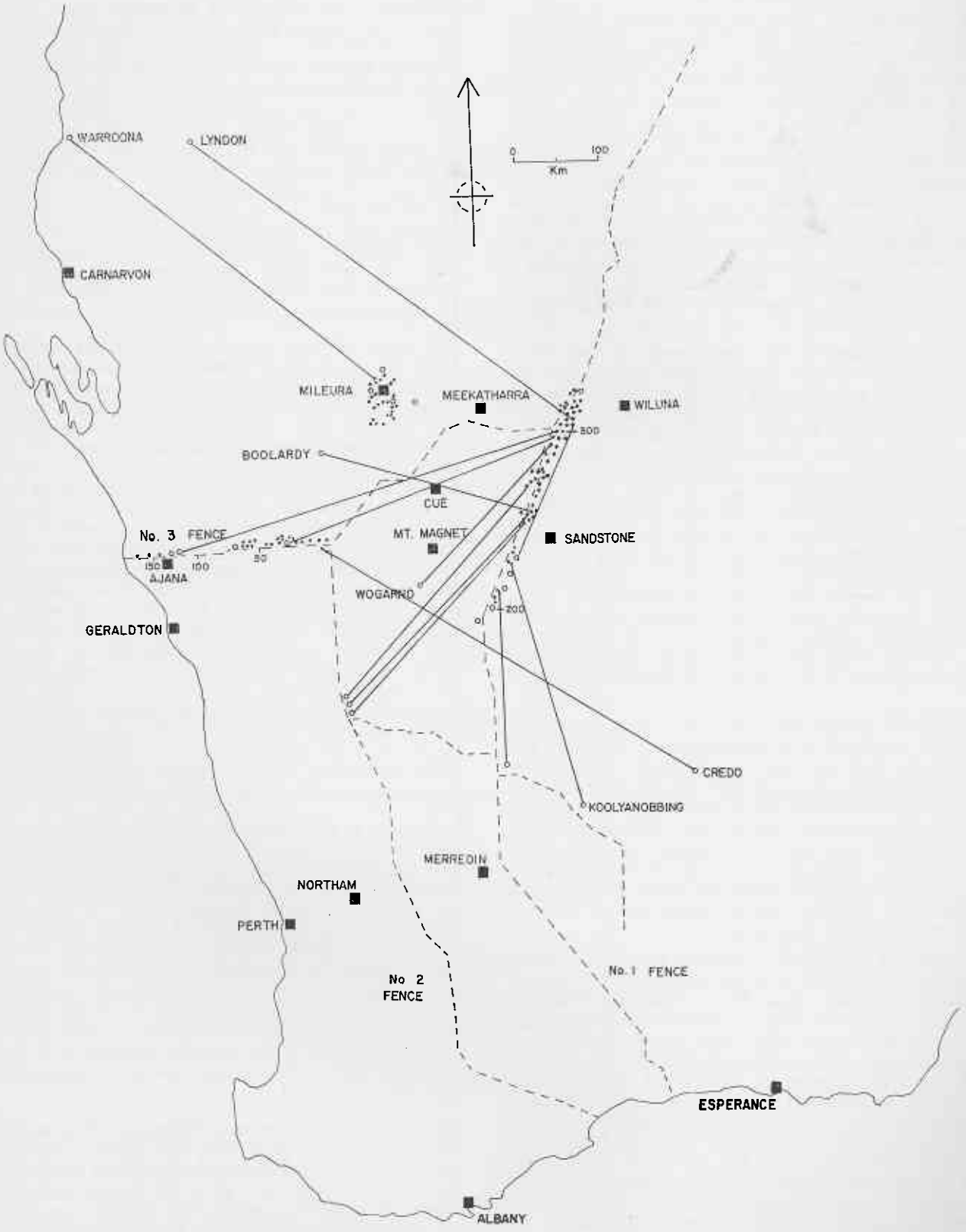

Figure 2. Movements of banded Emus established from recaptures. Individual banding and recovery sites are joined by a line except when movements took place along the fences. Davies (1971).

place in dry winters because at those times emus have less time to collect food (because of short daylight period) and are most in need of it. This aspect of the emu's life cycle is most likely to produce some of the information for predicting when emu migrations may occur and for what reason.

IV—DELIBERATIONS OF THE EMU COMMITTEE

This first meeting of the Emu Committee was held in September, 1971 and a general discussion took place as to the committee's terms of reference, the past and present status of the emu in Western Australia and the problems arising from attempts to control and manage this species.

The Director of the A.P.B., Mr. A. R. Tomlinson, tabled the A.P.B.'s present policy towards emus, which is given below:—

1. The Board considers landholders should have the right to protect agricultural production from emus, which are declared vermin throughout the State, with the exception of the South-West corner.
2. The Board is prepared to support the conservation of emus, and agreed to their protection in the South-West part of this State when the matter was discussed by the Co-ordinating Committee.
3. It is considered that the State vermin fence system protects the main farming areas from mass movements of emus originating in pastoral areas. The original rabbit proof fence system was modified for this purpose. The Board has dropped the bonus payments, while retaining the declaration as vermin.
4. Where emus are a problem to farmers within the fence system (mainly those adjoining reserves or other undeveloped country) the Board recommends poisoning or shooting of the emus which are troublesome on properties. The Board is prepared to organise control drives where warranted and where farmers are prepared to participate.
5. The A.P.B. does not wish to become involved in control within the protected area other than to give advice on control methods and to sit as an intermediary for passing on complaints. Complaining farmers or organizations are advised to contact the Department of Fisheries and Wildlife.
6. However, the Board considers that because of its responsibilities regarding the protection of primary production from pest animals or birds, it has an obligation to ensure that farmers are able to obtain this protection.
7. The Board has requested me to convey to the Department of Fisheries and Wildlife its concern at the emu position in the protected areas, as stated in a number of complaints received recently.
8. Board staff have carried out investigations into control measures.

In addition, Mr. Tomlinson explained that bonus payments on emus were reduced from 40 to 20 cents per bird in the financial year 1970-71 and thought all bonus payments would be stopped by mid 1972.

Mr. C. D. Gooding, Officer-in-Charge Vermin Control, explained in detail the research work carried out by the A.P.B. on emu control since 1959 in the Northern Agricultural areas within the Vermin Proof Fences. This work was generally orientated towards population reduction. In general, the present attitude of farmers living in agricultural areas where emus are causing damage is that the A.P.B. should eradicate emus on Crown Land before they reach the private properties. This arrangement is not satisfactory to the A.P.B., nor is it physically possible. The present method of reducing emu numbers in the agricultural area is to poison them with Strychnine which is mixed into grain and left in paddocks or stubble.

Dr. Davies, of the C.S.I.R.O. Wildlife Research Division, spoke on his research work on emus in the area west of Meekatharra. Included in his talk were aspects of field investigations which he carried out in the lower South-West of Western Australia. There were basically three types of damage; firstly, to cereal crops, secondly to grazing areas and thirdly to fences. His observations lead him to believe that much of the damage attributed to emus in pasture crops, i.e. clover, was in fact from rabbits and kangaroos and not emus. This usually occurred when fencing around the pasture area was totally inadequate or non-existent. Before any major management programme took place, it would be well worthwhile to actually investigate what was emu damage and what was not. This in itself might well bring the problems with emus in the South-West back into the right perspective. The emu population of the lower South-West was directly aligned with the amount of forests and unlceared land present and when this is cleared the emu population will decline.

On the 13th September, 1971, members of the committee attended a meeting at McAlinden Shire Hall near Collie from where many of the complaints on file in the Department of Fisheries and Wildlife on emu damage originated. The meeting was attended by nineteen farmers whose properties were in the immediate area of McAlinden, all of whom had emus on their properties at various times of the year. The discussion ranged from quite sensible approaches to the problem to quite rediculous ones made by farmers who wanted all emus within Western Australia eradicated and all State Forests and State Reserves fenced by the Government. The main idea which came forward from the meeting was that farmers wanted a system whereby they could take immediate action against emus feeding on their crops. At the present time, this was not possible because of the necessity to acquire a damage permit from the Department of Fisheries and Wildlife before taking any action. By the time the permit was in hand, the damage had occurred and the emus had moved on. Of the nineteen farmers attending the meeting, only seven were in possession of damage permits. Names and addresses of all farmers not holding permits were taken and a Warden was instructed to call upon each farmer to discuss the emu problem on his property and issue a damage permit if necessary.

The general impression from the meeting at McAlinden was that farmers need the opportunity, if necessary, to take remedial action against emus if they are seriously damaging their grain crops. The farmers in the McAlinden area would have as serious an emu problem as exists in the lower South-West which emanates from

their area being surrounded by State Forests. Even with the potential emu problem that exists in the McAlinden area, the majority of people at the meeting showed a tolerance towards the damage that emus cause to crops and fences. The few vocal people at the meeting who formed the minority were the same people whose names continuously re-occurred in our files expressing dis-satisfaction at the Department's protective attitude.

In April, 1972, the Emu Committee arranged a meeting for the various state associates which are concerned with agricultural or pastoral activities. Invitations were sent to the Farmers' Union, Australian Wheat Board, Pastoralists and Graziers Association, Combined Vermin Boards Association and Country Shire Councils. All groups invited sent delegates to the meeting which was held at the Department of Fisheries and Wildlife on 11th April, 1972.

At the meeting, both the A.P.B. and the Department of Fisheries and Wildlife explained the present policies towards emus and the legislative power which was given to both of the Departments to implement their policies. Dr. Davies gave a brief talk on his research programme which he had been carrying out over the past twelve years on the biology and general behaviour of this species. Delegates were then given the opportunity to ask questions on the Department's policies and the research work which had been carried out by the A.P.B. and C.S.I.R.O.

Delegates were asked if they could give their association's attitude on emus and what actions they would support in a management plan. Mr. Marinich of the Australian Wheat Board said that his Board wasn't seriously disturbed about damage caused by emus to grain crops. Although he recognized that locations such as Bullfinch, Southern Cross, Donnybrook and Collie had problems at certain times of the year, during the past year, the emu problem in the wheat growing area of the State was almost non-existent. He was satisfied with the present policies of the two Departments, but would like the situation kept under review so that if large populations of emus did erupt, as they did in the 1920's, they could be controlled and kept off the wheat crops.

Messrs. Brockman and Pearce, representing the Country Shires Councils Association, expressed the view that their Association was in favour of having the A.P.B. take control of the management of kangaroos and emus instead of the Department of Fisheries and Wildlife. This proposal came from a conference held in the South-West Ward with fourteen shires present and the motion was passed unanimously.

Mr. Brockman, said that emus were a problem at various times of the year on his property near Lake Jasper, especially when they broke fences and let sheep out into areas containing poisonous plants. He felt that areas around McAlinden and Collie had serious problems in that emus damaged oat and lupin crops and farmers were unable to take immediate action unless they had a damage permit in hand. Mr. Pearce said that in the Northern wheat growing areas there were still spasmodic problems with emus feeding upon grain crops; however, the damage permits system seemed to be working satisfactorily and he would like to see the system continued.

Messrs. Forrester and Skinner of the Farmers' Union were in favour of a system of immediate action against emus causing damage to crops and fences instead of the present damage permit system. They thought that a limited open season during the months grain crops were becoming ripe would help relieve the present problems. Thoughts were also expressed on emus outside of the Vermin Proof Fences and the possibilities of their numbers building up again if they were not kept in check by continuous poisoning campaigns.

Mr. Hardy, representing the Pastoralists and Graziers Association, expressed the opinion that emus are not generally a problem in pastoral areas. They do, at times, cause damage to fences but this is normally when they are pursued and forced to run into the fences. The eradication of emus in the pastoral area would be very expensive and probably not justifiable against the damage they cause. Mr. Hardy was asked if he thought it was necessary to have emus declared vermin in pastoral country or outside of the Vermin Proof Fences. He replied that in his opinion they should not be declared vermin in the pastoral country.

In summary, the delegates were mainly concerned with the area inside the Vermin Proof Fences where emus were damaging grain crops, pastures and fences. The damage to grain crops which was expressed as the foremost problem was occurring from October to December and a general open season on emus during this period would be welcomed by farmers. Secondly, it was thought that the financial loss attributed to emus generally was not of the magnitude that it required a major financial and man-power commitment to control their numbers. It was thought that by allowing farmers to shoot emus on their own properties when they were in large numbers and causing crop damage, much of the control work would be solved. In the pastoral areas, the damage was minimal and therefore of little consequence at the present time.

V—GENERAL DISCUSSION

Research programme and field surveys in Western Australia have collected much valuable information on emu biology, food requirements, movements, behaviour, population densities, agricultural damage and population reduction techniques. To consider some aspects of managing emu populations either north or south of the Vermin Proof Fences, it is necessary to consider a few facts about the general biology and habitats of the species.

Firstly, emus are winter breeding birds and lay their eggs in the winter months. Egg laying is dependent upon a combination of characters such as day-length and temperature. The emu seems to regulate its laying to periods when the light day-length and the temperature is declining and therefore in Western Australia, May to June is when the bulk of the birds breed. Exceptions to this rule can occur when climatic conditions cause the daylight period to become short associated with declining temperatures over a period with rain. This can cause emus to lay at odd times of the year. However, emus are basically winter breeders, because this enables them to use autumn rains to feed

upon before breeding. Also, winter rains cause the herbage to grow which is needed for young emus to feed upon. If emus breed later there is generally not enough green feed available to feed them which results in many dying.

During the incubation period the male sits on the eggs for approximately eight weeks without eating or drinking; the female may or may not stay around the nest. Both the male and female must therefore build up very large food reserves considering that the female will lay between eight and ten eggs weighing up to and over two kilograms each. This, in itself, is a lot of body material to put out. Also, the male may lose up to twenty-two kilograms weight during the incubation period when he is not eating or drinking and since the average weight of an adult male is approximately one hundred and ninety-eight kilograms, this represents a most significant weight loss.

Despite much popular talk about emu food, the two things emus do not eat are dried herbage and leaves of shrubs. Thus, in some ways the emus are not competing for food with sheep as sheep depend very largely on the leaves of shrubs and dried herbage. Emus do eat fresh green herbage from a variety of kinds of grasses and herbs. They also eat a lot of feed and it appears that the feed production in pastoral areas is very important in maintaining them through the summer. Flowers and succulent fruits of native plants are of great importance as a food source, especially many of the Proteaceous plants such as Hakea are heavily fed upon. Also important are insects, grasshoppers, caterpillars and sometimes beetles when they occur in large numbers.

In the North-West it appears that during winter months most of the food is ground food, i.e. fresh young grasses and herbage. Basically, because emus are herbivores, except for a few insects, there are some interesting implications about this diet. Firstly, emus must have a continuous food intake during the year. Feeding is done only during the day or on very bright moonlight nights and therefore during the winter which has less daylight hours there is less time for them to feed than in the summer. Secondly, their food intake must match their energy balance. In winter with its low temperatures emus must eat more to maintain body temperatures plus lay on additional fat supplies for the breeding season. The implication of these two factors is that emus must spend more time feeding in winter than in summer not only because the temperatures are lower in winter but because the day-length is shorter and they have fewer hours to feed. So again, contrary to many popular beliefs, emus suffer worse in the winter than in the summer. They are also more likely to run out of food in winter which explains why the migration of emus headed South occurs with large numbers collecting on the north-side of the Vermin Proof Fences in June through September. It also explains why the Department of Fisheries and Wildlife receives numerous complaints from farmers in the lower South-West during winter months concerning emu damage to pasture and fences which does not occur as readily in the summer months.

The study of movements by emus has shown two important characteristics which must also be taken into consideration when preparing any management programme for this species. Firstly, emus are capable of moving very large distances in a relatively short period of time and secondly, the Vermin Proof Fences have been found to be most effective in keeping emus from the Pastoral Country, out of the Agricultural Areas and vice-versa. Thus, when control programmes are planned it must be remembered that the effectiveness of eradicating emus within a small area is only going to be for a short period as others will soon replace them. This pattern of mobility has been repeatedly shown along the No. 3 Vermin Proof Fence with numbers building up on the north-side of the fence from June to September and again in December to February when numbers build up along the south-side of the fence, moving north.

Observations on emu behaviour suggest that emu density per given area may be directly linked with visual contact. Emus appear to avoid each other whenever possible and once the contacts reach a level when they become too frequent the birds move off until the frequency of contact drops to a tolerable level. This could explain what initiates emus to move in the first place. In heavy shrub or forestal areas the density of emus per unit of area is much greater than it is for equivalent areas of cleared or open country. This is probably one reason why emus persist in the numbers that they do in State Forests of the lower South-West.

In reviewing the types of agricultural damage caused by emus there seems to be three distinct types, two of which occur at specific times of the year. The main complaint arises from damage to cereal crops which occurs in the period from October to January when the plants have produced a seed head and are just becoming ripe. Emus invade the crops to feed on the heads and not only destroy the crop in this manner but also trample a great deal down while feeding. If the emus are disturbed while feeding they usually stampede and more crop is damaged this way than what is usually taken through being eaten. Secondly, damage to pasture in the months of March to June occurs as emus are feeding heavily so that they can build up fat reserves for the breeding season. Lastly, there is damage to fences resulting from emus crashing into them, breaking wire or pushing over steel pickets or small wooden posts. This last type of damage is not of great financial loss but most farmers look upon it as a nuisance, particularly if sheep or cattle are let out into adjoining properties or reserves. After observing areas of crops allegedly damaged by emus and discussing the problem with many rural people, it seems that in the majority of cases the problems are grossly exaggerated; however, there are places such as in the northern wheatbelt just inside the Vermin Proof Fence and in the lower South-West, directly adhering to the State Forest, where definite problems exist with emus and control measures are warranted.

The control methods of poisoning emus with Strychnines in grain has been proven to be the most effective; however, if at all possible to reduce the numbers by shooting I would prefer this as it is much more specific and more humane.

I firmly do not believe that farmers should be issued with poison by the various shires or any other govern-

ment authority for removing emus from their properties. Not only is this a dangerous practice, but using the method of open grain baits placed in the field for several days will undoubtedly kill non-target species of native fauna.

The basic assumptions which can be drawn from the research and field surveys carried out over the past twelve years are as follows:—

1. Emu populations in the lower South-West will diminish with clearing.
2. All emus inhabiting the South-West on the area inside the Vermin Proof Fences must be considered as one population.
3. At the present time the emu population is not threatened with severe depletion with the present control methods, i.e. damage licences plus controlled poisoning by the A.P.B.
4. The emu population north of the Vermin Proof Fences is a discrete population by virtue of the fence and has benefited enormously from the provision of permanent stock-waters and feed production. Emus within the pastoral area do not pose a serious economic threat to the pastoral industry.
5. A cost-benefit analysis calculated on the actual damage to agriculture crops caused by emus would not justify a government programme to destroy emus in the lower South-West.

The present A.P.B. policy towards emus is one of management with limited destruction in agricultural areas only. The A.P.B. has not become officially involved in the lower South-West because emus are not classified as vermin in this area; however, they will advise farmers on control methods if excessive damage is being done to their properties. They have refused to support applications by farmers in the lower South-West who want fences surrounding State Forests and State Reserves on two grounds. Firstly, because of the vast sum of money involved in fencing off all State Forests or Reserves and secondly, because it is the function of the landholder to protect his property against emus when they move out of the State Forest.

The Department of Fisheries and Wildlife had three methods open to it through its legislative powers under the Fauna Conservation Act to control emus in the lower South-West. Firstly, by means of a damage licence, which is given to the landholder after an inspection by a Fauna Warden of the damage caused to his property or crops by emus. The damage licence is explicit in setting out the numbers of emus to be taken in a specified time. Secondly, by a proclamation of an "Open Season" which allows the landholder, by means of a firearm, to destroy emus on his particular property which are causing damage. The period of time can be adjusted to a few weeks or for the full year. Lastly, is the method to declare a "General Open Season" and allow everybody to destroy emus on any property except State Forests or State Reserves. This last method of course is not really viable because of all the abuses to which the system would be open.

On 18th January, 1973 the Department of Fisheries and Wildlife, by procalmation in the *Government Gazette*, declared an "Open Season" for emus in forty shires of the lower South-West. Emus were to be taken by the owner or occupier of the land by means of a firearm only. In most of the remaining areas of the State (seventy-three shires) an "Open Season" was declared for landholders or leaseholders to destroy emus on their property by any means possible.

Under both proclamations it is an offence to buy or sell emu carcasses or skins unless holding the appropriate licence from the Department. This system of emu control has not been established long enough to make a value judgement on it; however, my first impressions are that it is somewhat too comprehensive and the period of "Open Season" should be reduced from a full year to only the months of October to January when the bulk of damage is done to the cereal crops. Also, I firmly believe that poisoning of emus should only be carried out by persons competent in handling these substances, such as field staff of the A.P.B.

In discussions held with the Supervising Fauna Warden, Mr. S. W. Bowler, on the time and effort put in by the Fauna Warden Staff on emu control and management problems, he advised me that his staff spend less than three per cent of their time on emu problems. The wardens have a routine procedure to follow when interviewing a farmer on emu damage which consists of actually viewing the damage to crops and fences. Usually, farmers are fairly co-operative with wardens, but there are incidents when emus are known to have been destroyed without farmers consulting wardens. The overall problem with emus has changed little in the past fifteen years and generally it is sporadic and very seasonal. Mr. Bowler also believes that "much of the emu problem is greatly exaggerated", but feels the Department should maintain its contact with farmers even though much of its value is only for public relations.

In considering the new regulations on the "Open Season", Mr. Bowler felt that the system would work as long as destruction only occurred on private property and not State Forests or State Reserves and that commercialization activities were not allowed. He also believes that emus will only survive in the future in small isolated pockets of State Forests.

VI—RECOMMENDATIONS

1. Emus are indigenous fauna of Western Australia and should not be classified as "vermin" under the Vermin Act, as this makes it obligatory by law that a landholder must destroy emus on his property.
2. Management programmes which require a reduction in the emu population in either the agricultural or pastoral area should be dealt with under a proclamation of a limited "Open Season".
3. In general, the period for the limited "Open Season" each year in the lower South-West should be from October to March.
4. The only means by which a property owner can destroy emus on his property during the proclaimed "Open Season" is by means of a firearm.
5. All poisoning of emus to be strictly carried out by the A.P.B. and poisoned grain must be removed from fields once the programme has been completed.
6. A job sheet should be prepared for use by Fauna Wardens to assist them in conducting their inter-

views with farmers on emu damage and these reports filed at the Department of Fisheries and Wildlife for future reference.

7. In changing future policies on emus, the Department must carry out a survey by interviewing a wider spectrum of landholders throughout the lower South-West. Presently the Department's files are heavily biased towards the feelings of a small minority of farmers living adjacent to State Forests who are suffering abnormally high crop damage from emus.

VII—POLICY OF DEPARTMENT OF FISHERIES AND WILDLIFE ON EMU CONTROL AND MANAGEMENT

1. The Department of Fisheries and Wildlife recognizes its responsibilities to conserve the emu as an indigenous species of Western Australian fauna.
2. The Department also recognizes that emus within some districts of Western Australia cause agricultural damage and through necessity emu numbers must be reduced in such districts and held at manageable levels.
3. The Department insists that the emu population existing in the lower South-West portion of the State (being the area South and West of the Perth-Kalgoorlie and Great Southern Railway Line) be safeguarded to ensure that a population of emus can be maintained in Western Australia with minimal interference
4. The Department is aware that emus within the lower South-West cause damage to agriculture properties at certain times of the year and has found it necessary to allow landholders or leaseholders to take remedial action without applying formally to the Department for a damage permit.
5. In addition, the Department accepts recent research findings that the Vermin Proof Fences divide the emus of the State into discrete populations. This concept must be taken into consideration when appraising proposed management programmes for emus.
6. The Department considers that any commercialization of any populations of emus must be strictly controlled in accordance with the Fauna Conservation Act. In other words it would be necessary to demonstrate that emus within the area where commercialization was proposed, could withstand harvesting and that such harvesting was necessary.

VIII—A JOINT STATEMENT OF POLICY ON EMU MANAGEMENT BY THE DEPARTMENT OF FISHERIES AND WILDLIFE AND THE AGRICULTURE PROTECTION BOARD

1. Emus are indigenous fauna and as such should not be subject to mandatory destruction. However, where agricultural or ecological damage results, some form of management control will be necessary. Management programmes for the species, before implementation, will be prepared and agreed upon by both the Agriculture Protection Board and the Department of Fisheries and Wildlife.
2. Management programmes which require a reduction in the emu population should be dealt with under a limited open season in the south-west of the State as defined by the two railways, (Perth-Kalgoorlie and Great Southern) and:— It is recommended that the conditions for the open season be those published in the proclamation for the South-West in the *Government Gazette* for 26 January 1973, with the addition of, in (2) after the word "Act", "or such other means as approved by the Chief Warden of Fauna, where necessary, under the supervision of the Agriculture Protection Board".
3. Management programmes which require a reduction in the emu population in areas other than the South-West, should be dealt with under a limited open season and: It is recommended that the conditions for the open season be those published in the proclamation for other than South-West areas in the *Government Gazette* of 26 January 1973.
4. It is recommended that the removal of emus by firearms only is impractical in some circumstances and that other techniques for their removal are warranted. Applications of these other means are currently under investigation and will be reported upon within twelve months.
   The long-term objective is that all poisoning, where required, should be carried out by, or under, Agriculture Protection Board supervision.
   In the interim period, landholders may continue with the present measures. It was accepted that there could be situations where measures may have to be specified to safeguard endangered wildlife.
5. The limited open season in the South-West should be restricted to the period from October to March. Damage Licences for periods outside the declared open season shall be issued where justified. It is recommended that there should be consultation initially, at regional level, between officers of both Departments regarding the issue of Damage Licences.
6. It is recommended that whenever possible joint training sessions be held for both Agriculture Protection Board and Department of Fisheries and Wildlife field staff to co-ordinate the programme laid down by each Department.

IX—ACKNOWLEDGEMENTS

As Chairman of the Emu Committee, I am indebted to all members of the Committee for their time and effort which they have so generously given. In particular to Mr. Gooding and Mr. Long for their help in collecting data from the files of the A.P.B. and Dr. Davies of the Division of Wildlife Research, C.S.I.R.O., for his co-operation in giving me numerous reports on his research into emus and for reading the manuscript of this report. Also, I would like to thank Mr. Mearns and Mr. Bowler of the Fisheries and Wildlife Department for their co-operation and for accompanying me on field trips into the country. Lastly, I would like to thank Mr. A. R. Tomlinson, Chief Executive Officer, Agriculture Protection Board and Mr. H. B. Shugg, Secretary, Department of Fisheries and Wildlife, for their help and guidance in bringing the recommendations of this report forward to formulate a joint future policy on emu management for Western Australia.

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