

Natural History February 1971

MOORUNDE WILDLIFE RESERVE
PROGRESS REPORT ON THE POPULATION STUDY OF THE HAIRY NOSED WOMBAT

The establishment of the Moorunde Wildlife Reserve has created the need for more detailed knowledge of the wildlife species living in this 5,000 acre reserve near Blanchetown.

Since the fundamental purpose of the Reserve is the preservation of the Hairy Nosed wombat, this naturally becomes the principal subject of any studies made in the area.

As the success of the Reserve in conservation of the wombats will be gauged by the increase in population, an essential requirement is an estimate of the population at the present time to form a basis against which future population estimates can be compared, and for this purpose I have undertaken to make a survey of the whole of Moorunde Wildlife Reserve. The support of enthusiastic companions has made it possible to cover the original 3,000 acres in three weekends (15, 16 August; 17, 18 October; and 5, 6 December 1970).

The survey is being made by walking across the Reserve at intervals of 200 yards, counting and observing each burrow and recording its position on the map. Extensive use is being made of aerial photographs taken by the Lands Department in locating warrens.

Summarising our findings on the original 3,000 acres:-

The number of burrows found total 1,354 grouped into 262 warrens consisting of from 1 to 62 burrows. Of these, 575 burrows (40% of the total) and 216 warrens (83% of the total) carried signs of wombat activity, No doubt some isolated burrows have been missed, but I am confident that all the larger warrens have been located.

At first it was considered that any burrow, carrying signs of activity such as fresh droppings and footprints was an occupied one, but observation of several warrens at dusk and during the night has thrown considerable doubt on this assumption. Therefore it is unlikely that the 575 burrows showing activity represent a population of that many wombats.

The assumption that each warren showing activity is occupied by at least one wombat would result in an estimate of 216, but much more detailed observation will be necessary before any confidence can be placed in such an estimate, and this is intended as soon as the general survey of the remaining 2,000 acres is completed.

It is quite definite that the wombat population of the area has suffered serious setbacks in recent years as witnessed by the number of deserted burrows and by the number of skeletons found on open ground - many more must have died in their burrows during recent severe droughts.

It is heartening, however, to find that most warrens seem to have survivors to form a breeding nucleus that we hope will increase into healthy communities under the improved pasture conditions resulting

from the fencing.

The survey has shown that the wombats favour the areas supporting shrubby growth of acacias, etc., where burrows are found in incredible numbers, rather than the areas timbered with Mallee.

A number of warrens have been established in clearings in the Mallee scrub covering the Western end of Moorunde but are completely absent from the large area of Mallee and Bluebush at the Eastern end.

The survey was commenced with the idea of reaching an answer to one question, that of population. As the survey progresses it seems that new questions far outnumber the answers - and this is just makes it so interesting.

It is hoped that after many more excursions to Moorunde we will have some of these answers.

GLEN TAYLOR.

Natural History March 1971

MOORUNDE WILDLIFE RESERVE
SECOND PROGRESS REPORT ON THE POPULATION STUDY OF THE HAIRY-NOSED
WOMBAT

A progress report on the survey covering the original 3,000 acres was presented in the February issue of "Natural History".

The survey of the northern section of 2,000 acres has since been made during two weekends (30, 31 Jan 1 Feb, and 20, 21 Feb) completing the preliminary survey of the whole of Moorunde.

We found a much lower population in this area compared to the original 3,000 acres and this is largely attributed to scrub cover discouraging wombat activity over the majority of this part of the Reserve.

Burrowing activity is mainly concentrated in a strip about 1/3 of a mile wide along the western fence forming a fringe to the wombat population of the adjoining Portee Station. A few large warrens have been established in the mallee areas and show signs of recent activity, but many isolated burrows have been deserted for a long time.

The number of burrows found total 471 grouped into 147 warrens consisting of from 1 to 32 burrows. Of these, 140 burrows (30% of the total) carried signs of wombat activity.

This brings the totals for the whole of Moorunde to 1825 burrows in 409 warrens, 264 of these warrens showing signs of activity.

Thus not only is the population of the northern section lower than on the original 3,000 acres, but a greater proportion of the burrows have been abandoned, indicating greater losses during drought seasons. Since this is also the last area to be fenced, recovery is expected to be a rather slow process.

However, although the wombats are not as numerous as in other parts of the reserve, there is such an abundance of wildlife, particularly birds, that preservation is well worthwhile and does serve to illustrate the relationship between wombats, other animals and vegetation.

Now that we have a general picture of the wombat distribution within the Reserve, our efforts will be concentrated on a small typical area which we can study much more intensively and from this work we hope to learn more about the wombats and eventually to be in a position to make an accurate estimate of population.

GLEN TAYLOR.

Natural History October 1972

PROGRESS REPORT ON WOMBAT POPLATION AT MOORUNDE

Earlier progress reports on the continuing survey undertaken to provide data on the population status of wombats on Moorunde Wildlife Reserve appeared in the Natural History journals February & March 1971.

In the preliminary survey an attempt was made to estimate the population by the arbitrary method of allowing one wombat to each warren showing definite signs of fresh activity. It is accepted this is approximate only, but tends to be conservative.

STUDY AREA

Since July 1971 and area of Moorunde has been under study to establish more reliable criteria for population estimates. An area 1 mile x $\frac{1}{2}$ mile has been accurately surveyed and detailed maps prepared showing the location of all known warrens. The study area was chosen to include three distinct vegetation types viz. Mallee, Geijera and open grassland. This occurs on the fringes of the main wombat communities of the Reserve and consequently the population density of the study area does not represent the maximum for the Reserve but rather an overall average.

The study area contains 29 warrens (253 burrows) and each of these has been mapped for record purposes. The underground connections between burrows have been determined and shown on the maps revealing an interesting complex of the interconnections which are no doubt related to the social organisation of the warren. For instance, Warren No. 34, typical of the larger warrens in the study area consists of 32 burrows without obvious signs of group division. When underground connections were determined, however, it was found that 9 distinct groups of burrows existed. The burrows of each group are connected but there is no connection between groups. One burrow in this group has a single entrance with no connections with other burrows.

The identification numbers allotted to all warrens during the original research survey in 1970 have been utilised and in addition all burrows of each warren have been allotted numbers to facilitate systematic recording of observations.

CARBON DIOXIDE DETERMINATIONS

At an early stage of the study an attempt was made to determine whether a burrow was occupied by measuring the temperature and carbon dioxide content of the air in the burrow. It was argued that an occupied burrow would be slightly warmer and the carbon dioxide content higher due to the animal respiration.

Many air samples, including some from burrows where wombats were observed, were collected and tested giving carbon dioxide content varying from 300 parts per million (0.03%) to 2500 parts per million (0.25%). Outside air was found to contain 240 parts per million (0.024%) carbon dioxide. Temperatures were found to be remarkably constant at 72°F (these were tests in summer 1971).

It is significant that all determinations of carbon dioxide were either very high or very low. The high levels were invariably from burrows with only a single entrance, the low levels from burrows with multiple entrances. The high level of carbon dioxide in single entrance burrows appears to be the product of excreta accumulated in a stagnant air space.

The efficient ventilation provided by multiple entrances ensures a low level of carbon dioxide and may well be the main reason for having several entrances. In a land where predators able to pursue a wombat underground is rare it seems improbable that the alternate entrances are provide for escape.

Enlightening as they were regarding the ventilation of warrens, the carbon dioxide determinations were concluded to be unsatisfactory for testing the presence of wombats and were consequently discontinued.

PERIODIC INSPECTION

Periodically all burrows in the study area are examined and any signs of activity and wombat sightings recorded. Four examinations have been made in the past 12 months and a fairly consistent pattern of activity is emerging, enabling certain groups of burrows to be considered regularly occupied.

A group of interconnected burrows (or in other words a burrow with multiple entrances) is assumed to be the habitation of one adult wombat and is regularly occupied if signs of recent digging and fresh droppings are consistently noted.

On this based the study area containing 29 warrens consisting of 253 burrows in 55 groups is estimated to have a population of 21 adult wombats.

After the original survey of this particular area 2 years ago the population estimate was 13 based on a count of 13 warrens where fresh activity was evident. In the light of later observations it is clear that the original estimates for the whole of Moorunde were much lower than the actual population and it is now felt that 400 would be a more relative figure than the previous estimate of 264.

As the data on the study area accumulates, further refinement can be expected and it is anticipated that eventually population trends can be assessed as a guide to management of the Reserve.

GLEN TAYLOR

RESEARCH

The establishment of the Moorunde Wildlife Reserve has created the need for more detailed knowledge of the Hairy-Nosed Wombat in this area.

Information on trends in population and any changes in distribution within the Reserve will facilitate wise management and is the basis on which the success of the Reserve will be judged.

As a matter of policy, any research on the Reserve must be non-destructive and involve minimal disturbance to the wombats. A research project within the terms of this policy has been undertaken to provide regularly upgraded data on wombat activity and to provide reasonably accurate estimates of population.

The first stage in the study, locating and mapping the warrens, began in August, 1970. With the aid of aerial photographs taken by the Lands Department, a systematic survey was made by walking across the Reserve at intervals of 200 yards, sketching each warren, fixing a small identification tag, plotting its position on the map and recording signs of activity. This involved well over 100 miles of walking in a period of five weekends.

Over 2,000 burrows grouped into about 400 warrens were found, but many had been abandoned and it was appalling to see the bleached bones of many wombats who perished in the severe 1967-68 drought. It was heartening, however, to find that most of the larger warrens had survivors to form a breeding nucleus which we hope will thrive in the improved conditions which have resulted from fencing and the removal of sheep.

The survey has shown that the wombats favour the areas supporting shrubby growth of geijera, acacia, etc. rather than the areas timbered with Mallee. Although a number of warrens have been established in clearings in the Mallee covering the western end of Moorunde, they are completely absent from the Mallee in the south eastern corner.

After this survey it was obvious that intensive study of such a vast number of burrows would be impossible and it was decided to select a half square mile study area which included sections of the three distinct vegetation types, viz. Mallee, Geijera and open grassland. There are 29 warrens in this area and each has been individually mapped to scale and the underground connections between burrow entrances determined. During inspections of the study area at approximately three month intervals in the past year, observations of activity and wombat sightings have been recorded and a fairly consistent pattern of activity is emerging, enabling certain groups of burrows to be considered regularly occupied. It is estimated that the present wombat population of the study area is 21, and this probably represents a fair average density for the whole Reserve.

It is proposed to select a further study area in a more densely populated section for comparative purposes and where the investigators will have greater opportunity to observe animal behaviour.

A second inspection of the whole of Moorunde began in August, 1972 and 3,000 acres have so far been re-examined. Observations made during the current inspection indicate that a substantial number of burrows have been brought into active use in the geijera and grassland areas since the inspection two years ago, offset to an extent by an apparent decline in activity in the Mallee scrub. The overall result, however, is a significant increase in activity, suggesting that the wombats are making good progress. The fact that many of the wombats sighted have been young ones is also a favourable sign.

The population estimate for the whole Reserve after the inspection in 1970 was approximately 260, but it is already evident that this number will be exceeded by a considerable margin by the time the current survey is completed.

It is intended to continue these surveys indefinitely and the accumulated data will be valuable in making accurate assessments of the population status and trends.

Some intriguing questions have been posed during these surveys and now that the majority of the preparatory work, such as mapping of the warrens is complete, time will be available to undertake a broader scope of studies that may provide answers to some of these questions.

Natural History August 1973

MOORUNDE WILDLIFE RESERVE

Progress Report on the Population study of the Hairy-Nosed Wombat.

During 1970 a comprehensive survey was made of the wombat warrens on Moorunde. Warrens were identified with inconspicuous tags and any signs of activity at each burrow were recorded to provide a basis for estimating the population trends.

A second inspection has just been completed and a comparison of the records for all tagged warrens shows an overall increase in activity (measured in number of warrens showing fresh activity) of 11%.

The increase is far from constant over the whole area, in fact, in the Mallee areas there has been an apparent decline in population but this is offset by a corresponding gain in adjacent geijera areas.

The most spectacular increase has been in the Northern Moorunde area i.e. the last area to be fenced, where a 48% increase in activity has been recorded in the two years.

Considering that in both 1971 and 1972 Moorunde received less than average rainfall (7.63" and 4.90" respectively) the increase in activity is quite impressive and augurs well for the coming year in which surplus feed seems assured.

Recording instruments

During these surveys I had been intrigued by the fact that relatively few sightings of wombats had been made when it is so obvious that they were so active.

Vigils late into the night produced only spasmodic information of limited value and I was soon convinced that only with a continuous record of the arrivals and departures of wombats from a warren could significant data be obtained.

Design of a suitable instrument to do this commenced in January 1972 and construction in the home workshop started in June. It was installed in a warren in January 1973.

At each burrow entrance in the warren a flap operated switch is installed and wired with buried cables to the centrally placed recording instrument in which a waxed paper chart advances at the rate of 14 mm. per day. As any switch is actuated by the passage of a wombat a solenoid operated stylus registers the event on the chart, defining whether the movement was into or out of the burrow.

The instrument has 21 channels, one registering daylight-darkness using a light cell circuit and the others for connection to individual burrows. At present 15 burrows are being recorded and it is intended that the remaining 5 will be connected to a neighbouring warren at a later date. The instrument operates continuously for four weeks after which the chart and battery must be changed.

An enquiring mind is apparently not exclusive to the human race; wombat footprints were seen along the entire length of nearly every run of wiring where the ground had been disturbed to bury the cables and in several places the wire had been carefully uncovered, one wire bearing the imprint of an exploratory bite.

Some difficulties arising out of switch design and wiring resulted in flat batteries during early field tests but these were overcome and satisfactory recording has now been achieved.

The charts show very regular use of several burrows in the warren and occasional use of all other burrows. Activity has been almost exclusively during darkness and at the present time about 8 hours per night is spent out of the burrow.

This certainly explains why so few wombats are seen during daylight hours but the full value of the project will not be realised until a record covering several seasons is available.

The project also aims to establish the number of residents in the warren, to show the effect of various seasons on feeding times and will provide Rangers with information to advise photographers and visitors to the Reserve the most favourable times to see the wombats in their native state.

GLEN TAYLOR

Natural History May 1975

MOORUNDE WILDLIFE RESERVE

Progress report on the population study of the Hairy-nosed Wombat.

Since my report in August 1973, Natural History journal, work has continued along several lines.

Study Area No. 1.

This area of approximately 140 hectares has been inspected periodically on 17 occasions since July 1971. The data noted during these inspections indicate consistent occupation of a large proportion of the warrens with some seasonal variations in activity. The estimate of population which stood at 13 in 1971 increased to 21 by October 1972, and has stabilised at approximately 30 since October 1973. The increase has been most evident in the larger warrens whilst some of the smaller warrens which showed activity in 1971 have been abandoned, in some instances due to burrows in soft soil caving in after heavy rains.

Study Area No. 2.

In December 1973, an area of approximately 80 hectares consisting of Geijera grasses community was selected for examination similar to that in study area No. 1. This area appeared more amenable to intense colonisation than study area No. 1 due to the better pasture available.

In 1970 when the area was first seen during the general survey, and again in 1972, both dry years, there were signs of activity at most of the warrens, large and small. However, since 1973, activity at most small warrens has declined or ceased, while some increase has been evident in the larger warrens, it appears that the wombats prefer to congregate in the large warrens when feed is plentiful and disperse into the smaller farflung warrens when feed near the main warrens is depleted. Observations in the next dry season may throw more light on this theory.

Recording instrument

The instrument set up to continuously monitor wombat arrivals and departures from each burrow of a selected warren is providing a wealth of information that is making the effort put into this project well worth while. The record now embraces a period of two full years allowing some direct comparisons to be made.

In that time there has been a marked increase in activity in the warren due to a buildup in average population from two to four. Since the report in August 1973, the coverage of the instrument has been extended to part of a neighbouring warren, and the results suggest that the fluctuation in the population from time to time is due to wombats changing residence temporarily to the adjacent warren.

The spread of hours of activity in the various seasons of the year appear to be governed mainly by the length of the night. Activity is spread throughout the hours of darkness and only on rare occasions has the instrument recorded excursions in daylight, these generally in the

late afternoon. The advent of rain seems to be a rather exciting event in the existence of the wombats. On most nights of substantial rain, the wombates are in and out of their burrows continually, sometimes 50 or more individual movements being recorded in the warren.

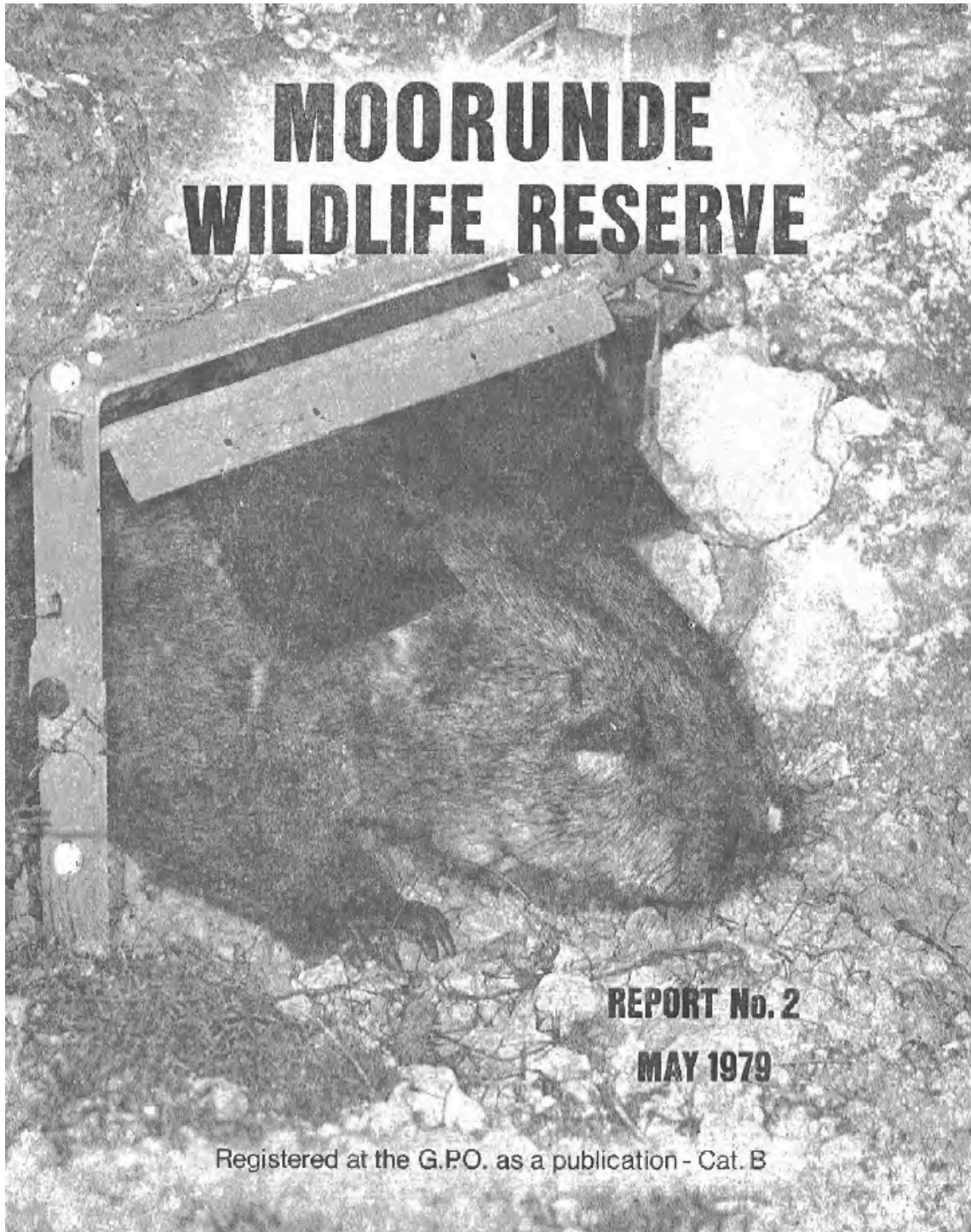
Visits from man very obviously have the opposite effect. Everytime a visit is made, the routine of the wombats is disturbed. In the early stages of the project, activity would be restrained for two or three nights but as the wombats have become accustomed to regular monthly servicing calls to change the chart, their concern has been far less pronounced and now usually at least one wombat comes out that night.

It is not surprising, then that a visitor is rarely rewarded with the sight of a wombat. I was treated to such a rarity when showing a friend over part of Moorunde recently. As we neared a warren, we sighted a wombat fast asleep near his burrow.

It became a challenge to see how close we could approach without disturbing him. I was amazed when he slept on contentedly while I knelt beside him and stroked his forehead. I would have preferred to creep away and let him sleep on, but felt obliged to wake him to be sure he was fit and well, so I stroked his shoulder until he looked up and saw me.

His reaction and hasty retreat into the burrow left little doubt about his health!

GLEN TAYLOR.



COVER PHOTO:- "Hairy Nosed Wombat tripping
recorder switch"

by Glen Taylor

WOMBAT POPULATION STUDY

When Moorunde Wildlife Reserve was established in 1968 the number of wombats coming under its protection became the subject of much speculation. The readily accessible parts of the Reserve carried obvious signs of wombat habitation in the form of large warrens and scattered burrows, but many areas had not been examined in detail and the actual wombat population could only be guessed at.

In 1970 the current research programme was undertaken with the specific aim of establishing trends in population as a guide to the effectiveness of the Reserve in its role as a sanctuary for the Hairy-nosed Wombat. It was important that the study be extensive enough to encompass the extremes of climate that this generally arid region experiences.

Being a shy nocturnal animal the Hairy-nosed Wombat is rarely seen and simple counting methods cannot be employed. The procedure adopted was to inspect the warrens at regular intervals for signs of activity and record these observations for later analysis.

The first step was to make a comprehensive survey of the entire Reserve, plotting the warrens on a map and allotting an identification number to each warren.

The survey revealed a wide variation in vegetation communities which can be divided into three distinct types - Mallee scrub, covering about 65% of the area, Geijera shrub with grass and open grassland.

The distribution of wombat warrens was found to have a very marked dependence on the vegetation type. In the Mallee areas the warrens were either widely spaced or completely non-existent. This is presumably due to the sparse supply of suitable food grasses in the scrub cover. In the shrub and grassland, however, the warrens are closely spaced, the density increasing as the number of shrubs diminishes.

The size of warrens varies tremendously, ranging from single burrows to complex systems with as many as sixty-two interconnecting burrows.

The survey revealed a total of 399 warrens comprising more than 2,000 burrows. It was obvious that time would not permit frequent regular inspections on such a large scale and it was decided to select a representative area 1.6km x 0.8km as a study area which could be inspected at intervals of approximately two months. Study area no.1 contains samples of each of the three vegetation communities in approximately the same proportion as the Reserve as a whole.

Later, study area no.2 was selected in Geijera shrub and grassland area for comparison purposes.

In addition to the two-monthly inspections of the study areas, the entire Reserve is inspected every two years when observations of activity are recorded and the trends noted.

As the data accumulated, the trends in activity began to fall into a

consistent pattern but the significance of the signs of activity in relation to actual wombat population still remained in doubt.

It was then decided to design and install an instrument in a selected warren to record all wombat arrivals and departures from each burrow. Design of a suitable instrument commenced in January 1972 and it was installed in a warren in January 1973. At each burrow entrance in the warren a flap operated switch is installed and wired with buried cables to the centrally placed recording instrument in which a waxed paper chart advances at the rate of 30mm/day.

As any switch is activated by the passage of a wombat a solenoid operated stylus registers the event on the chart, defining whether the movement was into or out of the burrow.

From the chart the following information can be read:-

1. The time at which a wombat leaves the warren and by which burrow entrance.
2. The time at which a wombat returns and by which burrow entrance.
3. The period of time spent out wandering and feeding.
4. The number of wombats out at any one time giving a guide to the population of the warren.

From this data can be determined the effect on wombat activity of the climatic seasons and the effect of drought and flush years.

The recorder operates continuously and is providing a tremendous amount of information on the wombat's behaviour. The charts indicate that:-

1. The wombats leave their burrows almost exclusively at night, the time of departure and the time spent out varying with the seasons.
2. Rain has a marked influence on activity. During nights of wet weather the wombats make many excursions from their regular burrows and frequently visit other burrows, giving the impression that rain is treated as quite an exciting event. Following heavy rains the burrows are often cleaned out. Also, seasons of higher rainfall result in higher levels of activity in the warren.
3. The wombats seem generally to be creatures of habit, using one or two entrances consistently for long periods. Suddenly, however, they will sometimes change to using alternate entrances for a time. There is also considerable exchange of population between neighbouring warrens.
4. Some burrows receive only casual visits on rare occasions.
5. Several wombats may share the same burrow.
6. Daylight excursions are extremely rare in good seasons but become more frequent during long periods of low rainfall when

food is scarce.

7. The wombats are particularly disturbed by human visits to their warren. Each time the warren is visited, the wombat's activity for the ensuing night is restrained, with only the boldest wombats venturing out generally much later in the night than usual.
8. There has been a marked increase in the population in the warren in the past three years.

The recorder provides a means of relating signs of activity to actual population. The ratio of activity signs/population established from the recorded warren is applied to the observed signs of activity in the study areas and the entire Reserve giving a population figure which is felt to be a realistic one.

On this basis the population in Study Area no. 1 has increased from 20 to 50 in five years and in Study Area no. 2 from 21 to 60 in three years. In the entire Reserve population estimates are:

1970 -	290 wombats
1972 -	310 "
1974 -	350 "
1976 -	370 "

The rate of population increase in Study Area no. 2 is of particular interest in that it is much greater than that which could be attained by natural breeding increase. Analysis of specific areas of the Reserve shows that some areas have lost population while others have gained, yet the overall population of the Reserve has shown a modest but steady increase. This change in population distribution is apparently the effect of food availability in varying seasons.

In years of good rainfall the population is more uniformly distributed with even the Mallee areas supporting substantial numbers of wombats. In dry seasons, such as the past three years, however, there is strong evidence of migration towards the open areas where good pasture exists.

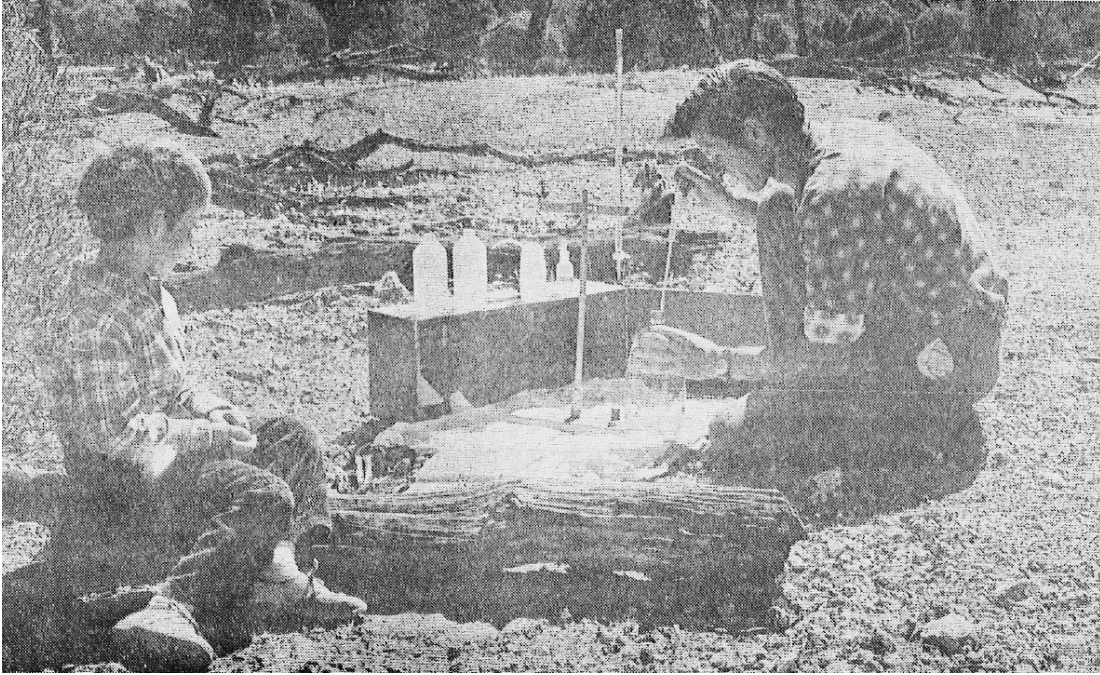
The study in a period of six years has encompassed extremes ranging from very dry (124mm of rainfall in 1972) to the wettest ever recorded for the area (579mm in 1973) as well as several more or less average years. It is of interest to note that a population increase occurred even in 1972, a year of rainfall only marginally above the record low of 1967 when the area that has since become Moorunde Wildlife Reserve was devastated by drought that killed a great number of wombats.

The fact that population has continually increased even in adverse years indicates that the full carrying capacity of the Reserve has not yet been reached. When it has, it must be expected that the population will fluctuate depending on the benevolence of the seasons.

The study confirms that the action taken by the Natural History Society to exclude sheep from the Reserve has allowed natural regeneration of the area thus providing conditions favourable to the recovery of the wombat population.

It is felt that the trend of results justifies the decision to continue the study along its present line so that up to date information will be available to the Management Committee when policy decisions are to be made.

by GLEN TAYLOR



The carbon dioxide content of air in burrows was determined by a modified Pettenkoffer's method.

Natural History April 1980

WOMBAT POPULATION STUDY

In the May 1979 issue of the Natural History journal I reported on research into wombat population trends on the Reserve up to the end of 1976. Up to that time there had been increasing numbers of wombats in the Reserve on every inspection since the population study began in 1970.

The rainfalls for 1976 and 1977 were respectively 15% and 35% below average resulting in drought conditions which severely tested the endurance of the wombat population. The reaction of this was a reduced birthrate - there were practically no signs of young wombats observed during the 1977 inspections. Adult wombats were often seen foraging in daylight during this drought period and while most looked healthy, all were very thin.

Naturally, the stress of difficult conditions increased the death rate of weak or aging wombats and there has been a consequent drop in the population. Whilst one would not wish suffering on the animals, it seems that this natural culling is an essential ingredient in maintaining a vigorous, drought resisting species.

Rains in 1978 that were 18% above average brought the needed pasture improvement. Daylight sightings again became rare but photographs taken by a camera that the wombats themselves triggered showed that they quickly gained condition.

During 1979 the small footprints of baby wombats were again regularly seen around the burrow entrances and occasional sightings of juveniles with their mothers have been made.

The rainfall for 1979 was a little above average but being late in the season did not produce the amount of grass that might have been expected. However, there is ample pasture in most parts of the Reserve and the continuing study will tell how soon the population recovers.

GLEN TAYLOR

Natural History Aug-Sep 1985 - Moorunde Wildlife Reserve Report No. 3

WOMBAT POPULATION STUDY

Although Moorunde Wildlife Reserve was established in 1968, time did not permit any serious research until 1970. Then, a comprehensive compass survey was made of the entire reserve, plotting all significant wombat warrens that could be located by examination of aerial photographs and by systematic search on foot.

Approximately 400 warrens have been found and identified with inconspicuous numbered markers. These warrens comprise over 2000 burrows. The size of the warrens range from single burrows to complex systems of more than 60 interconnecting burrows.

The distribution of the warrens is dependent on food availability. Wombats feed predominantly on grasses which grow best in open areas, thus the open areas contain the greatest density of warrens. The Mallee scrub which covers about 65% of the reserve area is very sparsely populated with wombats, but shelters other forms of wildlife coming under the protection of the reserve.

Daylight sightings of wombats are so rare that counting the animals seen during daytime inspections is of no use in estimating population and inspections at night by spotlight have been found impracticable.

The method that has been adopted to estimate the population is to make inspections of two sample areas of the reserve at 3 monthly intervals observing and recording signs of activity at each burrow. Every two years every warren in the whole reserve is inspected and signs of activity recorded. Comparing the numbers of active burrows observed in the inspections establishes trends in wombat activity.

To relate this to population, a recording device was installed in one warren in 1973 and has operated almost continuously, producing a record of every arrival and departure of wombats from each burrow in the warren. These records, now comprising over 30 thousand events, are used to determine the movements of wombats with the changing seasons and weather conditions and particularly to determine the population of the warren.

The relationship between the population and the observed signs of activity can be accurately established for the recorded warren and by extending the ratio to all warrens the population of the whole reserve can be estimated.

The period of the study has seen seasons of almost every extreme and population trends have been influenced by the vagaries of the climate. For the entire reserve the comprehensive inspections yielded estimated populations of:-

1970	-	290 wombats
1972	-	310 wombats
1974	-	350 wombats
1976	-	370 wombats
1978	-	330 wombats
1980	-	410 wombats
1982	-	180 wombats

Two years of low rainfall in 1976 and 1977 caused a decrease in breeding and as a result a population loss was recorded in 1978, but this was quickly recovered when good rains came in 1979.

The sustained drought which worsened as it progressed through the years 1980, 1981 and 1982 had a drastic effect on the wombat population as indeed it did on wildlife and domestic stock populations throughout Australia.

Early in the drought the reaction of the wombats was to cease breeding, resulting in a natural attrition of the population. However, as the drought moved into its third year, deaths resulted from direct starvation, particularly among immature animals.

During this period, various types of stock feed were provided at some warrens in an attempt to supplement the meagre food supply, but the experiment was unsuccessful in that the wombats totally ignored anything except their natural pasturage.

In March 1983, the rains produced a green tinge on the reserve but failed to germinate much grass which is the preferred diet of wombats. By contrast the well timed rains of 1984 resulted in the best growth of grass seen on the reserve for 10 years and good opening rains for 1985 will encourage early recovery of the wombat population.

A comprehensive inspection has not been completed since the 1982 population estimate, but observations so far reveal considerable activity and suggest that the 1982 estimate may have been conservative due to the activity of the wombats having been suppressed by drought conditions.

The study has demonstrated that the Society's conservation policies are succeeding in preserving a viable wombat population in the reserve even under the most adverse climatic conditions and the study will continue to monitor population trends over the next few years to ensure that this situation is maintained.

Glen Taylor

Natural History Feb-Mar 1987

WOMBAT POPULATION STUDY

My last report on the wombat population study at Moorunde appeared in the August - September 1985 special issue. At that time the most recent general inspection of all known warrens had been in 1982 at the height of the worst drought experienced since the Reserve was established.

Of the 2238 recorded burrows on the Reserve 21% showed signs of activity. On the next comprehensive inspection in January 1986, 30% of the burrows showed signs of recent activity. This indicates a substantial recovery occurring over a 3 year period in which 2 of those years yielded significantly less than average rainfall.

In the meantime, regular inspections of the two study areas indicate a gradual increase in activity over the same period.

Also, the activity recording device on a warren under study had recorded very little activity in 1982 and 1983, but is now recording regular use by several wombats.

It may be several years before the population achieves the peak experienced in 1980, but the upward trend is quite apparent and proves the resilience of the species.

There is adequate feed at present as a result of good rains in the latter half of 1986 and the general condition of the Reserve is good, comparing very favourably with adjacent properties where sheep are grazing.

I was fortunate to be at Moorunde on 7th December last year when the ground was awash after a sudden thunderstorm. Several wombats were seen moving around in daylight, obviously attracted out of their burrows by the moist atmosphere. On one warren I saw 3 wombats all in very good condition.

Viewing the same warren on my last visit in January 1987, I again watched 3 wombats until the sun rising above the horizon sent them retreating into their burrows.

Glen Taylor

WOMBAT POPULATION STUDY

Although passing reference has been made in recent Ranger Reports to the population study, there has not been a detailed report in the Journal since 1987. The study is indeed continuing and provides useful information for the management of the Reserve.

A basic tool in the gathering of data for the study is an activity recorder which monitors the activity of the wombats residing in a selected warren having 15 burrow entrances. Theoretically, the recorder, powered by solar cells, could operate unattended for two years, but in practice it is checked for correct operation and the chart removed for analysis every three months during my turn of Ranger duty.

Some interesting features are revealed by the recorder. The wombats are distinctly nocturnal, emerging at dusk in the cooler months, later in warm, dry weather and returning in the early hours of the morning.

They tend to use a favoured entrance for extended periods, but will then change to another entrance for a time. During the mating season, usually sometime between September and December, there is intensive activity using all burrow entrances.

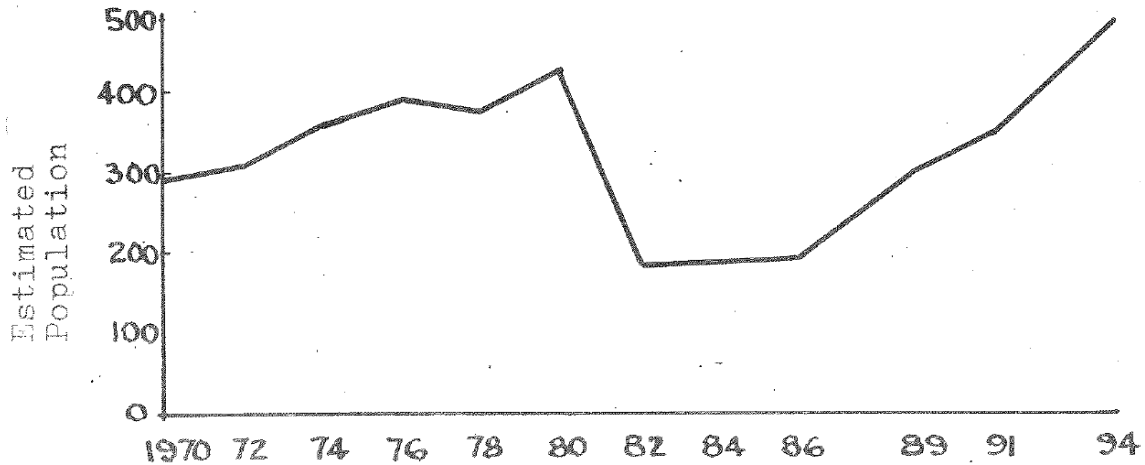
During times of drought when the wombats are feeling the stress of food shortage they will emerge during the day to bask in the sun, presumably to gain some warmth which, in normal times, would have been derived from their food. Also, during drought, they reduce their activity dramatically to conserve energy. Wombats are quite sensitive to human presence, every time I visit the warren to service the recorder most wombats in the warren stay underground all the following night, only the boldest venturing out much later than usual. This supports the Society's policy of minimising human activity near warrens on the Reserve.

From the data obtained by the activity recorder, a relationship between the number of active burrows and the number of wombats using the warren can be derived.

This ratio is used to estimate the population in two study areas containing 34 and 47 warrens respectively which I inspect every three months for signs of activity in the entrances, hence deducing the number of active burrows.

Graphs drawn of the number of active burrows and the estimated population show the trends in these representative areas in intervals of three months, enabling further refinement of the relationship between active burrows and population.

About every two years I inspect every burrow in every warren in the whole Reserve and using the ratio of active burrows/population derived from the study area graphs, the total population is estimated. The most recent inspection was in March this year. The trends from 1970 to 1994 are shown in the graph below.



Comparison with rainfall suggests that rainfall is a determining factor in population trends, with steady rises during years of average rainfall, but losses in times of extended drought. The most dramatic of the latter was the population crash in 1982 after three years of much less than average rainfall.

In three of the following four years, rainfall was below average, slowing the recovery, but the population grew steadily during the next six years of consistent seasons to achieve its current level, the highest since the study began.

Recent seasons have also been favourable for other animals and I expressed concern about the increasing numbers of rabbits as reported in the Journal July-Aug 1992, other Rangers too were expressing the same concerns. Unfortunately, late rains in 1992 and 1993 created conditions unfavourable to rabbit baiting and their numbers increased alarmingly. In the early months of this year feed was becoming scarce and no rain seemed to be forthcoming. The scene appeared to be set for another wombat population crash.

Meanwhile, as the situation was becoming favourable for bait laying, plans were being made and in March the rabbit control programme was carried out in ideal conditions as reported in the May-June Journal.

The dramatic reduction in rabbit numbers relieved grazing pressures, but much of the damage had already been done and it became common to see wombats out in daylight showing the first signs of drought stress. Luckily, the soaking rains in June came at an opportune time, germinating new grass and totally transforming the appearance of the Reserve.

The wombats are certainly out of danger for the present but we now wait anxiously for follow-up rains to carry the pasture through to a favourable conclusion to the growing season.

Glen Taylor

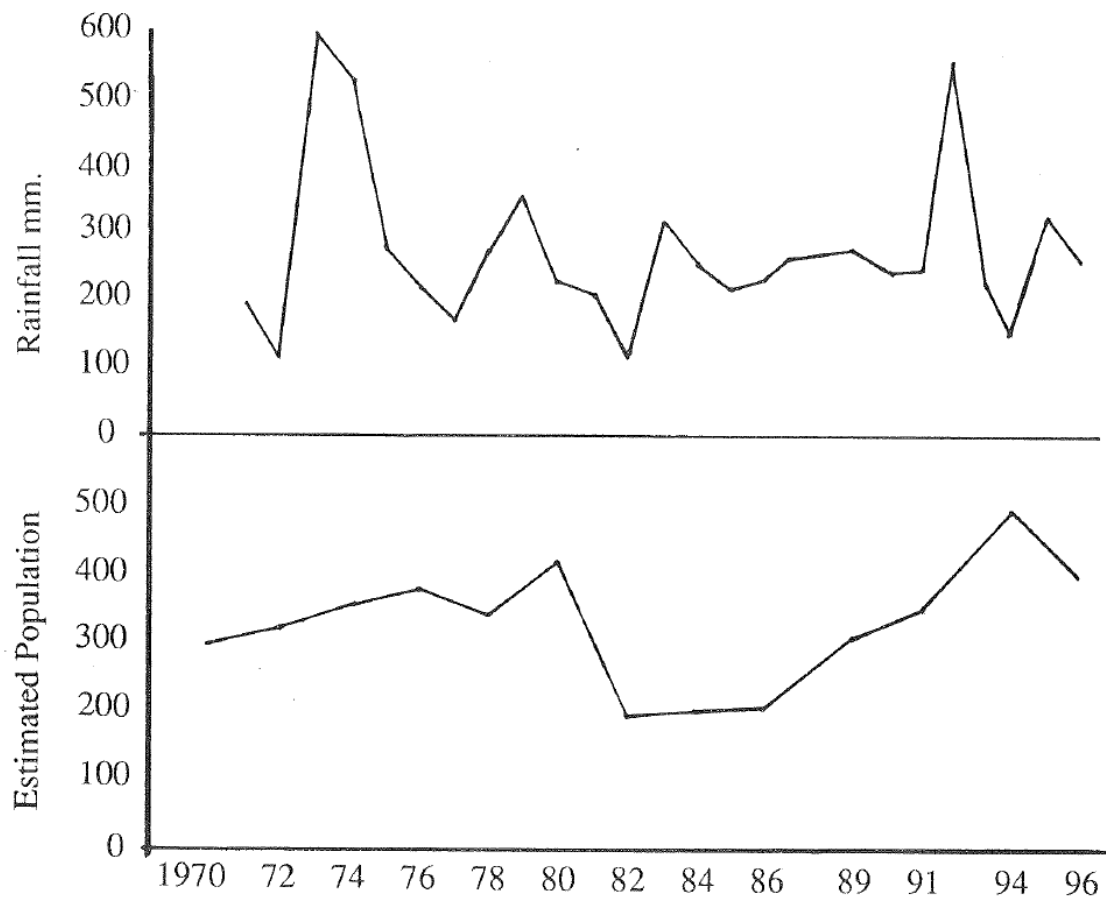
WOMBAT POPULATION STUDY

Progress of the wombat population study was last reported in the journal July-August 1994.

The activity recorder in warren no.90 continues to record the comings and goings of the wombats. This data provide the basic active burrows / population ratio on which the population estimations depend.

The recorder also helps to maintain consistent observing standards when assessing the activity of burrows during the 3-monthly inspections in the two study areas and the general inspections of all warrens on the reserve about every two years. By regularly comparing tracks and other signs of activity with the actual recorded activity one can recalibrate observing skills, an important feature in a long-term study such as this one which has now been in progress for 26 years.

An inspection of all warrens in the reserve was completed in March this year and the population trends over the total study period are shown in the graph below. Annual rainfall is also shown.



The drop in population in 1996-97 appears to be the result of low rainfall in 1993 and 1994. These were not killer droughts in which adult wombats die from starvation, they simply initiated conditions unfavourable for successful breeding and the population fell due to normal death rate exceeding a reduced birth rate.

The drop in population could have been more severe had it not been for the rabbit baiting programmes carried out in 1994, 1995 and 1996 and the effects of calicivirus. In spite of low rabbit numbers it is apparent that considerable grazing pressure still exists. The grazing experiment begun last year in the John Endersby exclosure may reveal the influence of various herbivores on Moorunde.

During the general inspections it is observed that most large warrens retain significant populations even in the most severe conditions. Many smaller warrens appear to have no permanent population, but do show evidence of occasional visits. Isolated burrows in low-lying clay deposits are usually shallow, subject to flooding and often collapse. I suspect they are just experimental diggings.

The fact that nearly 60% of the burrows in each inspection show no sign of recent activity and of these some appear to be totally unused, raises intriguing questions. Does it suggest there was once a much larger population or is it the result of changing distribution? We may never find out, but at least we know that under the policies governing the reserve in the last 29 years, wombat population has had a general positive trend.

GLEN TAYLOR

- **Research.** The wombat population study continues to be updated with data gathered during four inspections per year on two sizeable study areas on Moorunde.

A moderate drop in population followed the drought year of 2002, attributed to a low birth-rate that year, but numbers steadily recovered to greater than before, even through another drought in 2006. However, a low birth-rate in the drought of 2008 led to another population decline, noticeable by the end of 2009, from which it is now rebuilding.

These fluctuations are typical of arid and semi-arid climates, where populations adjust to sustainable levels in response to the availability of resources, generally dictated by the rainfall.

- **Research.** The wombat population study continues to be updated with data gathered during the three inspections in 2011 on two study areas totalling 192 hectares on Moorunde.

There appears to be a moderate drop in population even though the rainfall has been above average in the last two years. Fluctuations are typical of arid and semi-arid climates, where populations adjust to sustainable levels in response to the availability of resources and the drop in population may be due to a reduction in suitable grasses as a result of competition from kangaroos. From the Grazing Experiment we know that kangaroos do indeed exert a significant grazing pressure on the reserves.

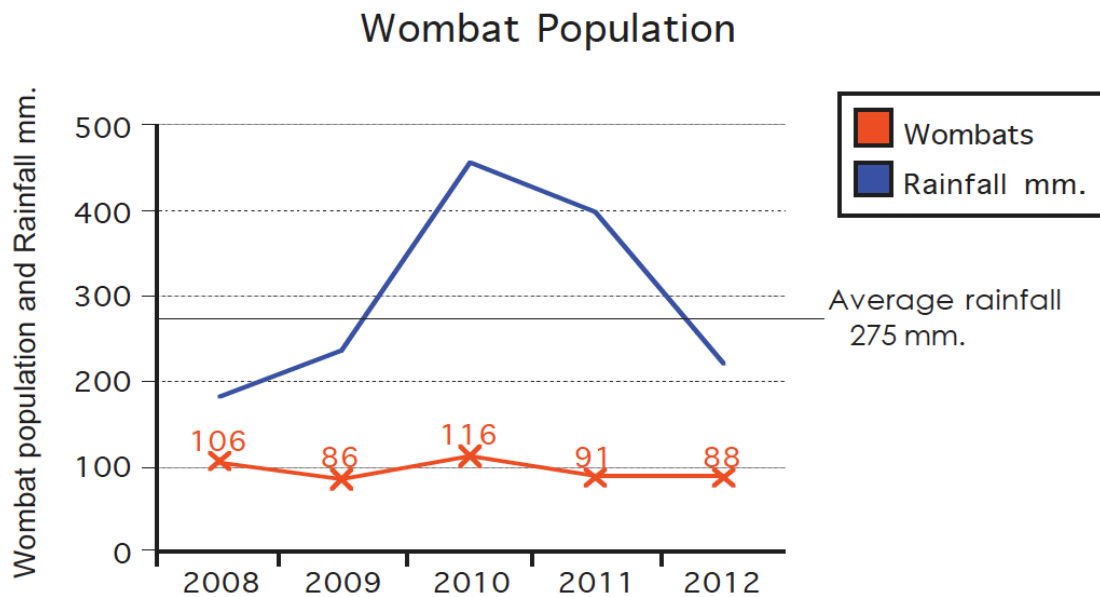
The additional exclosure allowing only wombat access, that John Endersby completed in May 2010 at the Grazing Experiment, nurtured a considerable amount of Spear Grass during the year. This is a favoured food source for wombats and strong evidence has been observed that a wombat has recently entered the exclosure and grazed the spear grass.

The exclosure is being watched with great interest and it appears that at least one wombat has made several visits using two of the six wombat gates, eaten and left telltale scats. The exclosure and these visitations add another important component to the grazing study.

Research

The population study begun in 1970 is ongoing and, although there have been only two inspections this year on my study areas both of which are in the original section of Moorunde, they clearly indicate that following a population decline in 2011, the numbers have remained virtually steady in 2012.

The following graph shows the total estimated population in the study areas (192 hectares) from 2008 to 2012.



General observations on Twelve Mile Plain would suggest that wombat losses in this more recently acquired area have been substantial. One is tempted to assume that the elimination of most toxic weeds in our long-term weeding programmes on the older sections of Moorunde has contributed to the wombats' health, but there is no scientific comparative research to confirm it at this stage.