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A CHANGING APPROACH TO DINGO CONTROL IN WESTERN AUSTRALIA

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ABSTRACT: The traditional method of dingo control on sheep properties in Western Australia relied on labour-intensive trapping and baiting. A cost/price squeeze in the rangeland sheep-grazing areas around 1970 forced a revision of these practices. Research was conducted on dingo biology, habitat preference and use, movements, social organization and damage to livestock. The data demonstrated the territorial nature of dingoes, that they usually occur in groups of 2 to 15, that long movements are rare, and that they quickly learn to harass and kill sheep. Aerial baiting trials using factory-manufactured baits and baits prepared from fresh meat demonstrated that an adequate level of control could be achieved in a buffer zone adjoining sheep-grazing areas to minimize the movement of dingoes onto sheep areas. Baiting success was higher for young and lone dingoes with the use of individual meat baits, and probably with a high-bait density and a low-prey population. The research findings have been largely incorporated in a refined strategy for dingo control based on the buffer zone concept at reduced cost for control. If the cost and results of the research are assumed to have led to the benefit of lower control costs over the next 20 years, a benefit:cost ratio of about 2.5:1 is indicated.

INTRODUCTION

The dingo (Canis familiaris dingo) is believed to have been introduced into Australia about 4,000 years ago (Gollan 1984). They spread across the whole continent and are now considered as an Australian mammal by both biologists and conservation groups.

White settlement in Australia began some 200 years ago while settlement in the pastoral areas of Western Australia is as recent as 100 years. The development of the rangeland grazing areas and of the farming areas coincided; but in contrast to the rangeland grazing areas, the dingo has been virtually eradicated from the farming areas by almost total development of the land.

These rangeland or pastoral areas of the state are characterized by large holdings which use little labour and relatively little machinery or other resources. The carrying capacity is one sheep per 20 to 40 acres on properties of up to 1,000,000 acres. The sheep population in the pastoral areas peaked at about 3,000,000 and the cattle population at about 1,000,000.

Established methods of control of dingoes on sheep properties were based on specialized labour employed on each property - doggers. Their job was to trap (using steel-jawed traps), carcass bait, shoot or use any other technique which would reduce numbers. Bonuses were paid at a local level and by the Government. Responsibility for the control of vermin rested solely with the landholder. At the same time, the State Government was pressured to control dingoes originating on vacant land or reserves which might invade adjacent sheep areas. As a result, a number of group schemes for dingo control have arisen over time. It was also considered that dingoes moved large distances to areas with more prey and hence control activities were often concentrated on "trails" or "leads" and in areas remote from pastoral holdings. Any dingo was considered a potential threat and hunted.

While aerial baiting has been used since the early 1950s, it has only been as an adjunct to the other techniques. In 1967/68, 1.28 million factory-manufactured baits were distributed, compared to 2.7 million in 1984/85, as well as 340,000 fresh meat baits. Factory baits, weighing about 0.25 oz were based on crackle and whale oil. The fresh meat baits were about 4 oz chunks of beef, kangaroo or other meat, allowed to dry out before distribution.

In 1967/68 there were 51 doggers employed by the Western Australian State Government or by landholder groups, in addition to employees on individual properties. Currently there are 38 doggers - either employed by Government or by groups of properties. (Agriculture Protection Board of Western Australia - Annual Reports 1967/68 and 1984/85).

CHANGE IN MANAGEMENT

Around 1970 saw a change in the economic climate for rangeland sheep - labour became too expensive, fuel costs too high and product price fell in real terms. This necessitated a drastic change in management of the properties and a review of dingo control. Many properties converted to cattle raising. The need for information on the role of dingoes in the rangeland management system led to research on biology, including diet, habitat preference and use, movements, social organization, damage to livestock and susceptibility to control. This has allowed a major change in the control strategies and techniques at markedly reduced cost and improved effectiveness.

Increased pressure from conservation groups, both against indiscriminate control of dingoes and the effects of control on nontarget species, also required that more information be obtained to substantiate the need for dingo control and to refute claims of unnecessary killing.

RESEARCH

Diet

The first research on dingo diet in Western Australia by Whitehouse (1977a) concluded that "the two most important items in the diet of dingo in Western Australia are the Red Kangaroo and the Euro which, between them, represent more than 70% by volume of the stomach contents and occurred in more than 65% of the stomachs containing food. These two large marsupials are widely distributed and occur commonly in the dingo's range in Western Australia.

"Rabbits are not widely distributed in the dingo's range and were found as food items only in stomachs obtained from the Nullarbor region, where they formed a large part of the diet. It is possible that dingoes in this area are largely dependent on rabbits for food, and that dingo numbers fluctuate in response to rabbit population changes.

"Sheep, goats and cattle were represented in the diet only to a small extent" (pp. 147-148).

A similar picture on dingo diet and the incidence of native species in stomach contents is given by Coman (1972) and Newsome et al.(1973).

While these results may suggest livestock do not comprise a large proportion of dingo diet, they do not provide information on the damage dingoes could cause by killing without eating and harassment of stock.

Movements

Work by Whitehouse (1977b) on movement of dingoes was based on capture and release of mainly pups. Some 10% were recaptured at a mean distance from the point of release to recapture of 21.7 kilometres for males and 11 kilometres for females.

The other important factor was that "all returns were from animals less than 12 months old at recapture. This may indicate that trappers are mostly catching pups which might die of natural causes in any event... If a dingo survives past one year, its chances of being killed seem drastically reduced" (p. 576).

The suggestion from this is that control by trapping may be wasteful of time and not necessarily effective in substantially reducing attacks on livestock. It also lay open the question whether control of dingoes away from livestock populations was of any value - or did it really only provide conclusions on short movements for young animals? More research was needed.

Social Structure, Prey Interactions and Movement

The establishment of a research area exclusively to study dingoes, and the use of radio telemetry to track dingoes, expanded the research effort. Constant monitoring of the location of radio-collared dingoes by light aircraft provided information that dingoes in the ironstone ranges of the Fortescue River area were arranged in tight social units in well-defined territories. While territories may overlap, contact is usually avoided. Group size ranged from 2 to 15. The larger groups were generally split into smaller subgroups of flexible size and composition. The territory sizes range upwards from about 30 square miles and are generally about 6 to 10 miles in width (Thomson 1984a), Thomson unpubl. data).

In addition some loners can also live in the same territory in loose association with the groups. From the aircraft, observations were made of social interaction, breeding areas and success, interaction with prey, hunting, killing and feeding. Some nonbreeding members of groups played a part in the raising of pups. Hunting of kangaroos usually involved two or more members of a group. (Thomson, unpubl. data).

The observations on the patterns of use of territory and resources gave valuable insights into the placement of baits. This information supported the practice of baiting operators placing baits near water courses, cover and prey concentrations. Results from some of the North American wolf research (e.g., Mech 1970, citing various studies) had suggested that the disruption of established groups may lead to increased breeding. In addition, any measures which resulted in increased dispersal would be counterproductive in terms of effect on the nearby sheep populations.

Subsequent research, described below, demonstrated that these effects, if present, were masked by the level of control achieved.

When the research programme began in the Fortescue study area in 1975, dingo numbers were relatively low as a result of previous control activities. Over the 5 years up to 1980, the dingo numbers built up steadily in the study area with 18 collared dingoes moving onto the adjoining sheep-grazing areas. The majority of these animals quickly learned to chase, bite and kill sheep, although they had no previous exposure to them. In order to gather damage information, sheep deaths were allowed to occur, with the approval and compensation of the property owner, until it became necessary to control the dingoes. It was observed that while the dingoes killed many sheep, they still killed and ate kangaroo (Thomson 1984b).

The research results showed that dingoes occupied territories; that dispersing dingoes cannot normally settle in alien territories; and that dispersing dingoes have a poorer chance of survival when they encounter dingo-occupied areas (and the converse). They would therefore be unlikely to survive long-distance moves through others' territories. Findings that long-distance dispersal was rare supported this.

From these findings it could be concluded that dingoes entering sheep-grazing areas would not be expected to have moved far; this was found to be so.

Since dingoes were likely to settle in suitable vacant areas, the research aimed to provide such an area or buffer adjacent to the sheep-grazing areas rather than on the sheep-grazing land. The buffer must be at least one territory wide (so that enough resources are available), hence a width of 6 to 10 miles was chosen for the testing of the buffer concept by aerial baiting trials in 1980.

This buffer concept fitted with the difficult problem of controlling dingoes on sheep-grazing areas. It was found that dingoes used the many pads established by sheep and thus they had less chance to contact either baits or traps. In addition the ample food supply made the taking of bait less likely. The control of dingoes in a buffer zone therefore posed a simpler solution in that given a substantial level of control, but not 100%, there would be less chance of dispersal into the sheep-grazing areas. In the sheep areas, 100% control is necessary.

Control

During 1980 and 1981 a series of trials were undertaken to examine the effectiveness of aerial baiting in controlling dingoes (Thomson 1986).

In May 1980, an aerial baiting of part of the study area was undertaken using factory-produced crackle baits containing 1080. The area in which control was attempted was approximately 12 miles by 30 miles. The 12,000 baits were laid from a light aircraft by experienced baiters who had no knowledge of the dingo distribution in the study area.

Of the 14 collared dingoes in the area, nine (63%) had died within 2 weeks. Both sexes appeared to be equally susceptible to baiting but younger dingoes were more readily killed. All the animals less than 2 years old were killed by baits while only 50% of those over 2 years old succumbed.

By October 1980, there were 18 collared dingoes in the previously baited area and in closely adjoining areas. An aerial baiting experiment based on fresh meat 1080 baits was undertaken, and within 2 months all the collared dingoes had been killed. In addition, all, except perhaps one, uncollared dingoes known to be in association with radio tracked animals were also killed. Included in the 18 animals which died were 7 survivors of the May baiting. By October 1981, there were known to be 6 to 8 dingoes in the areas baited during 1980.

October 1981 Baiting

An aerial baiting of an adjoining area further upstream from the previously baited area was carried out in October 1981 using 25,000 factory-produced baits.

Known to be at risk were 13 collared dingoes, 10 uncollared and 4 litters of pups. Within 3 weeks, only 4 of the collared dingoes had died, and these were mostly loners who were less likely to benefit from group hunting of kangaroos (Thomson, unpubl. data).

After 4 weeks and only a 31% kill, the same area was baited using fresh meat baits. The same spread of baits was made so that the fresh meat baits would overlay the previous factory baits on a ratio of about 1:3. A further 4 dingoes died in the area as a result of eating the fresh meat baits. Although both baits were available to dingoes, the taking of fresh meat baits was confirmed by the presence of coloured marker pellets in dingo remains. A total of 62% kill was thus achieved on this area by the combination of the two bait types.

Two years after the 1980 baiting, 15 dingoes were known to occupy the area which had been completely cleaned out. Kangaroo numbers had built to a high level and there was apparently no need for dingoes to move from the study area onto the adjoining sheep-grazing area. This suggested that up to 2 years' effective control can be achieved by a highly successful baiting.

Nullarbor Research

The results from the Fortescue study area suggested that aerial baiting would provide an adequate level of control and would fit better with current property management than the traditional trapping and poisoning methods. A markedly different area was chosen as a second research area on the Null arbor Plain east of Kalgoorlie. The area has very flat terrain compared to the Fortescue, is relatively treeless, waterless, and has a relatively high population of rabbits as well as kangaroos.

Radio-tracking results from the Nullarbor indicate that dingoes there move over areas of 15 to 20 miles across, which is larger than those at the Fortescue. The Nullarbor dingoes are generally seen in smaller groups, and their associations and territorially appear to be somewhat looser than at the Fortescue. There is considerable overlap of area usage at the limited number of watering points (Thomson, unpubl. data).

A major factor contributing to the social structure is undoubtedly the availability of rabbits as food supply. Lone dingoes can readily catch and kill rabbits and so co-operative group hunting, as was seen for the dingoes preying on kangaroos at the Fortescue, is unnecessary (Thomson, unpubl. data).

In October 1984, 1080 factory baits were laid in a circle about 0.3 to 0.5 miles from water supplies. Only 5 out of 17 radio collared dingoes were killed by the baiting. While young animals were found to be at greater risk than older animals, as occurred in the Fortescue trial, social status was of less importance since lone individuals can efficiently hunt rabbits and feed on the cattle carrion in the area.

It was thought that a low-bait density might have contributed to the poor results. Bait numbers had been kept low to avoid possible poisoning of cattle and nontarget species. However, a second trial with three times the bait density resulted in only 1 death from 16 collared dingoes at risk. This was followed by a third trial, using fresh meat baits at high density, which resulted not only in 5 deaths from 8 collared dingoes but also a large number of uncollared dingoes (7 were found).

It can be concluded that for areas such as the Null arbor, the buffer zones will need to be much larger, baitings will need to be based on water supplies shared by dingoes in different territories and a relatively high bait density will be required - preferably with fresh meat baits.

DISCUSSION

The factors which appear likely to contribute to a successful baiting are: 1.) Age and social status, 2.) Type of bait, 3.) Intensity of baiting, and 4.) Available food supply.

1. Age and social status. The baiting trial results from the Fortescue in particular, indicated that dingoes less than 2 years old and dingoes which were not closely associated with others in a group were much more prone to take baits. Both factors can be attributed to success in hunting as both young and lone animals have less opportunity to participate in kangaroo kills (Thomson, unpubl. data) and their food supply is therefore less reliable.

2. Type of bait. Evidence from the 1980 October baiting, using fresh meat baits where 100% kill was achieved, suggested that fresh meat baits may be more successful. This was supported by the evidence of the 1981 baiting when fresh meat baits killed a number of animals which had been exposed to the factory baits and, subsequently, had a choice of both types of baits. The same sequence of baiting on the Null arbor further supported the preference for and success of fresh meat baits.

While factory baits are designed to be attractive to dingoes, both their small size and the unfamiliarity of the odour could result in their being less attractive than larger pieces of "fresh" meat which would be more familiar to dingoes. While the assistance of property owners is readily available to provide the meat and prepare the baits, it will remain a viable alternative preferred by them.

3. Intensity of baiting. In one portion of the Fortescue area baited in October 1981, it is possible that because of a low intensity of baiting, some dingoes did not encounter baits at a time when they were hungry. This factor alone could explain the difference between the level of kill in the two parts of the baited area. However, other factors could also have been involved. The area with the low-baiting intensity had a higher food supply and lower proportion of lone dingoes than the other area. The relative importance of these factors is uncertain.

4. Available Food Supply. The data from the research suggests equivocally that low kangaroo numbers should result in a greater baiting success. The 1980 Fortescue results of 100% kill suggests a low prey population; the 1981 trial gave highest dingo kill in the low kangaroo population area (but was also associated with more lone dingoes and a higher baiting intensity); and Nullarbor results can be considered poor due to a high or readily accessible prey population (with kangaroos and rabbits).

Both intensity of baiting and available food supply are likely and logically associated with the success of aerial baiting but further work in more extreme prey populations is necessary.

The Effectiveness of Aerial Baiting

Results from these trials indicate that conventional aerial baiting can be an effective means of delivering baits to dingoes. In favourable circumstances, an almost total kill can be achieved. The factors most clearly implicated in affecting the results of these trials were the type of bait and the age and social status of dingoes.

The timing of baiting in relation to the breeding season of dingoes as well as to the seasonal changes in water distribution, the occurrence of rain leaching poison from the baits, the amount of food available to dingoes, and in particular, the number and distribution of baits dropped may also have affected the outcome of these trials, although the data were equivocal for these latter five factors.

The 1980 aerial baiting resulted in a relatively low dingo population in the trial area for at least 3 years. It gave effective dingo control for the adjoining sheep areas for 2 years, although this may have been affected by further baiting in the adjoining study area which may have reduced immigration into the 1980 baited area.

Statewide Control

The decline in the level of control undertaken by property owners from about 1970 had led to an increase in the amount of aerial baiting carried out by the APB both on properties and adjoining areas. From the results of research up to 1980, and especially following the baiting successes in trials in 1980 and 1981, the distribution of aerial baiting has been modified substantially.

The buffer zone concept of baiting only within 10 to 15 miles of sheep-grazing areas has been widely accepted while aerial baiting on sheep properties continues as a technique for reducing dingo numbers. Arrangements have been made with owners of adjoining cattle properties for baiting to be undertaken on their land using a central fund contributed to by all properties. Similarly, where Crown land, national parks, or reserves border on adjoining sheep properties, these areas have been baited only as a buffer so that dingo numbers are not affected through the majority of the national parks or Crown lands.

On sheep properties, it is not anticipated that 100% kill of dingoes can be achieved using the aerial baiting technique and it has therefore been necessary for properties to jointly employ a contract dogger to eliminate the few remaining dingoes or those which occasionally move onto the area.

Since 1980, the number of contract dogging groups has been reduced as their workload has fallen, particularly in some areas with a high proportion of sheep properties, such as the Gascoyne area east of Carnarvon. This has enabled the transfer of funds to other areas where dingoes continue to be a major problem to pastoralists. The number of scalps submitted for bonus payment has fallen markedly in some areas as a result of the lower dingo population brought about by the more effective aerial baiting control programmes. For the State, scalps were 5,555 in 1968, and 2,283 in 1985.

Cost:Benefit

The total cost of research since 1975 has amounted to about $2 million. At its peak the expenditure was about $325,000 per year. This compares with a total value of production of about $30 million per year from wool produced in the areas prone to dingo attack. This production was achieved from about 2 million sheep in 1983/84. While sheep numbers do fluctuate in response to seasonal conditions, this level of production can be considered normal.

Measurement of sheep losses through dingo damage is impossible to predict in a realistic way. Over the 1979 and 1980 period a total of 19 dingoes moved onto the adjoining sheep property from the research area, contributing to the deaths of several hundred sheep in the period. While this demonstrates the massive damage which can occur under extreme circumstances, normal control measures would have been undertaken before losses of this magnitude were effected. Some quick control measures, such as batting or trapping would normally have provided some relief from the losses. Some damage would have been expected, however, until all the dingoes were eventually killed.

With the use of buffer zones, there would be fewer dingoes moving into an area and some control activity would be undertaken at the first sign of damage.

Aerial baiting of sheep-grazing areas and the adjoining buffers has resulted in a substantially reduced cost of control both on and off the property. Whereas each property previously employed at least one dogger full time as well as other staff on a part-time basis to control dingoes, the input is now reduced to a $1,000 to $2,000 contribution to a state-wide control fund; several days assisting in the aerial baiting programme; and perhaps the cost of some ground baiting considered necessary in problem situations.

A benefit:cost ratio was calculated using only the expenditure of Government controlled funds (including some funds contributed by property owners) on research and control measures.

It is assumed that the level of control undertaken in 1967/68, before the economic problems of 1970, was the "old" normal expenditure on employing doggers, aerial baiting and supervision.

Research expenditure each year from 1975 is known, as is the spending on control from 1975 to 1985. The "new" normal control expenditure Is assumed

a) to be the same as in 1984/85 and

b) to be achieved in 1994/95 after continued falls of 5% per year for 5 years and 2.5% for a further 5 years.

The benefit:cost ratios which result (based on a 6% discount rate) are:

1.) 20-year period (10 years research, 10 year pay-off); and control costs at 1984/85 level (1.32:1).

2.) 20-year period; control costs decreasing till 1995 (1.68:1).

3.) 30-year period (10 years research, 20 year pay-off); and control costs at 1984/85 level. (1.77:1).

4.) 30-year period; control costs decreasing till 1995 (2.46:1).

At a 4% discount rate the ratios are 1.52, 1.97, 2.18 and 3.12 for the four scenarios.

It can reasonably be expected that the research up to 1984/85 will continue to influence control techniques for a further 20-year period, and that some further reduction in control costs will occur. The B:C ratio of 2.46:1 is therefore the most likely outcome.

Three important assumptions are included in these ratios. Firstly, that the reduction in control costs (and increased effectiveness) is solely attributable to the research. The precise correlation cannot be assessed although it would be expected to be high. Other factors which may have contributed to reduced costs would result in a lower B:C ratio.

Secondly, research is continuing in a logical fashion based on results to date. Further data could increase both the size and period of pay-off further - giving an increase in the B:C ratio.

Thirdly, the biggest reduction in control costs between 1967/68 and 1984/85 was the decision by property owners not to employ full-time doggers on individual properties. While this decision was made prior to the research and was based on economic grounds, the research has allowed the lower expenditure level to be sustained while still achieving the effective dingo control necessary for sheep raising. If this saving was attributed to the research, the B:C ratio would rise substantially.

The most satisfying measure of improved dingo control on properties is the level of satisfaction of the landholders as expressed at industry meetings. Currently the dingo problem is considered to be well under control and landholders are very supportive of Agriculture Protection Board activities.

At the same time, the buffer zone approach to aerial baiting has resulted in co-operation and agreement with the Department of Conservation and Land Management responsible for national parks, reserves and Crown land, and less criticism of dingo-control practices by the more radical conservationists. Acceptance of the need for protection of sheep properties and the use of 1080 as a poison have made the future of the sheep industry more assured.

Further Research

While the full benefits from the change in control techniques cannot be credited solely to the research programme, it has undoubtedly played a major part in refining the procedures and in satisfying both landholders and conservation groups.

Much further work is still required. The seasonal timing of baiting may be important. With reliable methods of analysis for 1080 in biological material only recently developed, the effect of rain and general exposure on bait longevity can now be assessed. Size of bait in relation to target specificity can be explored and improved, and development and acceptability of attractive baits can be pursued.

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