ANNUAL REPORT
of the
Branch of Tsetse and
Trypanosomiasis Control

Department of Veterinary Services
Ministry of Agriculture
Rhodesia

for the year ended 30th September, 1973
THE Branch's efforts to control the disease, trypanosomiasis of domestic stock and the vector, the tsetse fly (Glossina morsitans Westw. and G. pallidipes Aust.), have been continued at a high level throughout the year. Generally, the country-wide position can be regarded as very satisfactory at this point in time, the exceptions once again being the Chiswiti Tribal Trust Land, Masoso Tribal Trust Land and Chimanda Tribal Trust Land region of Darwin district and the international border region of the Sabi Valley, Chipinge district. It is particularly pleasing to be able to "highlight" here that the gains made in the Gokwe district with tsetse control operations, as mentioned last year, have been considerably extended. No case of trypanosomiasis has been recorded in the Copper Queen Purchase Land since March, 1973 and the position elsewhere in the Gokwe district is equally gratifying. The spraying operation conducted in the lakeshore region of Kariba district during 1972 (Sanyati River to Kariba township) was successful in achieving a very high knockdown of the tsetse population, to the point where tsetse flies could no longer easily be found (and following from this it is now considered that the human trypanosomiasis risk along the lakeshore has been largely eliminated). It is noteworthy that the Branch has received requests during the year to hasten the reclamation of the infested area between the Angwa and Maenedzri rivers, south of the Zambezi escarpment, Lomagundi and Sipili districts. As a result, plans are now in the course of preparation for this work. And once again pleasing progress was made in the joint international operations in Mozambique, south of the Rio Save.

The research programmes of the veterinary and glossinological research sections of the Branch proceeded very satisfactorily throughout the year. The work of the former section was directed to rat colony breeding problems, trypanosomiasis of game animals, trials with chemotherapeutic agents, trypanosomiasis in sheep, cerebral trypanosomiasis in canines and the analysis of blood meals derived from tsetse flies, the successful production of highly specific anti-sera to wart-hog and to bush-pig using the domestic Large White x Landrace pig being a pleasing development in the last mentioned work. In the case of the latter section, the work has involved trials of insecticides and studies of resting behaviour by tsetse flies and their responses to hosts. In particular, the work on the sight and smell of tsetse flies has been extremely illuminating.

STAFF

We have been fortunate in obtaining the services of Dr. R. J. Phelps, a very experienced glossinologist, who was proceeding on sabbatical leave from the University of Rhodesia, to assist with the important research work in hand.

Two glossinologists and 21 tsetse field officers were recruited during the year and a vacant senior field officer post was filled by a promotion from the tsetse field officer strength.

Eleven new posts were authorized with effect 1st July, 1973, these being two tsetse field officer posts, eight learner/tsetse field assistant posts and a clerical assistant post, and a twelfth post, that of a senior tsetse field officer, was authorized with effect 1st August, 1973. The incumbent of the senior tsetse field officer post will be employed full-time at the Branch headquarters in Salisbury.

Miss V. W. Emslie, Immunologist, continued her studies overseas. Reports indicate that she is doing very well.

Mr. G. A. Vale, Regional Glossinologist, Research Stations and Field Investigations, presented a thesis entitled "The responses of tsetse flies to their host animals" during the year, in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

CENTRAL TSETSE AND TRYPA NOSOMIASIS CONTROL COMMITTEE

The Central Tsetse and Trypanosomiasis Control Committee met on three occasions during the year, at which meetings reports presented by the Branch were discussed. The Branch was represented on each occasion by the Assistant Director of Veterinary Services, Tsetse and Trypanosomiasis Control, in his capacity as member, and the Chief Glossinologist and Chief Veterinary Officer (Trypanosomiasis) in the capacity of observers.

It is of particular note that Dr. G. R. Ross retired from the position of Chairman of the Committee immediately after the meeting held on 4th January, 1973, a position he had held since 25th January, 1955. His place has been taken by Mr. W. H. H. Nicolle, until recently Secretary for Internal Affairs.

CONFERENCES

The International Standing Committee on Tsetse and Trypanosomiasis Control in South East Africa met in Pretoria, Republic of South Africa, on 7th December, 1972, to consider plans for the 1973 control operations. This Committee met again in Lourenço Marques, Mozambique, on 17th April, 1973, to appraise the results of the joint anti-tsetse spraying operations which had been conducted
the previous season and to finalise the planning of the 1973 spraying operation, which was scheduled to begin on 1st June.

The Assistant Director of Veterinary Services, Tsetse and Trypanosomiasis Control, attended the annual meeting of the International Committee for the Control of Tsetse Fly and Trypanosomiasis in the Kwando-Okovango Drainage Area, which was held in Luanda, Angola, on 4th April, 1973, as an observer.

MEETINGS

The Branch was regularly represented at District Commissioners' meetings in affected districts.

Members of the Branch have addressed Farmers' Associations and local I.C.A. Committees on matters related to tsetse and trypanosomiasis control.

LECTURES

Members of the Branch have taken part in radio discussions and given lectures to scientific groups, schools and scientifically orientated societies on the subject of tsetse flies and their control.

PUBLICATIONS

The following contributions were published or offered for publication:


Knottenbelt, D. C. Some pathological findings in the natural population of bushbuck (Tragelaphus scriptus). (In press.)

Knottenbelt, D. C. An investigation into the incidence and pathology of natural trypanosomiasis in bushbuck (Tragelaphus scriptus) and kudu (T. strepsiceros). (In press.)


Vale, G. A. Attractants for controlling and surveying tsetse populations. (Submitted to Prof. D. S. Bertram in September 1973, for presentation at a Laboratory meeting of the Royal Society of Tropical Medicine and Hygiene.)

TRYPANOSOMIASIS CONTROL

(see maps 1-4)

Tables 1 and 2 illustrate the incidence of trypanosomiasis and the scale of treatments given during the year.

The steady improvement in the trypanosomiasis position throughout the country, with the exceptions of the eastern region of Darwin district and the international border region of Chippings district, has been maintained, this being clearly demonstrated by the decrease in the infections recorded from cattle under regular inspection (from 5 698 cases among 495 905 cattle in the previous year to 4 124 cases among 505 094 cattle in the current reporting year) and the reduction in the number of treatments administered (from 104 469 to 75 282). In particular, the improvement registered in the Gokwe district has been most spectacular with cases falling from 1 094 to 449 and treatments from 42 197 to 25 478.

Protection of the 505 094 cattle which were regularly inspected during the year involved the taking and examination of 140 071 blood films, a reduction of 38 227 or 21.44 per cent. from the previous year's figure of 178 298.

Parasites were detected in 4 124 or 2.9 per cent. of these blood films, which was a slightly lower ratio than in 1971-72, with the breakdown into species being as follows:

- Trypanosoma congoense ........................................ 3 138
- T. vivax .......................................................... 886
- T. brucei .......................................................... Nil
- Mixed infection .................................................. 100

Of the 75 282 treatments administered to cattle during the year, 504 were Ethidium, 37 336 were Berenil and 37 442 were isometamidium.

Difficulties were again experienced with the prophylactic regimes at centres in the Binga district, where the presence of isometamidium-resistant strains of T. congoense has been clearly established.
### Table 1
CATTLE AT RISK, SMEARS, INFECTIONS AND TREATMENTS BY DISTRICTS

<table>
<thead>
<tr>
<th>District</th>
<th>1971 cattle</th>
<th>1972 cattle</th>
<th>1973 cattle</th>
<th>Infections</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14,002</td>
<td>15,443</td>
<td>15,980</td>
<td><strong>50</strong></td>
<td><strong>26</strong></td>
</tr>
<tr>
<td>Luwero</td>
<td>33,194</td>
<td>28,796</td>
<td>6,531</td>
<td><strong>3</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Wankie</td>
<td>34,920</td>
<td>33,452</td>
<td>12,528</td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>Gokwe</td>
<td>61,834</td>
<td>68,816</td>
<td>40,796</td>
<td><strong>418</strong></td>
<td><strong>27</strong></td>
</tr>
<tr>
<td>Gokwe (donkeys)</td>
<td>11,854</td>
<td>12,172</td>
<td>3,141</td>
<td><strong>120</strong></td>
<td><strong>13</strong></td>
</tr>
<tr>
<td>Nkazi</td>
<td>15,833</td>
<td>16,612</td>
<td>16,397</td>
<td><strong>5,733</strong></td>
<td><strong>320</strong></td>
</tr>
<tr>
<td>Gaita</td>
<td>81,893</td>
<td>87,745</td>
<td>81,165</td>
<td><strong>6,666</strong></td>
<td><strong>391</strong></td>
</tr>
<tr>
<td>Manyasi</td>
<td>58,284</td>
<td>56,701</td>
<td>54,030</td>
<td><strong>856</strong></td>
<td><strong>13</strong></td>
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<tr>
<td>Daro/Blindura</td>
<td>51,166</td>
<td>57,515</td>
<td>57,622</td>
<td><strong>11,757</strong></td>
<td><strong>10</strong></td>
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<tr>
<td>Pwani</td>
<td>1,098</td>
<td>966</td>
<td>597</td>
<td><strong>17</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>Centenary West</td>
<td>1,498</td>
<td>2,168</td>
<td>1,163</td>
<td><strong>55</strong></td>
<td><strong>1</strong></td>
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<tr>
<td>Sigillo</td>
<td>27,131</td>
<td>27,908</td>
<td>27,679</td>
<td><strong>8,939</strong></td>
<td><strong>433</strong></td>
</tr>
<tr>
<td>Mbulu</td>
<td>15,836</td>
<td>17,231</td>
<td>16,433</td>
<td><strong>2,617</strong></td>
<td><strong>1</strong></td>
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<tr>
<td>Menya</td>
<td>467</td>
<td>430</td>
<td>449</td>
<td><strong>9</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>Jayanga</td>
<td>24,241</td>
<td>29,095</td>
<td>31,853</td>
<td><strong>9,810</strong></td>
<td><strong>9</strong></td>
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<tr>
<td>Chipinga</td>
<td>25,071</td>
<td>24,091</td>
<td>27,641</td>
<td><strong>9,993</strong></td>
<td><strong>315</strong></td>
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<tr>
<td>Chipinga (donkeys)</td>
<td>25</td>
<td>59</td>
<td>69</td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>Bwika</td>
<td>6,906</td>
<td>3,232</td>
<td>2,037</td>
<td><strong>202</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Chiredzi</td>
<td>17,913</td>
<td>14,457</td>
<td>14,834</td>
<td><strong>2,267</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Numanen</td>
<td>11,707</td>
<td>12,402</td>
<td>13,935</td>
<td><strong>4,696</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>Chiredzi (donkeys)</td>
<td>20</td>
<td>—</td>
<td>—</td>
<td><strong>2</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>Totals, Cattle</strong></td>
<td>493,835</td>
<td>495,905</td>
<td>505,094</td>
<td>140,071</td>
<td>3,138</td>
</tr>
<tr>
<td>Donkeys</td>
<td>10,453</td>
<td>11,864</td>
<td>12,408</td>
<td>3,230</td>
<td>121</td>
</tr>
<tr>
<td>Horses</td>
<td>—</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### Table 2
SMEARS, POSITIVES AND INOCULATIONS: 1955-73

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of smears</th>
<th>Number of positives</th>
<th>Positives as percentage of total smears</th>
<th>Inoculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955-56</td>
<td>23,028</td>
<td>198</td>
<td>0.9</td>
<td>47,126</td>
</tr>
<tr>
<td>1956-57</td>
<td>22,982</td>
<td>422</td>
<td>1.5</td>
<td>61,561</td>
</tr>
<tr>
<td>1957-58</td>
<td>32,334</td>
<td>578</td>
<td>2.2</td>
<td>70,409</td>
</tr>
<tr>
<td>1958-59</td>
<td>35,734</td>
<td>930</td>
<td>2.5</td>
<td>91,021</td>
</tr>
<tr>
<td>1959-60</td>
<td>51,005</td>
<td>1,398</td>
<td>2.7</td>
<td>115,773</td>
</tr>
<tr>
<td>1960-61</td>
<td>35,714</td>
<td>1,207</td>
<td>3.7</td>
<td>82,260</td>
</tr>
<tr>
<td>1961-62</td>
<td>36,592</td>
<td>1,614</td>
<td>4.4</td>
<td>99,284</td>
</tr>
<tr>
<td>1962-63</td>
<td>42,038</td>
<td>2,795</td>
<td>6.6</td>
<td>87,589</td>
</tr>
<tr>
<td>1963-64</td>
<td>66,423</td>
<td>5,382</td>
<td>8.1</td>
<td>125,298</td>
</tr>
<tr>
<td>1964-65</td>
<td>85,430</td>
<td>5,366</td>
<td>6.3</td>
<td>175,404</td>
</tr>
<tr>
<td>1965-66</td>
<td>109,302</td>
<td>5,228</td>
<td>4.8</td>
<td>178,404</td>
</tr>
<tr>
<td>1966-67</td>
<td>130,533</td>
<td>8,134</td>
<td>6.2</td>
<td>181,526</td>
</tr>
<tr>
<td>1967-68</td>
<td>144,652</td>
<td>6,313</td>
<td>4.4</td>
<td>164,879</td>
</tr>
<tr>
<td>1968-69</td>
<td>146,285</td>
<td>5,356</td>
<td>3.7</td>
<td>121,354</td>
</tr>
<tr>
<td>1969-70</td>
<td>164,768</td>
<td>6,717</td>
<td>4.1</td>
<td>98,540</td>
</tr>
<tr>
<td>1970-71</td>
<td>186,586</td>
<td>5,710</td>
<td>3.1</td>
<td>117,849</td>
</tr>
<tr>
<td>1971-72</td>
<td>178,298</td>
<td>5,698</td>
<td>3.2</td>
<td>104,469</td>
</tr>
<tr>
<td>1972-73</td>
<td>140,071</td>
<td>4,124</td>
<td>2.9</td>
<td>75,282</td>
</tr>
</tbody>
</table>

In addition, 12,808 donkeys were inspected regularly and of the 3,230 blood films taken from these animals, 121 showed *T. congolense* infections and 13 others showed *T. brucei* infections. Treatments administered to these donkeys totalled 4,629 (one Berenil and 4,628 isometomidium). Two *T. congolense* infections were also recorded in horses.

It is particularly noteworthy that all this work required considerable patience, effort and skill on the part of the field staff of the Branch of Veterinary Services (Field), who work under the guidance of the Chief Veterinary Officer (Trypanosomiasis) of this Branch. We are grateful to them.
In the Wankie district, two cases only were recorded, one at Simangani and the other at Inyangwe, both of which centres lie in the east, within the influence of the Sebungwe fly-belt, but well away from the known infected area. The source of these infections is therefore uncertain, although mechanical transportation of the vector is a likely explanation. In the west of the district (Victoria Falls region), the problem seems to have dwindled away quite naturally to nothing. Inspections, however, have continued throughout the year.

Once again the trypanosomiasis picture showed little change in the Binga district. Mention has already been made of the difficulties experienced with the isometamidium prophylactic regimes at certain centres, namely Lubu, Siansali, Manjolo, Masumo and Kamakube, and in this context it is of interest that the drug cover has now been removed from these centres, excepting in the case of those Manjolo and Masumo cattle depasturized east of the Northern Sebungwe game fence, in order to assess the efficacy of the 1973 spraying operation. The last prophylactic treatment was in July. The disease persisted at the centres Mudzi, Shalaba and Sebungwe, but in the extreme west infection was minimal, with only eight cases being recorded in all amongst the Tinde, Lubjana and Manyanda cattle.

The situation in the Lupane district was particularly satisfactory with only three cases being diagnosed. Of these, two cases occurred at Dongamusi, which is situated in an area where, it will be recalled, a minor outbreak of the disease was experienced last year (Bimba, Mzola and Cewali were also involved), necessitating the diversion of an element of the Sebungwe Operations Area spraying effort in order to control the problem. The low incidence reflects the success of the spraying. The third case occurred in the Dandanda test herd, which had been clear of the disease since its inception in October. 1970. Mechanical transportation of the vector is suspected.

As has already been mentioned above, there has been a further dramatic improvement in the Gokwe district, reflecting the success of the spraying operations over the past few years (see Table 3). The distribution of the cases occurring during the year was: Upper Kana region—four, Lutsope drainage—nine, Mbumbui drainage—17, Gokwe plateau region (Sengwa, Sessami and Chinchenyeta)—six, Ummati-Mzoonwe region—two, Copper Queen Purchase Land—21 (of which all occurred at Marowa), Makore 26 and Goredema 292. Three centres, Saboranda, Gwame and Njambwe, were held under prophylaxis for the greater part of the year, but treatment has now been withheld (since August) in order to assess the efficacy of the 1973 spraying. It is noteworthy that the Ummati-Mzoonwe region has been clear of the disease since October and the Copper Queen Purchase Land-Makore region since March. In the case of the Goredema infections the majorities of the cases occurred amongst cattle depasturized to the north, near the Sessami game fence, an area which had only had limited treatment with insecticide in 1972. Four test herds were set up during the year to assess the effects of tsetse control operations in the Gandavaroyi Tribal Trust Land and the northern half of the Copper Queen Purchase Land.

### Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967-68</td>
<td>2634</td>
</tr>
<tr>
<td>1968-69</td>
<td>2633</td>
</tr>
<tr>
<td>1969-70</td>
<td>2533</td>
</tr>
<tr>
<td>1970-71</td>
<td>1993</td>
</tr>
<tr>
<td>1971-72</td>
<td>1064</td>
</tr>
<tr>
<td>1972-73</td>
<td>449</td>
</tr>
</tbody>
</table>

The satisfactory position to the east of the Ummati River (Gatooma West and Lomagundi South districts) was maintained. No cases were recorded in the Sanyati Tribal Trust Land (four in 1971-72), the Chenziri Purchase Land, nor the Tribal Trust Land areas immediately to the east of the Umfuli River. In view of the improvement in this general region, the two test herds in the unoccupied northern section of the Chenziri Purchase Land were disbanded during the year.

The trypanosomiasis position in the Urungwe and Kariba districts improved still further with 311 cases only as opposed to 421 in 1971-72. The distribution of the cases was Karoi European area 62, Vuti Purchase Land 132, Urungwe Tribal Trust Land 22, Mukwichi Tribal Trust Land 59 and the test herds 36. It is noteworthy that many of the cases on the European farms were probably attributable to vectors carried into the area by mechanical means. The occurrence of cases in the Guche Gache test herd was a disappointment (March one, June one, August five and September two), indicating that tsetse flies continue to persist in this region, albeit at a very low level.

A minor outbreak of trypanosomiasis occurred on Ilanga farm in Lomagundi Central district in October, two cases being recorded. This farm lies on the Huyani River, just south of Sinoa, and adjoins Fletcher Estates, which experienced a similar inexplicable outbreak last year. No further cases have been diagnosed. Again, with some presumption, these cases can be reasonably attributed to tsetse flies carried by motor transport from the Urungwe tsetse areas to the north.

Surveillance of the Raffingora infected farms (Lomagundi East district) was maintained. No infections were recorded.
The position in the Doma-Mangula farming area (Lomagundi North district) showed a considerable improvement from the previous year (28 cases as opposed to 101 cases). Nineteen of these cases occurred on two farms situated within the Rukute-Angwa drainage and the remaining nine on four farms lying within the Hunyani drainage.

In the Sipolilo district there has been little change from that of the previous year, when, generally speaking, it was described as satisfactory. Cases were European area 11, Sipolilo Tribal Trust Land 23, Kachuta Tribal Trust Land 106, Nyakapupu Purchase Land 39, Bakasa Tribal Trust Land 12 and Gutsa Tribal Trust Land 143 (inspections in this Tribal Trust Land included cattle from Mzaramba Tribal Trust Land, Darwin district, to the east). Isometamidium prophylaxis was again used in Gutsa Tribal Trust Land in the late wet season/early dry season period.

In respect of the Darwin district it has been concluded that the trypanosome risk was almost certainly higher during the year than last year, particularly in the Chimanda Tribal Trust Land and Masoso Tribal Trust Land region. It is pleasing to note though, that the upsurge in infections in this region appears to have been controlled to some extent, by the recent spraying, albeit that the improvement, at the most, can only be temporary in view of the continuing build-up of the tsetse population in Mozambique. In particular, cases have fallen away at Makosi in recent months. The situation in the European areas of Palm Block and Centenary West remained satisfactory with only a single case being recorded.

No cases were recorded in the Mrewa district.

Ten cases only were diagnosed in the Mtoko district during the year, compared with 52 last year. Details of these were Ngwwe Tribal Trust Land one, Chikwizo Tribal Trust Land one and Baobab Beacon test herd eight. Generally the position in this district is very satisfactory.

All centres in the old infected areas of the Inyanga district were inspected regularly throughout the year. Nine cases were recorded, Fombe two and Chimansa seven, both of which centres are located in close proximity to the international border, a region where cases can be expected. This was a very similar result to that of last year when 12 cases were recorded between the centres Fombe, Chimansa and Matisi.

No cases were recorded in Makoni, Umfuli or Melsetter districts.

A total of 1 195 infections was recorded amongst cattle in the Chipinge district, three of which occurred in the European area, on the farm Hermit, and the remainder in the African area. In the case of the European area infections, these were the first since May, 1971. It is noteworthy that Hermit farm is situated within the Umseleswe drainage. The majority of the African area cases occurred at centres lying in close proximity to the international border, although there was a very noticeable greater involvement of the centres lying further to the west than in the previous year, e.g. Marishe (151 cases compared with 42) and Chinyamakwawwa (71 compared with 15). The appearance of infection amongst Chisumbanje II cattle (13 cases) on the Sabi was yet another pointer to the steadily deteriorating situation and strongly suggested that tsetse flies, almost certainly G. pallidipes, were becoming established on the Masowe River. It is hoped that the 1973 spraying will have arrested this westerly spread, but it can only be regarded as a holding measure in that the extension of this work into Mozambique, the source of the advance, was disappointingly minimal. No cases were recorded at Chibune and the other associated riverside tanks and the Chief Veterinary Officer (Trypanosomiasis) states that this, together with an absence of cases at Humani and Devuli, west of the Sabi (Bikita and Chiredzi districts), engenders confidence that the sporadic and troublesome problem in these areas has at last been overcome. A test herd was established near Mahenya’s, on the lower Sabi, in order to provide early warning of tsetse encroachment in that region.

No cases were recorded in Bikita, Chiredzi or Nuanetsi districts in either privately owned European and African cattle, or amongst the Branch’s nine test herds, of which two are deployed between the Sabi and Lundi rivers and the remainder south of the Lundi.

**TSETSE CONTROL**

(see maps 1-4)

The 1973 spraying operations, involving the application of residual insecticide to the dry season resting and refuge sites of tsetse flies, were conducted during the period 1st June to 30th September. Problems were minimal and once again the operations were notable for the very few holdups caused by the breakdown of transport, due to the unfailing service provided by the Central Mechanical Equipment Department. Fifty-nine spraying teams were mounted, which represents an increase of eight teams over last year, excluding the three Portuguese teams which were mounted then. A total quantity of 265 900 kg of 75 per cent. DDT wettable powder was dispensed over 10 369 km² of tsetse habitat in Rhodesia and Mozambique (11 250 km² in 1971-72) by pneumatic sprayers, the application rate varying according to the particular situation, but on the country-wide basis (inclusive of Mozambique) at an average rate of 18,18 kg/km² active ingredient (15,00 in 1970-71 and 16,65 in 1971-72). Conventional spraying was applied to 10 585 km², using 3 784 955 litres of 5 per cent. DDT wettable powder suspension, at an average rate of 358 litres per km² and parallel line pattern spraying to 384 km² using 203 625 litres at an average rate of 530 litres per km². The increase in application rate reflected by the above
figures and bearing in mind the increased number of teams, confirms the observation that there has been a growing tendency over the past few years for planning officers to progressively intensify the spraying cover. The explanation for this can be attributed in part to inexperience in the case of certain planners, but more particularly, the situations requiring heavier applications have increased in recent years, e.g. Kariba lakeshore region, the eastern half of the Masoso Tribal Trust Land, Darwin district and the international border region, Chipinge district, where, in each case, the essential habitats were undoubtedly more dense and in some cases very much more complicated.

The spraying effort in the Sebungwe Operations Area (Binga, Wankie East, Lupane and Gokwe West districts) was stepped up from eight to twelve teams by moving four teams from the Operations Area immediately to the east. Conventional spraying was applied to a total area of 2,629 km², using 820,875 litres of insecticide, at an average rate of 312 litres per km². Areas covered included the greater part of the region stocked with cattle lying between the Northern and Southern Sebungwe game fences in the north-west, the immediate environs of Binga village, the objective being to arrest the build-up of tsetse in the vicinity of the station (the District Commissioner had made a request for this to be done), the Lubu Valley and the southern third of the Chirisa game reserve (Sengwa Research Area), with extensions to the west, south and east.

Eleven spraying teams were used in the Gokwe-Sanyati-Gatooma Operations Area (Gokwe Central and East and Gatooma West districts), which was a reduction of four on the previous year. Conventional spraying was applied to a total area of 2,597 km², using 795,750 litres of insecticide, at an average rate of 306 litres per km². Generally the operation was directed to extending the reclaimed area in the northerly and westerly directions, in order to ensure the safety of the cattle in Copper Queen Purchase Land, the south-eastern region of Gokwe Tribal Trust Land and the Malungabusi plateau region. Virtually the total area planned for spraying was completed.

Spraying in the Urungwe Operations Area (Urungwe and Kariba districts) had of necessity to be restricted to more-or-less the same area as that sprayed in 1972, for the reason that both G. morsitans and G. pallidipes continued to persist at a low level over the greater part of the area previously treated. Despite this, however, it had been planned to include the northern tributaries of the Charara River more completely, but, regrettably, the access system necessary for the work could not be developed in time. The very difficult terrain in the spraying area also slowed the progress of the teams. Conventional spraying was therefore started to a total area of 1,991 km², using 983,250 litres of insecticide, at an average rate of 494 litres per km². As already intimated above, the high application rate was a reflection of the very heavily wooded habitat in the lakeshore and lower Charara regions.

Regrettably, the spraying in Sipolilo Operations Area, (Lomagundi North and Sipolilo districts), had once again been restricted to four teams only, due to more urgent commitments in other operations areas. This level of effort can only be regarded as palliative and it is hoped that with the improving position in other areas it will be possible to build up the number of teams to at least eight or preferably to ten. Spraying was carried out to the north of the Doma farms, in the Mvumi/Hunyanire confluence region, in Rachuta Tribal Trust Land, in Nyakapupu Purchase Land and in the northern region of Sipolilo Tribal Trust Land. Conventional spraying was applied to a total area of 968 km², using 237,750 litres of insecticide, at an average rate of 246 litres per km². Progress of the teams was slow due to the difficult terrain, consequently about one-third of the area planned for spraying remained undone at the end of September, when the operation was terminated.

The number of spraying teams was increased in the Darwin-Mtoko-Inyanga Operations Area (Darwin, Mtoko and Inyanga districts) from eight to ten, with the main effort being directed to the Masoso Tribal Trust Land (between the Ruya and Mazoe rivers) and Chimamba Tribal Trust Land region. Limited spraying was also carried out in the Baoxbab Beacon region (Mtoko Tribal Trust Land) where trypanosomiasis has been recorded sporadically in the test herd in recent years (see above), and G. morsitans have been taken, and along the international border between the Chikwizo cattle fence (Chikwizo Tribal Trust Land) and Chimasa (Inyanga North Tribal Trust Land). In the Darwin-Mtoko-Inyanga Operations Area as a whole, conventional spraying was applied to a total area of 1,540 km², using 590,600 litres of insecticide, at an average rate of 383 litres per km². Here again, as already intimated, the high application rate was a reflection of the heavily wooded habitat in the Masoso-Chimamba region.

Four teams worked throughout the entire spraying season in the international border region of the Sabi Valley, Chipinge district (Chipinge-Sabi/Lundi-Mocambique Operations Area). Virtually the whole of the area planned within Rhodesia was completed but, as has already been said above, the extension of this work into Mocambique, the source of the tsetse advance into Rhodesia, was disappointingly minimal. The reason for this was the difficult terrain, but more important was inadequate access. It has become obvious that a very much greater effort will have to be made to develop access in this region before the next operation. Conventional spraying was applied to a total area of 624 km², using 285,170 litres of insecticide, at an average rate of 462 litres per km². Here, also, the high application rate was a reflection of denser habitat. Thickets were frequent and some rivers were heavily wooded.

Spraying in Mocambique was again conducted, for the third year running, on a limited "consolidation basis", in the region of the so-called "Massangena-Chigamane Consolidation line", with only
very limited eastward extension being undertaken (Chipinga-Sabi/Lundi-Moçambique Operations Area). Four Rhodesian teams were used for the work, with Republic of South Africa Division of Veterinary Field Services staff assisting in the supervision of the teams from the beginning of July. Heavy transport for the teams was also provided by the Republic of South Africa, with effect beginning of June. Conventional spraying was applied to a total area of 236 km², using 72,000 litres of insecticide, at an application rate of 305 litres per km² and parallel line pattern spraying to 384 km² using 203,625 litres at an average rate of 230 litres per km². It should be noted that conventional spraying was generally limited to certain areas treated in 1972, in which tsetse flies had been subsequently taken in very small numbers by surveys. Limited spraying was also carried out in the environs of Borehole 4, where sporadic cases of trypanosomiasis occurred in the test herd during the period January to May. This spraying was done conventionally, forming part of that referred to above.

Tsetse control selective hunting operations were continued throughout the year, excluding the months of April and May, along the Zambezi tsetse front. Hunting teams were employed on access and fence line maintenance during the two months when hunting was not carried out. Twenty-three teams were deployed in these operations, the distribution being the same as for last year, namely Sebungwe Operations Area six, Gokwe-Sanyati-Gatooma Operations Area seven, Urungwe Operations Area five and Sipolilo Operations Area five. A total of 3,634 animals was destroyed. The breakdown of this total was 3,493 selected species (kudu 532, bushbuck 1,335, wart-hog 1,047 and bushpig 579), elephant 65, buffalo 24 and “other species” 52. In the case of the last named, these were either shot on fence protection work, or were killed accidentally, or were found dead, having been killed by predators. Hunting proceeded satisfactorily in the Sebungwe Operations Area, with greatest emphasis being directed towards the western and central regions. In the Pohwe region, Gokwe-Sanyati-Gatooma Operations Area, where an intensive elimination operation was commenced in the latter part of last year, kills have fallen away considerably. The effect on the tsetse population has been impressive, with catches on one particular fly-round dropping from an average of 201 flies to three per month over a period of five months. Three Gokwe-Sanyati-Gatooma Operations Area teams have again been used in the Deve Section of the Urungwe Operations Area (during August and September), in order that all five Urungwe Operations Area teams could be deployed in the Mwandi-Angwa region. It is pleasing to note that the intensive hunting of this last mentioned region has had a marked effect on both the G. morsitans and G. pallidipes populations. Hunting in Sipolilo Operations Area has shown improved results with a consequential marked effect on the tsetse populations. This was achieved by removing the incentive bonus from bushbuck kills, thus encouraging hunters to hunt kudu and wart-hog more intensively.

Once again, game and cattle fences have played a major role in the control operations on all fronts. Totals of 1,213 km of game fence and 1,091 km of cattle fence were maintained. The difference of 48 km from last year for game fences, is explained by the removal of the Chefu game fence (34 km), the Guluene game fence (30 km) and Extension game fence (40 km), and the construction of the first 56 km of the new Border Barrier Northern game fence, all in the Chipinga-Sabi/Lundi Operations Area. (It should be noted that although 86 km of the Border Barrier Northern game fence had been completed by the end of September—see below—only 56 km were regarded as falling within the maintenance category for the purposes of this paragraph.)

In the Urungwe Operations Area the projects of reconstructing the Naodza-Angwa game fence on an all-steel basis, using nine-foot steel standards fabricated from half-inch plough-beam and ten-foot strainer-post units and corner posts fabricated from second-hand 60- and 81-lb. railway-line and the realigning of the accompanying service track on a gradient of never more than 1:10, both of which were commenced in October and June 1971, respectively, were completed in July 1973. The total length of the fence and track is 181 km. The total cost for the two projects were $18,500 and $58,500 respectively. The satisfactory completion of this fence and access track is regarded to be a major achievement in field construction work. The country traversed was, without doubt, some of the most broken in Rhodesia, thus requiring the application of considerable skill and experience in planning the route from aerial photographs and marking it out on the ground. The new fence provides a permanent barrier to the increasing pressures of the game populations in the wild life lands to the north, with consequential greater security for the cattle areas in the south, in the tsetse/trypanosomiasis control sense.

In the Sipolilo and Darwin-Mtoko-Inyanga Operations areas a start has been made on erecting an all-steel game fence along the international border from the Kadzi-Msengedi confluence region to the Ruya river, a distance of 140 km, where it will link up with the existing Darwin Border game fence, which follows the border between the Ruya and Mazoe rivers. The purpose of this fence is to control the anticipated increased movement of game into Rhodesia, which, it is believed, will occur as a result of the filling of Cahora-Bassa Dam in Mozambique. Work commenced in mid-August and by the end of September a total of 45 km had been completed, which is regarded as very satisfactory progress.

Good progress has been made with the construction of the Border Barrier Northern game fence, Chipinga-Sabi/Lundi Operations Area. By the close of the reporting year the fence line and service track had been completely cleared from Marumbi to the Lourenço Marques railway-line, a distance of 116 km and 86 km of fence had been erected, commencing from Marumbi.

In order to arrest the easterly spread of Musumo cattle, Sebungwe Operations Area, a short cattle fence, 11 km long, was erected near the west bank of the Senkwe river, from the foot of the
Chizarira range to the main Binga-Siabwuka-Karoi road. This fence is called the Sinekoma cattle fence. It will be extended in the north-westerly direction to the Chete game reserve boundary in the near future.

Good access roads and tracks are a prerequisite for the efficient prosecution of tsetse control measures. Some 355 km of access track were constructed and 9 615 km of access road and track continued to be maintained. The explanation for the reduction in the maintenance figure from that of last year (10 425 km) is the recent abandonment of access systems in reclaimed areas, e.g. Chenjiri Purchase Land and sections of the Gona-re-Zhou game reserve.

Fifty-two traffic control points were maintained at strategic sites within and adjacent to the various tsetse operations areas throughout the period under review and 24 others were operated for part of the year. Considerable reorganization of traffic control was effected in the Gokwe-Sanyati-Gatooma Operations Area in the light of the very much improved position in the Copper Queen Purchase Land-Ummiati River region. And in the Chinga Section of the Chinga-Sabi/Lundi Operations Area, four gates of very long standing, namely Njeravase, Ndanga, Honde and Rupembe, were closed down after 35 months of nil returns.

**MAPPING AND PLANNING**

The staff of the Mapping and Planning section of the Branch were engaged in the tracing of 1:50 000 maps and in transferring new information from recent aerial photography on to these. They prepared maps for hunting and spraying operations, up-dated 1:250 000 sheets, gave courses of instruction to field staff in aerial photograph interpretation and produced illustrations for professional officers’ contributions to scientific journals. The Mapping Officer calculated bearings and distances for access and game fence development projects. A total of 7 907 map prints was made for the various requirements of the operations. Work was also carried out for the other branches of the Department.

**RESEARCH**

A. **GENERAL**

The research programme has continued to be conducted at the Central Laboratory in Salisbury and at the three field stations maintained by the Branch, Lusulu Research Station, Binga district, Rekomitije Research Station, Urungwe district, and Gwebi Research Station, which is situated just outside Salisbury.

Despite the severe drought, experimental stock on the three field stations were reported to be in good condition.

Additional European and African accommodation, storage for stores, materials and equipment and a large open-sided working shelter to provide protection from the heat for staff preparing equipment for field experiments, were erected at Rekomitije Research Station.

Improved water storage was provided at Rekomitije Research Station by the Ministry of Water Development.

B. **VETERINARY**

Considerable routine work was carried out at the Central Laboratory and research into various aspects of animal trypanosomiasis continued.

1. **General laboratory work**

The routine examination of human and animal blood-smears continued to be a major task for the laboratory staff, involving the processing and examination of 5 304 blood-smears. In addition, the laboratory undertook the biochemical analysis of 1 842 specimens and 890 haematological investigations.

2. **Rat colony**

Investigations were continued into the aetiology of a condition causing low conception rates and high infant mortality in the colony of Norwegian Albino rats. The isolation of a mycoplasma and subsequent transmission experiments have led to the conclusion that the condition is probably due to the mycoplasma, but complicated by some other disease organism. Work on this matter continues.

3. **Trypanosomiasis of game animals**

Work on the incidence and pathological effects of trypanosomiasis in game animals, initiated in 1972, was concluded during the year. Two species of game animal were studied, the bushbuck (Tragelaphus scriptus) and the kudu (Tragelaphus strepsiceros). From the wild specimens collected, infections were minimal, with only a single T. congolense infection being recorded amongst the 44 bushbuck examined and in the case of the 12 kudu collected only one mixed T. brucei/T. congolense infection was diagnosed.

Detailed post-mortem and histological studies revealed no evidence whatsoever of any pathological effects which could be attributed to trypanosomiasis, apart from marked haemosiderosis of the spleens of all animals examined.
(4) Chemotherapeutic agents

Investigations were conducted into the efficacy of a mixture of diminazine aceturate and pyrrolidinomethyl-tetraycline (Berenil and Reverin), in the ratio of one to one. The drug was found to effect a cure for both T. vivax and T. congolense infections in cattle, when administered at a dosage rate of 2,5 mg/kg of the Berenil fraction.

The effects of Berenil on thiamine-deficient rats were studied to assess whether thiamine deficiency was a predisposing factor in the development of toxic effects, as seen in dogs. No cerebro-cortical necrosis was produced and it was therefore concluded that Berenil would not produce toxicity in rats deficient in thiamine.

(5) Trypanosomiasis in sheep

Studies were continued into the pathology of T. congolense in sheep. It was demonstrated that in the chronic form of the disease, fibrosis of the lymph glands was a common feature, varying in severity in proportion to the longevity of the infection. One particular case of chronic trypanosomiasis showed no deterioration in haematological values 12 months after being infected, despite the animal continuing to harbour a patent parasitaemia and demonstrating fluctuations of body temperature throughout the 12-month period. Further work was conducted into the immunology of the disease using the complement fixation test.

(6) Cerebral trypanosomiasis in canines

A further case of cerebral trypanosomiasis in a dog was investigated. The causative organism was a trypanosome of the T. brucei sub-group. The trypanosomes were found to be resistant to treatment with Melarsen oxide/BAL, which was a rather alarming discovery, in that the particular trypanosome may well have been T. rhodesiense. A study of the pathological effects of the infection is in hand.

(7) The identification of blood meals derived from tsetse flies

Excellent progress was made with the identification of blood meals during the year and for the first time since the inception of the blood meal section of the Central Laboratory, the back log of meals was cleared.

The majority of the blood meals processed were from tsetse flies caught in areas where tsetse control and hunting operations were being conducted. The results have proved extremely useful in detecting isolated pockets of Suids and other preferred hosts, thus enabling a much more critical approach in hunting direction. The percentage of blood meals which could not be identified increased as the tsetse flies came under stress (due to the reduction in numbers of preferred hosts) and it is now envisaged that further anti-sera will have to be prepared in order to embrace those animal species not normally fed on, but which could provide sustenance to tsetse flies in the absence of their preferred hosts. Primate meals continue to be a feature of the diet of tsetse flies and seems to have an inverse relationship to Bovid and Suid meals. It has also become apparent that in order to assess the effectiveness of selective hunting operations by means of blood meal examinations, it is essential to take into account changes in tsetse density.

The separation of 350 Suid blood meals, collected in the Sengwa Research Area, Gokwe district, into wart-hog and bush-pig feeds, showed that 97,7 per cent. were derived from wart-hog. Successful production of highly specific anti-sera to wart-hog and to bush-pig was achieved by using the domestic Large White x Landrace pig. Specific anti-sera to eland and sable were also produced using ox and sheep respectively. An unsuccessful attempt was made to produce sheep anti-diuker serum.

An investigation to determine the preferred hosts of G. pallidipes in Rhodesia has been commenced, as it has been suspected for a while now, that, despite the availability of bushbuck, this animal is probably not the prime food host of this species of tsetse fly in this country, as has generally been believed to be the case. A total of 1 000 G. pallidipes blood meals has been collected in an area where the game animals are undisturbed and bushbuck are numerous. Preliminary results show that 29 per cent. of the first 300 meals tested were derived from Bovids.

C. GLOSSINOLOGY

(1) Insecticide trials

Messrs. Klipfontein Organic Products Corporation have suggested the use of a sticker to prevent deposits of DDT WP being washed away by rain. Bushbuck and Colophospermum mopane trees were sprayed in October 1972 with several formulations of 5 per cent. DDT WP suspension and the recommended sticker, and samples of bark deposits taken at intervals during the following rains were bioassayed with female G. pallidipes. The results offered no reason to suppose that the sticker greatly affected the longevity of the deposits. The efficacy of the sticker is being investigated at higher concentration.

(2) Resting behaviour

To investigate the distribution of G. morsitans and G. pallidipes near a large Tamarindus indica tree, known to be a good resting site for many tsetse, electric nets, 1,5 m long by 3,3 m high, have been used to catch tsetse flying at different times of day at various heights near the tree and at various
distances from the bole. The scaffolding provided by the Rhodesia Cattle Producers' Association has been fitted as a tower next to the tree to assure the placement of electric nets (Plate 1). This study is being conducted on a seasonal basis and is not yet complete, but the following generalizations hold good for the data produced in May, July and September 1973:

(i) Although a few flies are caught at heights above 9 m, by far the most flies are caught within 3 m of the ground.

(ii) Catches close to the bole are usually a little greater than those made several metres from the bole.

(iii) Catches are greatest in the late afternoon and early evening.

(iv) The proportion of females in catches of each species approaches 70 per cent.

(v) G. pallidipes predominate considerably over G. morsitans in catches.

(vi) The greatest catches which can be expected from a net operated in an optimum situation are only 20 flies per four-hour period.

It is not clear to what extent this technique samples flies seeking a resting place as opposed to flies ranging for a host. This matter is being studied by comparing the sex and species composition and hunger stages of the samples obtained by this technique and by techniques which sample resting flies and food-seeking flies.

Equipment has been produced to electrocute tsetse as they alight on branch and bole resting places, and so study resting behaviour more directly (Plate 2).

(3) Responses to hosts

(a) Sight and smell

The report for 1971-72 described the use of a ventilated pit to attract tsetse to stationary odour-sources and the capture of the attracted flies by a small electric net, 0.60 m wide by 1.20 m high. A deeper understanding of the importance of odour attractants is considered important, because of its bearing on the use of attractants to control and survey tsetse populations. Further studies were performed using a very large expanse of electric netting consisting of a cage, 1.35 m high by 1.50 m long by 0.79 m wide, and with a net 3.3 m long and 1.5 m high, extending 0.3-3.6 m from each side of the cage. The cage and wings of netting were placed so as to provide the maximum cross-section to the prevailing wind. The centre of the cage was baited with a visual stimulus (small black model of an animal), olfactory stimulus (oxyodour), both stimuli combined, or with nil bait. Fig. 1 shows the catches on each portion of the netting complex and shows for comparison the catches obtained on the upwind and downwind faces of a small electric net used in other experiments.

The total of catches of all portions of the cage and wings were 225 with nil bait, 442 with visual bait alone, 2730 with odour bait alone and 3868 with visual and olfactory bait together. These figures give a ratio of about 1 : 2 : 12 : 17. With the small electric net the total catches were 66 with nil bait, 803 with visual bait alone, 892 with odour bait alone, and 2902 with both visual and olfactory baits, giving a ratio of about 1 : 12 : 14 : 44. There are several suggestive contrasts in the ratios produced by the two sizes of net. Firstly, the efficacy of odour alone was about equal to that of visual stimuli alone when small nets were used, but odour was six times more effective than visual stimuli when the large net was used. Secondly, the addition of a visual stimulus to the odour increased catches by only half when the large net was used, but trebled catches when the small net was employed.

An explanation for these effects becomes clearer when the distribution of catches on the large netting complex is considered. With no bait the catches are fairly evenly distributed, suggesting that flies were caught while ranging randomly. With the model as bait catches were concentrated on the cage, indicating a precise orientation to the model. With odour alone as bait the concentration on the cage was less marked than with the model, indicating a less precise orientation, but catches were strongly concentrated on the downwind faces, indicating an upwind flight to the baits. With both model and odour as bait the concentrations on the cage and on the downwind faces were especially pronounced.

The above findings suggest that a stationary visual stimulus attracts only those few flies which range within a few metres of the bait, but it does permit precise orientation; olfactory stimuli attract many flies from a distance, but precise orientation will not be possible unless flies perceive visual stimuli at close range. The poor efficacy of odour alone, when used with small nets, is explained by the precise orientation required if flies are to be available to such nets.

(b) Identification of odours

No significant difference was found in the catches using odour from a normal ox, an ox with a dampened coat (which increased the body odour as perceived by humans), and an ox whose body was washed thoroughly with water or Teepol solution (which decreases body odour). The apparent unimportance of body odour was investigated further with a special pit divided into two similar chambers by an air-tight sheet of canvas. The body of an ox or donkey was isolated in one chamber and the head and upper-neck passed through a laced slit in the sheet, to be isolated in the other chamber. Tests with odour drawn from each chamber showed that the catches produced by a small electric net, at the odour
Plate 1.—The tower next to the Tamarindus indica tree

Plate 2.—The base of the Tamarindus indica tree showing three artificial branches, the under surfaces of which are electrified (1, 2 and 3) and a section of electrified bale (4)
outlet, were several times greater (significant) with head odour than with body odour and the head odour was sufficient to account for most odour attraction to an ox or donkey (Table 4 shows the data for the ox).

**Table 4**

<table>
<thead>
<tr>
<th>MEAN CATCHES USING ODOURS FROM DIFFERENT BODY REGIONS OF AN OX, APRIL-JUNE, 1950-1951</th>
<th>SIX REPLICATES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body region</strong></td>
<td><strong>G. morsitans</strong></td>
</tr>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Whole ox</td>
<td>24.6</td>
</tr>
<tr>
<td>Head only</td>
<td>23.3</td>
</tr>
<tr>
<td>Body only</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Attraction to carbon dioxide and to odour produced from the fresh fodder placed in the head chamber appears insufficient to account for the efficacy of head odour.

**HUMAN TRYPANOSOMIASIS**

Two Africans and one European, all males, contracted trypanosomiasis during the year. All were treated, but very regrettably, one African died, as a result of a delay in obtaining medical attention. Localities of infection were, respectively, Rekomitjie Research Station, Bougainville camp, situated 16 miles downstream from Chirundu, and A and B camps, lying just downstream from Kariba Gorge, all within the Urungwe district. In the case of the Rekomitjie Research Station infection, this was in an employee of the Branch, Learner Tsetse Field Assistant Timothy Gwenere, who was a very new arrival and represents the first human infection on the station since it was established in 1958.
ACKNOWLEDGEMENTS

The achievements of the year would have been impossible without the co-operation and assistance of other departments of government. We are extremely grateful to all these organizations, in particular the Ministry of Internal Affairs, the Central Mechanical Equipment Department, the Department of Conservation and Extension, the British South Africa Police, the Army and the Air Force, the Department of National Parks and Wild Life Management, the Ministry of Water Development, and the Department of the Surveyor-General.

A special category of thanks is due to the Assistant Director of Veterinary Services (Field) and to his Provincial Veterinary Officers and staff. We are also grateful to the Assistant Director of Veterinary Services (Research) for laboratory facilities.

I have great pleasure in recording my thanks to all staff in the Branch, both in the field and at headquarters, for their continued loyalty and devotion to duty, despite, at times, tremendously difficult, or even hazardous, working conditions.

Finally, I am deeply indebted to the Director of Veterinary Services and to the Secretary for Agriculture and his Ministry for their support and sympathy in resolving our many problems.

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