FINAL REPORT FOR PROJECT DAQ07 - PART 1

ABSTRACT

A serological survey of cattle from throughout Queensland and sheep from cattle/sheep interface areas was conducted to determine the distribution and prevalence of antibodies to Bluetongue virus serotypes. This information allowed preliminary designation of arbovirus-free zones and identification of livestock populations at greatest risk to introduction of exotic Bluetongue viruses.

Throughout the state antibodies were detected to only serotypes 1 and 21. In cattle prevalence decreased with increasing distance from the coast ranging from 73% in the far north to less than 1% in the southwest.

In sheep, prevalence of bluetongue antibodies in the major cattle/sheep interface areas in the north-west and central Queensland ranged from 0% to 5%.

A system of strategically placed sentinel herds of 10 young serologically negative cattle was established across northern Australia to monitor the distribution and seasonality of bluetongue viruses. Initially 23 herds were located in Queensland, 4 in Northern Territory and 2 in Western Australia but by the completion of the project the number of herds in Queensland had been reduced to 12.

No bluetongue virus activity was detected in Western Australia or Northern Territory herds throughout the project although testing of one herd in Northern Territory with a history of bluetongue activity was not done after June 1991.

In Queensland, activity to bluetongue serotypes 1 and 21 was detected in all years of the project. Transmissions occurred predominantly in the period April to September and were more widespread in wetter years.

The pathogenic bluetongue serotypes previously isolated from the Northern Territory have not spread to adjoining States.

PROJECT SUMMARY

PROJECT TITLE: Distribution of bluetongue and other arboviruses in northern Australia

PROJECT NUMBER: DAQ67

RESEARCH ORGANISATIONS AND LOCATIONS:

Queensland Department of Primary Industries
Oonoonba Veterinary Laboratory
PO Box 1085
Townsville 4810
QUEENSLAND

COMMENCEMENT: March 1990

COMPLETION: October 1992

PROJECT INVESTIGATORS: Dr S.J. Johnson
Mr M. Flanagan

PHONE NUMBER: (077) 222 688

FAX NUMBER: (077) 784 307

OBJECTIVES:

(i) To establish a system to monitor the seasonal activity of bluetongue and other arboviruses across northern Australia.

(ii) To define arbovirus-free zones to permit access to new export markets

(iii) To identify livestock populations at greatest risk to the introduction of exotic Bluetongue viruses

(iv) To provide a testing service for sentinel herds to Queensland, Northern Territory and the Kimberley/Pilbara area of Western Australia.

METHODOLOGY: A series of sentinel herds of 10 young, serologically negative cattle was established throughout Queensland, Northern Territory and northern Western Australia. The cattle were bled monthly and sera were tested for antibodies to bluetongue and clotted blood samples were held for virus isolation studies. Serologically positive cattle were replaced annually.

A statistically designed serological survey for Bluetongue antibodies was conducted on 20,000 cattle from throughout Queensland and on 1000 sheep from cattle/sheep interface areas.

Results from the serological survey and the sentinel herds allowed designation of arbovirus free zones and identified livestock populations at greatest risk to introduction of exotic Bluetongue viruses.

RESULTS:

Queensland

1990 : 20 herds established (see Figure 1 and Table 1).
10 herds seroconverted to bluetongue. Two serotypes BTV.1 and BTV.21, were detected (see Table 2).

1991 : 15 herds monitored (Table 1).
3 herds seroconverted to bluetongue. Two serotypes, BTV.1 and BTV.21, were detected (see Table 2).

1992 : 12 herds monitored (Table 1).
2 herds seroconverted to bluetongue. Only BTV.1, was detected (see Table 2).

Northern Territory

1990, 1991 : 4 herds were established (see Figure 1).
No seroconversions to bluetongue occurred.

1992 : No samples submitted.

Western Australia

1990, 1991, 1992 : 2 herds were established (see Figure 1).
No seroconversions to bluetongue occurred.

Serological survey : Antibodies to BTV1 and BTV21 widespread in cattle (see Table 2 and Figure 2)
: low prevalence of bluetongue antibodies in sheep (see Table 3)
: extensive areas of west and south identified as arbovirus free
: sheep flocks in central highlands at greatest risk to exotic bluetongue viruses

CONCLUSIONS:

Only 2 bluetongue virus serotypes, BTV.1 and BTV.21 were detected in Queensland during the monitoring period. No bluetongue virus activity was detected in Western Australia. The pathogenic serotypes previously isolated from Northern Territory have not spread to adjoining states.

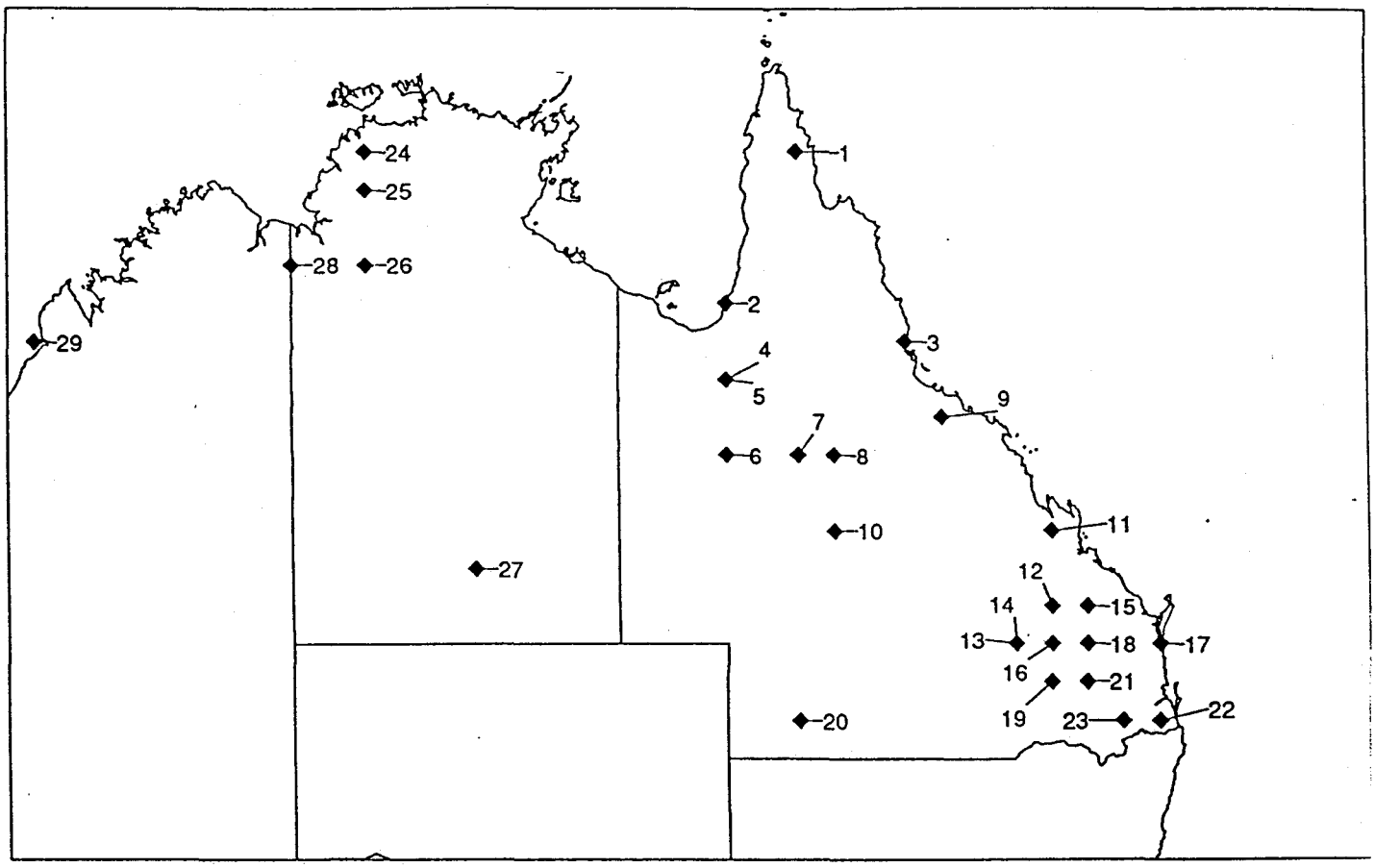
Commercial sheep flocks in Queensland have little immunity to bluetongue virus infection. Evidence of previous infection and recent transmissions with endemic serotypes indicates that flocks in central Queensland are at greatest risk to introduction of pathogenic bluetongue viruses. Much of the west and south of the state are currently bluetongue virus free.

TABLE 1

SENTINEL HERDS ESTABLISHED IN QUEENSLAND

	Map No.		Map No.	
1990:	1	Batavia Downs Res Stn	12	Brigalow Res Stn
	2	Karumba Hldgs	13	Mt. Kinglsey
	3	Utchee Creek Res Stn	15	Lochaber
	5	Cowan Downs	16	Avalon
	6	Jersey Plains	17	Owanyilla
	7	Sandhills	19	Glenleigh Pk
	8	Hughenden Stn	20	Orient
	9	Swans Lagoon Res Stn	21	Linden
	10	River View Dairy	22	Mutdapilly
	11	Etna Ck Prison Farm	23	Warwick
1991:	1	Batavia Downs Res Stn	15	Lochaber
	2	Karumba Hldgs	16	Avalon
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	19	Glenleigh Pk
	6	Jersey Plains	21	Linden
	9	Swans Lagoon Res Stn	22	Mutdapilly Res Stn
	11	Etna Ck Prison Farm	23	Warwick
	13	Mt. Kingsley		
1992:	1	Batavia Downs Res Stn	14	Oakwells
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	18	Hidden Valley
	6	Jersey Plains	19	Glenleigh Pk
	9	Swans Lagoon Res Stn	21	Linden
	11	Etna Ck Prison Farm	22	Mutdapilly

FIGURE 1: LOCATION OF SENTINEL HERDS



QLD	1.	Batavia Downs Res. Stn.		17.	Owanyilla
	2.	Karumba Hldgs		18.	Hidden Valley
	3.	Utchee Ck Res. Stn.		19.	Glenleigh Pk.
	4.	Donors Hill		20.	Orient
	5.	Cowan Dns.		21.	Linden
	6.	Jersey Plains		22.	Mutdapilly Res. Stn.
	7.	Sandhills		23.	Warwick
	8.	Hughenden Stn.	NT	24.	Coastal Plains Res. Stn.
	9.	Swans Lagoon Res. Stn.		25.	Douglas Daly Res. Stn.
	10.	River View Dairy		26.	Victoria River Res. Stn.
	11.	Etna Ck Prison Farm		27.	Arid Zone Res. Stn.
	12.	Brigalow Res. Stn.	WA	28.	Kununurra
	13.	Mt Kingsley		29.	Roebuck Plains
	14.	Oakwells			
	15.	Lockaber			
	16.	Avalon			

TABLE 2

BLUETONGUE SEROCONVERSIONS IN QUEENSLAND SENTINEL HERDS

YEAR	HERD	BLUETONGUE SEROTYPE	
		BTV.1	BTV.21
1990	Batavia Downs Res Stn	-	July, August
	Utchee Ck Res Stn	May, June, July, Nov.	-
	Swans Lagoon Res Stn	-	June
	Etna Ck Prison Farm	Prior to June	Prior to June
	Brigalow Res Stn	Prior to Aug; Dec.	Prior to Aug.
	Mt. Kingsley	June, August	-
	Lochaber	June	-
	Glenleigh Pk	July - Sept.	July - Sept.
	Linden	August	-
	Mutdapilly Res Stn	-	May, June, July
1991	Avalon	April	-
	Linden	May	-
	Owanyilla	-	Feb., April
1992	Batavia	May, June	-
	Owanyilla	May	-

TABLE 3

PREVALENCE AND DISTRIBUTION OF ANTIBODIES TO BLUETONGUE VIRUS SEROTYPES 1 AND 21 IN CATTLE IN QUEENSLAND

Region	AGID test prevalence (%)	BTV 1 prevalence (%)*	BTV 21 prevalence (%)*
1	42.67	20.19	8.49
2	77.25	48.69	24.45
3	41.14	19.36	16.39
4	17.97	3.00	2.82
5	47.71	18.38	6.59
6	16.67	5.28	0.98
7	3.81	0.36	0.36
8	9.14	2.24	1.52
9	5.26	1.43	0.17
TOTAL	37.17	15.48	8.32

* (No. sera SNT + ve/No. sera SN tested) x AGID test prevalence.

\+ Regions are shown in Figure 2

FIGURE 2: MAP OF QUEENSLAND SHOWING REGIONS USED FOR ANALYSIS OF DATA FROM SEROLOGICAL SURVEY OF CATTLE

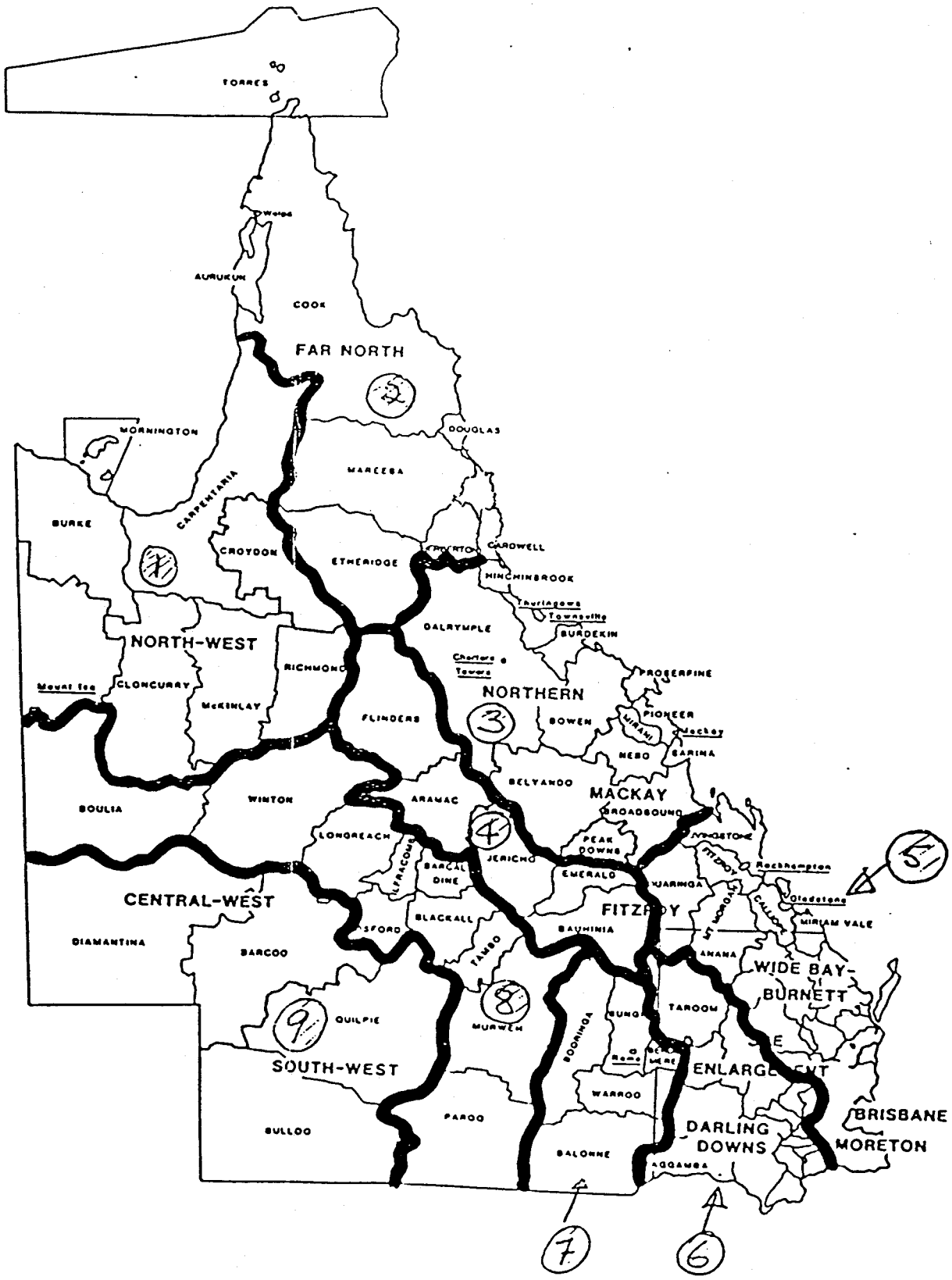


TABLE 4

BLUETONGUE ANTIBODIES IN SHEEP FROM NORTHERN AND CENTRAL QUEENSLAND IN 1990-91

Region	Property	No. of Sheep	No. and % of AGID* Reactors	No. and % of SN+ Reactors		
				BLU 1	BLU 21	Others
1	1	100	0	0	0	0
	2	100	0	0	0	0
	3	101	3(3)	0	0	0
	4	100	1(1)	0	0	0
	5	100	0	0	0	0
	6	80	0	0	0	0
2	1	35	2(5.7)	0	0	0
	2	4	0	0	0	0
	3	28	2(7.1)	0	0	0
	4	14	5(35.7)	1(7.1)	0	0
	5	12	5(41.7)	3(25)	0	0
	6	5	0	0	0	0
	7	13	2(15.4)	1(7.7)	1(7.7)	0
	8	10	0	0	0	0
3	1	16	2(12.5)	2(12.5)	0	0
	2	69	1(1.5)	1 (1.5)	0	0
4	1	100	1(1)	1(1)	0	0
	2	100	11(11)	5(5)	0	0

Region 1 on or north of the western rail line between Hughenden and Julia Ck.
2 the Atherton Tableland
3 the coastal strip between Townsville and Bowen
4 the Coastal Highlands between Emerald and Clermont

* = agar gel immunodiffusion
\+ = serum neutralisation

FINAL REPORT FOR PROJECT DAQ67 - PART 2

1. BACKGROUND AND INDUSTRY CONTEXT

Eight serotypes of bluetongue virus (BTV) have been isolated in Australia. The viruses are transmitted by biting midges of the genus *Culicoides* and studies have identified *C. brevitarsis* as the principal vector in eastern Australia. The viruses circulate in cattle in the absence of clinical symptoms but infection of sheep can result in bluetongue disease. Studies have shown BTV.23 to be the most virulent, killing 30 - 40% of infected sheep and BTV.3, 15 and 16 are moderately virulent killing up to 10% of infected sheep. BTV.1 appears of low virulence and BTV.9 is avirulent. The virulence of field isolates of BTV.20 and 21 has not been established.

All 8 serotypes have been isolated from the Northern Territory but serological evidence indicates that only 2 serotypes, BTV.1 and 21 have spread from there. Infection of sheep with both serotypes has been detected serologically in Queensland and New South Wales but no clinical disease has been reported. The absence of clinical disease may be due to a combination of low virus virulence, the low density of vectors, a vector preference for cattle and limited vector competence to transmit the viruses. However, the presence of susceptible sheep, competent vectors and bluetongue viruses means a high probability that an outbreak of clinical bluetongue will occur in Australia at some time. The costs incurred due to stock losses would depend on the number of sheep infected but the loss of export earnings could be substantial.

The discovery of BTV in Australia in 1975 caused disruptions in the export of ruminant animals and, in some instances, of products such as meat and wool to a number of countries. An appreciation of the epidemiology of BTV in Australia and the complex relationships that exist between virus, vector and susceptible host subsequently led to a rationalisation of importation protocols. Some countries at present permit importation from all parts of Australia providing relevant testing is done. Other countries accept only livestock or germ plasm from vector-free regions of Australia and other such as the European Economic Community and Syria do not accept any Australian material. Some measure of the complexity of the situation is seen in the fact that not all countries accept the same regions of Australia as vector-free.

It is clear that an outbreak of bluetongue in Australian sheep would lead many countries to reassess the current arrangements with respect to importation of Australian livestock. This could have a major economic impact. For example, Middle Eastern countries which imported over 6 million sheep and goats in 1984/85 at present do not place any restrictions on the importation of Australian livestock.

2. PROJECT OBJECTIVES

(i) To establish a system to monitor the seasonal activity of bluetongue and other arboviruses across northern Australia.

(ii) To define arbovirus-free zones to permit access to new export markets.

(iii) To identify livestock populations at greatest risk to the introduction of exotic Bluetongue viruses.

(iv) To provide a testing service for sentinel herds to Queensland, Northern Territory and the Kimberley/Pilbara area of Western Australia.

3. METHODOLOGY

Strategically placed sentinel herds of 10 young serologically megative cattle were established across northern Australia. The cattle were bled monthly and sera tested for antibodies to bluetongue virus. Initial screening of sera was by AGID test and seropositives were examined in SNT to identify viral serotype. Clotted samples from freshly seroconverted sentinels were inoculated into susceptible sheep to isolate virus. Serilogically positive cattle were replaced annually. A statistically designed serological survey for Bluetongue antibodies was conducted on 20,000 cattle from throughout Queensland and on 1000 sheep from cattle/sheep interface areas.

Results from the serological survey and the sentinel herds allowed designation of arbovirus free zones and identified livestock populations at greatest risk to introduction of exotic Bluetongue viruses.

4. RESULTS AND DISCUSSION

The Statewide serological survey confirmed that only bluetongue serotypes 1 and 21 were present in Queensland.

Prevalence of serological reactions in cattle decreased with increasing distance from the coast and ranged from 73% in the far north to less than 1% in the far west and south (see Table 3 and Figure 2). The small numbers of seropositive animals in regions 7,8 and 9 resulted from movement of store cattle previously infected in regions farther north. The distribution and prevalence of serological reactions to Bluetongue matched closely the distribution of *Culicoides brevitarsis*.

Infections in sheep were restricted to two areas of the State, in small non commercial flocks on the Atherton Tableland and in a commercial flock on the central highlands between Emerald and Clermont. No evidence was found of bluetongue infections of sheep in commercial flocks in the north west. (Table 4).

Cattle and sheep with antibodies to bluetongue serotypes 1 and 21 showed little or no cross reaction in neutralisation tests to more pathogenic serotypes recorded from the Northern territory. Therefore, the Queensland cattle and sheep populations must be regarded as susceptible to infection with exotic bluetongue serotypes.

A total of 23 herds were established in Queensland, 4 herds in Northern Territory and 2 herds in Western Australia. The locations of the herds are shown on the accompanying map (Figure 1).

No bluetongue activity was detected in Western Australia or Northern Territory throughout the study period; however, no sera were received from the Coastal Plains herd after June 1991. The absence of BTV activity was probably the result of low vector numbers resulting from poor wet seasons during the study period.

In Queensland the number and location of herds was modified during the project as shown in Table 1. Activity to 2 BTV serotypes, BTV.1 and 21 was detected (see Table 2). Throughout the State transmission occurred predominantly in the period April to September and only sporadic transmissions occurred between October and March. This seasonal pattern of transmission is best explained in relation to vector prevalence. The higher incidence of bluetongue transmission in 1990 was correlated to higher vector numbers occurring in the wetter year. A field isolate of BTV1 was recovered from a herd in southern Queensland and is to be assessed for its pathogenicity for sheep.

In most areas of the State there is a peak emergence of *C. brevitarsis* in late Winter and early Spring (August - September). Following this populations decline and remain low from October to February/March, but increase in response to summer rainfall. A second peak of *C. brevitarsis* activity which is accompanied by peak activity of *C. wadai* occurs in April and May. Most transmissions in Queensland occur during or soon after this late summer peak.

The seasonal pattern of virus transmissions supports the contention that transmission to sheep resulting in an outbreak of clinical disease is most likely to occur in late summer and early autumn. Any outbreaks occurring at this time are likely to be of limited duration because the onset of cooler weather in the sheep producing areas will eliminate the vectors. In some years; however, such transmissions could commence as early as April and persist until July. A control policy based on "masterful inactivity" may be difficult to sustain under such circumstances.

The absence of seroconversions in sentinel herds in western and south-western areas of queensland confirmed the preliminary result of the serological survey that much of those areas were free of bluetongue virus.

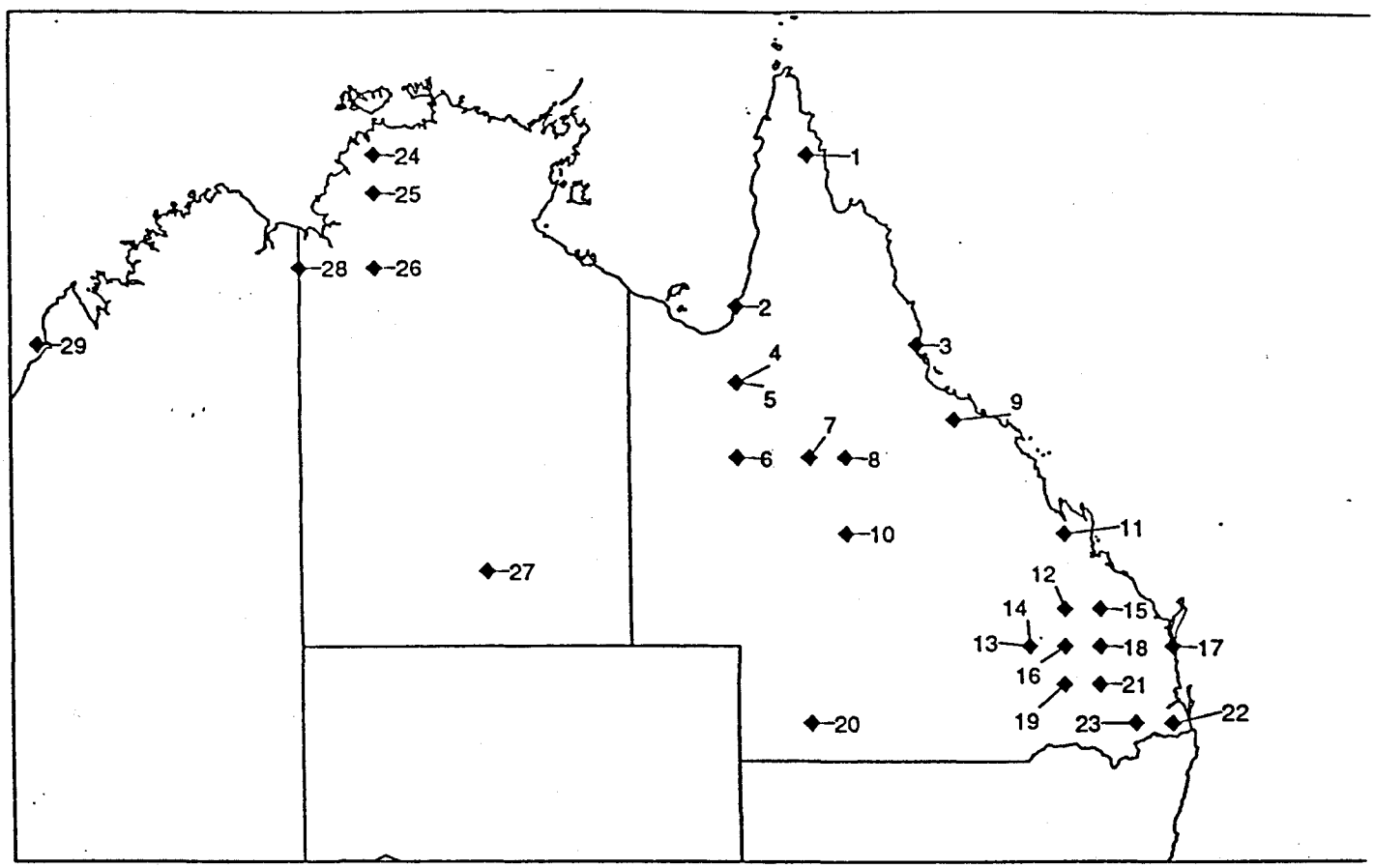
The presence of seropositive sheep in commercial flocks and the transmission of bluetongue virus in several sentinel cattle herds in central Queensland in 1990 indicate that sheep in this area are most at risk to the introduction of exotic or pathogenic bluetongue serotypes.

TABLE 1

SENTINEL HERDS ESTABLISHED IN QUEENSLAND

	Map No.		Map No.	
1990:	1	Batavia Downs Res Stn	12	Brigalow Res Stn
	2	Karumba Hldgs	13	Mt. Kinglsey
	3	Utchee Creek Res Stn	15	Lochaber
	5	Cowan Downs	16	Avalon
	6	Jersey Plains	17	Owanyilla
	7	Sandhills	19	Glenleigh Pk
	8	Hughenden Stn	20	Orient
	9	Swans Lagoon Res Stn	21	Linden
	10	River View Dairy	22	Mutdapilly
	11	Etna Ck Prison Farm	23	Warwick
1991:	1	Batavia Downs Res Stn	15	Lochaber
	2	Karumba Hldgs	16	Avalon
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	19	Glenleigh Pk
	6	Jersey Plains	21	Linden
	9	Swans Lagoon Res Stn	22	Mutdapilly Res Stn
	11	Etna Ck Prison Farm	23	Warwick
	13	Mt. Kingsley		
1992:	1	Batavia Downs Res Stn	14	Oakwells
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	18	Hidden Valley
	6	Jersey Plains	19	Glenleigh Pk
	9	Swans Lagoon Res Stn	21	Linden
	11	Etna Ck Prison Farm	22	Mutdapilly

FIGURE 1: LOCATION OF SENTINEL HERDS



QLD	1.	Batavia Downs Res. Stn.
	2.	Karumba Hldgs
	3.	Utchee Ck Res. Stn.
	4.	Donors Hill
	5.	Cowan Dns.
	6.	Jersey Plains
	7.	Sandhills
	8.	Hughenden Stn.
	9.	Swans Lagoon Res. Stn.
	10.	River View Dairy
	11.	Etna Ck Prison Farm
	12.	Brigalow Res. Stn.
	13.	Mt Kingsley
	14.	Oakwells
	15.	Lockaber
	16.	Avalon
	17.	Owanyilla
	18.	Hidden Valley
	19.	Glenleigh Pk.
	20.	Orient
	21.	Linden
	22.	Mutdapilly Res. Stn.
	23.	Warwick
NT	24.	Coastal Plains Res. Stn.
	25.	Douglas Daly Res. Stn.
	26.	Victoria River Res. Stn.
	27.	Arid Zone Res. Stn.
WA	28.	Kununurra
	29.	Roebuck Plains

TABLE 2

BLUETONGUE SEROCONVERSIONS IN QUEENSLAND SENTINEL HERDS

YEAR	HERD	BLUETONGUE SEROTYPE	
		BTV.1	BTV.21
1990	Batavia Downs Res Stn	-	July, August
	Utchee Ck Res Stn	May, June, July, Nov.	-
	Swans Lagoon Res Stn	-	June
	Etna Ck Prison Farm	Prior to June	Prior to June
	Brigalow Res Stn	Prior to Aug; Dec.	Prior to Aug.
	Mt. Kingsley	June, August	-
	Lochaber	June	-
	Glenleigh Pk	July - Sept.	July - Sept.
	Linden	August	-
	Mutdapilly Res Stn	-	May, June, July
1991	Avalon	April	-
	Linden	May	-
	Owanyilla	-	Feb., April
1992	Batavia	May, June	-
	Owanyilla	May	-

TABLE 3

PREVALENCE AND DISTRIBUTION OF ANTIBODIES TO BLUETONGUE VIRUS SEROTYPES 1 AND 21 IN CATTLE IN QUEENSLAND

Region	AGID test prevalence (%)	BTV 1 prevalence (%)*	BTV 21 prevalence (%)*
1	42.67	20.19	8.49
2	77.25	48.69	24.45
3	41.14	19.36	16.39
4	17.97	3.00	2.82
5	47.71	18.38	6.59
6	16.67	5.28	0.98
7	3.81	0.36	0.36
8	9.14	2.24	1.52
9	5.26	1.43	0.17
TOTAL	37.17	15.48	8.32

* (No. sera SNT + ve/No. sera SN tested) x AGID test prevalence.

\+ Regions are shown in Figure 2

FIGURE 2: MAP OF QUEENSLAND SHOWING REGIONS USED FOR ANALYSIS OF DATA FROM SEROLOGICAL SURVEY OF CATTLE

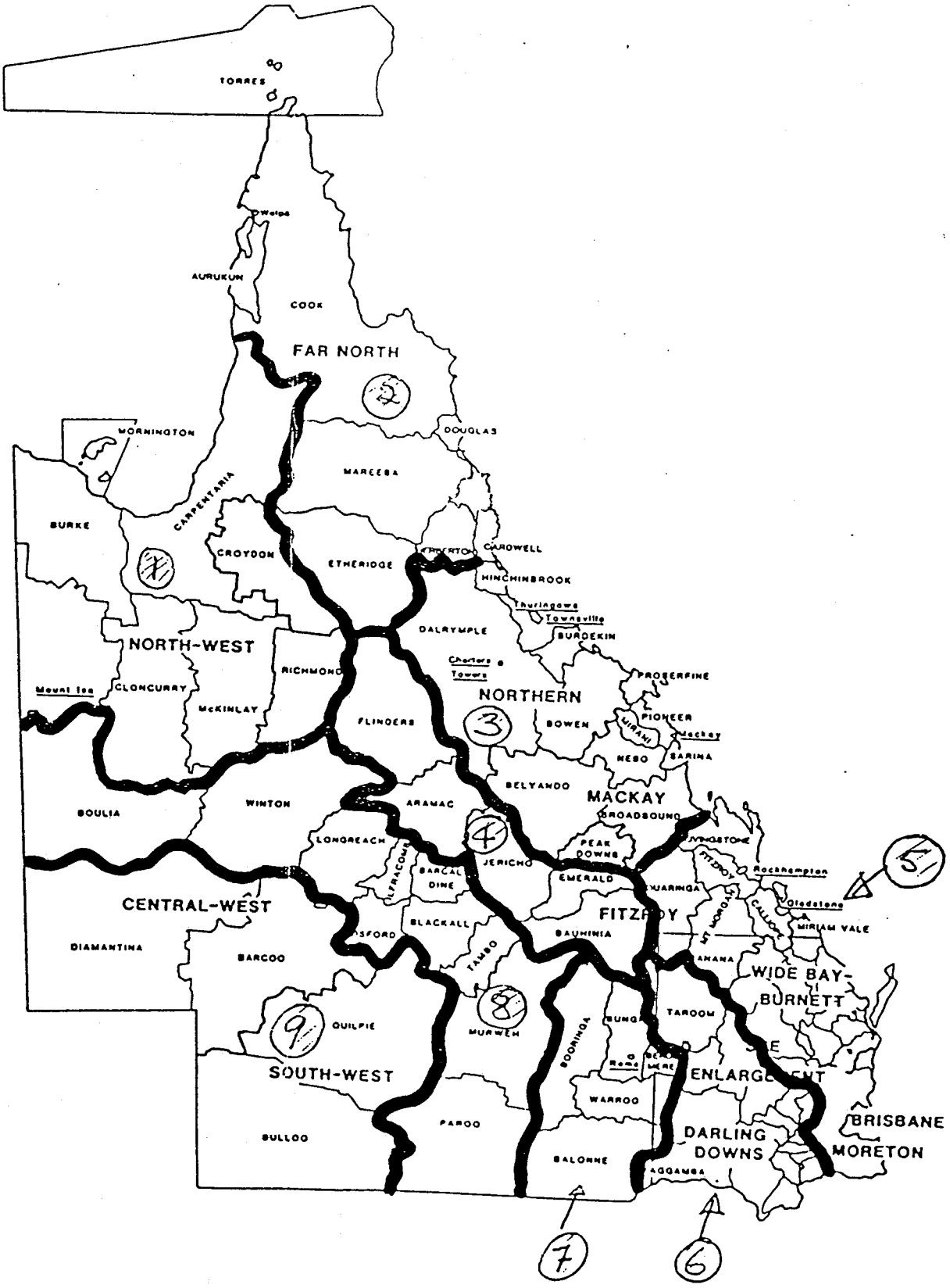


TABLE 4

BLUETONGUE ANTIBODIES IN SHEEP FROM NORTHERN AND CENTRAL QUEENSLAND IN 1990-91

Region	Property	No. of Sheep	No. and % of AGID* Reactors	No. and % of SN+ Reactors		
				BLU 1	BLU 21	Others
1	1	100	0	0	0	0
	2	100	0	0	0	0
	3	101	3(3)	0	0	0
	4	100	1(1)	0	0	0
	5	100	0	0	0	0
	6	80	0	0	0	0
2	1	35	2(5.7)	0	0	0
	2	4	0	0	0	0
	3	28	2(7.1)	0	0	0
	4	14	5(35.7)	1(7.1)	0	0
	5	12	5(41.7)	3(25)	0	0
	6	5	0	0	0	0
	7	13	2(15.4)	1(7.7)	1(7.7)	0
	8	10	0	0	0	0
3	1	16	2(12.5)	2(12.5)	0	0
	2	69	1(1.5)	1 (1.5)	0	0
4	1	100	1(1)	1(1)	0	0
	2	100	11(11)	5(5)	0	0

Region 1 on or north of the western rail line between Hughenden and Julia Ck.
2 the Atherton Tableland
3 the coastal strip between Townsville and Bowen
4 the Coastal Highlands between Emerald and Clermont

* = agar gel immunodiffusion
\+ = serum neutralisation

FINAL REPORT FOR PROJECT DAQ67 - PART 2

1. BACKGROUND AND INDUSTRY CONTEXT

Eight serotypes of bluetongue virus (BTV) have been isolated in Australia. The viruses are transmitted by biting midges of the genus *Culicoides* and studies have identified *C. brevitarsis* as the principal vector in eastern Australia. The viruses circulate in cattle in the absence of clinical symptoms but infection of sheep can result in bluetongue disease. Studies have shown BTV.23 to be the most virulent, killing 30 - 40% of infected sheep and BTV.3, 15 and 16 are moderately virulent killing up to 10% of infected sheep. BTV.1 appears of low virulence and BTV.9 is avirulent. The virulence of field isolates of BTV.20 and 21 has not been established.

All 8 serotypes have been isolated from the Northern Territory but serological evidence indicates that only 2 serotypes, BTV.1 and 21 have spread from there. Infection of sheep with both serotypes has been detected serologically in Queensland and New South Wales but no clinical disease has been reported. The absence of clinical disease may be due to a combination of low virus virulence, the low density of vectors, a vector preference for cattle and limited vector competence to transmit the viruses. However, the presence of susceptible sheep, competent vectors and bluetongue viruses means a high probability that an outbreak of clinical bluetongue will occur in Australia at some time. The costs incurred due to stock losses would depend on the number of sheep infected but the loss of export earnings could be substantial.

The discovery of BTV in Australia in 1975 caused disruptions in the export of ruminant animals and, in some instances, of products such as meat and wool to a number of countries. An appreciation of the epidemiology of BTV in Australia and the complex relationships that exist between virus, vector and susceptible host subsequently led to a rationalisation of importation protocols. Some countries at present permit importation from all parts of Australia providing relevant testing is done. Other countries accept only livestock or germ plasm from vector-free regions of Australia and other such as the European Economic Community and Syria do not accept any Australian material. Some measure of the complexity of the situation is seen in the fact that not all countries accept the same regions of Australia as vector-free.

It is clear that an outbreak of bluetongue in Australian sheep would lead many countries to reassess the current arrangements with respect to importation of Australian livestock. This could have a major economic impact. For example, Middle Eastern countries which imported over 6 million sheep and goats in 1984/85 at present do not place any restrictions on the importation of Australian livestock.

2. PROJECT OBJECTIVES

(i) To establish a system to monitor the seasonal activity of bluetongue and other arboviruses across northern Australia.

(ii) To define arbovirus-free zones to permit access to new export markets.

(iii) To identify livestock populations at greatest risk to the introduction of exotic Bluetongue viruses.

(iv) To provide a testing service for sentinel herds to Queensland, Northern Territory and the Kimberley/Pilbara area of Western Australia.

3. METHODOLOGY

Strategically placed sentinel herds of 10 young serologically megative cattle were established across northern Australia. The cattle were bled monthly and sera tested for antibodies to bluetongue virus. Initial screening of sera was by AGID test and seropositives were examined in SNT to identify viral serotype. Clotted samples from freshly seroconverted sentinels were inoculated into susceptible sheep to isolate virus. Serilogically positive cattle were replaced annually. A statistically designed serological survey for Bluetongue antibodies was conducted on 20,000 cattle from throughout Queensland and on 1000 sheep from cattle/sheep interface areas.

Results from the serological survey and the sentinel herds allowed designation of arbovirus free zones and identified livestock populations at greatest risk to introduction of exotic Bluetongue viruses.

4. RESULTS AND DISCUSSION

The Statewide serological survey confirmed that only bluetongue serotypes 1 and 21 were present in Queensland.

Prevalence of serological reactions in cattle decreased with increasing distance from the coast and ranged from 73% in the far north to less than 1% in the far west and south (see Table 3 and Figure 2). The small numbers of seropositive animals in regions 7,8 and 9 resulted from movement of store cattle previously infected in regions farther north. The distribution and prevalence of serological reactions to Bluetongue matched closely the distribution of *Culicoides brevitarsis*.

Infections in sheep were restricted to two areas of the State, in small non commercial flocks on the Atherton Tableland and in a commercial flock on the central highlands between Emerald and Clermont. No evidence was found of bluetongue infections of sheep in commercial flocks in the north west. (Table 4).

Cattle and sheep with antibodies to bluetongue serotypes 1 and 21 showed little or no cross reaction in neutralisation tests to more pathogenic serotypes recorded from the Northern territory. Therefore, the Queensland cattle and sheep populations must be regarded as susceptible to infection with exotic bluetongue serotypes.

A total of 23 herds were established in Queensland, 4 herds in Northern Territory and 2 herds in Western Australia. The locations of the herds are shown on the accompanying map (Figure 1).

No bluetongue activity was detected in Western Australia or Northern Territory throughout the study period; however, no sera were received from the Coastal Plains herd after June 1991. The absence of BTV activity was probably the result of low vector numbers resulting from poor wet seasons during the study period.

In Queensland the number and location of herds was modified during the project as shown in Table 1. Activity to 2 BTV serotypes, BTV.1 and 21 was detected (see Table 2). Throughout the State transmission occurred predominantly in the period April to September and only sporadic transmissions occurred between October and March. This seasonal pattern of transmission is best explained in relation to vector prevalence. The higher incidence of bluetongue transmission in 1990 was correlated to higher vector numbers occurring in the wetter year. A field isolate of BTV1 was recovered from a herd in southern Queensland and is to be assessed for its pathogenicity for sheep.

In most areas of the State there is a peak emergence of *C. brevitarsis* in late Winter and early Spring (August - September). Following this populations decline and remain low from October to February/March, but increase in response to summer rainfall. A second peak of *C. brevitarsis* activity which is accompanied by peak activity of *C. wadai* occurs in April and May. Most transmissions in Queensland occur during or soon after this late summer peak.

The seasonal pattern of virus transmissions supports the contention that transmission to sheep resulting in an outbreak of clinical disease is most likely to occur in late summer and early autumn. Any outbreaks occurring at this time are likely to be of limited duration because the onset of cooler weather in the sheep producing areas will eliminate the vectors. In some years; however, such transmissions could commence as early as April and persist until July. A control policy based on "masterful inactivity" may be difficult to sustain under such circumstances.

The absence of seroconversions in sentinel herds in western and south-western areas of queensland confirmed the preliminary result of the serological survey that much of those areas were free of bluetongue virus.

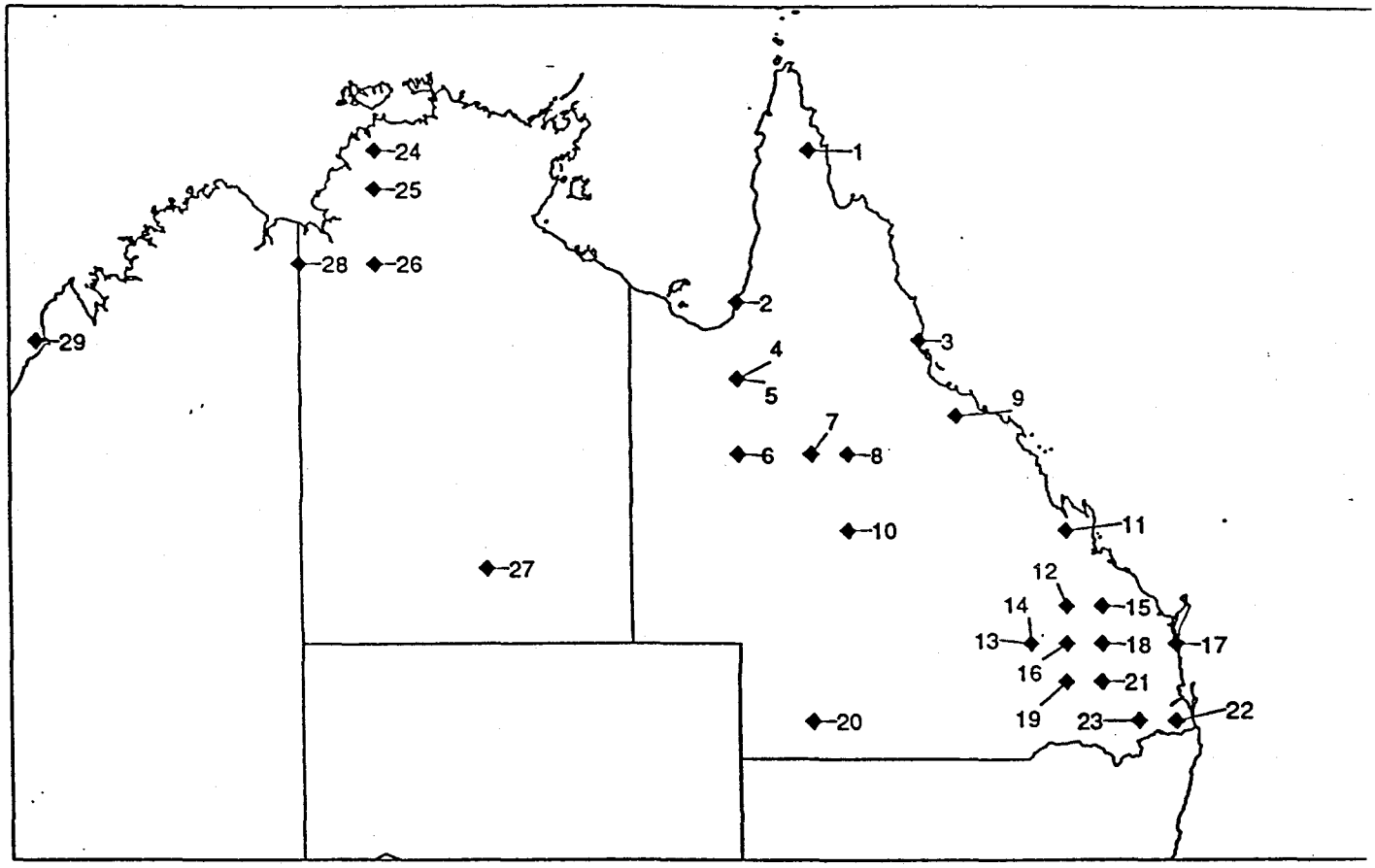
The presence of seropositive sheep in commercial flocks and the transmission of bluetongue virus in several sentinel cattle herds in central Queensland in 1990 indicate that sheep in this area are most at risk to the introduction of exotic or pathogenic bluetongue serotypes.

TABLE 1

SENTINEL HERDS ESTABLISHED IN QUEENSLAND

	Map No.		Map No.	
1990:	1	Batavia Downs Res Stn	12	Brigalow Res Stn
	2	Karumba Hldgs	13	Mt. Kinglsey
	3	Utchee Creek Res Stn	15	Lochaber
	5	Cowan Downs	16	Avalon
	6	Jersey Plains	17	Owanyilla
	7	Sandhills	19	Glenleigh Pk
	8	Hughenden Stn	20	Orient
	9	Swans Lagoon Res Stn	21	Linden
	10	River View Dairy	22	Mutdapilly
	11	Etna Ck Prison Farm	23	Warwick
1991:	1	Batavia Downs Res Stn	15	Lochaber
	2	Karumba Hldgs	16	Avalon
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	19	Glenleigh Pk
	6	Jersey Plains	21	Linden
	9	Swans Lagoon Res Stn	22	Mutdapilly Res Stn
	11	Etna Ck Prison Farm	23	Warwick
	13	Mt. Kingsley		
1992:	1	Batavia Downs Res Stn	14	Oakwells
	3	Utchee Ck Res Stn	17	Owanyilla
	4	Donors Hill	18	Hidden Valley
	6	Jersey Plains	19	Glenleigh Pk
	9	Swans Lagoon Res Stn	21	Linden
	11	Etna Ck Prison Farm	22	Mutdapilly

FIGURE 1: LOCATION OF SENTINEL HERDS



QLD	1.	Batavia Downs Res. Stn.
	2.	Karumba Hldgs
	3.	Utchee Ck Res. Stn.
	4.	Donors Hill
	5.	Cowan Dns.
	6.	Jersey Plains
	7.	Sandhills
	8.	Hughenden Stn.
	9.	Swans Lagoon Res. Stn.
	10.	River View Dairy
	11.	Etna Ck Prison Farm
	12.	Brigalow Res. Stn.
	13.	Mt Kingsley
	14.	Oakwells
	15.	Lockaber
	16.	Avalon
	17.	Owanyilla
	18.	Hidden Valley
	19.	Glenleigh Pk.
	20.	Orient
	21.	Linden
	22.	Mutdapilly Res. Stn.
	23.	Warwick
NT	24.	Coastal Plains Res. Stn.
	25.	Douglas Daly Res. Stn.
	26.	Victoria River Res. Stn.
	27.	Arid Zone Res. Stn.
WA	28.	Kununurra
	29.	Roebuck Plains

TABLE 2

BLUETONGUE SEROCONVERSIONS IN QUEENSLAND SENTINEL HERDS

YEAR	HERD	BLUETONGUE SEROTYPE	
		BTV.1	BTV.21
1990	Batavia Downs Res Stn	-	July, August
	Utchee Ck Res Stn	May, June, July, Nov.	-
	Swans Lagoon Res Stn	-	June
	Etna Ck Prison Farm	Prior to June	Prior to June
	Brigalow Res Stn	Prior to Aug; Dec.	Prior to Aug.
	Mt. Kingsley	June, August	-
	Lochaber	June	-
	Glenleigh Pk	July - Sept.	July - Sept.
	Linden	August	-
	Mutdapilly Res Stn	-	May, June, July
1991	Avalon	April	-
	Linden	May	-
	Owanyilla	-	Feb., April
1992	Batavia	May, June	-
	Owanyilla	May	-

TABLE 3

PREVALENCE AND DISTRIBUTION OF ANTIBODIES TO BLUETONGUE VIRUS SEROTYPES 1 AND 21 IN CATTLE IN QUEENSLAND

Region	AGID test prevalence (%)	BTV 1 prevalence (%)*	BTV 21 prevalence (%)*
1	42.67	20.19	8.49
2	77.25	48.69	24.45
3	41.14	19.36	16.39
4	17.97	3.00	2.82
5	47.71	18.38	6.59
6	16.67	5.28	0.98
7	3.81	0.36	0.36
8	9.14	2.24	1.52
9	5.26	1.43	0.17
TOTAL	37.17	15.48	8.32

* (No. sera SNT + ve/No. sera SN tested) x AGID test prevalence.

\+ Regions are shown in Figure 2

FIGURE 2: MAP OF QUEENSLAND SHOWING REGIONS USED FOR ANALYSIS OF DATA FROM SEROLOGICAL SURVEY OF CATTLE

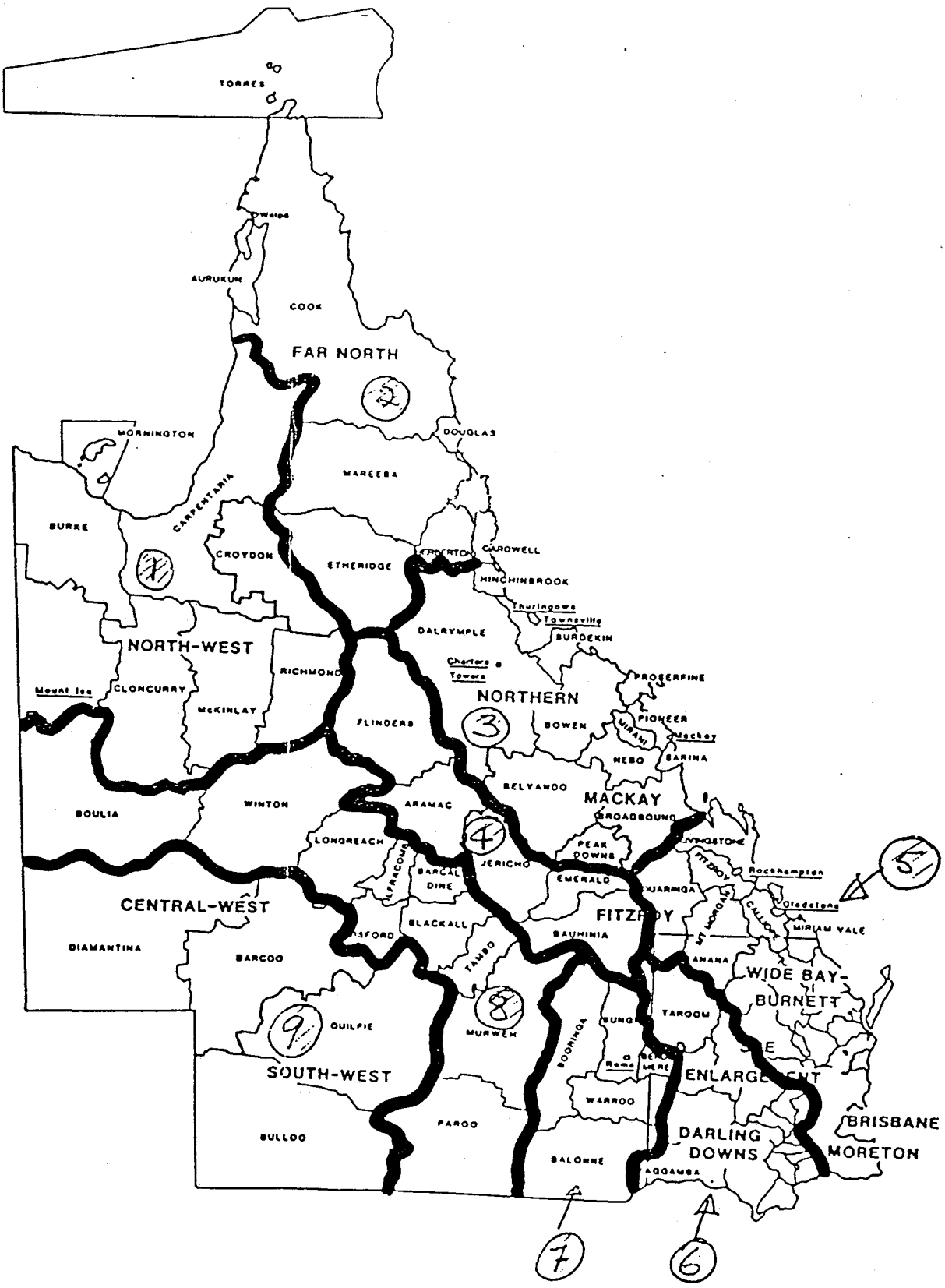


TABLE 4

BLUETONGUE ANTIBODIES IN SHEEP FROM NORTHERN AND CENTRAL QUEENSLAND IN 1990-91

Region	Property	No. of Sheep	No. and % of AGID* Reactors	No. and % of SN+ Reactors		
				BLU 1	BLU 21	Others
1	1	100	0	0	0	0
	2	100	0	0	0	0
	3	101	3(3)	0	0	0
	4	100	1(1)	0	0	0
	5	100	0	0	0	0
	6	80	0	0	0	0
2	1	35	2(5.7)	0	0	0
	2	4	0	0	0	0
	3	28	2(7.1)	0	0	0
	4	14	5(35.7)	1(7.1)	0	0
	5	12	5(41.7)	3(25)	0	0
	6	5	0	0	0	0
	7	13	2(15.4)	1(7.7)	1(7.7)	0
	8	10	0	0	0	0
3	1	16	2(12.5)	2(12.5)	0	0
	2	69	1(1.5)	1 (1.5)	0	0
4	1	100	1(1)	1(1)	0	0
	2	100	11(11)	5(5)	0	0

Region	1	on or north of the western rail line between Hughenden and Julia Ck.
	2	the Atherton Tableland
	3	the coastal strip between Townsville and Bowen
	4	the Coastal Highlands between Emerald and Clermont

* = agar gel immunodiffusion
\+ = serum neutralisation

5. ACHIEVEMENT OF OBJECTIVES

The project achieved complete success in establishing a system of sentinel herds across northern Australia. Within Queensland the number and location of herds was modified during the term of the project and resulted in a reduction from 20 herds to 12. Some herds in arbovirus-free areas were discontinued and others were relocated for logistical reasons or to more strategic locations. In the Northern Territory the project used the herds previously established by the Berrimah Laboratory for their arbovirus program.. Apart from minor difficulties with a few herds occasioned by extreme seasonal conditions, the system operated continuously for the duration of the project. The herds will be maintained temporarily with State Department resources until an alternate source of funding can be secured.

The combination of serological survey and sentinel herds was successful in identifying arbovirus free areas and livestock populations most at risk to the introduction of exotic bluetongue serotypes.

6. INTELLECTUAL PROPERTY

Not applicable.

7. COMMERCIAL EXPLOITATION

Not applicable.

8. IMPACT ON MEAT AND LIVESTOCK INDUSTRY

The sentinel herd system established under this project provided a capacity to monitor arbovirus activity and thereby enable early warning of the entry of new or pathogenic virus serotypes. Such information will allow prediction of possible outbreaks of clinical disease in susceptible populations and enable veterinary authorities and industry to prepare control strategies including production and use of appropriate vaccines.

Another benefit of such a system is the monitoring of arbovirus activity, particularly when operated in conjunction with a vector surveillance program, will be necessary for negotiations on regional or temporal freedom from arbovirus diseases. The maintenance of any negotiated area freedom will undoubtedly require the continued existence of such a monitoring system.

9. TOTAL FUNDING AND MRC CONTRIBUTION

As per original application and contract.

10 (a) CONCLUSIONS:

(i) Only 2 bluetongue virus serotypes, BTV.1 and BTV.21 were detected in Queensland during the monitoring period. No bluetongue virus activity was detected in Western Australia. The pathogenic serotypes previously isolated from Northern Territory have not spread to adjoining states.

(ii) Substantial areas of western and southern Queensland were identified as free of bluetongue virus.

(iii) The detection of previous and ongoing infections of sheep with endemic bluetongue viruses indicated an area at greatest risk to introduction of exotic pathogenic bluetongue viruses.

(b) RECOMMENDATIONS:

The system of sentinel herds be maintained to provide

(i) early warning of the movement of pathogenic bluetongue virus serotypes towards sheep producing areas of Australia.

(ii) epidemiological data on distribution and seasonality of other arboviruses for export trade requirements.

(iii) detection of the entry of arboviruses exotic to Australia.

11. MEDIA COVERAGE

The bluetongue surveillance work undertaken at Oonoonba was widely publicised during the project. A static display was prepared and used widely at field days and industry meetings. Numerous seminars were given by project staff to livestock producers, veterinarians and stock inspectors in Queensland and Victoria. Media releases included a background feature on QTV news which was syndicated to regional stations around Australia and several newspaper releases were issued (appendices 1 and 2).

APPENDIX 1

North Queensland Primary Industries team plays a vital link inAustralia's bluetongue monitoring program.

Early warning centres have been established in NSW, Qld, WA and theNT to alert the sheep industry to the possible movement ofbluetongue disease within Australia.

Bluetongue is a virus disease of sheep and cattle which, along withfoot and mouth disease and rinderpest, is one of the three mostfeared exotic livestock diseases Australia faces.

Several strains of bluetongue are already present in Australia butso far these viruses have not caused any major livestock problems.

As a precaution, State and Commonwealth Governments have decidedto keep a close watch on the situation by setting up and monitoringa chain of sentinel herds across the country.

Each State is responsible for maintaining its own set of sentinelherds and there are twenty of these in Queensland.

Staff monitoring the sentinel cattle take blood samples from thestock at regular intervals in order to check for the presence ofbluetongue and related viruses.

These blood samples are then sent either to the QueenslandDepartment of Primary Industries' Oonoonba Veterinary Laboratoriesat Townsville, or the NSW Department of Agriculture's GlenfieldLaboratories in western Sydney.

Staff from the DPI's Oonoonba Labs monitor the blood samples fromthe twenty sentinel herds in Queensland, five herds in the NorthernTerritory and the five herds located in the north of WesternAustralia.

Bluetongue is spread by biting insects such as midges.

These biting pests are known as insect vectors.

In addition to carrying bluetongue, these vectors spread otherrelated virus diseases, known as arboviruses.

spreading bluetongue andits related viruses, known as arboviruses.

Because of the dangers of bluetongue to the sheep industry, it isessential that both animal health scientists and producers have anearly warning system in place to alert them to the possible entryof these Timorese species into Australia.

Identifying and locating bluetongue vectors may also have importantimplications for Australia's live sheep export trade.

Some countries are already insisting that sheep for export onlycome from areas that are free of bluetongue viruses or are free ofthe bluetongue vectors.

As the distribution of vectors can change from winter to summer,it is important for our live sheep trade that we are able toidentify those areas of Australia that are free of the bluetonguevectors in any given season.

The trapping surveys will help to determine these safe areas.

The Australian Wool Corporation has been a big supporter of thework, providing funds to conduct the surveys in Queensland, NSW and Victoria, while the Australian Meat and Livestock Research andDevelopment Corporation has provided funds to finance the surveywork across the Northern Territory and Western Australia.

ENDS....

Wednesday 10th January 1990.

Prepared by Queensland Department of Primary Industries Media andPublic Relations Unit, 12 Wickham Street, Townsville, Q. 4781.
Ph (077) 22-1440 Fax (077) 72-1958.

Further Information: Dr Steve Johnson. (077) 78-2688.

Journalist: Peter Bowey. (077) 22-1459.

North Qld in bluetongue defence link

A NORTH Queensland DPI team are playing a vital link in Australia's bluetongue monitoring program.

Early warning centres have been established in New South Wales, Queensland, Western Australia and the Northern Territory to alert the sheep industry to the possible movement of the bluetongue disease within Australia.

Bluetongue is a viral disease of sheep and cattle which, along with foot and mouth disease and rinderpest, is one of the three most feared exotic diseases Australia faces.

Several strains of bluetongue are already present in Australia but so far these viruses have not caused any major livestock problems.

As a precaution, State and Commonwealth Governments have decided to keep a close watch on the situation by setting up and monitoring a chain of sentinel herds across the country.

Each state is responsible for maintaining its own set of sentinel herds and there are 20 of these in Queensland.

Staff monitoring the sentinel cattle take blood samples from the stock at regular intervals in order to check for the presence of blutongue and related viruses.

These blood samples are then sent to either the DPI's Oonoonba Veterinary Laboratories at Townsville or the NSW Department of Agriculture's Glenfield Laboratories in western Sydney.

Staff from the DPI's Oonoonba labs monitor the blood samples from 20 sentinel herds in Queensland, five herds in the Northern Territory and the five herds located in the north of Western Australia.

Bluetongue is spread by biting insects such as midges. These biting pests are known as insect vectors.

In addition to carrying bluetongue, these vectors spread other related virus diseases, known as arboviruses.

These viruses cause three diseases, ephemeral fever and akabane.

Ephemeral fever causes three day sickness in cattle, while akabane causes causes abortions and birth abnormalities in cattle.

Staff from the CSIRO's Division of Animal Health's Long Pocket Laboratories, in Brisbane, and the DPI's Oonoonba labs are about to begin a series of surveys of Australia to determine what species of bluetongue vectors are present here.

From these surveys, the scientists hope to establish the distribution of the insect vectors. These survey trips are to be carried out once a year.

Staff from Oonoonba will cover all of Australia north of a line running through Rockhampton in Queensland and Geraldton in WA, while scientists from the CSIRO's Long Pocket labs will cover the southern half of the continent.

The first vehicle survey from Townsville will start in mid-February and will be a two-month marathon of more than 5000km, ending in Broome, WA.

While on the trip, the team will be looking for suitable field sites to set up vector traps.

By monitoring these traps the scientists hope to establish the distribution of the vectors.

The two vectors most worrying animal health authorities and producers are two species of biting midges called Culicoides wadi and Culicoides brevitarsis.

Both are common in eastern Australia and the north of WA, where they are found from the base of the Kimberleys and then across into the Northern Territory.

Timor, a close northern neighbor of Australia, also has a species of Culicoides that is very efficent at spreading bluetonuge and its related viruses.

Because of the dangers of bluetongue to the sheep industry, it is essential that both animal health scientists and producers have an early warning system in place to alert them to the possible entry of these Timorese species into Australia.

Identifying and locating bluetongue vectors may also have important implications for Australia's live sheep trade.

Some countries are already insisting that sheep for export come only from bluetongue free areas.

As the distribution of vectors can change from winter to summer, it is important for our live sheep trade that we are able to identify those areas of Australia that are free of the bluetongue vectors in any given season.

The trapping surveys will help to determine the safe areas.

FRESH blood is taken from an animal as part of the DPI's ongoing program designed to give an early warning to the presence of bluetongue in Australia.

New legume from NT

THE Northern Territory Department of Primary Industries is set to release Llanos macro is similar in appearance to siratro, except that leaves are

NQ Register Jan 18 1990

APPENDIX 2

Bluetongue Surveillance Line set up in North

North Queensland is playing a vital link in Australia's bluetongue monitoring program.

Early warning centres have been established in NSW, Qld, WA and the NT to alert the sheep industry to the possible movement of bluetongue within Australia.

Bluetongue is a virus infection of sheep and cattle which, along with foot and mouth disease and rinderpest, is one of the three most feared exotic livestock diseases Australia faces.

Several strains of bluetongue are already present in Australia but so far these viruses have not caused any major livestock problems.

As a precaution, State and Commonwealth Governments have decided to keep a close watch on the situation by setting up and monitoring a chain of sentinel cattle herds across the country.

Each State is responsible for maintaining its own set of sentinel herds and there are twenty of these in Queensland.

Staff monitoring the sentinel cattle take blood samples from the stock at regular intervals in order to check for the presence of bluetongue and related viruses.

These blood samples are then sent either to the Queensland Department of Primary Industries' Oonoonba Veterinary Laboratory at Townsville, or the NSW Department of Agriculture's Camden Laboratory in western Sydney.

Staff from the DPI's Oonoonba Lab monitor the blood samples from the twenty sentinel herds in Queensland, five herds in the Northern Territory and five herds located in the north of Western Australia.

Bluetongue is spread by biting insects such as midges.

These biting pests are known as insect vectors.

In addition to carrying bluetongue, these vectors spread other related virus diseases, known as arboviruses.

These viruses cause the diseases ephemeral fever and akabane in cattle.

Ephemeral fever causes three day sickness in cattle, while akabane results in abortions and birth abnormalities.

Akabane is a serious disease in New South Wales and extends from the north of the state as far south as the Central Coast and Highlands.

Staff from the CSIRO Division of Tropical Animal Health's Longpocket Laboratories, in Brisbane, and the DPI's Oonoonba labs have begun a series of surveys of Australia to determine what species of bluetongue vectors are present here.

From these surveys, the scientists hope to establish the distribution patterns of the insect vectors.

These survey trips are to be carried out once a year.

Staff from Oonoonba are in charge of monitoring all of Australia north of a line running through Rockhampton in Queensland to Geraldton in WA, while scientists from the CSIRO's Longpocket Labs cover the southern half of the continent, down to Bega on the NSW south coast.

The first vehicle survey from Oonoonba started in mid February and was a two month marathon of over 17 000

kilometres going as far as Geraldton in Western Australia.

While on the trip, the team looked for suitable field sites to set up vector traps.

By monitoring these traps the scientists hope to establish the distribution of the biting insect vectors.

Local landholders and Government officers volunteered to operate the traps and any insects caught will be preserved in alcohol and sent back to Oonoonba for positive identification.

The two vectors most worrying animal health authorities and producers alike, are two species of biting midges called *Culicoides wadai* and *Culicoides brevitarsis*.

Both of these vectors are common in eastern Australia and the north of Western Australia, where they are found from the base of the Kimberleys and then across into the Northern Territory.

Timor, a close northern neighbour of Australia also has a species of *Culicoides* that is very efficient at spreading bluetongue and its related viruses.

Because of the dangers of bluetongue to the sheep industry, it is essential Australia has an early warning system in place for the possible entry of these Timorese species of *Culicoides* into Australia.

Identifying and locating bluetongue vectors may also have important implications for Australia's live sheep export trade.

Some countries are already insisting that sheep for export only come from areas that are free of bluetongue viruses or are free ofthe bluetongue vectors.

As the distribution of vectors can change from winter to summer, it is important for our live sheep trade that we are able to identify those areas of Australia that are free of bluetongue vectors in any given season.

The trapping surveys will help to determine these safe areas.

The Australian Wool Corporation has been a big supporter of the work, providing funds to conduct the surveys in Queensland, NSW and Victoria, while the Australian Meat and Livestock Research and Development Corporation (AMLRDC) has provided funds to finance the survey work across the Northern Territory and Western Australia.

Bill Doherty an entomologist at Oonoonba and Dean Gibson, a senior technical officer with the CSIRO left on the survey in late February.

Drove to Normanton via Hughenden and Mackinlay, establishing *Culicoides* surveillance as they went.

There they put traps in at Cowan Downs station then drove to Katherine in the Northern Territory via Mount Isa and Tennant Creek.

The next stage of the journey was to Broome and Port Headland via Kununnurra.

They established traps at Karatha and Carnarvon then drove down to Geraldton where Dr Steve Johnson Officer In Charge of the Oonoonba Labs was waiting to join the team on the 8th of March.

Bill Doherty flew home from there while Dean and Steve Johnson established a trap at Geraldton then drove up through the Pilbara to Meekatharra where they set up a trap with the local Stock Inspector.

Over the next few days they established surveillance traps at Nullagi, 600 km north of Mt Newman, Roebuck Plains Station near Broome, and at the Lombardina Aboriginal Community on Cape Ladique, 200 km to the north of Broome.

Steve Johnson flew to Kununurra and chartered a plane to get into Drysdale River Station and Kalumburu mission, as there were no accessible roads.

While Steve was at Kalumburu, Dean went onto Derby and established a trap at Kimberley Downs Station.

Then he drove onto Hall's Creek and Kununurra establishing traps on the way.

Steve and Dean met again at Wyndham and drove to Darwin.

They had traps established through the Northern Territory government at Port Keats, Peppimenarti, the Coastal Plains Research Station near Darwin and on the Coburg Peninsula. They also had traps established at Pickertaramoor off the central Arnhemland Coast and at Gove.

Then they drove home to Townsville in two days.

They had covered 17,000 km in just five weeks.

As a result of their work Australia now has a network of surveillance traps that should pick up any early incursions of *Culicoides* midges into the north.

The traps are all the way along the coast from Geraldton to Townsville.

The lines of sentinel traps should also show what the vector distribution limits are and how close they come to sheep.

Steve Johnson says we need to know exactly where the *Culicoides* are and how far south they go in summer in W.A. and the eastern states.

The only gap in the trap line is now on Cape York Peninsula and surveillance traps will be sited at Bamaga and Batavia Downs next month. These should monitor any vector entries from the Cape York region.

Steve Johnson says we aren't going to pick up the first insect that drops in here.

"What's going to happen is that the insects will have to get established in the cattle population and multiply. We

will then pick them up as they radiate out to reach the trap sites, as it is not feasible to put traps out all the way."

Steve Johnson also organised for the establishment of sentinel cattle herds in WA at Kununurra, Roebuck Plains and Hall's Creek. The Northern Territory has similar herds at the Douglas-Daly Research Station.

In Queensland there are twenty sites from Normanton east to Charters Towers, and Utchee Ck north to Batavia Downs.

There are also sentinel herds in NSW, Vic and SA.

There are none in Tasmania, as neither the vectors nor the viruses can survive there.

The surveillance traps are looked after by local people. These are either stock inspectors, managers, stockmen or the missionaries at Kalumburu.

Northern Australian Quarantine officers in these areas also look after traps and the offices in Broome and Darwin keep in touch with the local people to offer help if needed.

... Ends.

25th May. 1990.

Prepared By the Queensland Department of Primary Industries Media and Public Relations Unit. PO Box 931 Townsville. Q. 4810. Ph (077) 22-1440 Fax (077) 72-1958.

Further Information: Steve Johnson (077) 78-2688.

Journalist: Peter Bowey. (077) 22-1455.