

## **An updated survey of African swine fever in Malawi**

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### SUMMARY

Cases of African swine fever (ASF) confirmed in the laboratory in 1985 and 1986 and other data obtained since 1984, in particular an extension of the serological survey of free-ranging domestic pigs undertaken from 1981 to 1984, are presented to give an updated survey of the ASF situation in Malawi and a revised estimate of the ASF enzootic area. Evidence is presented that the area may include some border areas in Dedza and Ntcheu districts and may be expanding in some localities.

### INTRODUCTION

The results of a survey of African swine fever (ASF) in Malawi, undertaken between 1981 and 1984, have already been described (Haresnape, Lungu & Mamu, 1985). The ASF enzootic area of Malawi was identified using (a) data from a serological survey of free-ranging domestic pigs, (b) laboratory data on confirmed cases of ASF and (a) information obtained from interviews with village pig owners. It covered the western part of the Central Region, including Mchinji district and parts of Kasungu, Ntchisi, Dowa and Lilongwe districts. There was no indication that ASF had become enzootic further south, although numerous outbreaks had occurred, for example in Dedza district.

Data collected since the end of 1984 are presented in this paper, and together with the information obtained previously provide an updated summary of the situation regarding ASF in Malawi, and a more accurate estimate of the current ASF enzootic area.

### MATERIALS AND METHODS

#### *Definition of localities*

The localities studied in the original survey were assigned letters and numbers according to district (Haresnape, Lungu & Mamu, 1985). Studies have now been carried out in a further 25 localities, and all the localities studied are listed in Table 1.

#### *Laboratory diagnosis of clinical cases*

ASF was routinely diagnosed by examination of spleen smears by a fluorescent antibody (FA) test using fluorescein-conjugated anti-ASF IgG.

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Table 1. *Localities in Malawi in which the ASF situation was studied*

| District   | Localities studied   |
|------------|--|
|            | Central Region   |
| Mchinji    | Sitolo (MC1), Ndawambe (MC2), Kondoole (MC3), Tikoliwe (MC4), Menyani (MC5), Bongera (MC6), Likasi (MC7), Kankhowo (MC8), Chalaswa (MC9), Chawala (MC10), Kalulu (MC11), Tembwe (MC12)                             |
| Lilongwe   | Mfuti (LL1), Namitete (LL2), Mkoko (LL3), Mtsilo (LL4), Chisikwa (LL5), Chilinda (LL6), Sinyala (LL7), Malimbwe (LL8), Mbabzi (LL9), Malandi (LL10), Katola (LL11), Chikuse (LL12), Chimutu (LL13), Dickson (LL14) |
| Kasungu    | Kaluluma (KS1), Kasikidzi (KS2), Rusa (KS3), Mkhota (KS4), Kavizinde (KS5), Chamakala (KS6), Bua (KS7), Mchenga (KS8), Lisandwa (KS9)  |
| Ntchisi    | Mkanda (NT1), Mwera Hills (NT2), Khuuwi (NT3), Malomo (NT4), Kamsonga (NT5)  |
| Dowa       | Chisepo (DO1), Dzoole (DO2), Simakuni (DO3), Makalani (DO4), Kalisha (DO5), Chimangamasasa (DO6), Moya (DO7), Madise (DO8)   |
| Dedza      | Ndebvu (DE1), Kafotokoza (DE2), Chamangwana (DE3), Maonde (DE4), Nadulu (DE5), Chiphazi (DE6), Magunditsa (DE7), Bembeke (DE8), German (DE9), Chilikumwendo (DE10)   |
| Nkhotakota | Mwansambo (NK1)  |
| Salima     | Thavite (SA1), Chipunza (SA2)  |
| Ntcheu     | Mpamadzi (NC1), Lizulu (NC2), Mlangeni (NC3), Dombole (NC4), Kwataine (NC5), Likudzi (NC6), Kabango (NC7), Lisungwi (NC8)  |
|            | Southern Region  |
| Mwanza     | Nsambi (MW1)   |
| Machinga   | Phalulu (MA1)  |
| Zomba      | Namiwawa (ZO1), Thondwe (ZO2)  |
| Blantyre   | Matindi (BL1), Chirimba (BL2)  |
| Chiradzulu | Thumbwe (CD1)  |
| Thyolo     | Bvumbwe (TH1)  |
| Mulanje    | Mphonde (ML1), Mpasa (ML2)   |
| Chikwawa   | Kanjedza (CK1), Chimkole (CK2), Tomali (CK3), Ngabu (CK4)  |
| Nsanje     | Bangulu (NS1), Nsanje (NS2)  |

### *Collection of interview data*

Individual pig owners were interviewed and a presumptive diagnosis was based on assessment of the clinical details given as described previously (Haresnape, Lungu & Mamu, 1985).

### *Serological survey*

Blood samples were taken from 1984 to 1986 from village pigs in 37 localities in the Central Region and two localities in the Southern Region. Most of these were localities not studied during the original survey.

### *Enzyme-linked immunosorbent assay (ELISA)*

The ELISA test was done as described by Haresnape, Lungu & Mamu (1985) (CVL test) using either the ASF antigen supplied by Dr Thomson, Onderstepoort, South Africa, or the VP73 supplied by Dr Wilkinson, Pirbright, UK. Tests described previously had shown that there was excellent agreement between results obtained using the two antigens. Some sera were tested in parallel using an ELISA kit prepared by FAO (kit A, supplied by Dr Ozawa).

## RESULTS

The diagnosis of ASF was confirmed by laboratory demonstration of the presence of ASF virus in tissue samples from 13 localities during 1985 and 1986. In a further 11 localities there were outbreaks of disease which were considered to be ASF on the basis of interviews. Also described are three outbreaks which occurred before the end of 1984 but were not included in the previous paper because information about them was only obtained much later. These are shown in Fig. 1 together with the 24 localities which are known to have had ASF outbreaks during 1985 and 1986. Outbreaks shown in Fig. 1 by a symbol only, without locality and date, are those described previously (Haresnape, Lungu & Mamu, 1985). All but one of the outbreaks were in the Central Region and affected free-ranging pigs. One outbreak, in locality BL2 in Blantyre district in which 20 pigs died and 30 were destroyed, was at a commercial pig farm. This was the only known ASF outbreak in the Southern Region of Malawi since 1984. There is no evidence that ASF has ever occurred in the Northern Region.

The results of the serological survey (Fig. 2) are based on results obtained by ELISA. Thirty-nine sera were tested in parallel using the ELISA kit supplied by FAO, in which sera were scored positive, negative or doubtful. There was good agreement between the two tests. Eighteen sera were positive and 14 sera were negative by both tests. Of the other 7, 5 were positive and 2 negative using the CVL test, and 3 scored negative and 4 doubtful using the kit.

*Central Region*

As before, there was evidence of ASF in many localities in Mchinji district, with a high proportion of pigs tested being seropositive in some localities. In total 39 seropositive pigs were identified out of 106 tested during 1985 and 1986 (Table 2).

In Lilongwe district there were at least three more ASF outbreaks during 1985 and 1986, but no seropositive pig identified out of 48 tested (Table 3).

In Kasungu district, 10 seropositive pigs were identified out of 20 from KS9 tested 9 months after an ASF outbreak, confirming that this locality is within the enzootic area. The other parts of Kasungu district sampled were further north, where no ASF was reported (Table 4).

There were at least two outbreaks in Ntchisi district and at least four outbreaks in Dowa district in 1985–6, but no clear evidence of the disease being enzootic in any newly studied localities, although one seropositive pig in NT5 and two in DO8 were identified 2 months after an ASF outbreak, and a further three were identified in DO2 4 months after an outbreak (Table 4). How much longer these animals survived is not known, but they had clearly survived longer than the 3–4 weeks for which disease normally lingers before death in animals with the subacute form of ASF (DeTray, 1963). They may therefore have been suffering from the chronic or subclinical forms.

In Dedza there were at least eight outbreaks in 1985–6, six of these being confirmed in the laboratory. The majority of the 224 sera tested were negative, but 6 seropositive pigs were identified in DE1 in November 1985, and a further 6 in DE10 in July 1986 (Table 5). In DE10 the seropositive pigs were identified 3 weeks after the laboratory-confirmed case, but 4 months later all had either died

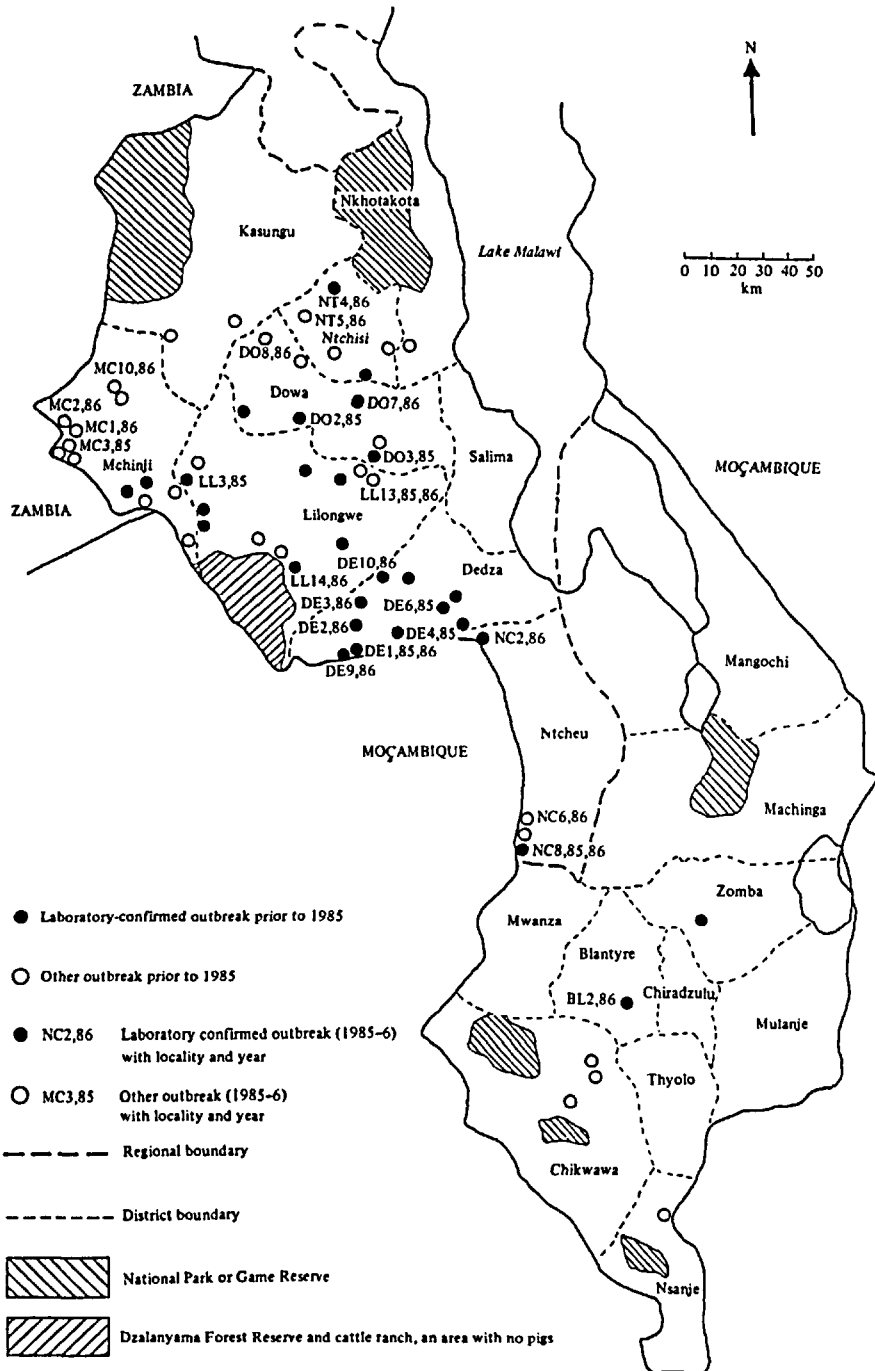


Fig. 1. African swine fever outbreaks in Central and Southern Regions of Malawi, 1981-6.

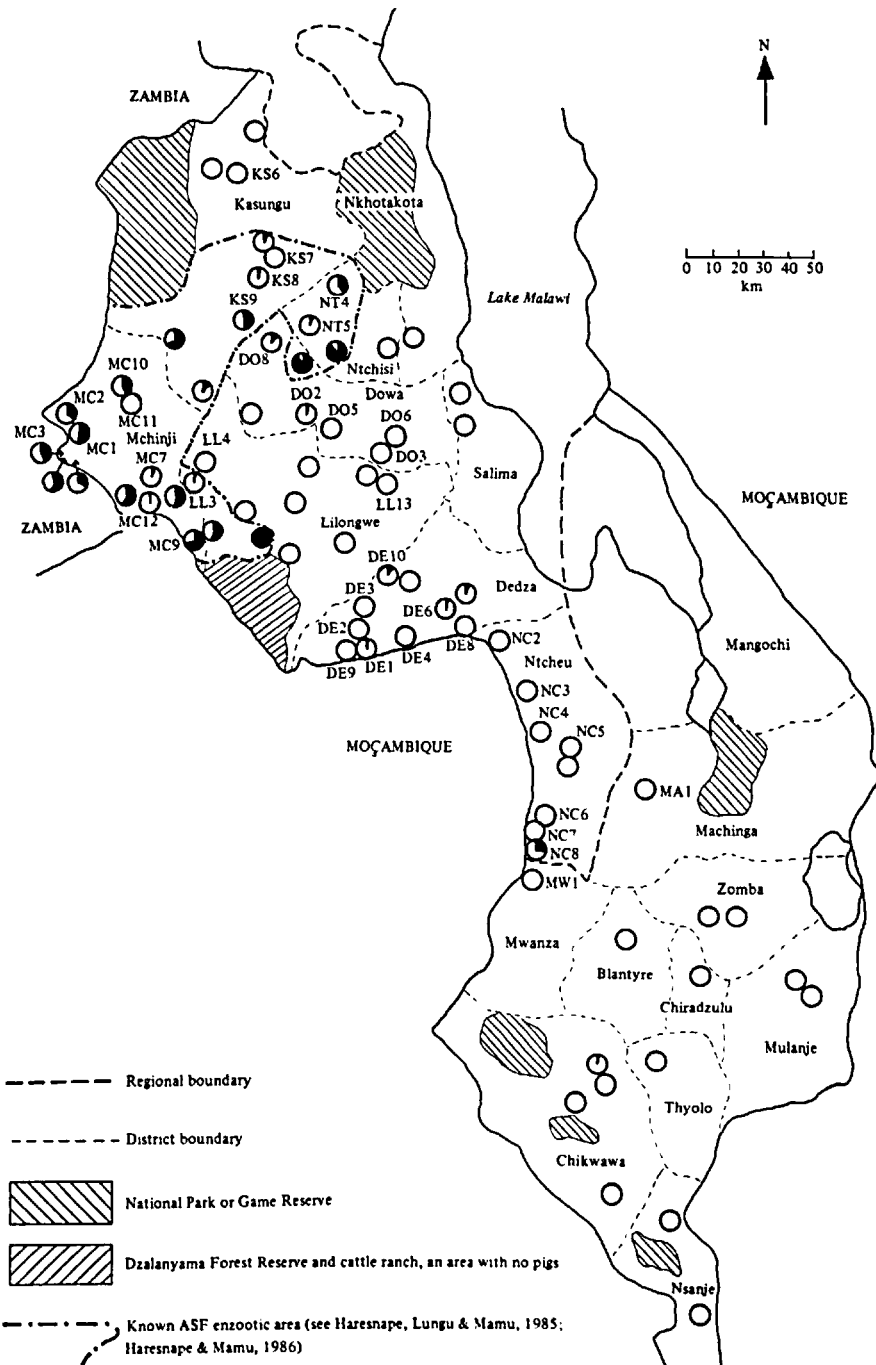


Fig. 2. Serological survey of free-ranging pigs in the Central and Southern Regions of Malawi, 1981-6. ●, Locality included in serological survey; shaded area shows proportion of sera positive. Only those localities surveyed during 1985-6 are numbered.

Table 2. *ASF data from Mchinji district*

| Locality | Sera positive/<br>sera tested | Overall<br>percentage<br>positive* | Date<br>collected | Interview data  |
|----------|-------------------------------|------------------------------------|-------------------|---|
| MC1      | 5/6                           | 55                                 | Apr. 1986         | ASF outbreak Feb. 1986.<br>Mortality substantially less<br>than 100%      |
| MC2      | 4/7                           | 32                                 | Apr. 1986         | ASF outbreak Feb. 1986.<br>Mortality substantially less<br>than 100%      |
| MC3      | 6/6                           | 46                                 | Apr. 1986         | ASF outbreak Dec. 1985.<br>Mortality substantially less<br>than 100%      |
| MC7      | 2/19                          | 11                                 | May 1985          |   |
| MC9      | 6/12                          | 71                                 | Apr. 1986         |   |
| MC10     | 15/18                         | 42                                 | Apr. 1986         | ASF outbreak Oct.-Nov. 1985.<br>Mortality substantially less<br>than 100% |
| MC11     | 0/22                          | 0                                  | May 1985          | ASF outbreak 1983   |
| MC12     | 1/16                          | 6                                  | May 1985          | ASF outbreak 1981   |

\* Including sera collected prior to 1985.

Table 3. *ASF data from Lilongwe district*

| Locality | Sera positive/<br>sera tested | Overall<br>percentage<br>positive* | Date<br>collected | Interview data                                      |
|----------|-------------------------------|------------------------------------|-------------------|---|
| LL3      | 0/18                          | 9                                  | Apr. 1986         | ASF outbreak<br>Oct.-Nov. 1985†,<br>> 120 pigs lost |
| LL4      | 0/20                          | 0                                  | Apr. 1986         |   |
| LL13     | 0/10                          | 0                                  | Jan. 1986         | ASF outbreak<br>Dec. 1985-Jan.<br>1986              |
| LL14     |                               | No serum collected                 |                   | ASF outbreak<br>Oct. 1986†                          |

\* Including sera collected prior to 1985.

† Laboratory-confirmed outbreak (other outbreaks were considered to be ASF on the basis of interview data only).

or been slaughtered. In DE1 the sera were collected shortly after the first deaths from ASF, but a follow-up visit showed that three seropositive pigs were still apparently healthy 5 weeks later. The other three had died of ASF and had presumably had a subacute form of disease. How much longer these three survived is not clear, as by the time of the next follow-up visit in November 1986 they could not be traced, but they may have had a prolonged form of the disease.

Only one locality in Ntcheu district was studied in the original survey, and no evidence that ASF had ever occurred in the district was found. However, it has since become apparent that there was an outbreak in NC7 towards the end of 1984, and further outbreaks occurred in the district during 1985-6, two cases being confirmed by laboratory tests. One of these was in NC8, a mountainous,

Table 4. ASF data from Kasungu, Ntchisi and Dowa districts

| Locality | Sera positive/<br>sera tested | Overall<br>percentage<br>positive* | Date<br>collected | Interview data                  |
|----------|-------------------------------|------------------------------------|-------------------|---------------------------------|
| KS6      | 0/18                          | 0                                  | May 1985          | No report of ASF                |
| KS7      | 0/16                          | 0                                  | May 1985          | No report of ASF                |
| KS8      | 1/19                          | 5                                  | May 1985          | No convincing report of ASF     |
| KS9      | 10/20                         | 50                                 | May 1985          | ASF outbreak Aug. 1984          |
| NT4      | 11/27                         | 41                                 | Jan. 1985         | ASF outbreak Oct. 1986†         |
| NT5      | 1/18                          | 6                                  | Apr. 1986         | ASF outbreak Feb. 1986          |
| DO2      | 3/20                          | 7                                  | Apr. 1986         | ASF outbreak Dec. 1985†         |
| DO3      | 0/19                          | 0                                  | Dec. 1985         | ASF outbreak Dec. 1985†,        |
|          | 0/10                          |                                    | Jan. 1986         | > 70 pigs lost                  |
| DO5      | 0/24                          | 0                                  | Jan. 1986         | No report of ASF                |
| DO6      | 0/28                          | 0                                  | Jan. 1986         | ASF outbreak Sept.-Oct.<br>1983 |
| DO7      |                               | No serum collected                 |                   | ASF outbreak Aug. 1986†         |
| DO8      | 2/14                          | 14                                 | Apr. 1986         | ASF outbreak Feb. 1986          |

\* Including sera collected prior to 1985.

† Laboratory-confirmed outbreak (other outbreaks were considered to be ASF on the basis of interview data only).

Table 5. ASF data from Dedza and Ntcheu districts

| Locality | Sera positive/<br>sera tested | Overall<br>percentage<br>positive* | Date<br>collected      | Interview data  |
|----------|-------------------------------|------------------------------------|------------------------|---|
| DE1      | 6/29<br>0/24                  | 6                                  | Nov. 1985<br>Nov. 1986 | ASF outbreaks Nov.<br>1984-Feb. 1985†, > 70<br>pigs lost, Sep.-Nov.<br>1985†, > 100 pigs lost   |
| DE2      | 0/23                          | 0                                  | Nov. 1986              | ASF outbreak Sept. 1986†  |
| DE3      | 0/26                          | 0                                  | Nov. 1986              | ASF outbreak Sept. 1986†  |
| DE4      | 0/21                          | 0                                  | Mar. 1986              | ASF outbreak Nov. 1985  |
| DE6      | 0/18                          | 7                                  | Mar. 1986              | ASF outbreak Nov.-Dec.<br>1985  |
| DE8      | 0/21                          | 0                                  | Mar. 1986              | ASF outbreak Nov. 1984  |
| DE9      | 0/19                          | 0                                  | Mar. 1986              | ASF outbreak Feb. 1986†   |
| DE10     | 6/22<br>0/21                  | 14                                 | July 1986<br>Nov. 1986 | ASF outbreak July 1986†   |
| NC2      | 0/22                          | 0                                  | Mar. 1986              | ASF case Jan. 1986† in<br>pig brought for sale at<br>market, no further<br>deaths               |
| NC3      | 0/24                          | 0                                  | Mar. 1986              | No report of ASF  |
| NC4      | 0/22                          | 0                                  | Feb. 1986              | No report of ASF  |
| NC5      | 0/23                          | 0                                  | Mar. 1986              | No report of ASF  |
| NC6      | 0/25                          | 0                                  | Jan.-Feb. 1986         | ASF outbreak Jan.-Feb.<br>1986, > 20 pigs lost  |
| NC7      | 0/23                          | 0                                  | Feb. 1986              | ASF outbreak Oct.-Nov.<br>1984  |
| NC8      | 11/42                         | 26                                 | Dec. 1985-Jan. 1986    | ASF outbreak Oct. 1985-<br>Feb. 1986† > 120 pigs<br>lost, mortality estimated<br>64% (see text) |

\* Including sera collected prior to 1985.

† Laboratory-confirmed outbreak (other outbreaks were considered to be ASF on the basis of interview data only).

Table 6. *ASF data from Southern Region (Mwanza, Machinga and Blantyre districts)*

| Locality | Sera positive/<br>sera tested | Date<br>collected | Interview data  |
|----------|-------------------------------|-------------------|---|
| MW1      | 0/21                          | Feb. 1986         | No report of ASF  |
| MA1      | 0/24                          | Mar. 1986         | No report of ASF  |
| BL2      | No serum collected            |                   | ASF outbreak on an estate<br>Nov. 1986† 20 pigs died,<br>30 destroyed |

† Laboratory-confirmed outbreak.

inaccessible area adjacent to NC7 and close to the Moçambique border, in which interviews revealed that more than 120 pigs died between October 1985 and February 1986 and ASF was confirmed as cause of death in October 1985. The other was in NC2, also on the border with Moçambique, in a pig which had apparently been brought across the border for sale in Malawi. Samples were examined in January 1986 when the carcass failed routine meat inspection and ASF was confirmed. No further deaths were reported in the locality. A total of 181 sera were collected in seven localities in Ntcheu district during 1985–6, and the majority were negative, but 11 of the 42 pigs sampled in NC8 were seropositive. One of the seropositive pigs was a single survivor in a khola in which eight pigs had died in October 1985, and was still apparently healthy 3–4 months later. Eight were the survivors from two kholas in which a total of eight pigs had died 2–3 months previously. The mortality estimated from the data from these three kholas is thus 64%. The other two seropositive pigs were identified only 3–4 weeks after others in the khola had died, and how much longer they survived is not known (Table 5).

#### *Southern Region*

There was no report of ASF in village pigs in the Southern Region in 1985–6, but a laboratory-confirmed outbreak of ASF occurred on a privately owned estate in BL2 in November 1986. Sera were collected in two localities, one in Mwanza district close to the ASF outbreak in NC8 and the other in Machinga, but all were negative (Table 6). Both Mwanza and Machinga districts were omitted from the original survey.

#### DISCUSSION

All the known cases of ASF in village pigs in Malawi in 1985 and 1986 were in the Central Region. Many of these were in localities within the previously defined enzootic area (MC1, MC2, MC3, MC10, KS9, NT4, NT5 and LL3), and a number of seropositive pigs were identified in most of these localities, indicating that mortality had been significantly less than 100%. One outbreak in DO8 was just outside the previously defined enzootic area, but the identification of a pig which was seropositive and apparently healthy 2 months after the outbreak indicates that infection is persisting there, and therefore that this locality may be within the ASF enzootic area. A more thorough survey of this part of Dowa district and other localities near the boundary of the enzootic area would be necessary to ascertain the boundary with complete accuracy.



Many outbreaks were in localities well outside the previously defined enzootic area (LL13, LL14, DO2, DO3, DO6, DO7, DE1, DE2, DE3, DE4, DE6, DE9, DE10, NC6 and NC8), but seropositive pigs were identified in three of these (DE1, DE10 and NC8). The six seropositive pigs in DE10 may not have survived more than 3 weeks after infection, but three of those in DE1 survived at least 5 weeks after infection, and eight of those in NC8 survived more than 2 months after infection, indicating that infection is now persisting in DE1 and in NC8. DE1 in Dedza district is a locality near the border with Moçambique which has suffered frequent losses from ASF, laboratory-confirmed outbreaks having occurred in the locality each year from 1982 to 1986 (Haresnape, 1984; Haresnape, Lungu & Mamu, 1985; Table 5). Extensive interviews were undertaken in this and adjacent localities, and a total of 173 sera were collected following outbreaks of ASF between November 1982 and August 1984, and there was no evidence that the disease was enzootic in the district at that time. All sera were negative except five, but none of the five seropositive pigs survived more than a few weeks, so it was assumed that they were suffering from a subacute form of the disease (Haresnape, Lungu & Mamu, 1985). The recent evidence of persisting infection in DE1 is therefore likely to be significant, and may indicate a changing situation in this locality, with ASF perhaps becoming enzootic. NC8 is an inaccessible locality in Ntcheu district which was not included in the initial survey, but ASF had not been reported in the area prior to 1984. It seems unlikely that frequent ASF outbreaks causing high mortality could have occurred in past years even in this remote locality without ever having been reported, though if the disease is already enzootic in the area, and consequently mortality is significantly less than 100%, outbreaks could perhaps have gone unreported. Alternatively, it may be that the disease has only recently become enzootic in the area. It is interesting to note that NC8 is adjacent to one of the few localities in the Southern Region where the soft tick *Ornithodoros moubata* was found. This known vector of ASF is widespread throughout most parts of the ASF enzootic area, but appeared to be largely absent further south (Haresnape & Mamu, 1986).

The known ASF enzootic area covers not only Mchinji and parts of adjacent districts in the Central Region of Malawi but also the Eastern Province of Zambia (Wilkinson *et al.* 1987). South of this area, in the Angonia district of Tete Province, Moçambique, clinical cases of ASF were noted between 1980 and 1984, with recovered pigs sometimes being encountered (H. Koch, personal communication), and three of six sera originating from domestic pigs in this district were positive (J. M. Haresnape, unpublished observations), indicating that the enzootic area probably also extends southwards into Moçambique. The recent evidence of persistent infection in locality NC8 indicates that a part of Ntcheu district near the Moçambique border may also fall within the enzootic area. It is possible that locality DE1 represents a further extension, the enzootic area having either spread to Dedza through Lilongwe district around the northern edge of Dzalanyama Forest Reserve and cattle ranch, or from the Angonia district of Moçambique. Further surveys conducted over a period of several years will be necessary to ascertain whether or not this is the case.

Spread of ASF into Malawi from neighbouring countries has long been regarded as a problem, and outbreaks in border areas may start following introduction of

an infected carcass, such as that identified in NC2, or of infected animals. Disease control in border areas has always been difficult, and in the present circumstances, with much greater movement across the Moçambique–Malawi border, has become virtually impossible.

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