

# A Bovine Practitioner Survey of Johne's Disease

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Johne's disease is a chronic diarrheal disease of ruminants caused by *Mycobacterium paratuberculosis*. It has been reported in most countries including the United States and Canada. Although it occurs in the United States in a wide variety of domestic and exotic ruminant species, the disease is of greatest concern in cattle due to the large economic losses it can cause. In the 1930's, it was reported that Johne's disease had been on the increase in France and Great Britain for twenty years resulting in huge financial losses. It was felt that in some parts of Great Britain Johne's disease should be placed first among the major bovine diseases.(3) Through the years various researchers have tried to estimate the prevalence of the disease and the economic losses it causes.(12) Due to the insidious nature of the disease, the fact that an infected animal does not show clinical signs until after two years of age, and until recently, the absence of a reliable test this information has proved elusive.

A comprehensive study of Johne's disease in Great Britain was conducted between 1946 and 1949. Fecal samples from suspected animals were submitted by veterinary practitioners for laboratory confirmation. The diagnosis was confirmed by microscopic identification of the acid-fast organism in the fecal samples. Nine hundred twenty-six (25%) of the 3,815 samples submitted were found to be positive and another 19% were considered suspect. In addition to defining the areas of highest occurrence in the country, the authors also identified the breeds affected most often. Without clarifying whether their test population was representative of the cattle population at large, the authors reported that of the suspected animals 30% were Friesian, 27% Shorthorn, 26% crossbred, 22% Guernsey and 22% Ayrshire. A high number of positives were also reported in the Devon, Angus and Hereford breeds. It was concluded that no breed was more susceptible than any other.(2)

Doyle and Spears also reported that the largest number of positive samples were from cows 2-5 years of age. A few positives were found under 2 years or over 8 years of age. The age of greatest risk, however, cannot be inferred because the age distribution of the general population was not reported.(2)

In 1959 another British researcher cultured ileocecal lymph nodes of slaughtered cattle in an attempt to assess the occurrence of Johne's disease. It was found that 11% of all

cattle slaughtered were infected.(14) In another study in Great Britain, it was estimated that 30% of emergency slaughtered cattle were positive for Johne's disease.(9) The incidence of Johne's disease in a large number of cattle in a Devon England slaughter house was investigated. They reported a prevalence of 24% in 1954 based on lesions and 34% based on culture of ileo-cecal lymph nodes.(10)

In Canada cases of Johne's disease diagnosed at the Ontario Veterinary College between 1950 and 1974 were summarized. A total of 52 cases were diagnosed during a 24 year period. The incidence of this disease was thought to be increasing in Canada.(5)

In the United States, Johne's disease has been a growing concern since it was first recognized approximately 75 years ago. Based on studies of beef and dairy herds in 1942, Johne's disease was found to be more prevalent than previously suspected.(11) In 1949 Larsen and Groth made the first attempt at assessing its distribution in the United States. They obtained information from regulatory agencies for all years prior to 1949. Any available testing methods were accepted to identify positive cattle. Johne's disease was identified in 36 states and was found to be particularly widespread in Wisconsin, Indiana and Ohio.(8)

An update of the Larsen and Groth report was later published by Kopecky.(6) Data for this study was collected for the period from 1949 to 1971. These data included the number of diagnosed cattle, as reported by the state veterinarian's office in each state, combined with cases diagnosed at the National Animal Disease Laboratory (NADL). In this report 46 states reported a diagnosis of Johne's disease, 10 more than reported earlier. In addition, Johne's disease was now found to have widespread distribution in 11 states: Maryland, Pennsylvania, Florida, Iowa, Minnesota, Oregon, Washington, and California, in addition to Wisconsin, Indiana and Ohio which had previously been identified.

As in the report by Larsen and Groth, Kopecky did not report the total number of diagnosed individual cattle or number of infected herds. Instead, results were reported as counties in which one or more cases of the disease had been diagnosed during the reporting period. It was concluded that the apparent increase in the disease between 1949 and 1971 could be attributed to one or more factors including:

increased awareness of the disease with increased reporting of laboratory confirmed diagnoses, better diagnostic methods, or increased spread of infection. It should be noted that this study was performed prior to the advent of fecal culture as a widespread standard laboratory diagnostic method. Since fecal culture is the only method to reliably detect preclinical Johne's disease, this survey probably underestimated the actual number of cattle infected and their distribution during the time period studied.(6)

A survey of slaughtered cattle was conducted in California in 1974. Fecal and tissue cultures and serum complement-fixation tests were used to diagnose Johne's disease. Samples of feces, ileo-cecal junction and associated lymph nodes were obtained for culture. Of the 313 samples collected, 5 (.016) were positive for *Mycobacterium paratuberculosis*. There was no correlation between culture and serology. The inconsistency of the complement-fixation test is illustrated by the fact that serum samples showed 7 of the 313 animals (.022) to be positive at the 1:32 dilution, while fecal and tissue cultures on the same population identified 5 different individuals as being positive. In the survey, 228 adult dairy cattle and 85 adult beef cattle were sampled. All five positive animals were from dairy breeds and each represented a different herd of origin.(1)

Thoen reported the number of cattle positive on fecal culture for *Mycobacterium paratuberculosis* at the National Animal Disease Laboratory (NADL) between 1972 and 1977.(13) A total of 91 positive cultures were found. Because many states have laboratories with culture capability and did not submit samples to NADL, the report could not provide an indication of the true incidence or distribution of the disease.

A recent survey indicated that cultures of ileo-cecal valves of 1000 slaughtered cows in Wisconsin yielded 10.8% positive for *Mycobacterium paratuberculosis*. A similar study from Connecticut involving ileo-cecal lymph node cultures from 100 slaughtered cows revealed 18% positive results.(4)

In 1978 the American Association of Bovine Practitioners (AABP) regulatory committee initiated a survey of the membership regarding Johne's disease in order to extend the knowledge about the incidence and geographic distribution of this disease. The methods used in this survey and the results are the subject of this report.

### Materials and Methods

A total of 2,755 questionnaires were sent to the membership of AABP in the United States and Canada. Each practitioner was asked to report the number of individual animals and the number of herds in which he had obtained confirmed diagnoses of Johne's disease in the previous 5 years (1973-1978). They were also asked to indicate how many animals and herds had been confirmed by bacteriologic culture versus the number of each confirmed by other means. In reviewing the questionnaires, the inves-

tigators accepted only positive fecal cultures, positive acid-fast stains of intestinal biopsy specimens, and positive necropsies as an adequate basis for a "confirmed" diagnosis.

Practitioners were also asked to report the individual cattle and herds which were suspected of having Johne's disease but were not confirmed by the performance of one of the tests specified previously. By providing this category it was hoped that diagnoses reported in the confirmed category could be truly confirmed and not inflated by the inclusion of highly suspected but unconfirmed diagnoses. Practitioners were also asked to report the breeds involved in both the confirmed and suspected categories.

In order to obtain estimated incidence rates of Johne's infected herds during the reporting period, practitioners were asked to report the total number of different cattle herds for which they provided services during the years 1973-1978. The infected herd incidence rate was calculated using only confirmed Johne's disease infected herds as follows:

$$\text{Infected Herd Incidence Rate} = \frac{\text{Number of confirmed Johne's disease infected herds (1973-1978)}}{\text{Number of herds observed (1973-1978)}}$$

The herd incidence rate was calculated both by state and AABP region. Some practitioners failed to report the number of different cattle herds for which they had provided veterinary services. It was therefore assumed that the number of herds for which each of these practitioners provided veterinary services was equal to the average number of herds served by the other respondents from his state. By doing this, their response could be used in the calculation of herd incidence rates. The state data were then combined according to the AABP districts to obtain district specific Johne's disease infected herd incidence rates (Fig. 5).

**Eighteen practitioners reported extremely high numbers of herds (ie. over 500 herds) cared for during the survey period. Assuming that most of these were mistakes in interpreting the question, they were eliminated in the rate calculations. Due to the referral nature of their work, there was a good possibility of duplicate reporting by the university, diagnostic laboratory and extension veterinarians. Therefore the information from the 8 respondents in this category were also excluded from the rate calculations.**

### Results

A total of 799 questionnaires were returned yielding a response rate of 29%. The percent reporting in various AABP districts was fairly constant (Fig. 1). Nearly all of those returning the questionnaire (99.2%) were in private practice. Eight questionnaires (0.8%) were returned by university clinicians, diagnostic laboratory, and extension veterinarians.

The 799 responding practitioners reported a total of 2,148 cattle with confirmed diagnoses of Johne's disease. These cattle were representing 608 different infected herds in the United States and Canada during the period 1973 to 1978 (Figs. 2 and 3). In addition, they reported 3,037 cattle with suspected but not confirmed Johne's disease representing an additional 1,098 herds (Fig. 4). There appeared to be a regional pattern with the highest numbers reported from the Great Lakes region. The states of California and Washington also reported large numbers.

The United States veterinarians reported that they had provided services for 93,462 herds during the survey period. When the adjustment was made for the 33 veterinarians omitting a response to this question, as explained previously, a total of 106,947 herds was obtained. Using this denominator the overall adjusted confirmed Johne's disease infected herd rate for the 5 year period was 4.3 per 1,000 herds.

The adjusted infected herd rates were calculated for each of the AABP districts (Fig. 5). The highest rate was reported from district II (Delaware, Maryland, New Jersey, Pennsylvania and Virginia) followed closely by district X (Arizona, California and Nevada) and district IV (Kentucky, Michigan, Ohio and West Virginia). These were followed by district VIII (Texas, Louisiana and Arkansas) district V (Wisconsin, Illinois and Indiana) district VI (Minnesota and Iowa) district III (Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Florida) and district XI (Washington, Oregon, Idaho and Montana). At the time of the survey Canada was considered one district with an infected herd rate of 4.4 per 1,000 herds.

**All respondents were asked to report the breed(s) in which they saw confirmed cases of Johne's disease. The questionnaire did not specifically request the breed for each individual animal or herd having Johne's disease. Therefore, we can report the breeds mentioned most often but we cannot report a true breed specific incidence rate (Table 1). The Holstein breed had the greatest number of responses followed by Guernsey, Angus and Shorthorn.**

### Discussion

Several practitioners stated that they purposely did not confirm the diagnosis in suspected Johne's disease cases because of quarantine restrictions in their state. Except for these individuals, practitioners who reported the highest number of confirmed diagnoses in individual animals also tended to report the highest number of suspected diagnoses as well. In a number of states it appeared that one practitioner diagnosed a number of cattle with Johne's disease while surrounding practitioners reported none. This could be accounted for as follows: 1) One heavily infected herd happened to be located in an otherwise low incidence area. The practitioner servicing that herd reported those cases. Based on written comments this appeared to be the

TABLE 1  
Breeds listed in order of frequency of reporting

BREEDS	NO. REPORTING EACH BREED
HOLSTEIN	131
GUERNSEY	75
ANGUS	56
SHORTHORN	48
JERSEY	33
HEREFORD	30
CHAROLAIS	10
BRAHMAN	9
CROSSBRED	6
LIMOUSIN	4
SANTA GERTRUDAS	3
BROWN SWISS	2
GALLOWAY	1
SIMMENTAL	1
BEEFMASTER	1
AYRSHIRE	1
BUFFALO	1
BRANGUS	1

reason in a few instances, 2) the practitioner who saw no cases may have been less diligent in seeking the diagnoses.

By far the majority of the respondents reported culture and/or necropsy as the test used to confirm the diagnosis. Others reported using acid-fast stains of rectal biopsies, intravenous Johnin test, complement-fixation, and intradermal Johnin test. The complement-fixation and intradermal tests were considered to be inaccurate tests for the purpose of this survey. By comparison the 1949 and 1973 surveys accepted diagnoses submitted from state diagnostic laboratories and the national animal disease laboratory with no discrimination for the type of tests used to confirm the diagnosis.

The overall questionnaire return rate was 29% with the range in the various AABP districts of 18-36% (Fig. 1). The small disparity in the regional return rate was not thought to account for the regional differences in estimated infected herd incidence rates.

The geographic distribution of infected herd incidence rates may reflect what is known about the transmission of Johne's disease; namely that the fecal-oral transmission of *Mycobacterium paratuberculosis* is enhanced by high cattle density and confinement housing. In general the states where cattle are raised primarily in confinement tended to have higher incidence rates. The district with the lowest infected herd incidence rate was district IX which includes most of the Great Plains and Rocky Mountain states. In this region, herds are maintained on open range in relatively low density. Climatic and other factors affecting survival of the organism may also modify the geographic distribution of Johne's disease. The herd incidence rates also tended to be higher in states with higher dairy cattle populations where confinement housing is more often practiced. There is also a lower dairy cattle population found in the Great Plains and

Figure 1—Percentage of practitioners returning questionnaires by AABP district. Colors are used only to delineate the districts.

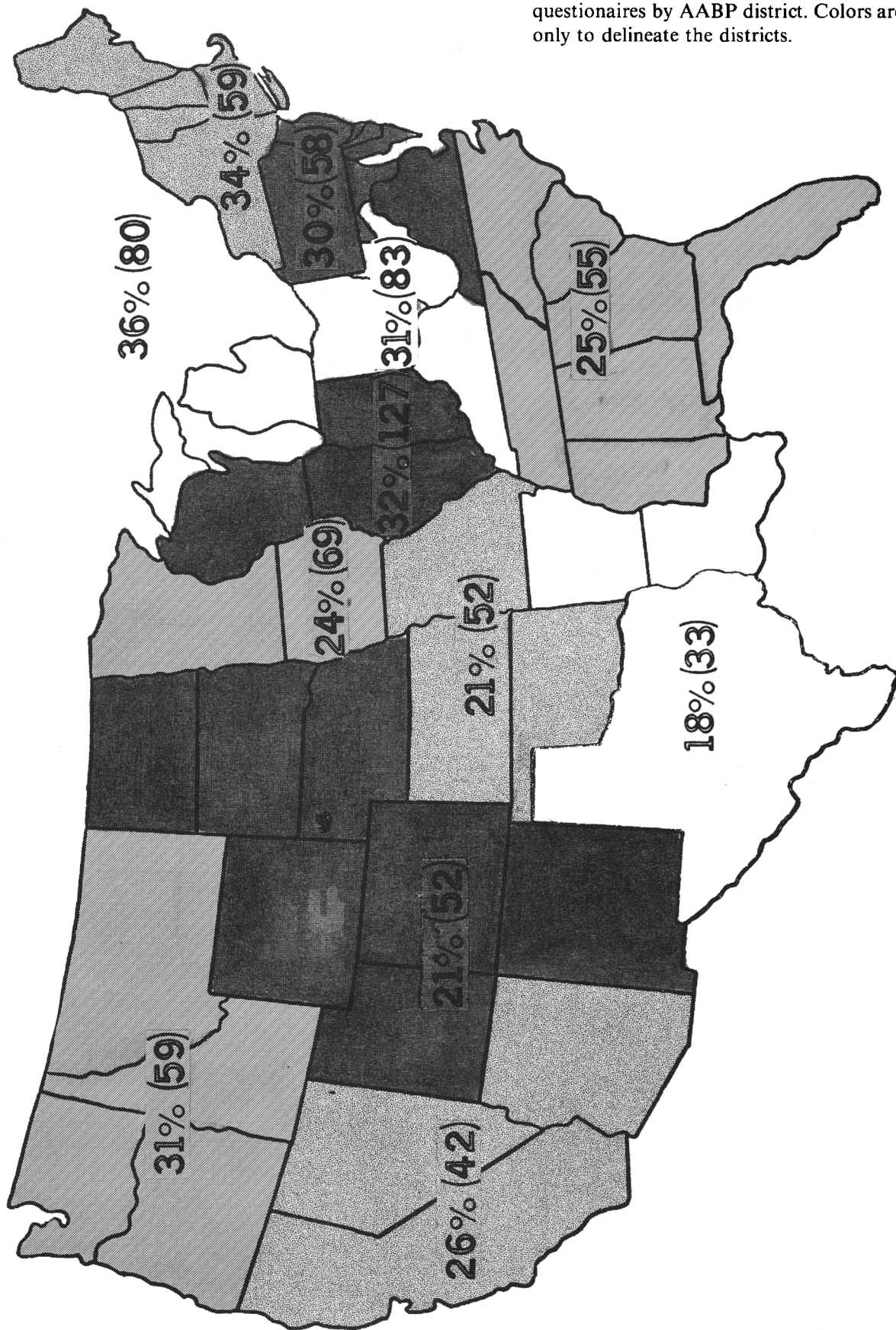
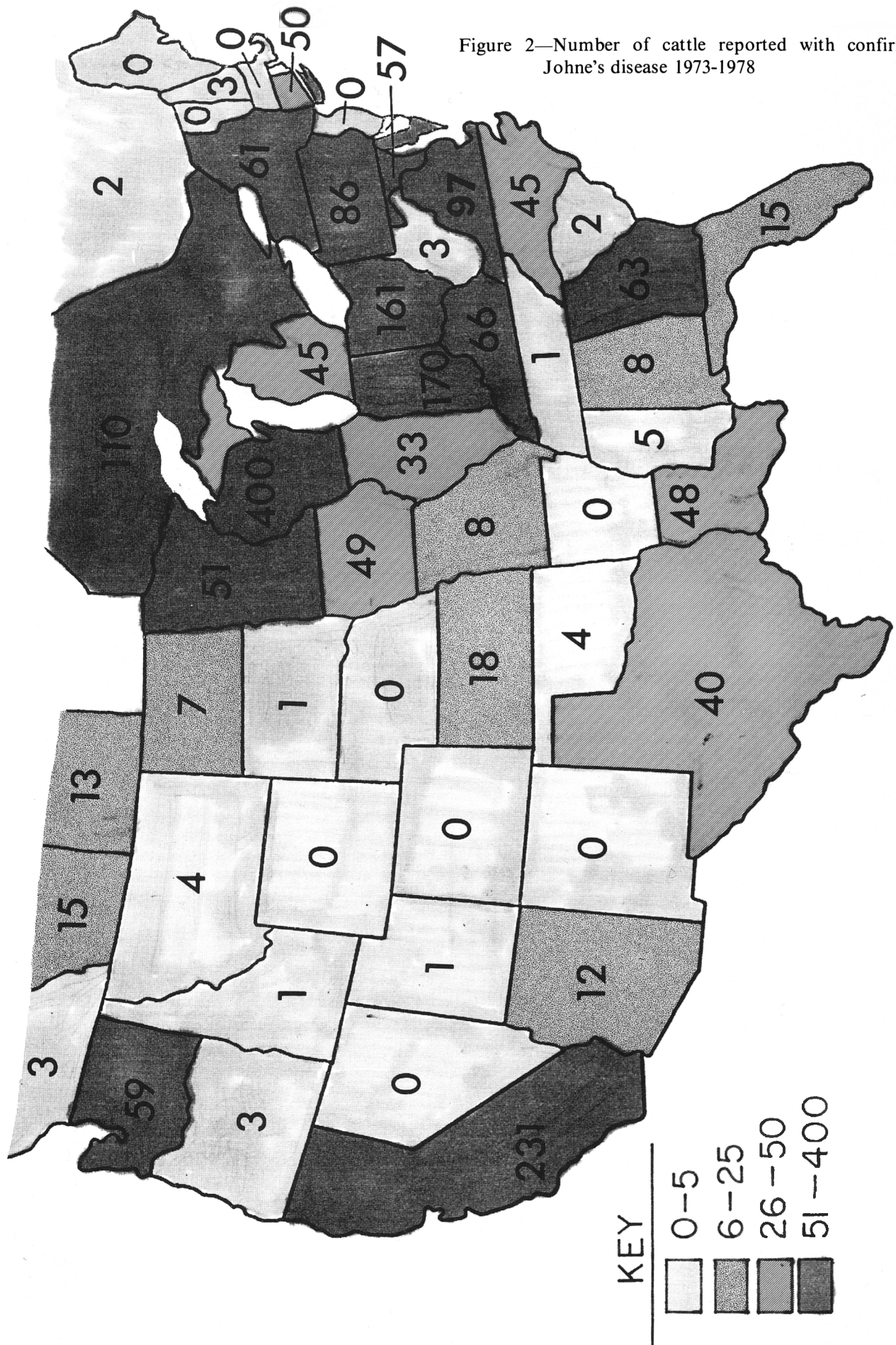




Figure 2—Number of cattle reported with confirmed Johne's disease 1973-1978



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Figure 3—Number of herds reported with confirmed Johne's disease, 1973-1978

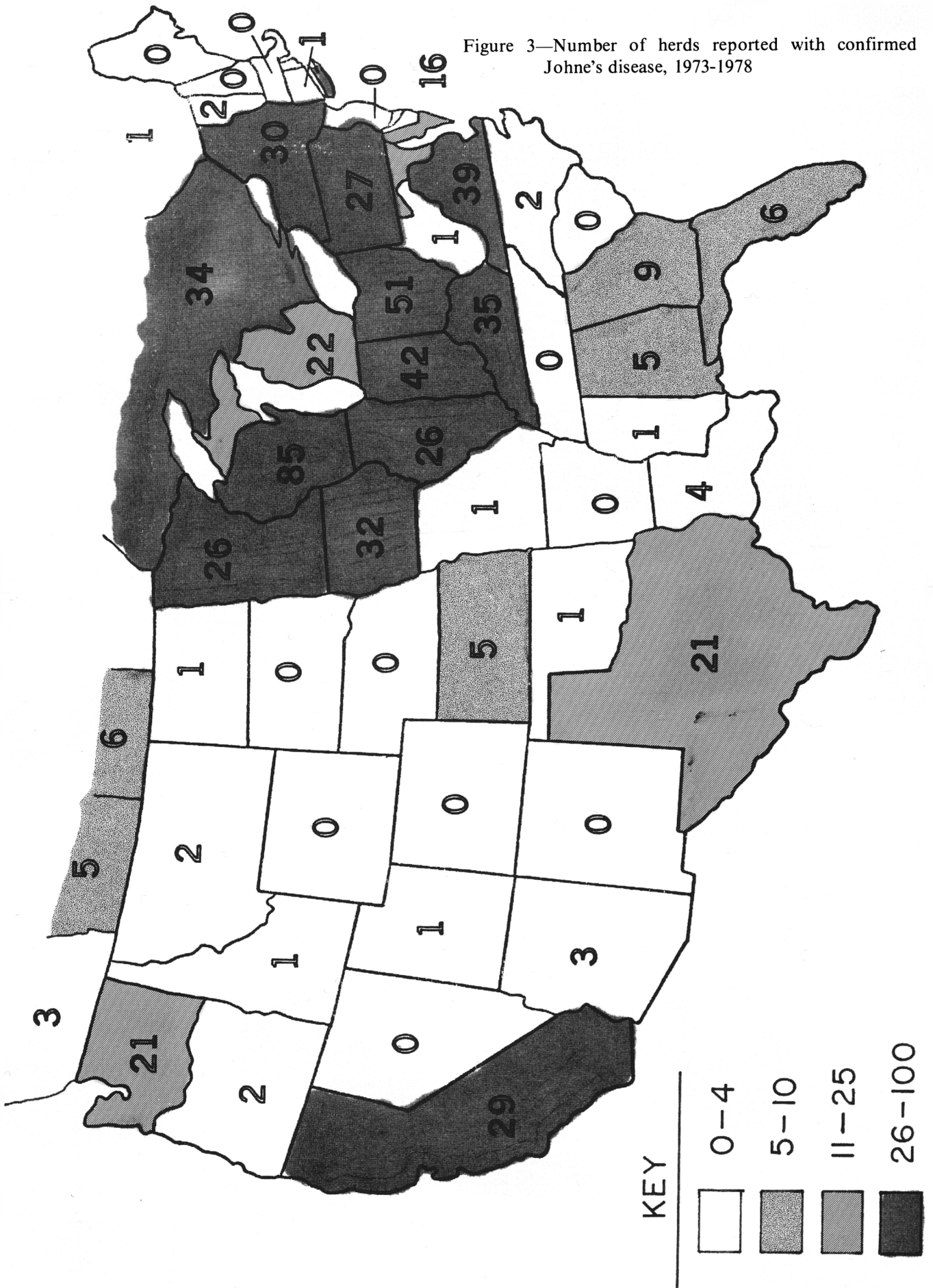


Figure 4—Number of cattle suspected to have Johne's disease, 1973-1978

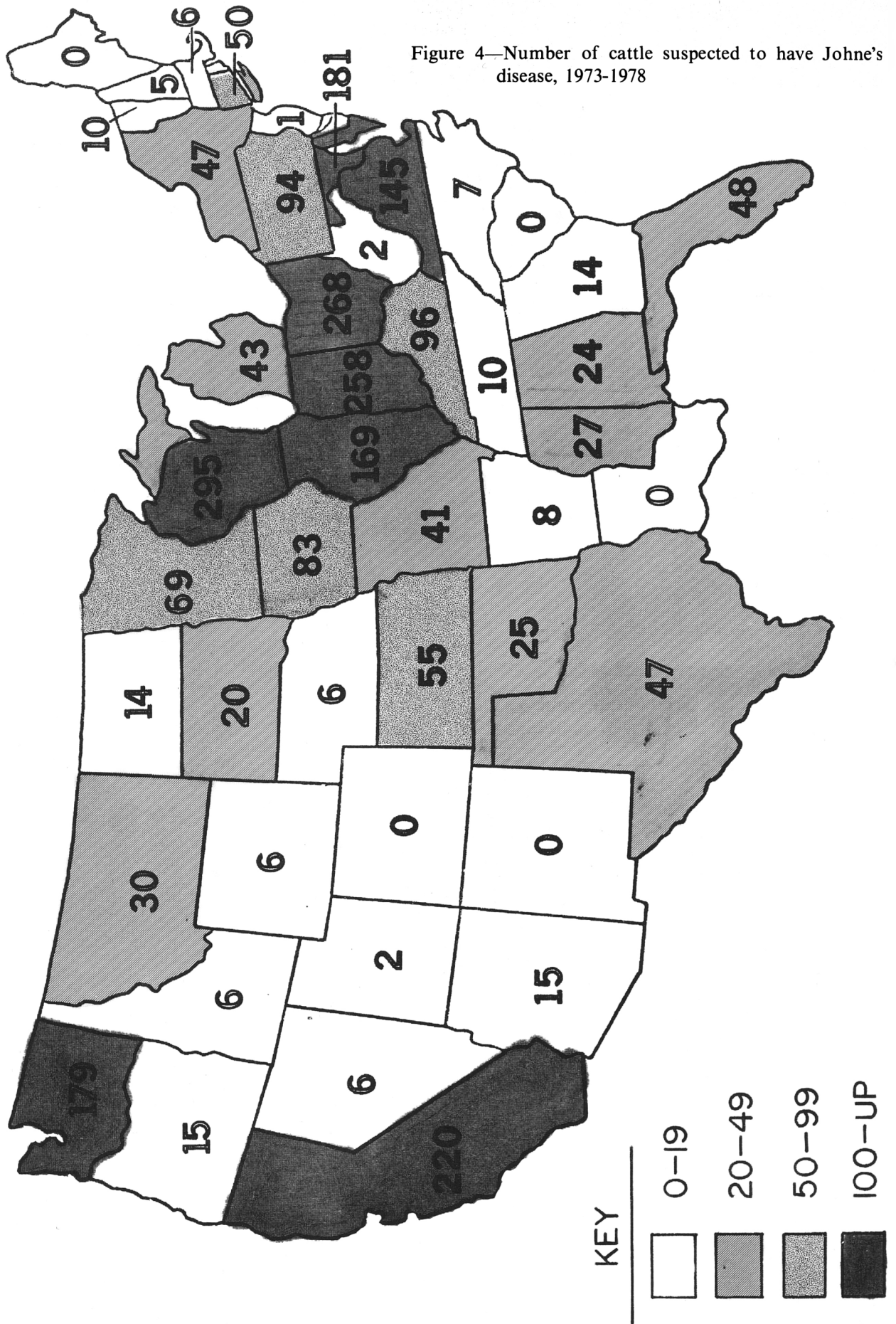
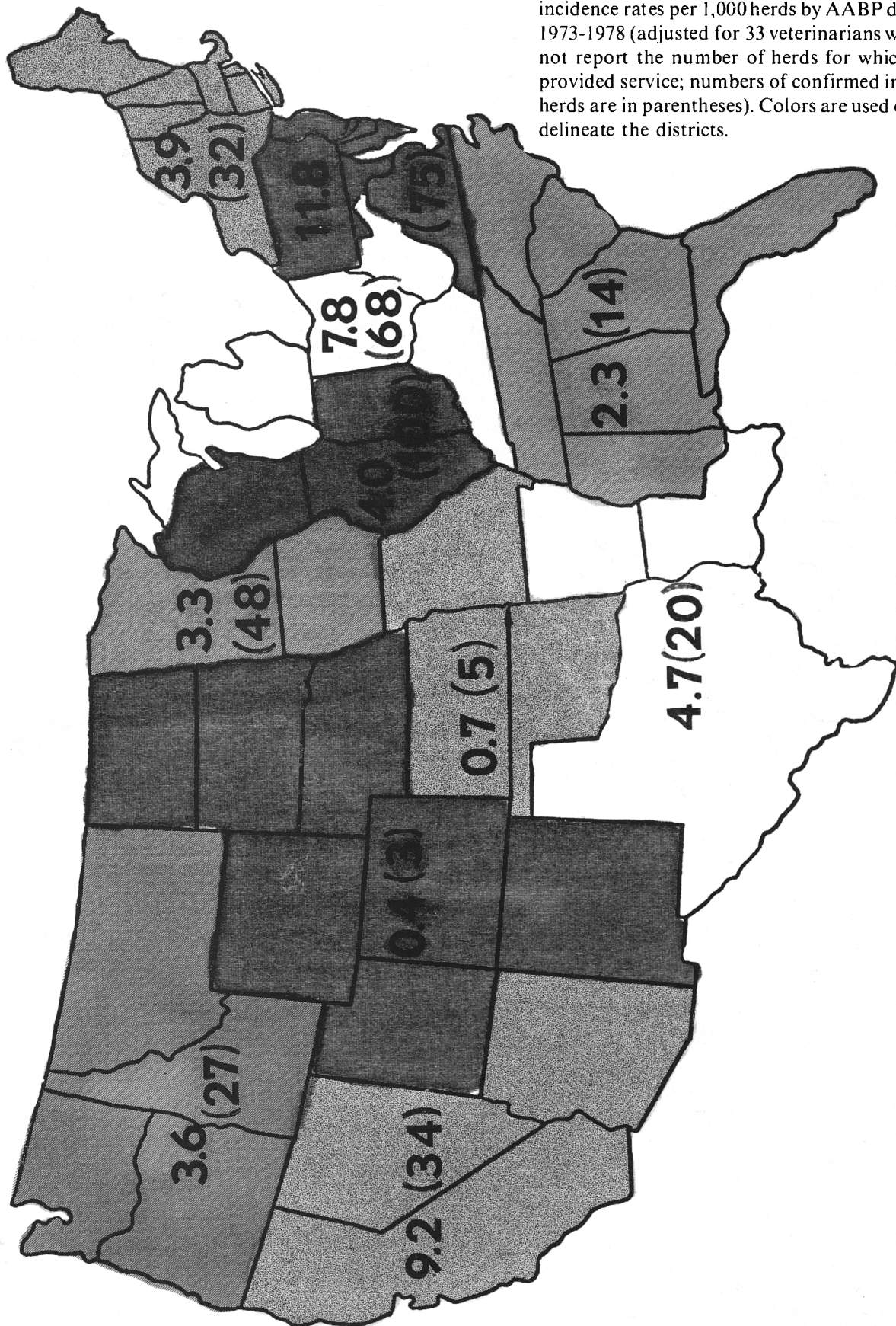




Figure 5—Confirmed Johne's disease infected herd incidence rates per 1,000 herds by AABP district, 1973-1978 (adjusted for 33 veterinarians who did not report the number of herds for which they provided service; numbers of confirmed infected herds are in parentheses). Colors are used only to delineate the districts.



Rocky Mountain states.

It could be concluded from the breed data (*Table 1*) that practitioners are most likely to encounter the disease in the Holstein breed. However, it could not be concluded that the incidence of Johne's disease is higher in Holsteins than other breeds. Because of their prominence among the dairy breeds and because of the lack of population data needed for calculation of breed specific incidence rates, it is possible that one of the breeds further down the list actually has the highest breed incidence rate. These data should emphasize that no breeds are resistant to infection and the diagnosis should be considered in any breed with suggestive signs. The adjusted infected herd incidence rate of 4.3 infected herds per 1,000 herds cannot be compared with data from previous reports for several reasons. The level of ascertainment is greatly increased when all of the cattle in the survey population are sampled as in the studies performed on slaughtered cattle. Furthermore, surveys of slaughtered cattle provide prevalence rates which would be expected to be much larger than true incidence rates in the general population. This is particularly true because slaughter based studies sample a population of cull cattle and a high number of Johne's disease infected animals would be expected to be culled from the herd because it is a chronic debilitating disease. They would therefore be found in a higher proportion of slaughtered cattle than in the general cattle population.

The Doyle and Spears study conducted in Great Britain reporting higher rates than in North America may reflect true geographic differences in the occurrences of Johne's disease, differences in testing methods, or differences in the sampling techniques. Little is known about possible temperal and management trends in the occurrence of Johne's disease that might affect the frequency of Johne's disease between two different time periods. These factors should be considered when making comparison between the various studies.

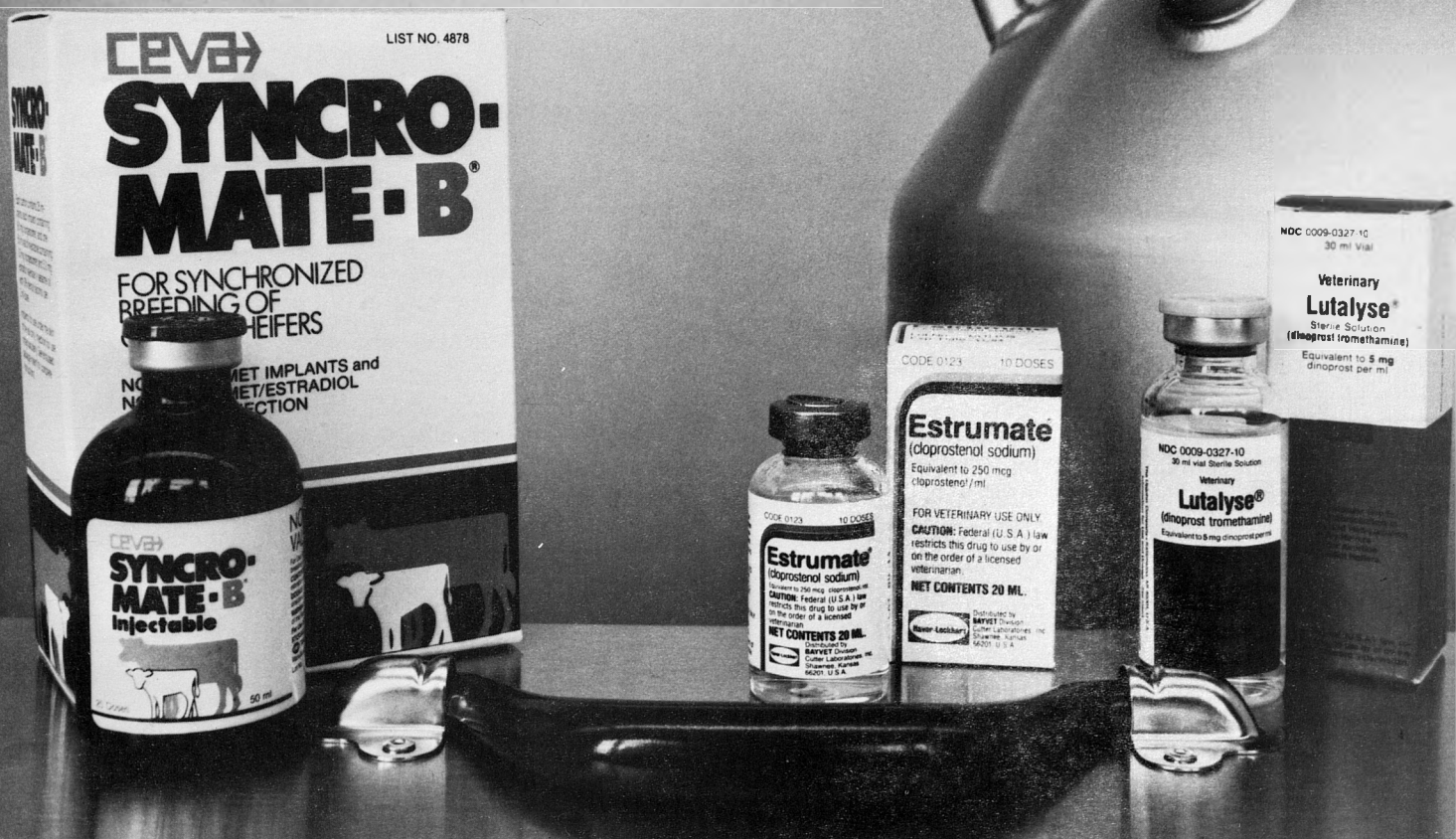
Fecal culture is a sufficiently accurate test upon which to base diagnostic and control programs for individual herds. (7) The major disadvantages of expense and time requirements have been largely overcome. With the advent of private laboratories performing fecal culture, there is now adequate laboratory space available to accommodate testing on a large scale. New and more sensitive serologic tests such as agar gel immunodiffusion and Elisa are showing great promise for detecting preclinical disease. These developments will greatly aid in future survey and epidemiological studies as well as aiding practitioners in accurately diagnosing the disease and implementing control programs.

## Summary

A questionnaire survey was conducted among members of the AABP to determine the incidence of Johne's disease in their practices. A total of 2,755 questionnaires were sent out and 799 (29%) were returned. For the 5 year (1973-1978) period, 2,148 confirmed and 3,037 suspected individual infected cattle were reported. In addition, 608 confirmed and 1,098 suspected Johne's disease infected herds were identified. An estimated adjusted herd infection rate (confirmed infected herds only) of 4.3 per 1,000 herds was calculated for the 5 year period. The highest infected herd rate was reported from district II (Virginia, Pennsylvania, Delaware, Maryland). Several other districts had similar infection rates. The lowest infection rate was from district IX which represented the Great Plains and Rocky Mountain states. The district specific incidence rates were highest in regions where management tended toward high cattle density and confinement operations, suggesting that these factors increase the risk of Johne's disease transmission. There were more reported individual infected cattle in Holsteins than in any other breed; however, the breed population data were not available for calculating breed specific incidence rates.

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