United States Department of Agriculture

Swine Hemorrhagic Fever Surveillance

Evaluation Brief

April 2021

INTRODUCTION

The increased spread of African swine fever (ASF) in Asia and Europe and classical swine fever (CSF) in the Caribbean and South America has increased concern about the potential introduction of these diseases into the United States. In response, Veterinary Service (VS) — a program within USDA's Animal and Plant Health Inspection Service (APHIS) — implemented an integrated surveillance plan to enhance vigilance for both diseases and improve the country's emergency preparedness. VS recently evaluated the effectiveness of this plan in meeting outlined goals one year after its implementation. This report highlights the plan's success and outlines areas for improvement.

SURVEILLANCE GOALS

To strengthen ASF and CSF detection capabilities and enhance outbreak preparedness
by testing high-volume sample collection, laboratory capacity, and data management prior to an outbreak and by establishing a baseline of disease absence through timely and consistent surveillance.

Support claims of ASF and CSF disease freedom
by the diagnostic testing of targeted subpopulations of swine collected via five surveillance components:

- Foreign Animal Disease (FAD) Investigations
- Sick Pig Veterinary Diagnostic Lab Component
- Slaughter or Aggregation Point Component
- Higher Risk Component
- Feral Swine Component

SAMPLING

VS, Wildlife Services (WS), States, and private veterinarians collected specimens from June 1, 2019 to May 31, 2020 from three targeted populations:

Large Commercial swine consist of domestic swine raised for food production and confined to a housing facility designed to prevent exposure to feral swine.
Higher Risk swine consist of swine raised in non-commercial settings such as waste feeders, outdoor raised swine, swine with known or suspected feral swine exposure, and show swine.
Feral swine consist of free roaming swine with an increased risk of exposure to CSF.

During the first year of implementation, the Foreign Animal Disease Diagnostic Laboratory (FADDL) and National Animal Health Laboratory Network (NAHLN) laboratories tested 6,522 specimens for ASF and CSF and 4,975 specimens for CSF only, strengthening detection capabilities and disease freedom claims (Figure 1).

BY THE NUMBERS

Due to targeting efforts and the tests being used, the specimens collected from sick and dead swine provide diagnostic value if tested for both ASF and CSF. Those collected from apparently healthy animals are tested for CSF only. For more information please refer to the Swine Hemorrhagic Fevers Surveillance Plan.

Foreign Animal Disease (FAD) Investigations: 59 investigations

Target swine disease events in any population where ASF and CSF are suspected and an FAD investigation is initiated by State and Federal animal health officials.

Sick Pig Veterinary Diagnostic Lab (VDL) Component: 3,263 specimens

Target clinically ill or dead swine on larger commercial farms for ASF and CSF testing.

Slaughter or Aggregation Point Component: 2,909 specimens

Target slaughter condemnations and clinically ill or dead swine for ASF and CSF testing.

Higher Risk Component: 2,937 specimens

Target clinically ill or dead Higher Risk swine on farm for ASF and CSF testing and target apparently healthy Higher Risk swine on farm for CSF testing.

Feral Swine Component: 2,044 specimens

Targeting performed by USDA APHIS Wildlife Services for CSF testing.

Figure 1. Specimens Tested for ASF and CSF, Total and by Component

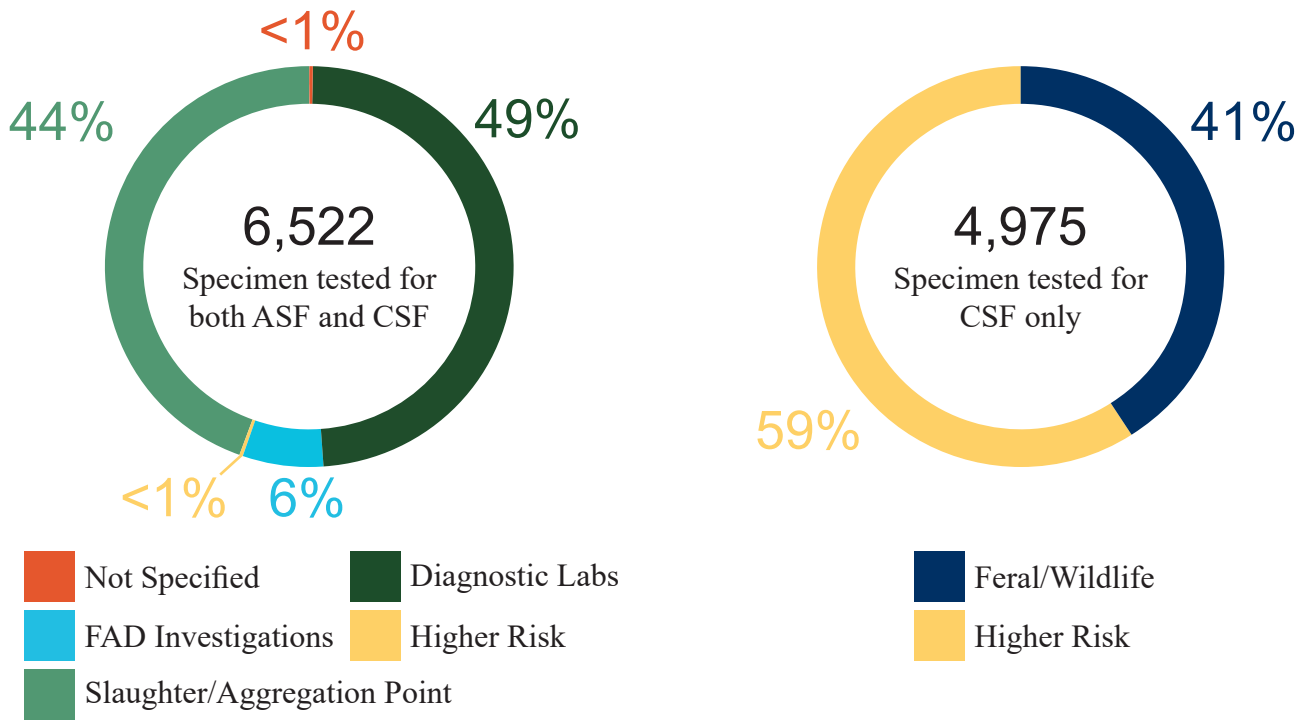


Figure 1: 6,522 specimens were tested both ASF and CSF, the majority of which were tested through the Sick Pig VDL (49%), the Slaughter/Aggregation point (44%), and the FAD investigations (6%) component. 4,975 specimens were tested for only CSF through the Higher Risk (59%) and Feral/Wildlife (41%) components

ACCOMPLISHMENTS AND CHALLENGES

VS has put lot of effort into educating federal staff and industry, and into implementing the new data collection and management systems. We are already seeing the benefits from such investments, which are denoted below. Importantly, we have identified areas for improvement as the surveillance plan moves into its second year.

Benefits:
•Improved system flexibility and timeliness.
•Increased ease of data analysis.
•Increased system acceptability by industry.
•Consistent field sample collection from all targeted surveillance components and reliable diagnostic results.

Areas for improvement:
•Slow adoption of the new electronic specimen submission systems.
•Some data was not collected due to limitations among data collection systems. The consistent collection of clinical signs, age/production type, and premises identification number would improve outbreak response and future surveillance system evaluations.

EFFECTIVENESS METRICS

An effective, targeted surveillance system ensures that samples represent the different production phases and associated risks as well as the geographic distribution of populations. Similarly, distributing testing for disease across time ensures that we have a clear picture of swine health year-round.

The CSF ASF Procedure Manual for State and USDA Employees provided some States with targets for the number of specimens to collect annually. No states met the Higher Risk component targets, with the majority of States (45%) achieving 0-10% of their target (Figure 2). However, 36% of States met or exceeded the Slaughter/Aggregation Point targets, with 21% achieving 0-10% of the target (Figure 3). We are exploring ways to adjust the system to maximize its usefulness and help States meet the assigned targets.

Figure 2. Percentage of States by Proportion of Sampling Target Met for Higher-Risk Swine

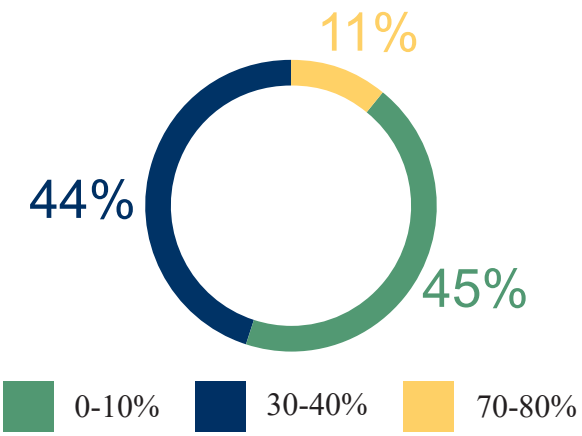


Figure 3. Percentage of States by Proportion of Sampling Target Met for Slaughter/Aggregation Point Swine

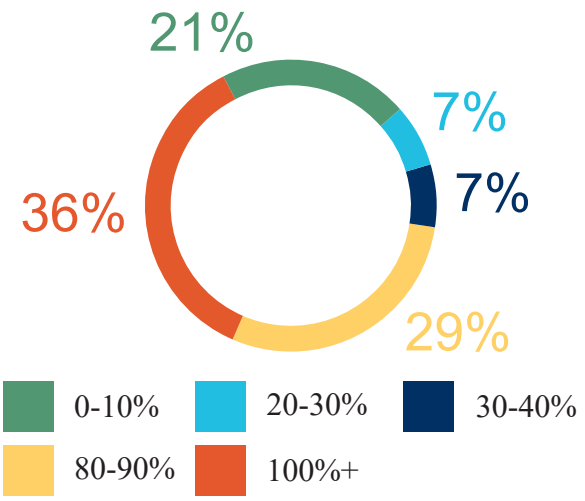
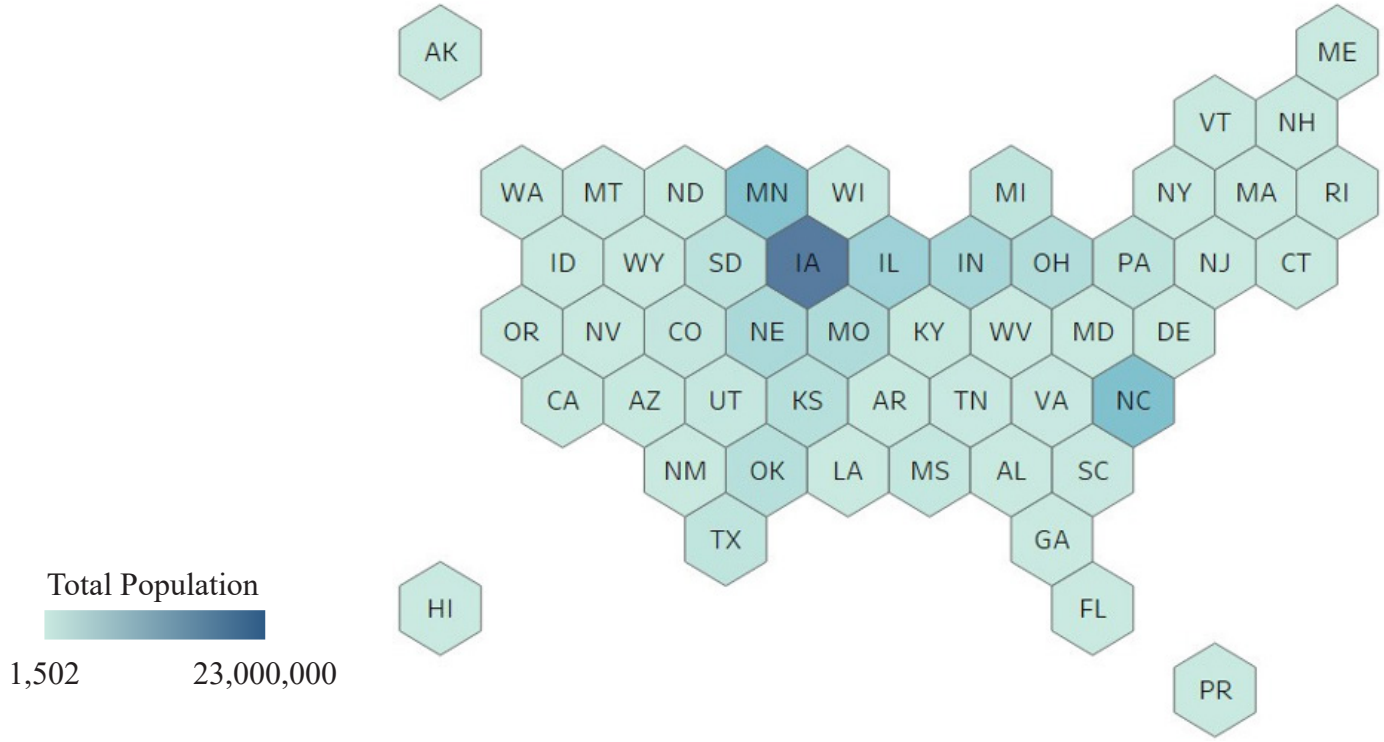


Figure 2: 45% of States achieved 0-10% of the assigned Higher Risk target, while 44% achieved 30-40% and 11% achieved 70-80%. Figure 3: 36% of States achieved 100%+ of the assigned Slaughter/Aggregation Point target, while 29% achieved 80-90%, 21% achieved 0-10% and 7% achieved 20-30% and 30-40% of the target.

To achieve geographic representation, the distribution of samples submitted for the Sick Pig VDL and Slaughter/Aggregation Point components should be proportional to the population distribution of U.S. swine. Comparing the total swine population by State (Figure 4) and the total samples collected from the Sick Pig VDL and the Slaughter/Aggregation Point component (Figure 5) show that, in general, VS, States, and private veterinarians are collecting specimens from animals originating from those States with larger swine populations. However, Figure 6 illustrates that representativeness can be improved.

Figure 4. Total Swine Population by State



2017 NASS Census

Figure 4: Map of the United States colored on a gradient corresponding to total swine population by State.

Figure 5. Total Specimens of Sick Pig VDL and Slaughter/Aggregation Point Components

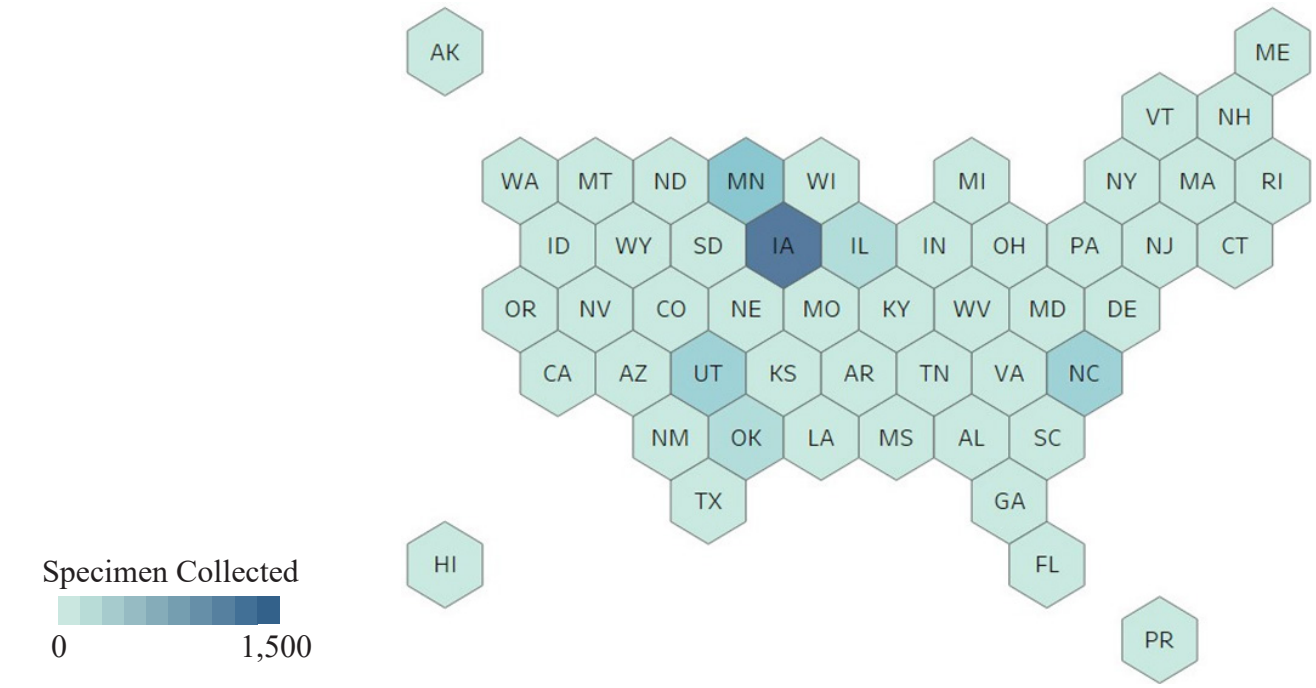


Figure 5: Map of the United States colored on a gradient corresponding to total specimens collected via the Sick Pig VDL and Slaughter/Aggregation Point components by State.

Nine of the top 15 swine producing States were under sampled to a very high or moderate degree (Figure 6). This is not a reflection of the efforts made by State or federal sample collectors as animal origin does not always coincide with the sample collection location. Instead, it demonstrates that while we are on the right path, we still have work to do to ensure representative samples are collected nationwide.

Shading does not denote the degree of over- or under-sampling, but rather the statistical significance of the over- or under-sampling that occurred. Higher significance (darker shades) indicates a larger potential impact on the geographic representativeness of samples collected nationally for the Sick Pig VDL and Slaughter/Aggregation Point components.

Figure 6. Geographic Significance

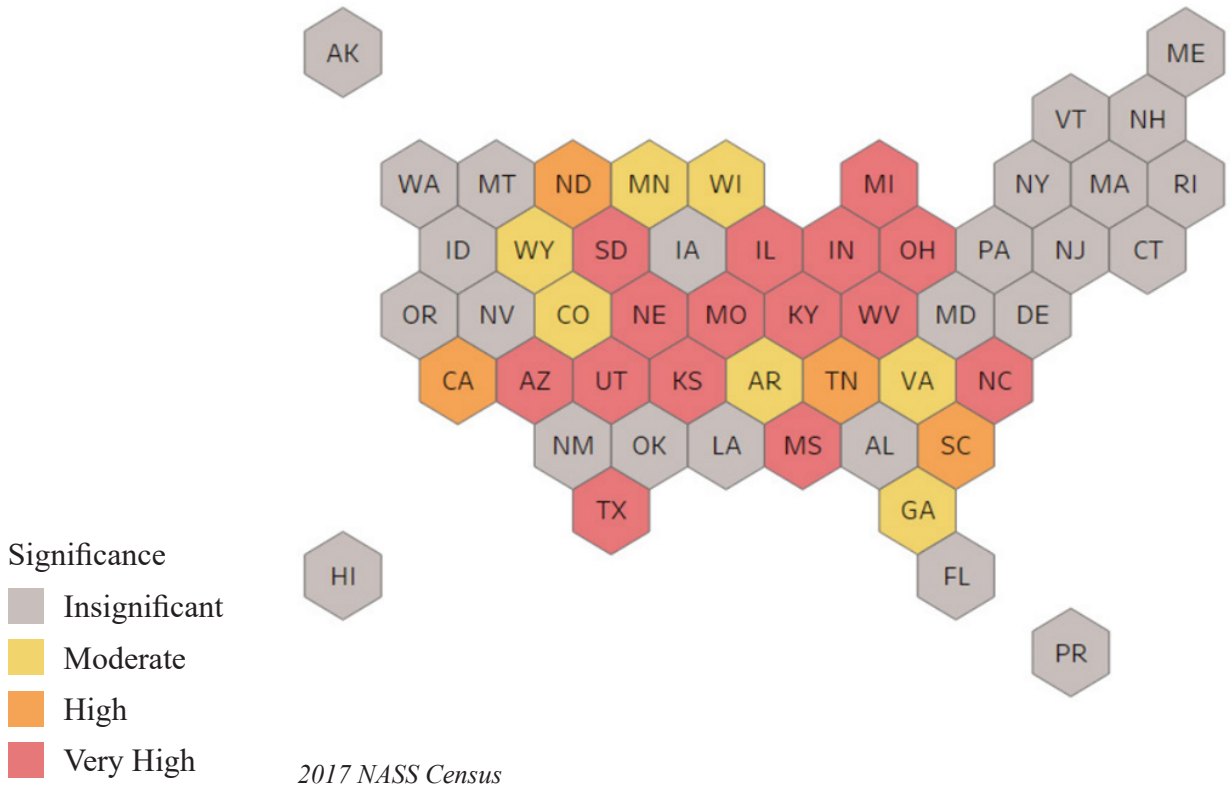


Figure 6: Map of the United States colored to correspond to the statistical significance of under or over sampling by State based on the samples collected through the Sick Pig VDL and Slaughter/Aggregation Point components and 2017 NASS Census.

Feral swine sample collection should represent the distribution of feral swine nationally. Inspection of total population estimates (Figure 7) and sample collection (Figure 8) shows that this is indeed the case.

Figure 7. Feral Swine Population Estimate

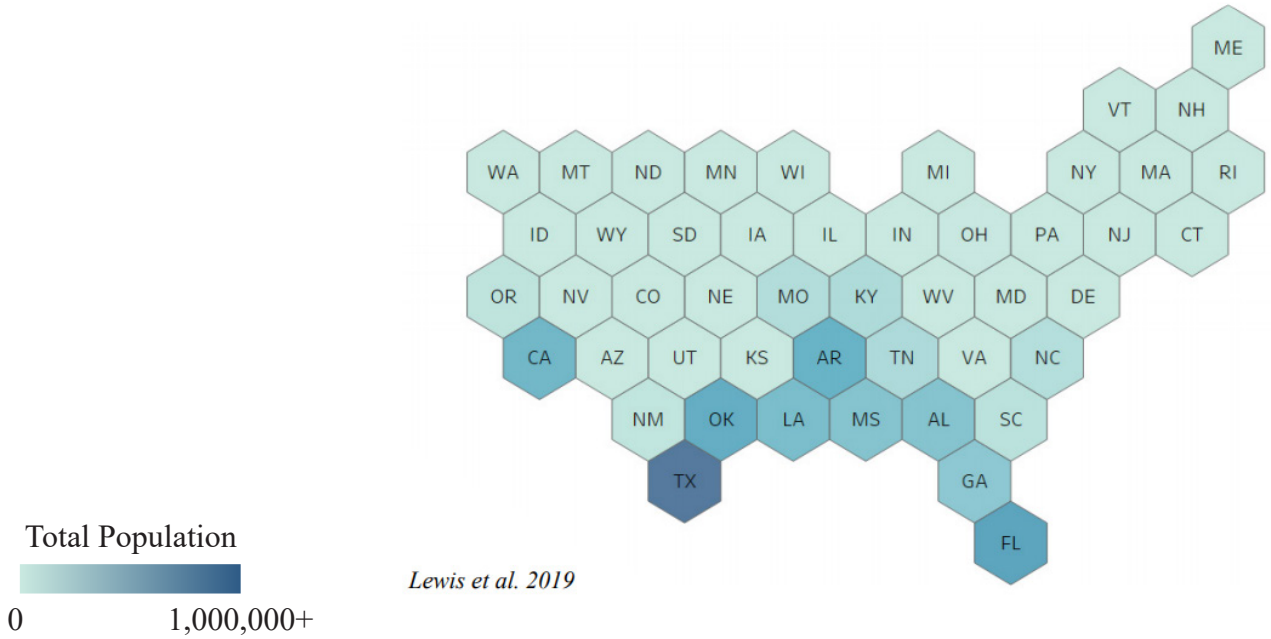


Figure 7: Map of the United States colored on a gradient corresponding to total swine population by State.

Figure 8. Feral Swine Collection Sample

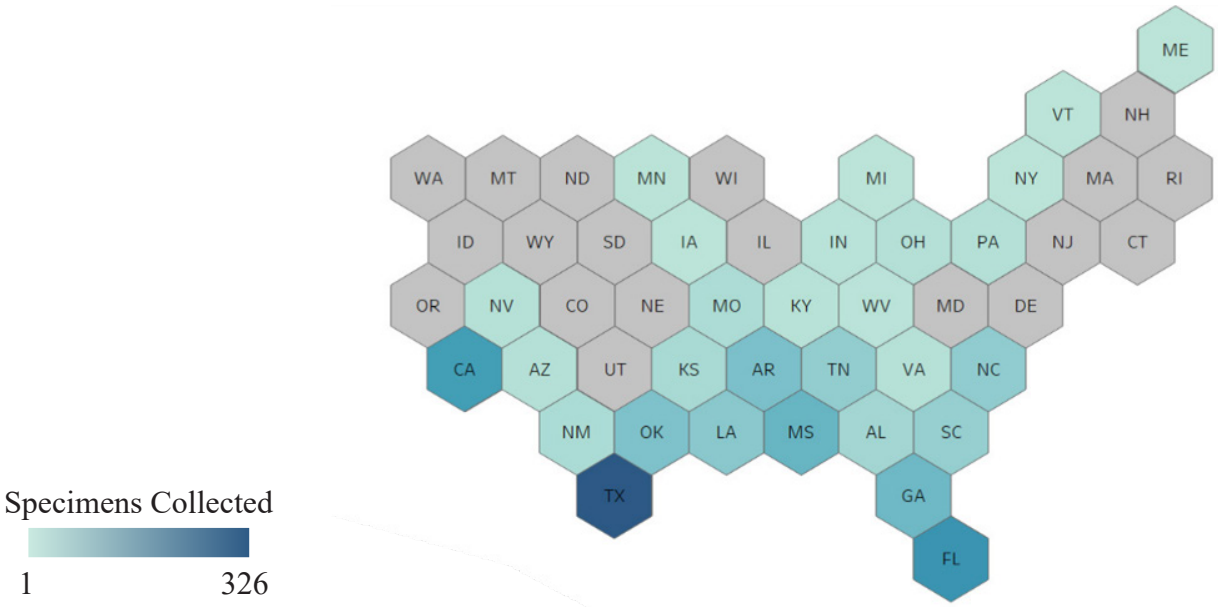


Figure 8: Map of the United States colored on a gradient corresponding to total specimens collected via the Feral/Wildlife component by State.

There was relative temporal consistency in sample collection across the first 9-month period. The virus SARS-CoV-2 had a significant impact on the number of samples submitted during March-May. Primary effects were seen in Slaughter/Aggregation Point sampling when slaughterhouses were closed due to human COVID-19 cases; however, we observed a decrease in samples submitted in all surveillance components. We are still seeing these effects; however, sample numbers begin to return to pre-COVID numbers in late 2020 (data not shown).

Figure 9. Samples Collected

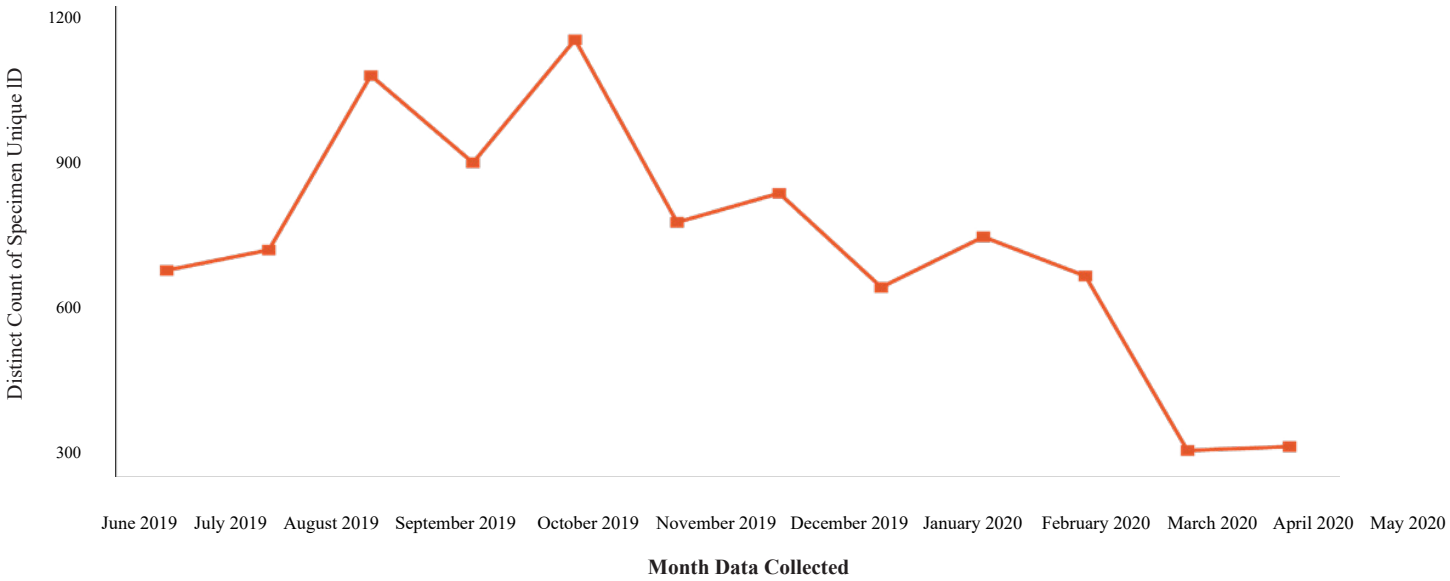


Figure 9: Graph displaying the distinct count specimen unique IDs by month. A sharp drop is observed in April and May when slaughter facilities were shut down due to human COVID-19 cases.

CONCLUSION

Despite some short comings, the Swine Hemorrhagic Fevers Surveillance Integrated Plan has met most of its goals and added value to ongoing hemorrhagic fevers surveillance. Limitations in geographic representativeness and failure to meet targets affects the ability to apply findings to all populations; however, it does not nullify the benefits gained. Through early adoption of new tools and capitalizing on existing nationwide NAHLN laboratories, this surveillance system provides timely, accurate data supporting claims of disease freedom and improving detection capabilities and outbreak preparedness. While it has taken time to fully integrate these tools, we have made a lot of progress toward making this an efficient and effective surveillance system. This has resulted in an increased number of specimens tested for ASF and CSF and an approximate 6-fold increase in the number of FADs over previous years. VS put forth tremendous effort to implement new electronic data collection and management systems, and the benefits are already clear. Additionally, the risk- based, targeted nature of the surveillance system increases the probability of rapid detection of ASF or CSF incursion into the United States. While this plan is beneficial, it is not perfect; we are exploring solutions to improve its effectiveness for supporting disease freedom, strengthening detection capabilities and improving outbreak preparedness.

COLLABORATIVE GOALS FOR IMPROVING THE SYSTEM

- Encourage complete adoption of new electronic submission and reporting systems to reduce human error and improve timeliness
- Discuss data requirements with stakeholders and adjust data management systems to allow for consistent collection of epidemiologic information (e.g. clinical signs, age/production type, and traceability data)
- Increase sample sizes in geographically representative locations

Further evaluations are planned to identify the most efficient methods of implementing these recommendations

For more information, please visit the Swine Hemorrhagic Fevers Surveillance Plan: https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/swine/hemorrhagic-fevers-integrated-surveillance-plan.pdf