

Active Sentinel Flock Surveillance for the Early Detection of Asian H5N1 HPAI Guidelines for Developing Surveillance Plans

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Two risk factors that increase the probability of disease emergence in non-commercial poultry flocks are the movement of birds or owners of small flocks (people/fomites) to shows, fairs, or swap meets, and husbandry practices that result in direct or indirect exposure to migratory waterfowl or migratory waterfowl habitat. Some gamefowl hobbyists travel frequently to fairs, domestically and internationally. Game birds and some gamefowl are commonly reared with exposure to the outdoors and many small farm backyard flocks are free to roam outside. Additionally, the United Gamefowl Breeders Association (UGBA) has expressed interest in cooperating in a sentinel avian influenza (AI) monitoring program. For these reasons, non-commercial backyard poultry, gamefowl, fancy fowl, and game birds may be employed as active sentinels for early detection of Asian H5N1 HPAI. Sampling non-commercial poultry at concentration points may also provide opportunities for enhanced surveillance, and encouraging flock owners to submit mortality for necropsy will enhance passive surveillance systems already in place.

Recently, the *U.S. Interagency Strategic Plan, An Early Detection System for Asian H5N1 Highly Pathogenic Avian Influenza in Wild Migratory Birds* proposed a preliminary list of migratory bird surveillance candidates that reflects both “primary” species that could come to the United States directly from breeding grounds in Asia, as well as “secondary” species that would likely intermingle with Asian migrants and could be subject to secondary transmission. In addition, the strategic plan proposed sampling methodologies that may be used for the early detection of Asian H5N1 in migratory waterfowl. Each U.S. Flyway Council has been asked to expeditiously develop its own plan and to identify target species, priority States and sampling areas. Exposure of species not listed on the “primary” or “secondary” species list through infected common water sources is considered likely. States may choose to conduct surveillance at sites with significant concentrations of waterfowl that aren’t designated “primary” or “secondary” species.

Overall, more efficient surveillance will result if an array of methods is used in the context of regional, flyway, and national efforts. U.S. Fish and Wildlife Service (USFWS) biologists will be conducting surveillance on USFWS management areas (hunter kill bag checks and live trapping of target species). Animal and Plant Health Inspection Service (APHIS) Wildlife Services personnel plan to work through State wildlife agencies to collect water and environmental samples at sites designated by State biologists. Other opportunities for surveillance using opportunistic sampling of exhibition poultry at shows and fairs and investigations of mortality events in non-commercial flocks also provide valuable sources for surveillance.

The use of sentinel backyard poultry is one method proposed for active surveillance. Risk factors for sentinel flock selection are outlined here and sampling methods and intensity are discussed.

I. Active Sentinel Compartments with High Risk Factors for Exposure to HPAI

A. Identifying Risk Factors for Active Sentinel Flocks

1. Premises located near natural wetland areas (within 2 to 5 miles) where waterfowl congregate (i.e., USFWS waterfowl management areas) OR premises located in counties immediately surrounding wetland areas identified by one of the four U.S. Flyway Councils where priority waterfowl species congregate.
2. Premises where fancy fowl and other non-commercial poultry are moved on and off premises to shows, fairs, swap meets, trade, or exhibitions, etc., and returned to the premises five times per year or more, or where the flock owner has taken at least one international trip per year with exposure to poultry.
3. Premises located in areas with high densities of backyard or other non-commercial flocks (i.e., geospatial methods using surrogate data may be used to locate areas most likely to have high densities of backyard poultry).
4. Premises where poultry are allowed free range (i.e., not always kept within a fenced enclosure) and are free to leave the premises.
5. Premises located where wild waterfowl are frequently observed on the property or where there is a farm pond on the property.
6. Premises where visitors who have had poultry exposure are allowed direct access (contact with birds) to poultry.
7. Premises where waterfowl are raised for release.

B. Sampling Intensity and Methodology for Active Sentinel Flocks

1. Every State has at least one large waterfowl management area (e.g., Illinois has only one) and many States have several. One to five surveillance sites per State may be a reasonable estimate (e.g., large States like Texas and California may have five sites; most will have one to two.)
2. The timing of sample collection will vary by geographic area (location along a flyway). For example, sentinel flocks adjacent to some waterfowl management areas may be most at risk of AI introduction by migratory birds because they are used as stopover points during spring or fall migration seasons (e.g., Prairie Pothole region of the northern Great Plains during late summer and early fall as juvenile birds emerge and congregate) while others may be most at risk in winter months (e.g., Texas and Louisiana from September through February where birds congregate to overwinter). Recommendations from State WS Directors and USFWS biologists will ultimately be required in order to time sample collection with periods of highest probability of disease occurrence at specific locations. Reasonable estimations for six U.S. regions can be made to account for temporal factors that must be considered in overall sample strategy (i.e., generally, States in the south central region should do surveillance during winter months, etc.).
3. Exposure of species not listed on the “primary” or “secondary” species list through infected common water sources is considered likely. States may choose to conduct surveillance at sites with significant concentrations of waterfowl that are not

designated “primary” or “secondary” species. The National Audubon Society’s “Important Bird Areas Program” lists breeding, wintering, feeding, and migration sites for species that occur at high density based on their congregatory behavior.

4. The Geographic Information Systems Team at the Centers for Epidemiology and Animal Health is available for phone consultation to assist States with implementation planning and risk mapping to identify geographic areas likely to have significant concentrations of backyard flocks once high-risk areas are identified.
5. Since exposure to waterfowl is not the only risk factor for disease introduction, other temporally related risk factors for sentinel flocks warrant surveillance visits outside the migratory waterfowl seasons outlined above. These include frequent introductions into the flock, frequent visitors on the premises, or frequent attendance at exhibition events.
6. The infectious period for avian influenza is generally considered to be 21 days. For early detection, active sentinel flocks should ideally be visited and sampled every 21 days throughout the period of highest risk, either for migratory bird exposure or the show/fair season. Obviously, constraints on personnel and resources may not allow for frequent premises visits. Another approach might be to divide surveillance visits among the number of months within the transmission season.
7. The dynamics of disease transmission and estimated disease prevalence depend largely on proximity of premises with backyard flocks to each other and biosecurity practices. Sample size estimates based on estimated prevalence may differ according to how the target population is defined.
 - a) A multi-county area surrounding a large waterfowl management area may contain a number of discrete premises with backyard flocks (target population) and flock-to-flock transmission may not be efficient if distance between premises creates an ecological barrier. A lower flock prevalence estimate is reasonable. If an area flock prevalence estimate or detection limit of 10 percent or greater is chosen, 27 premises would have to be sampled in counties surrounding the target area in order to detect infection at a 95 percent confidence level. Once a sentinel premises is located, a within-flock prevalence estimate of 25 percent can be assumed. The number of birds to be sampled per flock is listed in Table 1.

Table 1. The sample size required for detecting disease within backyard flocks at 25% prevalence with 95% confidence.

Number of Birds in the Flock	Sample Size
10	7
20-30	9
40-120	10
>120	11

- b) In contrast, multiple premises located immediately adjacent to a large reservoir or farm pond could be considered to be one flock. These premises may be contiguous and share fence lines, or the source of exposure is considered likely to be common (i.e., flock of infected mallards or contaminated pond water). In this case, all individual premises would be considered to be a single “flock” and a lower within-flock prevalence is assumed. Given a 10 percent prevalence estimate, samples from 29 individual birds from this exposure area would detect infection at a 95 percent level of confidence.

II. Opportunistic Sampling at Shows, Fairs and Fancy Fowl Exhibits and Swap Meets

- A. Introduction of H5N1 may occur on any property with poultry. Poultry with exposure to other poultry are at increased risk compared to backyard poultry with limited exposure to other birds.
- B. Sampling at concentration points provides a valuable opportunity for surveillance of birds from flocks with representation over a wide geographic area.
- C. Birds exchanged at swap meets have potential exposure to disease; also, birds at swap meets may be sold for food. Listed is a prioritized sampling strategy for swap meets based on risk.
 - 1) Sick birds.
 - 2) Most active traders.
 - 3) Random sampling from all vendors at the event.
- D. Healthy birds are typically exhibited at fairs and shows. Birds at shows may be available for testing with consent of their owners. Owners may be most receptive to having samples collected from the birds by tracheal and cloacal swabs and likely will be reluctant to provide birds for blood collection due to the risk of hematoma or damage to feathering. The following is a suggested approach to prioritized sampling at fairs and shows based on risk.
 - 1) Sick birds identified by show officials (typically identified by fair officials at show registration and isolated or refused entry).
 - 2) Bird owners who have traveled to other shows or exhibitions once or twice during the past month.
 - 3) Birds from flocks with recent introductions (within past 21 days).
 - 4) Birds present at the show the longest amount of time (multi-day event).
 - 5) Ducks and geese.
 - 6) Random sampling at shows at check-in (sample of all owners).
- E. Many States already require testing for pullorum either pre-movement or at fairs and shows. AI testing could be accomplished at the same time. In States not requiring or enforcing pullorum testing, eggs could be collected at fairs and shows for AI antibody testing.

III. Passive Surveillance Data

- A. Samples from flocks experiencing mortality are of highest value irrespective of risk factors.

- B. Flock owners should be encouraged to submit dead birds to local diagnostic laboratories for necropsy and testing. These activities should be linked with the USDA/VS “Biosecurity for The Birds” campaign and owners should be informed that most States will complete a full necropsy at no charge to the owner or with a cost offset, providing valuable information on flock management practices and disease status.

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