Guidelines for Local Agencies Conducting Plague Surveillance and Control in California

2023

The primary goal of a public health plague surveillance program is the early detection of plague activity and conditions that may present increased risk for disease transmission to humans. The California Department of Public Health, Vector-Borne Disease Section (CDPH/VBDS) strongly recommends that local agencies conducting plague surveillance and/or control operations consult with and work collaboratively with VBDS. The following summary and recommendations are provided to help ensure appropriate evaluations and risk reduction measures are implemented.

Executive Summary

- CDPH/VBDS does not recommend routine surveillance for *Yersinia pestis* in rodents or fleas outside of current plague endemic areas (see endemic map on page 5). This recommendation is based on decades of environmental surveillance, findings from published literature, and distribution modeling.
- Due to the ecology of plague in California, serological testing of select rodent and carnivore species is the best method for routine monitoring of plague activity. Serological surveillance alone should not be used to determine increased plague risk but should be supported by other surveillance methods (e.g., rodent and burrow counts, observation of rodent die-offs, flea collections) along with testing of vector flea species and rodent carcasses when/where applicable.
- PCR testing of animal tissues for *Y. pestis*, other than from cultures of suspect specimens (e.g., dead or dying rodents from a plague endemic area) is not an efficient or reliable diagnostic method. Furthermore, testing of potentially infectious samples may require enhanced biosecurity levels and adherence to other regulations.[1]
- Contact CDPH/VBDS if there is suspicion or indication of increased plague activity in a specific area, or if you have questions regarding the need for local plague surveillance or control efforts.

Routine environmental surveillance

- Plague surveillance should be limited to endemic areas—see the California Compendium of Plague Control[2] and consult with VBDS staff for specific regional information.
- In recent decades, plague is found in focal areas typically in foothill and mountainous areas of the state (see endemic map on page 5). Urban transmission of plague has not occurred in California since 1925. Plague surveillance outside of currently recognized endemic areas is not warranted without evidence to suggest its reintroduction. Consult with VBDS biologists to determine areas suitable for surveillance.
- Testing should be limited to species typically involved with plague transmission in California—see Submission Criteria for Rodents and Wild Carnivores.[2] Testing of

commensal rodents (*Rattus and Mus)*, eastern gray squirrels, or fox squirrels is not warranted without evidence of plague activity in the local area (e.g., major rodent die-off or human case).

- To properly evaluate the presence or level of plague activity in an area, attempts should be made to sample all rodent species involved with local plague ecology. This typically requires full day and overnight trapping and use of various sizes and types of live traps to successfully sample relevant rodent species (e.g., ground squirrels, chipmunks, and woodrats).
- Serological testing should be used to determine animal exposure to *Y. pestis*. Because antibodies to *Y. pestis* typically persist in mammals for weeks to months after exposure, serological tests allow for a greater window of detection, thereby increasing the likelihood of detecting animals recently exposed to *Y. pestis*. Molecular testing (e.g., PCR) may only detect DNA in blood or tissue when an animal is actively infected and will likely result in few or no detections, particularly in live rodents and even when sampling in plague endemic areas. Furthermore, testing of potentially infectious samples and/or necropsies of rodents or carnivores collected for plague surveillance must be conducted under biohazard security level 3 (BSL 3) conditions and the storage, use, and transfer of any diagnostic plague samples (other than Nobuto strips) may require registration and approval by the Federal Select Agents Program.[1]
- Positive serological tests from a single or few animals are not sufficient to evaluate current plague activity or assess human risk. Serological evidence must be evaluated with a more thorough environmental assessment to estimate the level of plague activity and current human risk—see Epizootic Investigation below and the California Compendium of Plague Control.[2]
- Fleas taken from rodents or collected from burrows should be identified to species to assess abundance of known or suspected vectors.
- If serological testing or other surveillance indicators suggest increased plague activity in an area, fleas should also be collected for testing and to assess abundance. Plague-positive fleas are difficult to obtain, even in plague endemic areas and during epizootics. As a result, flea testing should be secondary or complementary to rodent testing. Consult with VBDS biologists for requests for flea testing and/or assistance with flea identification and submission.
- Detection of plague bacteria in rodents or their fleas confirms current plague activity and should prompt an immediate follow-up investigation and risk evaluation.
- CDPH collaborates with other agencies to obtain carnivore samples to test for antibodies to *Y. pestis*. However, detection of antibodies in carnivores does not necessarily indicate that plague is active in the area where the sample was obtained. Detections in carnivores should be interpreted with caution and should only be used as a regional indicator of plague activity.

Evaluating Plague Activity: Epizootic Investigation and Risk Evaluation

When environmental surveillance detects plague or suggests increased plague activity, additional surveillance and a risk evaluation should be completed to help guide an appropriate public health response.

- An evaluation of current plague activity involves direct surveillance of rodent and flea populations to acquire additional evidence of increased activity (epizootic plague). The presence of multiple seropositive rodents (>25% of tested rodents) or the detection of plague bacteria in rodents and/or vector fleas indicates recent or current plague activity and potential for increased local transmission risk. Additional surveillance efforts should aim to confirm current plague activity and estimate the extent and magnitude of increase. The additional surveillance also provides an opportunity to help estimate human risk by evaluating the abundance and diversity of rodents involved in plague transmission and associated vector flea densities.
- Direct surveillance can be augmented by other (indirect) indicators of plague activity, such as documentation of rapid decreases in rodent populations (which requires prior knowledge of local "baseline" populations), evidence of burrow abandonment, fleas on the ground or in burrow entrances, or carrion flies emerging from or near burrows.
- Direct and indirect surveillance results should be integrated into a comprehensive risk evaluation which also considers: 1) recent plague history and current ecological conditions of the area, and 2) potential human exposure to infected animals and their fleas (type and degree of human activities and their proximity to plague activity or other identified risk factors)—see CDPH/VBDS plague surveillance evaluation form.[2]

Plague Control Activities

Plague control should be a collaborative effort between state and local public health authorities, county agricultural officials, and the appropriate land-use jurisdictional authority (e.g., USFS, state parks, BLM, DOD, other public agencies).

- The presence of active plague transmission closely associated with human activities may necessitate the suppression of potentially infective vector flea populations to rapidly lower the current disease risk. In these instances, temporary closure of recreational or other public-use areas prior to and during insecticide applications (or in lieu of applications) may be warranted.
- An area with one or a few seropositive rodents without other evidence of plague activity (e.g., positive fleas or rodent carcasses) does not necessarily indicate increased human disease risk or the need for flea suppression. Public education and continued monitoring are typically indicated in these circumstances.
- Limit flea suppression to areas of actual or potential human plague exposure. Routine and/or repetitive insecticide treatments can lead to the development of resistance and should be avoided.

- Exposure of the public and non-target wildlife to insecticides should be minimized during flea control operations. Insecticides used for burrow treatments or in bait stations must follow product label instructions and all other applicable laws and regulations. Insecticide treatments should continue a minimum of seven days before assessing control efficacy.
- Pre- and post-treatment flea counts are necessary to determine the efficacy of the insecticide application. Reduction of flea density to less than one flea per rodent host is considered sufficient to interrupt transmission to humans. Public use areas closed due to plague activity should remain closed until surveillance and control activities suggest the potential for human disease has been sufficiently mitigated.
- Managers of public use areas with potential for plague should be strongly advised to adopt an on-going integrated disease management program that includes habitat manipulation and sanitation methods to reduce rodent abundance. In some cases, additional rodent control measures (e.g., trapping, poisoning) may be warranted, but these activities should be directed by qualified and experienced professionals and should not precede flea control. Rodent control using toxic baits or fumigants is not a viable option to rapidly reduce plague risk—see California Compendium of Plague Control.[2]

Supporting documentation and recommended reading

[1] Biosafety in Microbiological and Biomedical Laboratories—6th Edition (cdc.gov)

[2] California Compendium of Plague Control
https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CAPlagueCompendium.pdf

Contact information

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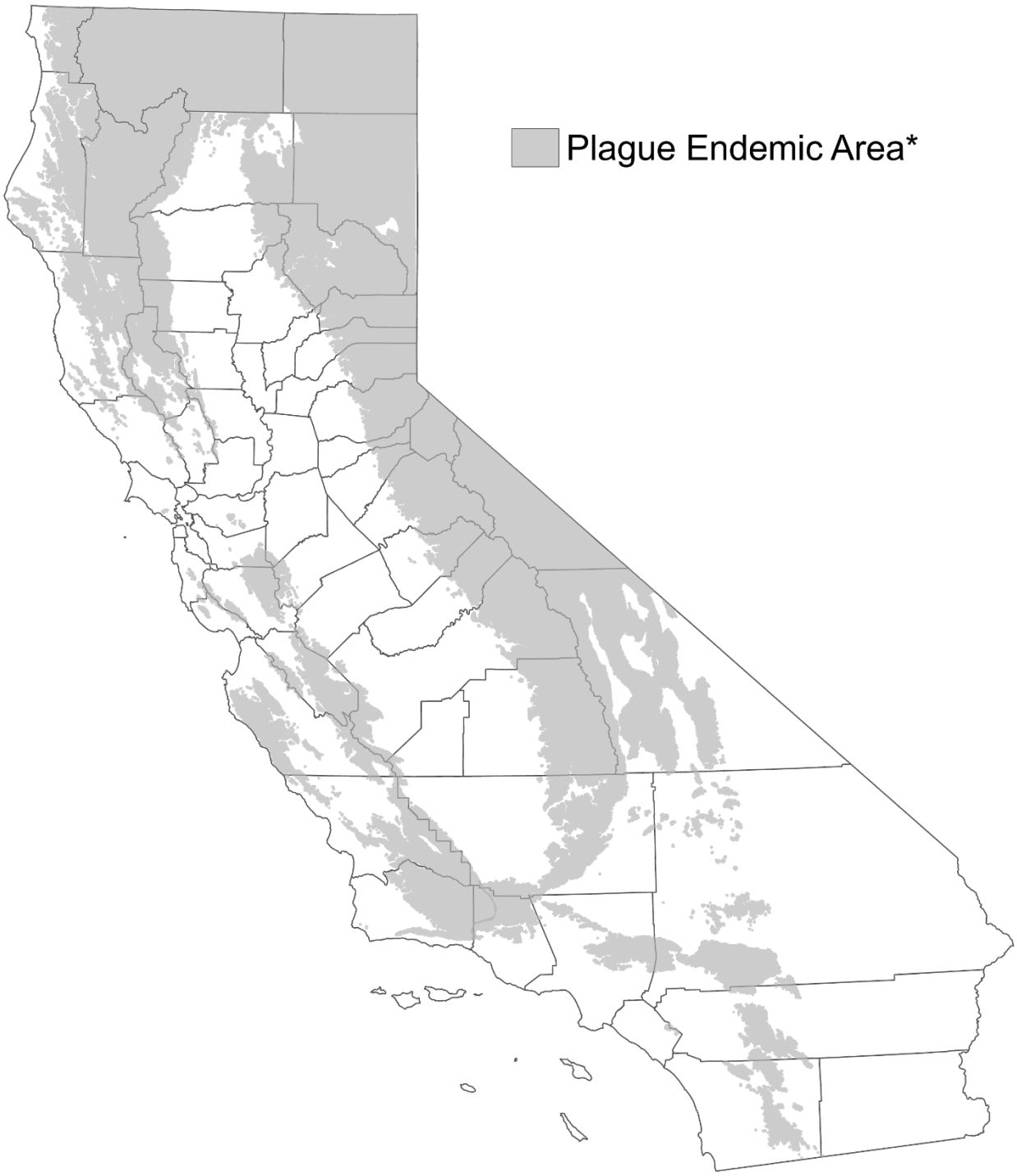

*Plague endemic areas in California are estimated based on the location of surveillance indicators (plague positive rodent or carnivore samples) collected from 1983-present, with appropriate regional elevation limits (e.g., > 3,000 feet for interior areas) and distance buffers.