Is timely discovery of an *Echinococcus multilocularis* outbreak possible?

Animal & Plant Health Agency

A simulation model of *E. multilocularis* surveillance in Great Britain

Budgey, R., Smith, GC. NWMC, APHA, Sand Hutton, York, UK YO41 1LZ

Fig 1. A fox carcase being examined for disease at APHA

Introduction

The UK, and other nations in Europe, carry out surveillance of foxes (*Vulpes vulpes*) to demonstrate freedom from *Echinococus multilocularis*, a parasite that causes a nasty disease in humans, but could it be found in time to achieve eradication?

Detection must occur within 10 – 15 years of introduction, as after this the complex biology of the parasite means eradication is probably not feasible[1]

Method

We simulated GB's current surveillance strategy and four alternatives based on risk of introduction (dog density) or establishment (fox and vole density) and a random distribution. We overlaid these on simulated disease spread to estimate the probability of disease discovery under each strategy within 15 years of introduction.

We also simulated increasing the number of carcases collected each year to see if discovery is possible in the 15 year window with reasonable effort.

Results and Discussion

The current surveillance strategy, although appropriate for demonstrating freedom from disease, achieved less than 5% probability of timely discovery (figure 1). No strategy achieved greater than 32%, too low to give confidence that disease could be easily eradicated once found.

Surveillance in Great Britain aims to achieve good coverage of the whole country, however carcasses are sourced from farmers and pest controllers, so spatial coverage may be compromised.

The better performance of a randomly distributed sampling pattern suggests that current convenience sampling is biased towards unproductive areas.

Basing sampling on risk of establishment (fox and vole density) or risk of introduction (dog density), improves the chance of timely discovery.

Increasing the number of carcasses collected improves the probability of detection. collecting 1000 carcases per year based on dog gave 32% probability of discovery within 10-15 years.

Extrapolating from these results suggests that 90% probability of timely discovery could be achieved with 4,300-4,800 carcases in a year.

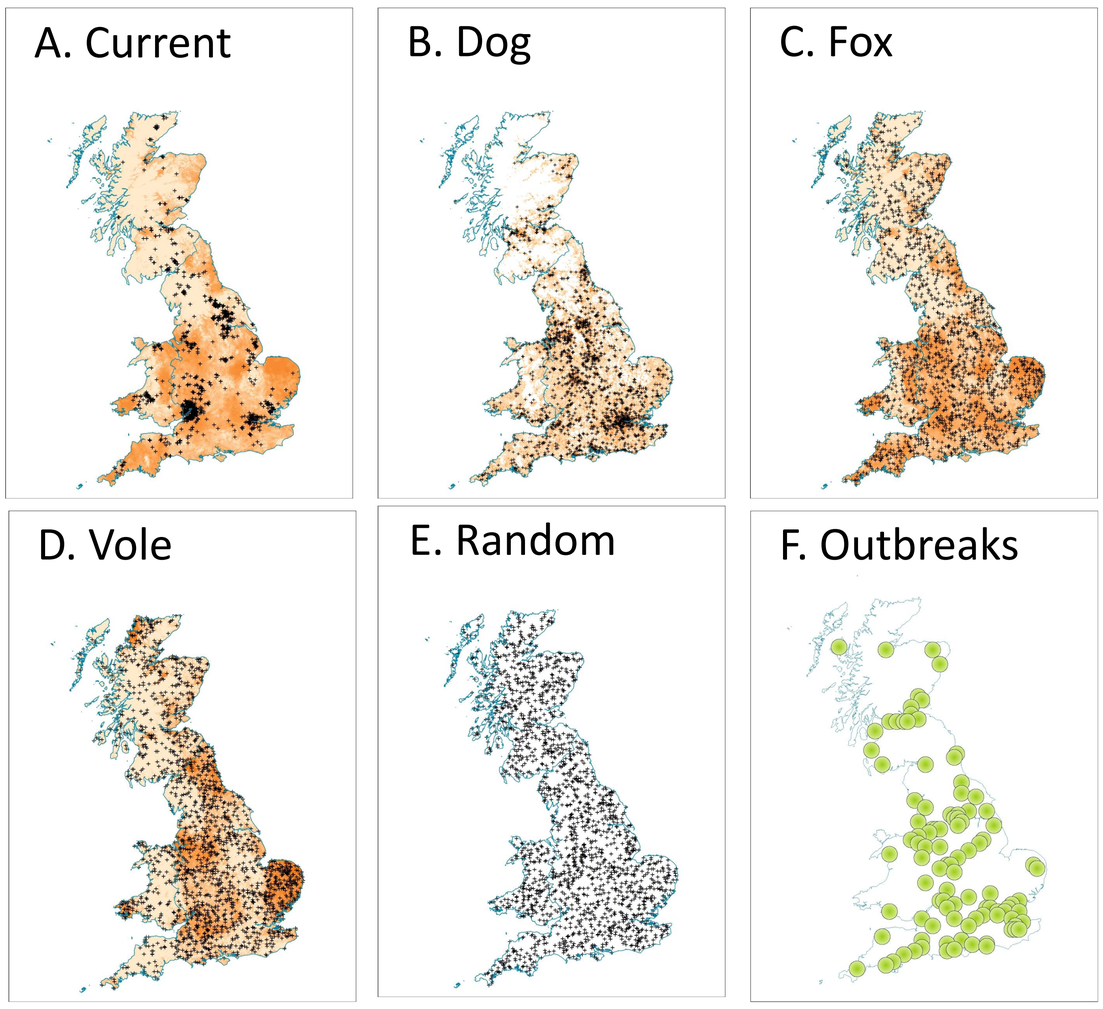

Fig 2 A-E Distribution of carcases overlaid on animal density (current is shown on fox density); F. location of simulated disease outbreaks

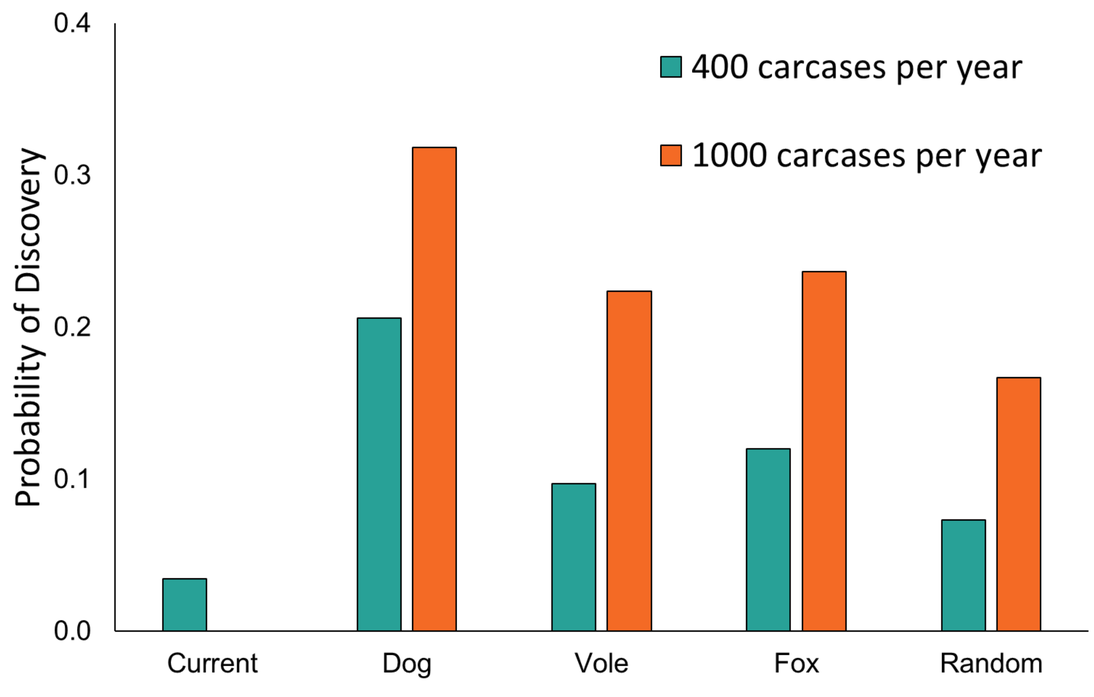

Fig 3. Probability of timely discovery, when 400 or 1000 carcases were collected each year.

References

1. Budgey, R., Learmount, J., Smith, G.C., 2017. Simulating control of a focal wildlife outbreak of *Echinococcus multilocularis*. Veterinary parasitology 237, 47-56.