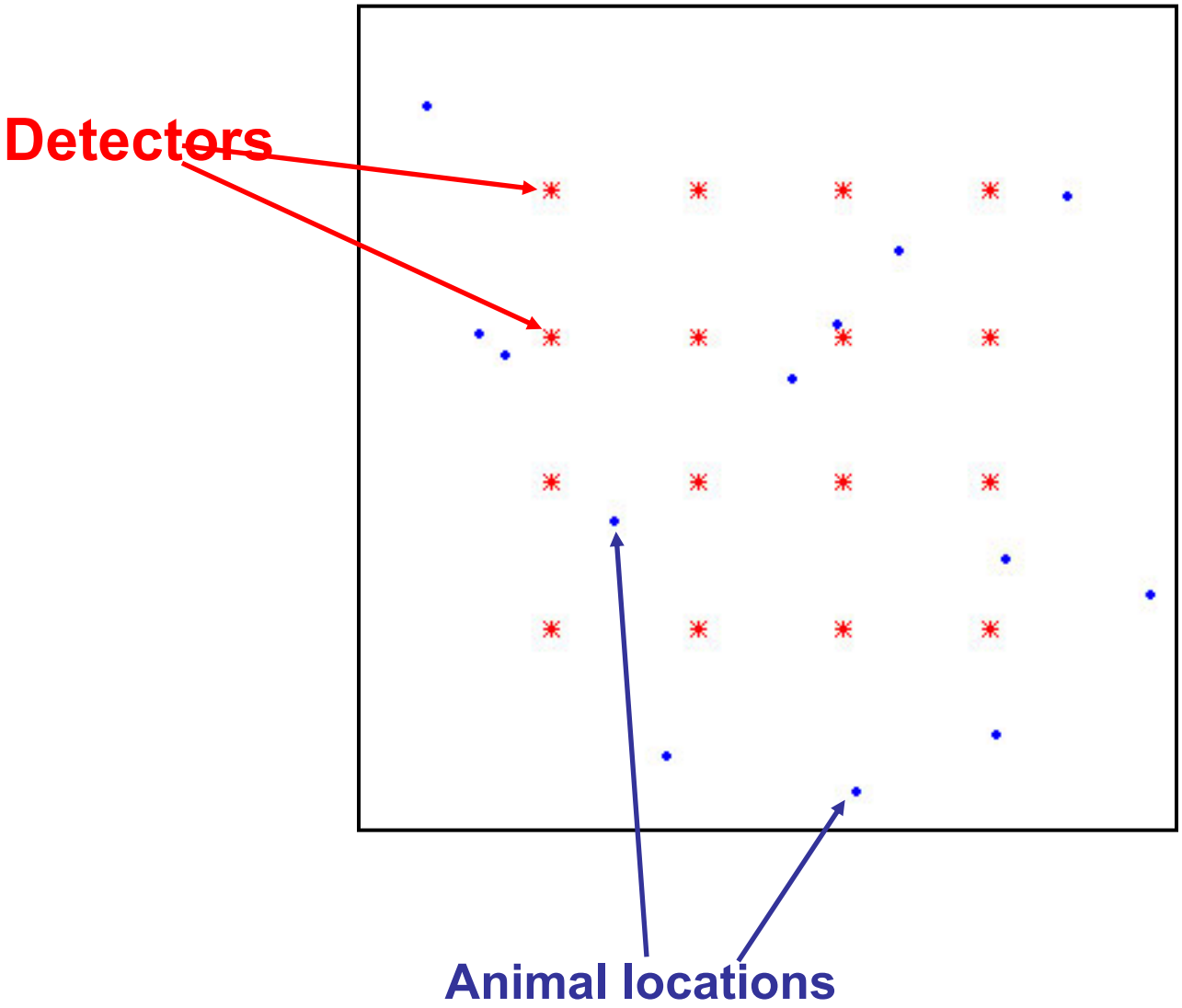
# Spatial Capture-Recapture

# Scenario



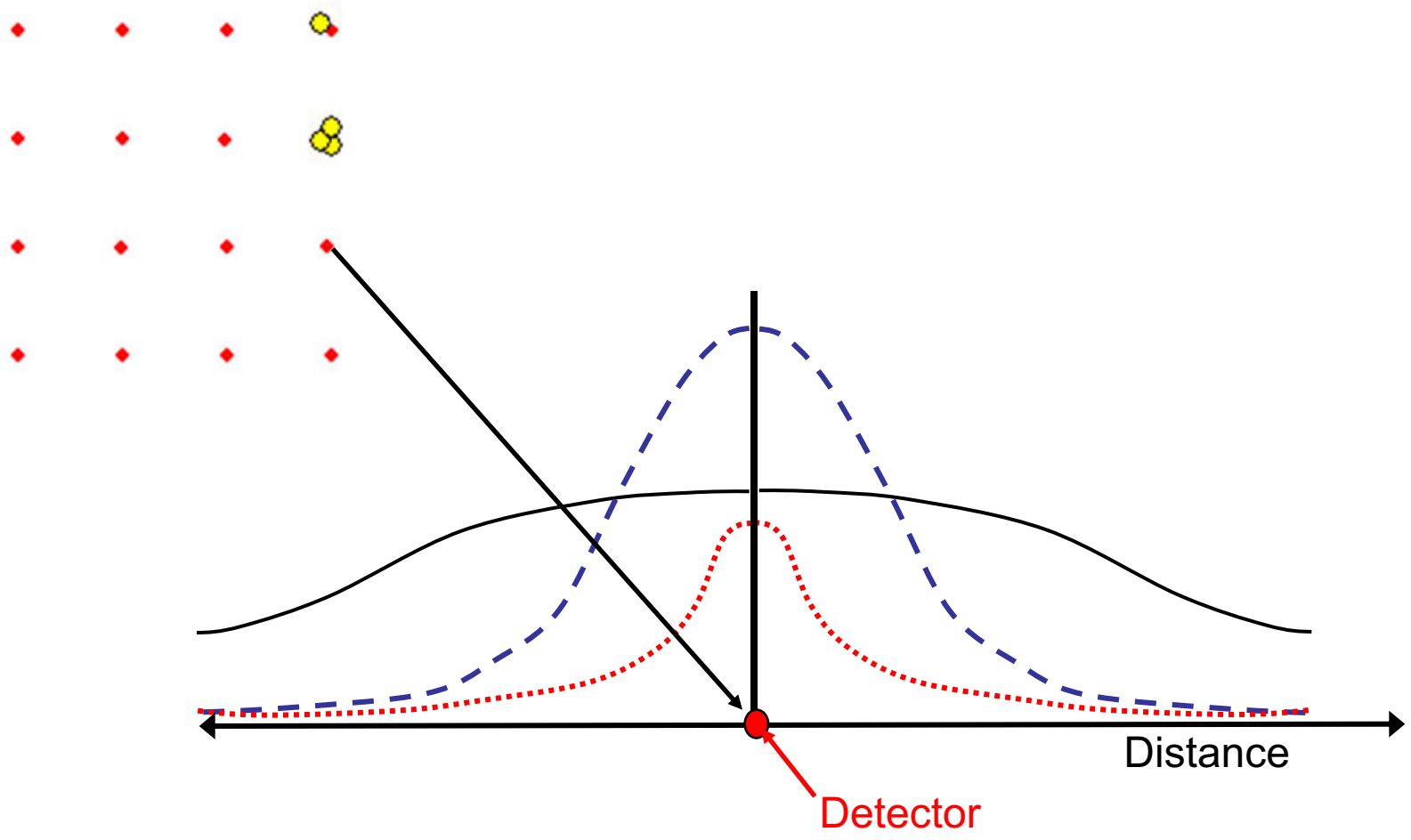
# Effective area? – No Problem: bread & butter to Distance Samplers!

- This is just MRDS Point Transect Survey

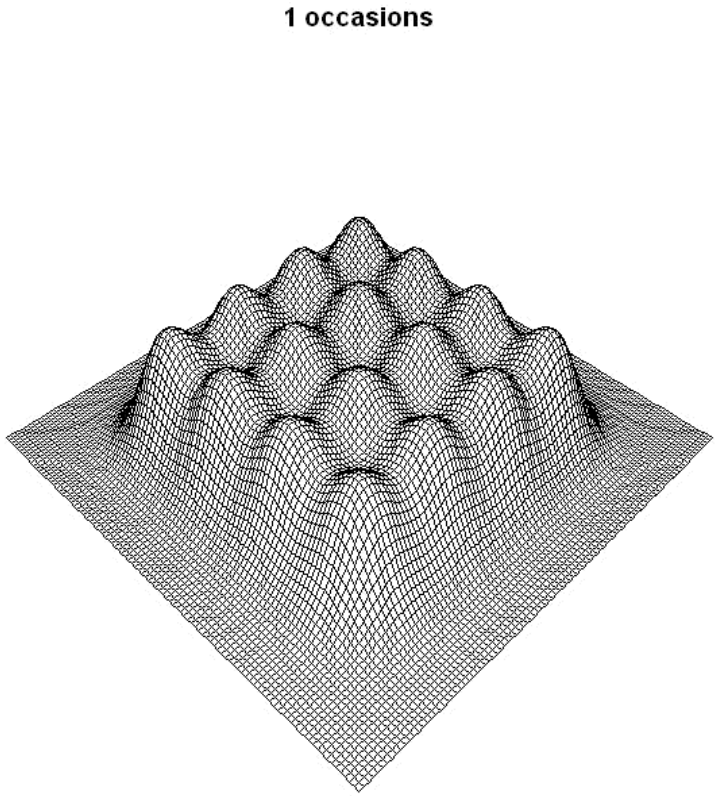
| | Detector | |
|---|---|---|
| ID | 1 | 2 |
| 1 | 0 | 1 |
| 2 | 0 | 0 |
| 3 | 1 | 1 |
| 4 | 0 | 1 |
| 5 | 1 | 1 |
| | etc. | |

- … but with lots of points, (and sometimes counts instead of 0/1 data)

# Detection function

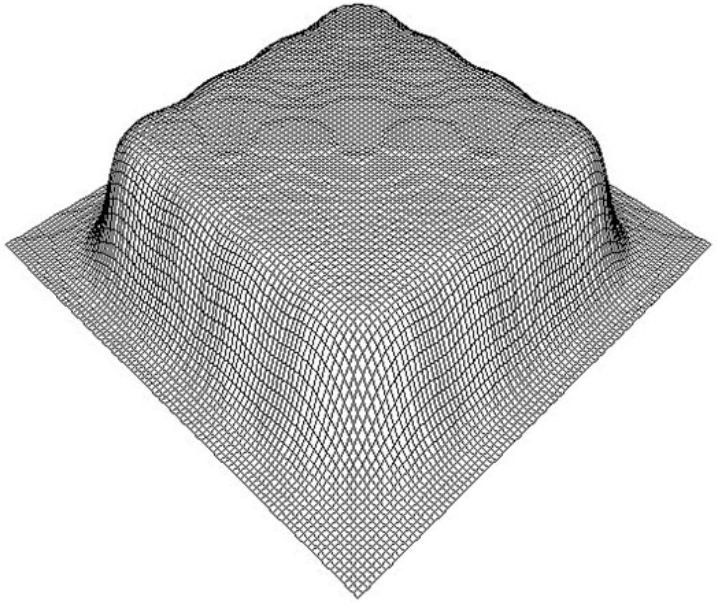


# Combining across detectors and occasions



# Combining across detectors and occasions

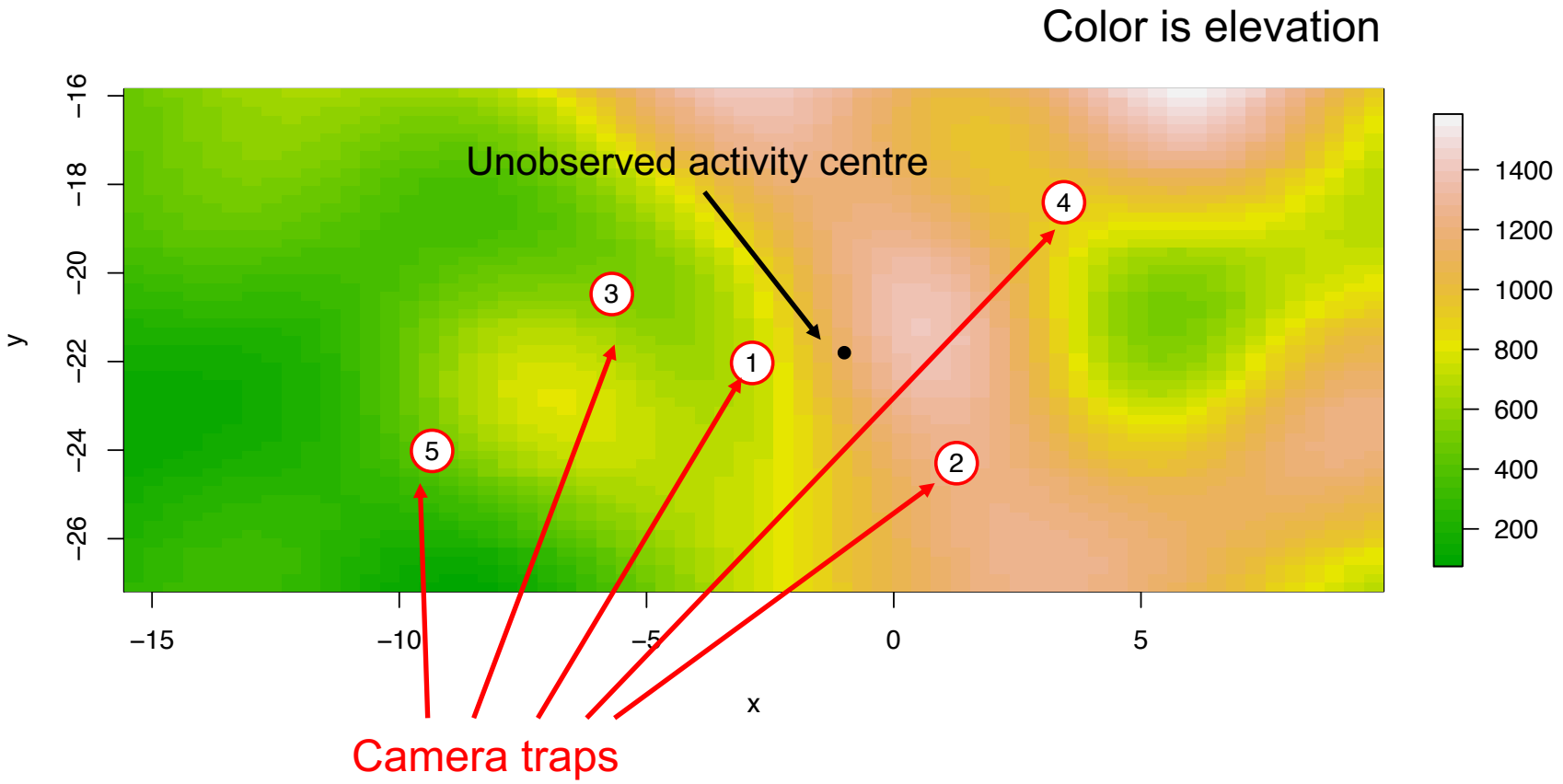
$$a = \int p_{\bullet}(\underline{\mathbf{X}})d\underline{\mathbf{X}}$$ is the area effectively sampled by detectors (if animal density constant in space).



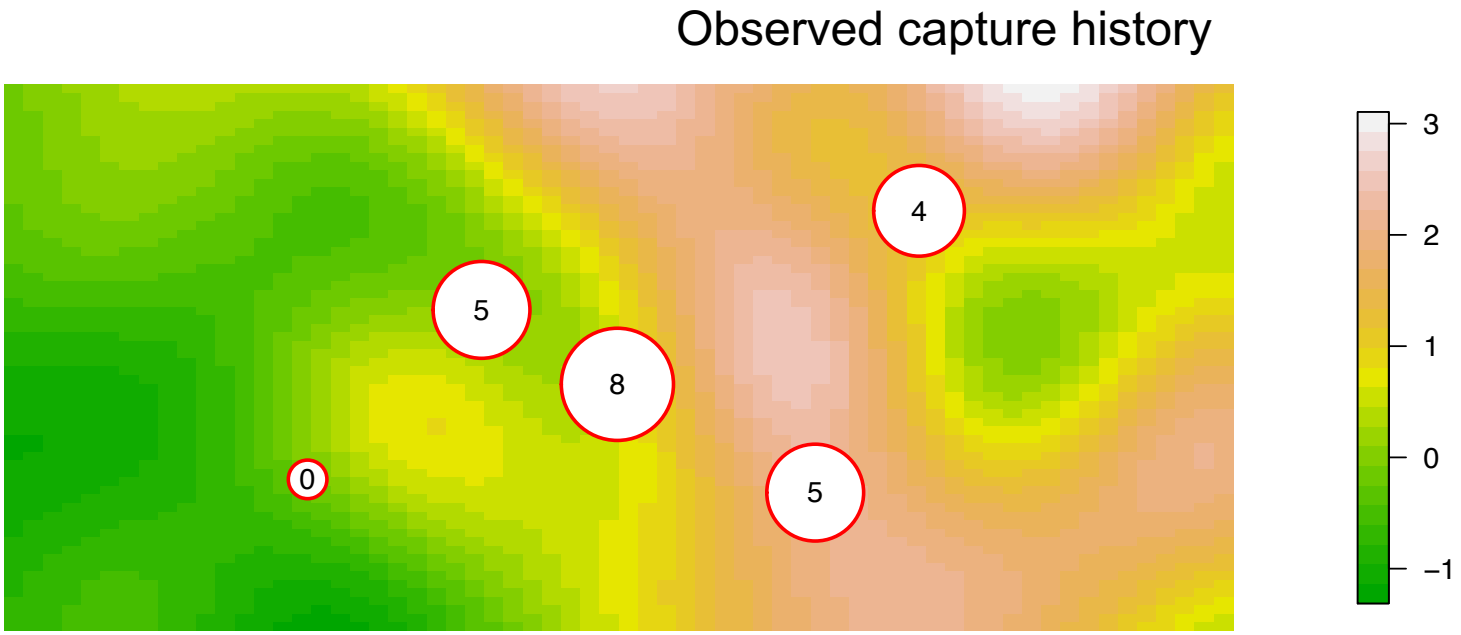
# Problem: Don’t observe distance, only observe capture location

- But locations of captures/non-captures contains information about detection probability and location/distance.
- Like a multiple-point point transect survey with errors in distance estimation.

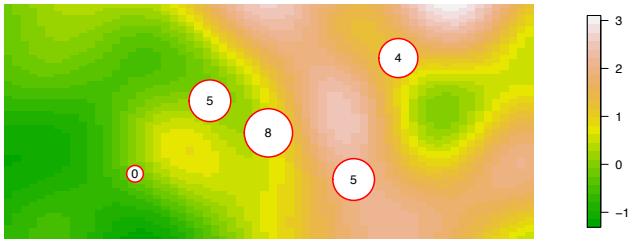
# Where is the information on location?



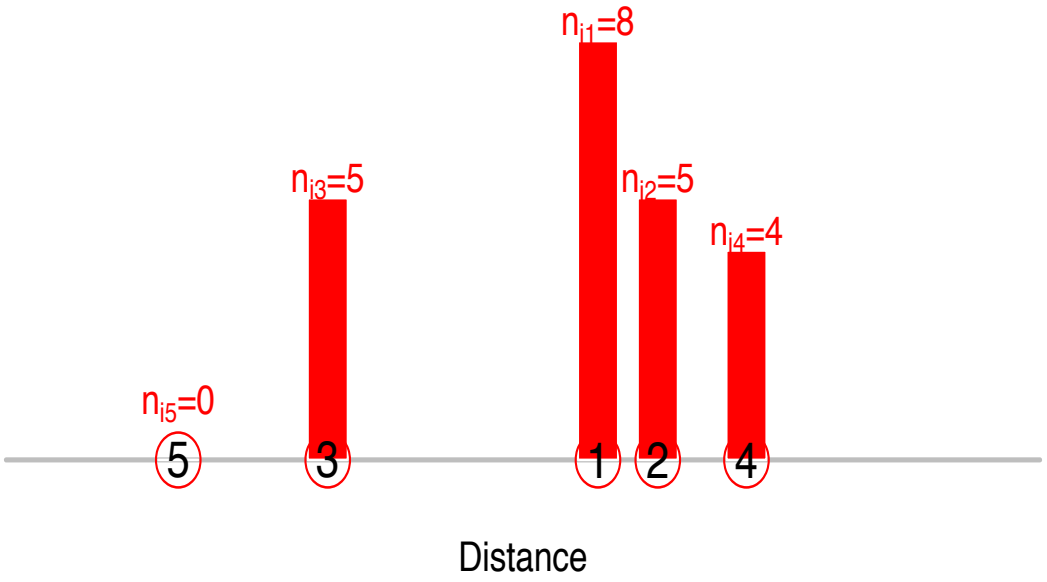
# Where is the information on location?



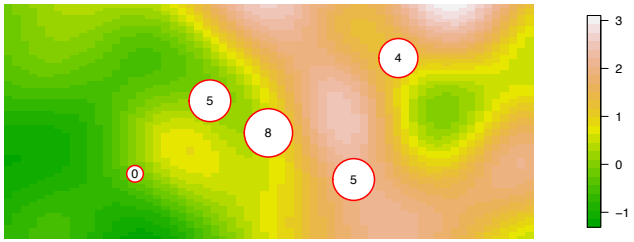
# Where is the information on location?

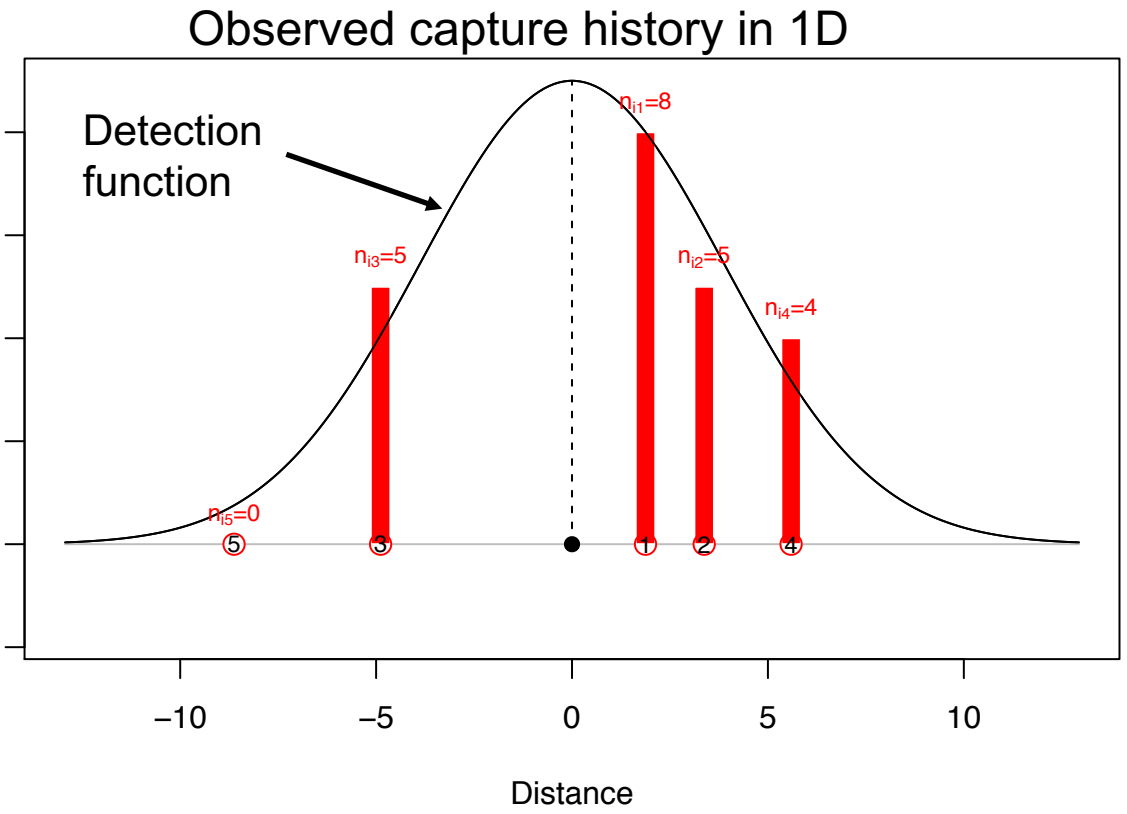



Observed capture history in 1D

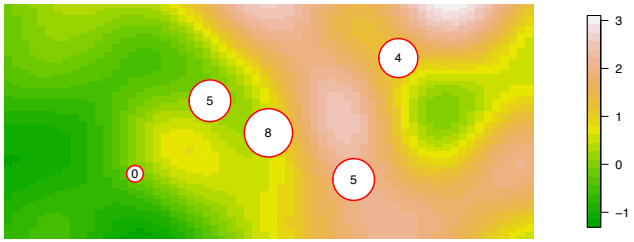


# Where is the information on location?

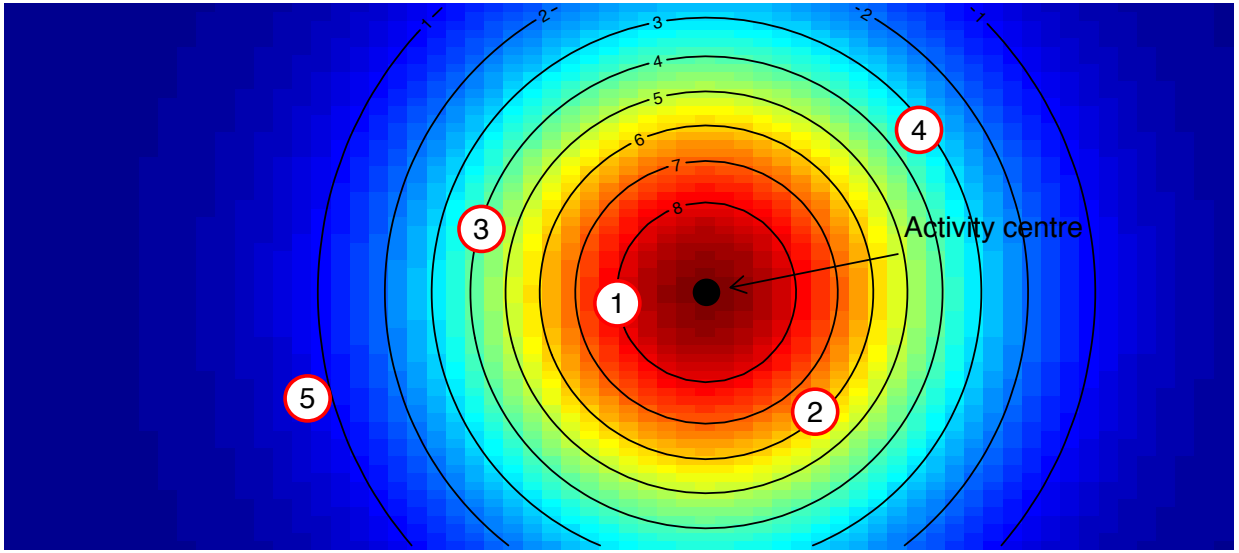


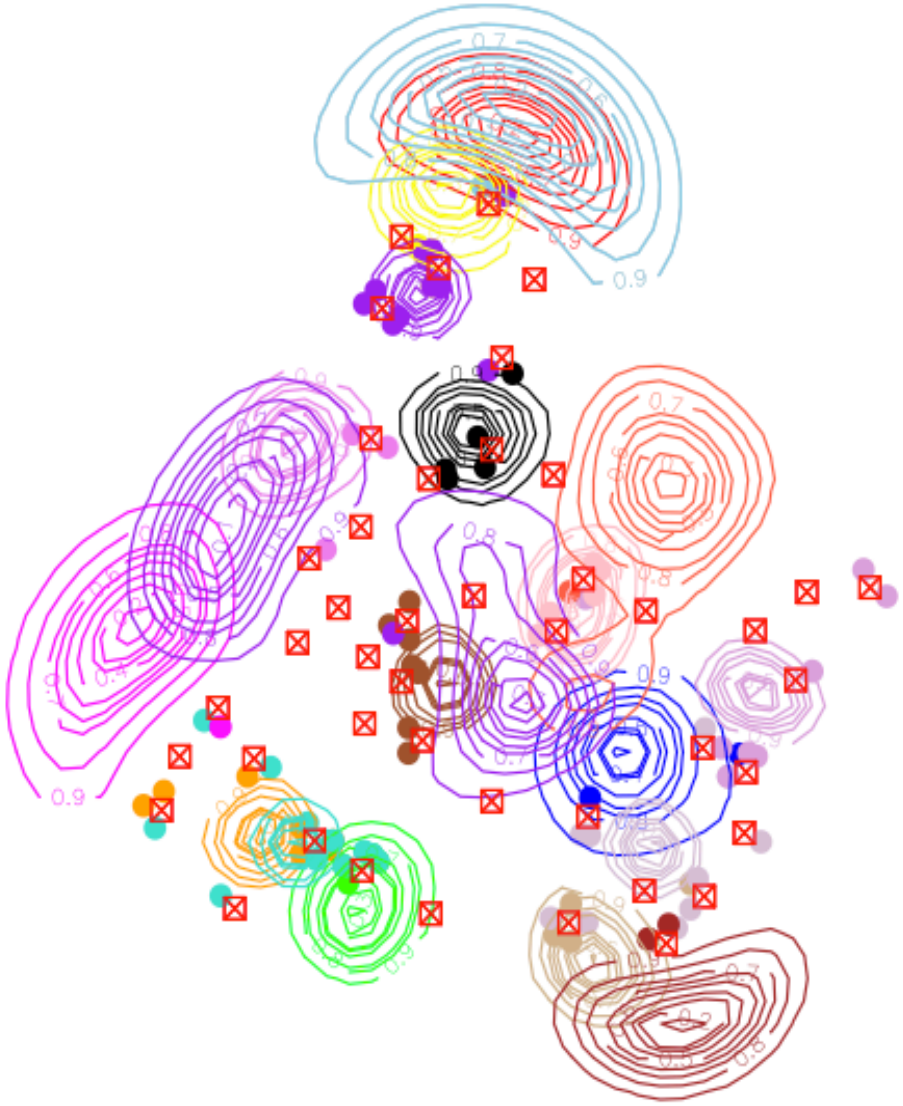
# Where is the information on location?



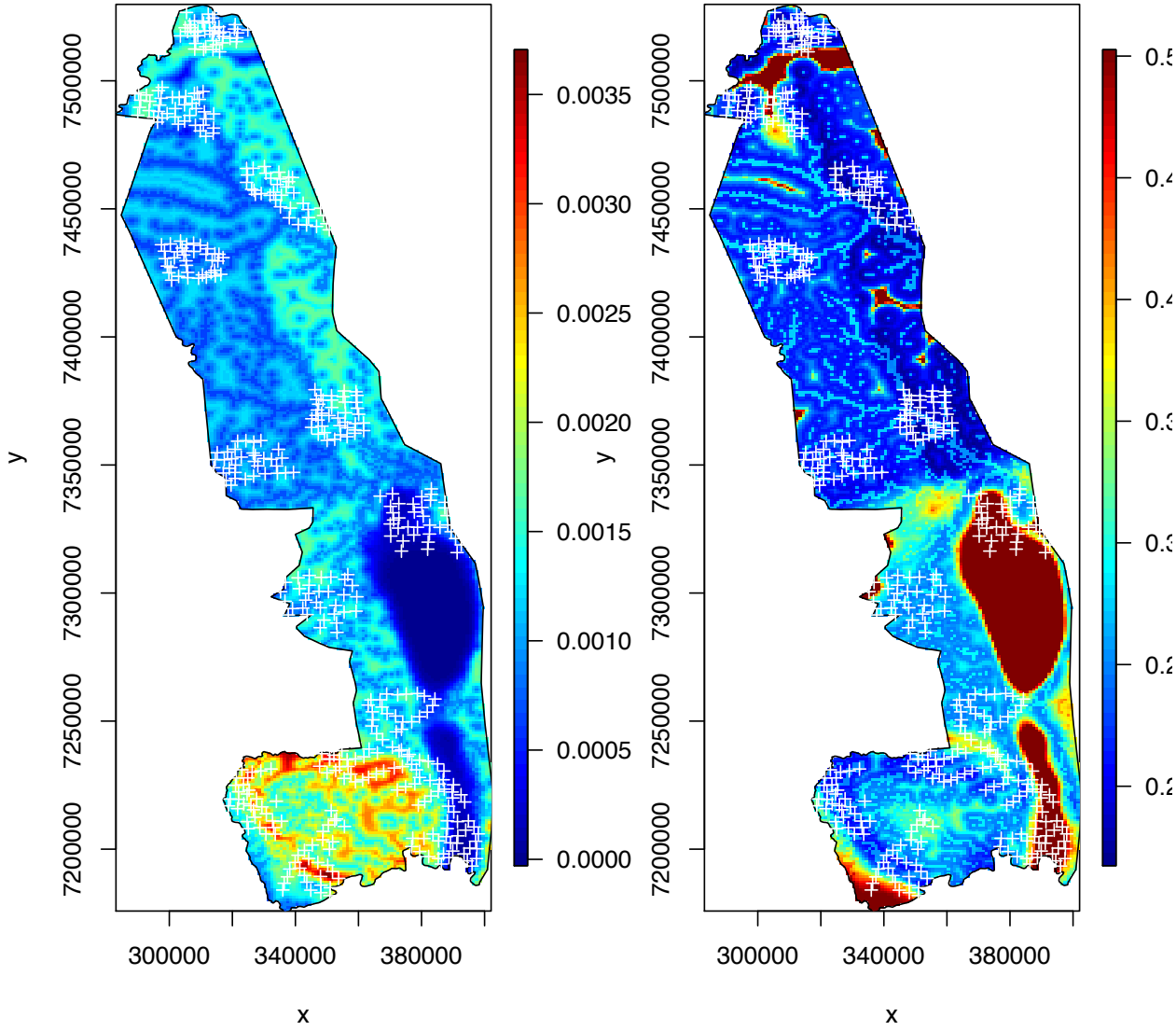

Detection function in 2D



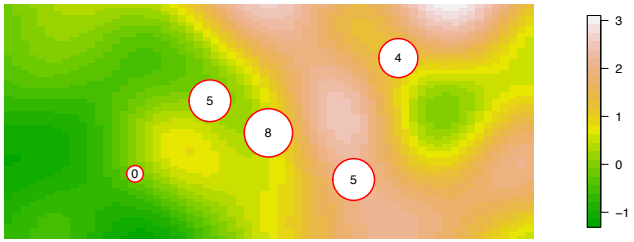
# (Can also predict locations after the event)

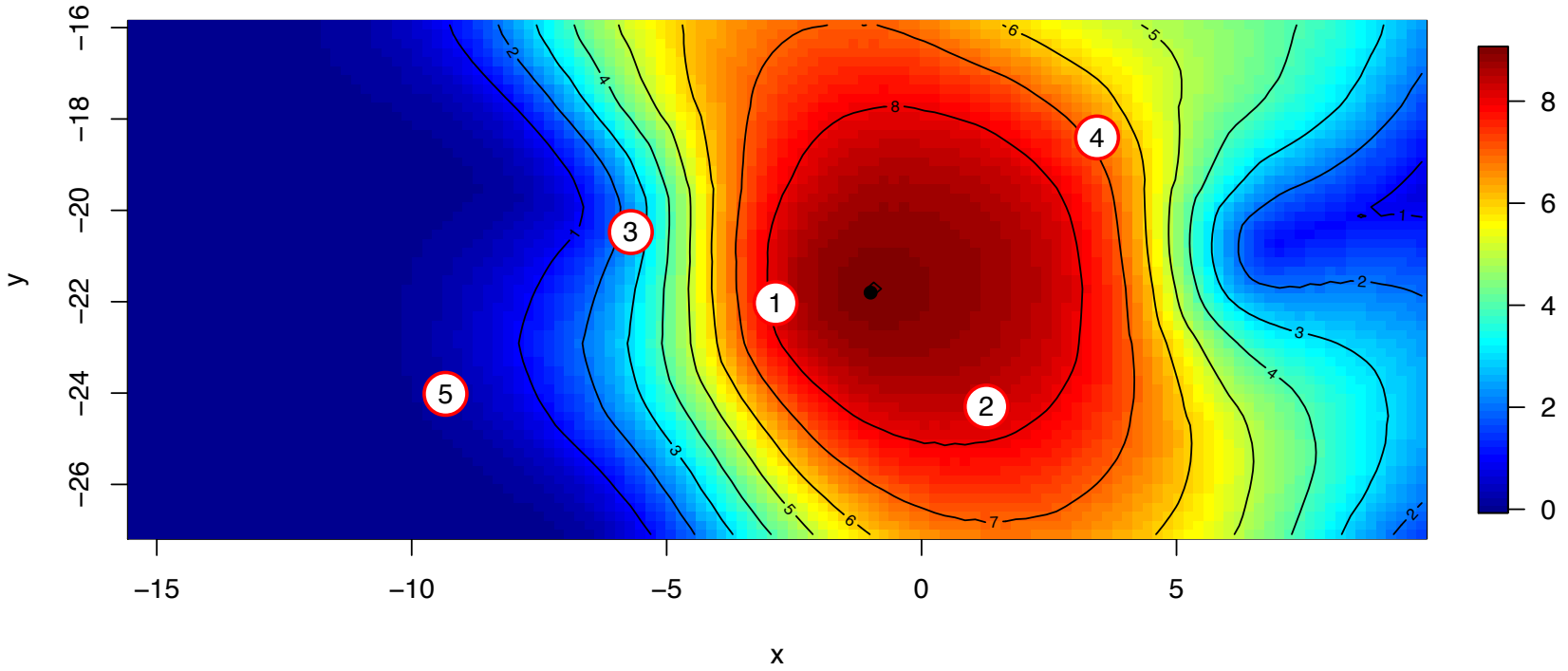


# Can fit Density Surface Models



# Can Model Habitat Use



# Mist-netting red-eyed vireo

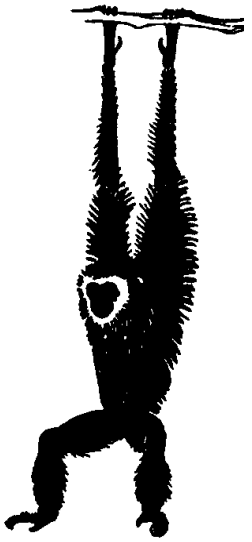
| Model index | Density model | Capture model |
|---|---|---|
| M1 | $D.$ | $hn(\sigma., h_{0.})$ |
| M2 | $D(y)$ | $hn(\sigma., h_{0.})$ |
| M3 | $D_y$ | $hn(\sigma., h_{0.})$ |
| M4 | $D.$ | $hz(\sigma., h_{0.})$ |
| M5 | $D(y)$ | $hz(\sigma., h_{0.})$ |
| M6 | $D(y)$ | $hz(\sigma_{\psi_2}, h_{0.})$ |
| M7 | $D(y)$ | $hz(\sigma., h_{0\psi_2})$ |
| M8 | $D(y)$ | $hz(\sigma., h_{0.})$ |
| M9 | $D.$ | $hz(\sigma., h_{0y})$ |
| M10 | $D(y)$ | $hz(\sigma_y, h_{0.})$ |
| M11 | $D(y)$ | $hz(\sigma., h_{0y})$ |
| M12 | $D(y)$ | $hz(\sigma., h_{0b})$ |
| M13 | $D_y$ | $hz(\sigma., h_{0b})$ |
| M14 | $D(y)$ | $hz(\sigma_y, h_{0yb})$ |
| M15 | $D(y)$ | $hz(\sigma_y, h_{0b})$ |

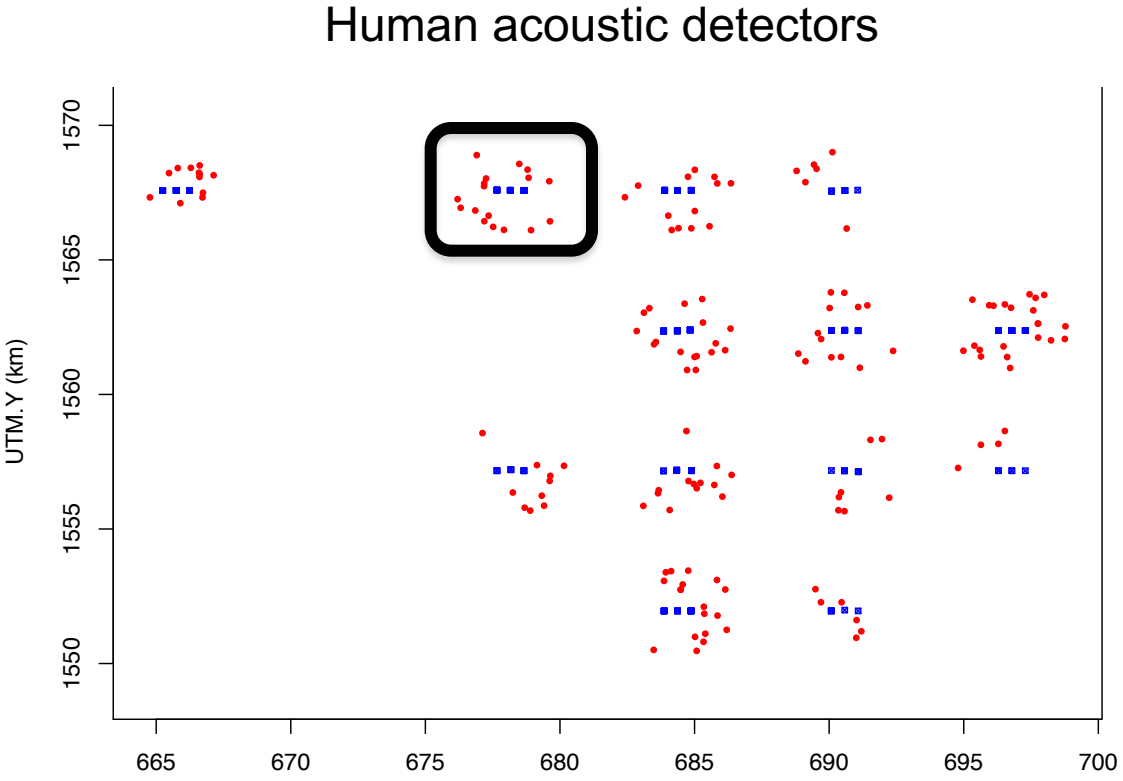
# Genetically capturing stoats

*Photographs: Bruce Warburton*

*Picture: Murray Efford*

# Acoustically Surveying Gibbons

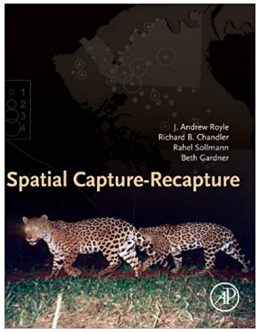




# Acoustically Surveying Frogs

# Summary

- Mark-recapture with distance detection function (and unknown distance)
- R library “secr” on CRAN (Murray Efford)
- Also Bayesian software




- R library “ascr” (Ben Stevenson) for acoustic SCR at https://github.com/b-steve/asecr/