

EFFECTS OF SEARCHER EFFICIENCY AND SURVEY COVERAGE ON THE PRECISION AND ACCURACY OF FATALITY ESTIMATES AND DETECTION OF RARE FATALITIES

**Gabriel Reyes; Meredith J. Rodriguez; Kenneth T. Lindke;
Katherine L. Ayres; Murrelet D. Halterman; Brian B. Boroski;
Dave S. Johnston**



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Account for fatalities missed due to imperfect searcher efficiency, scavenger removal, and partial survey coverage of a site

Fatality Estimates

Huso Estimator

$$F = \frac{C}{rpv}$$

C =Carcasses that you find on the landscape

r = Carcass persistence rate, estimated from trials

p = Searcher efficiency rate, estimated from trials

v = Proportion of interval effectively surveyed

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Scent Detection Dogs

Dogs as a tool to improve bird-strike mortality estimates at wind farms

João Paula^{a,*}, Miguel Costa Leal^a, Maria João Silva^a, Ramiro Mascarenhas^b,
Hugo Costa^a, Miguel Mascarenhas^a

^a Bio3 – Estudos e Projectos em Biologia e Valorização de Recursos Naturais, lda., Rua D. Francisco Xavier de Noronha, 37B, Almada, Portugal

^b INRB/INIA-URGRMA – Fonte Boa, Vale de Santarém, Portugal

Dogs increase recovery of passerine carcasses in dense vegetation

H. Jeffrey Homan

United States Department of Agriculture, National Wildlife Research Center

George Linz

United States Department of Agriculture, National Wildlife Research Center

Brian D. Peer

North Dakota State University, Bismarck, ND

A Preliminary Evaluation on the Use of Dogs to Recover Bat Fatalities at Wind Energy Facilities

EDWARD B. ARNETT¹

Bat Conservation International, Austin, TX 78746, USA

¹ E-mail: earnett@batcon.org

Purpose

Compare human-only and dog-handler search teams in locating fatalities

Use simulations to examine how changes in searcher efficiency and survey coverage impact accuracy and precision of fatality estimates, and probability of detecting rare species

Human Search Team



Dog-Handler Search Team



Field Methods

Industrial scale solar project in the Mojave desert

Human-only and dog-handler search teams surveying difficult, vegetated terrain

Field Methods



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Field Methods

-Large birds, >101g
(n=21 for dog-teams, 24 for humans)



-Small birds, <100g
(n=16 for dog-teams, 20 for humans)



-Feather spots, >10 feathers/m²
(n=226 for dog-teams, 26 for humans).

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Field Results

Searcher-efficiency rates

Empirical

Fatality type

Dog-

handler

Human

Feather spot

0.61

0.23

Small carcass

0.69

0.40

Large carcass

0.86

0.54

Field Results

Searcher-efficiency rates

Empirical

Hypothetical

Fatality type

Dog-

handler

Human

Low

High

Feather spot

0.61

0.23

0.05

0.75

Small carcass

0.69

0.40

0.20

0.90

Large carcass

0.86

0.54

0.30

1.00

Simulations

Total number of fatalities per fatality type

Proportion of area surveyed

Search interval

Carcass Persistence Rate

Searcher Efficiency Rate

Searcher Efficiency/Carcass Persistence Trials

Length of Study

Number of rare (e.g., endangered) fatalities

Simulation Parameters

Total fatalities = 1,000

76 Large Carcasses, 526 Small Carcasses, and 398 Feather Spots

Carcass Persistence =

Fatality type	Proportion persisting	Model parameters	
	through search interval	Shape	Scale
Feather spot	(<i>r</i>) 0.905	2	13
Small carcass	0.612	2	5
Large carcass	0.937	2	16

Simulation Parameters

Searcher efficiency: Four scenarios (two observed, two hypothetical)

Proportion of site surveyed: 10-100% of site, in increments of 10%

3 levels of rare species 1, 5, and 15 fatalities

Searcher efficiency, Carcass Persistence Trial sample size =100 per type

Survey interval =1 week

Study Length = 1 year

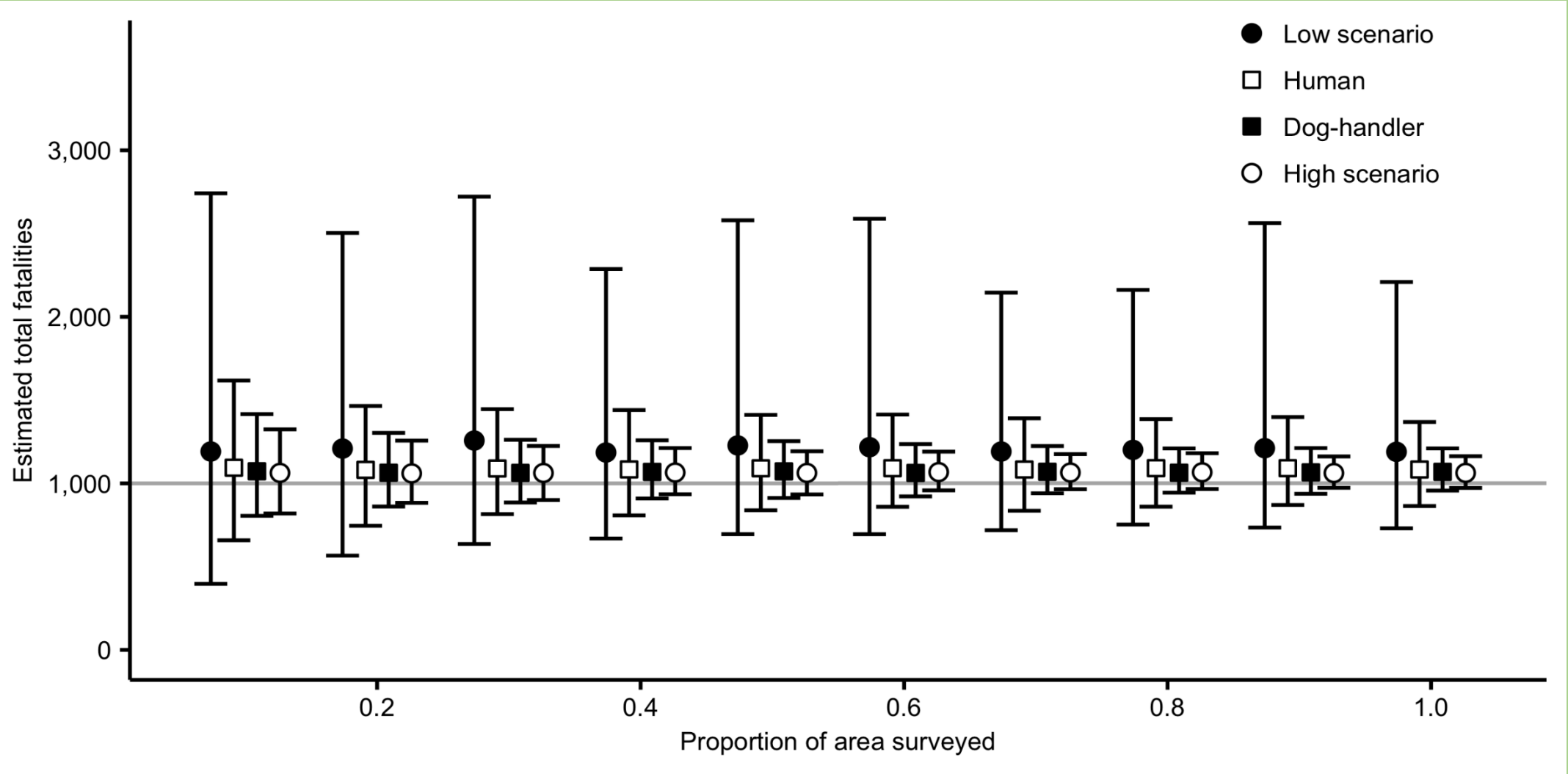
Assumptions

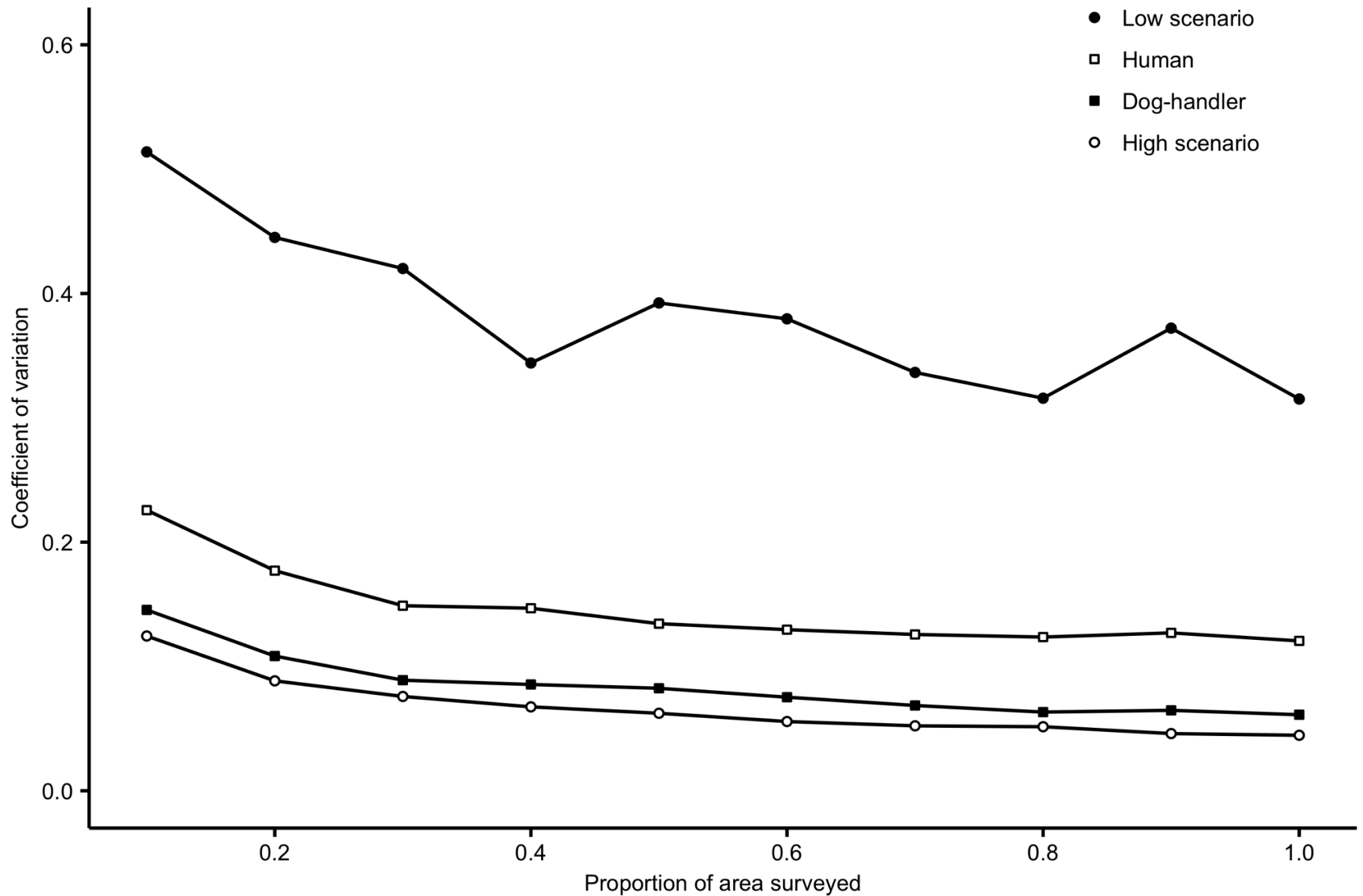
Fatalities are spatially and temporally randomly distributed

No seasonal effects on searcher efficiency/persistence

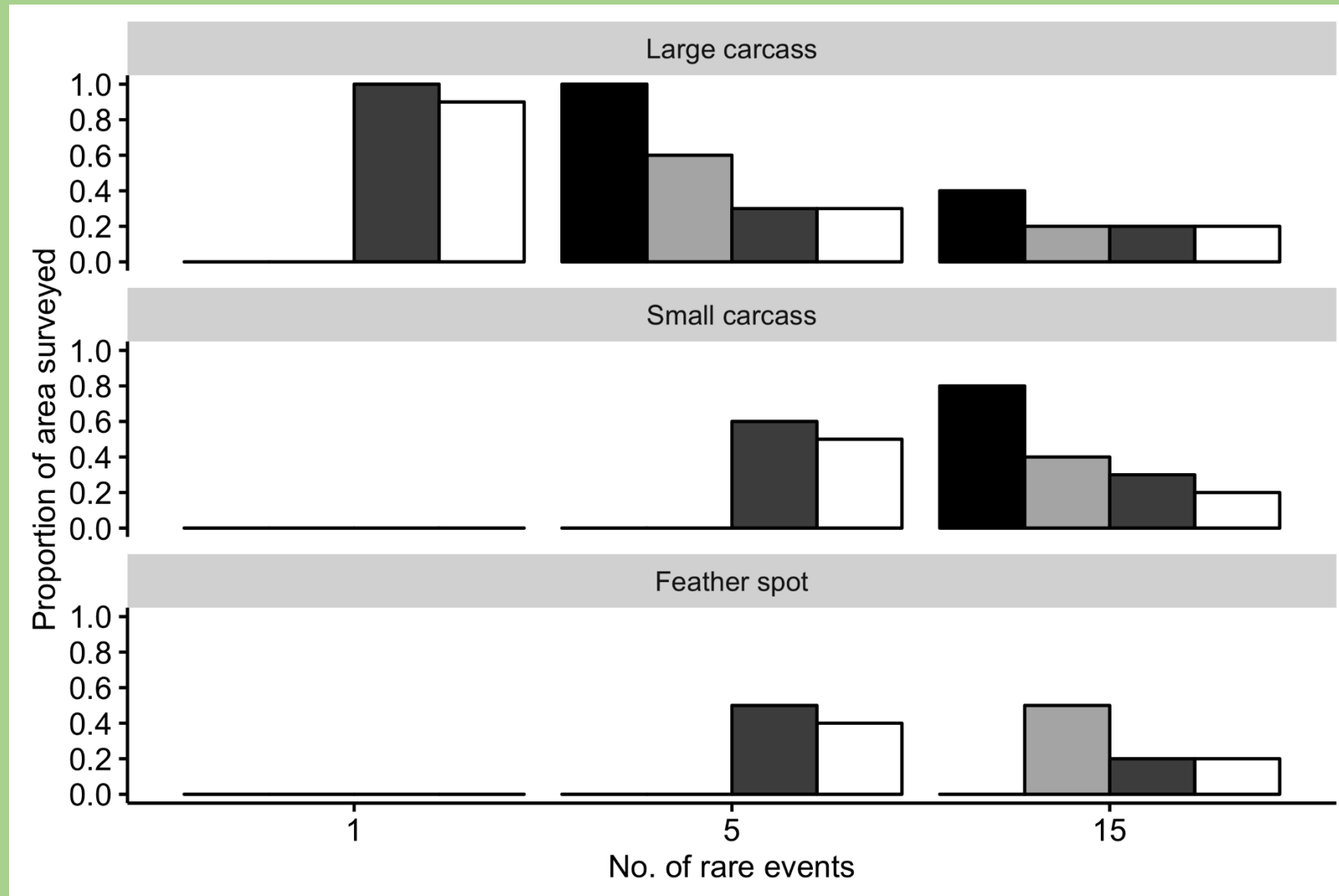
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Results





Survey Area Required to Find at least one Rare Fatality at least 80% of the time





Bias in Fatality Estimates

Searcher-efficiency scenario	Mean fatality estimate	Range	Percentage relative bias
High	1,063.7	1,059.9–1,067.8	6.4%
Dog-handler	1,067.3	1,062.7–1,072.6	6.7%
Human	1,087.8	1,081.1–1,093.9	8.7%
Low	1,208.1	1,185.3–1,257.0	20.8%

Bias in Fatality Estimates

Searcher efficiency rates were estimated by sampling from the real values

$$F = \frac{C}{rpv}$$

Searcher efficiency error was symmetrically distributed around true value

Not a big effect when searcher efficiency is high

As searcher efficiency decreases, underestimates in searcher efficiency lead to disproportionate overestimates in fatality rates, leading to systematic bias

Take Home Messages

Dogs have better searcher efficiency than humans

Improving searcher efficiency improves precision and accuracy of fatality estimates

Under this scenario (randomly distributed carcasses, etc.), increasing survey area had diminishing returns for improving precision after a certain point

For detecting very rare fatalities, good searcher efficiency and high survey coverage may both be required

Take Home Messages

Feather spots are not carcasses (consistently ~20% harder to find)

Bias Trial Sample Sizes are IMPORTANT

Define goals prior to start of study, and select searchers/survey coverage to meet those goals

When combining estimates, recognize that substantial amounts of bias may result from low searcher efficiency

Thanks!



H. T. HARVEY & ASSOCIATES

Ecological Consultants

