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Correspondence on Home Range Determination for Small Mammals

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CORRESPONDENCE ON HOME RANGE DETERMINATION FOR SMALL MAMMALS

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June - November, 1971

UNIVERSITY OF CALIFORNIA, LOS ANGELES

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LABORATORY OF NUCLEAR MEDICINE
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900 VETERAN AVENUE
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June 14, 1971

Dr. David Balph
Ecology Center
Utah State University
Logan, Utah 84321

Dear Dave:

In talking to Bernie yesterday a small problem occurred to me. You recall that you and I talked about estimating the width of the band by which a trapping grid is expanded to estimate the area actually being sampled. You mentioned that one uses half the diameter of the home range inferred from dispersions of capture loci within the grid. Hence, one is estimating home ranges from dispersions of at most five points per individual (assuming an animal is captured every night) by some sort of polygon method. As Bob Jennrich has rather nicely shown, there are distinct sample size biases associated with home range estimates based on either convex or concave polygons. Home ranges estimated from five capture loci are around 1/8 of the unbiased estimate (see Table 2 of enclosed). Or, an estimate based on 5 captures is about half the size of one based on 10 loci.

The point of this is that Bernie has based his estimates of home range size on the Calhoun and Casby recapture radius (which does not have a sample size bias). This means he will be estimating much larger home ranges, assuming an appreciably larger area trapped, and coming up with lower densities, than someone using a grid extension based on polygonal home ranges. I don't know how important this might be, but it's worth bearing in mind.

It was good to see you again in Logan, Dave.

Best regards

Fred

Frederick B. Turner

FBT:lg
cc.: Lendell Cockrum, Clive Jorgensen, Jim MacMahon, B. Maza, Walt Whitford
Enclosures

June 28, 1971

Dr. Frederick B. Turner
Laboratory of Nuclear Medicine and Radiation Biology
900 Veteran Avenue
Los Angeles, California 90024

Dear Fred:

The point you made in your letter of June 14 is well taken. I was thinking of increasing n with additional trapping off the sites and using A_1 (Jennrich and Turner, 1969). However, if A_4 works, I'm all for using it. I, too, think we should use the same procedure for estimating home range. Can we get agreement to use A_4? I shall use it if others agree.

Sincerely,

David F. Balph
Associate Professor

DFB:bh

cc: Len Cockrum
Clive Jorgensen
Jim MacMahon
Bernard Maza
Walt Whitford

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September 13, 1971

Dr. David F. Balph
Ecology Center
Utah State University
Logan, Utah 84321

Dear Dave:

This is a sort of belated response to your letter of June 28 regarding home range sizes and their pertinence to areas trapped and associated density estimates. I can't visualize how to use elliptical home ranges as a means of calculating areas actually trapped. For one thing, I'm not sure how you pool data from a number of animals (except to average the areas of each one's range). But then what? You'd probably end up converting this average area to a circle and using the radius of the circle ~~of~~ to scale up the trapped area. The old Calhoun and Casby technique permits the combination of trapping records for a number of individuals and yields a common estimate of the "recapture radius," which is then easily applied to the area trapped. So right now I think I favor the use of the recapture radius as the distance by which the trap grid should be extended on each side when the area trapped is calculated.

Best regards,

Fred

Frederick B. Turner

FBT:ak
cc: B. G. Maza
Jim MacMahon

First, one estimates s (as given on p. 4 of Calhoun and Casby). Then 3s is supposed to be the radius of a circle within which the probability of the animal being present is 99% (p. 3). Thus, we have increased each side of the trapping grid by 3s. Thus, if the original 12 x 12 grid was 165 m (between corner points) then the area considered trapped is 165 + 6s on a side.

November 12, 1971

Dr. Fredrick B. Turner
Lab. Nuclear Med. & Radiation Biology
900 Veteran Avenue
University of California
Los Angeles, California 90024

Dear Dr. Turner:

This is in reply to your letter of 13 September to Dave Balph regarding the expansion of trapping grid areas by some factor of home range size in order to estimate the area actually sampled.

I see some advantage in using elliptical home ranges based upon A_4 (Jennrich and Turner 1969) over the Calhoun and Casby (1958) recapture radius (A_3 in Jennrich and Turner). A home range area calculated by A_4 will be smaller than one based on the same data and calculated by A_3, which assumes a circular home range. It is probable that the assumption of circularity fails more often than not.

Elliptical home range areas may be pooled to form common estimates of home range area using equation 22 in Jennrich and Turner. They point out that a simple unweighted average could also be used.

If we were to determine a common home range area in this manner, we could then expand each side of our trapping grid by the radius of a circle of this area. The advantage of this over the Calhoun and Casby technique is that elliptical home range areas are more realistic; as deviation from circularity increases, A_3 increasingly overestimates home range area. Thus, by using A_4, we would be increasing the area of our trapping grid by less than if we used A_3 and consequently, density estimates would be larger.

Another point is whether we should use an estimated area that includes 99% of the animals home range (3_8 in Calhoun and Casby, the substitution of 9 in A_4 in Jennrich and Turner).

Due to the relatively short trapping period (5 days) in our validation sampling I would prefer a more conservative estimate of area sampled and therefore favor a 95% estimate (2_s in Calhoun and Casby, A_4 in Jennrich and Turner).

Sincerely,

Robert D. Anderson
Research Technician

cc/D. F. Balph
J. MacMahan
B. Maza

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November 22, 1971

Mr. Robert D. Anderson
Ecology Center
Utah State University
Logan, Utah 84321

Dear Mr. Anderson:

Thanks for your recent letter. I'm willing to do what you propose, for the elliptical method has got to be a better home range estimator than the recapture radius.

Where things get a bit nebulous is in deciding how one will increase the extent of the area assumed trapped according to the mean home range estimate. I guess your way is the best practical expedient. However, it really would depend on how the home ranges happened to be oriented with respect to the borders of the trapping grid. If most of them lay with their long axes perpendicular to the grid border one would underestimate the actual area sampled. I think this is a relatively trivial problem for what we're doing though.

So we're going to do the following:

1. estimate home ranges for the various species in Rock Valley using A_4 and data accumulated in past years.
2. estimate home ranges for the same species in the same manner using 1971 data (much more restricted, obviously).
3. try to decide from the outcome of this work whether we can afford to assume that home range parameters are reasonably stable, or whether one has to measure these each year. (There are a few hints in the literature that home ranges may vary inversely with density).
4. Revise the density estimates we presently have (based on home ranges estimated by A_3) according to the outcome of the foregoing.

I hope that this may lead to consistent procedures throughout the biome!

Sincerely yours,

Fred Turner

Frederick B. Turner
Research Biologist

FBT:ak
cc: D. Balph

References

Calhoun, J. B., and J. U. Cosby. 1958. Calculation of home range and density of small mammals. Public Health Monog. No. 55, U.S. Gov. Printing Office, Washington. 24p.

Jennrich, R. I., and F. B. Turner. 1969. Measurement of non-circular home range. J. Theoretical Biology. 22:227-237.