October 30, 1940

My dear Jackson,

Many thanks for your wire and later letter. I enclose two formal statements so as not to encumber the letter with them. I do hope you will let me know if ever you find it possible to make a visit here. The excitement seems to have moved to somewhere half way between us. The bee-eater discovery is most exciting. It suggests that paints using different organic solvents might be worth comparing.

London is not much damaged, though there is a good deal of rubbish about. University College has caught it a little, but in my building I find that all the damage is due to keeping it unoccupied with the windows shut. Our officials seem to be taking the first steps towards sanity, but have not got very far.

Yours sincerely,

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Mean Life

With a death rate constant at all ages the mean age of flies caught must be the same as the mean age of flies dying, i.e. the mean length of life; since death is, as it were, mimicing the entomologist in catching them at random.

Since any fly caught, if released, would live longer it follows that the mean age at death of flies caught exceeds that of the general population. Indeed, as the expectation of death at release is the same as at emergence, or any other stage, the mean age of natural death of flies caught is just double the mean age of natural death in the general population.

But if all lived exactly the same span the mean age at capture would be exactly half the mean length of life of the general population as well as of the flies captured.

With constant death rate the mean interval between marking and recapture is also equal to the mean length of life to the mean age at ~~recapture~~ marking and therefore half the mean age at recapture.

With a fixed span of life the mean interval between marking and recapture is one third of the mean span and equal to the mean age at marking of flies subsequently recaptured, or half the mean age at recapture of such flies. Is that rational?

Ambits

In relation to a given sampling area any fly belonging to the district, or indeed any fly in Africa, may be classified according to the probability (p) of its being in that area. Effectively this is the proportion of its time which it spends within the area, i.e. of daytime or time during which it is liable to be caught.

Between any limits of p, such as typically

$$p \pm \tfrac{1}{2}dp$$

there will be a certain number of flies whose p value lies within these limits. We can denote this number by n_p

Then the number of flies of any class within the area at any given instant is

$$pn_p dp$$

the total number being

$$\int_0^1 pn_p dp$$

Supposing now a fraction of these α to be caught and marked, then the number marked in any class will be

$$\alpha pn_p dp$$

this being the fraction αp of all the flies of each class.

Suppose now that after complete redistribution of the flies in each place a sample of number

$$\beta \int_0^1 p n_p \alpha p$$

is taken, i.e., a fraction βp of each class, the number of marked flies captured in any class will be

$$\alpha \beta p^2 n_p dp$$

and the total number of marked flies captured will be

$$\alpha \beta \int_0^1 p^2 n_p dp$$

Ambits (continued)

Hence the population estimated by sampling will be

$$\frac{\left\{\int_0^1 (pn_p dp)\right\}^2}{\int_0^1 p^2 n_p dp}$$

instead of the actual population

$$\int_0^1 pn_p dp.$$

The estimate is thus exaggerated in a fixed ratio $\frac{1}{P}$ where

$$P = \frac{\int_0^1 p^2 n_p dp}{\int_0^1 pn_p dp}$$

i.e., P is the average value of p in the population of flies available for sampling.

A simple way of regarding this factor is that the population calculated from samples taken from a given area should be ascribed to an area $\frac{1}{p}$ times as great including some of the surrounding country. This concept would hold even for the record of a man catching and releasing flies while standing always in the same spot, when P would be very small, but the estimated population would certainly refer to some finite area.

If the ambit of each fly is not extensive compared with the sampling area, many flies caught in the central region will have p = 1. The effect of increasing the sampling area will be principally to increase the population of such flies. That of other classes may be expected to increase more nearly proportionately to the length of the permieter than to the area. Consequently, a

Ambits (continued)

simple and ~~approximately~~ ~~probably~~ approximate representation of the effect of individual ambits with areas of different sizes would be to ascribe the fly population estimated by sampling to an area extended to a fixed distance beyond the boundary of the area sampled, the distance being a characteristic of the topography of the country, and perhaps of seasonal habits of the fly, but nearly independent of the area sampled.