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INITIAL INVESTIGATIONS INTO THE ECOLOGY OF THE BANANA SLUG (*Ariolimax columbianus* G.)

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ABSTRACT

Research concerning the indigenous slug, *Ariolimax columbianus* G., followed a three-pronged approach resulting in information on spatial distribution, population dynamics, and consumer roles. Investigations were carried out in a high slug density site at Carkeep Park, Cedar River and the laboratory.

SPATIAL DISTRIBUTION

Initial investigations in the high slug density site at Carkeek Park, Seattle accelerated basic knowledge of this species and was invaluable in testing and determining ecological techniques applicable on the Thomson Site. The belt-transect method was found to be the most effective and efficient method for sampling slug densities and distribution. Using this method on a 400 m^2 plot an impressive population of between 12,400 and 24,700 slugs (C.I. .95) were recorded per hectare.

Fisher's coefficient of dispersion (Southwood 1966) and a comparison of $\underline{X}^2$ values to the expected Poisson for the same distribution indicated that the population was aggregated.

Biomass for this same population was estimated between 165 and 422 µg per hectare greater than that of any other consumer with the possible exception of insects.

From biomass and consumption values calculated in the laboratory, a rough estimate of field foraging was determined. By assuming that *Ariolimax columbianus* normally eats 5 percent of its body weight per twenty-four hours it was determined that 8-21 µg per ha are consumed during the same period. Experiments simulating slug foraging after the summer dry spell (period of limited slug activity) indicated that slugs will eat as much as 30% of their body weight, which when extrapolated to field data, results in a consumption of 49-127 µg per ha per 24 hours.

Slug activity appears to be directly correlated to temperature and precipitation. Daily observations at Carkeek Park and Cedar River indicate limited activity at temperatures below 5°C (41°F) and above 24°C (75.2°F) with maximum activity between 13°C (55.4°F) and 18°C (64.4°F). Precipitation initiated dispersion, foraging and reproduction.

Marked slugs were introduced into Cedar River to obtain data on dispersal and growth. Similar data is being gathered on indigenous slugs to determine if movement is random, directed, or localized. Maximum dispersal for introduced slugs was 2.5 meters per day as compared to 3 meters for the indigenous population. Data for both experiments are still too limited for significant conclusion.

POPULATION DYNAMICS

Accurate assessment of population parameters are prerequisites for the determination of ecological effects of consumers. The method used to obtain tentative life-table data was to plot the number of slugs per weight class (Figures 1 and 2) and analyze for breaks in the distribution which can be interpreted as representing age class separations. Inherent in this assumption is that (a) little or no winter growth occurs in nature and (b) separation of older slugs on basis of size differences can be made with less confidence since reduced growth rates somewhat obscures age class differences.

Assuming that weight is an adequate indicator of age and that slug densities of a weight class can be interpreted as age specific survivorship, a life-table (Table 1) and survivorship curve (Figure 3) was constructed for Carkeek Park slug populations. Cedar River data does not resemble that of Carkeek Park therfore any interpretation of Cedar River data is inconclusive.

Tentative investigations into the biology of Banana Slug reproduction indicates that slugs mate after attaining an age of 1 1/2 years (22 grams) but can mate at 1 year (13 grams) under manipulated conditions. Slugs kept at high densities (5-30 slugs/aquarium) capulated at a younger age and more frequently than natural populations. It appears that body weight may be an estimate of reproductive maturity and slug density the factor that effects its occurrence.

Mating occurs with the advent of precipitation in late summer. After an initial series of behavioral maneuvers, including the eating of each others exuded slime, copulation commences upon dusk and continues for 36 hours through the next day and into the following morning. Under laboratory conditions copulation occurred several times between the same slugs and therefore it was difficult to determine gestation periods without separation of each pair. Of three slugs laying eggs in the laboratory, the gestation period varied from 48 to 67 days.

An average of 36 eggs, three to four mm in diameter and weighing 0.25 grams each are laid under moss where soil conditions were not excessively wet or dry. Fertility and suvivorship rates of young slugs have yet to be determined.

CONSUMER ROLE

Because foraging must be analyzed in terms of population densities, biomass, and energy flows, continuous data gathering techniques have been postponed until the basic ecology of *Ariolimax columbianus* has been more adequately described. However, anecdotal information is being recorded on foraging behavior with concomitant effects on vegetation.

Experimentation is now in progress to determine the impact of slugs in accelerating the decomposition of plant biomass with initial on Alder litter. Slugs, as herbivores, may return large quantities (70-85%) of ingested nitrogen, phosphorus, pottasium, etc., to the soil in a readily available form. Chemical analysis of slug excreta now in progress will indicate percentage composition and chemical state of the major inorganic elements.

CONCLUSION

Data accumulated so far has been gathered mainly to determine life history processes with limited information on foraging and slug interaction with the environment.

REFERENCES

SOUTHWOOD, T. R. E. 1966. Ecological Methods. Methuen and Co. Ltd. London. 391 p.

Table 1. Life Table for the Banana Slug (*Ariolimax columbianus*) based on a survey of 152 slugs gathered in Carkeek Park on 21 August 1972.

Weight Class	Age Class	#Surviving at beginning of age interval out of 1000 hatching	# dying in age interval out of 1000 alive	mortality rate per 1000 alive at beginning of age interval
		lx	dx	1000qx
4-9	0-1	1000	513	513
18-21	1-2	487	329	675
25-27	2-3	158	99	625
29-33	3-4	59	59	1000

Figure 1. Density of slugs in Carkeek Park by weight classes, 21 August 1972.

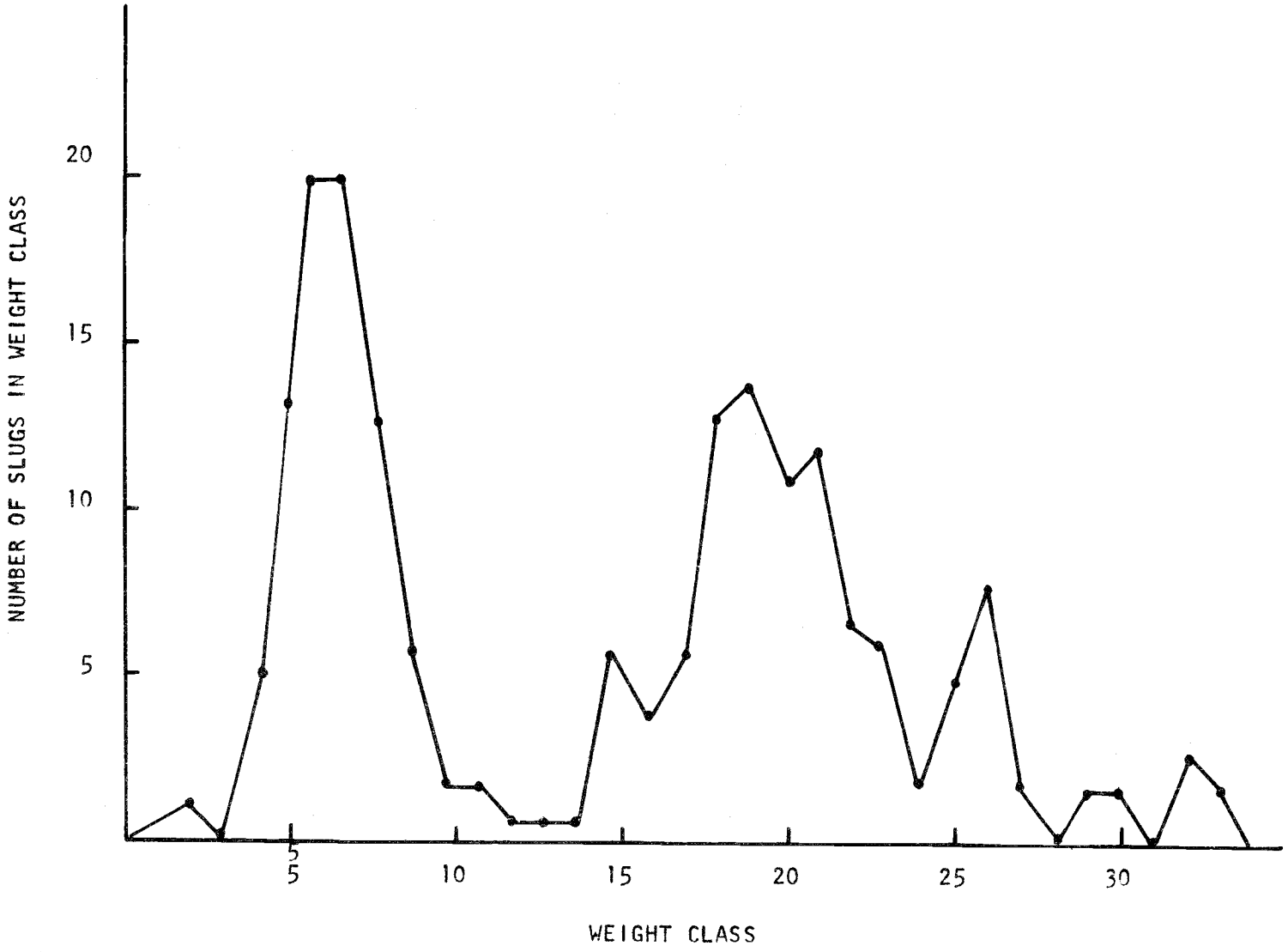

Figure 2. Number of slugs found at Cedar River and their respective weight classes, 10-20 October 1972.

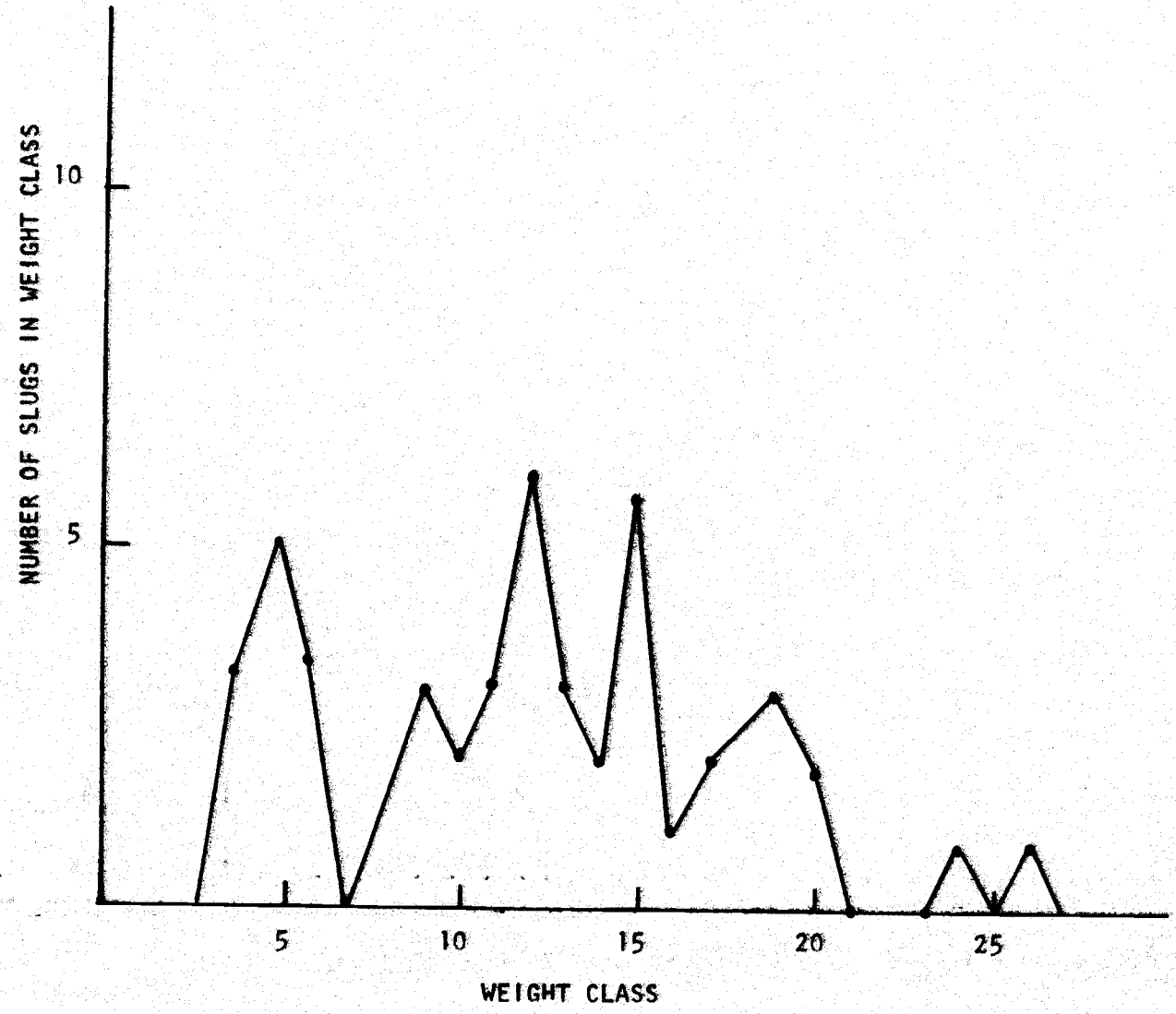

Figure 3. Survivorship (L_x) curve for the banana slug.