

THE UNIVERSITY OF UTAH

ECOLOGY AND EPIZOOLOGY RESEARCH

DUGWAY, UTAH 84022

April 25, 1968

Park Supervisor
Bryce Canyon National Park
Bryce Canyon, Utah

Dear Sir:

Enclosed is a copy of the results of our plague investigations at Bryce during September 1967. You will note that P. pestis was again isolated from chipmunks in the "problem area". In view of this, I would strongly recommend continuing in 1968 the insecticide bait box and public relations program you instituted during 1967.

Very truly yours,



Peter F. Olsen, Ph.D.
Head, Ecology Section

PFO:af
Enclosure

RECEIVED	
NPS-BRYCE CANYON	
APR 25 1968	
☒ Superintendent	<i>AS</i>
☒ Adm. Assistant	<i>AS</i>
☒ Ch. Naturalist	
☒ Chief Ranger	<i>AS</i>
☒ Maint. Supv.	<i>AS</i>
<i>Thompson</i>	<i>AS</i>
<i>Head</i>	<i>AS</i>
☒ Series	
☒ Files	

Bryce Canyon

Plague was isolated from E. umbrinus and associated fleas ^{M.}Z. eumolpi taken from Bryce Canyon during September 1965 and 1966. A follow-up survey was undertaken in September 1967 during which 128 rodents were sampled at 10 different locations within the Park. Table ¹⁴ summarizes the species composition of the sample and the flea indexes and infestation rates. P. pestis was isolated from a pool of ^{the tissues of} three adult male E. minimus taken near the Lodge. This is from the same area where all previous evidence of plague has been found, i.e., a strip approximately one mile long and $\frac{1}{2}$ mile wide in the center of visitor activity, campgrounds, and lodging areas.

This is the first time that this species of chipmunk has been incriminated at Bryce. Of 13 E. minimus taken in the Lodge area, 10 were found to be infested with an average of 1.3 fleas (^{M.}Z. eumolpi). This chipmunk seemed more abundant in the area this year than in the two prior years studied.

Because of the potential for human involvement in the sylvatic plague cycle at Bryce Canyon, the insecticide bait-box method of controlling fleas on rodents was instituted during the summer of 1967 by the National Park authorities. A total of 59 bait-boxes employing peanut butter and oatmeal bait and using 5% Malathion dust were set out in the residential and other areas of high human-chipmunk contact where plague has been detected. No pre-treatment studies of flea indexes were conducted in areas where the control program was instituted for evaluation purposes but some indication

of the effectiveness was made as a result of our trapping efforts in September after the program had been in effect for about six weeks. Some of our specimens were obtained from areas where the bait boxes had been placed whereas others were from areas which had not been subjected to this treatment. It was noted that even in the latter areas the flea index on E. umbrinus was reduced by 51.7% from 2.71 in 1966 to 1.31 in 1967 and the flea infestation rate dropped from 83% to 48%. Therefore, the fact that E. umbrinus from areas where bait-boxes had been placed exhibited an average flea index of 0.98, a 42.6% reduction from the 1.70 index in areas where no control was exercised does not reveal the full story. By examining ~~examining~~ the indexes obtained in 1966, it was ascertained that the areas where the control program was conducted in 1967 had flea indexes 1.33 times higher than those where control was not exercised in 1967; thus, the expected flea index in 1967 would be greater by this factor here than in the non-control areas. Using this technique one derives an expected index for the controlled area E. umbrinus of 1.74 whereas an index of 0.98 fleas was actually found. This reduction of 44.7% is thought to be the best estimate of the actual effects of the control program on the flea populations. Although there was apparently good acceptance of the bait boxes by the chipmunks and little disturbance from Park visitors, the reduction was not as great as might have been expected judging from other reports.

An educational program warning of the possible dangers of too close association with the rodents was instituted along with the bait-box method. The effectiveness of this campaign seemed to be reflected in the fact that reports of chipmunk bites incurred while feeding or handling the animals were far less numerous in 1967 than in previous years.

No serological reactors have ever been detected in the three years of sampling at Bryce; however, the majority of the E. umbrinus serum is inherently anti-complementary and thus not suitable for CF testing. The maintenance cycle of P. pestis at Bryce Canyon is unknown but appears to involve both rodent and flea species which are different from those involved in other areas of the state. The response of E. umbrinus to infection is not known; other members of this genus have been shown to be both highly susceptible (including E. minimus) and highly resistant. Monopsylla^{us} eumolpi has only been found on Eutamias spp. at Bryce although another flea M. wagneri wagneri, which is the dominant flea on P. maniculatus, does occur in small numbers on E. umbrinus. There is no serological evidence to indicate that P. maniculatus is involved as a reservoir species at Bryce Canyon but then the lack of seropositive chipmunks does not indicate that this species is a reservoir either. The unsupported conclusion which is drawn from the available data is that only E. umbrinus and E. minimus and their primary flea, M. eumolpi are involved in the P. pestis cycle^{at Bryce} with either the fleas or the chipmunks or both serving as the reservoiring mechanism.

Rodent - Flea Associations

Bryce Canyon, September, 1967

Malaraeus sinomus

M. telchinum

Monopsyllus eumolpi

M. w. wagneri

Opisocostris tuberculatus

TOTAL

S. lateralis	E. umbrinus	E. minimus	P. maniculatus	Total
			1	1
			2	2
	61	17		78
			4	4
4				4
4	61	17	7	89

Table 2^d. Rodents and fleas collected and processed for special plague investigations at Bryce Canyon National Park, September, 1967.

<u>Species</u>	<u>Number Processed</u>	<u>Fleas/Animal</u>	<u>Percentage</u> <i>Infestation</i>
<u>Spermophilus</u> <u>lateralis</u>	13	0.92	53.8%
<u>Eutamias</u> <u>umbrinus</u>	71	1.28	47.9%
<u>E. minimus</u>	21	1.52	71.4%
<u>Peromyscus</u> <u>maniculatus</u>	<u>23</u>	<u>0.61</u>	<u>34.8%</u>
Total	128	1.16	50.0%

BRYCE

Species	Natural Bridge	Paria View	Residences	Cabins	Inn	Lodge	Rainbow Point	Inspiration Point	Roadside	Sunset Campground	Total	% of Total
<u>Spermophilus lateralis</u>	* 4			2		6			1		13	10.2
<u>Eutamias umbrinus</u>	14	9	8	8	1	3	12	6	4	6	71	55.4
<u>Eutamias minimus</u>			1	4	3	13					21	16.4
<u>Perognathus maniculatus</u>	2	11	1		2	6	1				23	18.0
	* 20	20	10	14	6	28	* 13	6	* 5	6	128	100.0
<u>FLEA INDEX</u>												
Total fleas <u>All Rodents</u>	16	22	9	12	9	22	22	7	20	7	146	
Fleas/Animal	0.8	1.1	0.9	0.86	1.5	0.78	1.7	1.2	4.0	1.2	1.14	
% infested	55	60	40	42.8	50	53.8	58	16.7	80	50	50	
<u>E. umbrinus only</u>												
Total fleas <u>E. umbrinus</u>	13	10	6	6	1	3	21	7	17	7	91	
Fleas/ <u>Eu</u>	.93	1.10	0.75	0.75	1.0	1.0	1.75	1.2	4.25	1.2	1.28	
% infested	64.3	66.7	25	25	100	33.3	50	16.7	75	50	47.9	

* No dusters used at these three areas

Bryce Flea Indexes, 1965-1967

Area	1965		1966		1967		Bait box?
	# E. umbrinus	Flea Indexes	# E. umbrinus	Flea Indexes	# E. umbrinus	Flea Indexes	
Inspiration Point	21	3.3	8	6.0	6	1.2	Yes
Sunset Campgrounds			10	2.2	6	1.2	Yes
Rainbow Point	31	3.7	11	2.9	12	1.75	No
Lodge			17	4.2	3	1.0	Yes
Natural Bridge			17	2.6	14	0.93	No
Paria View			6	8.0	9	1.1	Yes
Cabins			30	2.67	8	0.75	Yes
Residences			6	1.3	8	0.75	Yes
Service Road	11	4.4	7	5.4			No

		1966 index	1967 index	% reduction
1966 vs 1967	Areas w/ bait boxes	3.61	0.975	73.0%
	Areas w/o bait boxes	2.71	1.31	51.7%
1967 only	Areas w/ bait boxes		0.975	
	Areas w/o bait boxes		1.700	42.6%

Theoretically, since areas w/ (3.61) had flea index in 1966 of 1.332 X that of areas w/o (2.71), expected index in 1967 would be $1.332 \times 1.31 = 1.745$

reduction from 1.745 to 0.975 of 0.770 = reduction due to bait box = 44.7%