from turkey bait sites, they slept considerably longer. We believe that a drug to bait ratio of two grams of alpha-chloralose per cup of bait to be a very effective dosage for hogs. It will be tested extensively in the near future.

When treated shelled corn is used to capture hogs, there is considerable risk that other wildlife will be narcotized by the remaining bait left widely scattered by the hogs. Great care should be taken to remove all excess bait after a drugging operation. Continued research should be encouraged to find baits which hogs like better than corn and which are not generally preferred by other species.

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RADIOACTIVE ZINC AS A FECES TAG IN RABBITS, FOXES, AND BOBCATS[1]

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ABSTRACT

The radioactive isotope, ^{65}Zn was fed and injected into rabbits, opossums, foxes, and bobcats. When injected, ^{65}Zn was detectable in feces from these animals for over a year after injection. The radioactive zinc present in the fecal pellets is also very stable to weathering. The injection of ^{65}Zn is an excellent technique for long-term marking of feces in censusing, home range, and migration studies. Public health dangers, although largely imaginary, seriously limit the use of this technique and are discussed.

INTRODUCTION

Feces tagging has been most frequently used as a technique for study of movements and home ranges of various mammals. Sowls and Minnamon (1963) used glass beads to mark the feces of peccaries, a dog, and a fox, in each case the majority of the beads were passed within 36 hours. Kindell (1960) fed dyes to ruminants and found they marked the feces for 2-4 days. New (1958) used dyed bait to study the movement of small mammals and was able to identify the feces up to 48 hours after ingestion.

Feces tagging could be used as a censusing technique if employed as a modified Lincoln Index. A small number of animals would be feces tagged and released, then the percentage of marked feces in the field would give an indication of the total population.

The major disadvantage of the above methods of feces tagging is the short period of time the tag is detectable. The purpose of this study was

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to develop a technique for long-term tagging of feces which would employ safe and easily available amounts of radioisotopes.

METHODS AND MATERIALS

^{65}Zinc chloride in aqueous solution was fed or injected at the rate of two microcuries per kilogram into the experimental animals. Fecal pellets were collected, dried, and weighed. The ^{65}Zn content of the fecal pellets was then determined in either a single channel or multichannel scintillation counter using a two-by-two or three-by-three inch sodium iodide crystal. The stability of ^{65}Zn in the fecal pellets was tested both by long term weathering and by aqueous extraction.

RESULTS

Only tiny amounts of zinc are excreted in the urine and we found that the majority of zinc excreted from the body is excreted by the walls of the alimentary tract into the fecal material. The 250-day physical half life of ^{65}Zn is excellent in that it decays at a rate which gives maximum detectability and a minimum of environmental contamination. When ^{65}Zn is fed to a fox, opossum, or bobcat it is detectable in the feces for about a month. If it is injected into a fox, bobcat, opossum, or rabbit it is detectable for approximately a year (Table 1). If the time in days

TABLE 1 — DETECTION TIME OF TWO METHODS OF ADMINISTRATION OF ^{65}ZINC.

Animal	*Method of Administration*	*Amount*	*Time detectable in Feces*
Rabbit 1	Injected IM.	6 uc	300+
Rabbit 2	Injected IM.	6 uc	300+
Bobcat 1	Fed	80 uc	400+
Bobcat 2	Fed	10 uc	35
Bobcat 4	Injected IP.	10 uc	400+
Fox 1	Fed	10 uc	30
Fox 2	Injected IP.	10 uc	300
Opossum 1	Fed	36 uc	180
Opossum 2	Fed	10 uc	35
Opossum 3	Fed	10 uc	140+
Opossum 4	Injected IP.	10 uc	300

after injection is plotted against concentration of ^{65}Zn in the feces on a log, log scale the relationship forms a straight line (Nellis, 1967).

The results of stability tests showed that ^{65}Zn present in the fecal pellets could not be removed by aqueous extraction. If fecal pellets are subjected to weathering, the ^{65}Zn content per gram of fecal material actually increases (Table 2).

TABLE 2 — RETENTION OF ^{65}ZINC BY FECAL MATERIAL.

Retention of ^{65}Zinc by Fecal Material

Days	*Weight of Feces*	*pCi*	*Corrected pCi*	*pCi/g*
0	35.3 g	264,000	264,000	7,478
95	30.1 g	176,230	229,000	11,393
191	16.7 g	122,072	204,000	12,215

DISCUSSION AND CONCLUSIONS

^{65}Zn as a long-term feces tag shows real promise as a tool for the study of home range, migration patterns, and censusing. Unfortunately there are some disadvantages to the technique. Whenever a radioisotope is released into the environment, the public health aspects must be considered. The maximum permissible body burden for ^{65}Zn is 60 uc, permissible limits for general public exposure have been set lower. The public radiation dosage limit is 500 milliroentgens and for occupational exposure 5000 mr or 5 roentgens per year. In the case of ^{65}Zn a body burden of 6 mircocuries or an allowable daily intake of .22 uc would yield a 500 mr exposure per year. The concentrations of the various nuclides may be allowed to vary provided the total intake during any 13-week period does not exceed the total intake permitted by exposure at the constant levels indicated (ICRP, 1959).

During the summer of 1965 some Alaskan Eskimos had a whole body burden of around one microcurie (1000 nanocuries) of $^{137}Cesium$ resulting from food chain concentration from lichen to caribou to man from fallout. It is the general concensus that current amounts of fallout nuclides in the diet do not constitute a radiological health hazard (Hanson, 1966).

The following hypothetical example represents the worst possible situation which might occur when using ^{65}Zn as a feces tag in cottontail rabbits. An attempt is made to mark thirty percent of the rabbit population with ^{65}Zn on an area of 100 acres with a population of thirty rabbits. Ten rabbits are each injected with two uc of ^{65}Zn. These rabbits are shot on the day of release by a hunter who takes them home and eats them at the rate of one per day. This hunter would have ingested 20 uc of ^{65}Zn which is still less than the maximum permissible body burden for occupational exposure (60 uc). This material is quickly excreted and the exposure would be of little or no significance. The average effective human half-time is 154 days (Richmond, 1962). However, this situation must be avoided and public fear of radioactivity will always seriously limit use of radioactive tags in field experiments. It has been recommended that an unmeasurable population limit their radiation exposure to 170 mr per year or about the equivalent of the interior Alaskan Eskimos.

In studying epidemics of animal-borne diseases, particularly in species not used for human consumption, the use of these low levels of ^{65}Zn as a tracer could well be justified. This radioactive tag for censusing of non-food species in isolated areas may be acceptable but for edible game species a serious public relations problem will exist and this technique will probably not be useful.

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