LONGEVITY OF THE NORTHERN SHORT-TAIL SHREW (*BLARINA BREVICAUDA*) AT RICE CREEK FIELD STATION, SUNY OSWEGO

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Long-term longitudinal studies can provide information on habitat quality over time. The Short-tailed shrew (*Blarina brevicauda*) is carnivorous, abundant in most habitats and lives 18 months or less. Ageing criteria based on weight or reproductive condition provide unreliable results since shrews are nearly adult weight at emergence from the nest and can begin reproduction shortly thereafter. The only reliable ageing criterion is microscopic evaluation of wear on cheek teeth of preserved specimens: not applicable to live animals. We used field measurements of incisors of marked individuals trapped repeatedly over a 7 month period to see if incisor length could be reliably related to known age. We live trapped short-tailed shrews (*Blarina brevicauda*) at SUNY Oswego's Rice Creek Field Station every 1-2 weeks, May- November 2007. Individuals were marked with PIT tags and released. We trapped 62 individuals a total of 263 times (max. captures/individual = 14; max. interval between first and last capture: 193 days). Tooth wear is measurable over longer intervals of time, and incisor length can be used to place individuals into 3 age classes.

I. Introduction

The northern short-tailed shrew is the most abundant small mammal at Rice Creek Field Station. They are known to be relatively short lived with starvation, exposure, predation, and old age the primary causes of mortality. Individuals in captivity have lived for over 30 months and wild caught specimens have been shown to live at least 15 months (Pearson, 1945).

Most long term longitudinal studies of shrew populations (e.g. Getz et al., 2004) lack aging criteria, a fundamental demographic component, due to the difficulty of accurately determining the age of living shrews. General criteria for an ideal age determination technique for short-tailed shrews include: independence from irregular nutritional and physiological variations; clear separations into age classes without subjective judgment; suitability for living animals of all ages; and easy application (Larson & Taber, 1980). Criteria of this caliber are thus far absent from the literature regarding age identification in the northern short-tailed shrew (*Blarina brevicauda*). The most reliable criterion requires microscopic evaluation of wear on the cheek teeth of preserved specimens: a method not applicable to live animals (Pearson, 1945; Pruitt, 1954; Choate 1968; Strait & Smith 2006).

Here we discuss the value of using length of the pigmented portion of the upper incisor, a measurement that is easy to take in the field, as an appropriate aging criterion. We test the reliability of incisor pigment length as an indicator of age, and apply this measurement to a living population of *B. brevicauda* at Rice Creek Field Station, Oswego, New York.

II. Materials and Methods

A museum study of preserved material was first conducted to assess the accuracy of using incisor pigmentation as an indicator of age. The skulls of specimens (n=102) used in this study were collected throughout the central New York area, preserved by Dr. J. A. Lackey, and held at SUNY Oswego's Rice Creek Biological Field Station, Oswego, New York. The upper mandibles of these skulls were inspected under a dissecting microscope, examining the occlusion of the three molars and third premolar (Fig. 1). Wear classes were established using criteria published by Pruitt (1954) and Pearson (1945) based on wear on the occlusion surfaces of the molars. Measurements of the length of the pigmented portion of the right upper incisor were taken using calipers accurate to 0.01 mm without reference to molar wear class.

Incisors were measured twice, from beginning of pigmentation to the tip of the tooth. The repeated measures of incisor pigmentation were analyzed for experimenter consistency using Pearson's correlation.

A representative photographic record of the dentition of the upper mandible, as well as a lateral view of the upper incisor was taken for each wear class (Fig. 2).

After establishing and testing the aging criteria, we applied the aging method in a mark and recapture study of living individuals. Shrews were live trapped at SUNY Oswego's Rice Creek Field Station every 1-2 weeks from May-November 2007. Due to the mainly nocturnal summer activity cycle of *B. brevicauda*, Sherman live traps were set at dusk and checked 3-4 hours later. Individuals were marked with Biomark 8.5mm X 2.12 mm passive integrated transponders (PIT tags) and released. Animals were handled at night by headlamp, and immobilized in rip-stop nylon cones. Basic data were recorded on each animal at the time of each capture, including weight, reproductive status, total body length, tail length, and right hind foot length. Incisor pigment length was measured using a set of calipers.

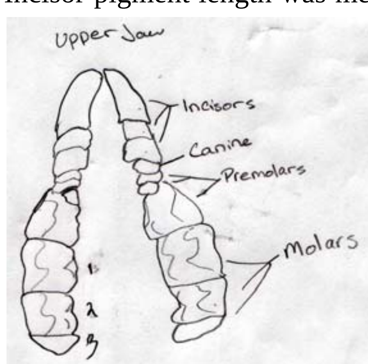


Fig. 1: Dorsal view of *B. brevicauda* upper jaw. Dental formula P3M 1M2M3

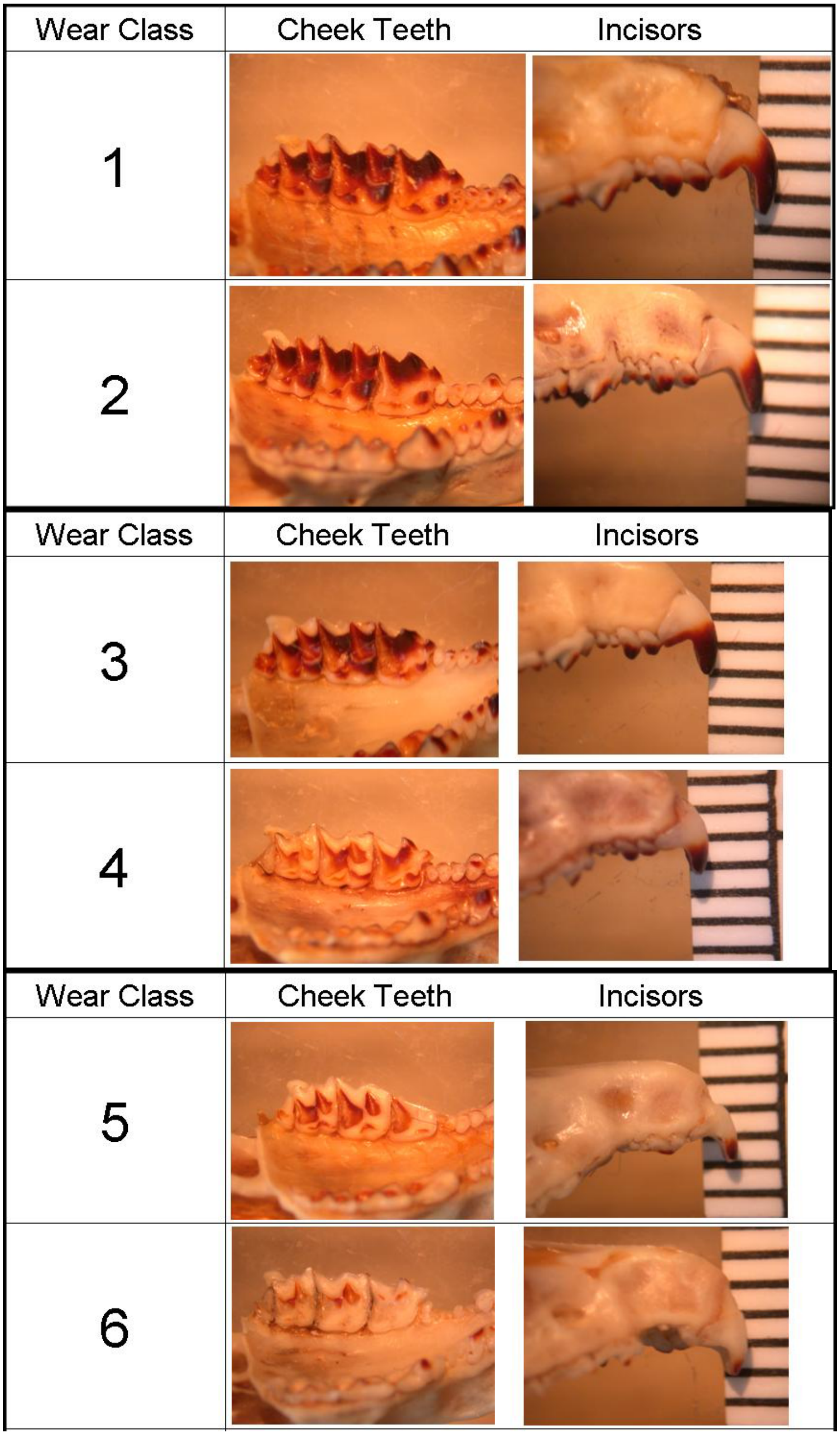


Fig. 2: Age Wear Classes based on Pearson (1945) and Pruitt (1954). Photographs show the dentition of the upper mandible and lateral view of the upper incisor at each wear class.

III. Results

The relationship between incisor pigment length and wear class based on wear of the occlusal surface of the molars was highly significant (r= - 0.768, p= 0.000, n=102, Pearson’s Correlation); however there was some overlap between wear classes (Fig. 3). Observer consistency was very high for incisor pigment length remeasure (r = .950, p = 0.000, n=102, Pearson’s Correlation).

Table 1 shows range of incisor pigment length for age groups. Age classes were assigned based on Pearson’s (1945) established wear classes with young adults encompassing classes one and two; adults expected to have teeth consistent with wear classes three and four, and old adults would be considered in wear class five and six.

In the field study, 62 individual shrews were trapped a total of 263 times. A regression of tooth wear over time using only the first and last measurements showed significant change for the shrews of the upper field (P = 0.0001; R^2 = 37%) but not for the lower field (P = 0.903; R^2 = 0%) (Fig. 4). A comparison of total change in incisor pigment length and days between first and last capture (Fig. 5) shows considerable variability over shorter periods of time, but measurable decrease in incisor length over longer periods of time. Average change in one month was less than one millimeter, however after two months, the average change, 0.21 mm was substantial enough to be measured using calipers Standard deviation in changes in incisor pigment length (SD=0.3 mm) is not large enough to move individuals from one age class to another.

In Fig. 6, age profiles over the trapping period are shown. On average, 64% of individuals captured were adults, 29.6% were young adults, and 6.4% were old adult animals based on the criteria outlined in Table 1. Fig. 7 shows the longevity of animals marked at the upper and lower field. The maximum number of captures per individual was 14, and the largest interval between first and last capture was 193 days. Forty-eight percent of marked animals were not subsequently recaptured. The average number of captures per individual was 3.5.

Efforts were made to reduce trap mortality in the shrews. The use of cardboard inserts reduced trap mortality from 40% to 30.4% (Chi-squared, P=0.0104); and using animal protein as bait in the trap reduced trap mortality from 28.8% to 12.9% (Chi-squared, P=0.0010); but only very frequent trap checks (<4 hours) reduced trap mortality to an acceptable level of 3%. These results were reported in a poster presented by Chepko-Sade and Gerald Zoanetti at the American Society of Mammalogists meetings in 2001,

Table 1: Age categories based on incisor pigment length in *B. brevicauda*.

Age Category	Pigmented Part of Incisors (mm)
Young Adult	>2.0
Adult	1.0 – 2.0
Old Adult	<1.0

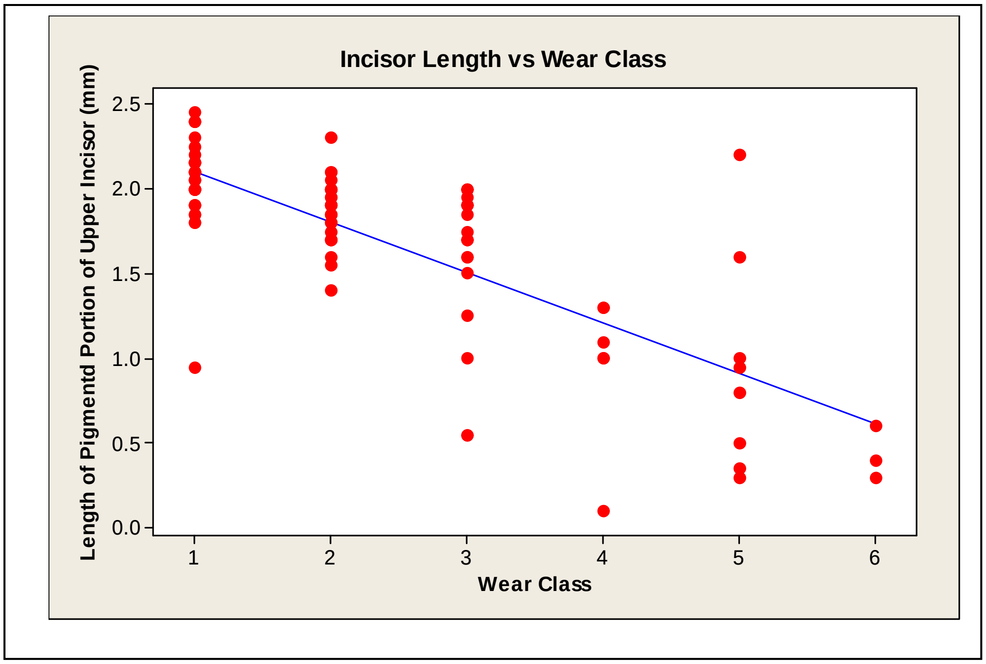


Fig. 3: Degree of incisor wear is highly correlated with degree of wear on the cheek teeth (r = -0.768, p = 0.000, n=102).

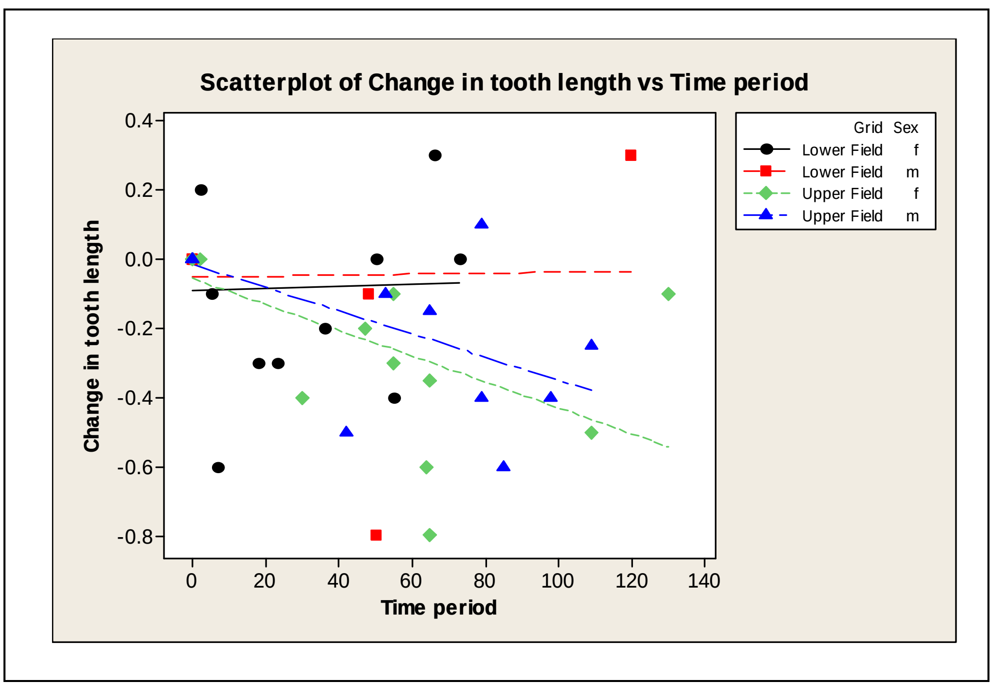


Fig. 4: Regression of tooth length over time shows a significant change for individuals in the upper field (Upper Field: P = 0.0001; R^2 = 37%, n=37), but not for the lower field (Lower Field: P = 0.903; R^2 = 0%; n=28).

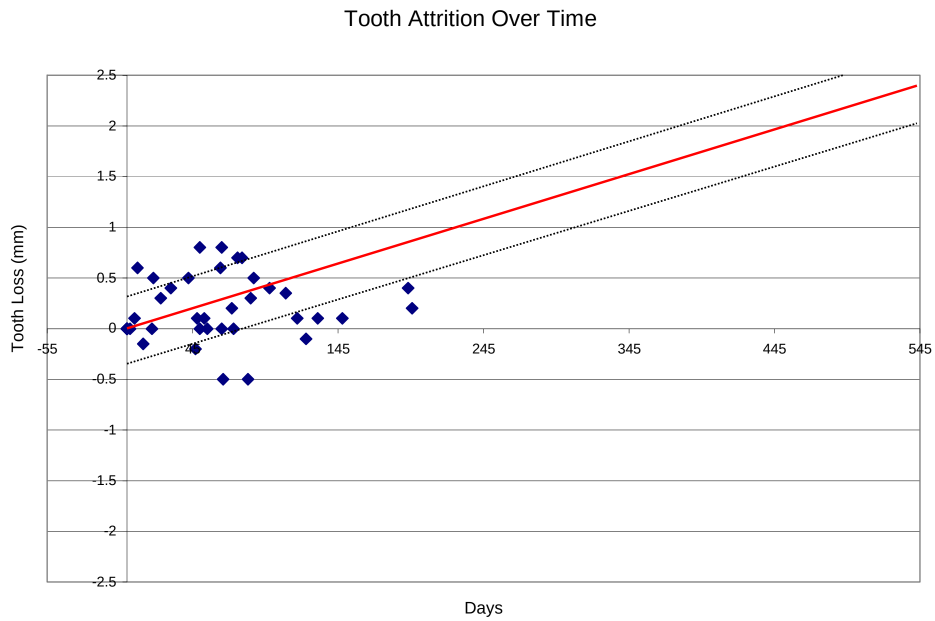


Fig. 5: Reliable measures of wear may take 18+ months. Total tooth loss over capture interval is depicted. The red line shows the projected change in tooth length, with ±0.3mm standard deviation shown by dotted lines.

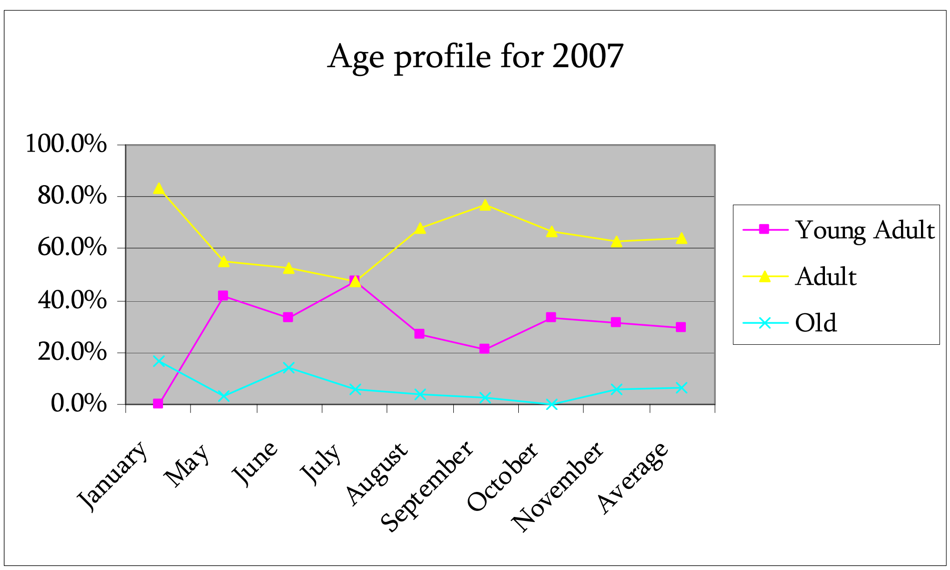
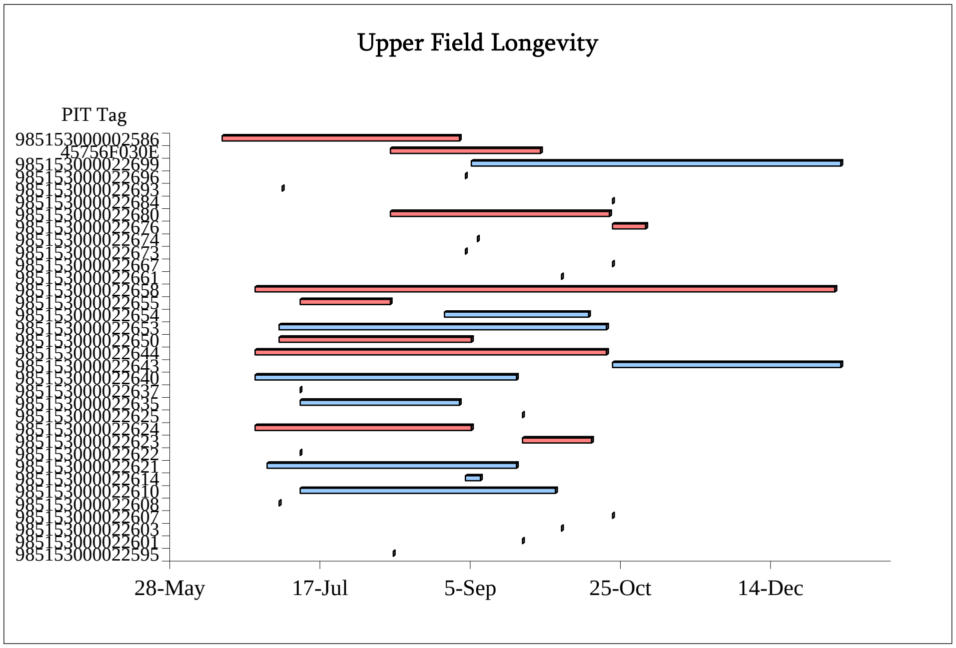


Fig. 6: Graphed age profile indicates the progression of aging as spring young mature, and adults from the previous spring die off. Over the trapping period 64% of individuals captured were adult, 29.6% were young adult, and 6.4% were old adult animals.



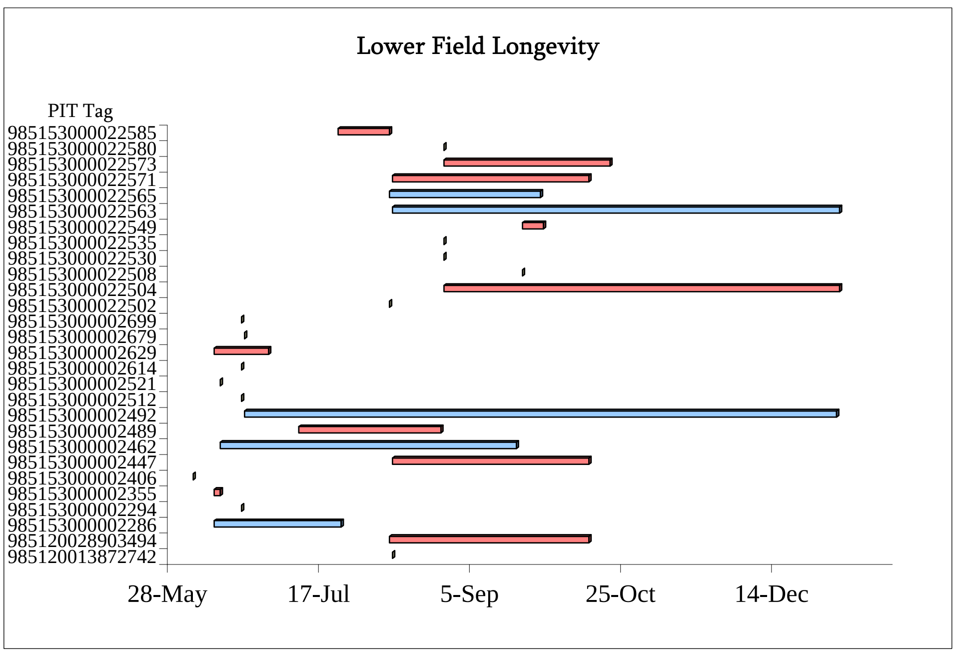


Fig. 7: Persistence of short tailed shrew on the upper and lower field grids. Date of the first and most recent capture for each individual is shown. The largest interval between first and last capture was 193 days. Blue bars are males, pink are females.

IV. Discussion

Incisor pigment length is an accurate and reliable indicator of age in short-tailed shrews and can be used to place individuals into three age classes as shown in Table 1. As individuals age, their teeth wear down which is confirmed by decreases in the amount of pigment measured on the upper incisors. The practical application of using these criteria for aging animals in the field is clear. Individuals can be placed in age groups (Fig. 6) to create a demographic profile for a living population for comparison with results of previous studies based on dead individuals (Pearson, 1945). This allows the periodic examination of the age profile of the same population at different times without the impact of removing large numbers of individuals from the population to ascertain age profiles based on cheek teeth attrition.

Mortality for this trapping session was greatly reduced compared to mortality recorded in previous seasons (Chepko-Sade, unpublished data). *B. brevicauda* weaken and die quickly in Sherman traps due to their fast metabolism and the stress of captivity. Frequent trap checks reduced mortality the greatest amount, but the inclusion of cardboard inserts and animal protein in the traps also had an effect.

Due to small sample sizes and high variation between successive measurements of the same individual, further trapping is needed to alleviate the spread in the data. The project will be continued over the summer in order to further quantify the rate of tooth attrition over time so that individuals may be more precisely aged rather than just assigned to age classes. This information will allow us to study the demographics of this population in more detail.

V. Acknowledgements

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