



AN ABSTRACT OF THE THESIS OF

Ashley Danielle Messner for the Master of Science Degree

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Title: ENERGY ALLOCATION AFTER CAUDAL AUTOTOMY IN THE GREAT PLAINS SKINK, *PLESTIODON OBSOLETUS*

Abstract approved: \_\_\_\_\_

Dr. Lynnette Sievert

Caudal autotomy is a common anti-predatory defense among certain species of reptiles, amphibians, and mice. Studies have investigated the consequences of caudal autotomy in reference to locomotion and reproduction, but few studies have focused on how other factors may influence the regrowth of the tail. This study investigated caudal autotomy in the Great Plains skink, *Plestiodon obsoletus*, and how diet influenced energy allocation after caudal autotomy. Skinks were divided into size classes, three skinks per class with no greater than three mm difference in snout to vent length, and then divided into three treatment groups; fed crickets daily, fed crickets every other day, and a daily diet alternating between crickets and mealworm larvae. After the nine week study period, I found that diet and size class were not significant factors for tail regrowth, but diet and size class had a significant impact on the mass gained. A comparison of the three smallest and largest size classes for snout to vent length was significant for length gained, but could have been attributed to normal somatic growth. Mass was gained in every diet and

size class, showing enough food was provided to exceed the amount needed to survive, however, the rate of tail regeneration may have been at its maximum. Energy was allocated differently among size classes and treatment after caudal autotomy.

Key words: *Plestiodon obsoletus*, Great Plains skink, caudal autotomy, tail autotomy, diet, energy, regrowth, tail

ENERGY ALLOCATION AFTER CAUDAL AUTOTOMY IN THE GREAT PLAINS  
SKINK, *PLESTIODON OBSOLETUS*

A thesis presented to  
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## PREFACE

This manuscript will follow the format of the peer-reviewed journal *Copeia*.



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## Introduction

Autotomy is the voluntary release of an appendage. Caudal autotomy is the ability to shed a tail, which often happens as an anti-predator response. Caudal autotomy can be a distraction that keeps a predator occupied as the dropped tail wriggles around, or if the predator already had the individual's tail, it could allow time for the individual to escape (Bateman and Fleming, 2009; Kelehear and Webb, 2006). Many species, including different types of lizards, amphibians, fishes, crustaceans, echinoderms, insects, and spiders, have the ability to autotomize parts of their bodies (Maginnis, 2006).

Numerous studies have been performed on caudal autotomy, but they have focused on aspects concerning reproduction, behavior, locomotion, agility, and the physiology behind the ability to shed and regrow a tail. Caudal autotomy may affect reproductive behavior by reducing litter size, although there has been conflicting information concerning the relationship between caudal autotomy and egg mass and energy content (Chapple et al., 2002). For Texas banded geckos (*Coleonyx brevis*), tailless females produced eggs lower in mass and energy content. Conversely, with the common side-blotched lizard (*Uta stansburiana*), tailless females produced heavier hatchlings than tailed females (Dial and Fitzpatrick, 1981; Fox and McCoy, 2000). Animal behavior after caudal autotomy changes as the individuals tend to stay closer to cover, flee further distances away from approaching predators, make fewer attempts on prey items, and decrease overall surface area time (Cooper, 2003). For aquatic species, swimming burst speed decreases 40-50% (Marvin, 2010). Terrestrial sprint speeds, such as for the five-lined skink (*Plestiodon fasciatus*), are initially reduced but can be recovered several weeks after autotomy (Chapple et al., 2004; Goodman, 2006). Species

with the ability to jump are not negatively impacted as the jump distance is not decreased after caudal autotomy (Fleming and Bateman, 2012). And lastly, the physiology associated with shedding and regrowing a tail involves many aspects, including increases in lactic acid after autotomy that are not associated with LDH concentrations, and elevated lipid levels in regenerated tails (Meyer et al., 2002; Simou et al., 2008).

Even with all this information, very little data is available on how the environment and nutrition may affect the ability of an individual to actually regrow its tail. For example, it has been noted that hydra heads can regenerate faster in warmer climates, but that nutrition can also alter the rate of regeneration (Dinsmore, 1996). For lizards, which are ectothermic, their body temperature and diet dictate their physiology as well as their behavior (Huey and Stevenson, 1979).

Although caudal autotomy has its benefits, there is a high energy price to the individual. Some species of salamanders and lizards store excess energy in the tail, in the form of lipids, for future use. A study by Chapple and Swain (2002) showed the metallic skink (*Niveoscincus metallicus*) had a high probability of lipid depletion once its tail was autotomized, but there was rarely a large enough loss in lipid storage to be lethal. Most tail breaks occurred at fraction planes along the tail, but not at the base, and did not affect essential locomotory muscles, hemipenes in males, or the centralized areas of lipid storage. The loss of the lipid storage did not equate to an increase in food consumption in the reproductive female metallic skinks. However, in the Texas banded gecko (*Coleonyx brevis*), tailless reproductive females had a greater rate of food ingestion and, therefore, more energy available for reproduction, but they did not allocate that energy into their eggs but instead into the recovery of their tail (Dial and Fitzpatrick, 1981). The loss of

lipid storage, as well as the loss of a defense mechanism, decreases an individual's fitness and can be associated to shortening an individual's life span (Bernardo and Agosta, 2005; Cooper and Frederick, 2010).

A study by Qun et al. (2008) investigated the selected body temperature and food intake for Mongolian racerunners (*Eremia argus*) from three populations. They autotomized the lizards' tails to investigate how food and temperature preference had changed since the autotomy of their tails. The tailless lizards preferred a lower body temperature, which suggests the loss of the tail may have changed the thermoregulation set-point. They also noted that despite the increased energy demand placed on the tailless lizards, which were fed *ad libitum*, they did not consume more food than lizards with their tails intact. But there was no investigation of how size classes could have contributed to the consumption of food.

Caudal autotomy not only results in a loss of a lipid storage, but also may require a shift in energy allocation to regrow the lost appendage. Energy demands and allocation differ between stages of development, and autotomy may result in various physiological constraints (Bateman and Fleming, 2009; Paulissen, 1987). The tail regeneration rates among age classes in the black-bellied salamander (*Desmognathus quadramaculatus*) showed that the larger the individual, the longer the regeneration period (Marvin, 2011). This has been attributed to the need for juveniles to regrow their tail as quickly as possible, because they lack other anti-predatory options compared to larger individuals, who also allocate energy into reproduction (Marvin, 2011). A juvenile lizard will have to allocate energy into the tail as well as into somatic growth (Bateman and Fleming, 2009).

Overall, the diet of lizards can consist of a variety of vertebrates, invertebrates, and plants. The nutrition value received from different sources in their diet can play numerous roles in how growth takes place and its energy demands (Pough, 1973). Energy is allocated differently through the ontogeny of an individual (Mautz and Nagy, 1987; Pough, 1973), but how does the diet influence energy allocation after caudal autotomy?

This study focused on the energy allocation of Great Plains skinks (*Plestidon obsoletus*) after caudal autotomy by investigating how diet affected the regeneration rate of the tail, body mass, and body length. Great Plains skinks are one of the largest lizards in the United States and have a fairly large geographic range of southwestern states into Mexico, but are readily found in the Flint Hills of Kansas (Fitch, 1955). For this study, specimens were divided into separate treatments, each with different diets, to determine if one type of food source and diet caused more average tail growth. I predict skinks fed at a higher rate will regenerate more of their tails, and have greater body masses and body lengths by the end of the study, than those fed at a lower rate.

## Materials and Methods

**Collection Sites.**—Great Plains Skinks (*Plestiodon obsoletus*) were collected between May and July 2014. A total of 19 skinks were collected from Greenwood County, Kansas (Lat. 38.08759, Long. -96.37950), 17 skinks were collected at Chase County Fishing Lake (Chase County, Kansas Lat. 38.36718, Long. -96.59135), and two skinks were collected from the Emporia State University (ESU) Ross Natural History Reservation (Lat. 38.49504, Long. -96.33568). All sites were visited in early morning hours, and all individuals were obtained by hand and transported to the laboratory in vented plastic tennis ball containers with one skink per container.

**Housing.**—All skinks were housed individually at the ESU Biology department in Emporia, KS in a ventilated enclosure. The most common enclosure was a Reptibreeze open-aired reptile screen cage (40.64 x 40.64 x 50.8 cm) and the second most common enclosure was a Sterilite plastic container (41.9 x 33.0 x 31.1 cm) with ventilated cover. All enclosures had a newspaper lined floor, an Exo Terra reptile cave or PVC pipe for the skinks to hide under or sit upon, and a water bowl. The newspaper was changed on a weekly basis and the water daily. Heating lamps, 60W for Reptibreeze open-aired reptile screen cage and 40W for Sterilite plastic container, were set atop the enclosures with timers set for a 12 hr photoperiod beginning at 0800 CDT. Every skink was allowed to freely thermoregulate, as well as consume water *ad libitum*.



**Design.**—I used a randomized block design in the experiment. Each individual was measured for total body length (mm), snout vent length (mm) and total body mass (g). Each lizard was then placed into blocks of three individuals based upon snout vent length, with each block having no more than three mm total difference in snout vent lengths. Since the snout vent lengths of all individuals ranged from 66 mm to 114 mm, which was enough difference to create size classes, individuals needed to be blocked together by size to keep larger or smaller individuals together throughout the study (Appendix A; Appendix B).

The skinks in every block were then divided into three treatment groups. The first group was fed three large crickets (*Gryllobates sigillatus*) every other day. The second group was fed three large crickets every day. The third group was fed a mixed diet of three large crickets or two medium mealworm larvae (*Tenebrio molitor*), alternating between the food sources every other day. There were three treatments of 12 blocks, creating a total of 36 skinks used in the experiment. The experiment was conducted for nine weeks from July through September 2014, which coincides with their active season (Fitch, 1955). After the study period, the skinks were released where they were collected.

**Caudal Autotomy.**—Each skink autotomized approximately half of its tail. This was done by holding each skink's tail with a padded forceps at the midpoint and allowing the lizard to autotomize its own tail (Gillis et al., 2009). The tail was held for one minute, and if the skink did not autotomize its tail, the tail was released to allow the skink a resting period. If the tail was not autotomized after several attempts, the process was repeated several hours later. Once autotomized, the dropped tail section was measured and weighed.

***Feeding and Measurements.***—Each meal was weighed prior to a feeding. The three crickets weighed between 0.5-1.0 g and the mealworms weighed between 0.15-0.25 g. The feeding range was setup for the crickets and mealworms due to the variability between the sizes acquired from purchase orders, and because the insects generally grew larger in size in captivity. The mealworms were calorically equivalent to the crickets based on published values (Bernard et al., 1997; Van Huis et al., 2013). The amount of food consumed by each skink, and any uneaten food that was present after 24 hrs, was documented.

The skinks were measured weekly for tail regrowth (mm). At the end of the study period, each individual was measured for total length (mm), snout vent length (mm) and weight (g). The data were analyzed using a two-way ANOVA (Analysis of Variance) without replication, and randomized block design with significance set to  $\alpha=0.05$ . The diet data of crickets and mealworm larvae consumed by each lizard were analyzed using a one-way ANOVA. All statistics were analyzed using Statistical Package for the Social Sciences (IMB, Armonk, NY) The assumptions of an ANOVA were checked for homogeneity of variances and normal distribution of the data.

## Results

The two-way ANOVA without replication showed no significant effect for tail regeneration for block factor,  $F=1.346$ ,  $df=11,21$ ,  $p=0.268$  (Fig. 1), and no significant effect for treatment,  $F=4.417$ ,  $df=2,21$ ,  $p=0.928$  (Fig. 2). Neither diet nor size class significantly influenced tail regrowth.

The two-way ANOVA without replication showed significant effect for mass gained for block factor,  $F=2.523$ ,  $df=11,22$ ,  $p=0.031$  (Fig. 3), and significant effect for treatment,  $F=40.017$ ,  $df=2,22$ ,  $p=0.000$  (Fig. 4). Diet and size class significantly influenced mass gained. Tukey's post hoc test ( $\alpha=0.05$ ) was significant for each treatment, concerning mass gained, with  $p=0.002$  or less.

The two-way ANOVA without replication showed no significant effect for snout to vent growth for block factor,  $F=1.679$ ,  $df=11,22$ ,  $p=0.145$ , and no significant effect for treatment,  $F=1.331$ ,  $df=2,22$ ,  $p=0.285$  (Fig. 5). But, focusing the results to the three largest and three smallest size classes, a significance occurred for block factor,  $F=24.523$ ,  $df=5,10$ ,  $p=0.000$  (Fig. 6), but not for treatment,  $F=1.315$ ,  $df=2,10$ ,  $p=0.311$ . The smallest lizards allocated resources into snout to vent length growth and the largest lizards did not.

The one-way ANOVAs of the mass of food eaten by each lizard within each treatment group were not significant. Therefore, the amount of food eaten by lizards within a treatment group did not change over time. The treatment of crickets every other day showed no significance for the variance of cricket masses,  $F=0.767$ ,  $df=11,360$ ,  $p=0.673$ ; crickets every day showed no significance for the variance of cricket masses,  $F=1.336$ ,  $df=10,671$ ,  $p=0.207$ ; and mixed diet showed no significance among the cricket

masses,  $F=0.482$ ,  $df=11,360$ ,  $p=0.914$  or among the mealworm larvae masses,  $F=0.504$ ,  $df=10,308$ ,  $p=0.887$ . Each individual compared against all three treatments also showed no significant effect.  $F=0.154$ ,  $df=2,33$ ,  $p=0.858$ . The variability in the diet mass sizes throughout the study was not a significant factor in this study.

## Discussion

Based on the collected data, the Great Plains skinks did allocate energy to increase their mass, snout vent length, and autotomized tail, but not all of it was significant between treatments and/or blocks. Growth was expected in overall lengths (tail and snout/vent), and mass, with the different treatments causing varying amounts of growth. The prediction was that the group fed crickets every day would have the highest growth, the group with a mixed diet of crickets and mealworm larvae would have less growth, and the group with crickets every other day would have the least growth. Individuals given crickets every day were expected to have the greatest growth because crickets contain more protein than mealworm larvae, and in return, mealworm larvae contain more fat than crickets (Bernard et al., 1997; Van Huis et al., 2013). Protein is a significant factor on the growth and most lizard species need a diet containing 11-20% protein. Lipids consumed in food are put into fat storage and then used to provide energy in the future (Aiello and Moses, 2011). Avery et al. (1993) studied slider turtles (*Trachemys scripta*) and showed that individuals consuming a high crude protein diet had significantly greater plastron length, carapace length and body mass. Of all the treatments, those fed crickets every other day would have the least growth because of the restriction to their diet when compared to the other treatments.

All individuals, regardless of diet or size class, had tail growth, but there was not a significant difference between the treatments or size classes. Diet influences growth rate in reptiles (Avery et al., 1993; Nagy, 2000; Li et al., 2009), but there must be a maximum tail regeneration rate and the lizards in this study may have been at or near that maximal growth rate. The regeneration of the tail is energetically very expensive,

especially to adults. For adults in the Genus *Eumeces* (= *Plestiodon*), the tail contains 50% of the body's lipids (Vitt and Cooper, 1986). The negative consequences of tail autotomy on reproduction can include a reduced clutch size, with eggs lower in mass and energy content (Dial and Fitzpatrick, 1981). Breeding of Great Plains skinks in Kansas occurs from April into early June, and eggs are laid from June into early August (Fitch, 1955). Juvenile skink somatic growth is not effected by tail autotomy, but autotomy could have consequences for a reproductive adult (Vitt and Cooper, 1986). This study was conducted in early fall, after breeding and egg laying seasons, which is an energetically expensive period for reproduction. A study done on female Texas banded geckos (*Coleonyx brevis*) showed that 53% of the total energy reserves were invested into vitellogenesis of tailed individuals and only 29% in tailless individuals (Dial and Fitzpatrick, 1981). If this study occurred in early spring when reproduction was in full swing, the additional restriction on the energy reserves could have resulted in different energy allocations for the breeding size classes in this study where less energy may have been allocated to regenerating the tail. Concerning tail regeneration, plenty of nutrients were available from the treatments, no matter the size class, for there to be allocation to tail regeneration.

Conversely, mass gained among size classes and treatments was significant. From the treatments, the most mass gained was in the treatment order of crickets every day, mixed diet of crickets and mealworm larvae, and crickets every other day. Tukey's post hoc test ( $\alpha=0.05$ ) was significant for each treatment with  $p=0.002$  or less. It was not surprising that the mass gained from the treatment with crickets every day was more than the treatment of crickets every other day, the caloric intake was doubled over the nine

week study period between the treatments. Cox et al. (2008) studied Yarrow's Spiny Lizard (*Sceloporus jarrovi*) and found that those who consumed one cricket a day versus three crickets a day showed a significant reduction in growth. The mixed diet treatment contained more crude fat whereas the daily cricket treatment contained more crude protein while staying calorically equivalent (Bernard et al., 1997; Van Huis et al., 2013). Protein allows for additional muscle mass and weight gain compared to crude fat (Atti et al., 2004).

Mass gained among size classes occurred with the most mass gained by the smaller size classes and the least amount gained by the larger size classes (Fig. 3). Growth is associated with nutritional stress, quality, and availability, the less available the slower the growth (Arendt, 1997; Vitt and Caldwell, 2014). Troyer (1984) established that metabolic rates of green iguana (*Iguana iguana*) were proportional to body mass, as hatchling and juveniles had higher energy requirements and needed more protein than adults for somatic growth, while adults needed protein for maintenance. The individuals in the smaller size classes were utilizing all the nutrients, including protein, available for growth, mass and length, even though the standard metabolic rate rises 36% for recently autotomized tailed lizards (Naya et al., 2007). Skinks from each treatment were consuming the same amount of food, but it is apparent the larger size classes did not use nutrients in the same way as the smaller individuals. Smaller lizards grew despite the demand of a higher metabolic rate, with an allometry where body mass is raised to the 0.80 power, resulting in a reduction of mass-specific energetic requirements for larger individuals (Bennett and Dawson, 1976). But a lizard that is twice the size of a small individual still needs to consume more energy.

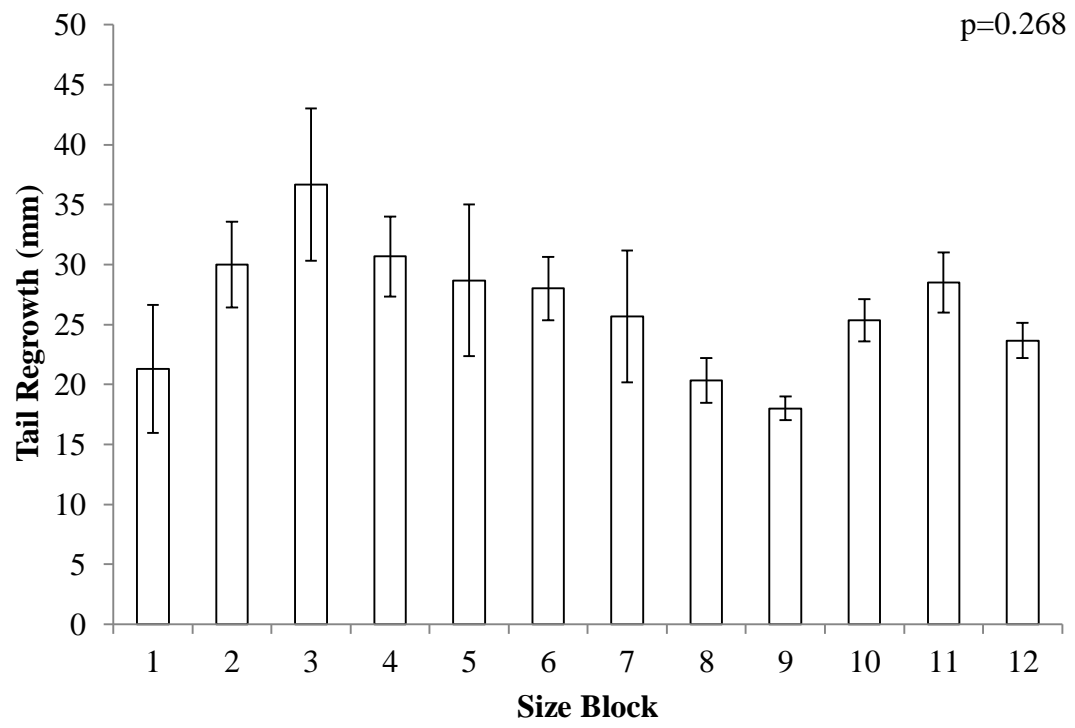
The growth in snout vent length between the largest and smallest size classes was also significant, but could be attributed to somatic growth. Growth after maturity has been documented in many species of squamate reptiles (Shine and Charnov, 1992). All individuals in the three smallest size classes would be classified as juveniles based on the snout vent length of under 100 mm, and all individuals in the three largest size classes would be classified as adults for their snout vent length being over 100 mm (Fitch, 1955). In two of the largest size classes there was no documented snout vent growth, as the mean growth was  $0.56\text{mm} \pm 0.56 \text{ mm}$ . Whereas juvenile Great Plains skinks have been documented to grow 6-10 mm snout to vent length in a four week period (Fitch, 1955), the smallest three size classes had a mean snout vent length growth of  $7.44\text{mm} \pm 0.44 \text{ mm}$ .

In this study, diet was not a limiting factor in tail regeneration after tail autotomy for any size Great Plains skink since all skinks grew in mass. A range of nutrients were available to each skink, which would result in regrowth of the autotomized tail assuming the tail is broken properly along a fracture plane (Abdel-Karim, 1993). Diet influenced the amount of mass gained. I did not determine whether the mass gained was muscle or fat, only that additional mass was established. In general, the smaller the individual the more mass gained, which could be attributed to allocating resources for somatic growth to reach maturity. Sexual maturity of the Great Plains skink occurs at a snout vent length of at least 100 mm, in which over half of the experimental skinks would have been considered sexually mature (Fitch, 1955; Appendix A). Diet also influenced the amount of mass gained based on treatments, showing that nutritional availability and consumption will influence mass. The significant difference in the snout vent length

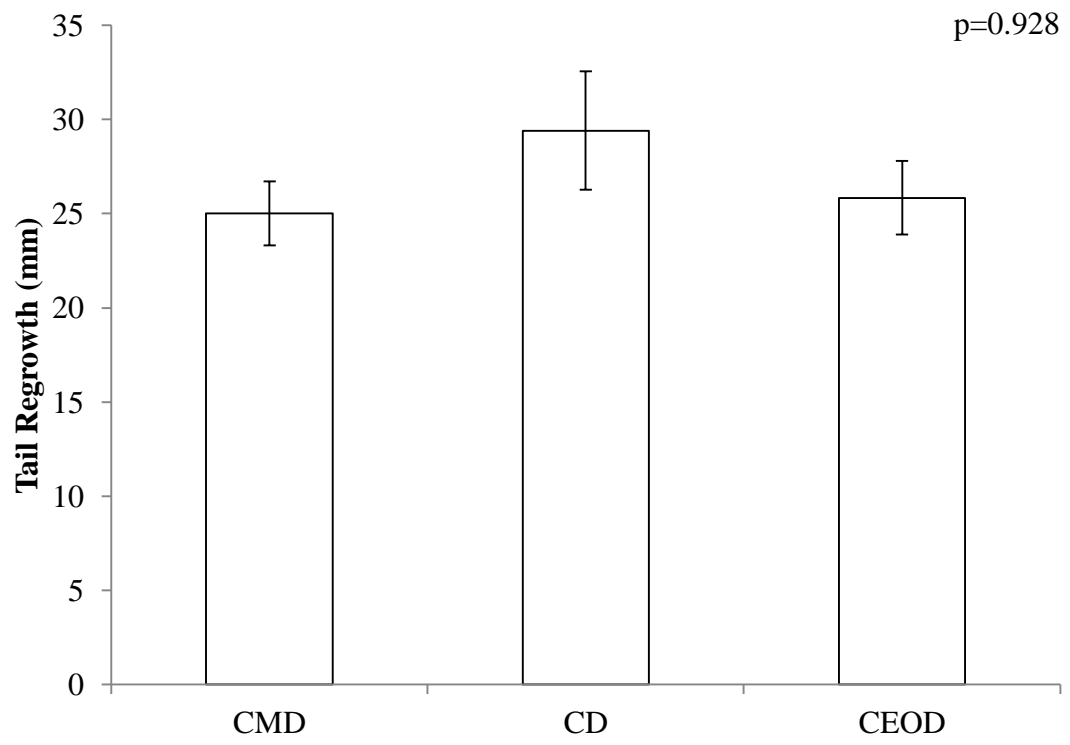


growth among the smallest and largest size classes can also be attributed to differences in how resources are allocated at different times throughout a skink's lifespan. Juveniles used resources to gain in snout to vent length whereas adults did not. All size groups and treatment groups allocated energy to tail regeneration and increased mass.

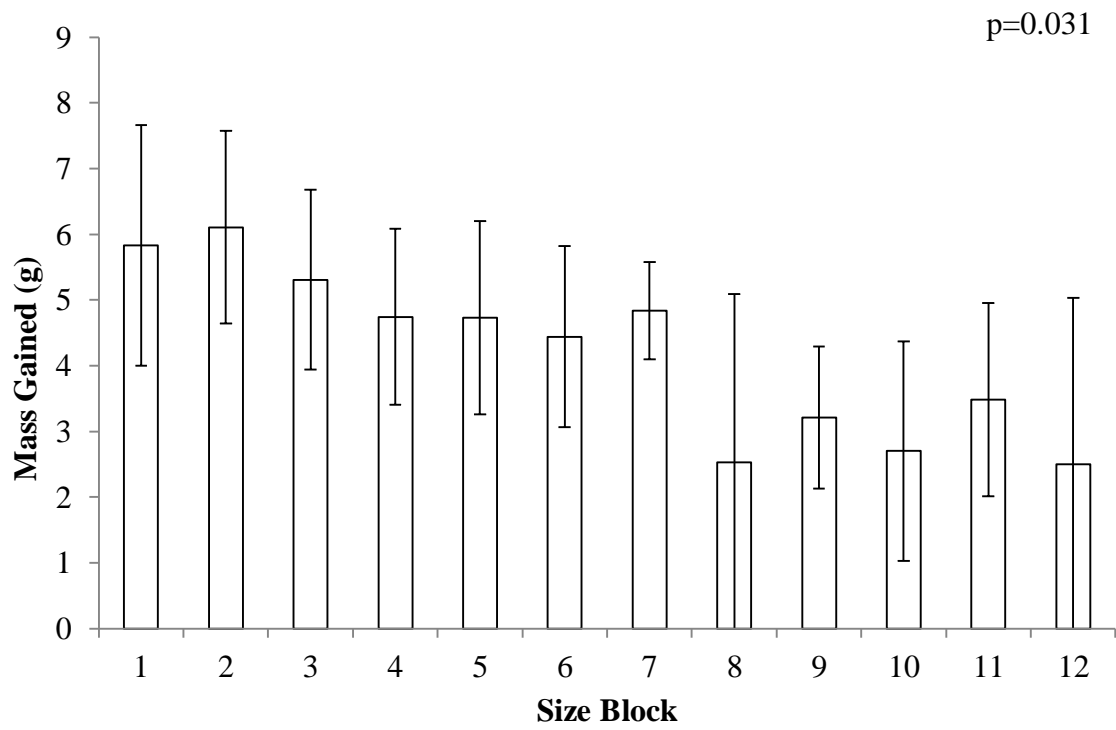
**Fig. 1.** Mean  $\pm$ SE of skink tail regrowth by blocks. Each block contains three skinks. Block one has the shortest snout vent length and block 12 has the longest. Half of each skink tail was removed and regrowth was measured after nine weeks. Refer to appendices.



**Fig. 2.** Mean  $\pm$ SE of tail regrowth of treatments. Each treatment had 12 skinks. Half of each skink tail was removed and regrowth was measured after nine weeks. Treatment labels are as follows, CMD= Crickets Mealworm Larvae Daily, CD= Crickets Daily, CEOD= Crickets Every Other Day.

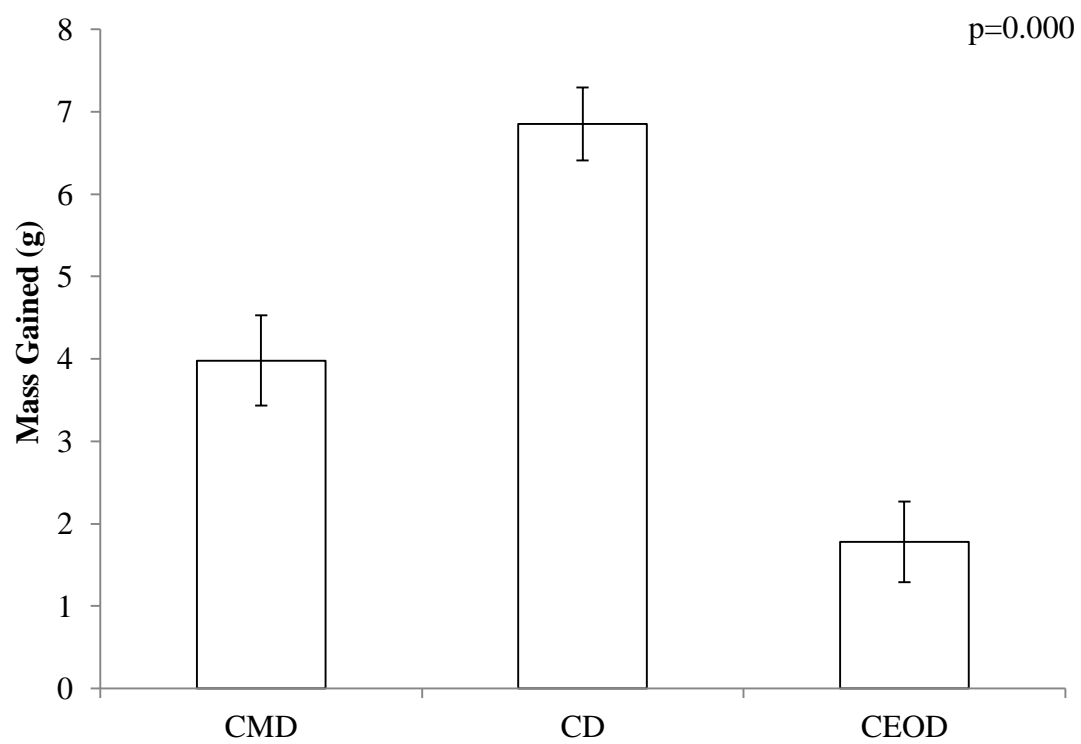


**Fig. 3.** Mean  $\pm$ SE of mass gained by blocks. Each block contains three skinks. Block one has the shortest snout vent length and block 12 has the longest. Half of each skink tail was removed and mass was measured after nine weeks. Refer to appendices.

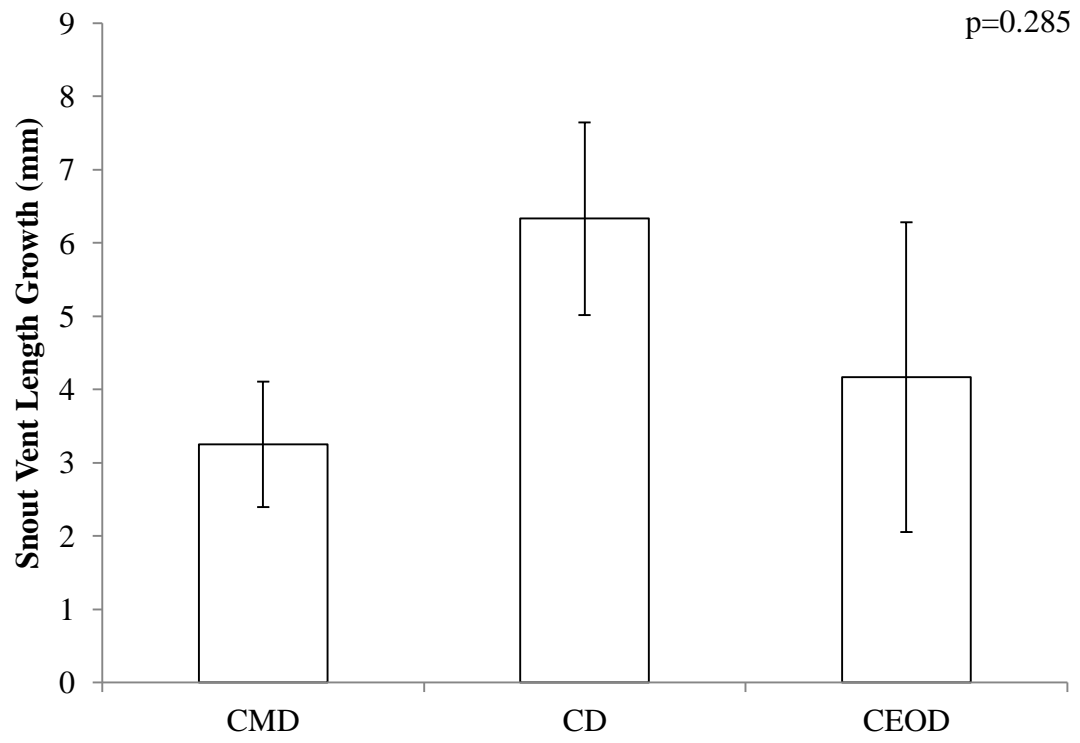


**Fig. 4.** Mean  $\pm$ SE of mass gained per treatment. Each treatment contained 12 skinks. Half of each skink tail was removed and mass was measured after nine weeks. Treatment labels are as follows, CMD= Crickets Mealworm Larvae Daily, CD= Crickets Daily, CEOD= Crickets Every Other Day.





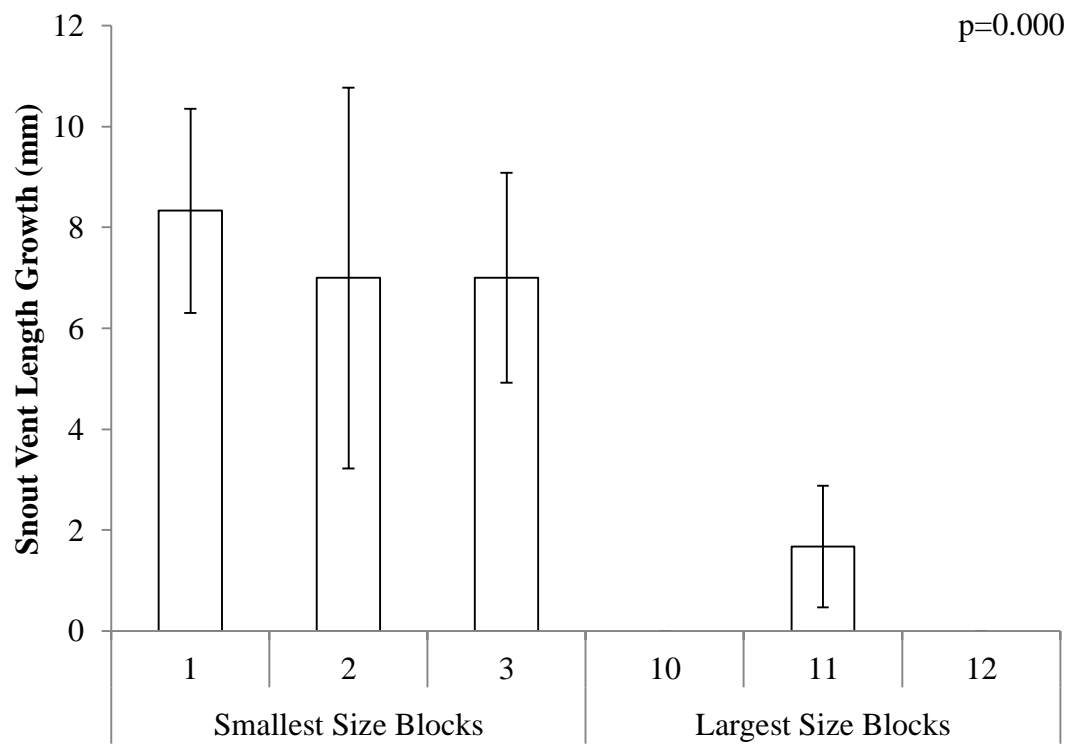
**Fig. 5.** Mean  $\pm$ SE of snout vent length growth by treatment. Each treatment had 12 skinks. Half of each skink tail was removed and snout vent length was measured after nine weeks. Treatment labels are as follows, CMD= Crickets Mealworm Larvae Daily, CD= Crickets Daily, CEOD= Crickets Every Other Day.



**Fig. 6.** Mean  $\pm$ SE of snout vent length growth of smallest and largest size class blocks.

Each block contains three skinks. Block one has the shortest snout vent length and block 12 has the longest. Blocks 10 and 12 had no growth in snout vent length. Half of each skink tail was removed and snout vent length growth was measured after nine weeks.

Refer to appendices.



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**Appendix A.** Raw data collected for all skinks used in this study. The initial data included body lengths (S-V is snout to vent), body mass before and after caudal autotomy, and autotomized tail mass and length. The final data includes body and tail lengths, body mass, and tail regrowth.

Skink	Initial							Final				
	Total Body Length (mm)	S-V Length (mm)	Tail Length (mm)	Total Mass Before (g)	Tail Mass Dropped (g)	Total Mass After (g)	Tail Length Dropped (mm)	Total Body Length (mm)	S-V Length (mm)	Regrown Tail Length (mm)	Total Tail Length (mm)	Mass (g)
2	177	70	107	9.80	1.00	8.80	71	167	83	35	84	17.38
3	255	98	157	26.91	2.11	24.80	96	188	102	19	86	26.31
4	162	77	85	10.94	0.51	10.43	51	145	79	24	66	15.58
5	179	74	105	9.57	0.35	9.22	47	174	79	26	95	15.16
6	171	71	100	8.52	0.36	8.16	48	153	71	23	82	11.65
7	164	68	96	7.81	0.37	7.44	53	155	76	29	79	10.14
8	165	66	99	6.48	0.22	6.26	47	165	78	11	87	15.32
10	231	92	139	20.72	1.01	19.71	68	205	97	33	108	25.97
11	211	90	121	19.46	1.02	18.44	65	186	94	35	92	21.47
12	169	90	79	14.05	0.33	13.72	44	156	92	24	64	19.07
13	180	72	108	9.75	0.75	9.00	72	163	80	32	83	15.25
14	194	78	116	11.45	0.84	10.61	70	175	88	34	87	17.43
15	188	76	112	11.35	1.06	10.29	73	158	79	36	79	12.98
16	210	87	123	14.77	0.77	14.00	68	163	87	16	76	17.50
17	206	104	102	26.05	1.58	24.47	52	185	104	22	81	30.49
18	215	101	114	27.36	0.50	26.86	43	196	105	21	91	29.92
19	160	96	64	24.57	1.17	23.40	25	169	103	26	66	29.71

Skink	Initial							Final				
	Total Body Length (mm)	S-V Length (mm)	Tail Length (mm)	Total Mass Before (g)	Tail Mass Dropped (g)	Total Mass After (g)	Tail Length Dropped (mm)	Total Body Length (mm)	S-V Length (mm)	Regrown Tail Length (mm)	Total Tail Length (mm)	Mass (g)
20	182	98	84	20.46	0.64	19.82	42	174	103	24	71	27.22
21	198	75	123	12.44	1.97	10.47	99	163	85	48	78	17.76
22	240	114	126	36.02	2.38	33.64	69	189	114	21	75	32.63
23	241	111	130	40.40	2.76	37.64	79	203	111	31	92	40.37
24	223	100	123	24.66	1.46	23.20	64	183	100	17	83	28.37
25	233	96	137	19.03	0.63	18.40	58	195	96	16	99	22.75
26	224	98	126	21.63	1.69	19.94	74	199	124	18	75	18.62
27	232	109	123	34.59	1.15	33.44	53	204	109	26	95	34.84
28	250	104	146	26.53	1.76	24.77	78	198	104	26	94	25.39
29	194	92	102	19.50	1.80	17.70	69	154	93	27	61	19.42
30	258	114	144	43.70	2.70	41.00	80	205	114	24	91	42.10
31	276	111	165	35.08	2.04	33.04	90	214	111	26	103	40.46
32	207	108	99	28.26	1.39	26.87	63	148	109	3	39	33.20
33	242	101	141	27.38	1.36	26.02	69	195	105	19	90	27.44
34	255	101	154	26.14	1.77	24.37	89	197	101	28	96	25.84
35	224	88	136	16.98	1.42	15.56	85	185	97	35	88	23.23
36	249	95	154	24.57	1.42	23.15	88	209	107	35	102	27.03
37	195	79	116	13.08	0.60	12.48	62	179	83	34	96	14.73
38	167	69	98	7.45	0.42	7.03	55	154	74	24	80	12.76

**Appendix B.** Experimental setup of the skink specimens. Each skink was separated into size blocks. Blocks were ranked by snout to vent length, in which there is no greater than 3mm difference between the skinks in each block. Each block has a single skink from each treatment. The number in the treatment section represents the skink that was placed into that block. Raw data, including snout to vent lengths and skink numbers, can be located in Appendix A. The treatments are labeled as follows, CD=Crickets Daily, CEOD=Crickets Every Other Day, and CMD=Cricket, Mealworm Larvae Diet.

Size Block	Treatment		
	CD	CEOD	CMD
1	8	7	38
2	2	6	13
3	21	15	5
4	14	37	4
5	35	11	16
6	10	29	12
7	19	25	36
8	20	26	3
9	18	33	24
10	17	28	34
11	32	27	23
12	31	22	30

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