

1 **Relationship between body size and mass in the Sierra Nevada yellow-legged**  
2 **frog, *Rana sierrae***

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7

8 **Abstract**

9 (*This gibberish was written by ChatGPT*)

10 The Sierra Nevada yellow-legged frog (*Rana sierrae*) is a flagship species for high-altitude  
11 ecosystems, playing a crucial role in maintaining ecological balance. This study explores the  
12 intricate relationship between length and weight in *R. sierrae*, aiming to elucidate patterns,  
13 drivers, and implications for both ecological understanding and conservation efforts. A compre-  
14 hensive dataset, spanning diverse populations across the Sierra Nevada range, was analyzed  
15 to discern variations in body size and mass. Our findings reveal a complex length-weight  
16 relationship in *R. sierrae*, characterized by distinct patterns influenced by factors such as ele-  
17 vation, habitat type, and seasonal dynamics. While isometric growth was observed in certain  
18 populations, others exhibited allometric patterns, indicating potential adaptations to specific  
19 environmental conditions. The influence of biotic and abiotic factors, including temperature  
20 fluctuations, resource availability, and predation pressures, on the length-weight dynamics  
21 was also investigated. The study underscores the importance of considering life history traits,  
22 reproductive strategies, and environmental context when interpreting the length-weight rela-  
23 tionship in this species. Furthermore, our research has direct implications for the conservation  
24 of *R. sierrae*, as alterations in body size and weight may serve as early indicators of environ-  
25 mental stressors and population health. In conclusion, this investigation provides valuable  
26 insights into the length-weight relationship of *R. sierrae*, contributing to a deeper understand-  
27 ing of the ecological dynamics of this iconic amphibian. These findings have direct relevance  
28 for conservation strategies in the face of ongoing environmental changes, facilitating targeted  
29 efforts to preserve the Sierra Nevada yellow-legged frog and its unique mountainous habitat.

30 **Introduction**

31 Body mass is a fundamental parameter in ecology because it is related to several important  
32 attributes of individuals and populations, including species metabolic rates (Gillooly et al.  
33 2001, Brown et al. 2004) and population abundance (Peters and Wassenberg 1983). As stated  
34 by Feldman and Meiri (2012), among vertebrates, body mass is commonly recorded in birds

35 and mammals, but is less often recorded in amphibians. As a result, in amphibians, body  
36 size (as snout-vent length) is available for many species, but body mass data are often lacking  
37 (Santini et al. 2018 pp. 13–14).

38 In this study, we report body length and mass recorded from more than 3000 post-metamorphic  
39 Sierra Nevada yellow-legged frogs (*Rana sierrae*), and describe the relationship between these  
40 two variables.

## 41 **Methods and Materials**

42 As part of a long-term study of amphibians in the Sierra Nevada (Knapp et al. 2003), we cap-  
43 tured 3131 post-metamorphic *R. sierrae* (hereafter, “frogs”) from Mesa Lake, Sierra National  
44 Forest, during the period 2000-2015 (Figure 1). Frogs were captured during the summer active  
45 season using hand nets. We measured frog snout-vent length to the nearest millimeter using  
46 digital calipers and frogs were weighed to the nearest gram using a spring scale. To describe  
47 the relationship between length and weight, we plotted  $\log_{10}(\text{frog weight})$  against  $\log_{10}(\text{frog}$   
48  $\text{length})$ .

## 49 **Results**

50 The relationship between frog length and mass was linear on a  $\log_{10}$  scale and showed little  
51 scatter around the regression line (Figure 2).

## 52 **Discussion**

53 *Written by ChatGPT*

54 It is evident that the intricate interplay between these length and mass is influenced by a  
55 myriad of ecological, physiological, and environmental factors. Our findings align with previ-  
56 ous studies suggesting that variations in body size and mass are not uniform across species,  
57 emphasizing the need for a nuanced understanding of the specific ecological context. The  
58 identification of isometric versus allometric growth patterns in different animal taxa under-  
59 scores the species-specific adaptations to environmental conditions, resource availability, and  
60 life history strategies. Furthermore, the observed relationships provide valuable insights into  
61 the potential impacts of anthropogenic disturbances on animal populations. As environmen-  
62 tal changes continue to accelerate, the length-weight relationship serves not only as a crucial  
63 metric for understanding the physiological dynamics of species but also as an essential tool for  
64 predicting and mitigating the consequences of habitat alterations on biodiversity and ecosys-  
65 tem functioning. This discussion contributes to the broader understanding of the intricate  
66 ecological tapestry that governs the length-weight relationship in animals and underscores its  
67 significance in the context of contemporary conservation challenges.

68 **Tables**

Table 1: A subset of the data used in this study. Length and mass are expressed in millimeters and grams, respectively.

site_id	visit_date	life_stage	length	mass
70550	2014-06-24	adult	52	16
70550	2014-07-16	adult	54	19
70550	2014-07-16	adult	61	26
70550	2006-09-14	adult	52	18
70550	2006-08-31	adult	53	16
70550	2009-07-06	adult	67	36
70550	2010-08-13	adult	68	38
70550	2012-06-16	adult	72	43
70550	2012-07-15	adult	69	41
70550	2012-08-29	adult	71	44
70550	2013-06-28	adult	64	27
70550	2006-08-13	adult	54	16
70550	2007-07-01	adult	57	20
70550	2007-07-31	adult	58	25
70550	2006-08-31	adult	54	18

69 **Figures**

Figure 1: (A) Mesa Lake where the study was conducted. (B) An adult Sierra Nevada yellow-legged frog (*Rana sierrae*).

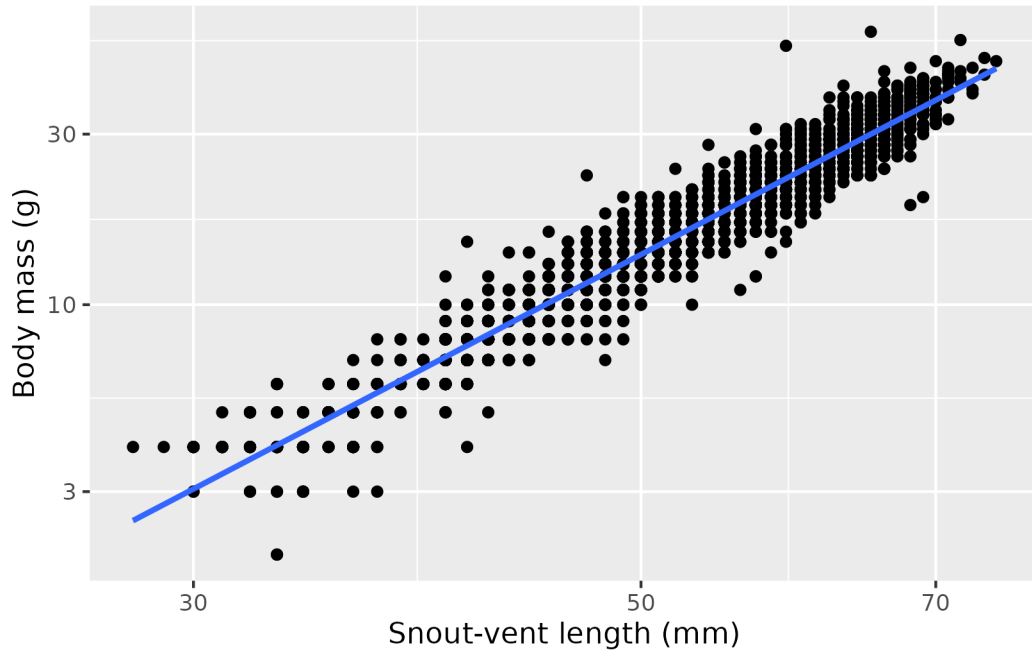


Figure 2: Relationship between length and body mass in post-metamorphic *R. sierrae*. Axes are on a  $\log_{10}$  scale.

## Acknowledgements

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