

A Step in Speciation

The small salamanders of the genus *Ensatina* are strictly terrestrial. They even lay their eggs on land. Nevertheless, these salamanders need a moist environment and do not thrive in arid regions. In California, *Ensatina eschscholtzii* has been studied by R. C. Stebbins at the University of California (Berkeley). This investigation is based on his work.

Materials (per team)

Outline map of California

8 different colored pencils/markers

Part A: Collection Areas

Procedure

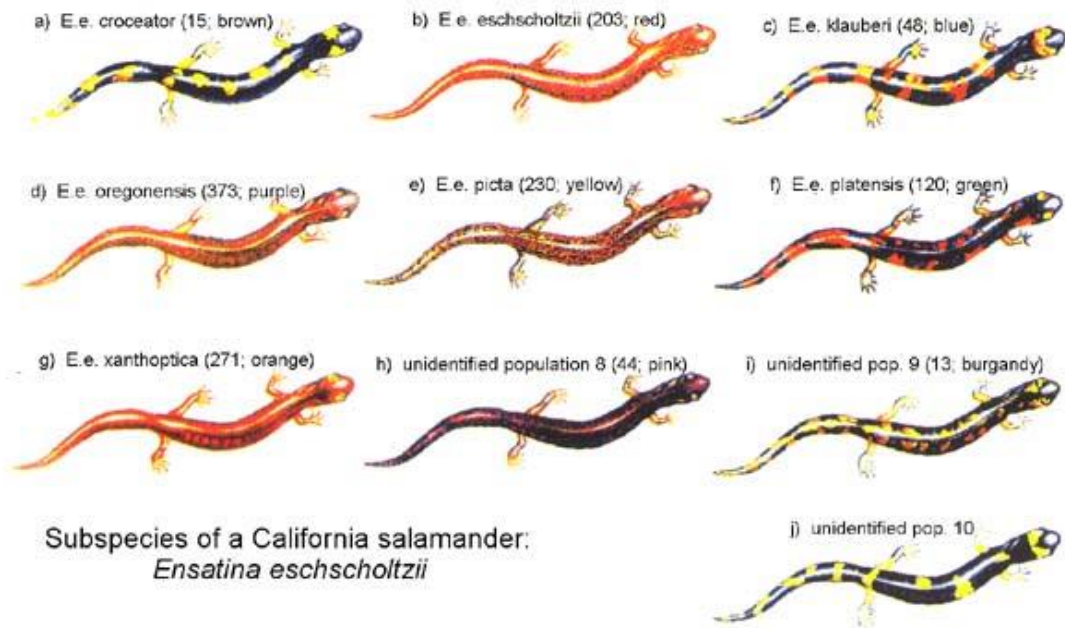
1. Imagine that you are working with Stebbin's salamanders specimens, some of which are pictured in Figure 9.24. In the following list, salamanders are identified by subspecies. (A subspecies is a geographically restricted population that differs consistently from other populations of the same species.) The parentheses after each subspecies contain a number and a color. The number is the total individuals Stebbins had available for his study. The color is for you to use in designating the subspecies. Following this is a list of collection areas. They are indicated by a code that fits the map of California in Figure 9.25. For example, 32/R means that one of more *E. e. croceator* specimens were collected near the intersection of Line 32 and Line R.
 - a. *E. e. croceator* (15; brown): 32/R, 32/S, 30/T, 31/T
 - b. *E. e. eschscholtzii* (203; red): 30/M, 32/O, 34/S, 35/V, 36/W, 35/Z, 38/Y, 40/Z
 - c. *E. e. klauberi* (48; blue): 36/Z, 38/a, 40/a, 39/a
 - d. *E. e. oregonensis* (373; purple): 9/B, 7/E, 6/E, 13/C, 10/C, 7/D, 15/D
 - e. *E. e. picta* (230; yellow): 2/B, 2/C, 3/C, 4/C
 - f. *E. e. platensis* (120; green): 8/J, 10/J, 11/M, 13/M, 15/M, 15/O, 17/M, 15/P, 20/Q, 24/S, 21/R, 25/T, 26/U
 - g. *E. e. xanthoptica* (271; orange): 17/G, 17/F, 19/H, 19/O, 20/I, 20/J, 21/I
2. Using Figure 9.25 grid of California, plot each collection by marking a small dot mark at the intersection of the number and letter given. Then, shade the adjacent upper left square with the colors indicated for each subspecies population. This will make a distribution map of all the *Ensatina eschscholtzii* (*E. e.*) in California.

Discussion

1. Is the species uniformly distributed? Use your knowledge of the species' ecological requirements to offer an explanation of its distribution. Are there any other factors that might affect distribution?
2. Consider the physiography of California in Figure 9.25. Does the species seem more characteristic of mountain areas or of valley areas?
3. Do you expect any pattern in distribution of subspecies? Why or why not?

4. Examine the salamanders in Figure 9.24. Note that some subspecies have yellow or orange spots and bands on black bodies. Some have fairly plain, brown-orange bodies. One has small orange spots on a black background. There are other differences as well. For example, some of them have white feet. Now refer to your distribution map. Does there appear to be any order to the way these color patterns occur in California? For example, do the spotted forms occur only along the coast? Do spotted forms occur in the north and unspotted ones in the south?
5. Subspecies *E. e. eschscholtzii* and *E. e. klauberi* are different from each other. What relationship is there between their distributions?
6. Following the completion of the activity, read through the different pages of the website on *Ensatina eschscholtzii* speciation known as a ring species:
 - a. http://evolution.berkeley.edu/evolibrary/article/devitt_01

Figure 9.24



Real Pictures of each salamander subspecies

a. *E. e. croceator*



b. *E. e. eschscholtzii*



c. *E. e. klauberi*



d. *E. e. oregonensis*



e. *E. e. picta*



f. *E. e. platensis*



g. *E. e. xanthoptica*

