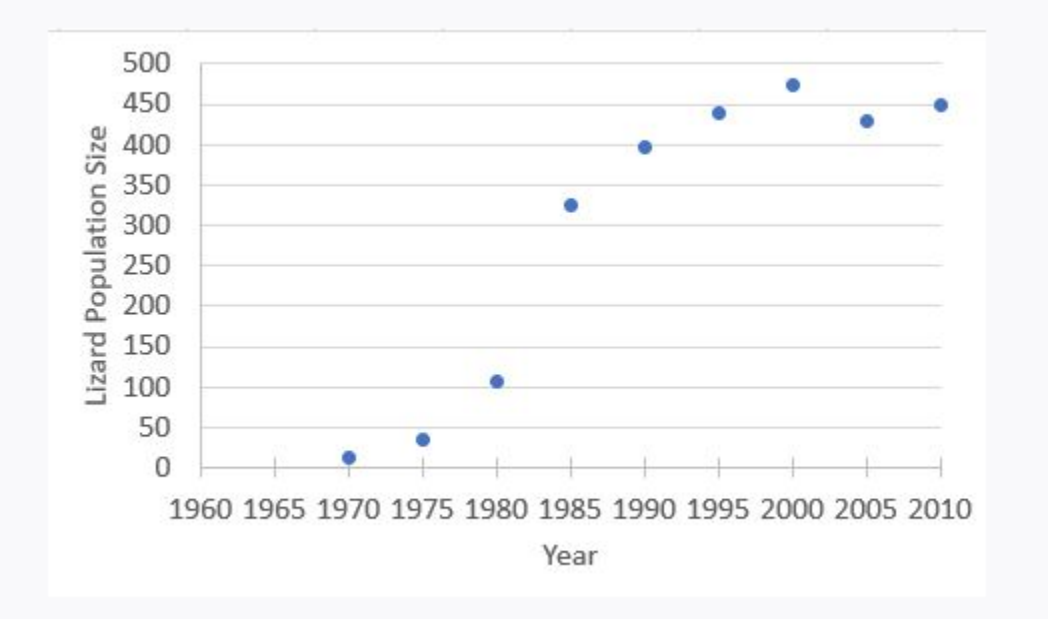
Optional Ecology Worksheet – Population Ecology of Wall Lizards - Key

The Common Wall Lizard (Podarcis muralis) is native to Europe. This lizard was first brought to British Columbia in 1967 to be housed in a private zoo near Victoria, B.C. In 1970, 12 European Wall Lizards were intentionally released when the zoo closed. Since their initial release, the distribution and abundance of these lizards has increased. This lizard species can now be found throughout most of southern Vancouver Island and has also been spotted in Vancouver and the Okanagan.

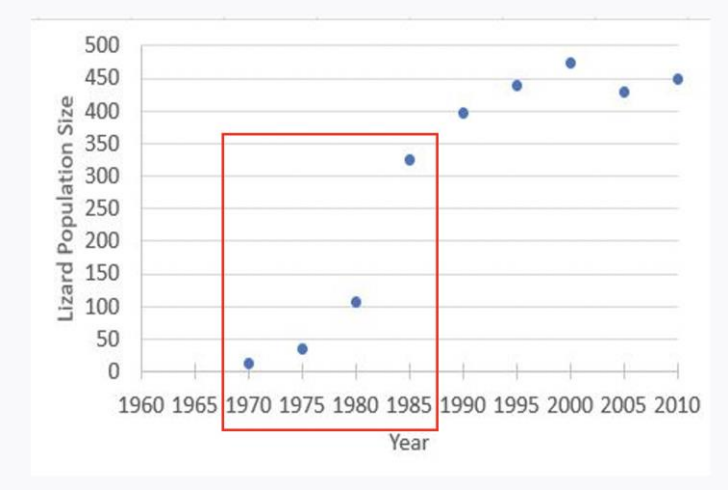
A) The figure below shows the estimated population size of the Common Wall Lizard at one location on Southern Vancouver Island from 1970-2010.



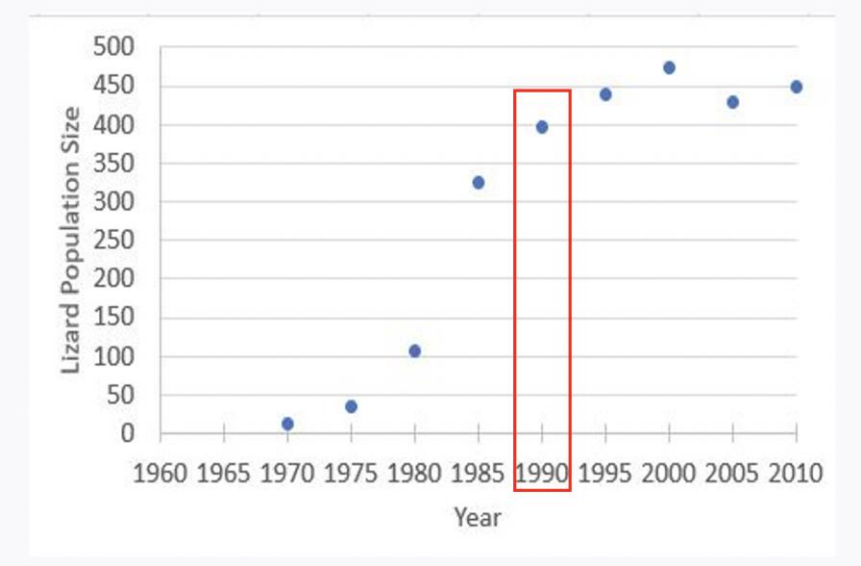
Based on the figure above, what is the environment's carrying capacity for the Common Wall Lizard at this location?

Between the years 1995 and 2010, the population size fluctuates between ~ 440 and 470 individuals, suggesting that the carrying capacity is approximately 455. (If you said K=450 that would be okay too)

B) Based on the figure in Question A above, during which years was the population growing near-exponentially? Circle the appropriate area on the graph.



C) Based on the figure in Question A above, in approximately what year did density-dependent factors start to strongly affect the per capital growth rate? Circle the appropriate area on the graph.



(Anywhere between 1985-1990 is fine)

D) List one **density-dependent** factor that could affect the population growth rate of the Common Wall Lizard population on Vancouver Island and briefly explain how this factor could potentially affect the population per capita growth rate (*r*) of the lizards.

Many possible answers. Sample answer:

Food availability is a density-dependent factor that could affect population growth of wall lizards. If available food per individual is low, we expect birth rates to decrease, death rates to increase, or both, resulting in a decrease in *r*. The factor is density-dependent because a certain amount of food could be limiting for large populations but not limiting for small populations.

E) List one **density-independent** factor that could affect the population growth rate of the Common Wall Lizard population on Vancouver Island and briefly explain how this factor could potentially affect the population per capita growth rate (*r*) of the lizards.

Many possible answers. Sample answer:

Temperature is a density-independent factor that could affect population growth of wall lizards. Lizards may have an optimum temperature for survival and reproduction, but if temperatures increase or decrease beyond that point, birth rates may decrease and/or death rates may increase, decreasing *r*. The factor is density-independent because the effect of temperature will be the same regardless of population size.

F) Recently, a population of Common Wall Lizards has been found in the Vancouver area. You have been hired to conduct a mark-recapture study to estimate the population size of this lizard population.

In your initial visit, you capture 100 lizards and mark them by painting an individual number on the bottom of their body. You return one month later and capture 150 lizards. 60 of these lizards are marked. What is the population size of Common Wall Lizards at your study site? Use the Petersen-Lincoln Index for your calculations (N/M = n/m). You do not need to show your work.

M = 100, n = 150, m = 60

N = (M*n)/m = (100*150)/60 = **250**

Not necessary to show work

G) What is one assumption that must be met for you to have confidence that your estimated population size is an accurate estimate of the true lizard population size? (1 mark)

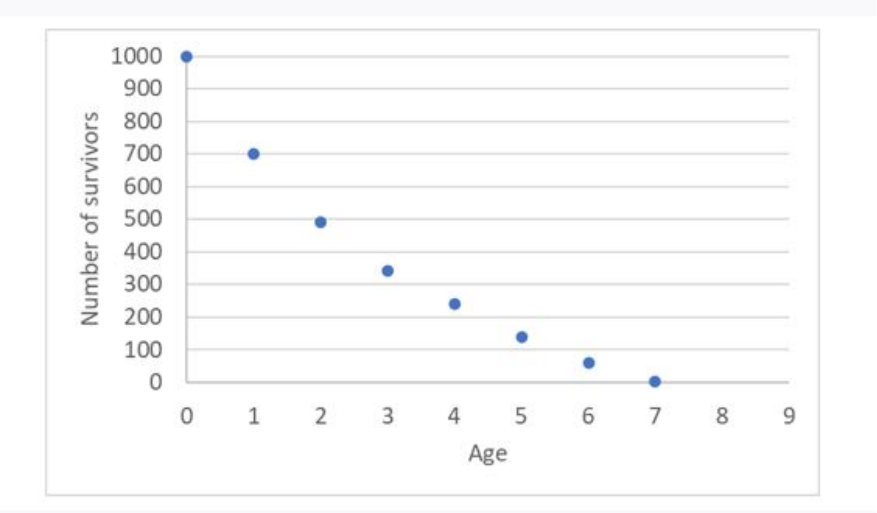
Many possible answers – just identify at least one assumption of Lincoln-Peterson estimation. Sample answer:

We assume the population is closed; i.e., no individuals are immigrating, emigrating, being born, or dying between sampling visits.

H) Below is a survivorship curve for the Common Wall Lizard. Which type of survivorship curve best fits the data for the Wall Lizards? Explain your choice.

The best answer is Type II survivorship, since individuals have a relatively equal probability of dying regardless of age.

Some may be able to justify answering Type III, but we generally don't see the large distinction between juveniles VS adults that would be expected under Type III survivorship, so it is arguably not the best answer.



I) Biologists are concerned that as the abundance and distribution of the European Wall Lizard increases, the lizard will come into contact with a native lizard species, the Northern Alligator Lizard (*Elgaria coerulea*)

Based on the information in the table provided below (on the next page), why would biologists be concerned if these two lizard species interact? Explain your answer. In your answer refer to the interaction that would occur between these two species, **one** potential ecological outcome of this interaction and the potential fitness effects for the Northern Alligator Lizard.

Factor	Common Wall Lizards (introduced)	Northern Alligator Lizard (native)
Body Size	Grows up to 20 cm total body length	Grows up to 20 cm total body length
Diet	Invertebrates, e.g., insects such as beetles, caterpillars, and moths.	Invertebrates, e.g., insects such as beetles, caterpillars, moths, plus spiders, snails
Habitat	Ground dwelling. Prefers open, exposed sites with cover, such as rocks and logs.	Ground dwelling. Found near sunny clearings with cover, such as rocks and logs.
Population Densities	Can be high (>600 lizards/ha)	Up to 111 lizards/ha

The table indicates that common wall lizards and northern alligator lizards overlap greatly in their ecological niche. Both lizards share similarities in diet (invertebrates), habitat (ground-dwelling, preferring open areas with cover objects, e.g. rocks and logs), and body size (up to 20 cm). In addition, common wall lizards can achieve much greater population densities (>600 lizards/ha) than northern alligator lizards (111 lizards/ha). Taken together, this suggests common wall lizards and norther alligator lizards will experience interspecific competition. The outcome of this interaction could be competitive exclusion of northern alligator lizards, since we can infer from their higher population densities that wall lizards are likely superior competitors (higher K). This further suggests northern alligator lizards will experience negative fitness as a result of the interaction.

J) Below are some life history traits for the European Wall Lizard and the Northern Alligator Lizard.

Life history trait	European Wall Lizard	Northern Alligator Lizard
Life expectancy	4 – 7 years	5 – 8 years
Age at first reproduction	24 months	32-44 months
Number of clutches per year	Up to 3 clutches	1 clutch
Number of offspring **per clutch**	Average=5 offspring per clutch (range 3-11)	Average 4.5 offspring (range 4-5).

Which of these two species is more K-selected in its life history? Briefly justify your answer making use of the data in the table.

Northern alligator lizard is relatively more K-selected. It lives longer (5-8 years), matures later (32-44 months), and has fewer offspring (1 clutch per year consisting of 4-5 offspring). Conversely, European wall lizards are relatively r-selected. They don't live as long as alligator lizards (4-7 years), mature earlier (24 months), and have more offspring (up to 3 clutches per year consisting of 3-11 offspring).