

POPULATION ECOLOGY WORKSHEET - NORTHERN SPOTTED OWLS – Answer Key

Question 1A

For each of the factors listed below, provide one example of an event that could influence that factor with respect to northern spotted owl populations:

Below are examples of possible answers

- a. Births: Restoration of old growth forest means a gain in nesting habitat more nests more offspring *increases birth rate*
- b. Deaths: Barred owl (a stronger competitor) consumes the mice that the spotted owl also preys upon spotted owls have less food to feed their owlets *increases death rate*; or barred owl successfully competes for nesting sites (a limited resource) fewer nesting sites means lower birth rates or perhaps higher predation risk for chicks if the nests are in sites easily accessible to predators.
- c. Immigration: Resources (mice) come to the area, owls follow from another population **increases immigration rate*; barred owls outcompete/chase away northern spotted owls from a distant area, owls leave and immigrate to local population *increases immigration rate*
- d. Emigration: Habitat loss due to humans (logging) reduces available habitat in area, so owls leave, *increasing emigration rate*; climate change makes the area too warm/inhospitable for the owls; so, the owls leave *increasing emigration rate*.

Question 1B

Was the example that you chose for "deaths" in 1A above an example of an abiotic factor or a biotic factor?

The answer to this question will depend upon what factor you chose for 1A. The example above is an example of a biotic factor (i.e. competition), e.g. appropriate nesting sites are in limited supply. Individuals will need to compete for sites. The more individuals in the population the more intense the competition. An example of an abiotic factor would be a fire within the home range of the owls.

Was it a density dependent factor or a density-independent factor?

Competition is an example of a density-dependent factor. Habitat (e.g. such as nesting sites) are in limited supply. Competition will have a greater impact the larger the owl population.

A fire in the home range of the owls would be an example of a density-independent factor, because the fire could negative impact the owl population regardless of the owl's population size.

Question 2

In 2004, a team of biologists conducted a mark-recapture study to estimate the population size of the northern spotted owls in the Great Bear Rainforest. In the first sampling period, they captured and marked 12 spotted owls. In the second sampling period, they captured 8 spotted owls. 6 of these owls were marked.

What is the estimated population size of the spotted owls in the Great Bear Rainforest?

$$\frac{12 \times 8}{6} = 16$$

Question 3A

In 2005, a team of biologists collected data on the population size of northern spotted owls in the same area. They were also able to collect data on the number of births and the number of deaths in this population (see table below). What was the rate of population growth (r) in 2005?

$$r = (\# \text{ births} / \# \text{ individuals in the population}) - (\# \text{ deaths} / \# \text{ individuals in the population})$$

Year	Population Size	Number of Births	Number of Deaths	r
2005	20	5	1	0.20

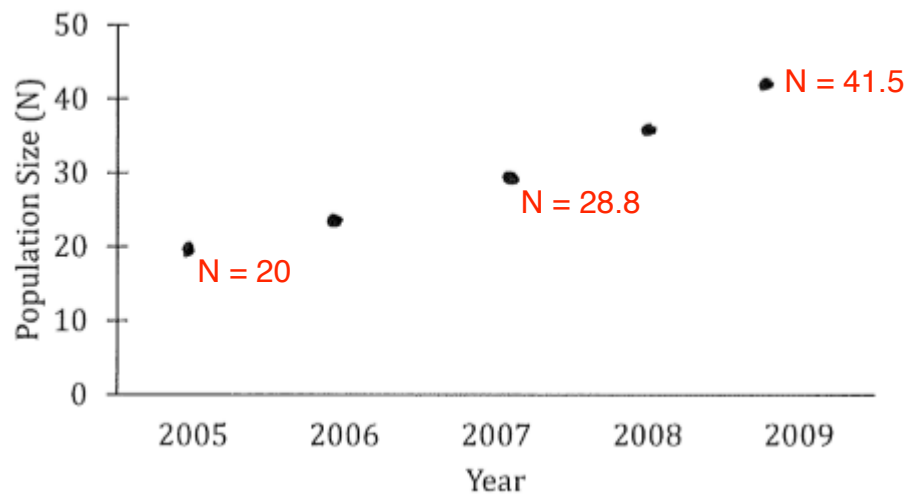
$$(5/20) - (1/20) = 0.25 - 0.05 = 0.20$$

Question 3B

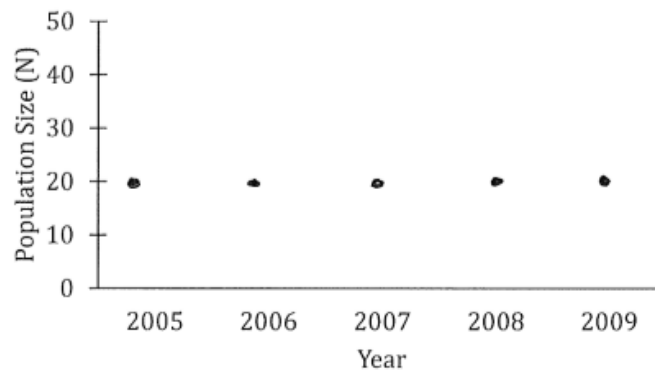
- i) Based on the rate of population growth calculated in 3A, plot the population size of the northern spotted owls from 2005 to 2009. Assume r remains constant.

Is the population size increasing, decreasing, or staying constant? Is the curve exponential or logistic?

Easiest approach is to use $N_{t+1} = N_t(1+r)$, but calculating $B - D$ each year and adding to last year will also work

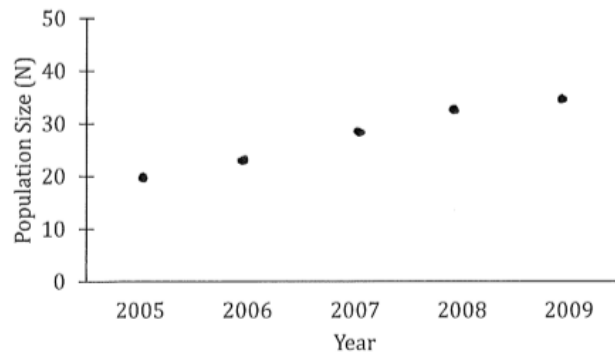


- ii) Plot the population size of the northern spotted owls from 2005 to 2009 if $r=0$.

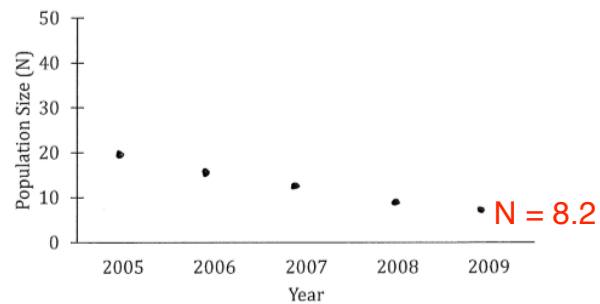


- iii) Plot the population size of the northern spotted owls from 2005 to 2009 if r declined from 0.2 to 0.

Will be variable. Try making up data (e.g. $r = 0.2$ for 2005/2006, $r = 0.1$ for 2006/2007, $r = 0$ for 2008/2009)



- iv) Plot the population size of the northern spotted owls from 2005 to 2009 if $r = -0.2$

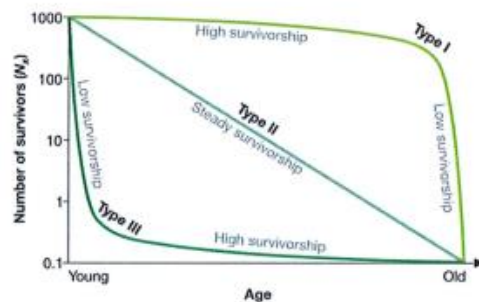


Question 4

In 2012, a captive breeding program was started in an attempt to increase the population size of the northern spotted owls. In total there were 13 adult owls in captivity, all of which survived. 10 eggs were laid, but only 6 eggs were fertile. Only 3 owlets were born. Of these 3 owlets, only one survived.

Based on the data below, which survivorship curve likely applies to the Northern Spotted Owl?

- A. Type I
- B. Type II
- C. Type III

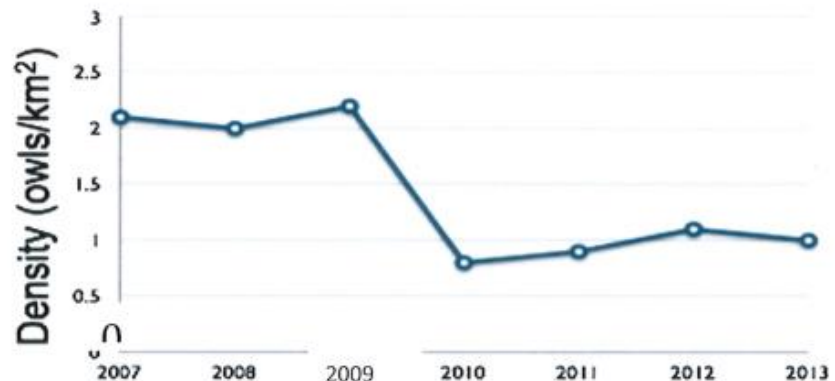


Question 5A

In 2009, in California, two new highways were built through the owl's habitat. One large habitat was fragmented into four smaller patches. Overall, the size of the habitat decreased from 102 km² to 101 km².

Based on the figure below, what was the approximate carrying capacity (K) of the environment after the habitat fragmentation?

- A. 1 owls/km²
- B. 1.5 owls/km²
- C. 2 owls/km²



Question 5B

Propose a hypothesis that could explain the change in size of the Northern California owl population between 2009—2010. Include: 1) the cause of the change, 2) how it links to factors that influence population size/growth, and 3) the resulting outcome.

For full marks, answer needs to:

Describe a mechanism and/or event explicitly associated with habitat fragmentation (just saying "habitat fragmentation was the cause of the change" is not enough)

Clearly explain how the mechanism above would affect one (or more) of births/deaths/immigration/emigration

Explicitly state how the change in births/deaths/immigration/emigration explained above would result in the observed change between 2009—2010 (i.e., drop in carrying capacity of the habitat)

For example:

Habitat fragmentation caused by the creation of the two highways in 2009 affected prey availability. There was less prey available (mice) for the owls in the fragmented areas due to the loss of key shelter and/or foraging sites for the mice due to the road construction. Fewer mice resulted in higher death rates amongst the owls due to starvation. Thus, the resulting outcome was a reduction in the carrying capacity of the remaining habitat and a decrease in the population size of the northern spotted owls.