

## Unit 2 review Quiz – a hard copy summary

↓ True/False: r or K

**Question** Strong density dependence is a K-selected trait

**Question** High investment in parental care is a K-selected trait

**Question** A population under strong top-down control is likely K-selected

**Question** High disturbance environments promote K-selected traits

**Question** High dispersal ability is a r-selected trait

**Question** A r-selected species grows after herbivory rather than defends against herbivory

**Question** Late maturity is a K-selected trait

**Question** A K-selected life history strategy is expected when fitness is variable through time

**Question** Intense intraspecific and interspecific competition is expected to lead to K-selected life histories.

**Question** High fecundity (= high per capita birth rate) is associated with K-selected traits

↓ **Multiple Choice: Understanding population plots:**

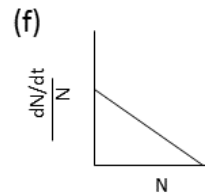
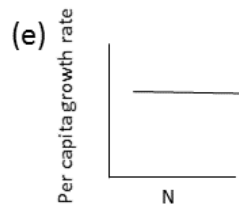
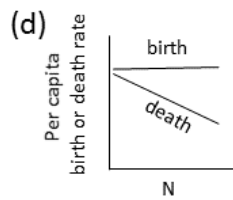
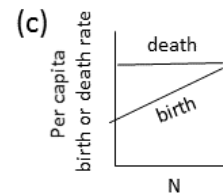
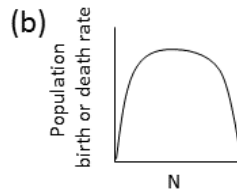
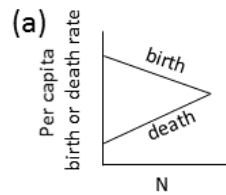
Which of these plots shows density independence (one answer):

Which of these plots shows an Allee effect (one answer):

Which TWO plots shows inverse density dependence?

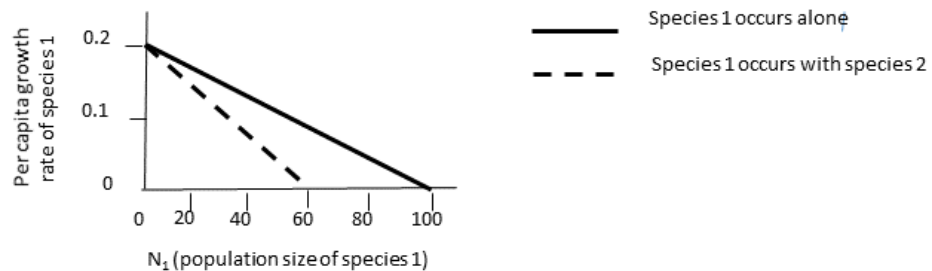
Which THREE plots show population regulation:

**Question**



## Multiple Choice: Two populations two islands

Species 1 occurs on two islands. The islands are identical in every possible way. On one island species 1 occurs alone. On the other island, species 1 occurs with species 2, and on this island, when the abundance of both species have stabilized, there are 80 individuals of species 2. The population dynamics of species 1 was studied on both islands for many years, allowing researchers to construct the graph below. Note that the subscript 1 on a parameter tells you that the parameter refers to species 1 (e.g.  $N_1$  is the population size of species 1).



(a) What parameter does the y-intercept represent?

**Question** (b) What parameter does 100 on the x axis represent?

Possible answers for (a) and (b) are:  $K_1$ ,  $r_1$ ,  $dN_1/dt$  and  $(dN_1/dt)/N_1$

(c) Why is the x-intercept lower when species 1 occurs with species 2 (dashed line) than when species 1 occurs alone (solid line)? Pretends you are marking

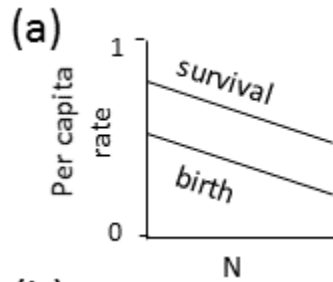
**Question** this question, select the best answer:

1. The x-intercept for both lines is the population size of species 1 when species 1 reaches its carrying capacity. When species 1 shares the habitat with species 2, the carrying capacity ( $K$ ) of species 1 decreases so that births equal deaths at a lower population size. Mathematically,  $dN_1/dt = 0$  when  $(1 - (N_1 + \alpha N_2)/K)$ , which occurs at a lower  $N_1$  when  $K$  is lower.
2. The x-intercept for both lines is the population growth  $((dN/dt)/N)$  of species 1 when species 1 reaches zero population size. When species 1 shares the habitat with species 2, the population size of species 1 decreases so that its population grows at a slower rate. Mathematically, when  $(N_1 + \alpha N_2)/K > (N_1)/K$  then  $dN/dt$  decreases.
3. The x-intercept for both lines is the population size of species 1 when species 1 has reached a stable population size (i.e. when  $dN_1/dt = 0$ ). When species 1 occurs alone, this stable population size is identical to the carrying capacity of species 1 (i.e.  $K_1$ ). However, when species 1 shares the habitat with species 2, individuals of species 2 use up part of species 1's carrying capacity, so species 1 reaches a stable population at a lower population size. Mathematically,  $dN_1/dt = 0$  when  $(1 - (N_1 + \alpha N_2)/K)$ , which occurs when  $N_1 = K - \alpha N_2$ , which must be a number less than  $K$ .
4. The y-intercept for both lines is the per capita growth rate  $((dN/dt)/N)$  of species 1 when species 1 is at a very small population size. When species 1 shares the habitat with species 2, the population size of species 1 decreases so that  $\alpha$  is able to increase. Mathematically, when  $((dN/dt)/N) < rN$ , then density dependence reduces the population size of species 1.

**Answer**

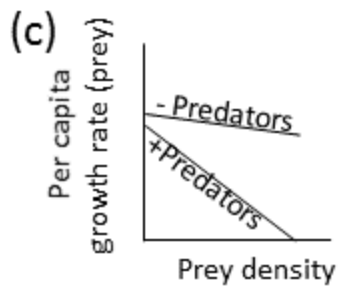
**Question** (d) What is the numerical value of  $\alpha$  (alpha)?

↓ Multiple Choice: Further pop graphs (a): What type of population?



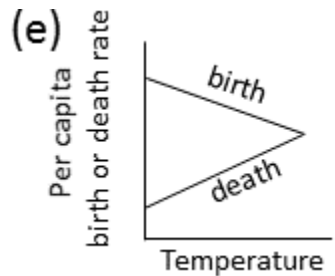
- Answer
- Density dependence
  - Density independence
  - Inverse density dependence
  - Insufficient information to determine

↓ Multiple Choice: Further pop graphs - "c" - there is no b: What type of population?



- Answer
- Independent of the predator
  - Limited by the predator
  - Regulated by the predator
  - Insufficient information to determine if limitation or regulation

↓ **Multiple Choice: Further pop graphs - "e" - there is no d: Which statement is true about this prey population?**



- Answer**
- Limited by increasing temperature
  - Regulated by increasing temperature
  - Unaffected by temperature
  - Insufficient information to determine if limitation or regulation

↓ **Multiple Choice: Chipmunks**

Suppose a population of eastern chipmunks has reached a stable population size of 800 individuals in a woodland, and its competitor, the gray squirrel, has 600 individuals.

**Question**

(a) If you knew that  $\alpha$  (the per capita effect of squirrels on chipmunks) was 0.5, what would the carrying capacity (K) of the chipmunk be? Remember that K is the equilibrium population size of chipmunks in the absence of interspecific competition

**Question**

(b) Continuing with the same chipmunk question, use your answer from part a to determine whether this is a neutral or niche-structured community.

Suppose you were marking this question, which of the following would be the best answer?

1. This is not a neutral community because alpha is 0.5, indicating that the per capita strength of interspecific competition is less than that of intraspecific competition. Thus each squirrel has a smaller effect on the chipmunks than each chipmunk, indicating that the trait differences between squirrels and chipmunks matter to the competitive outcome.

**Answer**

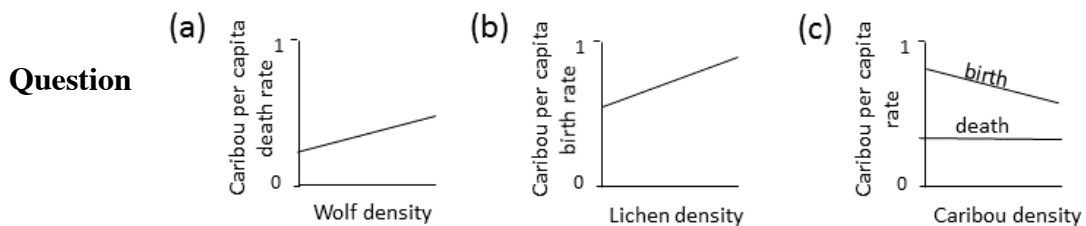
2. This is not a neutral community because the equilibrium number of chipmunks is below their carrying capacity.
3. This is a neutral community because alpha is 0.5, indicating that the effect of intraspecific competition is exactly counterbalanced by the

effect of interspecific competition. Therefore squirrels and chipmunks have similar effects on each other, so any differences in their traits are unimportant to the competitive outcome.

4. This is not a neutral community because there are more chipmunks than squirrels at equilibrium. In a truly neutral community, we would expect the intrinsic growth rate of these species to be identical.

### ↓ Multiple Choice: Wolves and caribou:

Consider a caribou population whose main predator is the gray wolf. This caribou population feeds almost entirely on lichens found on trees. (Incidentally, this caribou population is imaginary, so it may or may not follow the dynamics discussed in class for Mountain caribou). You have studied this population over many years, and can now produce the following graphs (the data points aren't shown, just the best fit line through them).



(a) Do the wolves and/or the lichens impart density dependence on the caribou population?

**Answer**

- Neither wolves nor caribou create density dependence
- Just wolves create density dependence
- Just lichens create density dependence
- Both wolves and lichens create density dependence

(b) Continuing with the same wolf-caribou example, use what you learnt in part a of this question to answer:

**Question**

Suppose the government ordered a wolf cull (i.e. a legal killing of most wolves in the area). If wolf numbers decreased, we would expect immediately following the wolf cull:

- Caribou birth rates to increase but death rates to not change
- Caribou birth rates to increase and caribou death rates to decrease
- No change in either caribou birth or death rates

**Answer**

- Caribou birth rates to not change but caribou death rates to decrease