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Zoology 468 Wildlife Biology Principles Second Hour Exam -- **ANSWER KEY**

22 questions 100 points total October 26, 2007

Read the questions and answers carefully and thoroughly

exponential growth: $N_t = N_0\lambda^t$

logistic growth: $\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$

1. (4 pts) Which of the following is **NOT** a characteristic of a population (**Choose all that apply**)
 - a) density
 - b) per capita growth rate
 - c) survival rate
 - d) home range**
 - e) age structure

2. (4 pts) Which of the following is **recruitment**? (**Choose one**)
 - a) physiological maximum birth rate
 - b) number born per individual in the population
 - c) number produced that survive to maturity**
 - d) number born per reproductive female

3. (4 pts) Suppose the red-spotted tweeter (a fake species) typically produces a clutch size of 10 eggs, but the purple-headed twigweaker (another fake species) typically produces a clutch size of 2. Give one explanation of how the twigweakers could actually produce more young per pair per year than the tweeters do.

Twigweakers could produce more clutches per year, or have much higher survival of chicks to fledging

4. (4 pts) Of the choices below, which are characteristics of an **Income Breeder** (**Choose ALL that apply**)
 - a) Reproductive output is controlled by the amount of resources on its breeding grounds**
 - b) Birds that must bring insects to feed their chicks**
 - c) Reproductive output is controlled by the amount of resources acquired before the breeding season
 - d) Mammals that rely on stored fat and nutrients to produce milk for their offspring

5. (3 pts)
 - a) True or **false**: a **static life table** is constructed by following a group of animals from birth to death and recording their life spans.

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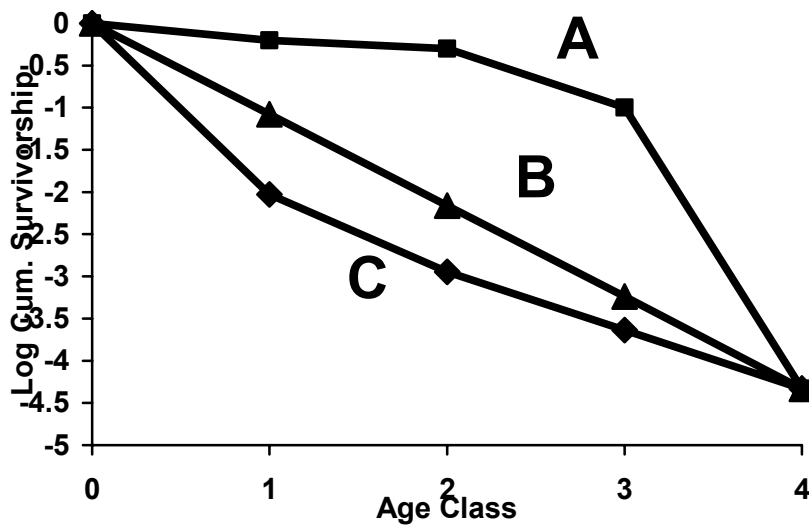
6. (8 pts) Complete the life table below

Be very careful: you will need correct results to answer the next question

Age class (years) (x)	Number at start (n_x)	Number dying (d_x)	Mortality rate (q_x)	Survival rate (s_x)	Cumulative survivorship (l_x)
0	380	266	$266/380 = 0.7$	$1-0.7 = 0.3$	$380/380 = 1.0$
1	114	80	0.7	0.3	$114/380 = 0.3$
2	34	24	0.7	0.3	0.09
3	10	7	0.7	0.3	0.026
4	3	3	1	0	0.008

7. (3 pts) Which survivorship curve below best describes the life table above:

B -- mortality rate is equal for all age classes



8. (5 pts) If a population of fence lizards consists of 90 lizards this year, and the population is growing exponentially with $\lambda = 1.15$, then how many lizards will be in the population in 2012?

$$90 * 1.15^5 = 181 \text{ lizards}$$

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9. (6 pts) Based on the survival rates (s_x), female fertility rates (m_x), and year t abundances ($n_{x,t}$) in each age class in the table below, project the population in year $t+1$.

Age class (x)	s_x	m_x	$n_{x,t}$	$n_{x,t+1}$
0	0.3	0.2	65	$65*0.2+42*1.4+20*1.7+6*0.8=110.6$
1	0.5	1.4	42	$65*0.3 = 19.5$
2	0.6	1.7	20	$42*0.5 = 21$
3	0	0.8	6	$20*0.6 = 12$

10. (6 pts) Suppose a population is growing continuously according to the logistic equation, with $r = 1.4/\text{year}$ and $K = 350$ animals / acre

a) If the current population density is 300 animals / acre, what is the per capita population growth rate?

Total growth = $rN(1-N/K) = 1.4*300*(1-300/350) = 60$

Per capita growth = total growth / N = $60/300 = 0.2$

b) As the population grows in the next year, will the per capita growth rate *increase* or decrease? **With logistic growth, per capita growth rate decreases as N increases**

c) As the population grows in the next year, will the total growth rate *increase* or decrease? **With logistic growth, total growth rate increases from N=0 to N=K/2, and decreases as N increases above K/2**

11. (10 pts) You are studying a population of ovenbirds, which breed once per year. The numbers of birds in the population from 1999 to 2002 are:

Year (t)	N_t	$\Delta N/N\Delta t$	λ
1999	60	$6/60 = 0.1$	$66/60 = 1.1$
2000	66	0.17	1.17
2001	77	0.26	1.26
2002	97	-----	-----

a) Calculate per capita population growth rate and finite rate of increase (λ) for each year

b) Which explanation best matches this pattern of population dynamics (choose one):

i) **Difficulty finding mates at lower population densities (per capita growth rate is increasing as population grows, indicating unstable equilibrium)**

ii) Competition for resources at higher population densities

iii) Greater parasitism and disease as the population grows

iv) Predators multiply when ovenbirds are abundant

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12. (3 pts) Match each form of overabundance with the most appropriate description
(one description per category)

- | | |
|-----------------------------|--|
| a) Dynamical overabundance | 1) population is threatening other species |
| b) Ecological overabundance | 2) population is causing health risks or economic damage to humans |
| c) Societal overabundance | 3) population is reducing its own carrying capacity |

a-3 b-1 c-2

13. (3 pts) Which environmental change is responsible for rapid growth of cormorant populations in the past few decades? (choose one)

- a) increased agriculture on their wintering grounds
- b) protection from hunting in suburban landscapes
- c) outlawing DDT**
- d) increased fish populations

14) (4 pts) According to the research of Paul Errington, predation only becomes important to muskrat populations when the muskrats are abundant enough that all potential territories are taken. Population density when this shift occurs is known as the: (choose one)

- a) rescue effect
- b) core area
- c) population cycle
- d) threshold of security**
- e) predator neutral zone

15) (4 pts) If a snowshoe hare population is high one year but begins decreasing rapidly the next year, this probably means: (choose one)

- a) the population has reached the peak of its cycle, and will reach high densities again in 10 years**
- b) the population has reached dynamical overabundance and is destroying its habitat
- c) humans have altered the environment, and the species is becoming endangered

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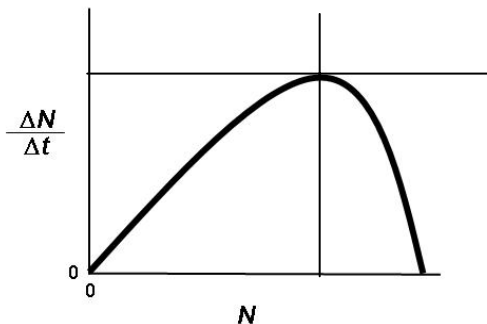
16) (5 pts) Match each term to the best description (**one description per term**)

- | | |
|----------------------------|---|
| a) quota | 1) balances harvest with long term population persistence and nonconsumptive values |
| b) optimum sustained yield | 2) means that the relationship between population growth and density is not known exactly |
| c) partial controllability | 3) means that total harvest is difficult to control exactly |
| d) structural uncertainty | 4) allows greater harvest, because harvested animals would otherwise die of other causes |
| e) compensatory mortality | 5) means that the season is ended after a specified # of animals is taken |

a-5 b-1 c-3 d-2 e-4

17) (4 pts) On the graph below:

- Indicate on the vertical axis maximum sustained yield (MSY)
- Indicate on the horizontal axis the population density at which MSY is achieved



18) (4 pts) What is one way managers can use data collected from hunters to monitor annual reproductive output of a population?

Examine harvested females for evidence of reproduction (lactation, pregnancy, corpora lutea)

Examine age ratios of harvested animals (especially juveniles : adults)

Should indicate how identifying ages of harvested animals can provide information about reproductive output.

Note: Sex ratio alone is not directly informative, nor is information about changes in abundance.

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19) (4 pts) Suppose a city would like to substantially reduce its raccoon population, which is currently estimated at 4,000 animals. Give one advantage and one disadvantage of trap-and-transfer as a method of reducing the population.

advantages: not directly lethal, few safety concerns, high public approval, can collect data on captured animals

disadvantages: costly, translocated animals might die or return, could move problem to new areas or spread disease

20) (4 pts) Porcine Zona Pellucida Vaccine is (**choose all that apply**)

- a) used to combat West Nile virus
- b) **currently being used to control populations of feral horses**
- c) 100% effective
- d) easy to administer to large numbers of animals
- e) **a method of immunocontraception**

21) (4 pts) Which of the following is an example of demographic stochasticity (**choose one**).

- a) very cold winter
- b) genetic drift
- c) **most offspring born happen to be male**
- d) meteor impact

22) (4 pts) Suppose a large patch of prairie is surrounded mainly by forest and agricultural fields, but some small patches of prairie are scattered nearby. For birds that specialize on prairie habitat, what sort of metapopulation is the landscape most likely to constitute? (**choose one**)

- a) Levins
- b) stepping-stone
- c) source-sink -- **partial credit**
- d) **mainland-island**