BIO 357
Exam 2
Multiple Choice (10 pts, 1 pt each)

1. ___A___Fisher's Theory of Adaptation predicts which of the following?
   a. **Small changes are most likely to be beneficial.**
   b. Large changes are most likely to be beneficial.
   c. Intermediate changes are most likely to be beneficial.
   d. Adaptation requires large changes in the gene pool.
   e. None of the above
2. ___B___What kind of predator has a low prey encounter rate, low daily metabolic expenses, and a limited learning ability?
   a. A widely-foraging predator
   b. A K-selected predator
   c. An r-selected predator
   d. **A sit-and-wait predator**
   e. None of the above
3. ___B___What is a disadvantage of being a widely foraging predator?
   a. Generally low volume of prey captured per day.
   b. **High daily metabolic expense**
   c. A high endurance capacity
   d. Enhanced ability to learn and remember
   e. Wide niche breadth
4. ___E___Which of the terms below describes the density-dependent portion of the Verhulst-Pearl equation?
   a. dN/dt
   b. rN
   c. K
   d. K-N
   e. **(K-N)/K**
5. ___D___When would altruistic behavior be selected for?
   a. When two individuals share a significant amount of genetic material.
   b. When both individuals benefit from the 'altruistic' action.
   c. When two individuals are not related.
   d. **Both A & B.**
   e. None of the above.
6. ___A___What is it called when birds fly in a tight flock to discourage predation?
   a. **Adaptive geometry**
   b. Lek formation
   c. Asexual selection
   d. Inclusive fitness
   e. None of the above
7. ___B___In females worker siblings in eusocial hymenoptera insect colonies are more closely related to each other than each is related to its mother because _____.
   a. Female workers are haploid and identical clones.
   b. **The father is haploid and passes all of its genes to its offspring.**
   c. Female workers are produced by asexual reproduction.
   d. Some worker females are the offspring of other worker females.
   e. Workers are identical twins.
8. ___B___What is it called when two dangerous species have similar warning signals or coloration?
   a. Batesian mimicry
   b. **Mullerian mimicry**
   c. Competition
   d. Mutualism

e. Amensalism

9. ___A___What is the Hutchinsonian ratio?
   a. 1.3:1
   b. 2.5:1
   c. 0.3:1
   d. 3:1
   e. 1:1

10. ___C___Which of the following is an indirect interaction?
   a. competition
   b. mutualism
   c. facilitation
   d. predation
   e. none of the above

11. Match names with contributions (some of each may not be used and others may be used more than once) (8 pts, 1 each):

a. n-dimensional hypervolume
b. Limiting Similarity
c. Realized Niche
d. Competition Experiments
e. Deterioration of Environment
f. Seed Eating Ants and Rodents
g. Keystone Predator
h. Optimal Foraging

_____ Rob Colwell

__e_____ R.A. Fisher

__d_____ Georgi Gause

_____ W. D. Hamilton

_abc_____ G. E. Hutchinson

__g_____ Bob Paine

_bh_____ Robert MacArthur

_____ E. O. Wilson

12. Definitions (22 pts, 2 pts each):

Aspect Diversity: evolution of divergent predator avoidance strategies that makes it more difficult for predators to exploit both prey types.

Interference Competition: direct, antagonistic competitive interactions between two organisms.

Mutualism: pairwise interaction from with both parties derive some fitness benefit; a +/+ interaction.

Parasitoid: an organism that spends a significant portion of its life history attached to or within a single host organism which it ultimately kills. Death of the host is obligate.

Haplodiploidy: sex is determined by the number of sets of chromosomes an individual receives. Offspring formed from a sperm and an egg develops as a female. An unfertilized egg develops as a male. Males haploid, females diploid. Results in higher (75%) relatedness between siblings than between offspring and parents.

Resource partitioning: the process by which natural selection drives competing species into different patterns of resource use or different niches

Character displacement: two species have overlapping a phenotypes when living in separate habitats, but reduced overlap or no overlap in their phenotype when living in the same habitat.

Competitive Exclusion: one species is able to exclude another via superior/more efficient use of resources.

Functional Response: the change in function of a species in response to a change. Specifically, response by predators to increased prey abundance. Each individual predator eats more prey in response to higher prey availability.

Diffuse Competition: widespread mild competition across a landscape. (optional: estimated by the summation over all other species of the products of the alphas times equilibrium densities.)

Zero isoclines: the set of population sizes at which the rate of change, or partial derivative, for one population in a pair of interacting populations is zero.

13. Fill in the name for each type of interaction (6 pts). (They don't have to fill out the entire grid as it repeats.)

	Positve (+)	Negative (-)	Neutral
Positive (+)	Mutualism, mullerian mimicry	Predation/parasitism/ Batesian mimicry	Commensalism
Negative (-)	Predation/parasitism/ Batesian mimicry	Competition	Amensalism
Neutral	Commensalism	Amensalism	Neutralism/ no interaction

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14. If you had two species of PARAMECIUM in a closed environment, what interaction(s) would you expect and what outcome(s) would you expect? (6 pts) p252, 249 Gause 1934

in a mixed culture, the 2 species competed for resources. One species will be a better competitor + will be able to exclude the other to local extinction

15. If you had one species of PARAMECIUM and one species of DIDINIUM in a microcosm, what interaction(s) would you expect and what outcome(s) would you expect? (6 pts) p 314, 313

~~I would~~ expected interaction(s): predation / prey escape

3 expected outcomes:

(1) homogenous env: prey eaten to extinction, predators starve

(2) heterogenous env: prey seek refugl from predators, predators starve, prey grow to carrying capacity

(3) homogenious w/ immegration: pred-prey oscillations. populations are rescued from collapse by immegration

16. Diagram and explain two of your favorite indirect interactions. (6 pts) p 237

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UT EID_____

17. a. Give the two equations for predator-prey interactions. (6 pts)

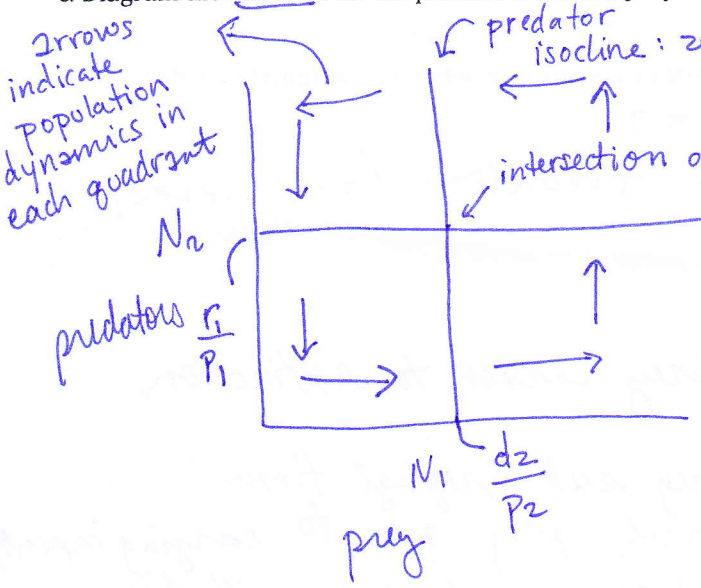
$\frac{dN_1}{dt} = r_1N_1 - P_1N_1N_2$ (prey) $\qquad \frac{dN_2}{dt} = P_2N_1N_2 - d_2N_2$ (predators)

b. Explain the predation coefficient(s)

P_1 = rate @ which predators ~~eons~~ encounter + consume prey

P_2 = rate @ which prey are converted into new predators.

c. Diagram the isoclines for the predators and the prey. Include population dynamics at the relevant points.



Predator + prey populations ~~oo~~ cycle around the point of equilibrium in neutral stability instead of maintaining ~~a~~ constant population densities.

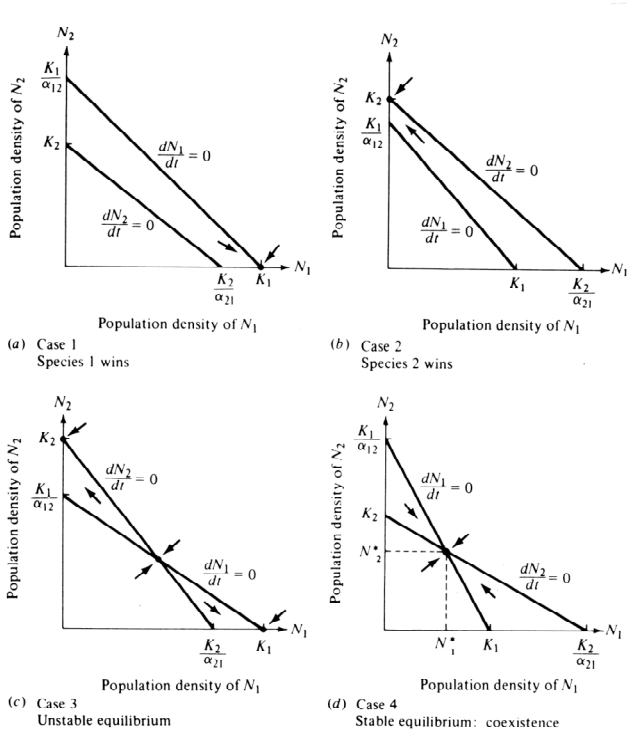
18. Discuss 3 assumptions of Optimal Foraging Theory as described by MacArthur. (6 pts)

P 71, 78+79

Assumptions:

1. Environmental Structure is repeatable with some statistical expectation of finding a particular resource
2. Food items can be arranged in a continuous + unimodal spectrum.
3. Principle of Allocation applies; no one phenotype is maximally efficient for all resource types.
4. Similar phenotypes are equivalent in harvesting abilites.
5. Individuals goal is to maximize total resource intake.

19. Draw the graphs for the three different cases of competition and explain the dynamics of each. Label the relevant points and show the dynamics in each sector. (6 pts) See page 245



(a) Case 1
Species 1 wins

(b) Case 2
Species 2 wins

(c) Case 3
Unstable equilibrium

(d) Case 4
Stable equilibrium: coexistence

20. What is the best evidence for kin selection? (6 pts)

Helpers at the nest in White-Fronted Bee Eaters in Kenya. Closely related individuals are more frequently helpers.

21. Explain how predators can exert both destabilizing and stabilizing effects on populations of their prey. (6 pts)

Predators that are too efficient are destabilizing because they can overexploit their prey. Density-dependent predator switching behavior between alternate prey can be stabilizing.

22. What is "Darwinian Medicine?" (6 pts)

Applying an evolutionary approach to disease, distinguishing host defenses from parasite manipulations rather than simply treating symptoms.