

PH.D. PROGRAM IN BIOLOGY - CITY UNIVERSITY OF NEW YORK
FIRST EXAMINATION
ECOLOGY, EVOLUTIONARY BIOLOGY AND BEHAVIOR
FALL 1989

Session 1. Short factual questions. Answer 10 of the following questions. On

1. What is paraphyly?
2. What is a phenon?
3. What is a taxon?
4. What is a type specimen?
5. What is an internal clock (Zeitgeber, entrainment)?
6. Differentiate among taxis, kinesis, and tropism.
7. Differentiate among territory, home range and personal space.
8. What is kin selection?
9. What is r_{max} ?
10. Differentiate between amensalism and neutralism.
11. What is facilitation?
12. What is functional response?
13. What is genetic load?
14. What is anagenesis?
15. What is quantum evolution?
16. What is effective population size?

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Session II. Longer factual essays. Answer two questions.

1. In your opinion, what are the major advances achieved during the history of systematics? Who made these advances, and when? Why are they significant?
2. Distinguish between Batesian, Mullerian, and Mertensian mimicry. Cite examples of each. Are all well accepted? If not, why?
3. Carrier pigeons are able to home from an unknown place. Describe and discuss in detail experiments and results that led Keeton and others to postulate a multisensory orientation mechanism.
4. "The principle of competitive exclusion is a useless statement in regard both to understanding and predicting the outcome of a competitive interaction in nature.-, Defend or refute. In developing your argument, provide a clear treatment of the meaning of the principle of competitive exclusion, its theoretical underpinning, and evidence from both laboratory and field studies in support of your viewpoint.
5. Discuss stabilizing, directional, and disruptive selection. Include the role each plays in the preservation of genetic variability. Give examples of each.

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Session III. Data analysis. Answer one question (three choices).

1. McLachlan et al. (1984; Marine Ecology Progress Series 16: 51-63) studied the distribution of benthic biomass, total number of species, dominant species and sediment grain size along inshore-offshore transects for two South African beaches. Given below are data for Kings and Sunday River beaches, along with a figure that shows sampling depths and some of the major hydrographic features such as position of the surf zone, break point (where waves break), etc. Based on the information presented, what conclusions would you make about the influence of wave energy on sediment and animal distributions? Why do biomass and species number increase offshore along both beaches?

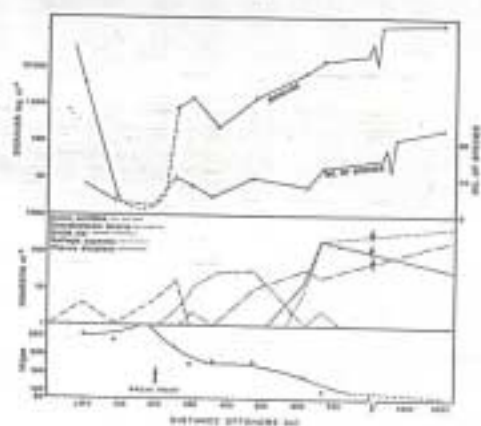


Fig. 1. Some gradients along a transect of Sibley River beach, including distribution of dominant species.
Note: 100(m) is position grain size in shore.

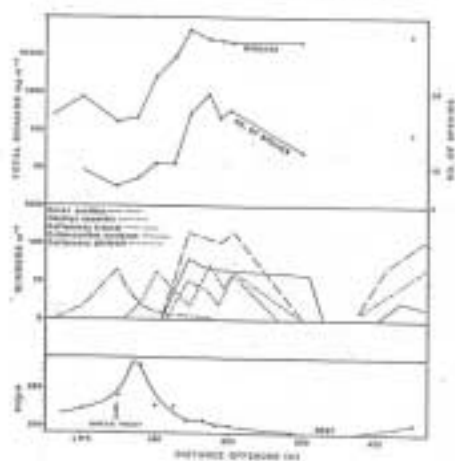


Fig. 2. Some gradients along a transect of Kings Beach, including distribution of dominant species.

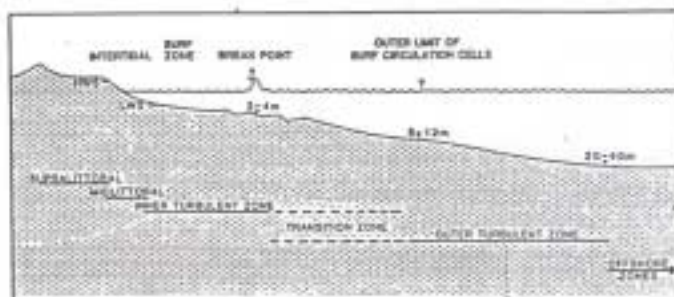


Fig. 3. Diagrammatic representation of zonation of intertidal and sublittoral macrofauna on high energy sandy coasts.

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Session III. (Continued)

2. There are five taxa (1-5), and nine characters (A-I), each of two states (a,b). Construct two branching diagrams for the five taxa: in diagram one assume that the states are ordered (a ---> b); in diagram two assume that the states are ordered (b --> a). Compare the two diagrams to determine if there are reasons for preferring one of them to the other. If so, state the reasons. If not, explain why there are not any.

Taxa	A	B	C	D	E	F	G	H	I
1	a	a	a	b	a	b	a	b	a
2	a	a	a	a	a	b	a	a	a
3	b	b	b	b	b	a	b	b	b
4	a	a	a	a	a	b	a	a	a
5	a	b	a	b	a	a	a	b	a

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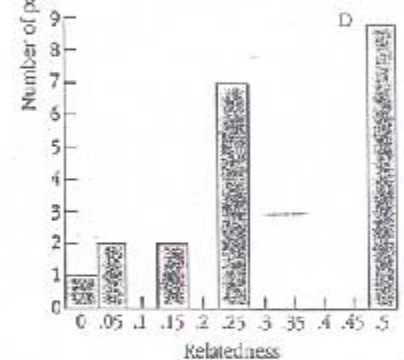
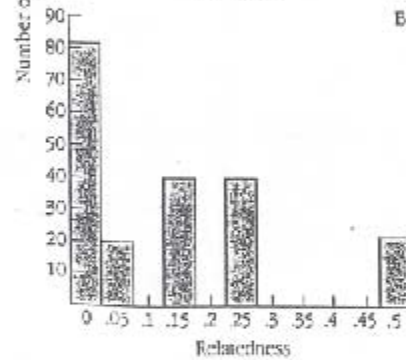
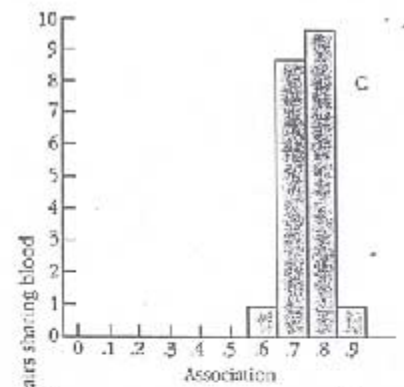
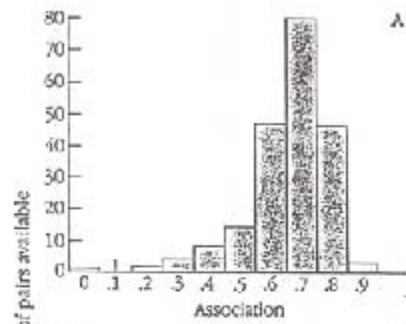
SESSION III. (continued)

3. Wilkinson (1984) studied-feeding reciprocity in vampire bats (Desmodus rotundus) in Costa Rica. At night these bats feed on blood, primarily from cattle and horses, then return to a hollow tree to roost during the day. Often one bat will regurgitate blood that is then eaten by another bat. Most, but not all, of these exchanges are between mother and offspring.

Data for the non-mother/offspring food sharing are provided below. Graphs A and B show the frequency of pairs observed, based on the degree of association and relatedness. Graphs C and D show the frequency of food-sharing. Association simply refers to the fact that these animals spend time together.

Write an essay in which you discuss the following:

1. What do the data regarding degree of association predict?
What do the data concerning relationship predict?
2. What are the implications for reciprocal altruism and kin selection
3. What conditions must exist for reciprocal altruism and/or kin selection to occur?



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Session IV. Research Proposal.

Choose one of the following topic areas for your research and carefully develop each of the following in your proposal:

- a) What are the critical questions you are asking?
- b) What field and/or lab methodologies would you use to examine the questions? What are your assumptions in using these techniques?
- c) What sort of data do you anticipate collecting?
- d) How would you organize and analyze the data?

1. Design a study to find out how long a particular species and its ancestors have lived in a particular area of the earth. Choose a specific area and a specific species, e.g., a species of Galapagos tortoise. Do not assume that you will be able to recover a complete fossil record of the species.
2. Among animal behaviorists interested in social communication, it is debated whether such interactions evolved (and currently function) as "-two-way" symbiotic information transfer systems or "one-way-- selfish manipulations. Design crucial experiments to evaluate these propositions.
3. Design a program to evaluate the importance of soil microinvertebrates in the regeneration of nutrients (nitrogen, phosphorous, etc.) from plant litter in any habitat of your choice (forest, desert, etc.).
4. Design a study to test whether two sympatric populations of an organism (such as a frog, bird, or insect) are conspecific or belong to two separate species.