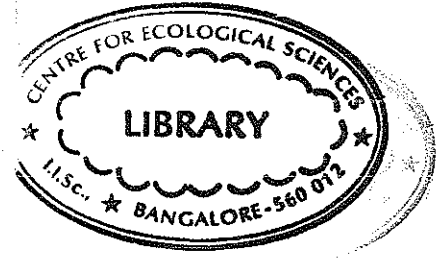
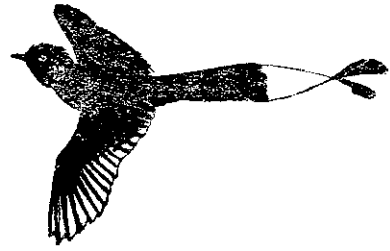


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BANGALORE-560 012, INDIA



Ph. D. PROGRAMME : COURSES

COMPILED BY : PALLAVA BAGLA

January 1987

Technical Report No. 31

COURSES OFFERED FOR Ph.D. PROGRAMME AT THE
CENTRE FOR ECOLOGICAL SCIENCES

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The following courses are offered at the Centre For
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- 1) Man, Environment And Development
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MAN, ENVIRONMENT AND DEVELOPMENT

INSTRUCTOR:- PROF. MAHNAV GADGIL

COURSE NO.: EC 103

CREDITS:- 2:1

This course will look at how living organisms have been changing their environment ever since life began and how man has tremendously increased this pace of change in recent millenia. Its focus will be on understanding the processes that underlie such changes, and the role of social interactions in moulding these processes. This understanding will then be applied to suggest a strategy of environmentally sound, sustainable development appropriate to the Indian conditions.

1. Earth as an open system subject to energy flows. Energy flows create order and cycles. Biogeochemical cycles. Activities of living organisms lead to states away from equilibrium. Concentrations of phosphates on sea bird breeding near the Peruvian region of upwelling.

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DICKERSON, R.E. (1978), Chemical Evolution and the Origin of Life, Scientific American 239:52-79

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GADGIL, H. (Ed.) (1983), Energy and Material Cycles, Lecture Notes of the Special Training Programme in Wild Life Biology (Bandipur Tiger Reserve, 1978) pp.24-27

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JANTSCH, E. (1980), The self Organizing Universe, Pergamon Press A.E. (1970), The Energy Cycle of the Earth, Scientific American 223:54-63

- PAULIK, G.J. (1971) , Anchovies, birds and fishermen in the Peru current , Environment: Resources, Pollution and Society Ed: W.W. Murdoch pp.156-185 , Sinauer Associates Inc. Publishers
- VASILJURN, S.L. (1978) , The Evolution of Man , Scientific American 239:146-154
2. An oxidizing atmosphere on the earth is a result of photosynthetic activity of plant Origin of life in a reducing atmosphere. Photosynthetic organisms gain an advantage through more intensive resource use. Changeover to the oxidised atmosphere led to largescale extinctions. Persistence of the original forms in specialised, restricted habitats.
- CLOUD, P. (1983) , The Biosphere , Scientific American 249:132-144
- GAEGIL, M. (Ed.) (1983) , Oxygen , Lecture Notes of the Special Training Programme in Wild Life biology (Bandipur Tiger Reserve, 1978) pp.611-628
- CLOUD, P. and GIBOR, A. (1970) , The Oxygen Cycle , Scientific American 223:111-123
3. Invasion of land became possible with the build up of ozone and filtering of ultra-violet radiation. Competition for light amongst land plants leads to investment in structural tissue. Forest vegetation provides an enormous variety of niches for other plants and animals.
- LOYLE, J.A. (1977) , Patterns of Evolution in Early Angiosperms , Patterns of Evolution Ed: A. Hallam pp.501-546 , Elsevier Scientific Publishing Co.
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- MAY, R.M. (1978) , The Evolution of Ecological Systems , Scientific American 239:119-133
- MAYR, E. (1978) , Evolution , Scientific American 239:39-47, 03
- RICHARDS, P.W. (1973) , The Tropical Rain Forest , Scientific American 229:58-57

RICHARDS, P.W. (1983) , the three-dimensional Structure of Tropical Rain Forest , Tropical Rain Forest: Ecology and Management Ed: S.L. Sutton, T.C. Whitmore and Chadwick pp.3-10 , Blackwell

SCHOPE, J.W. (1978) , The evolution of the Earliest cells , Scientific American 239:85-102

4. Evolution of insects following establishment of land plants. Adaptive radiation of ants. More specialised adaptations such as army ants, Acacia ants, aphid tending ants, leaf cutter ants.

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5. Can predators use their prey prudently? Selection at individual and group levels in relation to prudent resource use. Overgrazing of vegetation of Isle St Royale by mooses before their population was controlled by wolves. Leaf cutter ants may be harvesting trees around their long lived nests in a prudent fashion.

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LEWONTIN, R.C. (1970) , The Units of Selection , Annual Review of Ecology and Systematics Vol.1 pp.1-18 , Annual Reviews Inc.

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6. Mammals out compete reptiles through their ability to use resource more intensively. Metabolic demands of reptiles and mammals. Total energy demands of the mammalian populations of the earth.

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7. Food demands of the herbivorous mammals. How resource dispersion and predation pressure affect their patterns of social organization. Sociality and territoriality in ungulates and primates.

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The course comprises of a series of thirty lectures, and a field trip to the Uttara Kannada district and a project . The course is distributed as follows:

Assignments:	:15%
Report on field trip	:15%
Mid-term Examination	:15%
Final Examination	:25%
Project Report	:30%

The field work will be a study of on-going ecodevelopment efforts in Uttara Kannada district.

Some of the suggested topics for the course project, for 1986 are

1. The water budget of IISc campus.
2. Foraging for fuelwood by building labourers on IISc campus.
3. Energy requirements of the IISc hostel.
4. Production and harvest of grass on IISc campus.

EVOLUTION, BEHAVIOUR AND SOCIOBIOLOGY

INSTRUCTOR:- Raghavendra Gadagkar

COURSE NO:- EC 102

CREDITS:- 2:1

Suggested General Readings:

1. Lorenz, K.Z. (1952). King Solomon's Ring. Thomas Y. Crowell Company. New York.
2. Dawkins, R.D. (1976). The Selfish Gene. Oxford University Press.
3. Tinbergen, N. (1958). Curious Naturalists. The American Museum of Natural History.
4. Morris, D. (1979). Animal Days. Bantam Books.
5. Lawick-Goodal, J.V (1971). In the Shadow of Man. William Collins Sons and Co Ltd, Glassgow.
6. Crick, F. (1981). Life itself - Its Origin and Nature. Simon and Schuster. New York.
7. Lawick, H.V. (1973). Solo - The story of an African wild dog. Fontana Books.
8. Crick, F. (1966). Of Molecules and Men. University of Washington Press. Seattle and London.
9. Tinbergen, N. (1953). Social Behaviour in Animals. Chapman and Hall Ltd.
10. Wickler, W. (1973). The Sexual Code - The Social Behaviour of Animals and Men. Anchor Press.

Lecture 1

Introduction to Evolution by Natural Selection.

Essential Readings

1. Monod, J. (1970). Chance and Necessity. Collins/Fount paperbacks.

Suggested Readings

1. Ruse, M. (1982). Darwinism defended. Addison - Wesley Publishing company.
2. Ridley, M. (1983). The problems of Evolution. Oxford University press.
3. Haldane, J.B.S. (1932). The causes of Evolution. London:Longman's sreen.
4. Miller, J and Van Loon, B. (1982). Darwin for Beginners. Writers and Readers Publishing Co-operative Society.

Lecture 2

Elements of Population Genetics - Hardy-Weinberg law, Selection, Drift etc.

Essential Readings

1. Mays, L.L. (1981). Chapter 11, Genetic equilibrium and disequilibrium. In : Genetics, a molecular approach. Macmillan Publishing Co. Inc.
2. Ayala, F.J. (1982). Chapters 3 and 4 in Population and Evolutionary Genetics - A primer. The Benjamin/Cummings Publishing Company.

Suggested Readings

1. Roughgarden, J. (1979). Theory of Population Genetics and Evolutionary Ecology : An Introduction. Macmillan Publishing Co., Inc.

Lecture 3

Genetic Structure of Populations

Essential Readings

1. Ayala, F.J. (1982). Chapter 2, In : Population and Evolutionary Genetics : A primer. The Benjamin/Cummings Publishing Company.

Suggested Readings

1. Lewontin, R.C. (1974). The Genetic basis of Evolutionary change. Columbia University Press.

Lecture 4

Levels of Natural Selection - Individual, Kin and Group Selection.

Essential Readings

1. Lewontin, R.C. (1970). The Units of Selection. In : Annual Review of Ecology and Systematics., Vol.1, 1-18.
2. Trivers, R.L. (1985). Chapter 4, In : Social Evolution. The Benjamin/Cummings Publishing Company, Inc.
3. Vehrencamp, S.L. (1979). The roles of Individual, Kin and Group Selection in the Evolution of Sociality. In : Handbook of Behavioural Neurobiology, Vol.3. Plenum Press. New York and London.

Suggested Readings

1. Williams, G.C. (1966). Adaptation and Natural Selection. Princeton University Press.

Lecture 5

Historical Development of Ethology

Essential Readings

1. Gould, J.L. (1982). Chapters 1 and 2, In : Ethology-The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.

Suggested Readings

1. Thorpe, W.H. (1979). The Origins and rise of Ethology. Heinemann Educational Books.

Lecture 6

Classical Ethology - Contributions of Lorenz and Tinbergen

Essential Readings

1. Gould, J.L. (1982). Chapter 3, In : Ethology-Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.
2. Tinbergen, N. (1952). The Curious Behaviour of Sticklebacks. Sci.Am.187: (6) 22-26.

Suggested Readings

1. Tinbergen, N. (1972). The animal in its world, Vol.I and II. Harvard University Press.

Lecture 7

Modern Ethology - Releasers, Sign Stimuli and Pattern Recognition

Essential Readings

1. Gould, J.L. (1982). Chapter 4, In : Ethology-The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.
2. Hamilton, J.P. (1969). How an instinct is learned. Sci.Am.221:(6) 98-108.

Suggested Readings

1. Tinbergen, N. (1951). The study of Instinct. Oxford University Press.

Lecture 8

Elements of Neurobiology

Essential Readings

1. Gould, J.L. (1982). Chapters 5, 6 and 7. In : Ethology- The Mechanisms and Evolution of Behaviour. W.W.Norton and company. New York. London.

Suggested Readings

1. Kufner, S.W and Nicholas, J.G. (1977). From Neuron to Brain - A Cellular Approach to the Function of Nervous System. Sinauer Associates, Inc. Publishers.

Lecture 9

Neuroethology

Essential Readings

1. Gould, J.L. (1982). Chapters 11 and 12. In : Ethology-The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.

Suggested Readings

1. Camhi, J.M. (1984). Neuroethology. Sinauer Associates. Inc.

Lecture 10

Complex Behaviour - Learning

Essential Readings

1. Gould, J.L. (1982). Chapters 16 and 17. In : Ethology-The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.
2. Menzer, R and Erber, J. (1978). Learning and Memory in Honey bees. *Sci.Am.* 239 (1) 102-111.
3. Hess, E. (1972). Imprinting in a natural laboratory. *Sci.Am.* 227, (2): 24-31.

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1. McFarland, D. (1985). Chapters 17, 18 and 19. In : Animal Behaviour. Pitman Publishing Company Ltd.

Lecture 11

Complex Behaviour - Migration and Navigation

Essential Readings

1. Gould, J.L. (1982). Chapters 13 and 14. In : Ethology - The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.

Suggested Readings

1. Gould, J.L. (1980). The case for Magnetic Field Sensitivity in Birds and Bees. *Am. Sci.*, 68 : 256-267.
2. Wehner, R. (1976). Polarized-Light Navigation by Insects. *Sci. Am.*, 235, 106-115.
3. Hasler, A.D; Scholz, A.T and Horrall, R.M. (1978). Olfactory Imprinting and Homing in Salmon. *Am. Sci.*, 66, 347-355.
4. Keeton, W.T. (1974). The Mystery of Pigeon Homing. *Sci. Am.*, 231, 96-107.

Lecture 12

Thinking and Intelligent Behaviour in Animals

Essential Readings

1. Gould, J.L.(1982). Chapter 18. In : Ethology--The Mechanisms and Evolution of Behaviour. W.W.Norton and Company. New York. London.
2. McFarland, D.(1985). Chapters 26,27 and 28. In : Animal Behaviour. Pitman Publishing Company Ltd.

Suggested Readings

1. Griffin, D.R. (1984). Animal Thinking. Harvard University Press.
2. Griffin, D.R. (Editor) (1982). Animal Mind - Human Mind. Springer-Verlag Berlin Heidelberg. New York.

Lecture 13

Genetics of Behaviour

Essential Readings

1. Gould, J.L. (1982). Chapters 19 and 20. In : Ethology - The Mechanisms and Evolution of Behaviour. W.W.Norton and company. New York. London.
2. McFarland, D. (1985). Chapter 4. In : Animal Behaviour. Pitmann Publishing Company Ltd.
3. Hall, J.C. (1981). Sex Behaviour Mutants in Drosophila. Biosci., 31, 125-130.
4. Benzer, S. (1973). Genetic Dissection of Behaviour. Sci. Am. 229. (6) 24-37.

Suggested Readings

1. Hall, J.C. (1985). Genetic analysis of behaviour in insects. Chapter 7. In : Insect Physiology, Biochemistry and Pharmacology. ed. Kerkut, G.A and Gilbert, G.I, vol.9. Pergamon Press.

Lecture 14

The Honey Bee Dance Language

Essential Readings

1. Gould, J.L. (1982). *Ethology - The Mechanisms and Evolution of Behaviour*. Chapter 24. W.W.Norton and Company. New York. London.
2. Lindauer, M. (1978). *Communication among Social Bees*. Harvard University Press.

Suggested Readings

1. Von Frisch, K. (1962). Dialects in the language of the Bees. *Sci.Am.* 207 (2):78-87.
2. Dyer, F.C and Gould, J.L. (1981). Honey Bee Orientation - A Back up system for cloudy days. *Science*, 214 : 1042.
3. Gould, J.L. (1979). Do honey bees know what they are doing ? *Natural history* June-July 66-75.
4. Seeley, T.D. (1982). How honey bees find a home. *Sci.Am.* 247 (4):158-166.
5. Dyer, F.C and Gould, J.L. (1983). Honey bee Navigation. *Am. Sci.* 71, 587-597.

Lecture 15

The Honey Bee Dance Language Controversy.

Essential Readings

1. Gould, J.L. (1982). *Ethology - The Mechanisms and Evolution of Behaviour*. Chapter 24. W.W.Norton and Company.
2. Gould, J.L. (1976). The Honey Bee Dance Language Controversy. *Quart. Rev. of Biol.* 51: 211-44.

Lecture 16

Insect Societies - Primitively Eusocial Insects

Essential Readings

1. Wilson, E.O. (1971). Chapters 1, 2 and 3. In : The Insect Societies. Harvard University Press.

Suggested Readings

1. Jeanne, R.L. (1980). Evolution of Social Behaviour in the Vespidae. *Ann.Rev.Entomol.* 25: 371-396.
2. Michener, C.D. (1974). Chapter 5. In : The Social Behaviour of the Bees - A Comparative study. Harvard University Press.
3. Akre, R.D. (1982). Chapter 1, Social Wasps. In : Social Insects. Vol.4. ed.H.R.Hermann Academic Press.

Lecture 17

Insect Societies - Highly Eusocial Insects.

Essential Readings

1. Wilson, E.O. (1971). Chapters 4, 5 and 6. In : The Insect Societies. Harvard University Press.
2. Seeley, T.D. (1982). Adaptive Significance of the Age Polyethism Schedule in Honey Bee Colonies. *Beh. Ecol. Sociobiol.* 11 : 287-293.

Suggested Readings

1. Wilson, E.O. (1976). A Social Ethogram of the Neotropical Arboreal Ant Zacryptocerus varians (Fr.Smith). *Anim.Beh.* 24, 354-363.
2. Wilson, E.O. (1976). Behavioural discretization and the number of castes in an ant species. *Beh. Ecol. Sociobiol.*, 1, 141-154.

Lecture 18

Observational Methods in Ethology

Essential Readings

1. Colgan, P.W. (1978). Chapter 1. In : Quantitative Ethology. John Wiley and Sons, New York.
2. Lehner, P.N. (1979). Handbook of Ethological Methods. Garland STPM Press. New York and London.

Suggested Readings

1. Altmann, J. (1974). Observational Study of Behaviour : Sampling Methods. Behaviour, 49, 227-267.

Lecture 19

Quantitative Ethology - A Case Study.

Essential Readings

1. Gadagkar, R and Joshi, N.V. (1984). Social Organisation in the Indian Wasp Ropalidia cyathiformis (Fab.) (Hymenoptera: Vespidae). Z.Tierpsychol., 64 : 15-32.

Suggested Readings

1. Aspey, W.P and Blankenship, J.E. (1977). Spiders and Snails and Statistical Tales : Application of Multivariate Analysis to Diverse Ecological Data. In : Quantitative Methods in Study of Animal Behaviour. Edited by Brian.A.Hazlett. Academic Press.

Lecture 20

Evolution of Social Behaviour - Insect Models.

Essential Readings

1. Gadagkar, R. (1985). Evolution of Insect Sociality -- A review of some attempts to test modern theories. Proc. Ind. Acad. Sci.(Anim.Sci.), 94 : 309-324.
2. Brockmann, H.J. (1984). The Evolution of Social Behaviour in Insects. In : Krebs, J.R and Davies, N.B. (eds) Behavioural Ecology : An Evolutionary Approach. Oxford : Blackwell, second edition.

Suggested Readings

1. Starr, C.K. (1979). Origin and Evolution of Insect Sociality: A review of modern theory. In *Social Insects Vol.1.* ed. H.R.Hermann, pp.35-79. Academic press.
2. Hamilton, W.D. (1972). Altruism and related phenomena, mainly in social insects. *Ann. Rev.Ecol.Syst.*, 3: 193-232.

Lecture 21

Evolution of Social Behaviour - Vertebrate Models.

Essential Readings

1. Anderson, M. (1984). The Evolution of Eusociality. *Ann.Rev.Ecol.Syst.*, 15 : 165-189.
2. Krebs, J.R and Davies, N.B. (1981). Chapter 9. In : *An Introduction to Behavioural Ecology.* Blackwell Scientific Publications.

Suggested Readings

1. Wittenberger, J.F. (1981). Chapter 13. In : *Animal Social Behaviour* . Duxbury Press, Boston.
2. Brown, J.L. (1983). Co-operation - A Biologist's Dilemma. *Adv. Study Behav.*, 13 : 1-37.
3. Sherman, P.W. (1977). Nepotism and the Evolution of Alarm Calls. *Science*, 197, 1246-1253.

Lecture 22

Evolution of Sex Ratios.

Essential Readings

1. Trivers, R. (1985). *Social Evolution.* Chapter 11. The Benjamin/Cummings Publishing, Company.
2. Joshi, N.V and Gadagkar, R. (1985). Evolution of Sex Ratios in Social Hymenoptera : Kin-Selection, Local mate Competition, Polyandry and Kin Recognition. *J.Genet.*, 64 : 41-58.

Suggested Readings

1. Burley, N. (1981). Sex-Ratio Manipulation and Selection for Attractiveness. *Science*, 211 : 721-722.
2. Werren, J.H. (1980). Sex-Ratio Adaptations to Local mate Competition in a Parasitic Wasp. *Science*, 208, 1157-1159.
3. Charnov, E.L. (1982). The Theory of Sex Allocation. Princeton University Press.

Lecture 23

Kin Recognition in Animals.

Essential Readings

1. Gadagkar, R. (1985). Kin Recognition in Animals - A review of recent findings and a consideration of their relevance for the theory of Kin Selection. *Proc. Indian Acad. Sci. (Anim. Sci.)*, Vol. 94, 587-621.
2. Holmes, W.G and Sherman, P.W. (1983). Kin Recognition in Animals. *Am. Sci.*, 71 : 46-55.

Suggested Readings

1. Holldobler, B and Michener, C.D. (1980). Mechanisms of identification and discrimination in Social Hymenoptera. In : *Evolution of Social Behaviour : Hypothesis and Empirical tests* (ed. Hubert Mark). pp. 35-58. Dahleim Konferenzen. Weinheim : Verlag Chemie gmbh.

Lecture 24

Social Hierarchy in Animals

Essential Readings

1. Krebs, J.R and Davies. N.B. (1981). Chapter 5. In : *An Introduction to Behavioural Ecology*. Blackwell Scientific Publications.
2. Barash, D.P. (1977). Chapter 15. In : *Sociobiology and Behaviour*, second edition. Elsevier Science Publishing company, Inc.

Suggested Readings

1. Clutton Brock, T.H; Albon, S.; Gibson, R and Guinness, F. (1979). The Logical Stag : Adaptive aspects of fighting in red deer (Cervus elaphus), Animal Behaviour, 27, 211-225.

Lecture 25

The Adaptive Significance of Territoriality.

Essential Readings

1. Wittenberger, J.F. (1981). Chapter 7. In : Animal Social Behaviour. Duxbury Press. Boston.
2. Barash, D.P. (1982). Chapter 16. In : Sociobiology and Behaviour. Second edition. Elsevier Science Publishing Co. Inc.

Suggested Readings

1. Waser, P.M and Haven Wiley, R. (1979). Chapter 4 - Mechanisms and Evolution of Spacing in Animals. In : Handbook of Neurobiology. Edited by Peter Marler and J.G.Vandenbergh. Plenum Press. New York and London.

Lecture 26

Mating Systems in Animals

Essential Readings

1. Krebs, J.R and Davies, N.B. (1981). Chapter 7. In : An Introduction to Behavioural Ecology. Blackwell Scientific Publication.
2. Emlen, S.T and Oring, L.W. (1977). Ecology, Sexual Selection and the Evolution of Mating Systems. Science, 197, 215-223.

Suggested Readings

1. Wittenberger, J.F. (1981). Chapter 11. In : Animal Social Behaviour. Duxbury Press. Boston.

Lecture 27

Sexual Selection and Mate Choice

Essential Readings

1. Alcock, J. (1984). *Animal Behaviour*. Chapters 11 and 12. Sinauer Associates.

Suggested Readings

1. Krebs, J.R and Davies, N.B. (1981). Chapter 6, In : *An Introduction to Behavioural Ecology*. Blackwell Scientific Publications.
2. Eberhard, W.G. (1980). Horned Beetles. *Sci. Am.*, 242, 166-182.
3. Patridge, L. (1980). Mate choice increases a component of offspring fitness in fruit flies. *Nature*, Vol. 283 : 290-291.
4. Thornhill, R. (1980). Sexual selection in the Black-tipped Hangingfly. *Sci.Am.*, 242 (6), 162-172.
5. Thornhill, R. (1983). Sexual selection and Insect mating Behaviour. *The Am.Biol.Teacher*, 45, 310-319.
6. Gadgil, M. (1972). Male dimorphism as a consequence of sexual selection. *Am.Nat.*, 106 : 574-580.

Lecture 28

The Adaptive Significance of Infanticide

Essential Readings

1. Hrdy, S.B. (1979). Infanticide among animals : A review, classification and examination of the implications for the reproductive strategies of females. *Ethology and Sociobiology*. 1 : 13-40.

Suggested Readings

1. Hrdy, S.B. (1977). *The Langurs of Mount Abu : Female and Male strategies of reproduction*. Harvard University Press.

Lecture 29

The Evolution of Alternate Behavioural Strategies

Essential Readings

1. Krebs, J.R. and Davies, N.B. (1981). Chapter 8. In : An Introduction to Behavioural Ecology. Blackwell Scientific Publications.

Suggested Readings

1. Cade, W.H. (1981). Alternate Male Strategies Genetic differences in Crickets. *Science*, 212 : 563-564.
2. Dominey, W.J. (1980). Female mimicry in male blue gill Sunfish - A genetic polymorphism? *Nature*, 284 : 546-548.

Lecture 30

Evolutionary Stable Behavioural Strategies

Essential Readings

1. Barash, D.P. (1982). Chapter 8, In : Sociobiology and Behaviour. Second edition. Elsevier Science Publishing Co. Inc.
2. McFarland, D. (1985). Chapter 7, In : Animal Behaviour. Pitman Publishing Company Ltd.
3. Axelrod, R and Hamilton, W.D. (1981). The Evolution of Cooperation. *Science*, 211 : 1390-1396.

Suggested Readings

1. Davies, N.B. (1978). Territorial defence in the speckled wood butterfly (*Pararge aegeria*) : The resident always wins. *Anim. Beh.*, 26, 138-146.
2. Brockmann, H.J. et al (1979). Evolutionary stable nesting strategy in a Digger Wasp. *J. Theor. Biol.*, 77 : 473-496.

CONSERVATION BIOLOGY

INSTRUCTOR:- R.SUKUMAR

COURSE NO.:- EC : 101

CREDITS:- 2:1

1. Biological diversity - genetic diversity and species diversity, rationale for conservation.
2. Genetic diversity I
Gene pools, genotypic and genic frequencies, measuring genetic variation, genetic variation in natural populations.
3. Genetic diversity II
Random mating, Hardy-Weinberg law, Evolutionary change - mutation, migration, genetic drift. Founder effect and bottlenecks, effective population size.
4. Natural selection and genetic diversity, Selection for and against homozygotes/heterozygotes, frequency dependent selection.
5. Inbreeding and fitness, inbreeding depression, advantages of inbreeding.
6. Speciation, process of speciation geographic speciation, genetic differentiation rates of speciation.
7. Extinction - past and present rates of extinction, causes of extinction. Diversity as a balance between speciation and extinction.
8. Genetic diversity and evolutionary potential -- a long term view
9. Species Diversity
Measuring species diversity, patterns of species diversity - temperate/tropical, continent/Island, altitudinal gradients.
10. Island biogeography
immigration - extinction equilibria, island biogeography theory and conservation, lessons from case studies.
11. Biogeographic realms - Dasmann and Udvardy's classification, historical factors in floral and faunal distributions.
12. Conservation of species diversity. Single species - minimum viable population sizes.
13. Maintaining minimum viable populations, requirements of area, habitat, prey, mutualists, etc. should one or several viable populations be maintained.

14. Demographic parameters and management of single species populations.
15. Conservation of rare, specialist and keystone species.
16. Community diversity
Theories about maintenance of species diversity in communities, with sp. ref. to plants.
17. Habitat fragmentation - should conservation go in for few large or several small reserves?
18. Conservation of entire ecosystems - examples from aquatic and terrestrial ecosystems.
19. Historical review of conservation.
20. Captive breeding and reintroductions of wild species.
21. Conservation of domesticated plants and animals.
22. Biological diversity of India - review according to taxa and regions.
23. Problems and strategies for conservation of India's biological diversity.
24. Genetic engineering and conservation.

List of reference books

1. Frankel, O.H. and Soule, M.E. (1981)
Conservation and evolution. Cambridge Univ. Press.
Cambridge. (Topics 2 - 8, 20)
2. Soule, M.E. and Wilcox, B.A. (eds) (1980)
Conservation Biology. Sinauer Associates, Massachusetts.
(Topics 1, 3, 5, 7, 8 - 10, 12 - 14, 18, 20,)
3. Schonewald - Cox, C.M. et al (eds) (1983)
Genetics and Conservation. The Benjamin/Cummings Publ Co,
Menlo Park, California (General reference book for topics 1-8, 20)
4. Ehrlich, P.R. and A (1981)
Extinction. Random House, New York. (for general reading)
5. Ayala, F.J. (1982)
Population and Evolutionary Genetics. The Benjamin/Cummings
Publ, Menlo Park, California. (Topics 2-6)

CENTRE FOR
ECOLOGICAL SCIENCES

6. Emlen, J.M. (1973)
Ecology An Evolutionary Approach. Addison - Wesley Publ Co.
Reading, Mass., (Topics 3, 4, and 9)
7. Ayala, F.J. and Valentine, J.W. (1979)
Evolving - The Theory and Processes of Organic Evolution.
The Benjamin/Cummings Publ Co., Menlo Park, California. (Topics 2
- 4, 5, 7)
8. Beck, B.B. and Wemmer, C.M. (eds) (1983)
The Biology and Management of an extinct species- Pere
David's Deer. Noyes Publications, New Jersey. (General reading
for Topics 14 and 20)
9. Furley, P.A. and Newey, W.W. (1983)
Geography of the Biosphere. Butterworths, London (Topic 11)
10. Hartl, D.L. (1981)
A Primer of Population Genetics. Sinauer Associates,
Sunderland, Mass. (a good book for problems in population
genetics Topics 2 - 4)
11. Burgess, R.L. and Sharp, D.M. (eds) (1981)
Forest Island Dynamics in Man-dominated landscapes(s)
Springer - Verlag, New York. (case studies on topics 10 and 17)
12. Mac Arthur, R.H. and Wilson, E.O. (1967)
The theory of Island Biogeography. Princeton Univ. Press,
New Jersey. (Topic 10)
13. Christiansen, F.B. and Fenchel, T.M.
Theories of Populations in Biological Communities.
Springer-Verlag, New York (Topic 10)
14. Krebs, C.J. (1985)
Ecology. Harper and Row, New York (general text, covers a
number of background topics especially Nos 6, 9, 13, 15, 16 and 18)
15. Mac Arthur, R.H. (1972)
Geographical Ecology- patterns in the distribution of
species. Princeton Univ. Press, New Jersey. (Topics 9 and 10)
16. Levin, S. (1984)
(Lecture Notes in Biomathematics) Evolutionary Dynamics of
Genetic Diversity. Springer - Verlag, Berlin. (reference only
for topics 2 - 4, contains mainly quantitative data)
17. Strong, D.R. Jr et al. (eds) (1984)
Ecological Communities - conceptual issues and the evidence.
Princeton Univ. Press, New Jersey/ (collection of papers on
community diversity)
18. Pielou, E.C. (1979)
Biogeography. John Wiley, New York. (Topics 6, 10, and 11)

19. Patrick, R. (ed) (1983)
Diversity. Hutchinson Ross, Pennsylvania. (a collection of benchmark papers in ecological diversity at levels of species and communities)
20. Taylor, J.A. (ed) (1984)
Themes in Biogeography. Croom Helm, London. (general reference for topic 11, a collection of papers)
21. Sutton, S.L. et al. (ed) (1983)
Tropical Rain Forest: Ecology and Management. Blackwell Scientific, Oxford. (a collection of papers on tropical community diversity, topic 16,18)
22. Murrel, D.J. (1981)
Ecological Genetics. Longman, London. (Topics 2 - 6)
23. Solbrig, O.T. and Solbrig, D.J. (1979)
Introduction to Population Biology and Evolution. Addison-Wesley, Reading, Mass. (Topic 2-6)
24. Williamson, M. (1981)
Island Populations. Oxford Univ. Press. (Topic 10)

INTRODUCTION TO MATHEMATICAL ECOLOGY

INSTRUCTOR:- N.V. JOSHI

COURSE NO.:-EC 104

CREDITS:-2:1

1)BASIC:- Variables, Expressions- i/o -Conditional Branching -
Loops, Subroutines, Graphics

References

1) Programming with BASIC by B.S. Gottfried

2)FORTRAN:- Introduction to DEC-10/VAX -- use of editors,
scientific subroutine packages

References

1)Programming in FORTRAN by V.Sajaraman

3)DATA ANALYSIS: Parameter estimation - Curve Fitting technique,
Testing of significance - Cluster Analysis .

References

1) Quantitative Ecology by P.W. Colgan
2) Biometry by Sokal & Rohlf

4) Models of population growth:- Exponential, logistic, Chaotic,
Deterministic --- Simulations --- Limit cycles --- Multiple
Species Interactions.

References

1) Mathematical Ecology by E.C. Pielou
2) Theoretical Ecology by R.M. May

5) Models of spatial patterns: Measures & Aggregation - Distance
sampling - Monte Carlo simulations.

References

1) Models in ecology by J. Maynard Smith
2) Mathematical Ecology by E.C. Pielou
3) Theoretical Ecology by R.M. May

6) Models of Evolutionary Process : Natural Selection - Kin
Selection , Group Selection, - Molecular Evolution - Random
Extinctions/ Speciations.

References

1) Primer of Population Biology by Wilson & Bossert

7) Models of Conflict : Game Theory - Applications to Dispersal - Sex Ratios - Prisoners Dillemma - Evolution of Co-operation.

References

1) Evolution and the theory games : by J. Maynard Smith

2) Models in Ecology by J. Maynard Smith.