

Careers in Mammalogy

Mammalogy is the branch of biology that deals with the study of mammals, class Mammalia. It encompasses such diverse areas as the structure, function, evolutionary history, ethology, taxonomy, management, and economics of mammals. Approximately 4,200 species of living mammals and numerous extinct forms comprise the material for study. Included are egg-laying echidnas and the platypus, pouched marsupials, tiny shrews, bats, mice, whales, apes, and elephants, to mention only a few. The studies of mammals can be as diverse as these organisms themselves.

A mammalogist may study a wide variety of topics on a particular species or group of mammals, or may take a comparative approach and investigate one aspect in a wide variety of mammals. Some of the major subdivisions within the science of mammalogy include the following:

Natural History - the study of a species' "way of life," including descriptions of the habitats in which it lives, the food it eats, the predators that eat it, the stages of its maturation and reproduction, and its social structure.

Taxonomy and Systematics - the study of the classification of mammals into distinct orders, families, genera, species, and subspecies, thereby defining the geographic distribution of each taxon. In addition, the evolutionary relationships among extinct (paleontology) and/or living taxa are analyzed.

Anatomy and Physiology - the study of mammalian body structures and tissues, and how each functions.

Ethology - the study of the behavior of an animal and how these behaviors influence its survival and reproduction.

Ecology - the study of interactions between mammals and their environments (non-living and living). This discipline includes the study of special adaptations to environmental factors (physiological ecology), and the study of interactions within and among species (population and community ecology).

Management and Control - the interactions between man and other mammals in which man manipulates either the environment or populations of mammals to favor the use and/or survival of certain species, and to regulate or even reduce the populations of species whose activities conflict with man's interests.

Of course, individual studies are not necessarily restricted to one of the above categories; many studies combine aspects from two or more areas. For example, in game management, the ecology and natural history of the species must be understood, and in taxonomy, anatomical features are used to discern systematic relationships. In addition, mammalogists often collaborate with scientists in other fields, such as ornithologists in studies of predator-prey relationships between birds-of prey and rodents,

and botanists in studies of plant-herbivore interaction. Paleontologist may combine mammalian systematics with geology and geography, whereas toxicologists may combine studies of mammals and environmental pollutants. Obviously, becoming a mammalogist is not the only way to study mammals. In fact, many scientists who study mammals would not consider themselves "mammalogists" per se, but specialists in such fields as physiology or ethology, who happen to use mammals as the subjects in their research.

A number of employment opportunities exist for trained mammalogists and those interested in working with mammals. Each job tends to differ somewhat in terms of duties/responsibilities, methodologies, perspectives, compensation and level of training required. Some of the principal career opportunities for mammalogists are described below.

Universities

Though few universities have departments of mammalogy, most large universities employ professors who work with mammals, either in Biology/Zoology departments, or in departments such as Ecology, Evolution, Behavior, Physiology, Anatomy, Systematics, and Wildlife Management. University mammalogists typically are heavily involved in research activities. The research program at large universities is expected to be very productive and of high quality, as much of its funding must come from granting agencies outside the university. Therefore, the university mammalogist often directs a staff of lab technicians, undergraduates, and graduate students in his/her laboratory. In addition to actually conducting research, the duties of the university professor include maintaining quality control, managing personnel, writing proposals for submission to granting agencies, and writing the results of the laboratory's research, either as progress reports or as manuscripts for publication.

In addition, as a member of an academic department, most university mammalogists are expected to participate in the teaching and advising of undergraduate and graduate students. Often a course in mammalogy is taught, as well as other courses within the professor's area of specialization. Participation in the general courses of the department, such as General Zoology/Biology and Human Anatomy/Physiology, may be required as well.

In virtually all cases, faculty positions at large universities require the Ph.D. degree, and many institutions prefer candidates to have postdoctoral experience as well. Formal training in education is not a prerequisite, but some teaching experience, at least as a graduate teaching assistant in a laboratory course, is usually required. Salaries for university professors rang from \$18,000 -\$60,000 annually, depending on experience. The number of positions for mammalogists at major universities is limited, and competition for these is keen. Nonetheless, each year well-trained, productive candidates, often new Ph.D.s, succeed in obtaining such employment.

Colleges

The largest numbers of positions for biologists who study mammals have historically been as vertebrate biologists, teaching undergraduates and conducting limited research in colleges and small universities. Doctoral programs usually are not available at these institutions, but master's degree programs frequently are. College professors should be broadly trained in undergraduate/graduate vertebrate courses, with support courses in morphology, physiology, ecology, ethology, genetics and evolution. A Ph.D. degree is usually required. Also, opportunities should be sought during graduate training to teach a variety of introductory and advanced laboratory courses in biology. Individuals interested in a college position must be able to direct undergraduates in the classroom and on research projects, and to find such work rewarding and stimulating.

In contrast to the situation at a large university, mammalogists at colleges and small universities typically devote more of their time to teaching. The number of courses taught per year is greater and the importance of the quality of teaching in the assessment of overall performance is usually greater. Although research programs may be smaller and time commitments to research less at colleges and smaller universities, the quality of research at these institutions is still expected to be high. The salary range for a professor at a college or small university is often lower than at large universities.

Federal Government Agencies

Many agencies within the federal government employ mammalogists. These include the Public Health Service, National Park Service, U.S. Fish and Wildlife Service, Department of Agriculture, Army Corps of Engineers, Food and Drug Administration, Department of Commerce, and Environmental Protection Agency. As expected, the type of work within these agencies varies greatly. Within the federal government, individuals who work with mammals are employed as: 1) Ecologists; 2) General Biologists; 3) Geneticists - developing breeding methods and selection procedures for livestock and game mammals; 4) Husbanders - studying breeding and feeding of livestock; 5) Physiologists; 6) Range Scientists - managing the use and preservation of rangeland for both domestic and game mammals; 7) Wildlife Biologists - determining conservation and management practices for wild mammals; 8) Wildlife Refuge Managers - operating game reserves and refuges; and 9) Zoologists.

In general, the educational requirements for these positions include a minimum of a bachelor's degree (or equivalent) with at least 30 semester hours in biological sciences. Appointments start at the GS-9 level, or about \$20,000 per year, with a bachelor's degree. Scientists with a Ph.D. may start at GS-12, or about \$30,000. These jobs do not usually include teaching duties, and the selection of a specific research project is done by administrators, often on the basis of monetary impact or political considerations.

State Fish and Game Agencies

Educational requirements for this career are best met by the Master's of Science degree. A person having a bachelor's degree and some experience in the field is also employable at the entry level. Students should structure their coursework toward a degree in biology or game and resource management. Undergraduate coursework should include general and upper level biology courses. A strong background in communication skill such as writing and public speaking is recommended. Areas of specialization that would increase the chances of employment include some expertise in censusing, data analysis/statistics, and computer programming. A person can increase the probability of obtaining a job in this field by participating in seasonal work programs. Most state departments have these programs available to students, usually during the summer months. Participation in these programs is strongly advised for two reasons: 1) they allow the student to obtain a firsthand knowledge of the field and the type of work involved and 2) they allow the department to assess the individual for future employment. These programs are particularly good for establishing contacts within the field.

There are four basic divisions within most state Fish and Game departments. An Informations and Education division deals with public affairs. Law Enforcement divisions are also common within state agencies. The Game Division is usually composed of big game, small game, non-game, research, and waterfowl subdivisions. The final division of the department is Habitat Management; a background in biology and engineering would be useful for this division.

The outlook for future employment in state agencies is relatively static with hiring done to replace vacated positions. Salaries vary among states but an entry level person with a bachelor's degree can expect to earn \$17,000 - \$20,000 annually, depending on experience. A person entering the field with a master's degree would be hired with an annual salary of \$17,500 - \$22,000. Fieldwork and direct interaction with wild mammals are the big attractions for this type of employment, although some positions deal more with the public than with wild mammals. One major drawback is that employees often are not their own bosses. As with federal positions, long-term goals may be dictated by state and local political considerations and budgetary constraints.

Museums

A person receiving training in mammalogy may work in either a public or a university museum. There are several differences between these, including 1) the size of the collection, large public museums often have more specimens than university museums; and 2) the responsibilities of curators, e.g., along with responsibilities for curation of the collection and research, a university position usually includes teaching duties, such as a class in mammalogy or vertebrate biology. In both situations, appointments are based on an individual's ability to meet the highest level of scholarly achievement and to conduct and publish original research. A person generally must have a Ph.D. or the equivalent in order to qualify for such a position. However, some museums employ mammalogists without doctoral degrees as curatorial assistants. The areas of

specialization are generally systematics, ecology, or biogeography. Curatorial duties include acquisition, preparation, identification, maintenance, and cataloguing of specimens so that materials are readily available to researchers. Storage and retrieval systems for catalog information range from cardfiles to computers. Because many museums have turned to computer-based systems in order to facilitate efficient information retrieval, some knowledge of computer usage is important. Salaries vary widely depending on the institution. Mammalogists employed at university museums often start at a salary of \$16,000 - \$20,000 per year, which increases upon promotion to full professor or curator. Individuals with such positions typically hold a joint appointment in an academic department, such as Biology or Zoology. Not all universities offer tenure track positions for curators. At large public and private museums, starting salaries tend to be slightly higher, \$23,000 per year, and may increase up to approximately \$60,000 per year. Because there are few large prestigious museums, appointments are limited, and most museum curatorial positions are with smaller museums.

Zoos

There are several hundred zoo positions nationally that are filled by individuals with training in mammalogy. However, for college-educated biologists, the number of positions that open annually is very small. The majority of zoo (and aquarium) positions, such as zoo keepers, require only a high school education, and practical on-the-job training is provided. For higher level positions such as curators and directors, a minimum of a bachelor's degree in biology or zoology is usually required, as is some management training/experience. These positions typically pay \$10,000 - \$50,000 annually, depending on level and the size of the institution. Generally, some practical experience is also required for curatorial positions. Today an increasing number of zoos are using their captive animals as research subjects, and are employing mammalogists with bachelor's and advanced degrees.

Wildlife/Conservation Organizations

Although more job opportunities for mammalogists are found in education and government, a limited number of positions are available with private wildlife or conservation organizations, such as the Nature Conservancy, the National Audubon Society, and the National Wildlife Federation. These organizations obtain and maintain preserves and sanctuaries, interact with federal agencies, sponsor programs, and conduct research on endangered species and threatened habitats. The types of positions available include basic research scientists, lobbyists for wildlife legislation, administrators of sanctuaries and preserves, and directors of educational activities. Beyond these generalizations, job descriptions and expectations vary widely.

A Ph.D. degree is required for a research mammalogist involved in gathering data to be used in deciding strategies for management and preservation of rare or endangered species. On the other hand, there are many other positions for which an undergraduate degree in biology is the minimum requirement, although postgraduate

work (master's degree) would enhance the chances for success in a difficult job market. For example, preserve administrators, conservation educators, and lobbyists for environmental legislation must have an understanding of science, an ability to deal with people, and excellent communication skills. In addition to basic coursework in biology (which could emphasize mammalogy), students interested in careers with these organizations would be wise to seek background and/or experience in natural resource management, use of computers, public speaking, and semitechnical writing.

Short-term internships also are available to college students in some of the larger environmental organizations. These positions offer not only an educational experience, but also provide insight into the pros and cons of a career with this type of organization. Students may be assigned to work on preserves or sanctuaries, or to assist regular staff members in policy work. An internship with these organizations may substantially improve the likelihood of future employment.

Directories to wildlife and conservation organizations are often available in public libraries and should be consulted to gain an idea of the variety of employment opportunities.

Private Research Institutes/Private Industry

In the private sector, many companies employ scientists with training in mammalogy. These include the energy, lumber, and industries, as well as scientific supply/products companies. In addition, independent research institutes and consulting firms contract with smaller companies, government agencies, and other entities to perform a similar function. In either case, the research is usually applied than basic in nature.

The two primary types of mammal studies undertaken in the private sector are: 1) Toxicology - the effects of chemicals or pollutants on living systems. These studies are performed primarily in the laboratory and require an expertise in anatomy and physiology, and a background in histology, chemistry, and statistics. 2) Field Ecology - field studies of mammalian ecology. These studies usually are performed in the field, utilizing trapping and telemetry techniques.

Employment in research institutes and private industry depends somewhat on the economy and how much of the budget is available for research and development. Generally, technicians are hired with a bachelor's degree, starting at about \$12,000 per year. Scientists with advanced degrees earn from \$20,000 to over \$40,000 annually. Summer training for undergraduates is available at some research institutes and is recommended to gain experience and make employment contracts.

CONCLUSIONS

As can be seen in the above descriptions, career opportunities for mammalogists are many and diverse. However, students considering careers in

mammalogy should be realistic in their expectations. Presently, there are more mammalogists seeking employment than there are positions and this situation is likely to prevail into the foreseeable future. Competition for these positions is, and will continue to be intense, and it behooves the prospective mammalogist to acquire the best possible training, in order to be as competitive as possible for the available openings. In this regard, summer employment or volunteer work in the chosen career area can often be extremely valuable.

In general, a broad undergraduate background is desirable for positions in mammalogy. Training should include: 1) fundamental in biology - cell biology, development, genetics, evolution, and ecology; 2) zoology - introductory zoology, comparative anatomy, physiology, ethology, and taxonomy; 3) botany - introductory botany and taxonomy of flowering plants; 4) chemistry - inorganic, organic, and biochemistry; 5) mathematics - at least through calculus; 6) physics - a basic course; 7) paleontology - a basic course; 8) statistics; 9) computer science; and of course 10) mammalogy, if available at the undergraduate institution. Other coursework will depend on the specific field of mammalogy. For many careers, graduate degrees and even postdoctoral experience are required, and it is here that the mammalogist receives specialized training.

Prepared by the Committee on Education and Graduate Students of the American Society of Mammalogists