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Wildlife Research Priorities

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Seeking to establish meaningful goals for the development of research methodology, the Electronics Unit of the Denver Wildlife Research Center prepared and distributed a questionnaire to wildlife researchers. The specific purpose of this questionnaire was to identify the major areas of wildlife research where biological information is most needed, and to focus electronics development on these priorities rather than dissipate efforts on novel applications or minor problems. While our specific mission is electronics development in research methods with particular emphasis on animal damage control, much of the information about animals that has been difficult to obtain or beyond present capabilities is common to the entire wildlife field. The response to this questionnaire indicated distinct trends in research priorities that we feel are worth communicating to the wildlife community.

The evolution of the questionnaire proceeded in two stages. Initially, letters of enquiry were sent to four wildlife research laboratories and 18 Cooperative Wildlife Research units within the Bureau of Sport Fisheries and Wildlife, requesting a priority listing of their major needs in research along with specific developmental proposals. Nineteen replies (73 percent) were received to this first request.

The second stage consisted of organizing all the research problems presented in these 19 replies into a meaningful structure. The responses varied greatly in the amount of detail; some indicated only general areas of interest, while others detailed specific species, geographical locations, and seasonal changes. However, it was found that all suggestions for developing new methodology could be classified in five major categories. Through the aid and advice of personnel expert in these areas of research, a detailed, topical outline was developed around the five categories. This was then abbreviated to a three-level form which was used as the final questionnaire.

This method of formulating the questionnaire—in effect, asking researchers themselves to provide the questions through preliminary enquiries—served to reduce the influence of any single point of view and thereby to broaden the scope of its final form. The questionnaire, consisting of the topical outline and a set of instructions asking for priority choices among the categories (Appendix), was sent to about 60 researchers actively engaged in studies of wildlife. These men were associated with 24 research organizations throughout the United States.

Among the respondents are 27 wildlife biologists, 4 wildlife managers, 4 physiologists, 2 aquatic biologists, 2 ecologists, 1 forester, 1 biochemist, and 1 engineer; 22 are associated with Federal, 9 with State, and 11 with university research organizations. One researcher returned our questionnaire unanswered with a statement that he did not feel the approach was objective. On the other hand, at least 10 enquiries have been received requesting the results.

Of the 42 questionnaires returned, 40 were answered completely enough to be analyzed. These 40 questionnaires provided a numerical priority rating of all five major categories and additional ratings among the second- and third-level topics in which the researcher was interested. For example, if radiological developments, at the third level, were his first specific priority, "1's" would be placed beside Physiological Data, Monitor of Normal Body Functions, and Radiology for a code of "1, 1, 1." If the second priority was Biological Stresses, under the same major category but a different second-level topic, it would be coded, "1, 2, 1" and so on.

Table 1 shows the number of votes received at each priority level for the five major categories, and the overall ranking between them established by weighting and summing the votes. Priority sequences were also established for the subordinate levels of the topical outline—1 to 10 for the second level, and 1 to 20 for the third (the few lower-priority votes beyond these limits were judged too scattered to be meaningful). An overall ranking for these levels, again calculated by weighting and summing the votes, is indicated by the numerals entered in the blanks in the sample questionnaire (Appendix). The most frequently mentioned topic under each second-level entry is also indicated by an asterisk.

The number one priority topic of Mortality Studies showed the highest weighted sum; it was closely followed by the second priority topic of Census Techniques. The ranking reveals an ambiguous status for the major category of Physiological Data. Although it was ranked third in priority among the major categories, the third-level entries

TABLE 1. *Priority Ranking of the Five Major Categories in the Outline, Based on Votes From 40 Questionnaires.*

Major Category	Number of votes for priority					Overall ranking*
	1	2	3	4	5	
I. Wildlife Field Data	31	2	1	4	2	1
II. Physiological Data	5	4	12	9	8	3
III. Behavioral Data	1	18	10	9	1	2
IV. Environmental Measurements	3	9	7	7	12	4
V. Data Processing and Collection	0	7	9	8	14	5
	5	4	3	2	1	
	Weighting Factor					

*The overall ranking was established by multiplying the vote totals in each column by the arbitrary weighting factor and then summing these products across the row for each major category. The category with the largest sum was rated first.

Response for
Outline of Techniques and Methodology for Wildlife Research

1 I. Wildlife Field Data
- 2 A. Movement and Location
  - 6 1. Seasonal Migration
  - 4 2. Home Range
  - 3 3. Activity — *
- 1 B. Population Dynamics and Census
  - 5 1. Natality Studies
  - 1 2. Mortality Studies — *
  - 9 3. Longevity
  - 8 4. Sex Ratios
  - 10 5. Introduction of New Species
  - 7 6. Capture Techniques
  - 2 7. Census Techniques

3 II. Physiological Data
- 5 A. Monitor of Normal Body Functions
  - 14 1. Electrophysiological — *
  - 10 2. Metabolic
  - ___ 3. Analytical Biochemistry
  - ___ 4. Histology and Cytology
  - ___ 5. Physical Characteristics and Capabilities
  - ___ 6. Radiology
- 10 B. Monitor Under Stressed Conditions
  - ___ 1. Biological Stresses — *
  - ___ 2. Other Stresses

2 III. Behavioral Data
- 3 A. Reflex Responses (Normal)
  - 12 1. Sensory Preferences
  - 15 2. Social Order and Communications
  - 18 3. Competition and Interaction
  - 17 4. Reproduction
  - ___ 5. Grooming Behavior
  - 11 6. Habitat Usage — *
- 4 B. Learning Response
  - ___ 1. Operant Responses — *
  - ___ 2. Classically Conditioned

4 IV. Environmental Measurements
- 9 A. Weather Data
  - ___ 1. Temperature
  - ___ 2. Humidity
  - ___ 3. Moisture
  - ___ 4. Wind
  - ___ 5. Light
  - ___ 6. Barometric Pressure
- 8 B. Microclimate Measurements
- 6 C. Environmental Quality
  - 13 1. Contamination Levels — *
  - ___ 2. Contamination Duration
- ___ D. Geological Features
- 7 E. Monitor Changed Environments
  - 16 1. Vegetation — *
  - 20 2. Human Disturbance

5 V. Data Processing and Collection
- ___ A. Recording and Display Techniques
  - ___ 1. Magnetic
  - ___ 2. Graphic
  - ___ 3. Punched — *
  - ___ 4. Printed
  - ___ 5. Handwriting
  - ___ 6. Photographic
  - ___ 7. Electronic Symbolism
  - ___ 8. Real Time Analysis
- ___ B. Methods of Data Analysis
  - ___ 1. Digital
  - ___ 2. Analog
  - ___ 3. Calculator — *
  - ___ 4. Hand
- ___ C. Mathematical Techniques
  - ___ 1. Probability Theory
  - ___ 2. Modeling and Simulation — *
  - ___ 3. Integrodifferential Transformations

* Third-level topics in the questionnaire which were most frequently mentioned.

Name .....

Title .....

Affiliation .....

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under Environmental Measurements received higher priorities. One possible explanation of this anomaly could be the difficulty of disassociating behavioral and physiological measurements. Since behavioral information was rated second, the physiological instrumentation required for obtaining these results could possibly account for the major category emphasis on Physiological Data.

Several of the researchers indicated that the fifth category of Data Processing and Collection would have to be "developed concomitant with the others." In other words, as more efficient, faster data collection methods are incorporated into wildlife research techniques, similar advances must take place in data analysis. It was interesting to observe that a higher priority rating was generally given this fifth major category by those whose current research techniques yield large volumes of data.

Wildlife research personnel may want to study this outline in detail and note how these priorities compare with their own. This, of course, is not the complete picture, as economics, politics, and relative urgency all play a major role in developing a research program, but the questionnaire results may act as weighting factors in decisions for future research.

APPENDIX

Questionnaire instructions and topical outline sent to wildlife researchers. The numbers entered in the blanks opposite topics in the outline indicate overall rankings obtained by weighting and summing all votes from 40 questionnaires.

Survey of Wildlife Techniques Problems

A concerted effort is being made at the Denver Wildlife Research Center (DWRC) to identify the areas where development of techniques and measurements is most needed in Wildlife Research.

Attached is an Outline of Techniques and Methodology for Wildlife Research. This research outline is subdivided into five major topics as indicated by the Roman numerals. We would appreciate your help in establishing priorities. Would you please sequentially number 1 through 5 in the spaces provided these major topics in the order that you would evaluate their relative requirements for techniques development.

Now, would you please take the two selected major topics receiving top priorities and again set your own priority level for the next two levels of topical breakdown (i.e., those topics indicated by capital letters and arabic numbers). Any subtopic listed which holds no personal interest or potential just leave blank.

The results of this survey are to act as a guide in setting work priorities for electronics development at the DWRC. However, it is hoped that the results of this topical questionnaire will reflect only true biological research problem areas and not preconceived ideas for electronic gadgetry.

Thank you very much for your time and thoughts in filling out this outline.