CONTINUING EDUCATIONAL NEEDS OF STATE AGENCY FISH AND WILDLIFE BIOLOGISTS

by

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(ABSTRACT)

Fishery and wildlife biologists employed by state fish and wildlife agencies were surveyed to determine their continuing education needs related to specific job tasks. In addition, proficiency levels required for job tasks were rated. An organizational analysis was also conducted to ascertain agency climate for support of continuing education programs.

Forty-seven state fish and wildlife agencies responded to the organizational analysis. Agencies valued their employees and understand the benefits of continuing education, but did not allocate many resources to support programs. A positive climate does not presently exist for the development and implementation of continuing education programs. Continuing education was not an important part of state fish and game agencies' organizational culture.

Differences in continuing education needs of fishery

and wildlife biologist have little correlation to undergraduate/graduate curricula, highest degrees attained, or length in the profession. Biologists' greatest needs for continuing education related to technical tasks in research/data collection and analysis, and specifically computer and software usage. Other continuing education needs were related to population and habitat tasks. Biologists identified low proficiency levels needed for modeling and genetic tasks, but indicated a high need for continuing education.

Continuing education needs for non-technical tasks related to communication, interpersonal relations, management and leadership skills were rated significantly higher by agency administration than fishery and wildlife biologists. Additional data were provided on proficiency levels identified for job tasks. Recommendations are made to state fish and wildlife agencies, providers of continuing education programming, and university faculty.

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I would like to thank my parents, Bill and Jean Murphy, who instilled in their six children a love and appreciation for education and public service. I wish my father were alive to share this achievement with me.

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Table of Contents

LIST OF TABLES

Chapter One

Introduction

In this dissertation, I report my findings of a study conducted to identify the continuing educational needs of professional fishery and wildlife biologists employed by state fish and wildlife agencies. In addition, the results of an organizational analysis of state fish and wildlife agencies related to professional development will be reported. The goal of this research was to identify for the providers of continuing education the training needs of fishery and wildlife biologists. It is hoped that, as a result of this study, meaningful educational programs will be developed and implemented. These programs would contribute to the professional growth of biologists, and benefit the natural resources entrusted to them and the users of those resources.

In addition to providing relevant information for providers of continuing education programming, this study will provide data that should be helpful to higher

education. The education needs identified by practicing fishery and wildlife biologists should give valuable insight to university curricula committees as they design undergraduate and graduate programs to meet the demands of their students, the profession, and future employers.

"The very idea of a profession implies not merely that a person will enter it only when well prepared but also that preparation will be continued throughout life" (Osler 1984). Aldo Leopold (1940), the father of modern game management, commented over 50 years ago that the wildlife profession is more than just managing traditional game species. He stated that "our profession began with the job of producing something to shoot. However important this may seem to us, it is not very important to the emancipated moderns who no longer feel soil between their toes." His prescience is being played out today as roles of professional biologists become increasingly more complex.

The amount of new knowledge being generated in a given profession is enormous, and the methodologies for applying and utilizing this knowledge are dramatically changing. Professional obsolescence in various fields often is measured by the term "half life", the time after formal academic training when professionals are half as competent

to meet the demands of their profession. In 1940, the "half life" of an engineering graduate was 12 years, in 1970 just five years (Lukasiewicz 1971). While such estimates are not available for professional fishery and wildlife biologists, the assumption can be made that such a phenomenon exists and applies to the profession.

Fishery and wildlife biologists jobs are getting more complex and difficult. Data provided to Cutler (1982) by USDA Forest Service regional foresters and Soil Conservation Service supervisors provides insight into their training "wish list" for biologists: "improve your skills in ecology, economics and communications. Adopt a more open-minded attitude toward the views of others. Look for positive opportunities to enhance fish and wildlife values rather than hanging tough for the status quo so often."

Cross (1987) recognizes that universities provide a quality foundation, with "academic programs providing a balance of basic skills and knowledge needed to enter a profession." He further states that "in every advanced field of applied knowledge, the amount that must be learned is so great that it cannot be conveyed in the collegiate years...early preparation cannot do more than lay foundations for future study, which must occur throughout a

lifetime."

The need for lifelong learning and professional development has been widely recognized in the natural resource profession (Graf 1976, Donaldson 1979, Hester 1979, Krausman 1979 and Salwasser et al. 1990). A comprehensive study by George et al.(1974) surveyed 1,200 wildlife and fisheries managers on their continuing education needs. More than 80 percent of those surveyed indicated a need for training in new technologies, environmental management, pollution biology, interdisciplinary teamwork, long-range planning, budgeting, use of media and communication skills. In addition, this report stated that natural resource professionals want an organizational commitment to continuing education as an accepted, regularly programmed part of their employment.

Hamed (1990), in a more recent study, reports an urgency for professional development in three major areas: 1) application of new skills in systems ecology, computer technology, remote sensing and land use analysis; 2) environmental planning and management; 3) restoration, preservation and conservation of the natural environment within the complex context of human population growth.

The importance of life-long learning has been recognized by the leading professional organizations of fishery and wildlife biologists. Quoting from the American Fisheries Society's Continuing Education Manual: "One of the most important functions of the Society is the maintenance and enhancement of the technical, professional, and administrative knowledge and skills of its members."

A similar statement can be found in The Wildlife Society's Professional Development Program Administration Handbook: "Continuing education and professional development are increasingly important to wildlife biologists and related professionals. Rapid technological changes, the social significance of wildlife resources, increased public awareness, higher environmental standards, greater professional demands, and the ever-changing competencies required of professionals dictate the need for continuous learning and development."

What are the life-long learning needs of professional fishery and wildlife biologists? How can they be identified and quantified? One of the most widespread methodologies used to determine the content of training and continuing education courses is task analysis (Finch and Crunkilton 1993). This process allows for the identification and

Crunkilton 1993). This process allows for the identification and verification of tasks performed on the job. Once the tasks have been identified, the proficiency levels needed to successfully complete job requirements can be rated by the employee or employer. Simultaneously, the employee also identifies the need for continuing education related to the task.

Study Objectives

The overall objective of this study was to identify for continuing education providers the continuing education needs of fishery and wildlife biologists employed by state fish and wildlife agencies in the United States. The specific objectives were to:

1. Ascertain the organizational climate in state fish and wildlife agencies for supporting continuing education programs;

2. Determine the need for continuing education related to specific job tasks performed by state agency fishery and wildlife biologists and;

3. Provide university faculty with information on proficiency levels of job tasks performed by state fishery and wildlife biologists that may be useful in curricula development.

Chapter Two

Literature Review

In this review of the literature, I will briefly discuss trends in continuing education relative to the needs of professionals. I will comment on why professionals participate in continuing education as well as discuss the beneficiaries of continuing education. Finally, the various methodologies used in conducting assessments of continuing educational needs and curriculum development will be reviewed.

Within this context, it seems appropriate to establish an overall framework for adult continuing education. Darkenwald and Merriam (1982) have identified five major aims of adult education: to cultivate the intellect, to facilitate individual self-fulfillment, to promote personal and societal improvement, to catalyze social transformation, and to advance organizational effectiveness.

The explosive growth of applied knowledge poses a significant problem to professionals. Continuing education

was first applied as a practical solution to that burgeoning problem. Early continuing education focused on remediation of deficiencies in prior education. It then evolved into a process of correcting the gaps in knowledge and skills that practicing professionals increasingly encountered as they attempted to keep abreast of new developments in their fields (Scanlan 1985).

It is readily acknowledged that professional skills and knowledge are subject to obsolescence. The notion that continuing education is remedial for obsolete knowledge and skills is still the dominating impetus for activities in the technically-oriented professions such as engineering (Mali 1970). During the 1960s, Houle (1983) noted a shift occurring in the orientation of continuing education. Because of public pressures, governmental intervention in some occupations, and professional compliance, professional updating became a complex mechanism designed to assure professionals' competence. Although the health profession provided major impetus in this direction, assurance of professional competence has become the dominant ideology among diverse disciplines. This orientation in continuing education can be readily observed in licensing practices for certain professions, as well as the proliferation of accrediting procedures found in many professional societies

and organizations (Phillips 1983).

While early remedial approaches to professional development focused on knowledge deficiencies, recent trends in professional updating have increasingly emphasized gaps in proficiencies and performance deficits (Scanlan 1985). Continuing education that focused on updating knowledge or minimal competence is now realized to be insufficient. Professional and personal growth and development must also be facilitated (Houle 1980).

The movement to professional development for purposes of personal self-enhancement leads to a third trend in continuing education, facilitating change. Professionals' roles and functions are impacted by changing social, economic, and political conditions. Coupled with changes in societal and professional expectations and rapid advances in technology, dramatic alterations can be applied to one's profession (Pigott 1976, Houle 1980). Continuing education is being increasingly applied to facilitate such change.

A brief comment on the beneficiaries of continuing education is appropriate given the scope of this study. Traditionally, the orientation of continuing education programs has been focused on the individual. This is

evident in the processes used in identifying educational needs, selecting educational methodologies, and evaluating the learning outcomes. Houle (1980) notes that educational needs of professionals employed in organizational settings are receiving increasing attention. Corwin (1965) notices that there are often differences between individual professional's expectations of continuing education and learning outcomes and an organization's expectations for continuing education programs.

Individual professionals look toward upgrading skills and technical expertise, experiencing personal growth and preparing for anticipated change in their profession. The organizational approach views these impacts as intermediatory steps in increasing the effectiveness of the organization (Lauffer 1977). These activities are not necessarily conflicting; and indeed, should parallel the orientations mentioned above for continuing education, namely remediation, growth and change (Nadler 1970).

Differences do exist between learners involved in continuing education and learners involved in continuing professional education. Professionals can be categorized by their occupations, occupational status and level of formal education (Grotelueschen et al. 1981). General adult

learners are often characterized as volunteers for education. Professionals may not always have that choice. Finally, general and professional adult learners are both participants and beneficiaries of education. However, there may be secondary beneficiaries resulting from professionals receiving continuing education. For example, in the case of natural resource professionals, the secondary beneficiaries may be hikers, hunters, birdwatchers, photographers, etc. Houle (1980) argues that continuing professional development is deemed successful when the primary educational benefits obtained by the professional result in identified benefits to the secondary beneficiaries.

Providers of continuing education need to understand why professionals participate in continuing professional education. This understanding is a critical part of the overall process of identifying program priorities, program development, and marketing. One could reasonably assume that if the fishery and wildlife biologists' expectations and needs for professional development are not met, future participation would be jeopardized.

Comprehensive studies conducted by Grotelueschen et al. (1979) and Kenny and Harnisch (1982) through the Office of the Study of Continuing Professional Education at the

University of Illinois resulted in the development of a Participation Reasons Scale (PRS). This instrument has been administered to numerous professional groups. While differences according to professions are apparent, there are five basic clusters of reasons for participating in professional continuing education: 1) professional improvement and development, 2) professional service, 3) collegial learning and interaction, 4) professional commitment and reflection, and 5) personal benefits and job security. Knowing these participation factors can enhance the responsiveness and quality of education programming for designated professional audiences.

The identification of continuing education needs of professionals, by its very nature, is a necessary process that should be ongoing and dynamic in nature. Yet it is a mechanism often given only cursory attention by planners and providers of continuing education programs. The last part of this review will discuss various needs assessment tools. An understanding of these tools will help providers of continuing education structure the information-gathering process and assist in the decision-making process regarding program development, content, and delivery.

Lauffer (1982) suggests that a great deal of energies

are focused on program design and development, yet the assessment process often relies on professional experience and personal intuitions as to what is "best" for the potential recipient of the educational program. This is often referred to as the "introspection process." Its major shortcoming is individual or group bias, leading to programming content that may or may not be relevant (Finch and Crunkilton 1993).

Three orientations to needs assessment have been identified by Lauffer (1982): what is (here and now), what might be (anticipatory), and what ought to be (normative). The "what is" focuses on current problems, needs or deficiencies. The "what might be" orientation permits program planners and providers of professional development to anticipate and be proactive, rather than play "catch up" and be reactive to problems or needs. The "what ought to be" approach envisions a desired state of professionalism, or competencies. Although the "here and now" approach is most common, elements of the all the approaches are usually found in assessment activities.

Formal assessment of employee training needs can be traced to the term "job analysis" which appeared in the management literature early in the twentieth century.

Taylor (1916) referred to it as one of the four great principles of scientific management, the others being scientific employee selection, employee motivation through reward systems, and job redesign. This early principle, job or work analysis, encompassed elements of the other three principles, and included employee training. Further evolution of the term, as defined by Niebel (1962), shifted the focus to that of a "procedure for making a careful appraisal of each job and then recording the details of the work so that it can be equitably evaluated." Job analysis became useful in providing the data necessary for writing job descriptions and activities.

In employee training and development, job analysis is translated into task analysis, and is conducted as a routine part of human resource planning and development activities, including the assessment of training needs (Goldstein 1974). A careful analysis of a job, including detailed listings of specific tasks, can be translated into the knowledge, skills and abilities necessary for job performance. These data can also be used to determine learning outcomes and behavioral objectives, and facilitate the entire instructional design process.

An understanding of what is a task, function and job is

germane to understanding the development of assessment instruments. The job analysis literature commonly holds tasks to be discrete organized units of work, generally performed by an individual or individuals, with a beginning and end. It is a job-oriented activity that is purposeful and accomplishes a goal(s) of the job. Function is a broad subdivision of a job consisting of groups of tasks related to the nature of the work, and is generally broken down into two types: supervisory and direct work. Often, functions are determined after the tasks have been identified and task clusters emerge. A job is the summation of functions performed by a group of employees (McCormick 1979).

Job inventory is a popular analysis methodology that develops a comprehensive list of tasks that are performed to accomplish a job. Much of this methodology was developed by the United States Air Force in the late 1950's and implemented in 1965. Innovative elements included computer analysis of data, questions related to task importance, task difficulty, and time devoted to each task (Driskill 1975).

The most comprehensive program developed using the job inventory approach is the Work Performance Survey System (WPSS) developed in 1980 by American Telephone and Telegraph (AT&T). The advantages of the WPSS approach are that

detailed information about job activities can be obtained from workers dispersed geographically, it can address more than one objective at a time (job description, evaluation, training, etc.), and it is easily learned and administered by managers (Gael, 1983). This computer-aided job inventory produces information that can be used by managers to initiate human-resource planning, make administrative decisions and potentially analyze jobs in the planning stages.

The "critical incident technique" has limited use in identifying continuing education content, but does have a role in staff development activities that focus on developing appropriate attitudes and values (Flanagan 1954). This assessment technique, non-technical in nature, observes incidents and categorizes them for later analysis. For example, some categories that might emerge may be interpersonal relations, interpretation of company or agency policy, or personal initiative. This information can then form the foundation for programs focusing on developing appropriate attitudes and values (Finch and Crunkilton 1993).

The Nominal Group Technique has been used for program planning, problem solving, and identifying continuing

education needs. This process is structured so that a heterogeneous group, such as staff, management and even clientele, can identify problems or needs and come to agreement on a solution. The process can be summarized in four steps: 1) solitary generation of ideas in writing, 2) round-robin feedback from group members to record ideas, 3) discussion of each idea for clarification and evaluation, 4) rank-ordering or rating of ideas (Delbecq et al. 1986).

The Team Planning Technique (TPF) is a similar process that focuses on needs or problems relevant to the performance of work-related tasks. TFP incorporates individual, small group, intergroup and large group activities that identify work-related learning needs, as well as work-related problems and designs instructional programs to met those needs (Lauffer 1982).

The Delphi Technique, originally developed by the RAND Corporation in the early 1950's for predicting alternative defense futures, has been found to be a useful tool in developing curriculum and professional development programs (Sackman 1975). It is especially useful in reaching consensus among individuals on the most relevant components of program or curriculum content. This methodology is well suited to provide a information gathering structure when

group interaction might prove to be individually threatening. The group never meets face to face in this process. The anonymity of the Delphi Technique often causes a creative and thoughtful environment for program development. There is also a forecasting or predictive component to this technique that could be useful in identifying new occupational roles or changes in various professions and their subsequent professional development needs (Lauffer 1982).

Finch and Crunkilton (1993) describe the application of the Delphi Technique in the development of content for curriculum. This technique is basically a series of interrogations using mailed questionnaires. The initial questionnaire asks the participants for a list of content that should be included in the curriculum. The second round includes all the input from the first round and each item is rated. The third round provides participants with an opportunity to review the consensus ratings of the content items and revise their opinions. The fourth round allows for a final review of newly updated consensus ratings and one last chance for revision. This technique is often used as a first step in the content determination process because other data sources do not exist.

As mentioned earlier in this review, one of the goals of adult continuing education may be to facilitate change. Kurt Lewin (1951) developed a technique called Force Field Analysis. He postulates that individuals exist within an organizational space or "field." There are driving forces that move people into a new direction (change) and there are restraining forces that reinforce the status quo and support an individual's resistance to change. Kuriloff (1972) found this type of analysis to be useful in identifying the forces contributing to the work-related problems in organizations and developing educational programs to address the problems.

The DACUM (Developing A Curriculum) process (Norton 1985) is a popular technique for determining the tasks that are performed by people in an occupation. This analysis then can be used for training needs assessments and curriculum development. DACUM operates on the premises that expert workers can define their jobs better than anyone else, these jobs are described in terms of tasks that successful workers perform, and that workers need specific attitudes and knowledge in order to perform each task correctly.

The DACUM process (Norton 1985) involves working with a trained facilitator. A committee of experts from the

occupational area identifies duties and the specific tasks connected with the duties. The task statements are further developed, reviewed, and refined before being verified by experts selected from the ranks of practitioners of the occupation under analysis. The DACUM analysis provides results of traits and attitudes important to professionals in a given occupation and general knowledge and skill areas that are prerequisites to job performance. The finished DACUM profile for a given profession consists of a listing of detailed tasks and duties. Educational products can then be developed with the instructional content focused on developing skills relevant to the job tasks.

Task analysis is a very generic and flexible methodology. The DACUM process employs elements of task analysis, as do many of the techniques identified in this literature review. Task analysis has been used extensively as a strategy for determining educational content and for conducting occupational surveys (Morsh and Archer 1967). This approach is also used extensively by the Vocational-Technical Education Consortium of States (Finch and Crunkilton 1993). There is no specific formula, but the basic steps of task analysis include: reviewing relevant literature, developing an occupational inventory (task list), selecting a worker sample, administering the

inventory, and analyzing and interpreting the data.

A large number of diverse techniques and strategies to identify continuing education program content are available to providers of continuing education. Task analysis seems to be a critical component in many of these methodologies. An amalgam of the reviewed procedures can be used to best fit the needs the of providers of continuing education. Factors that must be taking into account include resources available, the ease of data collection, objectivity, validity and applicability (Finch and Crunkilton 1993).

Chapter Three

Organizational Analysis

Introduction

It is important to understand state fish and game agencies and how these organizations impact on the professional development of its employees. The professional development needs of fishery and wildlife biologists must meet the expectations and organizational needs of their agencies. Organizational analysis, like task analysis, is a critical component of the overall needs assessment process of developing and implementing continuing education programs.

Biologists involved in continuing education will apply newly acquired knowledge, skills and abilities within an environment called an organization (Goldstein 1986). Schein's (1980) defines an organization as "the planned coordination of the activities of a number of people for the achievement of some common, explicit purpose or goal, through division of labor and function, and through a

hierarchy of authority and responsibility."

Understanding the organization and the organizational culture relative to professional development is important to providers of continuing education. There are many elements of an organization that may affect training programs and outcomes. The success or failure of implementing continuing education programs is closely tied to the existing organizational climate for such activities.

The specific objectives of this organizational analysis were to provide a "snapshot" of the state agencies' organizational climate for continuing education by identifying organizational components that affect continuing education programs, quantifying resources available for professional development activities, and identifying constraints present in the organizational environment.

Methodology

The organizational analysis survey was developed with components taken from a Leadership Development Questionnaire and a Dominion Bankshares Development Questionnaire developed by Leffel (1992), a Professional Managerial Position Questionnaire (Mitchell and McCormick 1980), and

Strategic Analysis charts published by Burack (1988). Statements were designed or selected to obtain data related to staff development in the state fish and wildlife agencies. The questionnaire was reviewed by faculty members in the Department of Fisheries and Wildlife Sciences and the Department of Management at Virginia Polytechnic Institute and State University and Mr. Bud Bristow, chair of the International Association of Fish and Wildlife Agencies Education Committee.

The three page survey was sent on August 10, 1993, to directors (chiefs) of state fish and wildlife agencies with a cover letter from Mr. Bud Bristow. Thirty eight state agencies responded to the initial mailing. A follow-up letter was sent to the non-respondents on September 9, 1993. A total of 47 state agencies responded. Copies of the survey and cover letters are found in the Appendix B.

Data were analyzed using a SAS program, computing means, ranges and frequencies.

Results

Organizational Climate for Continuing Education

The first section consisting of twenty-eight statements was designed to look at elements of Fish and Wildlife Agencies that may affect professional development. The responses from agency heads provide a "top view" of their organization's continuing education environment. Participants were asked to respond to each statement using a Likert scale of 1 to 5, with **Strongly Disagree** being **number 1**, and **Strongly Agree** being **number 5**. Responses of **number 3** were interpreted to be neutral or non-committal on any one particular item. The mean results are reported in Table A, with statements ranked from the highest (agree) to the lowest (disagree). Responses of 1 and 2 were combined to become a percentage of Disagree. Likewise responses of 4 and 5 were combined to become a percentage of Agree.

Table A. Results of Continuing Education Environment.
n=47 state agencies reporting

Statement	Percent Agree	Percent Disagree	Mean
The goals of this organization are clearly stated.	80.8	8.5	4.19
This organization contracts for training activities.	61.7	17.0	3.59
The benefits of training and staff development to the organization are understood by top management.	59.6	10.7	3.59
The principle that the people of this organization are its greatest resource is widely supported.	57.5	10.6	3.59
Employees are encouraged to attend training courses offered by persons or organizations external to this organization.	55.3	12.8	3.44
The goals and priorities of this organization are understood by its employees.	51.1	17.0	3.40
The stated goals and priorities of this organization guide the allocation of financial resources.	57.4	17.0	3.34
Training and professional development efforts emphasize organizational needs.	38.3	10.7	3.34
Training programs are set up in order to achieve short-term objectives.	40.4	14.9	3.29
Career planning and development are supported in this organization.	42.5	23.4	3.23
Employment in this organization offers the employee training opportunities that promote personal growth.	40.4	27.7	3.23
Time is provided for employees to pursue professional development activities outside the organization.	38.3	27.7	3.23
Training and professional development needs emphasize individual needs.	38.3	17.0	3.21

Training and professional development activities are planned and offered annually to employees.	36.9	23.9	3.21
The development of the organization's training program occurs at the supervisory level or higher.	41.3	21.7	3.19
This organization is open to change.	40.5	21.3	3.19
In the budget development process, monies are targeted annually for professional development.	40.4	38.3	3.04
Professional employee training activities are developed with input from various levels of the organization.	33.4	27.7	3.0
Guiding the professional development of staff is considered a priority of top management.	25.5	27.7	2.91
Training is being used to overcome organizational problems or conflicts.	26.1	32.6	2.89
Creativity and risk-taking are encouraged at all levels.	21.2	36.2	2.82
This organization employs a training/staff development specialist.	36.2	48.9	2.80
Employees participating in training and development opportunities are rewarded during their performance appraisal.	19.1	44.6	2.65
Opportunities to attend training courses are used as rewards in this organization.	21.3	44.7	2.61
Training and professional development plans are included in long-range strategic plans for the organization.	21.3	53.2	2.53
Supervisors are evaluated for carrying out effective staff training and development programs.	14.9	49.0	2.44
Professional employee training needs are routinely assessed.	10.7	53.1	2.44
Professional employees in this organization are required to develop annual training plans.	8.5	74.4	2.0

The frequency of strongly agree responses to the 28 statements in the survey was extremely low, only 5.8 per item, hence the low mean values. The only statement that rated a mean response of 4.0 or higher dealt with clearly stated organizational goals, 80.8% of the states responding in agreement. The next three statements had mean responses of 3.59. These included contracting for training activities (61.7%), top management understanding benefits of staff development (59.6%), and support of the principle that the organization's people are its greatest resource (57.5%). The statement related to encouraging employees to participate in training offered by external persons or organizations had the next highest mean response (3.44, (55.3% agree).

Two other statements related to organizational goals received mild agreement: one dealt with employees understanding goals of the organization (mean 3.4, 51.5% agreeing), and goals driving financial allocations (mean 3.34, 57.4% agreeing). The remaining 21 statements, with one exception, had 42% or less agreeing with them (range 42.5% to 8.4%).

Ten statements had mean values below 3.0, a neutral or

non-committal response. The percent agreeing with these statements ranged from 36.2% to 8.4%, with a mean percent agreement of 20.5%. The three lowest responses dealt with supervisor's being evaluated for carrying out professional development programs (mean 2.44, 14.9% agreeing); routine assessment of employees' training needs (mean 2.44, 10.7% agreeing); and employees developing annual training plans (mean 2.0, 8.4% agreeing).

Constraints to Professional Development

This component of the organizational analysis listed five possible constraints to professional development activities. Space was provided for the listing of other identified constraints. A five point Likert scale was used, with the **number 1** being a **Not Important or Low Constraint**, and the **number 5** being a **Very Important or High Constraint.** Table B. summarizes the responses. Responses of 1 and 2 (not important/low constraint) were combined and reported as percent Low Constraint. Likewise responses of 4 and 5 (important/high constraint) were combined and reported as percent High Constraint. Statements were ranked according to the means.

Table B. Constraints to Professional Development.

n=47 state agencies reporting

Constraints	Low Percent	High Percent	Mean
Budget dollars to provide activities and professional development support.	17.0	66.0	3.82
Travel constraints.	17.0	59.5	3.63
Time taken away from job to participate in training and staff development.	19.1	53.2	3.44
Lack of a training specialist.	47.8	30.4	2.78
Personnel resistance to participate in training and professional development activities.	48.9	22.3	2.55

The highest constraint to professional development activities, as reported by 66% of the states, was lack of budget to implement programs. Travel constraints were rated high by 59.5% of the states, followed by time away from the job to participate in professional development, as reported by 53.2% of the states. Lack of a training specialist was seen as a high constraint by only 30.4%. Personnel resistance to participating in professional development activities was reported as a high constraint by only 22.3% of the states.

Other Constraints listed by those responding to the survey included:

1. Lack of a training vision.
2. Lack of understanding the need for new skills.
3. Attitude about training.
4. Lack of interaction with the professional community outside of agency.
5. Inability to effectively evaluate the value of professional development.
6. The training that is needed most, people skills, is not valued.
7. Top level management attitude that does not support planning for training needs.
8. Desire of supervisors and top managers to allow employees to apply what they learn to changing their work or approach to work.
9. Inaccurate training priorities set by upper level management.
10. Lack of additional training staff.
11. Lack of formal training policy to ensure broad, equitable participation.
12. Language barrier.
13. Employees determine what is adequate professional development time.

Resources Available for Professional Development

Questions were asked in order to provide an overview of budget commitment to professional development. In looking at a percent breakdown of the total budget, 40 state agencies reported Salary and Benefit dollars accounted for 62.07% (mean) of the budget, with a range of 30% to 85%. Other program dollars accounted for 38.18% (mean), with a range of 15% to 70%.

In terms of budget dollars identified for staff development, other than law enforcement training, 60% of the 46 state agencies reported dollars set aside for professional development, 40% reported none specifically designated for such activities. Of those agencies with identified staff development dollars in their budgets, expenditures per employee per annum ranged from $7.00 to $2,000, with a mean of $280.00. Those agencies that did not specifically identify professional development dollars in their budget estimated that they spent an average of $187.66 per employee per annum, with a range of $0.00 to $1,000.

Forty-two state agencies estimated that the average number of days personnel are involved in training or professional development activities range from none to 10 days, with the average being 3.3 days per year per individual. Forty-four agencies estimated that 30.9% of the training activities deal with people/managerial skills (range 0% to 90%), and 58.6% (range 0% to 100%) on technical skills.

Discussion

At the onset, it should be recognized that a tremendous amount of the teaching and learning that takes place in organizations is informal or self-directed. These interactions are numerous, do not show up in planning documents or in budgets, and are very difficult to quantify. The intent of this organizational analysis was to look at the "formal" or structured training and staff development commitment of state fish and wildlife Agencies. Although the survey was mailed to the Directors of the above mentioned agencies, it is not clear who precisely within the agency responded. The assumption is made that the responses reflect the views of top management.

Some state agencies are doing a good job of providing the environment and resources necessary for professional staff development. However, the data reported shows that the overall climate and commitment for continuing education for professional fisheries and wildlife biologists in state agencies is generally neutral or in some cases, negative. Overall, there appears to be a lack of strong commitment. With a few exceptions, administrators reported mild agreement, were non-committal, or generally disagreed with

the twenty-eight statements in the questionnaire designed to look at the organizational climate present for training and staff development.

Although 80% of the agencies agreed that the goals of their agency are clearly stated, only 59% agreed that the goals were understood by their employees. People are generally valued in these organizations (57.5%), yet their continuing educational needs are not. While 59.6% of the agencies acknowledge that top management understands the benefits of training and staff development, and 55.3% encourage employees to attend training offered external to their agency, professional development does not figure into strategic planning. Only 21% agreed that professional development was included in long-range strategic plans for their organization. Furthermore, only a third of the agencies agreed that training and professional development activities are planned and offered annually to employees.

Employee training needs are routinely assessed by only 10% of the agencies, and only 8% of the agencies require their professionals to develop annual training plans. This is consistent with the fact that only 19% of the agencies agreed with the statement that employees are rewarded for

participating in training and development opportunities during their performance appraisal. Coincidentally, only 14.9% of the agencies evaluate their supervisors for carrying out effective staff training and professional development programs.

Budget, travel, and time away from the job are reported as important constraints to initiating and having professional development opportunities. More than half the agencies (55.3%) reported that employees are encouraged to attend training offered by persons and organizations external to the agency. Yet, only 38.3% of the agencies agreed that time is provided for employees to pursue professional development activities outside the agency or that monies are targeted annually for professional development (40.4%). It is interesting to note that 22% of the administrators reported that personnel resistance to participation in professional development opportunities was a high constraint in their organization.

Sixty percent of the agencies reported that staff development dollars are identified in their budgets, estimating that they spend an average of $280 per year per employee. States that do not have line item budgets for

these activities estimate that they spend $187.00 per year per employee. Agencies further estimate an average of 3.3 days/year/individual spent on professional development. If the per employee expenditure ($280 and $187) is divided by the estimated days of training (3.3), the amount spent per employee per day of training ranged from $84.85 to $56.67.

These data are in sharp contrast with data reported for the private sector from the "1993 Industry Report...An Overview of Employee Training in America", as reported in the October, 1993 issue of Training. United States business' expenditures in professional development and training increased 7% in 1993. Industries with 100 to 499 employees reported an average training budget of $367,578, with 54% of those dollars spent on professionals. United States business allocates an average of six days per/year per/individual, spending on average $1,000 per employee, almost four times what fish and wildlife Agencies spend per individual. The per day expenditures are twice as high.

McGill et al.(1992), in looking at characteristics of innovative and effective organizations, note that these organizations are open to change, encourage creativity, personal flexibility, and risk-taking. That does not seem to

be the case with the agencies in this study. Some insight into the climate for continuing education in state Fish and Wildlife agencies may be discovered in examining specific survey data dealing with these issues. In response to the survey statement that "this organization is open to change", only 40% of the agencies agreed (4% strong agreement, 36% mild) and 21% of the agencies disagreed (4% strong disagreement, 17% mild). The remaining agencies (39%) were neutral to the statement. Further insight is revealed in the agencies' response to the statement that creativity and risk taking are encouraged at all levels. Only 21% of the agencies agreed with the statement, 36% disagreed, and 43% were neutral. At best, the climate for continuing education seems ambivalent.

A summary profile of the average state Fish and Wildlife Agency reveals that their people are valued, yet their professional development needs are not a high organizational priority and specific programs are lacking. Even though the benefits of training and staff development to the organization are understood by top management, professional development does not figure into strategic planning, financial resource allocation, performance appraisal or supervisor and employee reward systems.

Employees are encouraged to pursue outside professional development opportunities, yet they are not supported by release time and financial resources are not generally provided. Professional development needs are not routinely assessed, and career/professional development plans (annual and long term) for professional biologists are rare in these agencies. A positive climate for professional development does not seem to be the norm.

Kramlinger (1992) talks about an emerging ideal of a learning organization, committed to at least some of the following assumptions: "everyone can be a source of useful ideas, people closest to the problem usually have the best ideas, learning flows up as well as down in an organization, nothing is sacred, open dialogue improves ideas, the more information people can access the better, new ideas are valuable, and a mistake is simply an opportunity to learn." A challenge to state fish and wildlife agencies would be the incorporation of these ideals into their organizational culture, to the benefit of the organization, its employees, clientele, and the natural resources they have been entrusted to manage.

A number of constraints and barriers to professional

development within state fish and wildlife agencies has been identified in this study. Providers of continuing education should realize that these obstructions to professional development must be realistically addressed before a successful continuing education program can be implemented. Indeed, the first challenge for providers is to educate fish and wildlife agencies of the value of life-long learning for its employees. With the growth and establishment of positive climates for professional development in state fish and wildlife agencies, a great barrier to continuing education is removed. The remaining hurdles can be dealt with realistically, resulting in an environment in which providers of continuing education can successfully develop and deliver programming.

Chapter Four

Methodology

Task Analysis

The initial process of identifying job tasks performed by fish and wildlife biologists was initiated by Cross (1986) during a sabbatical leave with the U.S. Forest Service. Additional tasks were identified from the literature, including documents, training surveys, and reports on continuing education needs obtained from the Deitemeyer et al.(1988), Gallagher (1988), Porath et al.(1989), and the Virginia Department of Game and Inland Fisheries (1989).

Focus groups, a variation of the nominal group process, were conducted by Murphy (1991-1992) with biologists attending various short courses on the Virginia Tech campus to further identify tasks. The data collected on task identification were used to develop a task inventory questionnaire. A two page opscan form was custom designed with the assistance of Robert Frary, head of Measurement and Research Services at Virginia Tech for this research.

The questionnaire was pre-tested in July, 1993, with 1,700 U.S. Forest Service biologists. Responses from 800 fishery biologists, wildlife biologist, and botanists were scanned and analyzed to identify common statements and insignificant tasks. Based on cluster analysis of common responses and concern for survey length and the commonality of some tasks, the instrument was further modified to fit state agency fishery and wildlife biologists.

During the process of modifying both the fisheries and wildlife surveys, some areas of technical tasks increased (such as category of propagation and stocking), but overall the number decreased from sixty to fifty-one tasks. Coincidently, the same number of technical tasks was arrived at for both instruments.

The original survey had forty non-technical tasks listed under the sub-headings of External and Internal Relations, Communications, Awareness of the Environment, Leadership, Interpersonal Relations and Management. Factor analysis, Pearson's Correlation Coefficients, and reported frequencies were run on these questions to compare common responses to similar questions. This analysis, along with further review, resulted in twenty tasks being combined or discarded. Reference to categories was eliminated and an

introductory statement was written to precede the final twenty non-technical tasks.

The last input came from twenty-four state fish and wildlife biologists. They were sent the updated task analysis survey for final review and comment during August, 1993. The final questionnaires were modified from 100 tasks to seventy-one tasks.

In summation, two questionnaires were developed, one for fishery biologists and the other for wildlife biologists. Tasks for both surveys were printed on the opscan sheets and divided into two large categories: technical tasks and non-technical tasks that relate to communication, interpersonal , management and leadership skills. Fifty-one technical tasks were identified for both the wildlife and fishery biologists survey and grouped according to the following areas: populations, habitat, propagation/stocking (fishery survey), introduction/stocking (wildlife survey), impact assessments, research/data collection and analysis, socio-economic. Twenty non-technical tasks were identified and were common to both questionnaires. Sample fishery and wildlife biologists questionnaires are in the Appendix B.

Study Population

In order not to bias the sample population, it was decided that membership lists from professional societies would not be used in this study. In February of 1993, letters were sent to the directors of state Fish and Wildlife Agencies explaining the research project and asking for personnel rosters and job descriptions of fishery and wildlife biologists. State agencyies provided lists of fishery and wildlife biologists or agency personnel rosters.

Job descriptions were used for clarification if job titles were unclear on personnel lists. Follow-up phone calls to agencies were made to clarify confusing job titles and obtain missing personnel lists. For example, Texas labels all their biologists as Conservation Scientists. Many states were in the process of developing new job descriptions and new job titles. The majority, however, did have the title of fishery, wildlife, hatchery or research biologist.

By September, 1993, a total of 1,812 fishery biologists and 2,070 wildlife biologists were identified from forty-eight states. The only non-respondents were Rhode Island and Hawaii. Oklahoma did not send a list of wildlife

biologists, and South Dakota did not provide a fisheries biologists roster. A map of the study population is in Appendix A.

A database was developed using the XMAILER program on the Virginia Tech mainframe computer. This allowed for the generation of mailing labels, personalized letters and the tracking of respondents. Using a formula developed by Yamane (1967) to determine sample size for surveying a population at a confidence level of 95%, 335 wildlife biologists and 327 fishery biologists would have to be randomly sampled for a precision rate of plus/minus 5%. To maximize the response rate and confidence level with this large population, a systematic sampling technique (Smith 1983) was used instead of a table of random numbers. The sampling interval was 2, with every other name being selected as rosters were received. There was no detectable periodicity on personnel lists. The final sample included 906 fishery biologists and 1,035 wildlife biologists.

The cover letter for the questionnaire followed a format suggested by Dillman (1978) for mail surveys. The first mailings of the questionnaire were sent October 8, 1993. A follow-up mailing to non-respondents was sent November 5, 1993. For the fishery biologist, 696 useable

questionnaires were received, for a return rate of 77%. The return rate for wildlife biologists was also 77%, with 801 wildlife biologists responding. Because of the high rate of return from the initial and follow-up mailings, no further efforts were made to contact non-respondents.

Administrator's Survey

Sets of five questionnaires, composed of the twenty non-technical tasks related to communication, interpersonal relations, management and leadership skills, were sent to directors of state fish and wildlife agencies. The tasks listed were identical to those on the questionnaires sent to fishery and wildlife biologists. Directors were asked to distribute the questionnaires to administrators in their agency.

Administrators were asked to rate the proficiency levels of tasks and the need for continuing education based on what they perceive as meeting the needs of fishery and wildlife biologists. Of the 250 questionnaires sent, 185 useable forms were returned, for a response rate of 74%. Questionnaires were not received from four states at the time of analysis.

Data Analysis

Questionnaires were scanned at Measurements and Research Services at Virginia Polytechnic Institute and State University. SAS programs were used to compute frequencies, percents, and means. Correlations and Chi-Squares were calculated on demographic variables and the proficiency levels and continuing education needs for each task.

Chapter 5

Results

In this chapter I will report the results obtained from the task questionnaires sent to state agency fishery and wildlife biologists. Data reported will include demographic information on fishery and wildlife biologists and their rating of the tasks and identified needs for continuing education. The results of the administrator's survey of their rating continuing educational needs of non-technical tasks are also reported in this chapter.

Fishery Biologist Demographics

The demographic data collected included position title, total years in the profession, highest level of education, undergraduate major, graduate major, and region of employment (based on U.S. Fish and Wildlife Service's seven regions). The demographic data are summarized in Table I.

Table I. POPULATION DEMOGRAPHICS - FISHERY BIOLOGIST

POSITION TITLE
n=689

Job Title	Frequency	Percent
Fishery-Specific Area	70	10.2
Fishery-Large Area	269	39.0
Research Biologist	88	12.8
Supervisory Biologist	107	15.5
Hatchery Biologist	84	12.2
Game Biologist	7	1.0
Non-Game Biologist	8	1.2
Environmental Specialist	23	3.3
Education Specialist	5	0.7
Other	28	4.1

TOTAL YEARS OF PROFESSIONAL EMPLOYMENT
n=688

Years in Profession	Frequency	Percent
Less Than 5 Years	81	11.8
5-9 Years	125	18.2
10-14 Years	137	19.9
15-19 Years	137	19.9
20+ Years	208	30.2

HIGHEST LEVEL OF EDUCATION
n=681

Education	Frequency	Percent
Associate Degree	15	2.2
Bachelors	318	46.7
Masters	333	48.9
Doctorate	15	2.2

UNDERGRADUATE MAJOR
n=677

Undergraduate	Frequency	Percent
Fish/Aquatic Science	307	45.3
Wildlife	69	10.2
Biology/Zoology	237	35.0
Water Resource Management	5	0.7
Ecology	2	0.3
Environmental Science	21	3.1
Forestry	6	0.9
Other	30	4.4

GRADUATE MAJOR
n=428

Graduate	Frequency	Percent
Fish/Aquatic Science	296	69.2
Wildlife	9	2.1
Biology/Zoology	76	17.8
Water Resource Management	4	0.9
Ecology	10	2.3
Environmental Science	6	1.4
Forestry	1	0.2
Other	26	6.1

REGION EMPLOYED
n=681

Area Employed	Frequency	Percent
1. Pacific/NW	122	17.9
2. Southwest	47	6.9
3. Upper Midwest	181	26.6
4. South	112	16.4
5. New England/Atlantic	92	13.5
6. Plains/Mountains	89	13.1
7. Alaska	38	5.6

1. HI, CA, NV, ID OR, WA
2. AZ, NM, TX, OK
3. MN, IA, MO, WI, IL, IN, OH, MI
4. AR, LA, MS, AL, GA, FL, TN, KY, NC, SC, PR
5. VA, WV, DE, PA, NJ, CT, RI, MA, NY, NH, VT, ME
6. ND, SD, NE, KS, CO, UT, WY, MT
7. AK

The term "fishery biologist" may have been clearly understood twenty years ago, but today, many other titles are used by various state agencies. As mentioned earlier, all fish and wildlife biologists in Texas are called Conservation Scientists. A special effort was made to distinguish between those that had wildlife responsibilities and those that had fisheries responsibilities. In this study, an attempt was made to further refine fishery biologists' job titles to more accurately reflect their positions' responsibilities and to see if correlations could be made in analyzing continuing education needs.

Almost half (49.2%) of the study group identified themselves as fishery biologists managing the fishery resource in a specific area such as a designated management area (lake, watershed), or a larger, multi-county area. Supervisory biologists comprised 15.5% of the population, research fishery biologists 12.8%, and hatchery biologists 12.2%. Other biologists' titles included game biologist (1%), non-game biologist (1.2%), environmental specialists (3.3%), education specialist (0.7%). The "Other" category accounted for 4.1% of the population.

The biologists with less than five years professional experience accounted for 11.8% of the study group. The

percent professionals in the mid-range years of five to nine, ten to fourteen, and fifteen to nineteen, were almost identical (18.2%, 19.9%, 19.9% respectively) and accounted for a total of 58% of the population. Biologists with twenty plus years of professional employment comprised 30.2% of the respondents.

Fishery biologists were almost equally split in terms of undergraduate versus graduate education level: 46.7% had Bachelor degrees, 48.9% had Master degrees, 2.2% had Associate degrees and 2.2% had Doctorate degrees. The most common undergraduate major was Fisheries/Aquatic Science (45.3%), followed by Biology/Zoology (35%), and Wildlife (10.2%). All other listed majors accounted for 9.4% of the responses. In terms of graduate majors, almost 70% were in Fisheries/Aquatic Sciences, and 17.8% in Biology/Zoology. Graduate degrees in Ecology (2.3%) and Wildlife (2.1%) were the next highest identified specialization. All other majors accounted for 8.6% of the responses. A disparity existed in the number identifying graduate majors and the number listing advanced degrees. This may be due to the fact that an advanced degree is presently being pursued, or the biologist never completed the program, but declared a graduate major on the questionnaire.

The Upper Midwest accounted for 26.6% of the study population, the Pacific North West 17.9%, the South 16.4%, New England 13.5%, the High Plains/Mountains 13.1%, the Southwest 6.9%, and Alaska 5.6%. The state codes for each area were reported in Table I.

Continuing Education Needs - Fishery Biologists

Biologists were asked to rate the proficiency levels required for each of the tasks listed AND their need for continuing education. The choices were High(1), Medium High(2), Medium Low(3), Low(4) or NA (not applicable). Data on how biologists rated the proficiency levels related to job tasks are reported in the Appendix A.

The results of the continuing education needs associated with various tasks are reported task subcategories: Populations (Table II), Habitat (Table III), Propagation/Stocking (Table IV), Impact Assessments (Table V), Research/Data Collection/Analysis (Table VI), Socio-Economic (Table VII), and Non-technical tasks (Table VIII). The cumulative percent of High and Medium High responses is presented in these tables, along with the mean response, ranked from highest to lowest.

Table II. NEED FOR CONTINUING EDUCATION RELATED TO POPULATION TASKS (FISHERIES)

Task	Cumulative Percent	Mean
Determine factors limiting aquatic populations.	63.6	2.11
Collect and analyze population characteristics, i.e. age and growth, sex, survival & mortality.	56.2	2.29
Design and conduct surveys to identify aquatic species and estimate aquatic populations.	56.0	2.31
Monitor and/or recommend harvest regulations.	30.4	2.36
Establish genotypes of fish/determine genetic variability.	33.7	2.64
Assemble life history data and habitat requirements of aquatic species.	39.0	2.69
Conduct surveys to determine the distribution and movement of aquatic species.	36.8	2.73
Plan, coordinate and implement renovation projects (fish eradication, repopulation, etc.).	30.4	2.81
Monitor macro-invertebrate and other populations.	25.9	2.99
Measure physiological indices of fish species.	24.4	2.99
Determine food habits of aquatic species.	19.5	3.11
Manage animal damage.	6.7	3.46

Table III. NEED FOR CONTINUING EDUCATION RELATED TO HABITAT TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Restore, enhance or protect habitats to meet management objectives.	57.9	2.14
Determine and evaluate habitat's present and potential capabilities.	59.5	2.15
Develop strategies to mitigate habitat loss.	52.0	2.26
Measure and evaluate habitat changes associated with land management activities.	47.7	2.30
Plan and manage aquatic habitats to maintain viable populations (T&E recovery plans).	45.7	2.37
Use habitat models to determine carrying capacity and to develop conservation strategies.	44.4	2.42
Monitor projects, such as habitat improvements, for prescribed implementation and desired change.	39.6	2.56
Monitor environmental contaminants.	33.1	2.72
Measure and assess stream flows.	30.4	2.83
Control aquatic vegetation.	29.1	2.83
Inventory and/or map lotic aquatic habitats.	28.7	2.85
Inventory and/or map lentic aquatic habitats.	25.5	2.93
Collect and evaluate historical habitat data.	22.7	3.01
Inventory and/or map landscapes at ecosystem level.	20.4	3.01

Table IV. NEED FOR CONTINUING EDUCATION RELATED TO PROPAGATION AND STOCKING TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Evaluate genetic impacts of stocking.	49.4	2.20
Recommend/evaluate stocking performance and strategies.	44.8	2.45
Evaluate history/monitor impacts of exotic species stocking.	40.8	2.56
Recognize and treat infections and diseases.	32.1	2.58
Develop fish health management practices/policies.	27.0	2.70
Propagate and care for fish in hatchery situation (spawning, incubation, egg care, etc.)	21.6	2.94
Collect and handle fish for propagation or stocking.	21.1	3.08
Develop stocking schedules and fish transportation.	17.1	3.10

Table V. NEED FOR CONTINUING EDUCATION RELATED TO IMPACT ASSESSMENTS TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Use models to predict responses of populations to management alternatives.	59.9	2.17
Determine the cumulative effects of impacts upon habitats and/or population.	57.4	2.17
Conduct and/or evaluate environmental analysis or biological assessment.	48.7	2.41
Use models to predict outcomes of habitat modifications.	41.0	2.48
Review permit applications that may impact the aquatic resource.	36.9	2.57
Investigate fish kills.	35.8	2.67

Table VI. NEED FOR CONTINUING EDUCATION RELATED TO RESEARCH, DATA COLLECTION AND ANALYSIS TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Use computers and variety of software.	81.6	1.69
Collect, analyze and present/display field data.	70.4	1.98
Design scientific experiments/management studies.	63.8	2.08
Develop and maintain informational and other databases.	60.5	2.22
Develop and construct models.	45.6	2.43
Review or critique scientific experiments/studies.	44.3	2.52

Table VII. NEED FOR CONTINUING EDUCATION RELATED TO SOCIO-ECONOMIC TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Measure/assess public opinion, needs, satisfaction levels and knowledge.	53.1	2.33
Evaluate use of aquatic resources, i.e. angler days.	44.0	2.48
Measure/assess values associated with aquatic resources.	43.9	2.51
Determine the cost/benefit ratio for management alternatives.	37.8	2.59
Plan and/or manage public access to lakes and streams.	21.4	2.98

Table VIII. NEED FOR CONTINUING EDUCATION RELATED TO NON-TECHNICAL TASKS (FISHERIES)

Tasks	Cumulative Percent	Mean
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating).	57.4	2.29
Apply problem solving techniques.	57.3	2.35
Recruit, interview, supervise, mentor and evaluate personnel.	51.5	2.42
Prepare administrative and technical reports, routine correspondence.	51.9	2.44
Conduct briefings or make presentations at various types of meetings.	51.2	2.44
Resolve conflict at various levels.	51.4	2.45
Manage multiple priorities and assess progress.	48.6	2.45
Access current literature to maintain technical proficiency.	49.9	2.46
Network with other professionals and agencies.	49.8	2.48
Work with mass media (i.e., newspapers, radio, tv.)	47.4	2.55
Package and promote ideas and programs.	44.8	2.56
Liaison and coordinate activities with other agencies and various levels of government.	40.8	2.66
Prepare and justify budget(s) - projecting financial and staffing needs.	37.4	2.68
Plan/conduct various types of educational programs.	37.8	2.70
Author popular articles for newspaper and magazines.	33.4	2.83

Tasks	Cumulative Percent	Mean
Task (cont)	**Cumulative Percent**	Mean
Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws).	29.2	2.90
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace).	42.8	2.99
Prepare and/or administer contracts.	17.5	3.13
Manage inventories of supplies and equipment.	14.9	3.31
Manage and maintain building(s) and other facilities.	9.4	3.40

A mean value ranging from 1 to 2.49 would indicate a High to Medium High need for continuing education. Mean values ranging from >2.5 to 4.0 would indicate Medium Low to Low need for continuing education, with a mean value of 2.5 indicating a neutral response.

In looking at the data reported for continuing education, twenty-three of the fifty-one technical tasks had mean values between 1.69 and 2.48, indicating a High to Medium high need. Four of those identified were population tasks, six dealt with habitat, two were propagation and stocking tasks, four impact assessment tasks, five were concerned with research and data collection/analysis, and

two were socio-economic tasks. Almost half (48%) of those tasks were in the habitat and research/data collection and analysis categories.

In examining the mean values for the tasks with the highest demand for continuing education, four of top ten tasks identified were in the **Research/Data Collection and Analysis category.** Those tasks and mean values were: use of computers and a variety of software (1.69); collect, analyze and present/display field value (1.98); design scientific experiments/management studies (2.08); and develop and maintain informational and other databases (2.22). A total of five of the six tasks in the research/data collection category were identified as having a High to Medium High need for continuing education.

The remaining six of the top ten tasks, their categories and mean values were: **Population -** determine factors limiting aquatic populations (2.11); **Habitat -** restore, enhance or protect habitats to meet management objectives (2.14); determine and evaluate habitat's present and potential capabilities (2.15); **Propagation/Stocking -** evaluate genetic impacts of stocking (2.20); **Impact**

Assessments - use models to predict responses of populations to management alternatives (2.17); and determine cumulative effects of impacts upon habitats and/or populations (2.17).

In reporting the continuing education needs related to the twenty non-technical tasks, nine tasks (45%) had mean values ranging from 2.29 to 2.48, on the low side of a Medium High demand for professional development in those areas. The top two tasks and reported means were: "develop and administer plans of work, including setting goals and objectives, developing strategies, implementing and evaluating" (2.29); and "apply problem solving techniques" (2.35). The remaining seven tasks had an average mean value of 2.45. The other eleven tasks identified had mean values ranging from 2.55 to 3.4.

A more meaningful way to determine continuing educational needs of professional fisheries biologists is to identify tasks requiring a high proficiency level AND having a high need for continuing education. In this analysis, new variables are created for each task by cross-tabulating the data. High and Low responses to proficiency levels needed for the task are matched with High and Low responses to

continuing education needs. As with earlier analysis, the High and Low data reported are cumulative responses, that is, High equals High + Medium High, Low equals Low + Medium Low.

This analysis generates a matrix of cells for each task, depicting HI and LOW need for proficiency levels down the side, and HI and LOW need for continuing education across the top, is represented in the following diagram.

	HIGH	**LOW**
HIGH	HIHI	HILO
LOW	LOHI	LOLO

The critical cell is the **HI HI** cell, indicating that high levels of proficiency are needed for the listed task, and a high need for continuing education to develop the skills necessary to perform that particular task. If 40% or more of the sample population for any one task reported a HI HI, that task is listed in Table IX.

Table IX. FISHERIES TASKS REQUIRING A HIGH PROFICIENCY LEVEL AND HAVING A HIGH NEED FOR CONTINUING EDUCATION.

Population	Cumulative Percent
Determine factors limiting aquatic populations.	65.3
Design and conduct surveys to identify aquatic species and estimate aquatic populations.	63.5
Collect and analyze population characteristics, i.e. age and growth, sex, survival and mortality.	61.1
Monitor and/or recommend harvest regulations.	57.9
Conduct surveys to determine the distribution and movement of aquatic species.	40.9
Habitat	
Restore, enhance or protect habitats to meet management objectives.	59.3
Determine and evaluate habitat's present and potential capabilities.	57.1
Develop strategies to mitigate habitat loss.	49.2
Plan and manage aquatic habitats to maintain viable populations (T&E recovery plans).	48.1
Measure and evaluate habitat changes associated with land management activities.	43.2
Propagation/Stocking	
Recommend/evaluate stocking performance and strategies.	47.3
Evaluate history/monitor impacts of exotic species stocking.	40.1

Impact Assessments	Cumulative Percent
Determine the cumulative effects of impacts upon habitats and/or population.	53.6
Use models to predict responses of populations to management alternatives.	47.2
Conduct and/or evaluate environmental analysis or biological assessment.	46.1
Research/Data Collection/Analysis	
Use computers and variety of software.	75.0
Collect, analyze and present/display field data.	67.7
Design scientific experiments/management studies.	63.3
Develop and maintain informational and other databases.	54.7
Review or critique scientific experiments/studies.	40.0
Socio-Economic	
Evaluate use of aquatic resources, i.e. angler days.	46.8
Measure/assess public opinion, needs, satisfaction levels and knowledge.	44.6
Non-Technical	
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.	54.5
Prepare administrative and technical reports, routine correspondence.	50.4
Apply problem solving techniques.	47.6
Manage multiple priorities and assess progress.	47.5

Non-Technical (cont).	
Recruit, interview, supervise, mentor and evaluate personnel.	45.6
Conduct briefings or make presentations at various types of meetings.	44.6
Network with other professionals and agencies.	44.4
Access current literature to maintain technical proficiency.	41.9
Resolve conflict at various levels.	40.5

Tasks identified as requiring high proficiency levels and having a high need for continuing education have the most critical need for continuing education. In looking at frequencies reported by 40% or more of the population, twenty-two technical tasks were identified. Three tasks, included in **Table II - Table VII**, were not identified in **Table IX** using this type of analysis. However, four other new tasks were identified. In part, this is due to reporting cross-tabulated values greater than 40%. Another contributing factor is that biologists could have identified a task that did not require a high proficiency level in their job, BUT they had a high interest in obtaining professional development in that area. A high mean value could be reported for that task, but it would not show up as a HI HI task when cross-tabulated.

The three tasks dropped were: Habitat - Use habitat models to determine carrying capacity and to develop conservation strategies, Propagation/Stocking - Evaluate genetic impacts of stocking, and Research/Data Collection - Develop and construct models.

The four new tasks added were: Population - Conduct surveys to determine the distribution and movement of aquatic species, Propagation/Stocking - Evaluate history and monitor impacts of exotic species stocking, Impact Assessments - Conduct and/or evaluate environmental analysis or biological assessment, Research/Data Collection - Review or critique scientific experiments/studies.

Of the top ten technical tasks requiring a high proficiency level and having a high need for continuing education, four were in category Population, four in the category Research/Data Collection, and two in Habitat category. They are summarized in Table X.

The same nine non-technical tasks were reported using the cross-tab analysis, with the percent frequency of responses ranging from 40.5% to 54.5% (average 46%) of the study population identifying continuing education needed in those areas. However, as reported earlier in Table VIII,

using cumulative percents and mean values, the need for continuing education related to non-technical tasks received a limited endorsement by approximately one-half the sample population. Clearly, in looking at tasks related to communication, interpersonal relations, management and leadership skills, fishery biologists did not strongly identify a need for professional development in these areas.

Table X. TOP TEN...FISHERIES TECHNICAL TASKS IDENTIFIED REQUIRING HIGH PROFICIENCY LEVELS AND HIGH NEED FOR CONTINUING EDUCATION.

Task	Cumulative Percent
Use Computers and variety of software.	75.0
Collect, analyze and present/display field data.	67.7
Determine factors limiting aquatic populations.	65.3
Design and conduct surveys to identify aquatic species and estimate aquatic populations.	63.5
Design scientific experiments/management studies.	63.3
Collect and analyze population characteristics, i.e., age and growth, sex, survival and mortality.	61.1
Restore, enhance or protect habitats to meet management objectives.	59.3
Monitor and/or recommend harvest regulations.	57.9
Determine and evaluate habitat's present and potential capabilities.	57.1
Develop and maintain informational and other databases.	54.7

Twenty-five of the technical tasks were identified by at least 10% the respondents as having low proficiency level requirements in their jobs, but a high need for continuing education. The data are reported in Table XI. Three of those tasks were in the category Population, eleven in Habitat, three in Propagation and Stocking, four in Impact Assessment, one in Research, Data Collection and Analysis and three in Socio-Economic.

Of the above twenty-five technical tasks, six were reported by over 20% of the respondents. They were: "use models to predict outcomes of habitat modifications" (25.8%); "use models to predict responses of populations to management alternatives" (25.6%); "evaluate genetic impacts of stocking" (23.1%); "develop and construct models" (22.6%); "use habitat models to determine carrying capacity and to develop conservation strategies" (22.3%); and "establish genotypes of fish and determine genetic variability" (21.4%). As noted, four of the tasks dealt with models and two with genetics.

Table XI. FISHERIES TECHNICAL TASKS REQUIRING A LOW PROFICIENCY LEVEL AND HAVING A HIGH NEED FOR CONTINUING EDUCATION.

Population	Cumulative Percent
Establish genotypes of fish/determine genetic variability.	21.4
Monitor macro-invertebrate and other populations.	14.6
Measure physiological indices of fish species.	10.0
Habitat	
Use habitat models to determine carrying capacity and to develop conservation strategies.	22.3
Measure and evaluate habitat changes associated with land management activities.	15.28
Monitor environmental contaminants.	14.5
Develop strategies to mitigate habitat loss.	13.6
Control aquatic vegetation.	12.9
Inventory and/or map landscapes at ecosystem level.	12.3
Inventory and/or map lotic aquatic habitats.	11.2
Measure and assess stream flows.	10.9
Plan and manage aquatic habitats to maintain viable populations (T&E recovery plans).	10.7
Determine and evaluate habitat's present and potential capabilities.	10.2
Inventory and/or map lentic aquatic habitats.	10.1

Propagation and Stocking	
Evaluate genetic impacts of stocking.	23.1
Recognize and treat infections and diseases.	14.8
Evaluate history/monitor impacts of exotic species stocking.	11
Impact Assessments	**Cumulative Percent**
Use models to predict outcomes of habitat modifications.	25.8
Use models to predict responses of populations to management alternatives.	25.6
Determine the cumulative effects of impacts upon habitats and/or population.	14.5
Conduct and/or evaluate environmental analysis or biological assessment.	10.3
Research, Data Collection and Analysis	
Develop and construct models.	22.6
Socio-Economic	
Measure/assess values associated with aquatic resources.	18
Determine the cost/benefit ratio for management alternatives.	15.9
Measure/assess public opinion, needs, satisfaction levels and knowledge.	14.1

There were no significant correlations between continuing education needs identified by fishery biologists for each task and their years of professional employment (Rho < 0.095), undergraduate major (Rho < 0.119), graduate major (Rho <-0.192), highest education level attained (Rho < 0.176). and region employed (Rho < 0.185).

An analysis of continuing education needs for technical tasks by job position was conducted using the cross-tabulation analysis described earlier. In order to gain adequate sample size, fishery biologists, specific area and multi-county area were combined. Research biologists, supervisory biologists, and hatchery biologists were the other position categories. The other positions could not be analyzed because of low sample numbers. This analysis produced a 16 cell matrix for each task, with HIHI, HILO, LOHI and LOLO columns, and job positions listed above as the row headers. Frequencies, Percents, and Cell Chi-Squares were calculated.

Missing data because of non-response to a particular question or answering non-applicable to the task statement, as well as the number of cells, affected the analysis and invalidated some Chi-Square values for each cell. However, useful information related to job positions was apparent in

the HIHI column and the reported frequencies and percentages for each task compared to job position.

With the exception of one task, there were not meaningful differences between fishery biologists and supervisory biologists needs related to continuing education. Supervisory biologists identified a higher need for continuing education for the task of "measuring/assess values associated with aquatic resources."

Three tasks identified by research biologists showed higher cell percentages when compared to the other biologists. They were: measure and evaluate habitat changes associated with land management activities, use models to predict responses of populations to management alternatives, and develop and construct models.

Hatchery biologists had five tasks with higher cell percentages reported in the HIHI column, all in the subcategory Propagation and Stocking. Those tasks were: collect and handle fish for propagation and stocking, propagate and care for fish in hatchery situation, develop fish management practices/policies, recognize and treat infections and disease, and develop stocking schedules and fish transportation.

RESULTS

Wildlife Biologists Demographics

The same demographic information used for fishery biologists was obtained from the wildlife biologists: position title, total years in the profession, highest level of education, undergraduate major, graduate major, and region of employment. As with the fishery biologists, the title "wildlife biologist" was further defined. The various titles were identified utilizing the job descriptions obtained from state agencies. The wildlife biologist demographic data are summarized in Table XII.

Over half (53.6%) of the study population identified themselves as biologists managing the wildlife resource in a specific management area or a multi-county/regional area. Supervisory biologists comprised 13.2% of the population. Game species biologists (bear, upland game, waterfowl, etc.) accounted for 10.2% of the study group, Non-game biologists 7.1% , Research biologists 7%, Environmental specialists 2.9%, and Education specialists 1.1% . The "other" category of biologists were 4.8% of the sample population.

Table XII. POPULATION DEMOGRAPHICS - WILDLIFE BIOLOGIST

POSITION TITLE

n=787

Job Title	Frequency	Percent
Wildlife - Specific	108	13.7
Wildlife - Large Area	314	39.9
Research Biologist	55	7.0
Supervisory Biologist	104	13.2
Game Biologist	80	10.2
Non-Game Biologist	56	7.1
Education Specialist	9	1.1
Environmental Specialist	23	2.9
Other	38	4.8

TOTAL YEARS OF PROFESSIONAL EMPLOYMENT
n=793

Years in Profession	Frequency	Percent
Less Than 5 Years	72	9.1
5 - 9 Years	135	17.0
10 - 14 Years	183	23.1
15 - 19 Years	172	21.7
20+ Years	231	29.1

HIGHEST LEVEL OF EDUCATION
n=792

Education	Frequency	Percent
Associate Degree	8	1.0
Bachelors	390	49.2
Masters	361	45.6
Doctorate	33	4.2

UNDERGRADUATE MAJOR
n=784

Undergraduate	Frequency	Percent
Fish/Aquatic Science	25	3.2
Wildlife	507	64.7
Biology/Zoology	163	20.8
Water Resource Management	1	0.1
Ecology	6	0.8
Environmental Science	10	1.3
Forestry	28	3.6
Range Management	10	1.3
Other	34	4.3

GRADUATE MAJOR
n=503

Graduate	Frequency	Percent
Fish/Aquatic Science	16	3.2
Wildlife	335	66.6
Biology/Zoology	68	13.5
Water Resource Management	4	0.8
Ecology	20	4.0
Environmental Science	9	1.8
Forestry	5	1.0
Range Management	13	2.6
Other	33	6.6

REGION EMPLOYED
n=772

Area Employed	Frequency	Percent
1. Pacific/NW	90	11.7
2. Southwest	97	12.6
3. Upper Midwest	200	25.9
4. South	142	18.4
5. New England/Atlantic	100	13.0
6. Plains/Mountains	106	13.7
7. Alaska	37	4.8

1. HI, CA, NV, ID OR, WA
2. AZ, NM, TX, OK
3. MN, IA, MO, WI, IL, IN, OH, MI
4. AR, LA, MS, AL, GA, FL, TN, KY, NC, SC, PR
5. VA, WV, DE, PA, NJ, CT, RI, MA, NY, NH, VT, ME
6. ND, SD, NE, KS, CO, UT, WY, MT
7. AK

Wildlife biologists with less than five years professional experience constituted 9.1% of the study population. The biologists in the mid-range years of professional employment were 61.8% of the sample. Years of employment and percentages were: five to nine years (17%); ten to fourteen years (23.1%); and fifteen to nineteen years (21.7%). The twenty plus year category was 29.1% of the sample.

Wildlife biologists in state agencies were almost equally split in terms of undergraduate versus graduate education level: 49.2% had Bachelors degrees and 45.6% had Master's degrees. Associate degrees were held by 1% and 4.2% had Doctorate degrees. The most common undergraduate degree was in Wildlife (64.7%), followed by a degree in Biology/Zoology (20.8%), Forestry (3.6%) and Fisheries/Aquatic Science (3.2%). All other undergraduate majors listed accounted for 7.7% of the responses.

Of the biologists with graduate degrees, 66.6% were in Wildlife, 13.5% in Biology/Zoology, 4% in Ecology and 3.2% in Fisheries/Aquatic Science. Other graduate majors listed represented 12.7% of the sample. As mentioned with fishery biologists, the number discrepancy between graduate major and those biologists with advanced degrees could be

attributed to biologists responding who are presently in a graduate program, or had dropped out of a program, but declared a major on the questionnaire.

The upper Midwest accounted for 25.9% of the study population, the South 18.4%, the Plains/Mountains 13.7%, New England/Atlantic 13%, the Southwest 12.6%, the Pacific/NW 11.7%, and Alaska 4.8%.

Continuing Education Needs of Wildlife Biologists

Biologists were asked to rate the proficiency levels required for each of the tasks listed AND their need for continuing education. The choices were High(1), Medium High(2), Medium Low(3), Low(4) and Not Applicable (NA). Data on how biologists rated proficiency levels related to the job tasks are reported in the Appendix A.

The need for continuing education and associated tasks are reported by subcategories: Populations (Table XIII), Habitat (Table XIV), Introduction/Stocking (Table XV), Impact Assessments (Table XVI), Research/Data Collection/Analysis (Table XVII), Socio-Economic (Table XVIII), and Non-technical tasks (Table XIX). The cumulative percent of Hi and Medium Hi responses is presented in these tables, along with the mean response, ranked from highest to lowest. A mean value ranging from 1 to 2.49 would indicate a HI to Medium HI need for continuing education. Mean values ranging from >2.5 to 4.0 would indicate Medium Low to Low need for continuing education, with a mean value of 2.5 indicating a neutral response.

Table XIII. NEED FOR CONTINUING EDUCATION RELATED TO POPULATION TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Determine factors limiting wildlife populations.	66.2	2.10
Design and/or conduct surveys to identify and estimate wildlife populations and species diversity.	63.3	2.12
Monitor and/or recommend harvest regulations.	48.8	2.38
Monitor long term trends in populations.	52.6	2.40
Collect and analyze population characteristics i.e. age, sex, survival.	48.9	2.44
Determine viable population levels for terrestrial species.	46.1	2.45
Determine wildlife population-habitat interactions and usage (i.e. territory, home range).	48.7	2.47
Manage animal damage (i.e., vertebrate pest control, predator removal).	39.6	2.59
Conduct surveys to determine the distribution and/or movement of terrestrial species.	40.9	2.63
Assemble life history data and habitat requirements of terrestrial species.	40.4	2.68
Collect pathological material for analysis of disease or health.	32.8	2.77
Measure physiological indices/nutritional requirements of wildlife species.	26.2	2.91
Determine food habits of wildlife species.	24.9	2.99
Determine genotype/genetic variability in wildlife species.	19.2	3.00

Table XIV. NEED FOR CONTINUING EDUCATION RELATED TO HABITAT TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Make management recommendations to enhance, protect, or restore habitats.	74.0	1.85
Determine and evaluate habitat's present and potential capabilities.	72.6	1.95
Restore or enhance habitats to meet management objectives.	64.6	2.04
Determine and evaluate habitat relationships associated with land management activities.	63.3	2.10
Develop strategies to mitigate habitat loss.	59.1	2.19
Identify plant species and communities.	57.8	2.27
Use habitat models to determine carrying capacity and to develop conservation strategies.	52.6	2.31
Plan for and manage habitat to maintain viable populations (T&E recovery plans.)	53.1	2.32
Monitor projects, (i.e., habitat improvements) for prescribed implementation and desired change.	49.5	2.39
Inventory and/or map wildlife habitats.	47.7	2.46
Inventory and/or map landscapes at ecosystem level.	44.5	2.47
Analyze landscapes to predict future conditions.	41.3	2.54
Plan and/or manage wildlife habitat demonstration area.	30.1	2.82
Monitor environmental contaminants.	25.0	2.85
Collect and evaluate historical habitat data and monitor trends.	28.6	2.91

Table XV. NEED FOR CONTINUING EDUCATION RELATED TO INTRODUCTIONS/STOCKING TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Introduce/translocate species and evaluate impact.	29.6	2.85
Recommend stocking or re-introduction strategies.	27.2	2.90
Recommend stocking or reintroduction strategies.	27.0	2.90
Evaluate genetic impacts of stocking, reintroduction.	23.4	2.92

Table XVI. NEED FOR CONTINUING EDUCATION RELATED TO IMPACT ASSESSMENTS TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Determine the cumulative effects of impacts upon habitats, populations or ecosystems.	60.4	2.14
Use models to predict responses of populations to management alternatives.	54.0	2.25
Conduct or evaluate environmental analysis or biological assessment.	44.8	2.49
Use models to predict outcomes of habitat modifications.	42.1	2.49
Review permit applications that may impact wildlife.	34.4	2.67
Investigate unusual or high profile (i.e., bear) wildlife kills/die offs.	34.4	2.74

Table XVII. NEED FOR CONTINUING EDUCATION RELATED TO RESEARCH, DATA COLLECTION and ANALYSIS TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Use computers and variety of software.	84.7	1.59
Collect, analyze and present/display field data.	66.6	2.04
Develop and maintain informational and other databases.	61.0	2.16
Design scientific experiments/management studies.	49.5	2.36
Develop and construct models.	40.2	2.47
Review or critique scientific experiments/management studies.	42.0	2.57

Table XVIII. NEED FOR CONTINUING EDUCATION RELATED TO SOCIO-ECONOMIC TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Measure or assess public opinion, needs, satisfaction levels, and knowledge.	50.2	2.38
Determine the cost/benefit of projects and/or management alternatives.	43.6	2.51
Measure or assess values associated with wildlife resources.	39.6	2.60
Estimate the demand for wildlife resources.	34.6	2.71
Plan and/or manage for public access.	29.5	2.80
Measure the use of wildlife resource, i.e. user days.	25.7	2.94

Table XIX. NEED FOR CONTINUING EDUCATION RELATED TO NON-TECHNICAL TASKS (WILDLIFE)

Tasks	Cumulative Percent	Mean
Conduct briefings or make presentations at various types of meetings.	59.6	2.28
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.)	55.4	2.29
Apply problem solving techniques.	57.7	2.31
Manage multiple priorities and assess progress.	55.5	2.31
Network with other professionals and agencies.	56.3	2.33
Resolve conflict at various levels.	53.2	2.34
Access current literature to maintain technical proficiency.	53.5	2.37
Work with mass media (i.e., newspapers, radio, tv).	52.7	2.39
Package and promote ideas and programs.	51.1	2.39
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace).	52.2	2.41
Recruit, interview, supervise, mentor and evaluate personnel.	49.1	2.41
Liaison and coordinate activities with other agencies and various levels of government.	49.9	2.42
Prepare administrative and technical reports, routine correspondence.	49.1	2.49
Plan/conduct various types of educational programs.	46.7	2.51
Prepare and justify budget(s) - projecting financial and staffing needs.	42.5	2.59
Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws.	37.0	2.70
Author popular articles for newspaper and magazines.	34.8	2.76
Prepare and/or administer contracts.	25.8	2.92

Tasks	Cumulative Percent	Mean
Manage inventories of supplies and equipment.	16.8	3.27
Manage and maintain buildings(s) and other facilities.	11.4	3.37

In examining the data reported, twenty-eight of the fifty-one technical tasks had mean values between 1.59 and 2.49, indicating a High to Medium High need for continuing education. Seven of those identified were population tasks, eleven were habitat tasks, four were impact assessment tasks, five were research/data collection tasks, and one was a socio-economic task. Over 64% of the tasks were in the categories population and habitat.

Of the mean values for the ten tasks with the highest need for continuing education, four are in sub-category **Habitat**, three are in **Research/Data Collection**, two in **Population**, and one in **Impact Assessment.** The tasks and associated mean values were: use of computers and variety of software (1.59); make management recommendations to enhance, protect, or restore habitats (1.85); determine and evaluate habitat's present and potential capabilities (1.95); collect, analyze and present/display field data (2.04); restore or enhance habitats to meet management objectives

(2.04); determine and evaluate habitat relationships associated with land management activities (2.1); determine factors limiting wildlife populations (2.1); design and conduct surveys to identify and estimate wildlife populations and species diversity (2.12); determine the cumulative effects of impacts upon habitats, populations, or ecosystems (2.14); and develop and maintain informational and other databases (2.16).

Of the continuing education needs related to the twenty non-technical tasks, thirteen (65%) had mean values ranging from 2.28 to 2.49 (average 2.36), the low side of a Medium High demand for professional development in those areas. None of the reported means fell in the range of 1 to 1.75, which would have indicated a High demand for professional development related to those tasks.

As with the fishery biologists, a more meaningful way to determine continuing educational needs of professional wildlife biologists was to identify tasks requiring a high proficiency level and a high need for continuing education. The same analysis was conducted for the wildlife data as previously reported for the fishery biologists.

The critical cell in the data matrix is the **HI HI** cell, indicating that high levels of proficiency are needed for the listed task, and a high need for continuing education to develop the skills necessary to perform that particular task. High and Medium High responses were combined to represent the variable HI. If 40% or more of the sample population for any one task reported a HI HI, that task was listed in Table XX.

Tasks identified requiring high proficiency levels and a high need for continuing education have the most critical need for continuing education. In looking at frequencies reported by 40% or more of the population, twenty-five technical tasks were identified. Five tasks identified in Table XIII - Table XVIII were not identified using this type of analysis. However, two new tasks were identified. One reason for this discrepancy is the reporting of cross-tabulated values greater than 40%. Another factor is that a wildlife biologist could identify a task that did not require a high proficiency level in their job, BUT they had a strong interest in continuing education in that area. As a result, a high mean value could be reported for that task, but it would show up as a HI HI when cross-tabulated.

TABLE XX. WILDLIFE TASKS REQUIRING HIGH PROFICIENCY LEVELS AND HAVING A HIGH NEED FOR CONTINUING EDUCATION.

Populations	Percent
Design and/or conduct surveys to identify and estimate wildlife populations and species diversity.	64.71
Determine factors limiting wildlife populations.	64.56
Monitor and/or recommend harvest regulations.	54.42
Monitor long term trends in populations.	52.4
Collect and analyze population characteristics i.e. age, sex, survival.	50.72
Determine wildlife population-habitat interactions and usage (i.e. territory, home range).	46.74
Determine viable population levels for terrestrial species.	44.11
Conduct surveys to determine the distribution and/or movement of terrestrial species.	42.9
Assemble life history data and habitat requirements of terrestrial species.	41.2
Habitat	
Make management recommendations to enhance, protect, or restore habitats.	73.08
Determine and evaluate habitat's present and potential capabilities.	70.63
Restore or enhance habitats to meet management objectives.	61.97
Determine and evaluate habitat relationships associated with land management activities.	61.66
Develop strategies to mitigate habitat loss.	53.69
Plan for and manage habitat to maintain viable populations (T&E recovery plans).	50.09

Identify plant species and communities.	49.6
Monitor projects (i.e., habitat improvements) for prescribed implementation and desired change.	48.68
Inventory and/or map wildlife habitats.	45.22
Impact Assessments	
Determine the cumulative effects of impacts upon habitats, populations or ecosystems.	52.32
Use models to predict responses of populations to management alternatives.	44.47
Research, Data Collection and Analysis	
Use computers and variety of software.	73.65
Collect, analyze and present/display field data.	62.30
Develop and maintain informational and other databases.	57.05
Design scientific experiments/management studies.	47.52
Socio-Economic	
Measure or assess public opinion, needs, satisfaction levels, and knowledge.	45.47
Non-Technical Tasks	
Manage multiple priorities and assess progress.	54.6
Conduct briefings or make presentations at various types of meetings.	52.6
Network with other professionals and agencies.	52.5
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.	50.9
Apply problem solving techniques.	50.6
Prepare administrative and technical reports, routine correspondence.	48.4

Liaison and coordinate activities with other agencies and various levels of government.	48.2
Resolve conflict at various levels.	47.5
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace.)	45.9
Package and promote ideas and programs.	44.8
Access current literature to maintain technical proficiency.	43.8
Recruit, interview, supervise, mentor and evaluate personnel.	43.3
Work with mass media (i.e., newspapers, radio, tv).	41.4

The five tasks dropped were: Habitat - use habitat models to determine carrying capacity and to develop conservation strategies; inventory and/or map wildlife habitats; Impact Assessments - conduct or evaluate environmental analysis or biological assessment; use models to predict outcomes of habitat modifications; and Research/Data Collection/Analysis - develop and construct models.

Two new tasks added were in Populations: conduct surveys to determine the distribution and/or movement of terrestrial species; and assemble life history data and habitat requirements of terrestrial species.

Of the top ten technical tasks requiring a high proficiency level and having a high need for continuing education, four were in the category Habitat, three in category Populations, and three in the Research, Data Collection/Analysis category. They are summarized in Table XXI.

Table XXI. TOP TEN...WILDLIFE TECHNICAL TASKS IDENTIFIED REQUIRING HIGH PROFICIENCY LEVELS AND HIGH NEED FOR CONTINUING EDUCATION.

Task	Cumulative Percent
Use computers and a variety of software.	73.65
Make management recommendations to enhance, protect, or restore habitats.	73.08
Determine and evaluate habitat's present and potential capabilities.	70.63
Design and/or conduct surveys to identify and estimate wildlife populations and species diversity.	64.71
Determine factors limiting wildlife populations.	64.56
Collect, analyze and present/display field data.	62.30
Restore or enhance habitats to meet management objectives	61.97
Determine and evaluate habitat relationships associated with land management activities.	61.66
Develop and maintain informational and other databases.	57.05
Monitor and/or recommend harvest regulations.	54.42

The same thirteen non-technical tasks reported as having a Medium High need for continuing education were also identified in the cross-tabulated analysis, with the percent frequency of responses ranging from 41.4% to 54.6% (average 48%) of the study population. These data fell in between neutral and the low range of a Medium High need for continuing education in these areas.

Nineteen technical tasks were reported by at least 10% of the respondents as having low proficiency level requirements in their jobs, but a high need for continuing education. The data generated in the LO HI cells were reported in Table XXII. Seven of those tasks were in the category Habitat, four in Impact Assessment, three in Socio-Economic, two in Population and two in Research, Data Collection and Analysis.

Of the above nineteen technical tasks, three were reported by over 20% of the respondents and related to modeling. They were: use models to predict outcomes of habitat modification, use models to predict responses of populations to management alternatives, and use habitat models to determine carrying capacity and to develop conservation strategies. Three other tasks were reported by over 17% of the respondents and included: inventory and map

landscapes at ecosystem level, monitor environmental contaminants, and develop and construct models.

Table XXII. WILDLIFE TECHNICAL TASKS REQUIRING A LOW PROFICIENCY LEVEL AND HAVING A HIGH NEED FOR CONTINUING EDUCATION.

Population	Cumulative Percent
Collect pathological material for analysis of disease or health.	15.1
Determine viable population levels for terrestrial species.	10.3
Habitat	
Use habitat models to determine carrying capacity and to develop conservation strategies.	22.3
Inventory and/or map landscapes at ecosystem level.	17.7
Monitor environmental contaminants.	17.4
Identify plant species and communities.	12.5
Analyze landscapes to predict future conditions.	12.3
Develop strategies to mitigate habitat loss.	12.0
Plan for and manage habitat to maintain viable populations (T&E recovery plans).	10.5
Introductions/Stocking	
Evaluate genetic impacts of stocking, reintroduction.	11.5
Impact Assessments	
Use models to predict outcomes of habitat modifications.	23.9
Use models to predict responses of populations to management alternatives.	22.5

Determine the cumulative effects of impacts upon habitats, populations or ecosystems.	15.1
Conduct or evaluate environmental analysis or biological assessment.	11.4
Research, Data Collection and Analysis	
Develop and construct models.	17.2
Use computers and variety of software.	13.5
Socio-Economic	
Measure or assess values associated with wildlife resources.	11.6
Determine the cost/benefit of projects and/or management alternatives.	11.4
Measure or assess public opinion, needs, satisfaction levels, and knowledge.	10

Analysis of the data showed no significant correlations between continuing education needs of wildlife biologists and their years of professional employment (Rho < 0.114), undergraduate curriculum (Rho < 0.095), graduate curriculum (Rho < 0.118), highest education level attained Rho < 0.177), or region employed (Rho < 0.193).

The cross-tabulated analysis was used to examine continuing education needs of technical tasks by specific job titles. In order to gain adequate sample analysis, both titles of wildlife biologist (specific area and regional) were combined with game biologists into a single position

called wildlife biologist. The other three positions included in the analysis were research biologist, supervisory biologist, and non-game biologist. The other positions could not be analyzed because of low sample numbers. This analysis produced a 16 cell matrix for each task, with HIHI, HILO, LOHI and LOLO columns, and job positions as row headers. Frequencies, Percents, and Cell Chi-Squares were reported.

There were no meaningful differences in comparing the continuing education needs of wildlife biologists and supervisory biologists, except for one task. Supervisory biologists identified a significant training need for the task "Determine the cost/benefit of projects and/or management alternatives.

Research biologists identified eleven tasks that had measurably higher percentages and frequencies in the HIHI column.

1. Collect and analyze population characteristics.
2. Monitor and/or recommend harvest regulations.
3. Determine and evaluate habitat's capability.
4. Make management recommendations to enhance, protect, restore habitat.
5. Restore or enhance habitats to meet management objectives.
6. Plan for and manage habitat to maintain viable populations (T&E recovery plans).
7. Monitor projects for prescribed implementation and desired change.

8. Collect and analyze and present/display field data.
9. Develop and construct models.
10. Design scientific experiments/management studies.
11. Review or critique scientific experiments/management studies.

Non-game biologists had a common need with research biologists for continuing education associated with tasks number 1,3, and 10 listed above. In addition, they recorded higher percentages and frequencies in the HIHI column for five other tasks.

1. Conduct surveys to determine the distribution and/or movement of terrestrial species.
2. Monitor long term trends in populations.
3. Design and conduct surveys to identify and estimate wildlife populations and species diversity.
4. Analyze landscapes to predict future conditions.
5. Develop and maintain informational and other databases.

Administrator's Survey Results

This section reports the results of agency administration rating the same 20 non-technical tasks, based on their perception of proficiency levels and continuing education needed by fishery and wildlife biologists. Like biologists, the choices for administrators were High(1), Medium High(2), Medium Low(3) and Low(4). For each task, the cumulative percent of High and Medium High responses is presented in Table XXIII, along with the mean response. A mean value ranging from 1 to 2.49 would indicate a HI to Medium HI need for continuing education. Mean values ranging from >2.5 to 4.0 would indicate a Medium Low to Low need for continuing education.

Consistent with the biologists' analysis, administrators' task proficiency level responses were cross-tabulated with their responses for the need for continuing education associated with the listed task. If the HI HI frequency was 40% or more, the task was reported in Table XXIV. For comparison purposes, all the HI HI responses for both the fishery biologists and wildlife biologists, components of which were previously reported in Tables IX and XX, were also included in Table XXIV.

Table XXIII. NEED FOR CONTINUING EDUCATION RELATED TO NON-TECHNICAL TASKS (ADMINISTRATORS)

Task	Cumulative Percent	Mean
Resolve conflict at various levels.	82.7	1.76
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.	80.4	1.76
Conduct briefings or make presentations at various types of meetings.	79.6	1.85
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace).	78.2	1.85
Work with mass media (i.e., newspapers, radio, tv.	76.1	1.91
Apply problem solving techniques.	73.9	1.91
Manage multiple priorities and asses progress.	76.3	1.94
Recruit, interview, supervise, mentor and evaluate personnel.	62.0	2.14
Package and promote ideas and programs.	63.1	2.15
Prepare administrative and technical reports, routine correspondence.	60.5	2.31
Access current literature to maintain technical proficiency.	54.1	2.37
Plan/conduct various types of educational programs.	50.9	2.38
Network with other professionals and agencies.	50.3	2.43

Task	Cumulative Percent	Mean
Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws.	50.6	2.44
Prepare and justify budgets - projecting financial and staffing needs.	47.5	2.50
Author popular articles for newspaper and magazines.	45.6	2.52
Liaison and coordinate activities with other agencies and various levels of government.	40.4	2.66
Prepare and/or administer contracts.	26.5	2.97
Manage inventories of supplies and equipment.	12.0	3.36
Manage and maintain building(s) and other facilities.	8.9	3.46

Table XXIV. COMPARISON OF AGENCY ADMINISTRATORS, FISHERY AND WILDLIFE BIOLOGISTS' RESPONSES TO NON-TECHNICAL TASKS REQUIRING HIGH PROFICIENCY LEVELS AND HAVING A HIGH NEED FOR CONTINUING EDUCATION. POPULATION PERCENTS REPORTED.

Tasks	Admin.	Fishery	Wildlife
Resolve conflict at various levels.	79.4*	40.5	47.5
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.)	78.3*	54.5	50.9
Conduct briefings or make presentations at various types of meetings.	77.7*	44.6	52.6
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace.)	76.2*	37.7	45.9
Apply problem solving techniques.	74.3*	47.6	50.6
Manage multiple priorities and assess progress.	73.7*	47.5	54.6
Work with mass media (i.e., newspapers, radio, tv).	68.7*	37.2	41.4
Prepare administrative and technical reports, routine correspondence.	59.8*	50.4	48.4
Package and promote ideas and programs.	59.6*	38.2	44.8
Recruit, interview, supervise, mentor and evaluate personnel.	58.3*	45.6	43.3
Network with other professionals and agencies.	54.1	44.4	52.5
Access current literature to maintain technical proficiency.	53.9*	41.9	43.8
Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws).	50.3*	28	34.99
Plan/conduct various types of educational programs.	45.4*	28.3	37.9
Prepare and justify budge(s)-projecting financial and staffing needs.	43.8*	33.45	39.0

Tasks	Admin.	Fishery	Wildlife
Author popular articles for newspaper and magazines.	42.1*	23.8	26.5
Liaison and coordinate activities with other agencies and various levels of government.	41.3	36.7	48.2
Prepare and/or administer contracts.	21.3	18.9	27.1
Manage inventories of supplies and equipment.	11.0	13.7	16.9
Manage and maintain building(s) and other facilities.	8.0	12.5	15.4

* Significantly different $P > .05$

There were no meaningful differences when comparing responses of fishery and wildlife biologists. However, significant differences are apparent when comparing responses of administrators and biologists. Administrators responded with higher values on fifteen tasks related to interpersonal relations, communication, management and leadership skills. They expect high proficiency levels of their employees in these areas, and indicate that professional development is needed. Two of the five tasks in which no difference was detected dealt with networking with other professionals and coordinating activities with other agencies. The remaining three tasks were administrative, and received low ratings from both administrators and biologists.

Many of the non-technical tasks require a range of skills. It is interesting to note that in the top ten task listed in Table XXIV., seven are very dependent on communication and interpersonal skills. The remaining three tasks are management oriented.

Chapter 6

Discussion

The goal of this research was to identify, for providers, the continuing educational needs of fishery and wildlife biologists employed by state fish and wildlife agencies. The discussion will focus on the needs related to technical tasks identified by fishery biologists, then wildlife biologists. The educational needs of both fishery and wildlife biologists with regards to non-technical tasks and top-level management's perspective of that component of the study will then be discussed. I will make some comments on limitations of this study and will conclude with discussion on continuing education, universities' roles in both formal and continuing education, and offer some recommendations.

Fishery Biologists...Technical Tasks

Prior to a discussion of the technical tasks and continuing education needs of fishery biologists, a few remarks are appropriate related to the demographic data collected in this study. Fishery biologists employed by

state agencies were well-educated, with a minimum of a bachelor's degree earned in either fishery/aquatic science or biology/zoology, and almost half held advanced degrees. In looking at the length of professional employment, 50% of the biologists have had careers of 15 years or more, and 30% of have worked 20+ years in this field.

One could infer from the data that there is little turnover in the profession and that a large number of biologists received their degrees many years ago. The demographic data on length of professional employment would strongly suggest a need for continuing education and reinforces the importance of having comprehensive professional development programs available for fishery biologists.

What is surprising is that the continuing education needs as identified by fishery biologists with less than five years experience did not significantly differ from those of fishery biologists with 20+ years experience. Just as surprising is that biologists with advanced degrees basically identified the same training needs as biologists with bachelor's degrees. There were no significant correlations between continuing educational needs and years in the profession, undergraduate or graduate major, the

highest level of education attained, or in region of the country where employed. This could be the result of hiring practices. It is also possible that newly-hired biologists are being rapidly assimilated into the organizational culture, resulting in a very homogeneous professional workforce.

Obviously, formal education cannot prepare one for every employment situation. Yet, if recent graduates employed by state fish and game agencies are identifying the same continuing education needs as the older professionals, existing undergraduate and graduate curricula in the natural resource areas need to be re-examined.

Fishery biologists had the greatest need for professional development related to the tasks in the areas of Research/Data Collection and Analysis, followed by tasks identified with Populations and Habitat. The highest need for continuing education identified by fishery biologists focused on computer and software usage; the collection, analysis, and presentation of field data; and working with various databases. Fishery biologists recognized the importance of developing computer skills that would enable them to collect, store, analyze and display data more effectively. Related to developing computer skills was the

fishery biologists' concern for data quality and maintenance. This tied directly into their identified need for help in sampling, designing scientific and management studies, and maintaining informational databases.

Methodologies and tools employed in collecting, analyzing, maintaining and displaying data have changed dramatically in the last ten to fifteen years with the advent of various technologies. Certainly in the last five to seven years, there has been a movement from using mainframe computers to employing personal, highly portable computers and other data storage technologies. Accompanying this shift to personal computers has been the rapid development of software and other programming tools. The increasing dependency by fishery biologists on these technologies was certainly a contributing factor to the high need identified for continuing education in this area.

From personal experience with the Virginia Cooperative Extension and other Extension services nationally, I have observed that government agencies' adoption of technologies often lags behind that of business and industry. This probably applies to state fish and wildlife agencies as well. Given the career longevity of many practicing biologists, it is very likely that their formal exposure to

computers and other technological tools was minimal in college. With the rapid developments in computer hardware and software, even recent college graduates need to constantly upgrade skills.

Fishery biologists also reported a high need for continuing education in tasks dealing with population, specifically in tasks related to determining limiting factors of populations, conducting population surveys, analysis of population characteristics and harvest regulations. Traditionally, state fish and wildlife agencies manage game species. Much of what fishery biologists do and will continue to do will relate to managing sport fisheries and optimizing recreational opportunities. It is not surprising that a high demand exists for continuing education related to population tasks.

Fishery biologists reported professional development needs in tasks related to habitat evaluation, enhancement, protection and restoration. While such tasks have always been a component of fishery biologists' jobs, these tasks may be assuming greater importance. Environmental degradation of existing rivers and streams, loss of wetlands, increasing demands for fresh water consumption by various publics such as municipalities, agriculture and

industry, increasing demand for access to clean water for recreation and sport fishing...these and other pressures are threatening aquatic habitats. As organizational missions and goals of state fish and wildlife agencies change to meet these new threats to aquatic habitats, job roles of fishery biologists will change. On-going assessment of continuing education needs of fishery biologists will help to identify the skills needed to carry out new job responsibilities.

It was interesting to note that none of the tasks under the sub-categories Impact Assessments, Socio-Economic, and Propagation and Stocking were identified in the top ten tasks having a high proficiency level needed for the job and a high demand for continuing education. All levels of government are feeling pressures of accountability and public opinion. There seems to be a heightened public awareness of the environment and greater demand for fishery resources, for both commercial and recreational purposes. It is therefore surprising that tasks such as: "assessing public opinion, needs, satisfaction level and knowledge", or "measuring the values associated with aquatic resources" were not identified as having a higher need for professional development. Proficiency levels reported for these tasks were not very high either.

Osborne and Gaebler (1992) suggest public organizations that will survive and grow in the 1990's are responsive to the needs of the customer, and not the bureaucracy. The data indicate that greater emphasis needs to be placed on customer service and satisfaction. Constantly monitoring public opinion and satisfaction levels needs to be an integral function of state fish and game agencies. The skills required to assess public opinion and measure customer satisfaction need to be acquired and utilized, not only by top management and supervisory personnel, but biologists as well.

It is likely that many fishery biologists might not have the knowledge and skills needed to carry out tasks associated with assessing public opinion and satisfaction. This could be traced to lack of preparation in the social sciences during their formal education. Providers of continuing education need to further assess these tasks and how they integrate into a fishery biologists job. Providers can also develop programs focused on the concepts of public and customer service within governmental organizations. An attitudinal change must occur within agencies and employees, including biologists, before continuing education can address deficiencies in the knowledge necessary to assess customer needs and public opinion.

Performance of the socio-economic tasks such as "determining the cost/benefit ratio for management alternatives" and "assessing values associated with aquatic resources" did not seem to be an important job function of fishery biologists working in state agencies. The exception were the supervisory biologists, who identified a higher need for continuing education for the task "measuring /assessing values associated with aquatic resources." Inherent to their job role may be a more global perspective of the importance of socio-economic tasks. It is likely that many of these socio-economic tasks relate more directly to supervisory biologists' job functions.

Kelso et al.(1988) evaluated university fishery programs in the United States and reported a need for more emphasis on socio-economic education. While this might be applicable to the academic preparation of fishery professionals, it may not have as great an application to fishery biologists employed by state fish and game agencies. Performance of many of the socio-economic tasks might not be completely aligned with state fish and wildlife agencies goals and objectives. Perhaps these tasks are more appropriately accomplished by other natural resource agencies at the state or federal level, or are collaborative efforts by many agencies. Comparative studies involving

fishery biologists from other agencies such as the U.S. Fish and Wildlife Service, U.S. Forestry Service, and the Bureau of Land Management would provide useful information in this matter.

The analysis that looked at low proficiency levels required for a task, BUT identifying a high need for continuing education was revealing in its implications. The most meaningful continuing education needs reported were tasks that related to modeling and genetics. The modeling tasks dealt with the actual development and construction of models, the use of models to predict habitat modification outcomes, using models to predict population responses to management alternatives, and the use of models to determine carrying capacity and develop conservation strategies. The two tasks related to genetics were "establishing genotypes of fish and determining genetic variability", and "evaluating genetic impacts of stocking."

Between 20 and 25% of the fishery biologists indicated they wanted to have more continuing education on modeling and genetics. They wanted to understand and use models but indicated that a high proficiency level was not needed. Fishery biologists desired information about genetics and its relevance to their job functions and management

decisions. The program content of the continuing education in genetics and modeling should be practical in nature and not exceed the needs identified, since fishery biologists did not identify needing a high proficiency level for those tasks in their jobs.

It is plausible that the LO HI tasks data, such as modeling and genetics, might signify that fishery biologists think proficiency levels required for these tasks may increase, causing a greater demand for knowledge and skills in those areas. The questionnaire and subsequent analysis were designed to allow biologists to report anticipatory needs or what Lauffer (1982) refers to as "what might be." This "futuring" by professional fishery biologists and their anticipation of changing job functions and roles certainly merits further investigation by providers of continuing education. University curricula, as well as the researchers that are developing these modeling tools and working in the area of fishery genetics, will have to address these concerns.

In looking at the needs for continuing education by job position, few differences were noted. Low numbers in various job positions precluded further statistical analysis. However, two job positions did have some apparent

differences in continuing education needs. The simple statistics reported for hatchery biologists (12% of the study population), while not statistically significant, indicated greater educational needs in tasks related to fish propagation, stocking and stocking schedules, and fish health management. This is not surprising given their job responsibilities in comparison to the rest of the sample population.

Research biologists (also 12% of the study population) indicated a greater need for continuing education in developing models, using models to predict population responses, and measuring and evaluating habitat changes associated with management activities. Further assessment will identify the educational content necessary to help hatchery and research biologists meet their specific job functions.

Overall, professional fishery biologists have similar continuing education needs. Comparable educational background and similarity in job responsibilities and duties, regardless of the region employed, certainly contributes to this phenomena. However, the role of the fishery biologist is not static, but dynamic and ever changing as it responds to shifts in agency goals and the

needs of its customers. This role change was evident while obtaining employee rosters and job descriptions from state fish and wildlife agencies for this study. A number of chiefs and administrators stated that they were in the process of re-writing job titles and position descriptions. Providers of continuing education will have to constantly monitor and assess biologists' professional development needs as their roles and job responsibilities change.

Wildlife Biologists...Technical Tasks

The demographic data reported for state agency wildlife biologists were similar to the fishery biologists. Like their fishery counterparts, wildlife biologists were also well-educated, and with few exceptions, had at least bachelor's degrees in either the wildlife sciences or biology/zoology, and half held advanced degrees. Longevity in the profession, like the fishery biologists, was also the case with wildlife biologists. In fact, the data were almost identical to that of the fishery biologists, with 51% of the wildlife biologists having 15 years or more experience, and 29% having 20+ years in the profession.

Analogous to the fishery biologists, wildlife biologists' length of time in the profession was not

normally distributed, but skewed to the "older" or right side. The loss of experienced biologists to retirement in another ten to fifteen years will certainly have some impact on state fish and wildlife agencies, the natural resource profession, and the institutions of higher learning that prepare these professionals. This may result in a large infusion of young biologists into the profession, lacking experience and requiring on-the-job training. Professional mentoring by highly experienced colleagues might also be affected. Other potential impacts will need to be identified and anticipated by agencies and universities.

Like fishery biologists, time spent in the profession, undergraduate or graduate major, degrees attained, or region of employment had no significant correlations to continuing education needs identified by wildlife biologists. Again, like the fishery biologists, wildlife biologists reported the greatest need for continuing education in the same task categories: Research, Data Collection and Analysis, Populations, and Habitat.

Wildlife biologists also identified their greatest continuing education need in the use of computers and software. The tasks identified by the wildlife biologists for professional development were similar to those reported

by fishery biologists and occurred in the same subcategories. However, in comparing the "top ten" tasks rated for high proficiency and high continuing education needed, four habitat tasks were identified by wildlife biologists while fishery biologists identified two habitat tasks. Habitat management is an important component of a wildlife biologist's job and will require constant upgrading of skills and knowledge in habitat evaluation, enhancement, protection, and restoration.

The analysis that indicated low proficiency levels required for a task, BUT a high need for continuing education picked up the same four modeling tasks as discussed earlier for fishery biologists. Their responses were similar. Between 17% and 24% of the wildlife biologists responding indicated a need for professional development in modeling. In addition, wildlife biologists identified needs for continuing education in tasks involving mapping and inventory of landscapes. Training in the use of new tools, like geographic information systems, will be necessary to accomplish many of the tasks related to landscapes. Follow-up needs assessments will provide further insight into the appropriate level of instruction. It is clear, however, that the use of modeling techniques and tools is becoming an important job element for both

fishery and wildlife biologists. Providers of continuing education and institutions of higher learning educating biologists need to accurately assess the appropriate level of instruction before developing educational programs and curricula.

Correlation analysis by job positions and tasks indicated little difference in the educational needs of wildlife biologists (by definition in questionnaire) and supervisory biologists. For many tasks that had a high proficiency, high continuing education need, research biologists and non-game biologists reported greater needs in a few areas. While not statistically significant because of the small sample size, they merit consideration.

In this study, 7% of the wildlife biologist sample population identified themselves as research biologists. Many of the tasks they identified for continuing education needs related to the scientific methodology, such as designing and reviewing/critiquing experiments and management studies, collecting and analyzing data, and developing/utilizing models for population and habitat studies. Like all wildlife biologists, research biologists had the same high demand for continuing education in computers and software. This is not surprising in light of

their job functions. They would have a higher need for skills associated with these tasks than wildlife biologists who hold positions related more to management. Further consideration needs to be given to the continuing education needs of the research wildlife biologist.

While not statistically significant, it is interesting to note that many of the identified educational needs reported by the non-game biologists (7% of the respondents) related to population tasks. The specific tasks they identified included surveys of distribution and movement of terrestrial species, collecting life history data and habitat requirements of species, monitor population trends, and determine viable population levels for terrestrial species. Non-game biologists have job responsibilities that often deal with hundreds of species, a number of which may be threatened or endangered. In some instances, the species and population status may be unknown. While much research has been conducted on game species, little is known about many of the non-game species.

Game management has been a primary objective of most fish and wildlife agencies since their inception. Expertise in non-game species and managing habitat for species diversity is a fairly recent activity, brought on by

increasing demand for non-consumptive use of the wildlife resource. Biologists are being hired by state agencies to work specifically with non-game species. In addition, it is likely that some current professionals are being "re-tooled" to work in this area.

Further analysis of the academic background of the 46 non-game biologists in this study revealed no difference in the highest degree attained or academic majors when compared to the other wildlife biologists and job positions. This would suggest academic training in populations is not meeting their current job needs related to non-game species population tasks.

It is possible that techniques used to study game species populations might not transpose well to non-game species. This poses an interesting challenge to researchers at the university level to develop tools and techniques that non-game biologists can utilize in population studies. Universities must update existing curricula and extend that information through continuing education programs to the non-game biologists.

The unique continuing education needs of non-game wildlife biologists warrants further investigation,

especially in tasks and job roles related to populations. There seems to be a trend by state fish and wildlife agencies to employ more non-game biologists. Preparation of these professionals and maintenance of their professional expertise will become a greater challenge for colleges and universities and continuing education providers.

Non-technical Tasks

In the introduction to this study, I referenced Cutler (1982) and others who recognized the importance of professional biologists having skills in areas related to communication, interpersonal relations, management and leadership. Corwin (1965) noted that differences often exist between an individual's need and expectation for continuing education, and the organizations's expectations. For comparitive purposes the twenty non-technical tasks, common to both fishery and wildlife biologists questionnaire, were also sent to agency administrators. The format and task statements were the same. The only difference was that administrators were asked to rate proficiency levels and continuing education based on what they perceived their biologists needed.

The response of biologists to the needs for continuing education in the non-technical tasks could best be described as lukewarm indifference! The few tasks identified as having a modest demand for continuing education were: developing and administering plans of work (goal setting, developing strategies, etc.), applying problem solving techniques, and managing multiple priorities. Overall, there were no meaningful differences in the continuing education needs of fishery and wildlife biologists related to the non-technical tasks. It is important to note that NONE of the non-technical tasks were listed in the top ten tasks identified by both fishery and wildlife biologists for professional development and training.

Agency administrators had a sharply contrasting view of continuing education needs related to non-technical tasks. They significantly differed from biologists in their responses to proficiency levels required for the job and the need for upgrading skills for fifteen of the twenty non-technical tasks.

Seven of the top ten non-technical tasks identified by administrators as having a high need for continuing education were dependent on communication and interpersonal skills. A sample of the tasks included: conflict

resolution; conducting briefings; participating in various group processes (decision making, team building, working in a diverse workplace); and working with mass media. The only consensus between agency administrators and biologists was on low-rated administrative tasks such as managing inventories, building maintenance, and contract administration.

State agency administrators expect technical competence in employees. Indeed, their biologists are usually the products of natural resource curricula that emphasize technical and scientific courses. The organizational analysis of state fish and wildlife agencies, a component of this study, found that the majority of continuing education programs being provided to state agency biologists are predominantly technical in nature.

Fifteen years ago, Donaldson (1979) noted that state fish and game agencies want employees that can think, reason and communicate. He further stated that the technical skills necessary are much more easily acquired on the job. The data reported in this study indicate that agency administrators still want those types of employees but indicate that their professional biologists need continuing education in non-technical areas related to communication,

interpersonal relations, management and leadership.

Significant differences exist between agency administrators and the professional biologists in identifying continuing education needs related to non-technical tasks. This is an indication that the processes of determining continuing education program content within most state agencies are not involving all the stakeholders. The processes are informal at best, not well-defined and systematic, and in many cases, probably non-existent.

Providers of continuing education must become more involved in the needs assessment process. Their role cannot be limited solely to program design and delivery. If minimal attention is paid to the needs identification component, what is determining program content? Lauffer (1982) has suggested that too often continuing education needs are determined by personal and professional intuitions. This "introspection process" is problematic, whether originating within the agency at the biologist level, or the administrative level, or in a university. Clearly, evidence of introspection is found in this study, especially in continuing education related to non-technical tasks.

Agency Commitment

The strong response of agency administrators in identifying continuing education needs must be tempered by the data obtained from the organizational analysis reported and discussed in Chapter Three. The data strongly suggest that a positive climates does not presently exist in many state fish and wildlife agencies for the development and successful implementation of continuing education programs. The fact that such disparity exists between the importance of training needs identified by biologists and agency administrators certainly suggests that internal problems need to be addressed before substantial commitments will be made to professional development.

This study has identified a need for continuing education programs for state agency fishery and wildlife biologists. Data from this study suggest that state fish and game agencies value their professionals. State fish and wildlife agencies seem to understand the importance of employee professional development and the benefits accrued to the their organizations by such activities. McMullin (1993) reported that effective fish and wildlife agencies displayed strong commitments to continuing education, yet employees of those effective agencies still have concerns

about lack of training opportunities.

Agencies must take positive actions to validate their commitment to employees' personal and professional growth. First, the commitment must include identification of continuing education as an important component of agency culture. Further commitment will be indicated when continuing education becomes an important component of strategic planning, budget allocation, employee performance appraisal, employee reward systems, and plans of work. Incorporating these elements into agency structure and mission are the critical steps to be taken. Final confirmation of agency commitment will occur when an ongoing continuing education program is in place, providing employees with a systematic way of updating their personal and professional skills, knowledge and competencies. Not only will this benefit personnel and the agency, but it will reinforce the idea that the agencies' greatest resource is human capital.

Study Limitations

The major limitation of this study, like all survey research, is that it provides a "snapshot in time" of what is being researched. The data reported were based on

current job functions and tasks as identified by fishery and wildlife biologists employed by state agencies. Current continuing educational needs were identified. Providers of continuing education can certainly make inferences from the data and anticipate future educational needs.

Providers of continuing education must be careful in making assumptions that fishery and wildlife biologists employed in other agencies or the private sector have the same educational needs. Major differences were evident from a needs assessment involving U.S. Forest Service fisheries and wildlife biologists (G.H.Cross, Virginia Polytechnic Institute and State University, pers. commun., 1994). While this and other studies provide baseline data applicable to other biologists' educational needs, specific assessments must be conducted for each group targeted for continuing education.

The methodology used in this study, task analysis, was just the first step in an assessment process to determine continuing education needs of fishery and wildlife biologists. Task identification was critical to the task analysis process and indeed was a major component of this research. The challenge is to develop task descriptions that are short, meaningful statements relevant to the study

population. A major constraint was here are a limited number of tasks that can be included in a mail questionnaire. If the tasks are too specific, hundreds of items could be listed resulting in a lengthy survey instrument and low return rates. If the task statements are too general, one ends up with a job description, contributing little to the needs assessment process. The task analysis questionnaire developed and used in this study attempted to address issues of task numbers and length.

The not applicable (NA) responses warrant further scrutiny. Most of the NA responses were not due to missing data (blank on opscan), but were indeed NA responses, either to the proficiency level of the task, or the need for continuing education, or both. The tasks associated with high NA responses need to be re-examined for relevance to this study population. While the primary objective of this study was to identify continuing education needs, the NA data reported on proficiency levels required for job tasks (Appendix A) does provides some insight into the job roles of fishery and wildlife biologists. The proficiency level data and NA responses provide a useful starting point for further analysis identifying competencies needed by these biologists. Further analysis can be designed to specifically address how higher education can respond to

those needs.

The frequency of NA responses was magnified in the cross-tabbed analysis. If the response was NA in either column of the opscan, it would not show up in any of the data cells produced in the HIHI HILO analysis. This deficiency is outweighed, however, by the value of identifying and reporting tasks that have a combined high need for proficiency and a high continuing education need. The high reported frequencies and percentages for the total population and the most common job descriptions still represented useful data.

Conclusion and Recommendations

Universities are constantly reviewing and revising curricula in response to the needs of students and their potential employers. Incorporating more courses in the social and political sciences, education, and communication would certainly provide for a more well-rounded professional biologist in the future. However, new curricula development will not meet the immediate needs of state agencies and their biologists, especially in light of the low turnover rate of these professionals. Comprehensive continuing education programs offer a viable solution to this problem.

The data reported on proficiency levels needed for tasks should be closely scrutinized by curriculum committees at universities with fishery and wildlife programs. Professional biologists are reporting and rating the tasks relevant to their jobs. Universities are faced with the challenge to provide a foundation upon which future learning can take place. Are universities providing the appropriate foundation? This type of analysis can be a useful tool to be employed by curriculum committees to gather data and develop course content relevant to the profession. Using industry parlance, universities must constantly monitor and produce the product in demand by the consumers, in this case, state agencies that employ fishery and wildlife biologists.

Time is obviously a limiting factor in formal academic preparation for any profession. As mentioned above, universities provide the academic foundation. Hopefully, universities have also ingrained into their students a philosophy that learning is a life-long process. University faculty must become involved and committed to being providers of continuing education. Cookingham et al.(1980) reported that administrators of fish and wildlife agencies had a concern about the "real world" experience of university professors. Did they have administrative

experience? Management experience? Field experience? Do faculty participate in the Intergovernmental Personnel Act, allowing them field experience with various natural resource agencies? Can university faculty design relevant continuing education programs to meet professional biologists' needs?

A partial solution is to form partnerships between educational institutions, agencies, professional organizations and other potential providers of continuing education. These teams can conduct needs assessments and develop the programs necessary to meet identified needs. A byproduct of these partnerships is the practical field experience of professional biologists which can be shared with faculty, resulting in more meaningful educational programs.

Life-long learning in the form of continuing education and professional development is needed now more than ever. Professional resource managers must continually apply new knowledge and skills to remain productive and successfully manage the resources entrusted to them by society. Further education and training needs are usually not identified by biologists until they have had some job experience. Insight into what they need in professional development is usually not attained until that job

experience helps them determine relevance. Many fishery and wildlife biologists will engage in self-directed learning to fill the gaps created by a lack of agency continuing educational programs.

Continuing education needs assessment should be an on-going activity in state fish and wildlife agencies. One of the strengths of using task analysis methodology in needs assessment was that working biologists identified the tasks, then rated the proficiency levels their jobs required to perform the tasks. This was not "top down" task identification or an intuitive analysis by top level management who "know better." By rating proficiency levels required for each task, a more meaningful response was obtained to the continuing education needed for that task. Biologists validated what tasks were relevant to their jobs, then based on their own experience and evaluation, identified their continuing education needs.

Providers of continuing education programs can utilize the results of this study as a starting point in developing more meaningful professional development and continuing education programs for state fish and wildlife biologists. The data and analysis reported provides a baseline for program developers by identifying those tasks having the

highest need for continuing education as identified by practicing professionals.

As with many of the broad content areas identified for continuing education, providers will be challenged to dissect and further analyze the tasks reported in this study to determine the knowledge or skills needed to accomplish the job function. For example, the task "Use of computers and a variety of software" was identified by all biologists as having the highest proficiency level needed for the job and the greatest need for continuing education. What specifically is the need? It could be keyboarding skills, or specific knowledge of a software application. It very well may be an attitudinal change related to using computers, or information on how to connect to the INTERNET and access other databases. This assessment and delineating process will be the ongoing challenge to providers of continuing education as they identify and develop program content.

State fish and wildlife agencies and their partners need to form continuing education program committees. These committees can then undertake a more detailed analysis to identify specific knowledge, skills, attitudes, and abilities needed to complete the tasks relevant to the job

roles of today's professional biologist. Learning objectives can be identified and program content developed. With this type of collaboration and the data reported in this study, providers of continuing education can begin to address the professional development needs of state agency fishery and wildlife biologists.

In closing, the following recommendations are offered:

1. State fish and wildlife agencies should incorporate into their organizations a structured system for continuing education and stress agency recognition of the importance of employees' personal and professional development;

2. Agencies should budget for continuing education, assigning it a priority comparable to other employee benefits such as health insurance and retirement packages;

3. Providers of continuing education should employ task analysis and other needs assessment methodologies to systematically identify on-going continuing education needs of professional biologists; and

4. Universities must continue to evaluate and revise curricula AND assume a greater role in providing continuing education to fishery and wildlife biologists.

Literature Cited

American Fisheries Society. 1993. American fisheries society continuing education manual. The American Fisheries Society. Washington, D.C. 48p.

American Telephone and Telegraph Company. 1980. Survey of business service center jobs: technical supplement. American Telephone and Telegraph Company, Basking Ridge, New Jersey. 87p.

Burack, E.H. 1988. Creative human resource planning and applications - a strategic approach. Prentice Hall, Englewood Cliffs, New Jersey. 506p.

Corwin, R.G. 1965. Professional persons in public organizations. Educational Administration Quarterly 1:1-22.

Cookingham, R.A., P.T. Bromley and K.H. Beattie. 1980. Academic education needed by resource managers. Transactions of the North American Wildlife Conference 45:45-49.

Cross, G.H. 1986. Professional Development Questionnaire for conservation Biologists. Fisheries and Wildlife Department, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 8p.

Cross, G.H. 1987. Continuing education in natural resources: needs and opportunities. Transactions of the North American Wildlife Natural Resources Conference 52:691-696.

Cutler, M.R. 1982. What kind of wildlifers will be needed in the 1980's? Wildl. Soc. Bull. 10(1):75-79.

Darkenwald, G.G. and S.B. Merriam. 1982. Adult education: foundation of practice. Harper & Row. New York, New York, 260p.

Deitemeyer, S., R. Hickenbottom, D. Holthausen, Knapp, W., Norris, L. and D. Skeesick. 1988. Report of the committee for continuing education of wildlife and fish biologists - Pacific Northwest Region. U.S. Fish and Wildlife Service. Washington, D.C. 28p.

Delbecq, A.L., A.H. Van de Van, and D.H. Gustafson. 1986, Group techniques for program planning: a guide to nominal and delphi processes. Green Briar Press, Middleton, Wisconsin, 174p.

Dillman, D.A. 1978. Mail and telephone surveys. the total design method. John Wiley & Sons. New York, New York. 325p.

Donaldson, J.R. 1979. Fisheries education from the state perspective. Fisheries 4(2):24-26.

Driskill, W.E. 1975. Occupational analysis in the United States Air Force. in: P.E. Schroeder (ed.) Proceedings of a symposium on task analysis/task inventories. Center for Vocational Education, Ohio State University, Columbus, Ohio.

Finch, C.R. and J.R. Crunkilton. 1993. Curriculum development in vocational and technical education. Allyn and Bacon. Needham Heights, Massachusetts. 313p.

Flanagan, J.C. 1954. The critical incident technique. Psychological Bulletin 51(4):327-358.

Gallagher, T. 1988. Training questionnaire survey. Montana Department of Fish, Wildlife & Parks. Helena, Montana. 22p.

George, J.L., S.S. Dubin, and B.M. Nead. 1974. Continuing education needs of wildlife and fisheries managers. Wildl. Soc. Bull. 2(2):59-62.

Gael, S. 1983. Job analysis: a guide to assessing work activities. Jossey-Bass Inc. San Francisco. 282p.

Graf, R.L. 1976. Continuing education in wildlife administration. Wildl. Soc. Bull. 4(3):126.

Goldstein, I.L. 1974. Training: program development and evaluation. Brooks/Cole Publishing Co., Monterey, California. 231p.

Goldstein, I.L. 1986. Training in organizations: needs assessment, development, and evaluation (2nd edition). Brooks/Cole Publishing Co. Monterey, California, 315p.

Grotelueschen, A.D., D.L Harnisch, and Kenny, W.R. 1979. An analysis of the participation reasons scale administered to business professionals. Occasional Paper No.7. Urbana:Office for the Study of Continuing Professional Education. University of Illinois at Urbana-Champaign. 37p.

Grotelueschen, A.D., D.L. Harnisch, W.R. Kenny and R.M. Cervero. 1981. A comparative approach to research on reasons for participation in continuing professional education. Paper presented at the Adult Education Research Conference, DeKalb, Illinois. 8p.

Hamed, S.E. 1990. Academic training and continuing education of the environmental professionals: the north american experience in the early 1970's. Association of Egyptian-American Scholars Ninth Conference on EGYPT THE YEAR 2000. Cairo, Egypt. 18p.

Hester, F.E. 1979. Fisheries education from the federal perspective. Fisheries 4(2):22-24.

Houle, C.O. 1980. Continuing Learning in the Professions. Jossey-Bass Publishers, San Francisco. 390p.

Houle, C.O. 1984. Patterns of learning. Jossey-Bass Publishers, San Francisco. 243p.

Hester, F.E. 1979. Fisheries education from the federal perspective. Fisheries 4(2):22-24.

Kelso, W.E. and B.R. Murphy. 1988. University fisheries programs in the United States: structure and needs. Fisheries 13(2):9-15.

Kenny, W.R. and D.L. Harnisch. 1982. A developmental approach to research and practice in adult and continuing education. Adult Education 33:29-54.

Kramlinger, T. 1992. Training's role in a learning organization. pages 3.77-3.80 in: R. B. Frantzreb (ed.) Training and Development Yearbook 1993/1994. Prentice-Hall, Inc. Englewood Cliffs, New Jersey, 9.3.12p.

Krausman, P.R. 1979. Continuing (?) education for wildlife administrators. Wildl. Soc. Bull. 7(1):57-58.

Kuriloff, A. Organizational development for survival. American Management Association, New York, 275p.

Lauffer, A. 1977. The practice of continuing education in the human services. McGraw-Hill, New York, New York, 227p.

Lauffer, A. 1982. Assessment tools for practitioners, managers, and trainers. Sage Publications, Beverly Hills, California. 192p.

Leffel, L. 1992. Leadership development questionnaire. Division of Continuing Education, Virginia Polytechnic Institute and State University, Blacksburg, VA. 2p.

Leffel, L. 1992. Dominion bankshares development questionnaire. Division of Continuing Education, Virginia Polytechnic Institute and State University, Blacksburg, VA. 2p.

Leopold, A. 1940. The state of the profession. J. Wildl. Manage. 4:343-346.

Lewin, K. 1951. Field theory in social science. Harper & Row, New York, New York, 346p.

Lukasiewicz, J. 1971. The dynamics of science and engineering education. Engineering Education 6:880-882.

Mali, P. 1970. Measurement of obsolescence in engineering practitioners. Continuing Education 3(2):57-63.

McCormick, E.J. 1976. Job and task analysis. in: M.D. Dunnette (ed.) Handbook of Industrial and Organizational Psychology. Rand McNally, Chicago.

McGill, M. 1992. Management practices in learning organizations. Organizational Dynamics, Summer:5-17.

McMullin, S.L. 1993. Approaches to management effectiveness in state fish and wildlife agencies. Ph.D. dissertation. Virginia Polytechnic Institute and State University. Blacksburg, Virginia. 401p.

Mitchell, J.L. and E.J. McCormick. 1980. Professional managerial position questionnaire. Purdue Research Foundation, West Lafayette, Indiana 47907. 8p.

Morsh, J.E. and W.B. Archer. 1967. Procedural guide for conducting occupational surveys in the United States Air Force. Personnel Research Laboratory, Lackland Air Force Base. 24p.

Nadler, L. 1970. Developing human resources. Gulf, Houston, Texas. 225p.

Niebel, B.W. 1962. Motion and time study: an introduction to methods, time study, and wage payment (3rd. ed.) Richard D. Irwin, Homewood, Il. 189p.

Norton, R.E. 1985. DACUM handbook. National Center for Research in Vocational Education. 204p.

Osborne, D. and T. Gaebler. 1992. Reinventing government: how the entrepreneurial spirit is transforming the public sector. Adddison-Wesley Publishing Co., Reading, MA. 405p.

Osler, W. 1984. Creating a complete educational plan for professionals. pg. 146. in: Houle, C. (ed.) Patterns of learning. Jossey-Bass. San Francisco, California, 243p.

Phillips, L.E. 1983. Trends in state licensure. in: M.R. Stern (ed.) Power and conflict in continuing professional education. Wadsworth, Belmont, California.

Pigot, G.M. 1976. The effectiveness of a short-term accelerated programs for reorienting professionals. in: P.P. LeBreton (ed.) The assessment and development of professionals:theory and practice. University of Washington, Seattle.

Porath, W., Sheriff, S. and L. Fredrickson. 1989. Surveys of Conservation Agency Administrators and Wildlife Professionals concerning Continuing Education Programs. Missouri Department of Conservation. Columbia, Missouri. 31p.

Sackman, H. 1975. Delphi critique. Lexington Books and the Rand Corporation, Lexington, Massachusetts. 158p.

Salwasser, H., G.H. Cross, and W.B. Sidle. 1990. Continuing education for biologists: the forest service program. Transactions of the North American Wildlife and Natural Resources Conference 54: 127-131.

Scanlan, C.L. 1985. Practicing with purpose: goals of continuing professional education. pages 5-19 in: R.M. Cervero and C.L. Scanlan (ed.) Problems and prospects in continuing professional education. Jossey-Bass, San Francisco, 114p.

Schein, E.H. 1980. Organizational Psychology. Prentice Hall, Englewood Cliffs, N.J. 274p.

Smith, M.F. 1983. Sampling considerations in evaluating cooperative extension programs. Institute of Food and Agricultural Sciences. University of Florida, Gainesville. 31p.

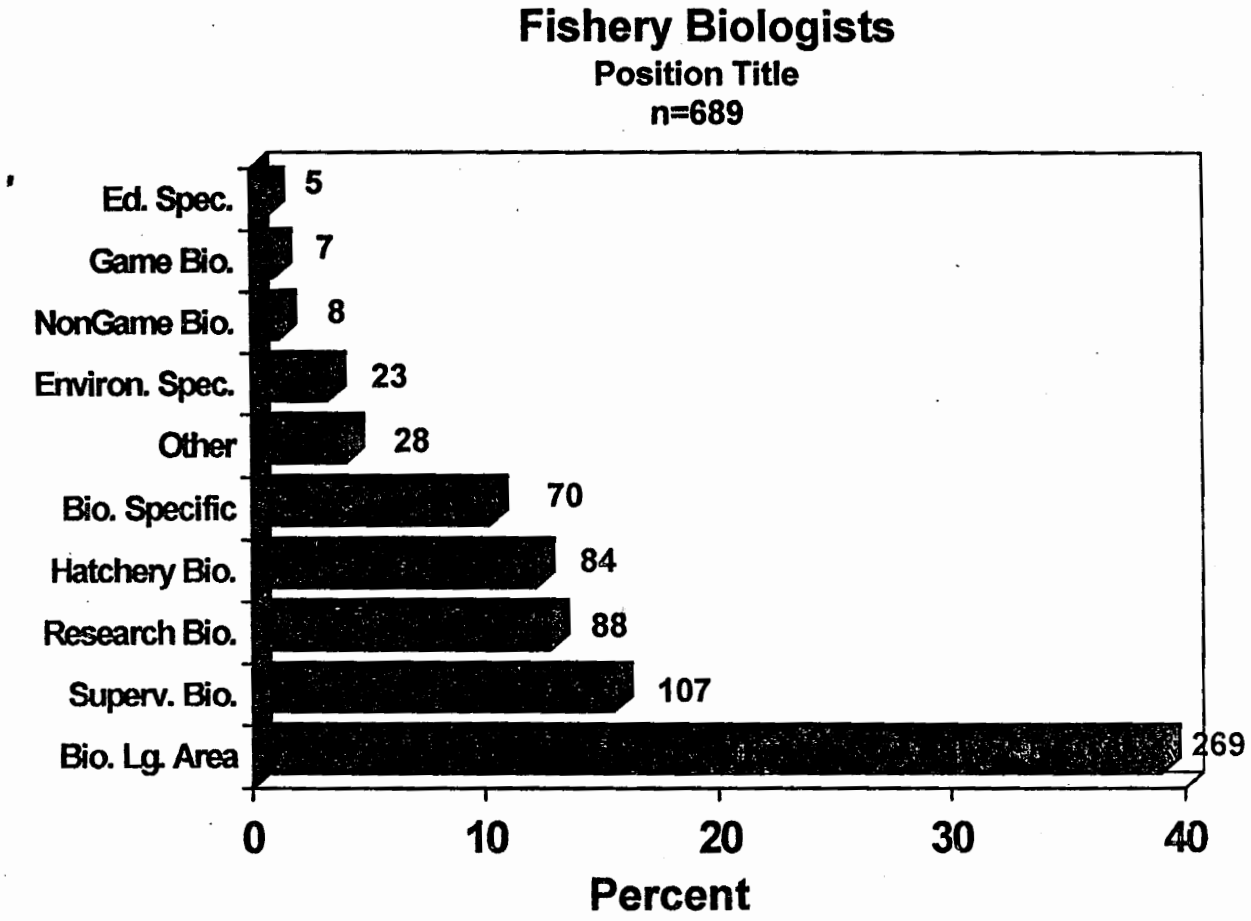
Taylor, F.W. 1916. The principles of scientific management. Bulletin of the Taylor Society. pages 9-23 in: J.M.Shafritz & P.H. Whitbeck (eds.) Classics of Organization Theory. Moore Publishing Co. Oak Park, Illinois.

The Wildlife Society. 1989. The wildlife society professional development program - administrator's handbook. 1989. The Wildlife Society. Bethesda, Maryland, 22p.

Virginia Department of Game and Inland Fisheries. 1989. Survey of biologists continuing education needs. Richmond, Virginia. 11p.

Yamane, T. 1973. Statistics, an introductory analysis, 3rd. ED. Harper and Row. New York, New York, 130p.

Appendix A


Fishery Biologists
Position Title
n=689
Ed. Spec.
Game Bio.
NonGame Bio.
Environ. Spec.
Other
Bio. Specific
Hatchery Bio.
Research Bio.
Superv. Bio.
Bio. Lg. Area
5
7
8
23
28
70
84
88
107
269
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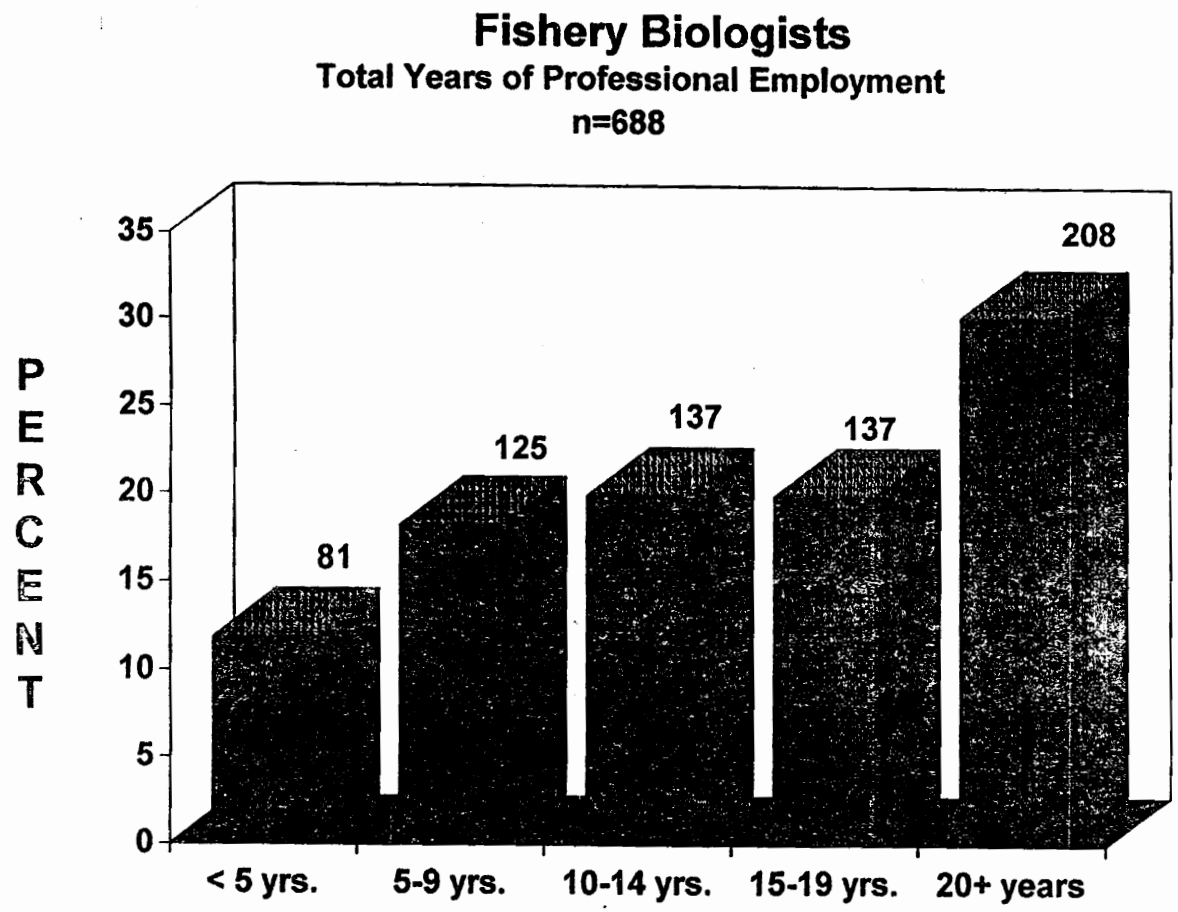
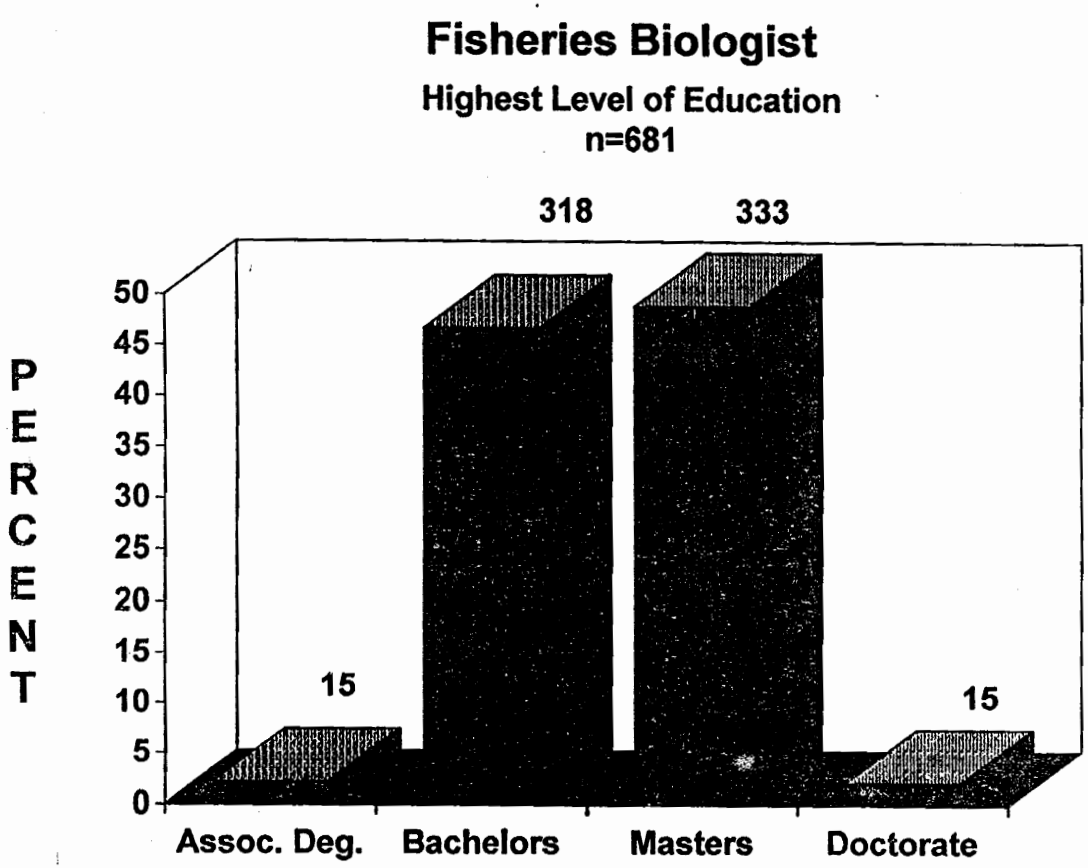
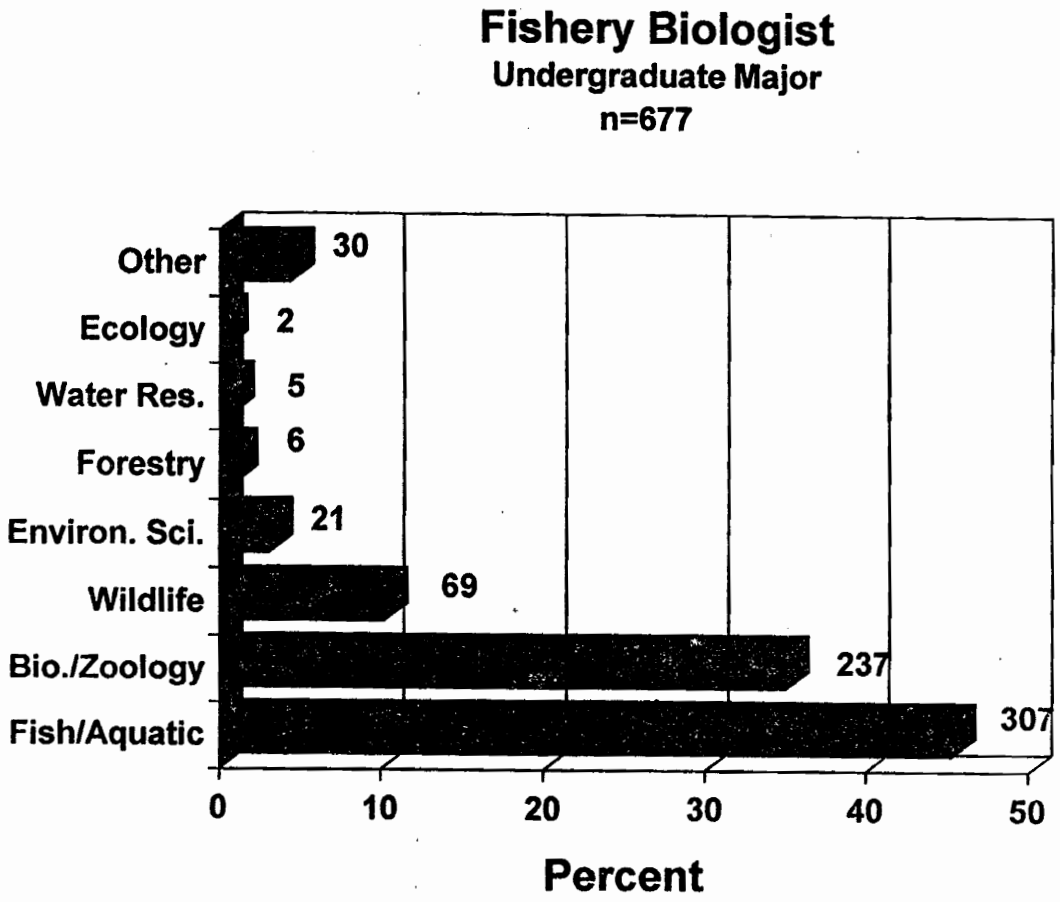
10
20
30
40
Percent


Fishery Biologists
Total Years of Professional Employment
n=688
PERCENT
35
30
25
20
15
10
5
0
81
125
137
137
208
< 5 yrs.
5-9 yrs.
10-14 yrs.
15-19 yrs.
20+ years


Fisheries Biologist
Highest Level of Education
n=681
318
333
PERCENT
50
45
40
35
30
25
20
15
10
5
0
15
15
Assoc. Deg.
Bachelors
Masters
Doctorate


Fishery Biologist
Undergraduate Major
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Other
Ecology
Water Res.
Forestry
Environ. Sci.
Wildlife
Bio./Zoology
Fish/Aquatic
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5
6
21
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307
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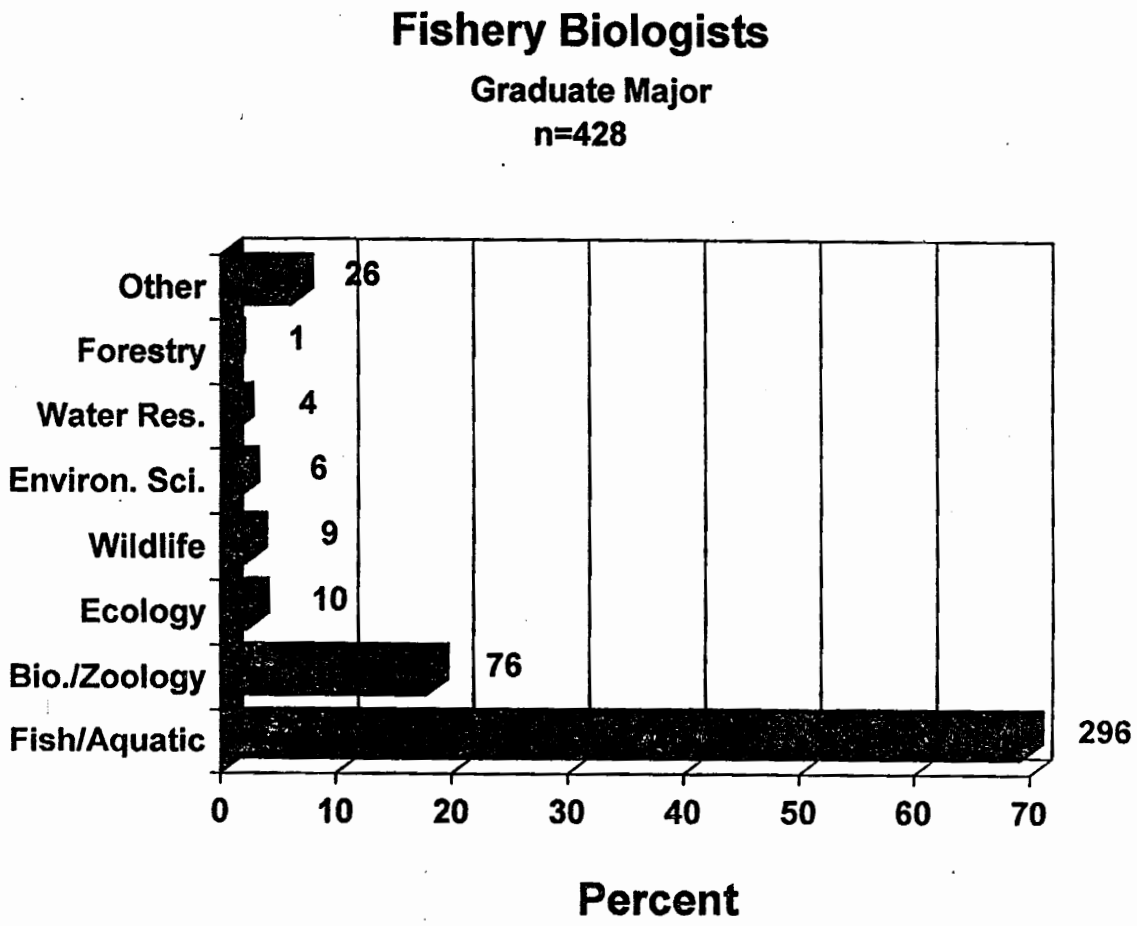
20
30
40
50
Percent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Graduate Major
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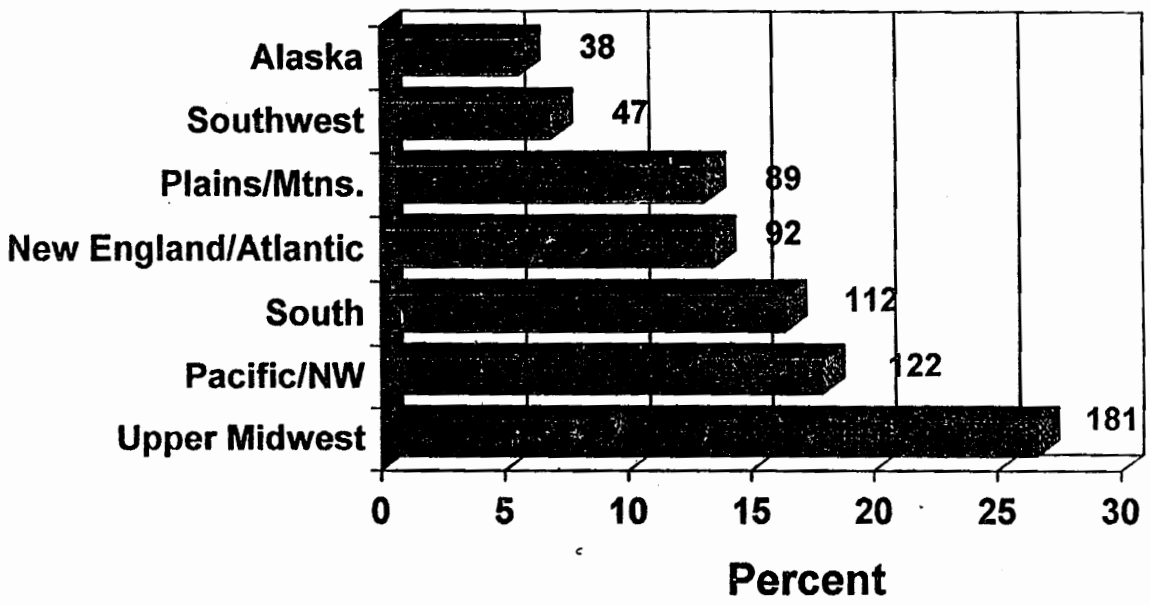
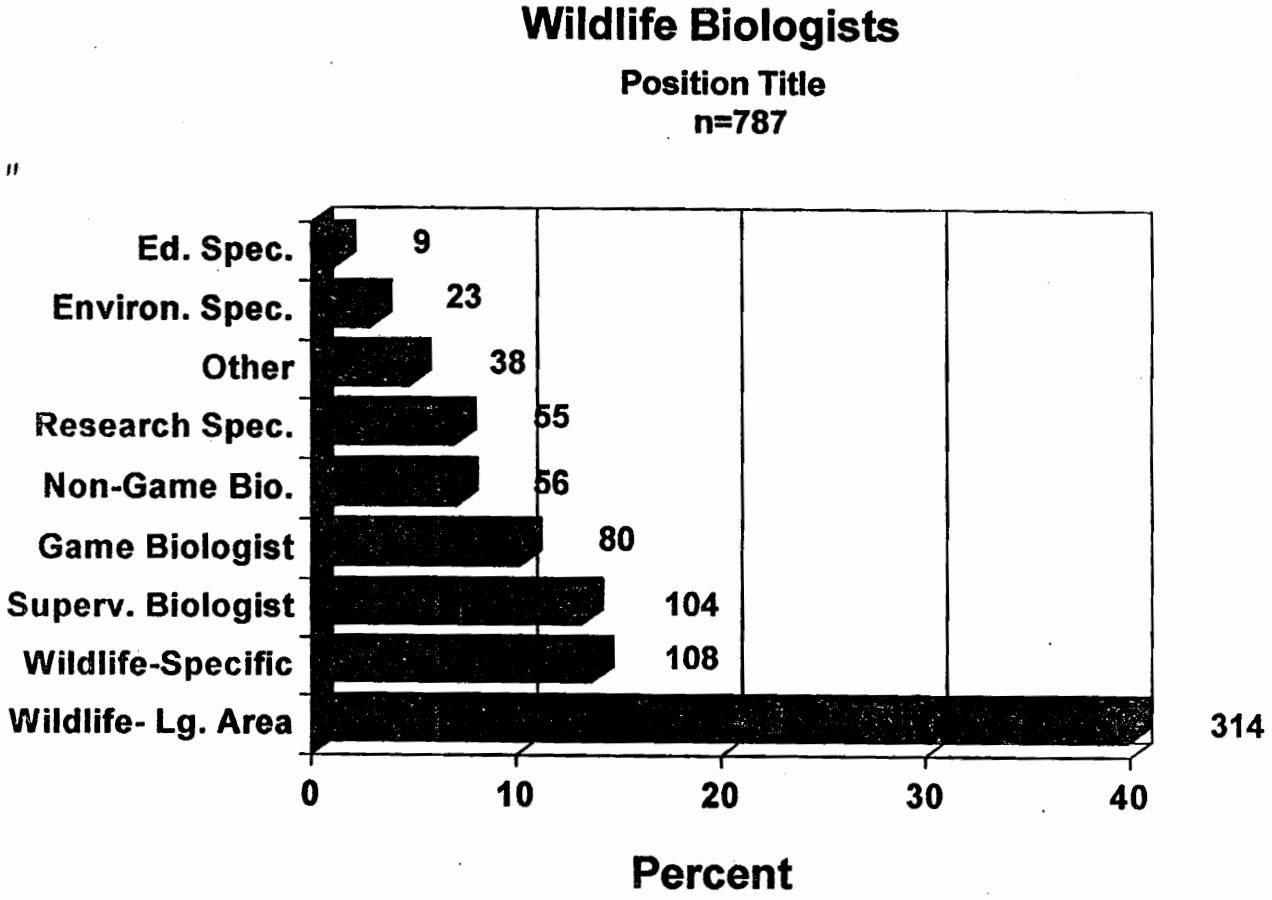
Other
Forestry
Water Res.
Environ. Sci.
Wildlife
Ecology
Bio./Zoology
Fish/Aquatic
26
1
4
6
9
10
76
296
0
10
20
30
40
50
60
70
Percent

Fishery Biologists

Region Employed
n=681




Wildlife Biologists
Position Title
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9
Environ. Spec.
23
Other
38
Research Spec.
55
Non-Game Bio.
56
Game Biologist
80
Superv. Biologist
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Wildlife-Specific
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Wildlife- Lg. Area
314
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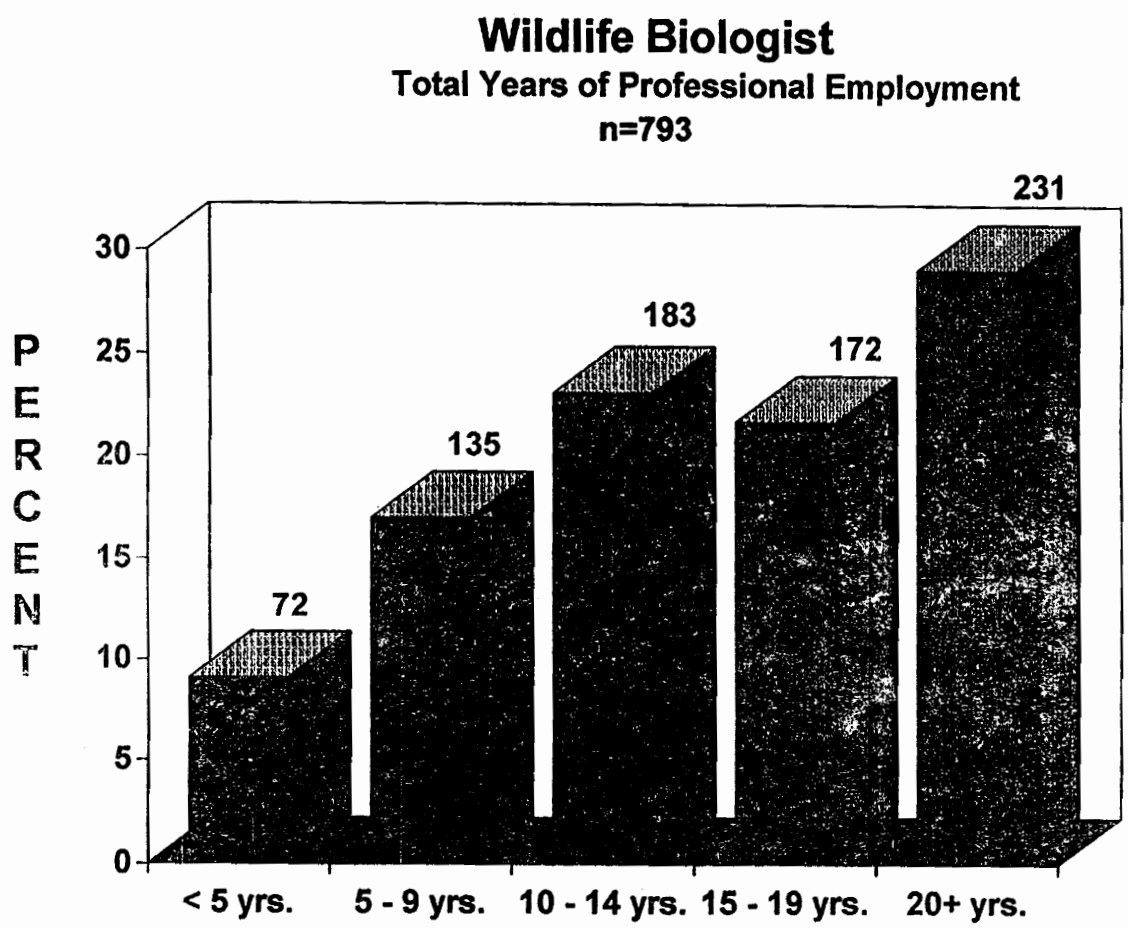
10
20
30
40
Percent


Wildlife Biologist
Total Years of Professional Employment
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PERCENT
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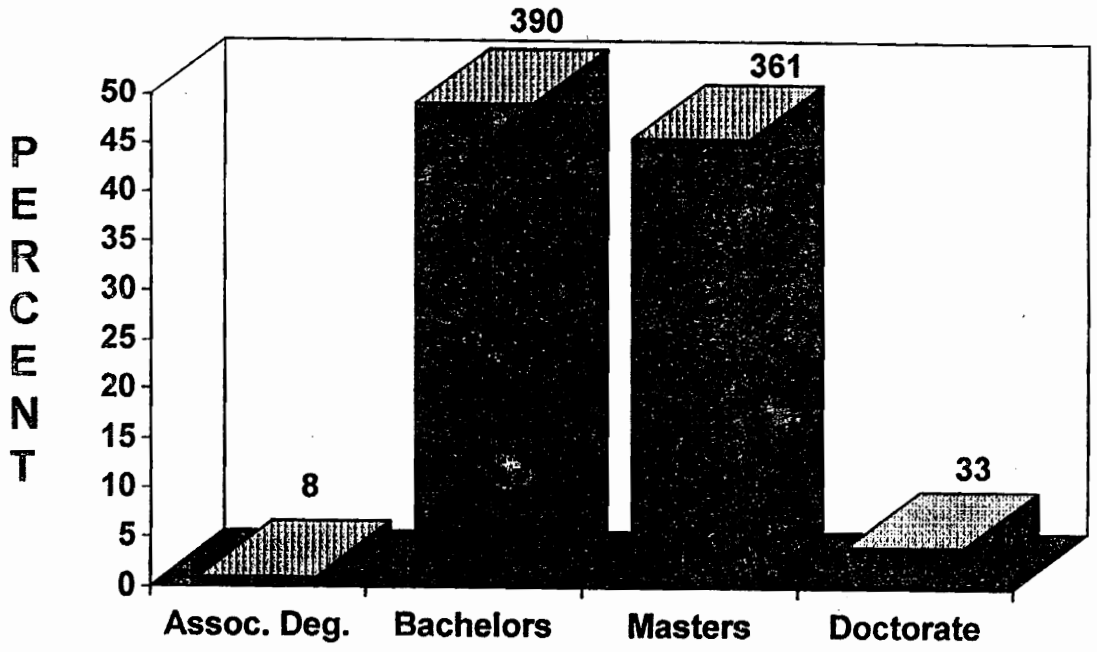
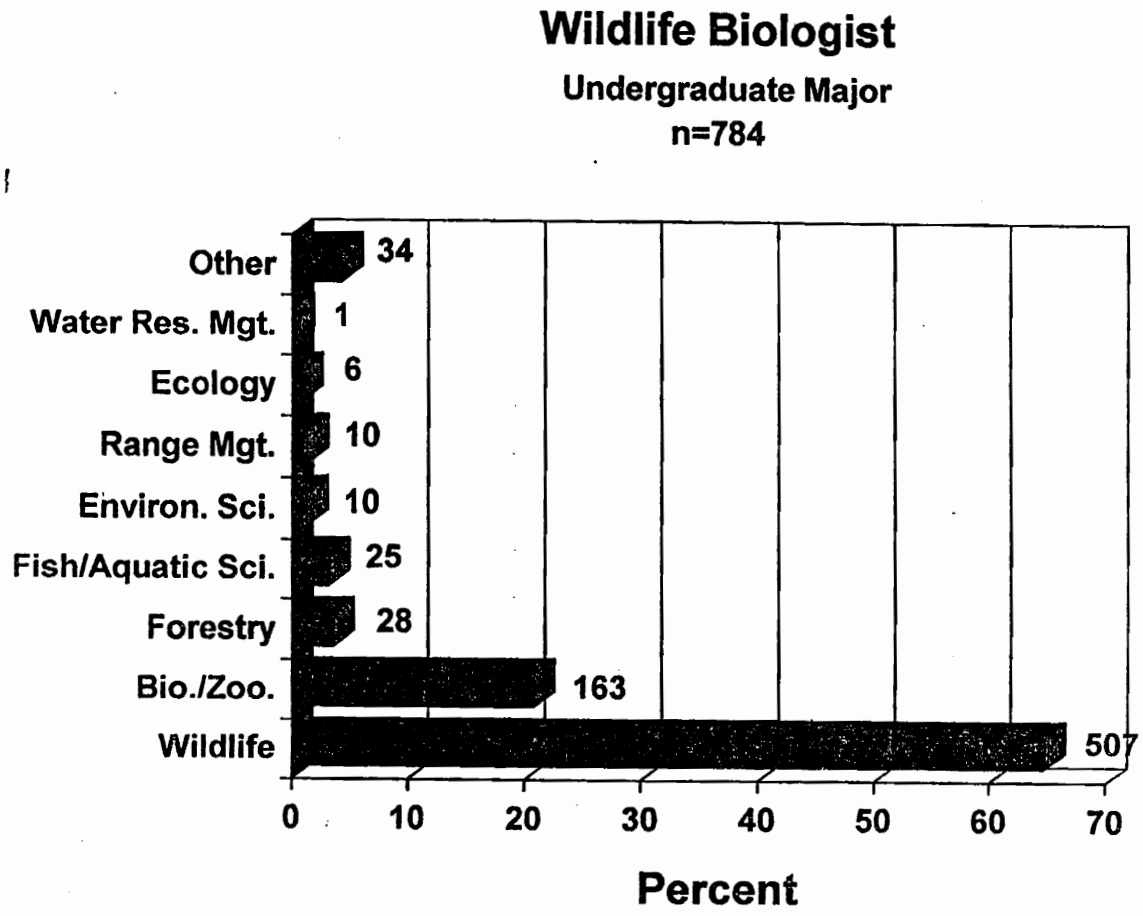
25
20
15
10
5
0
72
135
183
172
231
< 5 yrs.
5 - 9 yrs.
10 - 14 yrs.
15 - 19 yrs.
20+ yrs.

Wildlife Biologist

Highest Level of Education

n=792




Wildlife Biologist
Undergraduate Major
n=784
Other
Water Res. Mgt.
Ecology
Range Mgt.
Environ. Sci.
Fish/Aquatic Sci.
Forestry
Bio./Zoo.
Wildlife
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25
28
163
507
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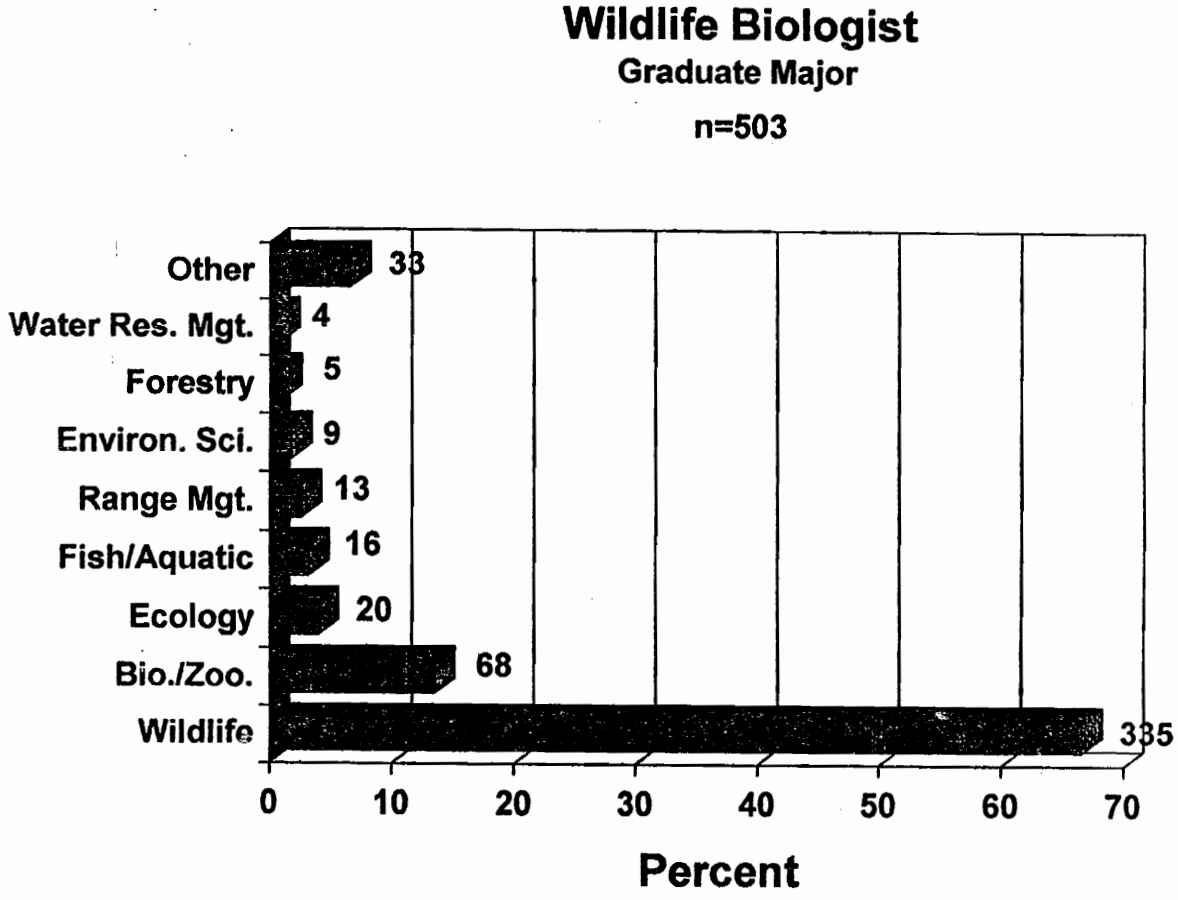
10
20
30
40
50
60
70
Percent


Wildlife Biologist
Graduate Major
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Other
Water Res. Mgt.
Forestry
Environ. Sci.
Range Mgt.
Fish/Aquatic
Ecology
Bio./Zoo.
Wildlife
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13
16
20
68
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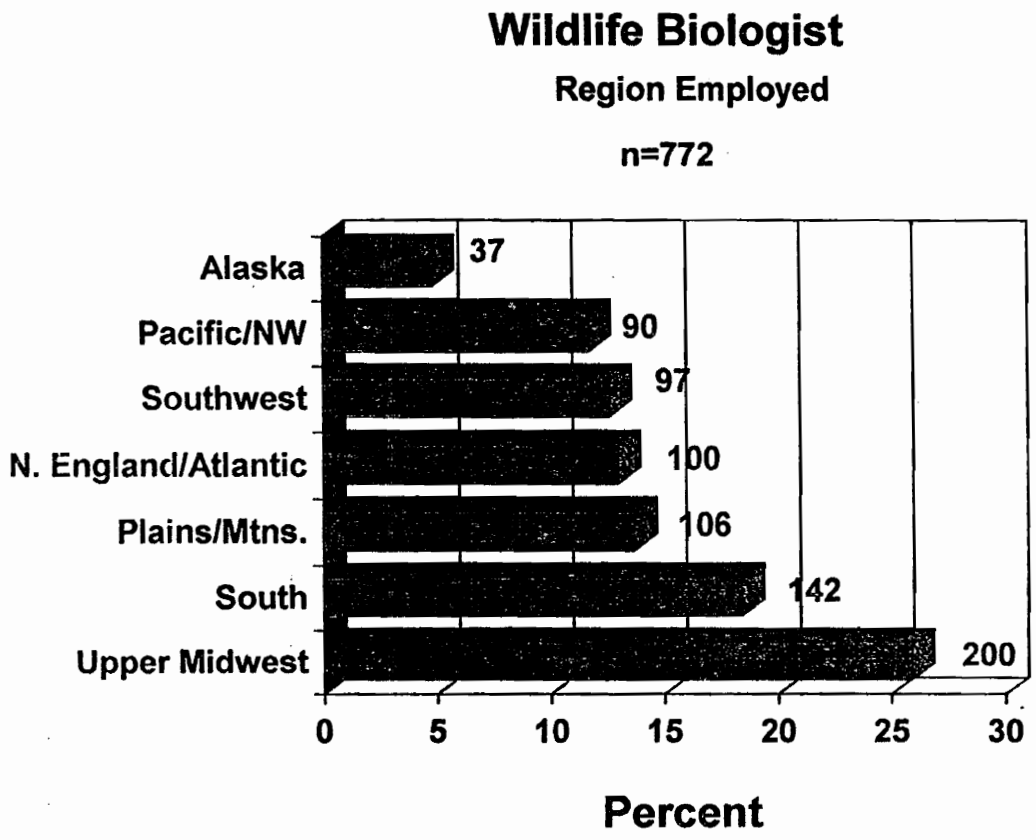
10
20
30
40
50
60
70
Percent


Wildlife Biologist
Region Employed
n=772
Alaska
Pacific/NW
Southwest
N. England/Atlantic
Plains/Mtns.
South
Upper Midwest
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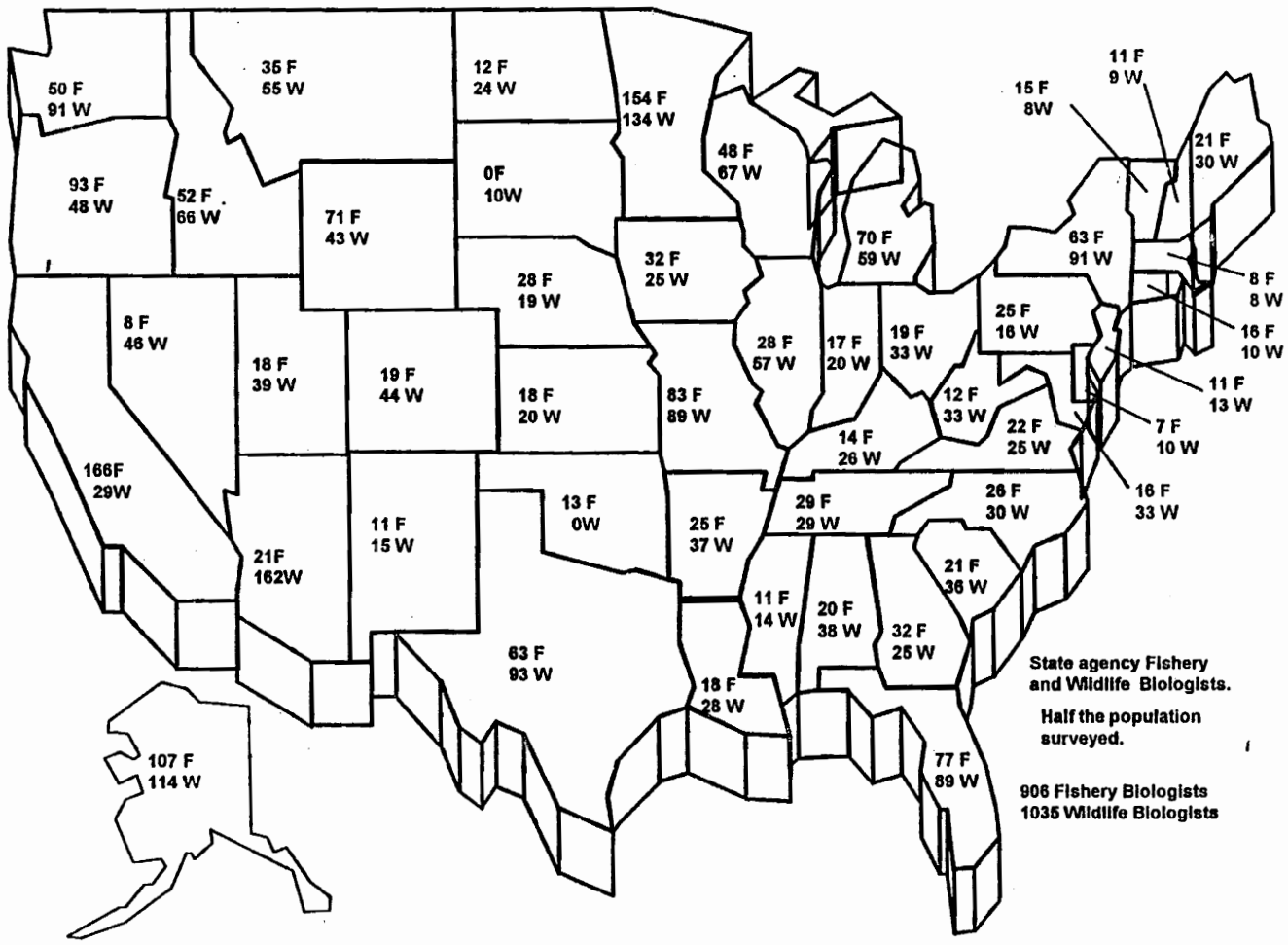
97
100
106
142
200
0
5
10
15
20
25
30
Percent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30 W
93 F
48 W
52 F
66 W
71 F
43 W
0F
10W
70 F
59 W
63 F
91 W
8 F
8 W
32 F
25 W
28 F
19 W
25 F
16 W
16 F
10 W
8 F
46 W
18 F
39 W
19 F
44 W
18 F
20 W
83 F
89 W
28 F
57 W
17 F
20 W
19 F
33 W
12 F
33 W
11 F
13 W
22 F
25 W
7 F
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14 F
26 W
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29 F
29 W
26 F
30 W
16 F
33 W
21F
162W
11 F
15 W
25 F
37 W
21 F
36 W
11 F
14 W
20 F
38 W
32 F
25 W
63 F
93 W
18 F
28 W
107 F
114 W
77 F
89 W
State agency Fishery
and Wildlife Biologists.
Half the population
surveyed.
906 Fishery Biologists
1035 Wildlife Biologists

PROFICIENCY LEVEL DATA FOR FISHERY BIOLOGISTS*

POPULATIONS

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Collect and analyze population characteristics, i.e. age and growth, sex, survival and mortality.	76	1.72	8.2
Design and conduct surveys to identify aquatic species and estimate aquatic populations.	71.6	1.78	12.3
Monitor and/or recommend harvest regulations.	68.9	1.8	14.5
Determine factors limiting aquatic populations.	72	1.87	8.4
Conduct surveys to determine the distribution and movement of aquatic species.	65.1	1.96	12.4
Assemble life history data and habitat requirements of aquatic species.	56.1	2.25	9.9
Plan, coordinate and implement renovation projects (fish eradication, repopulation, etc.)	43.6	2.45	18.3
Determine food habits of aquatic species.	28.6	2.85	14.8
Establish genotypes of fish/determine genetic variability.	21.9	2.92	35.3
Measure physiological indices of fish species.	22.6	3.02	23.8
Monitor macro-invertebrate and other populations.	21.3	3.06	19.3
Manage animal damage.	7.5	3.41	56.2

* Means calculated on the following variables: High (HI) = 1, Medium High (MH) = 2, Medium Low (ML) = 3, Low (LO) = 4. Any mean values ranging from 1 to 2.49 are considered in the Medium High to High range; 2.5 mean value neutral; mean values ranging from 2.51 to 4.0 are in the Medium Low to Low range. Task not applicable (NA) are reported as a percent of the sample population..

HABITAT (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Restore, enhance or protect habitats to meet management objectives.	60.3	2.02	16.2
Determine and evaluate habitat's present and potential capabilities.	60.0	2.1	13.2
Plan and manage aquatic habitats to maintain viable populations (T&E recovery plans).	49.4	2.36	22.7
Develop strategies to mitigate habitat loss.	49.8	2.39	21.4
Monitor projects, such as habitat improvements, for prescribed implementation and desired change.	44.1	2.44	19.4
Measure and evaluate habitat changes associated with land management activities.	43.0	2.47	19.9
Use habitat models to determine carrying capacity and to develop conservation strategies.	31.7	2.70	26.1
Inventory and/or map lotic aquatic habitats.	28.7	2.75	24.9
Measure and assess stream flows.	31.3	2.77	22.3
Inventory and/or map lentic aquatic habitats.	28.3	2.81	26.1
Control aquatic vegetation.	28.9	2.83	24.8
Collect and evaluate historical habitat data.	28.0	2.86	21.3
Monitor environmental contaminants.	29.4	2.94	28.9
Inventory and/or map landscapes at ecosystem level.	19.5	3.15	39.8

PROPAGATION AND STOCKING (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Recommend/evaluate stocking performance and strategies.	61.3	2.05	14.9
Collect and handle fish for propagation or stocking.	42.2	2.49	16.9
Develop stocking schedules and fish transportation.	36.6	2.53	28.3
Evaluate history/monitor impacts of exotic species stocking.	42.5	2.54	20.1
Evaluate genetic impacts of stocking.	37.1	2.56	26.0
Propagate and care for fish in hatchery situation (spawning, incubation, egg care, etc.)	27.3	2.61	40.8
Recognize and treat infections and diseases.	24.9	2.71	40.0
Develop fish health management practices/policies.	24.5	2.73	44.3

IMPACT ASSESSMENTS (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Review permit applications that may impact the aquatic resource.	46.4	2.29	22.5
Determine the cumulative effects of impacts upon habitats and/or population.	49.9	2.37	18.3
Conduct and/or evaluate environmental analysis or biological assessment.	47.6	2.38	17.1
Use models to predict responses of populations to management alternatives.	37.7	2.52	26.7
Investigate fish kills.	40.6	2.54	18.3
Use models to predict outcomes of habitat modifications.	24.4	2.82	35.5

RESEARCH, DATA COLLECTION AND ANALYSIS (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Use computers and variety of software.	83.6	1.64	1.7
Collect, analyze and present/display field data.	80.1	1.65	4.2
Design scientific experiments/management studies.	70.5	1.88	7.6
Develop and maintain informational and other databases.	69.6	2.01	3.5
Review or critique scientific experiments/studies.	59.2	2.26	7.6
Develop and construct models.	30.1	2.81	21.5

SOCIO-ECONOMIC (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Evaluate use of aquatic resources, i.e. angler days.	59.1	2.15	15.9
Measure/assess public opinion, needs, satisfaction levels and knowledge.	50.9	2.37	12.0
Plan and/or manage public access to lakes and streams.	31.5	2.65	27.1
Determine the cost/benefit ratio for management alternatives.	39.7	2.69	19.5
Measure/assess values associated with aquatic resources.	39.9	2.74	17.4

NON-TECHNICAL (FISHERY)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Prepare administrative and technical reports, routine correspondence.	89.9	1.63	1.6
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating.)	78.7	1.83	3.0
Network with other professionals and agencies.	77.1	1.84	0.6
Manage multiple priorities and assess progress.	68.7	2.02	5.0
Conduct briefings or make presentations at various types of meetings.	71.1	2.04	1.4
Access current literature to maintain technical proficiency.	68.8	2.06	1.2
Liaison and coordinate activities with other agencies and various levels of government.	67.4	2.06	3.3
Apply problem solving techniques.	66.5	2.13	1.9
Recruit, interview, supervise, mentor and evaluate personnel.	63.6	2.16	6.3
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace).	59.5	2.26	3.5
Prepare and justify budget(s) - projecting financial and staffing needs.	52.2	2.33	9.5
Resolve conflict at various levels.	53.5	2.38	5.3
Work with mass media (i.e., newspapers, radio, tv.)	53.5	2.43	4.1
Package and promote ideas and programs.	51.2	2.44	6.5

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws.)	49.3	2.55	11.4
Manage inventories of supplies and equipment.	41.2	2.64	26.1
Plan/conduct various types of educational programs.	37.2	2.76	9.4
Author popular articles for newspaper and magazines.	34.2	2.80	12.4
Prepare and/or administer contracts.	28.1	2.87	24.9
Manage and maintain building(s) and other facilities.	23.9	2.94	26.1

PROFICIENCY LEVEL DATA FOR WILDLIFE BIOLOGISTS*
POPULATIONS

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Determine factors limiting wildlife populations.	73.4	1.90	5.1
Design and/or conduct surveys to identify and estimate wildlife populations and species diversity.	68.5	1.92	8.7
Monitor long term trends in populations.	71.1	1.93	6.0
Monitor and/or recommend harvest regulations.	69.1	1.93	12.6
Collect and analyze population characteristics i.e. age, sex, survival.	63.9	2.06	9.0
Conduct surveys to determine the distribution and/or movement of terrestrial species.	64.1	2.07	8.4
Determine wildlife population-habitat interactions and usage (i.e. territory, home range).	54.8	2.32	9.8
Assemble life history data and habitat requirements of terrestrial species.	53.4	2.33	10.7
Determine viable population levels for terrestrial species.	43.9	2.45	17.7
Manage animal damage (i.e., vertebrate pest control, predator removal).	40.9	2.55	15.8
Determine food habits of wildlife species.	30.6	2.81	12.7
Measure physiological indices/nutritional requirements of wildlife species.	23.8	2.93	27.1
Collect pathological material for analysis of disease or health.	25.3	2.95	17.0
Determine genotype/genetic variability in wildlife species.	13.6	3.15	45.2

HABITAT TASKS (WILDLIFE)

Task	Percent Prof. level	Mean	Percent NA
Make management recommendations to enhance, protect, or restore habitats.	83.5	1.58	3.1
Determine and evaluate habitat's present and potential capabilities.	77.8	1.75	4.0
Restore or enhance habitats to meet management objectives.	69.8	1.89	7.9
Determine & evaluate habitat relationships associated with land management activities.	70	1.93	6.1
Monitor projects, (i.e., habitat improvements) for prescribed implementation and desired change.	59.0	2.17	9.4
Identify plant species and communities.	61.6	2.21	5.8
Develop strategies to mitigate habitat loss.	59.7	2.21	13.0
Inventory and/or map wildlife habitats.	56.9	2.26	8.4
Plan for and manage habitat to maintain viable populations (T&E recovery plans).	51.5	2.30	14.3
Analyze landscapes to predict future conditions.	40.1	2.60	16.3
Plan and/or manage wildlife habitat demonstration area.	34.7	2.60	23.8
Inventory and/or map landscapes at ecosystem level.	34.9	2.68	18.8
Use habitat models to determine carrying capacity and to develop conservation strategies.	39.4	2.70	15.6
Collect and evaluate historical habitat data and monitor trends.	36.3	2.73	12.4
Monitor environmental contaminants.	17.0	3.08	40.3

INTRODUCTIONS/STOCKING (WILDLIFE)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Recommend stocking or reintroduction strategies.	36.7	2.66	20.5
Introduce/translocate species and evaluate impact.	34	2.67	24.6
Evaluate genetic impacts of stocking, reintroduction.	18.4	3.0	39.8

IMPACT ASSESSMENTS (WILDLIFE)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Review permit applications that may impact wildlife.	46.6	2.33	20.1
Determine the cumulative effects of impacts upon habitats, populations or ecosystems.	50.3	2.35	13.0
Conduct or evaluate environmental analysis or biological assessment.	43.8	2.50	15.8
Use models to predict responses of populations to management alternatives.	38.5	2.55	22.3
Investigate unusual or high profile (i.e., bear) wildlife kills/die offs.	37.5	2.64	17.2
Use models to predict outcomes of habitat modifications.	26	2.84	30.1

RESEARCH, DATA COLLECTION AND ANALYSIS (WILDLIFE)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Use computers and variety of software.	76.6	1.80	3.6
Collect, analyze and present/display field data.	68.6	1.95	5.9
Develop and maintain informational and other databases.	62.7	2.08	8.0
Design scientific experiments/management studies.	46.0	2.39	16.9
Develop and construct models.	28.6	2.78	29.2
Review or critique scientific experiments/management studies.	46.3	2.46	12.8

SOCIO-ECONOMIC (WILDIFE)

Task	Percent Prof. Level	Mean	Percent NA
Measure or assess public opinion, needs, satisfaction levels, and knowledge.	50.9	2.36	10.8
Plan and/or manage for public access.	42.6	2.48	16.8
Determine the cost/benefit of projects and/or management alternatives.	41.9	2.58	15.2
Estimate the demand for wildlife resources.	38.1	2.62	17.3
Measure the use of the wildlife resource, i.e., user days.	34.8	2.67	16.1
Measure or assess values associated with wildlife resources.	37.4	2.71	16.1

NON-TECHNICAL (WILDLIFE)

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Prepare administrative and technical reports.	84.6	1.68	0.5
Network with other professionals and agencies.	83.4	1.69	0.8
Liaison and coordinate activities with other agencies and various levels of government.	77.5	1.81	2.1
Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating).	72.9	1.91	2.7
Conduct briefings or make presentations at various types of meetings.	74.7	1.96	0.9
Manage multiple priorities and assess progress.	71.2	1.97	4.3
Apply problem solving techniques.	68.6	2.10	1.8
Access current literature to maintain technical proficiency.	66.5	2.10	1.5
Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace).	64.9	2.15	2.5
Prepare and justify budget(s) - projecting financial and staffing needs.	53.6	2.29	11.3
Resolve conflict at various levels.	55.5	2.30	6.5
Package and promote ideas and programs.	56.2	2.32	6.7
Recruit, interview, supervise, mentor and evaluate personnel.	52.5	2.32	10.8
Monitor trends issues, and regulations (i.e., agency policies, political developments, new laws.)	53.8	2.34	6.7

Task	Cumulative Percent (HI+MH)	Mean	Percent NA
Work with mass media (i.e., newspapers, radio, tv.).	56.0	2.35	3.3
Plan, conduct various types of educational programs.	45.4	2.55	8.4
Prepare and/or administer contracts.	38.3	2.60	19.1
Author popular articles for newspaper and magazines.	39.8	2.69	8.8
Manage inventories of supplies and equipment.	33.8	2.79	9.2
Manage and maintain building(s) and other facilities.	21.5	3.01	30.0

Appendix B

COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries

August 16, 1993

Mr. Henry M. Sakuda, Director
Hawaii Divison of Aquatic Resources
1151 Punchbowl Street
Honolulu, HI 96813

Dear Mr. Sakuda:

The International Association of Fish and Wildlife Agencies Education Committee, The American Fisheries Society and Virginia Polytechnic Institute and State University are cooperating in the undertaking of an extensive analysis of continuing education needs of state fisheries and wildlife biologists. The assessment should be helpful in planning more meaningful and productive continuing education programs.

The two parts of the analysis include:

1). **Organizational Analysis**
To identify the agency components that impact the planning of continuing education programs and

2). **Task Analysis**
To identify the knowledge, skills and abilities needed to improve the performance of particular job activities or tasks.

This survey will be sent to a random sample of state fisheries and wildlife biologists and supervisors.

Your help in completing the Organizational Analysis or directing it to the correct person in your agency will be most helpful to the Education Committee. It is being sent to each State Director. Please return it to Dr. Gerald Cross in the return envelope at your earliest convenience. I would like to have a preliminary report on the results available at our annual meeting.

Sincerely,

Bud Bristow

Bud Bristow
Director

4010 WEST BROAD STREET. P.O. BOX 11104. RICHMOND, VA 23230-1104
(804) 367-1000 (V TDD) *Equal Opportunity Employment, Programs and Facilities* FAX (804) 367-9147

Virginia Tech

Virginia Cooperative Extension

September 13, 1993

Dear Mr. Farris:

You recently received from Bud Bristow a letter (see attached) describing a study being conducted by Virginia Polytechnic Institute and State University in cooperation with the American Fisheries Society. The purpose of that research is to determine the continuing education needs of state fisheries and wildlife biologists.

This research has two components, an Organizational Analysis and a Task Analysis. As Bud mentioned, your help in completing the Organizational Analysis is critical. I have received half of the surveys initially sent out. If you have not yet completed this short survey, could you please do so at your earliest convenience, or forward to the appropriate person in your agency for completion.

If this "reminder" letter and your completed survey have passed each other in the mail, please discard this material. Thank you very much for your input into this needs assessment. I am sure that Bud will be communicating the results to you in the near future.

I might also alert you that I will be sending you, at Bud's suggestion, a list of 20 managerial/communication tasks that you will be asked to rate on proficiency levels needed for the job and the need for continuing education. The tasks will be on an opscan sheet and will take no more than 10 minutes of your time. This data will be analyzed along with the surveys being sent to 2,000 fish and wildlife biologists.

Thank you again for your cooperation in this study.

Sincerely,

William Murphy
Distance Education Specialist
Virginia Cooperative Extension
Department of Fisheries & Wildlife
Virginia Tech

Organizational Diagnosis Relative to Human Resource Development
At the Professional Level

From time to time organizations consider it important to analyze themselves. The focus of this self-analysis is in the area of professional development and training. Provided below are some statements that may relate to your organization. Please use the following scale to indicate the extent to which you agree with each statement by circling the appropriate number. Be open and honest. All data collected will be treated in confidence.

	Strongly Disagree 1 2 3 4 5 Strongly Agree
The goals of this organization are clearly stated.	1 2 3 4 5
The goals and priorities of this organization are understood by its employees.	1 2 3 4 5
The stated goals and priorities of this organization guide the allocation of financial resources.	1 2 3 4 5
The principle that the people of this organization are its greatest resource is widely supported.	1 2 3 4 5
In the budget development process, monies are targeted annually for professional development.	1 2 3 4 5
Training and professional development activities are planned and offered annually to employees.	1 2 3 4 5
Training and professional development plans are included in long-range strategic plans for the organization.	1 2 3 4 5
The benefits of training and professional development to the organization are understood by top management.	1 2 3 4 5
Guiding the professional development of staff is considered a priority of top management.	1 2 3 4 5
Supervisors are evaluated for carrying out effective staff training and development programs.	1 2 3 4 5
Training is being used to overcome organizational problems or conflicts.	1 2 3 4 5

Over Please

	Strongly Disagree 1	2	3	4	5 Strongly Agree
Training programs are set up in order to achieve short-term objectives.	1	2	3	4	5
Training and professional development efforts emphasize organizational needs.	1	2	3	4	5
Training and professional development needs emphasize individual needs.	1	2	3	4	5
This organization employs a training/staff development specialist.	1	2	3	4	5
This organization contracts for training activities.	1	2	3	4	5
Employment in this organization offers the employee training opportunities that promote personal growth.	1	2	3	4	5
Professional employee training needs are routinely assessed.	1	2	3	4	5
Professional employees in this organization are required to develop annual training plans.	1	2	3	4	5
Time is provided for employees to pursue professional development activities outside the organization.	1	2	3	4	5
Creativity and risk-taking are encouraged at all levels.	1	2	3	4	5
Professional employee training activities are developed with input from various levels of the organization.	1	2	3	4	5
The development of the organization's training program occurs at the supervisory level or higher.	1	2	3	4	5
Employees participating in training and development opportunities are rewarded during their performance appraisal.	1	2	3	4	5
Career planning and development are supported in this organization.	1	2	3	4	5
This organization is open to change.	1	2	3	4	5
Opportunities to attend training courses are used as rewards in this organization.	1	2	3	4	5
Employees are encouraged to attend training courses offered by persons or organizations external to this organization.	1	2	3	4	5

The following is a list of possible constraints to your organizations professional development activities. Please rate their importance.

	Not important (Low Constraint) 1 2 3 4 5 Very important (High Constraint)
Lack of a training specialist.	1 2 3 4 5
Budget dollars to provide activities and professional development support.	1 2 3 4 5
Time taken away from job to participate in training and professional development.	1 2 3 4 5
Travel constraints.	1 2 3 4 5
Personnel resistance to participate in training and professional development activities.	1 2 3 4 5
Other _____ _____	1 2 3 4 5
Other _____ _____	1 2 3 4 5

Please answer the following questions as completely as possible.

1. Please provide a PERCENT breakdown of your total budget ...
   Salary & Benefit dollars _____
   Other program dollars _____

2. Do you have dollars identified in the budget for staff development/training, OTHER THAN LAW ENFORCEMENT? YES NO

   If YES, what are the dollars expended per employee on training/professional development, OTHER THAN LAW ENFORCEMENT. _____

   If NO, PLEASE ESTIMATE what you think you spend per employee on training/staff development, OTHER THAN LAW ENFORCEMENT. _____

3. Please provide an overall ESTIMATE of the average number of days per year individual personnel are involved in training/professional development activities.

   _____ days/year/individual

4. Please provide a percentage estimate of training activities spent on:
   people/managerial skills _____ technical skills _____

VIRGINIA TECH COLLEGE OF FORESTRY AND WILDLIFE RESOURCES

The following is a component of a task analysis and continuing education needs assessment questionnaire sent to state fishery and wildlife biologists across the country. The tasks listed in this part of the survey relate to communication, interpersonal relations, management and leadership skills.

I would like for you, as administrators and upper level management, to respond to these tasks. Rate the proficiency levels required for the various tasks listed at the level **you** think your biologists need to fulfill their job requirements. Likewise, rate what **you** think is their need for continuing education relative to any of the listed tasks.

The responses are: **H** - High, **MH** - Medium High, **ML** - Medium Low, **L** - Low, and **NA** - task not relevant to the job and/or no continuing education needed. **Use a no. 2 pencil to mark your responses.**

52. Network with other professionals and agencies.
53. Liaison and coordinate activities with other agencies and various levels of government.
54. Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws).
55. Access current literature to maintain technical proficiency.
56. Work with mass media (i.e., newspapers, radio, tv.).
57. Conduct briefings or make presentations at various types of meetings.
58. Plan/conduct various types of educational programs.
59. Prepare administrative and technical reports, routine correspondence.
60. Author popular articles for newspaper and magazines.
61. Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating).
62. Package and promote ideas and programs.
63. Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace)
64. Apply problem solving techniques.
65. Recruit, interview, supervise, mentor and evaluate personnel.
66. Resolve conflict at various levels.
67. Manage multiple priorities and assess progress.
68. Prepare and justify budget(s) - projecting financial and staffing needs.
69. Manage inventories of supplies and equipment.
70. Manage and maintain building(s) and other facilities.
71. Prepare and/or administer contracts.

Thank You Very Much

OVER PLEASE

	PROF. LEVEL REQUIRED	CONT. ED. NEED
	HI ⟷ LO NA	HI ⟷ LO NA
47		
48		
49		
50		
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SATELLITE PROGRAMMING
217 HUTCHESON HALL
BLACKSBURG, VA 24061-0449
703/231-6941

February 1, 1993

1~ 2~
3~
4~
5~
6~

Dear 1~ 2~:

The professional development needs of practicing fisheries and wildlife biologists are in a constant state of change. New knowledge and skills are needed in order to accomplish on-the-job tasks. This whole area of lifelong learning, as it applies to biologists, is of particular interest to me and the Department of Fisheries and Wildlife at Virginia Tech.

I am in the process of developing a research instrument that will identify the tasks performed by state fisheries and wildlife biologists. This task analysis will then be used to identify continuing education needs. In order to disseminate that survey to a random population of biologists, I need your help.

Could you please provide me with a personnel list of biologists in your organization, consisting of names, addresses, and job titles. If you can include specific job descriptions for those biologists, that would be most helpful.

These lists will be compiled and biologists will be randomly surveyed. The rosters will be kept confidential and only used for this survey.

Your timely response would be greatly appreciated. In return, I will share the results with you and alert you to any possible professional development opportunities that result from this research.

Please send the information to the address at the top of this letter. Thank you in advance for your assistance in this matter.

Sincerely,

William Murphy
Distance Education Specialist, VCE
Dept. of Fisheries & Wildlife, Virginia Tech

Virginia Cooperative Extension

Virginia Tech

Office of Distance Education/Satellite Programming
Virginia Polytechnic Institute and State University
217 Hutcheson Hall
Blacksburg, Virginia 24061-0449
703/231-6941 FAX: 703/231-4163
murph@vtvm1.cc.vt.edu

Chris Sample
Rt. 8, Box 5A
Florence, SC 29501

Dear Chris Sample:

I am in the process of designing a survey instrument to assess the continuing education needs of state fisheries biologists. A task analysis approach is being used to determine the continuing education needs that will be related to the performance of particular activities or job operations.

Task analysis begins with a task description of the activity or work operation performed on the job. Once the tasks are identified, a questionnaire will be sent to a national sample of state biologists to determine the relevance of the identified tasks to their jobs and the need for continuing education.

YOUR HELP IS NEEDED! Through a variety of methodologies, I have assembled a preliminary list of tasks related to fisheries management. It is critical that practicing fisheries biologists have input into the final review and revision process. Would you take the time and analyze the enclosed list of tasks? Please feel free to add (or delete) tasks and write specific comments you deem appropriate.

Please realize that tasks can be broken down into such small components that a task overload could occur! The result would be an unmanageable survey instrument with too many tasks listed and poor survey return rates. Use your best judgement on the specificity of the tasks.

WRITE ALL SUGGESTIONS, ETC. ON THE ENCLOSED LIST. ALSO IDENTIFY WHO YOU ARE WHEN RETURNING YOUR ANALYSIS (REASON LISTED BELOW!)

I need a timely and well-thought out response from you. Those professionals returning their survey input to me by August 18 will receive the new AFS Fisheries Management Book when it becomes available.

Thank you in advance for you valuable contribution to the development of this survey.

Sincerely,

William Murphy
Distance Education Specialist, VCE
Dept. of Fisheries & Wildlife, Virginia Tech

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

October 8, 1993

Ron Michaels
108 Darling Avenue
Waycross GA 31501

Dear Ron:

The International Association of Fish and Wildlife Agencies' Education Committee, the American Fisheries Society, and Virginia Polytechnic Institute & State University are cooperating in an extensive analysis of the continuing education needs of state agency fish and wildlife biologists. As your job becomes more complex, you may need additional skills and knowledge. Becoming involved in life-long learning becomes a necessary strategy to maintain professional competence.

Input for enhancing professional development may come from many sources, but none more important than you, the practicing biologist. This study will use task analysis methodology to assess continuing education needs. Your colleagues from around the country have assisted in the development of this questionnaire and were instrumental in editing the tasks to a manageable number.

You have been selected from a random sample of all state agency biologists to provide input and identify professional development needs. You may be assured of complete confidentiality. The enclosed obscan sheet has an identification number for mailing purposes only, so that your name can be checked off when the questionnaire is returned. The results of this research will be shared with state agencies. However, they will not know who participated in this research.

Please take a few minutes to complete the questionnaire and return in the enclosed envelope. I know you will want to take advantage of this opportunity to help identify professional development needs. As an added incentive, those returning questionnaires by October 26 will be eligible for a chance to win one of four $100 gift certificates from L.L. Bean.

Thank you for your assistance.

Sincerely,

William Murphy
Distance Education Specialist
Virginia Cooperative Extension
Fisheries and Wildlife Department

November 5, 1993

1001
William Sharick
Rt 10 Jefferson Rd, HC 01
Stamford NY 12167-9503

Dear William:

About four weeks ago, I wrote to you seeking your input on assessing the continuing education needs of professional fish and wildlife biologists. As of today we have not yet received your completed questionnaire.

This study, in cooperation with the International Association of Fish and Wildlife Agencies' Education Committee, the American Fisheries Society, and Virginia Polytechnic Institute and State University, will help identify additional skills and knowledge you may need to maintain your professional competence. In addition, the data collected will assist in the development of life-long learning strategies that you, the practicing biologists, might employ.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. Your name was selected through a carefully designed sampling process of state agency biologists nationwide. In order for the results of this study to be truly representative of the opinions of your peers, it is essential that each person in the sample return their questionnaire.

In the event that your questionnaire has been misplaced, a replacement is enclosed.

Your contribution to the success of this study is greatly appreciated.

Sincerely,

William Murphy
Distance Education Specialist
Virginia Cooperative Extension
Fisheries and Wildlife Department

VIRGINIA TECH *COLLEGE OF FORESTRY AND WILDLIFE RESOURCES*

This instrument lists various tasks that are executed by **fisheries biologists.** The intent is to identify proficiency levels needed to perform specific tasks and determine demands for continuing education. For each task listed indicate the proficiency level needed in your job and the need for continuing education. The responses are: **H** - High, **MH** - Medium High, **ML** - Medium Low, **L** - Low, and **NA** - task not relevant to my job and/or no continuing education needed. **Use a no. 2 pencil to mark your responses.**

Please answer the following questions related to your position.

1. Select the title that BEST describes your position.
   1. fishery biologist (assigned to specific area, lake, etc.), **2.** fishery biologist (multi-county/regional) **3.** research biologist **4.** supervisory biologist **5.** fish culturist or hatchery biologist **6.** game species biologist (i.e.,trout, walleye) **7.** non-game species biologist (i.e., other vertebrates or invertebrates, mussels, T&E) **8.** environmental specialist **9.** education specialist **10.** other

2. Total years of professional employment in Fisheries.
   1. less than 5 years **2.** 5-9 years **3.** 10-14 years **4.** 15-19 years **5.** 20+ years

3. Formal Education (highest level attained)
   1. Associate degree **2.** Bachelors **3.** Masters **4.** Doctorate

4. Undergraduate Major (If double major, select one)
   1. Fisheries/Aquatic Sciences **2.** Wildlife **3.** Biology/Zoology **4.** Water Resource Mgmt. **5.** Ecology **6.** Environmental Science **7.**Forestry **8.** Range Mgmt. **9.** Other

5. Graduate Major
   1. Fisheries/Aquatic Sciences **2.** Wildlife **3.** Biology/Zoology **4.** Water Resource Mgmt. **5.** Ecology **6.** Environmental Science **7.** Forestry **8.** Range Mgmt. **9.** Other

6. Find the state in which you are employed and select number.
   1. HI CA NV ID OR WA **2.** AZ NM TX OK **3.** MN JA MO WI IL IN OH MI **4.** AR LA MS AL GA FL TN KY NC SC PR **5.** VA WV DE PA NJ CT RI MA NY NH VT ME **6.** ND SD NE KS CO UT WY MT **7.** AK

		PROF. LEVEL REQUIRED	CONT. ED. NEED
		HI ⟷ LO NA	HI ⟷ LO NA
	POPULATIONS		
1.	Conduct surveys to determine the distribution and movement of aquatic species.		
2.	Assemble life history data and habitat requirements of aquatic species.		
3.	Design and conduct surveys to identify aquatic species and estimate aquatic populations.		
4.	Determine factors limiting aquatic populations.		
5.	Collect and analyze population characteristics, i.e. age and growth, sex, survival and mortality.		
6.	Monitor macro-invertebrate and other populations.		
7.	Determine food habits of aquatic species.		
8.	Measure physiological indices of fish species.		
9.	Plan, coordinate and implement renovation projects (fish eradication, repopulation, etc.).		
10.	Monitor and/or recommend harvest regulations.		
11.	Establish genotypes of fish/determine genetic variability.		
12.	Manage animal damage.		
	HABITAT		
13.	Determine and evaluate habitat's present and potential capabilities.		
14.	Restore, enhance or protect habitats to meet management objectives.		
15.	Plan and manage aquatic habitats to maintain viable populations (T&E recovery plans).		
16.	Measure and evaluate habitat changes associated with land management activities.		
17.	Use habitat models to determine carrying capacity and to develop conservation strategies.		
18.	Monitor projects, such as habitat improvements, for prescribed implementation and desired change.		
19.	Collect and evaluate historical habitat data.		
20.	Develop strategies to mitigate habitat loss.		

OVER PLEASE

A 0 1 2 3 4 5 6 7 8 9 B 0 1 2 3 4 5 6 7 8 9 C 0 1 2 3 4 5 6 7 8 9

		PROF. LEVEL REQUIRED	CONT. ED. NEED
		HI ⟷ LO NA	HI ⟷ LO NA
21	21. Inventory and/or map lentic aquatic habitats.	HI MH ML LO NA	HI MH ML LO NA
22	22. Inventory and/or map lotic aquatic habitats.	HI MH ML LO NA	HI MH ML LO NA
23	23. Inventory and/or map landscapes at ecosystem level.	HI MH ML LO NA	HI MH ML LO NA
24	24. Control aquatic vegetation.	HI MH ML LO NA	HI MH ML LO NA
25	25. Measure and assess stream flows.	HI MH ML LO NA	HI MH ML LO NA
26	26. Monitor environmental contaminants.	HI MH ML LO NA	HI MH ML LO NA
27	PROPAGATION AND STOCKING	HI MH ML LO NA	HI MH ML LO NA
28	27. Collect and handle fish for propagation or stocking.	HI MH ML LO NA	HI MH ML LO NA
	28. Propagate and care for fish in hatchery situation (spawning, incubation, egg care, etc.)		
	29. Develop fish health management practices/policies.		
29	30. Recognize and treat infections and diseases.	HI MH ML LO NA	HI MH ML LO NA
30	31. Develop stocking schedules and fish transportation.	HI MH ML LO NA	HI MH ML LO NA
31	32. Recommend/evaluate stocking performance and strategies.	HI MH ML LO NA	HI MH ML LO NA
32	33. Evaluate genetic impacts of stocking.	HI MH ML LO NA	HI MH ML LO NA
33	34. Evaluate history/monitor impacts of exotic species stocking.	HI MH ML LO NA	HI MH ML LO NA
34	IMPACT ASSESSMENTS	HI MH ML LO NA	HI MH ML LO NA
35	35. Use models to predict outcomes of habitat modifications.	HI MH ML LO NA	HI MH ML LO NA
36	36. Use models to predict responses of populations to management alternatives.	HI MH ML LO NA	HI MH ML LO NA
37	37. Determine the cumulative effects of impacts upon habitats and/or population.	HI MH ML LO NA	HI MH ML LO NA
	38. Conduct and/or evaluate environmental analysis or biological assessment.		
	39. Review permit applications that may impact the aquatic resource.		
38	40. Investigate fish kills.	HI MH ML LO NA	HI MH ML LO NA
39	RESEARCH, DATA COLLECTION AND ANALYSIS	HI MH ML LO NA	HI MH ML LO NA
40	41. Use computers and variety of software.	HI MH ML LO NA	HI MH ML LO NA
41	42. Collect, analyze and present/display field data.	HI MH ML LO NA	HI MH ML LO NA
42	43. Develop and construct models.	HI MH ML LO NA	HI MH ML LO NA
43	44. Design scientific experiments/management studies.	HI MH ML LO NA	HI MH ML LO NA
44	45. Review or critique scientific experiments/studies.	HI MH ML LO NA	HI MH ML LO NA
45	46. Develop and maintain informational and other databases.	HI MH ML LO NA	HI MH ML LO NA
46		HI MH ML LO NA	HI MH ML LO NA

(Please Continue on Sheet 2)

SHEET 2 *VIRGINIA TECH COLLEGE OF FORESTRY AND WILDLIFE RESOURCES*

		PROF. LEVEL REQUIRED	CONT. ED. NEED
		HI ⟷ LO NA	HI ⟷ LO NA
	(Fisheries Continued) SOCIO-ECONOMIC	47	
47.	Determine the cost/benefit ratio for management alternatives.	48	
48.	Measure/assess values associated with aquatic resources.	49	
49.	Measure/assess public opinion, needs, satisfaction levels and knowledge.	50	
50.	Plan and/or manage public access to lakes and streams.	51	
51.	Evaluate use of aquatic resources, i.e. angler days.	52	
	The previous list described tasks that require technical skills. The following are tasks that relate to communication, interpersonal relations, management and leadership skills.	53	
52.	Network with other professionals and agencies.	54	
53.	Liaison and coordinate activities with other agencies and various levels of government.	55	
54.	Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws).	56	
55.	Access current literature to maintain technical proficiency.	57	
56.	Work with mass media (i.e., newspapers, radio, tv.).	58	
57.	Conduct briefings or make presentations at various types of meetings.	59	
58.	Plan/conduct various types of educational programs.	60	
59.	Prepare administrative and technical reports, routine correspondence.	61	
60.	Author popular articles for newspaper and magazines.	62	
61.	Develop and administer plans of work (i.e., setting goals and objectives, developing strategies, implementing and evaluating).	63	
62.	Package and promote ideas and programs.	64	
63.	Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace)	65	
64.	Apply problem solving techniques.	66	
65.	Recruit, interview, supervise, mentor and evaluate personnel.	67	
66.	Resolve conflict at various levels.	68	
67.	Manage multiple priorities and assess progress.	69	
68.	Prepare and justify budget(s) - projecting financial and staffing needs.	70	
69.	Manage inventories of supplies and equipment.	71	
70.	Manage and maintain building(s) and other facilities.	72	
71.	Prepare and/or administer contracts.	73	
		74	

THANK YOU VERY MUCH FOR YOUR HELP!

OVER PLEASE

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VIRGINIA TECH *COLLEGE OF FORESTRY AND WILDLIFE RESOURCES*

This instrument lists various tasks that are executed by **wildlife biologists.** The intent is to identify proficiency levels needed to perform specific tasks and determine demands for continuing education. For each task listed indicate the proficiency level needed in your job and the need for continuing education. The responses are: H - High, MH - Medium High, ML - Medium Low, L - Low, and NA - task not relevant to my job and/or no continuing education needed. Use a no. 2 pencil to mark your responses.

Please answer the following questions related to your position.

1. Select the title that BEST describes your position.
   1. wildlife biologist (assigned to specific management area) 2. wildlife biologist (multi-county/regional) 3. research biologist 4. supervisory biologist 5. game species biologist (i.e., bear, upland game, waterfowl, etc.) 6. non-game species biologist (including T&E) 7. education specialist 8. environmental specialist 9. other

2. Total years of professional employment in Wildlife.
   1. less than 5 years 2. 5-9 years 3. 10-14 years 4. 15-19 years 5. 20+ years

3. Formal Education (highest level attained)
   1. Associate degree 2. Bachelors 3. Masters 4. Doctorate

4. Undergraduate Major (If double major, select one)
   1. Fisheries/Aquatic Sciences 2. Wildlife 3. Biology/Zoology 4. Water Resource Mgmt. 5. Ecology 6. Environmental Science 7.Forestry 8. Range Mgmt. 9. Other

5. Graduate Major
   1. Fisheries/Aquatic Sciences 2. Wildlife 3. Biology/Zoology 4. Water Resource Mgmt. 5. Ecology 6. Environmental Science 7. Forestry 8. Range Mgmt. 9. Other

6. Find the state in which you are employed and select number.
   1. HI CA NV ID OR WA 2. AZ NM TX OK 3. MN JA MO WI IL IN OH MI 4. AR LA MS AL GA FL TN KY NC SC PR 5. VA WV DE PA NJ CT RI MA NY NH VT ME 6. ND SD NE KS CO UT WY MT 7. AK

POPULATIONS

1. Conduct surveys to determine the distribution and/or movement of terrestrial species.
2. Assemble life history data and habitat requirements of terrestrial species.
3. Monitor long term trends in populations.
4. Design and/or conduct surveys to identify and estimate wildlife populations and species diversity.
5. Determine viable population levels for terrestrial species.
6. Determine factors limiting wildlife populations.
7. Collect and analyze population characteristics i.e. age, sex, survival.
8. Determine food habits of wildlife species.
9. Measure physiological indices/nutritional requirements of wildlife species.
10. Monitor and/or recommend harvest regulations.
11. Determine wildlife population-habitat interactions and usage (i.e. territory, home range).
12. Manage animal damage (i.e.,vertebrate pest control, predator removal).
13. Collect pathological material for analysis of disease or health.
14. Determine genotype/genetic variability in wildlife species.

HABITAT

15. Determine and evaluate habitat's present and potential capabilities.
16. Make management recommendations to enhance, protect, or restore habitats.
17. Restore or enhance habitats to meet management objectives.
18. Plan for and manage habitat to maintain viable populations (T & E recovery plans).
19. Monitor projects, (i.e., habitat improvements) for prescribed implementation and desired change.
20. Determine and evaluate habitat relationships associated with land management activities.

OVER PLEASE

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		PROF. LEVEL REQUIRED (HI ⟷ LO NA)	CONT. ED. NEED (HI ⟷ LO NA)
1		HI MH ML LO NA	HI MH ML LO NA
2		HI MH ML LO NA	HI MH ML LO NA
3		HI MH ML LO NA	HI MH ML LO NA
4		HI MH ML LO NA	HI MH ML LO NA
5		HI MH ML LO NA	HI MH ML LO NA
6		HI MH ML LO NA	HI MH ML LO NA
7		HI MH ML LO NA	HI MH ML LO NA
8		HI MH ML LO NA	HI MH ML LO NA
9		HI MH ML LO NA	HI MH ML LO NA
10		HI MH ML LO NA	HI MH ML LO NA
11		HI MH ML LO NA	HI MH ML LO NA
12		HI MH ML LO NA	HI MH ML LO NA
13		HI MH ML LO NA	HI MH ML LO NA
14		HI MH ML LO NA	HI MH ML LO NA
15		HI MH ML LO NA	HI MH ML LO NA
16		HI MH ML LO NA	HI MH ML LO NA
17		HI MH ML LO NA	HI MH ML LO NA
18		HI MH ML LO NA	HI MH ML LO NA
19		HI MH ML LO NA	HI MH ML LO NA
20		HI MH ML LO NA	HI MH ML LO NA

		PROF. LEVEL REQUIRED	CONT. ED. NEED
		HI ⟷ LO NA	HI ⟷ LO NA
21.	Identify plant species and communities.	21 HI MH ML LO NA	HI MH ML LO NA
22.	Use habitat models to determine carrying capacity and to develop conservation strategies.	22 HI MH ML LO NA	HI MH ML LO NA
23.	Collect and evaluate historical habitat data and monitor trends.	23 HI MH ML LO NA	HI MH ML LO NA
24.	Analyze landscapes to predict future conditions.	24 HI MH ML LO NA	HI MH ML LO NA
25.	Develop strategies to mitigate habitat loss.	25 HI MH ML LO NA	HI MH ML LO NA
26.	Inventory and/or map wildlife habitats.	26 HI MH ML LO NA	HI MH ML LO NA
27.	Inventory and/or map landscapes at ecosystem level.	27 HI MH ML LO NA	HI MH ML LO NA
28.	Plan and/or manage wildlife habitat demonstration area.	28 HI MH ML LO NA	HI MH ML LO NA
29.	Monitor environmental contaminants.	29 HI MH ML LO NA	HI MH ML LO NA
	INTRODUCTIONS/STOCKING		
30.	Recommend stocking or reintroduction strategies.	30 HI MH ML LO NA	HI MH ML LO NA
31.	Introduce/translocate species and evaluate impact.	31 HI MH ML LO NA	HI MH ML LO NA
32.	Evaluate genetic impacts of stocking, reintroduction.	32 HI MH ML LO NA	HI MH ML LO NA
33.	Recommend stocking or re-introduction strategies.	33 HI MH ML LO NA	HI MH ML LO NA
	IMPACT ASSESSMENTS		
34.	Use models to predict outcomes of habitat modifications.	34 HI MH ML LO NA	HI MH ML LO NA
35.	Use models to predict responses of populations to management alternatives.	35 HI MH ML LO NA	HI MH ML LO NA
36.	Determine the cumulative effects of impacts upon habitats, populations or ecosystems.	36 HI MH ML LO NA	HI MH ML LO NA
37.	Conduct or evaluate environmental analysis or biological assessment.	37 HI MH ML LO NA	HI MH ML LO NA
38.	Review permit applications that may impact wildlife.	38 HI MH ML LO NA	HI MH ML LO NA
39.	Investigate unusual or high profile (i.e., bear) wildlife kills/die offs.	39 HI MH ML LO NA	HI MH ML LO NA
	RESEARCH, DATA COLLECTION AND ANALYSIS		
40.	Use computers and variety of software.	40 HI MH ML LO NA	HI MH ML LO NA
41.	Collect, analyze and present/display field data.	41 HI MH ML LO NA	HI MH ML LO NA
42.	Develop and construct models.	42 HI MH ML LO NA	HI MH ML LO NA
43.	Design scientific experiments/management studies.	43 HI MH ML LO NA	HI MH ML LO NA
44.	Review or critique scientific experiments/management studies.	44 HI MH ML LO NA	HI MH ML LO NA
45.	Develop and maintain informational and other databases.	45 HI MH ML LO NA	HI MH ML LO NA
	SOCIO-ECONOMIC		
46.	Determine the cost/benefit of projects and/or management alternatives.	46 HI MH ML LO NA	HI MH ML LO NA

CP93-0396 (C2-VP)

SHEET 2 *VIRGINIA TECH COLLEGE OF FORESTRY AND WILDLIFE RESOURCES*

(Wildlife Continued)

		PROF. LEVEL REQUIRED	CONT. ED. NEED
		HI ⟷ LO NA	HI ⟷ LO NA
47.	Measure or assess values associated with wildlife resources.	47	
48.	Measure or assess public opinion, needs, satisfaction levels, and knowledge.	48	
49.	Plan and/or manage for public access.	49	
50.	Measure the use of wildlife resource, i.e. user days.	50	
51.	Estimate the demand for wildlife resources.	51	

The previous list described tasks that require technical skills. The following are tasks that relate to communication, interpersonal relations, management and leadership skills.

52.	Network with other professionals and agencies.	52	
53.	Liaison and coordinate activities with other agencies and various levels of government.	53	
54.	Monitor trends, issues, and regulations (i.e., agency policies, political developments, new laws).	54	
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58.	Plan/conduct various types of educational programs.	58	
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63.	Participate in various group processes (i.e., decision making, team building, interdisciplinary planning, working in a diverse workplace)	63	
64.	Apply problem solving techniques.	64	
65.	Recruit, interview, supervise, mentor and evaluate personnel.	65	
66.	Resolve conflict at various levels.	66	
67.	Manage multiple priorities and assess progress.	67	
68.	Prepare and justify budget(s) - projecting financial and staffing needs.	68	
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70.	Manage and maintain building(s) and other facilities.	70	
71.	Prepare and/or administer contracts.	71	
		72	
		73	
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OVER PLEASE

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VITA

William F. Murphy was born in Cleveland, Ohio on June 16, 1949. He was raised in Cleveland, and graduated from St. Ignatius High School in 1967. He attended Baldwin-Wallace College in Berea, Ohio and graduated with a B.S. in Biology in 1971. He moved to Blacksburg, Virginia to begin graduate studies at Virginia Polytechnic Institute and State University and received his M.S. degree in Fisheries and Wildlife Sciences in 1973.

He taught high school science and chaired the Science Department at North Cross School in Roanoke, Virginia from 1973 until 1977. In September, 1977, he was employed by the Virginia Cooperative Extension Service as an Extension Agent in Floyd County, Virginia. In 1982, he joined the faculty at Virginia Polytechnic Institute and State University as Assistant Director of Resident Instruction in the College of Agriculture and Life Sciences. In 1984, he was named Extension Specialist in Computing Resources. In 1987, he was appointed Satellite Program Coordinator and Distance Education Specialist for Virginia Cooperative Extension.

William married Marcia Miller in 1971. They have two children, Geoffrey, age 18 and Benjamin, age 14.