

Educational background and professional participation by federal wildlife biologists: implications for science, management, and The Wildlife Society

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Abstract Over 2,000 people are employed in wildlife biology in the United States federal government. The size of this constituency motivated me to examine the amount of formal education federal biologists have received and the extent of continuing education they undertake by reading journals or attending scientific meetings. Most federal biologists who are members of The Wildlife Society (TWS) have a graduate degree. However, one-third have only a Bachelor of Science degree, despite the current trend toward hiring people with graduate degrees. Most federal biologists are not research biologists. Numbers of journals subscribed to was positively related to educational level. Less than one-third of all wildlife biologists employed by the United States Fish and Wildlife Service are members of TWS or subscribe to any of its journals. In contrast, the majority of presenters at the TWS 2000 Annual Conference were research biologists and members of TWS. The failure of many federal wildlife biologists to read scientific literature or attend professional meetings indicates a failure to promote the importance of continuing education in the federal workplace. I identify 2 potential adverse impacts of this failing: an inability to recognize important and relevant scientific contributions and an ineffectiveness in carrying out adaptive management.

Key words continuing education, journal subscription, statistics, The Wildlife Society, United States Fish and Wildlife Service, wildlife biologist

Wildlife managers have a continual need for reliable ecological knowledge (Romesberg 1981, Nudds and Morrison 1991). That knowledge emanates from a scientific process that includes *a priori* hypotheses, well-designed studies, appropriate analyses, and biological interpretation of results. Not every biologist carries out all these scientific steps on a daily basis because only a minority of wildlife biologists have an explicit research function. Nonetheless, every wildlife biologist does (or should) use components of this process on a regu-

lar basis; identifying knowledge gaps hindering management is a precursory step in generating testable hypotheses, and understanding relevant research results can lead to modifications of management practices.

We might expect the performance of this scientific process in federal agencies to be influenced by the current knowledge level of federal wildlife biologists. I assumed that scientific currency was affected by past formal education and continuing education, through attendance at professional

meetings and reading journal articles. With this assumption, I examined highest education attained, meeting attendance, and frequency of subscription to technical journals among federal wildlife biologists. My focus was limited to meetings and journals sponsored by The Wildlife Society (TWS). I recognize that many capable and scientifically current biologists go to meetings, belong to societies, and read journals from organizations other than TWS. Nonetheless, I believe these measures of professional participation (TWS meeting attendance, membership, and journal subscription) serve as useful indicators of the overall level of scientific awareness among federal wildlife biologists.

My intent was to identify the extent these 3 forums for scientific learning are used by wildlife biologists employed by the United States federal government. I had several specific objectives in building a federal profile. The first was simply to describe numbers of wildlife biologists employed in federal governmental departments, and enumerate how well represented these departments were at the September 2000 Annual Conference of TWS. A second objective was to use the TWS membership directory to compare education levels of TWS members to type of employer, type of job, and the extent to which they receive TWS journals. Finally, I examined the extent to which wildlife biologists employed by the United States Fish and Wildlife Service (USFWS) are members of TWS.

Methods

All data collection consisted of extracting or synthesizing relevant information already assimilated by others. To describe numbers of employees in various federal departments, I examined links within the United States Office of Personnel Management's (USOPM) website, particularly employee statistics in USOPM (2000). In the federal government, specific jobs are grouped into occupational series, and I examined the Wildlife Biology and Wildlife Refuge Management series. Within occupational series, there are many job titles, the most common and pertinent of which I discuss more explicitly below.

I received an electronic membership directory from TWS containing information members provide when subscribing, such as employer, type of position, and highest attained degree of education. This directory allowed me to examine relationships among education and type of journal subscriptions,

research versus management positions, and whether federal biologists had similar educational backgrounds to biologists employed elsewhere. I ranked degree of education on a 1 to 5 scale corresponding to 5 degrees: 1 = High School, 2 = Associate, 3 = Bachelor, 4 = Master, and 5 = Doctorate. The category Other is also used by TWS, but for the purposes of this paper I eliminated this infrequently used category. This ordinal ranking allowed me to calculate mean level of education by job type. There are 4 categories of journal subscriptions for TWS members, which grade from none to all journals: those that receive just *The Wildlifer* newsletter; those that receive *The Wildlifer* and the *Wildlife Society Bulletin*; those that receive *The Wildlifer*, *The Journal of Wildlife Management*, and *Wildlife Monographs*; and those that receive all TWS publications.

To accomplish the third objective (percentage of USFWS biologists who are members of TWS), I contacted each geographic region of the USFWS and requested lists of all their personnel with associated job titles. I then restricted my analysis to the following job titles: Wildlife Biologist, Supervisory or Senior Wildlife Biologist, Biologist, and General Biologist. This set included the most common positions with "biologist" in their title, and I assumed these jobs were most likely to involve substantive biological work with wildlife species. I also included Refuge Managers because they have direct influence on research, monitoring, and management of wildlife species occurring on refuge lands.

I cross-referenced personnel lists with membership directories from TWS to determine what percent of biologists (or refuge managers) were members. Two of 7 regions of the USFWS (Pacific and Southwest) were unable to provide me with listings of their personnel by job title. For the most common job title, Wildlife Biologist, I further examined whether percent of professional society membership varied among the 5 sampled geographic regions.

Results

As of September 30, 1999, the United States federal government employed 2,248 people in the Wildlife Biology occupational series. Virtually identical numbers of biologists were employed by the Department of Interior (46%) and Department of Agriculture (46%), with the small remainder employed by the Department of Defense (5%) and

Table 1. Number of United States federal employees who were senior or junior authors of oral presentations at the September 2000 Annual Conference of The Wildlife Society, Nashville, Tennessee, USA. A total of 309 presentations were scheduled for the conference.

| Federal agency or bureau-federal department | Number |
|--|--------|
| Geological Survey ^a -Interior | 41 |
| Forest Service-Agriculture | 20 |
| Fish and Wildlife Service-Interior | 10 |
| Animal and Plant Health Inspection Service-Agriculture | 10 |
| National Park Service-Interior | 4 |
| Army-Defense | 1 |
| Total | 86 |

^a All employees of the Geological Survey were from the Biological Resources Division of that agency.

the Department of Commerce (1%). An additional 653 people were employed in the Wildlife Refuge Management occupation (all in the Department of Interior).

Federal biologists were frequent contributors to TWS's Annual Conference: 28% of oral presentations at the 2000 Nashville, Tennessee meeting listing a federal employee as senior or junior author (Table 1). The United States Geological Survey was the most frequently represented federal agency (15% of all presentations). Seventy-five percent of all senior authors were members of TWS.

Among TWS members, federal biologists ranked third (behind university and nonprofit employers) in average degree of education (Table 2). More than 60% of all TWS members identified their current job positions as either management (36%) or research (25%) from a set of 10 choices. Biologists

Table 2. Highest level of educational degree attained by regular members of TWS, sorted by current employer. Percentages refer to various degree categories within employers. Data do not include student, retired, lifetime, or honorary members, nor the 5.6% of members who did not provide employer information.

| Employer | Highest Degree (%) | | | |
|------------------------|--------------------------|----------|--------|-----------|
| | High school or associate | Bachelor | Master | Doctorate |
| University | 3 | 17 | 24 | 57 |
| Nonprofit organization | 2 | 28 | 42 | 29 |
| Federal | 1 | 33 | 45 | 21 |
| State or Province | 1 | 33 | 53 | 13 |
| Consulting firm | 1 | 36 | 50 | 13 |
| Other | 5 | 40 | 37 | 18 |
| Corporation | 4 | 41 | 41 | 15 |

Table 3. Relationship between degree of education and type of subscription among regular members of TWS.

| Subscription type | Highest Degree (%) | | | |
|---|--------------------------|----------|--------|-----------|
| | High school or associate | Bachelor | Master | Doctorate |
| <i>The Wildlifer</i> newsletter | 10 | 39 | 38 | 13 |
| <i>Wildlife Society Bulletin</i> | 4 | 34 | 45 | 17 |
| <i>The Journal of Wildlife Management and Wildlife Monographs</i> | 5 | 33 | 38 | 24 |
| All 4 TWS publications | 3 | 25 | 41 | 31 |

identifying themselves in management positions had less education than those in research positions (educational rank of 3.72 versus 4.25). Type of journal subscriptions TWS members received was related to degree of education (Table 3). Those with the most education subscribed to the most journals, whereas those with the least education had the greatest frequency of receiving only the society newsletter and no journals; 36% of all members and 33% of regular members received just the newsletter.

Within 5 of the 7 USFWS regions, 27% of biologists and refuge managers were TWS members (Table 4). For those explicitly identified as Wildlife Biologists, only 30% were TWS members. TWS membership rates by Wildlife Biologists varied among geographic regions as follows: Great Lakes-Big Rivers (17%), Southeast (27%), Alaska (31%), Mountain-Prairie (36%), and Northeast (39%).

Discussion

The federal profile

The large number of federal wildlife biologists connotes importance to considering their educational and employment experience. Most (66%)

Table 4. Number and percent of biologists and refuge managers in the USFWS who are members of TWS. Data reflect the most frequent, but not all, job titles containing "biologist." Five of 7 geographic regions of the USFWS contributed data.

| Job Title | Members n (%) | Nonmembers n (%) |
|--|------------------|---------------------|
| Wildlife Biologist | 93 (30) | 213 (70) |
| Supervisory/Senior Wildlife Biologist | 8 (61) | 5 (39) |
| Biologist or General Biologist | 13 (21) | 49 (79) |
| Refuge Manager | 33 (21) | 153 (79) |
| Total | 147 (26) | 420 (74) |

federal biologists who were TWS members had a graduate degree, with a Master of Science degree more than twice as common as a Ph.D., and one-third had only a Bachelor of Science degree. Less than one-third of federal biologists in the USFWS belonged to TWS, and I did not survey educational background of nonmembers. It seems likely that the large proportion of wildlife biologists who were not TWS members read less literature published by TWS than did members.

Despite the large number of federal biologists with just Bachelors degrees, most new hires have graduate degrees (Robertson and Nudds 2000) and research positions now consistently require a doctorate (Janik and Radloff 2000). Graduate training not only provides greater formal training in science; it also likely instills an enhanced proclivity toward maintaining scientific knowledge through continuing education, such as attending meetings and reading literature. Maintaining scientific currency is valuable, as otherwise paradigm shifts may go undetected and biologists may employ methods and knowledge garnered as students that are outdated and have been supplanted by improved methods and new knowledge.

Continuing education

Reading journals and attending professional meetings are 2 important forms of continuing education available to wildlife biologists. There are, however, several other forms. If a biologist is co-located with a university, there is the traditional process of taking a relevant semester class. In lieu of this option, more specific, more intensive, and shorter-duration instruction is often desired, and workshops of a week or less are common. The USFWS sponsors a broad set of such workshops at its National Conservation Training Center in West Virginia, and other ecologically or statistically oriented workshops are available from some universities and private organizations.

The internet has created many new opportunities for continuing education. Entire sets of course materials for many classes are being posted on university websites. These allow less time-structured, more user-specific learning to occur. More-structured learning could occur as video capabilities (Calamaio 1999) improve and become standard on personal computers, and internet connections become faster. People will have potential to take classes remotely, but in real time with instructor interaction. To achieve wide use, all these continu-

ing-education options require that federal supervisors promote their use.

I note that the internet is not a panacea for those lacking scientific knowledge. Rather, it simply is a means to sometimes more efficiently acquire new knowledge. Many ecological journals now offer electronic, internet-accessible journal subscriptions. However, one still needs to log on and read an article if one hopes to acquire new knowledge.

A culture of professional participation

I was surprised and disappointed to learn that more than two-thirds of USFWS biologists are not members of TWS and do not subscribe to any TWS journals. Is this an indication these publications do not meet the needs of wildlife managers? Even if partly true, I suspect this pattern is also an indication that many federal wildlife biologists do not read much peer-reviewed scientific literature from any journal. Understandably, most biologists in non-research positions have busy work lives in which day-to-day job tasks do not pose a conspicuous need to read journal articles. When information is needed, it is usually local in nature, and local biologists and gray literature are often sought (Biddle et al. 1995).

There are dangers to leaving general reading of scientific literature (and going to science-based meetings) out of this process of continuing education. First, the ecological results widely viewed as most important are those with broad generality. By focusing only on local information, one may be unaware of such relevant results of wide implication generated from other geographic areas. Paradigm shifts in thinking may happen in the scientific community but go undetected by local resource managers and biologists if they are not reading broadly. The second consideration involves the ability of biologists and managers to effectively carry out adaptive resource management. Ideally, all management actions should be treated as experiments in which objectives are identified, verbal or quantitative models (hypotheses) are stated *a priori*, the action is carried out with a sound design allowing strong inference, and the population(s) is monitored to see whether the management action was effective (MacNab 1983, Walters and Holling 1990). White (2001) commented that adaptive management was merely a buzzword given lip-service treatment because we fail to carry out all steps. Often, we fail to monitor the population to see whether management worked, due to either money or political constraints or an assumption that of course it

would work. I think there may be a pernicious additional contributor to this failure. Without habitual exposure and attention to methods and merits of how science is currently carried out (such as issues relating to sampling, study design, and statistical power of monitoring programs), it is too easy for a biologist to fail to recognize the cost of not carrying out all the steps of adaptive management.

I am not suggesting that every biologist needs to subscribe to all TWS publications. Rather, biologists simply need a stronger habit of continuing education to maintain and improve skills; otherwise, they senesce. For example, consider just the statistical component of scientific currency (relevant to monitoring populations in an adaptive management program). If every wildlife biologist spent 1 hour each workday reading ecological journals, they would not forget what stratified sampling is, they would recognize what an Akaike Information Criterion is (Burnham and Anderson 1998), and they would see examples of the value of replication. We need to create a culture in which all wildlife biologists, not just those actively engaged in research, are expected and allowed to temporarily forget about tomorrow's deadline and instead work on expanding their knowledge by reading and listening to science (Robertson and Nudds 2000). Academics must imbue this culture in students, and supervisors must condone and promote it for employees.

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