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Influence of Cooperative Wildlife and Fishery Units On Graduate Education and Professional Employment

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Introduction

In June 1982, several private conservation organizations will join the Iowa State University, and the Iowa Conservation Commission, in a 50-year celebration of the Cooperative Research Unit concept. The first Cooperative Wildlife Research Unit began there in 1932 in response to a recognized need for trained biologists and scientific information in the field of wildlife conservation. The unique partnership between federal, state, university, and private entities that resulted, evolved into the current nationwide program. There are currently 21 wildlife units, 26 fishery units, and 3 combined fish and wildlife units at 31 universities in 29 states (Figure 1). The Fishery Research Units were added in 1960, and the program is still supported as a truly cooperative venture between the Fish and Wildlife Service, universities, state fish and wildlife agencies, and the Wildlife Management Institute. The Wildlife Management Institute is a cooperator in 21 Wildlife and 3 Fish and Wildlife Research Units.

There are serious doubts about the future of the nationwide program because of budget constraints within the federal government. These doubts have surfaced old and new questions about Cooperative Units and are causing re-evaluation of the need for the program as it exists as well as consideration of possibilities for a better program if it remains. The objective of this paper is to document accomplishments of the Cooperative Wildlife and Fishery Research Units with specific reference to their role in graduate education leading to employment in fish and wildlife professions. In order to fulfill this objective, I will describe how units work and what they do, and present data that may be used to evaluate their contributions in research, graduate training, employment in the fish and wildlife field, and other professional activities.

Operation and Support of Cooperative Units

The Fish and Wildlife Service has stationed biologists to serve as Leader and Assistant Leader at each Cooperative Research Unit to carry out the basic program. Those staff must meet graduate faculty requirements at the cooperating university, and essentially work within the framework of the university to carry out research with graduate students. The university provides the administrative structure, libraries, laboratories, faculty, and scientific atmosphere for training and research. Research information is disseminated through scientific publications, management reports, teaching and workshops, and provision of technical assistance to cooperating agencies. Each state fish and wildlife agency assists with base

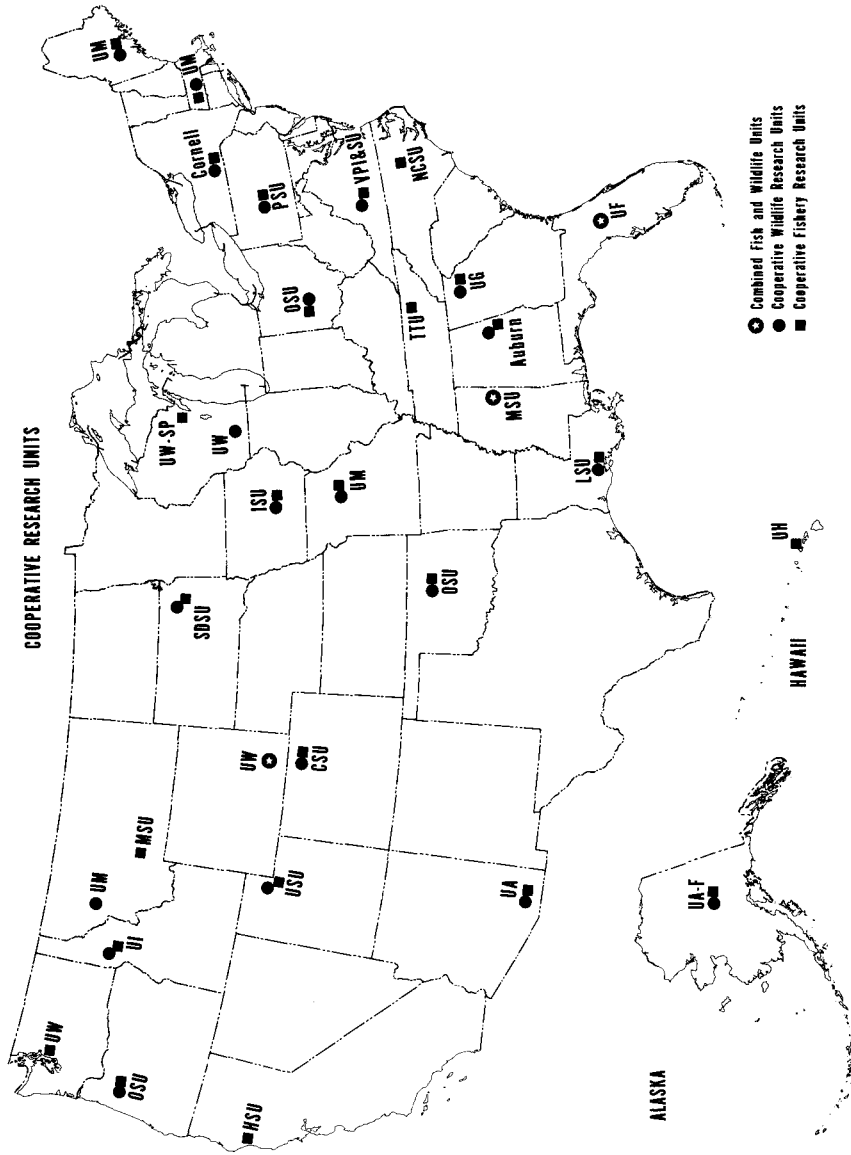


Figure 1. Location of existing Cooperative Research Units.

funding for student support and research. These and other base operating funds from the university, and the Wildlife Management Institute, allow the unit staff to develop research programs and build scientific expertise that attracts outside funding to finance most of the research (Table 1). In essence, support of each individual unit by federal, state, and private funds and the university structure provides a capability to conduct research and training, which the cooperating entities utilize to carry an increasing amount of their research load. At least nine states depend upon their units for their entire research program, and in many others the unit-university contact is the dominant research mechanism for the state agency.

The activities of the unit are guided by a Coordinating Committee, composed of representatives of each of the primary cooperators. Each unit develops, and periodically updates, a Program Direction Statement that indicates the focus for research and other activities that the cooperating agencies have agreed to support. The Unit Leader is charged with keeping up to date on the research needs of each of the cooperating organizations, and pursues funding for projects that help meet these needs. Funding for projects currently depends largely upon the information needs of state and federal agencies and private organizations or businesses, and comes to units in recognition of the expertise of unit staff and allied university scientists. Unit Leaders no longer function only as individual scientists training students, but are increasingly in a role of facilitating research through their peers at the university. Thus, a broader program of research is developed, drawing upon wider personnel diversity and allowing pursuit of a more directed program aimed at meeting agency needs.

A common misconception about Cooperative Research Units has been that they are independent research stations that conduct studies with federal funds on academic topics of their choice. In fact, Cooperative Units do not receive federal funds in their annual budget to conduct research. The federal base funds they do

Table 1. Support (in millions) for 50 Cooperative Research Units. Salaries utilize 95 percent of the Fish and Wildlife Service funds, and the remaining 5 percent plus state and university contributions provide an operating base to seek research funds. The Wildlife Management Institute provides \$1,000 annually to each Wildlife and Combined Unit, and assists in obtaining research funds. In FY82 more than 90 agencies and organizations have funded more than \$6 million in research through Cooperative Units.

	FY79	FY80	FY81	FY82
FWS base (salaries and operations)	\$4.388	4.482	4.629	4.444
State agency base	\$0.860	0.941	0.975	1.000
University (space, secretary, overhead waivers)	\$1.000	1.300	1.500	1.600
Contracts	<u>\$3.517</u>	<u>4.795</u>	<u>5.799</u>	<u>6.000</u>
Total	\$9.765	11.518	12.903	13.044

receive are utilized for salaries and minimal operating costs. Almost all of the additional funds come to the units on a contract or similar basis, tied specifically to some contractual statement of work expected in return. A Fish and Wildlife Service field office, for example, can get extensive technical assistance from Unit Leaders, students, or even allied university staff, but actual field work, surveys, or hard research on new topics must be paid for. Such costs are essentially student stipends and laboratory or field expenses. If a management office lacks funds to support such a study, units can work with them to try to fund the work from other sources.

Provision of adequate operating funds has been a perpetual problem. While salary increases have been provided, the Fish and Wildlife Service has been unable to proportionately increase the level of operational funds needed for travel, equipment, and operations. Units do not have enough federal funds to comply with federal requirements for training, or to conduct strictly federal business. Likewise, university provision of secretarial help, storage, laboratories, and office space has not been consistent at all locations. The average contribution from state agencies is \$20,000 annually, but this figure gives an inflated view of general state agency support. Many states still contribute a lesser amount; some at the same levels they started with decades ago. The Wildlife, and combined Fish and Wildlife Units, are generally supported by state funds at levels 50 percent higher than Fishery Units.

The Fish and Wildlife Service, and some state agency cooperators, have increased the level of their support through contracts for specific projects. These contributions are included in the contracts total in Table 1. Universities have increased their level of support through waiving indirect costs on contracts. These examples of increased support, plus the dramatic rise in outside contractual research (up 70% in 4 years), has broadened and strengthened many individual unit programs. However, the lack of better base support from immediate cooperators forces unit staff to spend much time seeking outside funding. Their personal involvement in research is reduced. Their ability to respond to specific needs of each cooperating agency is limited by demands of managing larger programs. In operating units in the future, a better balance must be sought between those conflicting forces. What has resulted is a mode of operation that is successful by some measures, but lacking in others.

Current Major Activities at Units

Research

The 50 Cooperative Research Units are currently conducting more than 730 research projects, ranging from short-term studies with a single student to multi-disciplinary projects. In addition to base support, those projects are supported in FY82 by more than \$6 million of basically contract research funds from more than 90 state and federal agencies, conservation organizations, and private companies. For example, the Oregon Wildlife Unit has pursued studies of spotted owls for almost a decade, which have led to major old growth forest management decisions in the Pacific Northwest. The U.S. Forest Service, and other agencies and organizations, have supported this work and received direct benefits from the results. A paper at this conference explores that research and related management deci-

sions. Also in the Northwest, cooperative fishery units in Washington, Oregon, Idaho, and California are conducting 35 projects on salmon and steelhead problems in the Columbia and Klamath rivers and their tributaries. These research projects are significant efforts that benefit the states involved, several federal agencies, and power development corporations.

In the Midwest, the Wisconsin and Missouri Wildlife Units have worked with groups of states and the Canadian government to conduct Canada goose research, both in Canada and the United States. This work has pooled the financial and logistical support of the various governmental agencies, with help from the Wildlife Management Institute, and focused it on a common management problem. The results have direct application in management plans for discrete goose population units. In the Northeast, Massachusetts Fishery Unit research on Atlantic salmon, coupled with almost two decades of providing student labor and management assistance, has played a major role in the restoration of Atlantic salmon runs. These issues are among the very top priorities of the Fish and Wildlife Service and other federal and state agencies, and in each case the Cooperative Units are carrying a major part of the effort.

Similar efforts may be described for many areas of the country where research is coordinated through several units, and therefore several state agencies and universities, to bring expertise to bear on common problems faced by state and federal agencies. A major advantage to these agencies is access to a focal point for work, which can pool funding resources and which does not require an extensive investment in facilities and permanent staff. The Fish and Wildlife Service has recognized this value and is involving units or groups of units with its research laboratories in joint research thrusts. The Idaho Wildlife Unit continues to conduct a major part of the whooping crane restoration project with the Patuxent Wildlife Research Center. The new Wyoming Fish and Wildlife Research Unit is working with the Denver Wildlife Research Center on wildlife habitat research and on black-footed ferrets. Fishery units in Idaho, Washington, and Oregon are coordinating their research on salmonids with the Seattle National Fisheries Research Laboratory.

Much research, funded by various sources, satisfied needs of a particular cooperating agency without that agency having to carry a major portion of the funding. For example, the Cooperative Units have recently been involved in more than 50 research efforts that have direct bearing on endangered species programs. Only a handful are financed directly by the Endangered Species Program of the Fish and Wildlife Service, but endangered species benefit from the results of many other projects. Many important contributions are in studies that may not deal with an endangered species, but that have direct benefit and application through developing techniques or breaking new ground with allied species.

The Alabama Wildlife Unit has been supported by the states of Georgia and Alabama, the National Wildlife Federation, Auburn University, and the Fish and Wildlife Service to initiate research and management efforts with the eastern indigo snake. With joint support, a Recovery Plan has been drafted, techniques for propagation have been developed, initial actions toward recovery have been initiated with snakes produced at the unit, and research is being conducted to evaluate the survival of released animals. In this case, an entire "package" of research and management activity has developed through the unit that would not have occurred

without the cooperative framework. The eastern indigo snake should be the most important beneficiary.

Special efforts to involve Cooperative Wildlife and Fishery Units in research on proposed water and associated land development projects began ten years ago with studies of stream channelization impacts. Pioneering studies were conducted at nine units in various ecosystems from North Carolina to Hawaii on both terrestrial and aquatic impacts. The Missouri Wildlife Unit began water resource work in 1970, and in 1974 began assisting with development and testing of new habitat evaluation techniques (HEP) for water development projects. This work produced prototype handbooks for use in field assessments on project sites. The Missouri effort has covered 12 years, involving many students and staff from about 20 state and federal agencies. As a result, more than half the Fishery and Wildlife Units have become involved in direct work in developing new methods and providing original field data for development of habitat evaluation methods. Massachusetts and Louisiana Wildlife Units took on large assessments of coastal bird colonies on the Atlantic and Gulf Coasts, and the data are incorporated in atlases of coastal resources. The Louisiana Units started studies of the Atchafalaya Basin fish and wildlife resources in 1971, and have continued to produce baseline information and new predictive tools for management of Basin resources.

The more than 100 research projects that annually deal with water and land developments through units are financed by a wide array of agencies, companies, and other organizations. The Corps of Engineers, Bureau of Reclamation, Environmental Protection Agency, many state fish and game and other resource management agencies, and private companies have benefitted directly from the research results. This strong involvement continues on the Columbia, Missouri, Mississippi, and other river drainages, and is expanding into studies on low-head hydro in New York and Massachusetts and acid precipitation in many affected areas of the Nation. The examples listed here are only a few out of the total.

There continues to be a wide array of significant, individual studies addressing specific problems, and long-range studies gradually unravelling complicated aspects of the biology of a single species. More than 25 years of research through a progression of graduate students at the Missouri Wildlife Unit has had significant impact on the management of mourning doves, and results of innovative research by the Missouri Fishery Unit on the use of variable length limits in the harvest of largemouth bass are used widely in many states. These and many other examples show direct management application of unit research results, fostered by the state-federal-private partnership through units.

Dissemination of Information

Publication of research results in refereed journals and other scientific outlets is acknowledged as a major tool for providing research results to users. For these reasons, it is an important part of graduate education to set the stage for future professional activity. The Cooperative Wildlife Research Units, including the staff and/or students, are responsible for 11 percent of the manuscripts published in the *Journal of Wildlife Management* from 1973 through 1980 (L.C. Hendry and R.F. Labisky, unpublished data). Table 2 summarizes publications by Cooperative Fishery and Wildlife Unit staff and students during a five-year period. These data

Table 2. Publications by Cooperative Research Unit staff and students from 1977–1981. Does not include 12 publications by combined Fish and Wildlife Units in 1981.

	1977	1978	1979	1980	1981
Journals, books, symposia					
Fishery Units	66	63	80	98	103
Wildlife Units	46	29	84	78	141
Subtotals	112	92	164	176	244
Technical reports, articles					
Fishery Units	61	78	34	65	91
Wildlife Units	38	44	64	26	33
Subtotals	99	122	98	91	124
Total	211	214	262	267	368

show a 74-percent increase in five years, with a 38-percent increase between 1980 and 1981. The latter change reflects both an increase in research funding and the advent of written performance standards that reaffirmed the importance of publication of research results. The Cooperative Units contributed 40 percent of the literature published by the Fish and Wildlife Service, as reported in its *Annual Report of Research* in 1979, and 24 percent in 1980.

Cooperative Units annually conduct and participate in about 40 workshops, short courses, and other organized activities to disseminate technical information. These range from regular annual involvement in training sessions for their state agency cooperator, to research management workshops that cover a wider range of audiences. Many of these are done on demand, with cooperative funding from the user. In addition, cooperative unit staff currently participate in or teach 80 courses annually to 1,500 students at the cooperating universities. These teaching assignments are most often in courses of special expertise taught by the individual unit staff, and also include team teaching with university faculty. The intent of unit personnel teaching is to strengthen existing graduate coursework, not to replace basic course offerings.

Cooperative research unit staff are utilized as technical experts by the primary cooperating agencies and advisory groups. The Fish and Wildlife Service depends upon cooperative units for assistance with development of habitat evaluation methods and background data, setting regulations, long-range planning, and permanent advisory groups on river basins, fish or wildlife populations, or assessments of management activities. Major involvements have included technical assistance to waterfowl flyway technical sections, assessing impacts of northern developments such as the Alaskan pipeline, technical advice on interpretation of the Boldt Decision regarding salmon rights in the Pacific Northwest, management of the Atchafalaya Basin, and fishery management in the National Park system. In many of these, and in other ways, the units directly aid the states as well. There are great educational benefits in a student being asked to participate in a management decision by the agency interested in his or her work. The depth of this involvement is great, and is increasing steadily.

Graduate Training

The federal staff at the 50 units serve as major professors to about 500 graduate students supported by research of the type described above. Several hundred additional students are involved in projects in which cooperative unit staff or equipment or other facilities play a significant role. The original purpose of the Cooperative Units was graduate training, and that still continues as the major focus through which units conduct research. While it offers some additional complexity to the student, involvement in the growing number of multidisciplinary or multi-agency projects gives them a baptism of fire in preparation for professional employment.

The close agency contacts offer important additions to the atmosphere of graduate training at a university and even spill over into the undergraduate programs. Among students at unit schools there is a strong level of awareness of various agency activities and missions, both state and federal. This added dimension, plus the potential to work directly on cooperative projects with agency biologists, leads a number of well established universities to periodically inquire about a unit for their location. The Fish and Wildlife Service has not advocated additional units for the last decade. While some requests have been targeted at program building, the motivation in many cases is to add something that seems to be otherwise lacking, particularly the interagency cooperation, even in large well-supported university settings.

A significant effort in training minorities and women in the fish and wildlife field has grown since 1970, increasing enrollment from few in 1970 to about 150 (25%) in 1982. More than 30 of these are minorities. This has occurred partly through a growth of interest in our field and partly through specific extra efforts to assist such students with their education. The past results in employment are not spectacular: of about 100 women and minorities trained through units in the 1970s, only about 20 percent were hired by the cooperating state and federal agencies. This partly reflects the attitudes of individuals doing the hiring, but also reflects individual decisions made by the graduates themselves. The reasons for this relatively low success rate are complex and include students placing personal constraints on location, type of acceptable job, and timing of their availability. Current hiring freezes and agency cutbacks are limiting the number of job actions and have interrupted strong progress in employing women and minorities which had begun about 1980.

Employment of Unit Graduates

Two major factors that seem to enhance employability of unit graduates are (1) training through research on contemporary fish and wildlife issues that provide experiences in socio-economic aspects of resource management decisions, and (2) the array of contacts and personal exposure unit students get with agencies during their graduate programs. In states with units, in a significant number of states without units, and in federal natural resource agencies, unit graduates are in considerable demand for jobs. Approximately 25 percent of the students graduating from cooperative units are hired by state agencies each year and from 20–25 percent are hired by federal agencies (Table 3). I do not have data on the number of hiring opportunities this represents. While employing agencies, including state fish and

Table 3. Employment status of Cooperative Unit students from 1977–1981. Data include 5–8 percent students who left prior to receipt of degree.

Professional Categories	1977	1978	1979	1980	1981
Fish and wildlife biology					
Fish and Wildlife Service	21	26	17	11	13
Other federal agencies	11	22	21	13	15
State agencies	40	56	39	31	38
Foreign government	2	2	5	2	1
Private industry	16	10	14	10	18
University	20	21	28	25	18
Subtotals	110(71%)	137(75%)	124(73%)	92(72%)	103(77%)
Other biology	1	4	6	3	4
Peace Corps	3	1	0	1	0
Continued education	25	21	19	15	8
Miscellaneous	8	9	11	4	5
Subtotals	147(24%)	172(19%)	60(21%)	115(18%)	120(13%)
Unemployed	7(5%)	11(6%)	11(6%)	13(10%)	14(10%)
Totals	154(100%)	183(100%)	171(100%)	128(100%)	134(100%)

wildlife agencies, report long lists of applicants for their job openings, a majority of those applicants are often only marginally qualified. Dr. Richard Anderson's paper, presented earlier at this conference, explores some of those problems in depth.

Cooperative unit graduates are a major component of individual state and federal agency staffs as field biologists in both research and management and in administration. In the Fish and Wildlife Service, graduates of unit schools have served in all capacities, from technician to Director. Other federal, state, and foreign natural resource agencies employ graduates of unit schools in a variety of positions. An excellent example of the impact of the unit program and unit-trained personnel on an agency is found in Werner Nagel's book, *Conservation Contrasts*, published in 1970 by the Missouri Department of Conservation, which traces the history of that Department. Similar impacts are traceable throughout the country.

Currently about 125 biologists annually complete graduate degree programs through units, and more than 70 percent of these graduates are employed directly within the first year in fish and wildlife management. More than 90 percent of all graduates are employed or continuing their education, mainly in fish and wildlife or related biology, in the year after graduation (Table 3).

Many of the research projects currently funded through cooperative units are of such complexity and duration that they are extended beyond a graduate student's tenure. It is increasingly common that additional years of post-graduate work experience are gained in some technical capacity either participating in, or actually supervising, significant research endeavors. These kinds of experiences enhance employability and provide a more seasoned researcher or manager when the individual reaches the permanent job market.

Role of Units in Graduate Education in Fish and Wildlife Management

When the Cooperative Units began, there were few universities training fish and wildlife biologists. Addition of Cooperative Units provided a stable core of activity that included a limited number of staff, a funding base, and a focal point for interaction with resource management agencies. There are many more university programs today, which leads some to question whether the Cooperative Units are still necessary.

Proliferation of fish and wildlife curriculums, and especially graduate programs, is a problem to our profession. It no doubt contributes to the perception that there are too many schools graduating fish and wildlife biologists. Both the American Fisheries Society and the Wildlife Society have set standards for certification that a biologist has received appropriate training and experience. Many newly added wildlife programs at universities cannot provide the breadth of training adequate to meet these professional standards. Regional groups of professional societies have worked with these certification standards to try to limit further proliferation of programs. All of the universities that currently have cooperative unit programs turn out students who generally meet these standards and have no problems in meeting the expectations of the future employer. They also have some advantages in the breadth of their training, as described earlier in discussing employment potential.

The quality of graduate students recruited through units and cooperating universities is high. Large undergraduate enrollments have increased competition to enter graduate schools, and this is especially so at units because of their visibility. I believe that reductions in numbers trained and increases in quality of training are goals that a unit program in the future must pursue. Units and cooperating universities are recognizing the need to reduce the number of students. For example, reductions in additions to the job market by unit graduates were as follows:

	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Numbers Reported	154	183	171	128	134
Degrees Received	145	176	157	122	126

These data show that after a peak in 1978, numbers added to the job market decreased 26 percent and number of degrees granted among those same students decreased 28 percent by 1981. This is in spite of a 70-percent increase in contract funds during the same period. The increased research load has not been accomplished by increasing the flow of students to the job market, but through increasing the role of post-graduate, technician, and allied faculty involvement.

Universities are under financial stress at least as severe as any state or federal government entity. Major state universities, in addition to private schools, are entering periods of decline in funding and staffing that are already stressing fish and wildlife education. Allied university staff are increasingly involved directly in research studies funded through units. Direct funding covers student stipends and field expenses and faculty salaries, and indirect benefits from research often play a major role in supporting the cooperating university program. More than half of the strong graduate programs in fish and wildlife management in America include units as an important core capability. Without that capability, a significant number of these programs might fall below that critical number of professional staff that

can offer a full curriculum to meet professional certification standards. If the Cooperative Research Units are discontinued, I believe that the fish and wildlife professions would have difficulty maintaining the cooperative ties that characterize this partnership.

Potentials for the Future

When the Unit Program began, the basis of the concept was an experienced biologist training a student in a one-on-one situation, supported by a cooperative framework. That basis is still present, but the shift in emphasis necessitated by growth in university fish and wildlife training, and increasing budget limitations, has broadened the concept of Cooperative Units. The Unit Leader in the future will be expected to assist in building a research and training program with recognized excellence in a definable area of fish and wildlife biology. Enough flexibility will be retained to cope with individual projects needed by the cooperators, but an identifiable thrust of the program will focus a large part of the energies of the unit staff and students, and resources of the cooperators, toward common objectives.

This conceptual approach has been followed in building the newest units that combine fish and wildlife research efforts. A hypothetical example would include a unit devoted to the study of wetlands, conducting approximately 75 percent of its research effort in wetland studies that fit a coordinated plan based on needs of the cooperating agencies in managing the fish and wildlife resources. Such an effort could include periodic involvements of hydrologists or economists to expand the application of the traditional biological data, with objectives leading to management applications. Within this framework, the Cooperative Units would likely evolve more than ever into a focal point for broader cooperative programs, rather than a one or two person individual research effort. One continuing advantage of units of the type described is that cooperating agencies can gain access to extensive expertise within the university, and even several universities, to focus on today's complex management needs.

This new conceptual framework is a different sort of challenge for the individual charged with running the unit, and offers somewhat different opportunities for the student. It is tailored to meet the needs of the times, providing relevance for an established training program through making it more flexible and directly productive in the conduct of its research. The true flowering of the concept of the Cooperative Units leads to coordinated, cooperatively supported efforts to solve common problems. There will certainly always be a need for individual research efforts as the core of a unit's expertise, but that will now have to fit into a larger, more focused program if the units are to continue to meet the needs of the nation.

If the Units persist in the future, I believe it is likely that existing programs will change significantly, perhaps reducing the number of stations and revising the mode of operation even further. If the program is retained but budgets cut further, it would be possible to devise a smaller but more strategically located program with a lesser number of units that would still meet the needs for which the program was established. Approximately two dozen units located on a basis of ecological regions of the nation, geography, agency interests, other existing capabilities, and needs related to resource developments, can be envisioned. The model "new unit"

described earlier would fit in this context. One can envision units emphasizing large geographical aggregations of similar resources, such as coastal marshes, arid lands, agricultural impacts on wildlife, wetlands, Rocky Mountain energy developments, Arctic development, and so on.

The influence and potential of Cooperative Units was expressed very well by a university cooperator, commenting on the need to get Wildlife Unit Leaders to the North American Conference. He said, paraphrasing, "We need our unit leaders here to tell us what they are doing in research, and to exchange ideas. They have been visible leaders in our field for many years and have had a strong influence on our field. We need them as a bridge to what agencies are doing in wildlife conservation."

Not every unit scientist has become a national leader, but overall the impact of the program has been great. One has only to look into the ranks of professional societies and journal editors, as well as the agency staffs and literature of our field as described earlier, to find a solid contribution and leadership role. The importance of those units as part of the core of our profession is supported by their record.

Acknowledgements

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