

White-tailed deer browse *Kalmia* in varying degrees, but under most circumstances it is not taken in areas where rhododendron is plentiful. Sprout growths are more commonly eaten than the less succulent portions, and deer rarely use more than a few twigs and leaves. It is known that both laurel and rhododendron are poisonous to deer, but that they do not seem to eat, of their own free will, enough of either to exceed their tolerance for them. One investigator concluded that, "Rhododendron does not seem to visibly affect deer even when it represents their main diet; but mountain laurel is suspected of indirectly causing numerous deaths among younger deer." It resulted in weakening the deer which probably made them more susceptible to a variety of pathogens and to dog predation. How long deer can endure this intake of these toxins has not been determined. Deaths of this type would be expected to occur in late winter.

#### COMMENTS

With reference to both plants and the circumstances which have been described, the theoretical aspects of this presentation should be reiterated. There are no confirmed accounts of poisoning in white-tailed deer caused by any of the toxic components which have been considered. In fact, very little work has been conducted to either prove or disprove the significance which plant poisons may have relative to major deer "die-offs."

From food studies, impressions have been gained that wild deer possess an inherent resistance to practically all naturally occurring toxic materials. A wealth of information is available, however, which incriminates many plants as being the etiology for heavy losses to the livestock industry. In testing over 300 drugs, the authors have consistently found white-tailed deer to be less resistant than domestic goats to poisonous products.

During the past 50 years, thousands of white-tailed deer in the Southeast have succumbed to recurrent diseases of an undetermined origin. Although various ideas have been proposed and sporadic searches have been conducted to incriminate an infectious organism, these efforts have been of little avail. Neither have poisonous plants been incriminated in causing "die-offs" among deer. It is therefore logical that these should receive maximum consideration, and whenever an occasion again arises, attention should be given to the ecological role that poisonous plants might contribute to deer mortality. This will require long and intensive studies, but when enough data have been compiled, it seems feasible that many major deer "die-offs" can be predicted, and under some circumstances even preventative measures are conceivable.

## FISHERIES SESSION

### THE NATIONAL SCIENCE FOUNDATION AND RESEARCH IN FISHERIES

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The opportunity for discussing the activities of the National Science Foundation as related to fisheries is indeed welcome. Federal support of this field is an old story to many of you who are either engaged directly in government supported research or in the administration of such research projects. The greater proportion of financial assistance from other agencies is specified for the applied aspects or management of commercial and recreational resources. Funds available from them for fundamental biological investigations are limited or earmarked especially for projects of lengthy duration.

The National Science Foundation is unique among government agencies in that the research which it can support must be basic, not applied, research.

Nevertheless, both the fisheries biologist and the administrator have something to gain from "NSF, Washington 25, D. C."

The term "fisheries" to many persons is interpreted as applied science or management, and it is automatically assumed that it is not fundamental biology. Many biologists are of this opinion, too. The Foundation, by law, can support only basic research, and any misunderstanding of this point can be quite misleading.

Before any relationship between the Foundation and fisheries can be discussed effectively, it is essential to know something of this particular agency's organization and responsibility.

As an outgrowth of concern for the nation's scientific progress in this current-day universal competition, and following considerable study, consultation, and planning, the 81st Congress enacted the National Science Foundation Act of 1950, "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." Thus, the National Science Foundation, consisting of a Director and a National Science Board, was established as an independent agency within the executive branch of the Government. The twenty-four members of the Board are appointed by the President and it is this Board which is charged with the final responsibility for establishing Foundation policies. The agency has specific functions, each of which is sufficiently important to merit thoughtful consideration and attention. The Foundation is authorized and directed: "to support a national policy for the promotion of basic research and education in the sciences; to support basic scientific research and to appraise the impact of research upon industrial development and welfare; at the request of the Secretary of Defense, to support scientific research activities; to award scholarships and graduate fellowships in science; to foster exchange of scientific information; to maintain a register of scientific personnel and to serve as a clearing house for information concerning such personnel; to evaluate scientific research undertaken by federal agencies and to correlate the Foundation's research programs with other such programs; and to cooperate in international scientific research activities."

Upon the establishment of the Foundation, the major basic research programs were incorporated within the framework of what soon became two divisions, the Division of Biological and Medical Sciences and the Division of Mathematical, Physical, and Engineering Sciences. It is the first of these divisions which is of immediate concern to us. The activities of the Foundation do not preclude fisheries. When one considers the eight research programs within the B&MS Division, their very names can be readily associated with the various aspects of the biology of the organisms making up our fisheries or those forms with which they are intimately associated. These Programs, listed alphabetically, are: Developmental, Environmental, Genetic, Metabolic, Molecular, Regulatory, and Systematic Biology, and Psychobiology. These Programs, as well as all Foundation activities in support of research, are directed primarily toward supporting qualified scientists in their efforts to investigate and discover new knowledge of a fundamental nature through research projects of superior or exceptional caliber. NSF grants are designed to permit the greatest possible freedom of action for the investigator in pursuing his research. This practice allows for optimal use of funds, as well as for any modification of the plan of research, should changes become necessary or desirable. One advantage to NSF grantees is that at the time the grant is made, the entire amount obligated is set aside. It is not necessary to depend upon funds "from next year's appropriation." These monies are available at any time should the rate of progress of the research deviate from the original plan.

In a news release of February 1959, from the Sports Fishing Institute, Mr. Robert Jenkins quotes the following statement from the Foundation Director's SEVENTH ANNUAL REPORT, "No field of science should be excluded from encouragement and support. The capital discoveries may occur in any field." And to quote directly from Mr. Jenkins' compilation of figures (which are accepted), "In fiscal year 1957, environmental and systematic biology research grants comprised about nine percent of the total (\$40 million) issued by NSF. Included were research grants totaling \$32,000 in fishery biology,

\$19,300 in fish parasites, \$326,400 in limnology and \$446,000 in marine laboratory facilities." This totals \$823,700. Merely a drop in the aquatic environment, but not small enough to be ignored!

Considering only those research grants dealing directly with fish, \$211,000 was awarded in FY'58. Including NSF expenditures for all basic studies relative to the field of fisheries brings out the fact that fishery scientists are not neglected. To illustrate such basic investigations, consider the research involved in such projects as "Productivity of an Aquatic Environment," "Effects of Conservation Measures upon Stream Ecology," "Bioassay Techniques for Organic Materials in Sea Water," "Productivity in Coastal Areas."

The Programs for Environmental and Systematic Biology support by far the majority of research proposals received by NSF in this field. The Environmental Program surpasses Systematics in its overall financial assistance to the field of fisheries research. Speaking of the Systematics Program, our support of ichthyology alone amounted to \$74,800 in FY'58; \$107,800 in FY'59; and in FY'60 we have already activated grants of \$93,800. The latter figure is only for the first quarter of the current year. These grants included provisions for such items as travel and subsistence for collecting in the United States and abroad; expendable and permanent equipment; emergency funds for putting into order fish collections of national importance, housed in academic institutions; research, field, and clerical assistance; and partial salaries for investigators. With the support mentioned above, grants from other Programs, and partial support of the forthcoming Pacific Science Congress, the B&MS Division has already given \$372,000 for the first quarter of the current fiscal year to projects of interest to fisheries. This is a conservative figure determined from project titles, which are not always indicative of the planned research.

During the past year approximately fifty percent of the environmental grants made was for the dynamics and structure of animal populations, biological oceanography, life history investigations, and quantitative community ecology. Systematics allocated monetary assistance for biological explorations in little known areas, preparation and publication of monographic reports, curating existing collections, and collecting new material. Support takes diverse paths depending upon the current needs and emphasis; for example, field travel, expendable supplies, and trips to museums for those who are contributing to parts of the FISHES OF THE WESTERN NORTH ATLANTIC. A report dated June 30, 1959, contains a list of currently effective basic research grants in the B&MS Division. By selecting from this report only titles of those investigations which without question are directly or indirectly associated with fisheries, the funds currently "at work" for fisheries includes \$2,446,000 from the eight Division Program; \$247,000 from general funds of the Division; and \$846,000 from facilities; or a total of \$3,539,000. Support from other sections of NSF would indeed swell these figures, such as fellowships and international travel. The Environmental Biology Program alone is now administering some 92 grants of \$1,964,150 concerned with one phase or another of biological oceanography and limnology. The annual rate of these grants is \$797,000. At present, Systematics is administering 44 grants with a total dollar value of 534,400 associated with aquatic organisms at an annual rate of \$222,203. Environmental anticipates supporting between one and one and a quarter million dollars worth during FY'60. The Systematics estimate for similar type support is approximately \$400,000.

To obtain research support from the National Science Foundation, interested fisheries scientists and personnel should develop their thinking in terms of the fundamental basic aspects of biological problems rather than along any over-all picture of management practices or applied science. Problems concerning life history studies, growth, population dynamics, systematics and evolution, physiological processes, specific environmental factors, nutrient materials, elements of productivity, fungi, bacteria, migration patterns, morphological development and modification, embryology, biogeography, behavior, isolation mechanisms, and genetic differences are among possible areas of support. Accumulation of scientific data, interpretation of these data, and publication of these findings in acceptable scientific journals are of utmost importance. Problems which offer opportunities for basic research should be considered carefully and worked

out in detail, objectives should be specific not general, and presentation should be concise and meaningful. Background material should be thoroughly reviewed so that there is no question that the investigator is conversant with the implications of the problem. NSF approves, in its judgment, only the very best of the requests which are received. Support of applications which are mediocre in quality would not be approved even if it meant a surplus of unused funds. Those persons seeking grants should be aware of deadlines for financial support as they develop for they are well publicized. Other activities supported by the Foundation are potentially valuable to any field of endeavor and they should be utilized. Keep in mind travel, publication of data, general funds for summer laboratories, various fellowships which can be used during a sabbatical leave as well as for assistance while attaining an advanced degree. Rather than expect academic personnel to assume the research responsibilities for solving biological problems free and on their own time, conservation officials should encourage the use of grants and then be willing to provide time for this and to lend equipment. Management personnel can take advantage of scientific production from basic research obtained by such mechanisms. Hundreds of pages are published each year from research which has been conducted with NSF support.

In closing, examples of the variety of problems for which NSF has provided funds may be of interest: "Freshwater Fishes of Florida," "Phylogeny of Spiny Rayed Fishes (Percoidea)," "Soft Rayed Bony Fishes of the Western North Atlantic," "Monograph of the Fish Family Ophidiidae," "Color Pattern Formation in Two Teleost Fish," "Basic Productivity in California Lakes," "Life History and Ecology of Some Clupeiform Fishes," "Nutrient Supply of Certain Alaskan Lakes," "Meristic Structures in Fishes," "Osmotic Regulation in Euryhaline Fishes," "Reproductive Hormonal Processes in Elasmobranch Fishes and Ascidians," "Speciation in Fish Populations," "Comparative Morphology of Sunfishes," "Morphology of the Lateral Line System in Cyprinidae," "Systematic Studies of Zeomorph Fishes," "Collecting and Study of the Fish Fauna of Florida," "Fish Fauna of the Florida Keys," "Collecting and Study of Pelagic Fishes of the South Atlantic," "Osmoregulatory Function of the Thyroid Gland in Flat Fishes," "Nutrient Supply and Productivity of Lake Washington," "Environmental Relationships of Some Marine Cottid Fishes," "Relations of Sound to Behavior of Fishes," "Energy of Marine Bottom Communities," "Movements of Early Stages of Marine Fishes," "Population Dynamics of Small Benthic Fish," "Ecology of Some Coral Reef Fishes," "Zoogeography of Some Bathypelagic Species of the North Pacific," "Life History of the Round Sting Ray," "Systematics and Ecology of Eggs and Larvae of Delaware Bay Fishes," "Biology and Ecology of *Paralichthys lethostigma*."

It is hoped that these remarks have clarified something of the potentialities as far as NSF and fisheries research are concerned. NSF is always willing to discuss ideas with potential applicants and/or examine preliminary drafts of proposals and offer suggestions. Modifications of proposals, circumstances, or even policy may result in support of proposals which had not previously received favorable consideration. Our budget has grown each year, so does the number and value of the requests we receive, but funds are available for basic research in fisheries as well as in any other field. We can never anticipate meeting one hundred percent demand but we do anticipate supporting those proposals of outstanding merit. NSF must make worthwhile investments in the future and this can be accomplished only by well planned and appropriate research requests from competent investigators.