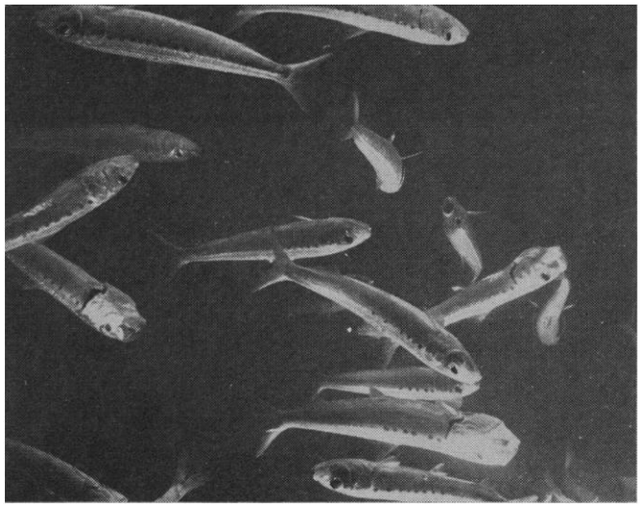
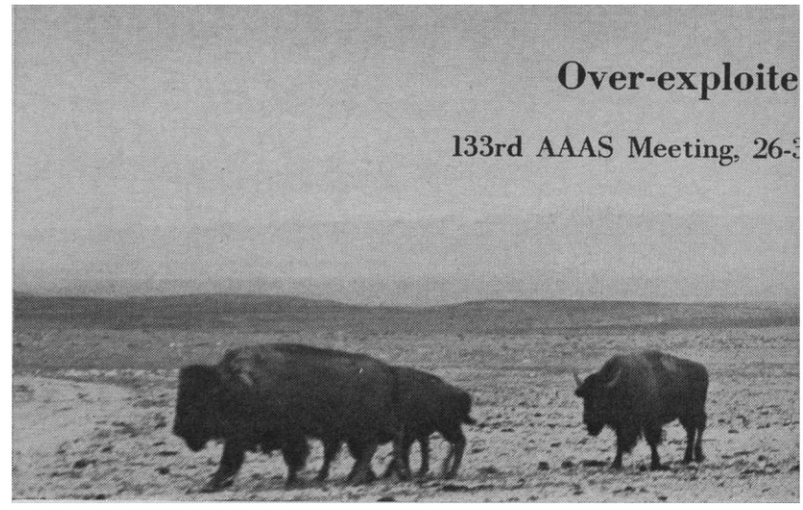




U.S. Bureau of Commercial Fisheries

Man's mistreatment of his natural environment is now a matter of record. The exploiting of animal life throughout the world has been progressing with amazing swiftness for several centuries. Many cases of complete and near extinction of various species of animal life can be cited. A prime example is that of the American bison. It is estimated that more than 60 million of these animals existed before the westward expansion of the United States. Only a few thousand remained before an effort to increase their number was initiated. Another symbolic American animal, the bald eagle, is threatened with complete extermination by the poacher's gun and by pesticides that may induce sterility. The story repeats itself many times throughout the world.

The balance of nature, whereby plants and animals are kept at a relatively constant ratio, is sometimes delicate and can be upset by well-meaning conservation attempts. This can be illustrated by the experiment which took place in the Kaibab Forest of northern Arizona in 1905. In order to protect the decreasing deer population within the forest, it was decided to eradicate lions and wolves. This eradication resulted in an overpopulation of deer by 1918, and in subsequent permanent damage to the forest and top-soil. Perhaps this and many other, similar errors taught man a much-needed lesson —that once the balance of nature is tampered with, the process may be irreversible.

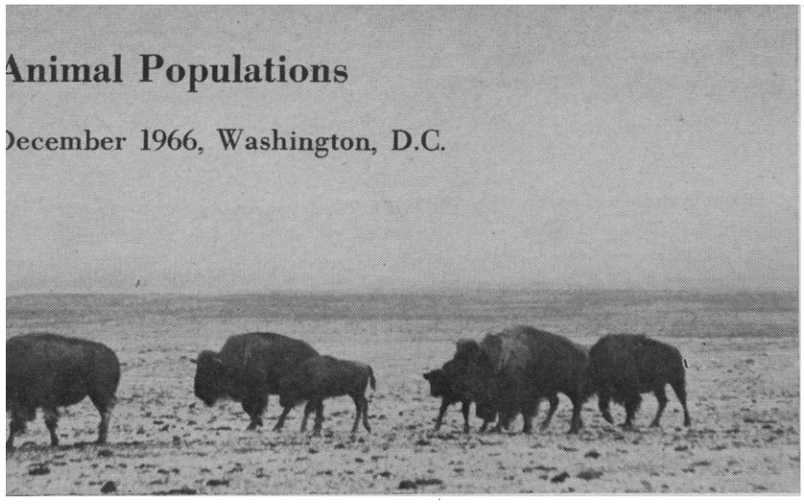
Even in the seemingly overabundant sea the problems of possible extinction of some species have caused concern. For decades man has exploited fish and mammals. Seals and sea otter, for example, have been slain indiscriminately for their fur. However, it is encouraging to note that some efforts of restoration have been highly successful. The fur seal herd living in the vicinity of the Pribilof Islands was faced with extinction until the U.S. Fish and Wildlife Service, through proper management and an international agreement, increased the herd to approximately the original size. Other attempts to restore nearly depleted species, or at least preserve a status quo, have become more numerous in recent years.

The general topic of exploitation of animals will be the subject of a two-part symposium to be held on 29 December at the 133rd AAAS annual meeting in Washington, D.C. The title of the symposium is "Over-exploited Animal Populations."

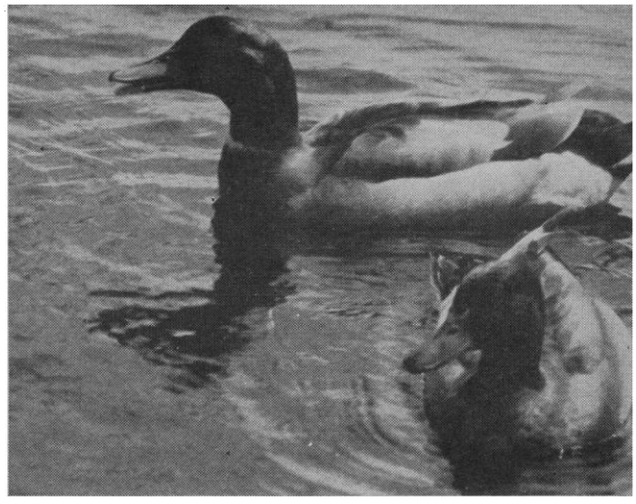
A suggestion that hunting regulations in the United States should provide for the greatest possible use of wildlife resources within the limits dictated by proper game management will come from Aelred D. Geis (Bureau of Sport Fisheries and Wildlife, Migratory Bird Population Station, Laurel, Maryland). His talk will deal more specifically with the "Effect of hunting mortality in North American ducks." Effective implementation of his suggestion regarding hunting regulations would require a comprehensive data-gathering program designed to measure the size, species, age, and sex composition of the kill; age and sex ratios in the population; harvest and annual mortality rates; and levels of breeding population. The surveys and data-gathering techniques for obtaining this information will be reviewed. It has been found that the hunting regulations affect the rate of hunting mortality, which influences total mortality rates, and that production rates are independent of breeding-population density. These findings for North American ducks are contrary to those for some other resident game species —a fact which demonstrates the importance of establishing sound hunting regulations. Population trends and kill statistics for the mallard will be reviewed in an examination of the relationship between regulations, the hunting kill, and the status of the resource. In 1964 the breeding population was depressed, due to overharvest. There is need for more information on how the greatest amount of recreation can be obtained without overexploitation. Certain experimental hunting seasons are examples of such research.

Attention will be focused at the symposium on changes in species of fish population in the Great Lakes. The significance of several of these events will be the subject of a talk by Stanford H. Smith (Bureau of Commercial Fisheries, Ann Arbor, Michigan). Changes in the species composition of stocks have been taking place since records were first kept, but they have been particularly abrupt in the past 10 to 20 years. Some changes are conspicuously related to changes in the environment, although they were undoubtedly influenced by the fishery. Environmental changes have been less marked in the open lake than in shore areas and bays, therefore Smith will emphasize change in deepwater stocks as related, since early times, to a highly selective commercial fishery and, more recently, to selective predation by the sea lamprey. Because the most intensive studies have been made in Lake Michigan, it will be used to illustrate events that have taken place in the other deep Great Lakes—Lakes Ontario, Huron, and Superior.

The ultimate changes that have resulted from the removal of the lake trout as a climax predator and the ex-



U.S. Department of Agriculture



U.S. Department of the Interior

ploitation by the sea lamprey have resulted in a complete revision of deepwater fish stocks. Two species of deepwater ciscoes have become extinct, four others are near extinction, and the remaining species of those which were once the forage base for the lake trout is undergoing rapid biological changes which imply that a complete population collapse may be imminent. The niche occupied by these species has been taken over by the alewife, which was first reported in Lake Michigan in 1949, became established in the lake about 10 years ago, and now dominates the entire lake.

Thus in less than 20 years an entirely new lake without a climax predator exists. The sea lamprey, which provided the primary impetus for the upset by its extreme depredation of larger fish, has almost been brought under control by methods which proved successful in Lake Superior. The lake trout is being reestablished, and the exotic coho salmon is being introduced as climax predator to establish a new population balance.

Proper regulating of fishing procedures pays dividends, but this regulation must be aided by strong research efforts in many cases. The numerous population studies of the yellowfin tuna will be summarized in a paper, "Fishery dynamics and present status of the yellowfin tuna population of the eastern Pacific Ocean," by Milner B. Schaefer (University of California, La Jolla). There have been many attempts to determine the migratory habits of the yellowfin. The greatest strides were made through the efforts of the Inter-American Tropical Tuna Commission (IATTC), which was established by international convention in 1950. As a result of its work and the various research studies it stimulated, the yellowfin population is now one of the best understood. Schaefer will discuss the various assessment methods and the underlying assumptions. Computations of populations have been complicated by changes in fishing procedures throughout the long period of data recording. The results show that overfishing has been occurring, and recently the IATTC has recommended that fishing for yellowfin tuna be curtailed so that the stock can be restored.

Even the favorite and apparently abundant sardine is not immune to possible extinction. Conclusions reached by Garth I. Murphy (University of Hawaii) bear out the view that the dramatic observed decline in the sardine population can be ascribed to overfishing. His presentation will include those aspects of the biology of the Pacific sardine that are pertinent to an understanding of the effect of exploitation. Methods of estimating the vital statistics of the population will be reviewed.

Seals will be the subject of an address by Ian A. McLaren (Dalhousie University, Halifax, Nova Scotia). He will discuss the finding that seal species vary widely in intrinsic rates of increase. Social species have higher rates of increase and restrict population growth through social interaction, as an inevitable, unadaptive consequence of sexual selection. Exploitation may remove environmental or social restraints on recruitment, but only within limits set by the rates of increase. This has happened in the case of a number of seal species in recent years. The selective forces acting on exploited populations may be very different from those acting on undisturbed populations, and there is evidence for genetic change in some species. Genetic as well as phenotypic responses of the seal populations should be considered in establishing optimum exploitation programs.

Richard S. Peterson (University of California, Santa Cruz) feels that the northern fur seal has been harvested according to a systematic, scientific plan, while the California sea lion has been indiscriminately slaughtered as an undesirable species. In his paper on "Social behavior in relation to exploitation of the California sea lion and northern fur seal" he will describe several years of study of the two species in their natural environment—the fur seal on the Pribilof Islands, Alaska, and the sea lion on various islands near the coasts of California and Mexico. The potential harvestability of the two species is closely related to their social behavior, since it is for social reasons (primarily reproduction) that they come onto land. The harvestability of the two is markedly different; this difference may be related partly to the harvesting methods that have been used. Peterson will discuss what is known about the social organization of these animals and other features that may relate to human exploitation.

Other speakers and their topics are as follows: Douglas Chapman (University of Washington), "Antarctic Baleen whales"; Marvin D. Grosslein (Woods Hole Laboratory), "Georges Bank haddock"; Peter A. Larkin (Biological Station, Nanaimo, British Columbia), "Sockeye salmon"; and Brian J. Rothschild (Bureau of Commercial Fisheries, Honolulu), "Central Pacific tuna." The program was arranged by Douglas S. Robson (Cornell University). Part I will be presided over by Walter F. Crissey (Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, Laurel, Maryland) and Part II by John McHugh (Bureau of Commercial Fisheries, Washington, D.C.).—GRAYCE A. FINGER