

JOB PROGRESS REPORT

State: California

Project Number: W-54-R-14 Project Title: Nongame Wildlife Investigations

Job Number: IV-9 Job Title: Bobcat Management Plan

Period Covered: July 1, 1982-June 30, 1983 Job Type: Survey and Inventory

SUMMARY:

A general outline for the plan was drafted and some data from recent studies were compiled. A great deal more remains in the raw data form. Information on the parturition dates of bobcats during 1979 and 1980 indicated that 80 percent of the young are born over a nine-week period from the beginning of April to the end of May. Young were born an average of two weeks later in 1980 than in 1979. Current research needs center on getting quantitative information on reproductive rates, understanding the relationship between weather and prey populations, and the structure of bobcat populations, and developing a predictive environmental population model.

BACKGROUND:

Bobcats have been hunted for sport and to stop depredations and trapped commercially for their fur for many years. In the 1920's, as many as 12,500 bobcats were taken commercially for their fur in one season. But, commercial take declined to an annual take of 1,500 to 3,000 during the 1930's and 1940's. Through the 1950's and 1960's, the commercial take declined to annual, commercial harvests of less than 400. During this same time, bobcats were being taken by federal animal damage control personnel, aided by state trappers from 1932 to 1954, at rates of 2,500 to 4,000 per year.

In the early 1970's, a number of changes occurred which drastically affected the use of the bobcat resource. First, the bobcat was classified as a nongame animal by the California Legislature. By doing so, it afforded bobcats some degree of protection. Second, the use of a number of predator control measures, aimed mainly at controlling coyote populations, was terminated. This caused a general increase in coyote populations and increased competition with bobcats, possibly resulting in a decrease in bobcat numbers. Third, there was a change in the international fur market creating a demand for the long-haired furs found on coyotes, gray foxes, raccoons and bobcats. Finally, the legal market for the fur of spotted cats was greatly restricted by an international treaty, the Convention on International Trade in Endangered Species (CITES). As a result of CITES, the future of cheetahs and ocelots may have been saved, but the commercial demand was shifted to two species of North American cats, the Canadian lynx and the bobcat. These events acted to increase the demand for and take of bobcats, as well as to force its active management. By the 1975-76 season, the average raw fur value of a bobcat pelt in California had increased to \$133.50, up from \$10.90 in 1970-71 and from \$2.80 in 1962-63. By 1980-81, the commercial harvest reached 9,595 bobcats, an increase of 2,900% from the commercial harvest of 319 in 1970-71. Sport take during the mid-1970's was high with an estimated take of almost 15,000 in the 1977-78 season.

Animal damage control policies also have changed to control depredators on a complaint by complaint basis. The take of bobcats by U. S. Fish and Wildlife Service animal damage control personnel in California decreased from 3,664 in 1959-60 to 24 in 1980-81.

Management control increased on both the federal and state level in reaction to the increased demand and take. Federal action has followed the requirements of CITES in monitoring the export of bobcats from the United States and in determining if sufficient biological information was available from each state where bobcats were harvested to warrant a finding that bobcat harvest in that state would not be detrimental to that state's bobcat population or any subspecific bobcat population.

In California, management activities have involved research (Table 1) into the status of bobcats followed by changes in harvest regulations (Table 2). Research on bobcats done by the Department of Fish and Game has involved studies on distribution, abundance, life history, population structure, population dynamics, the amount of harvest, and the effects of harvest. Regulation changes have dealt with establishing state-wide and regional seasons, varying season length in response to changes in the condition of local bobcat populations, establishing a bag limit, and monitoring both the commercial and sport harvest.

Throughout the last ten years, the Department has reacted with research and regulations as immediate needs arose, without any overall plan. At this time of continued pressure on the bobcat resource, there is a need to plan for the wise use of the limited resources of the Department to achieve efficient and timely management. This plan should describe what is currently known about the bobcat, the level of management desired, and the manner and schedule of gathering information needed to implement the desired level of management.

OBJECTIVE:

Develop a management plan which summarizes the current knowledge of the biology of bobcats in California, describes the species' status, establishes management goals, and outlines management procedures.

RESULTS:

Plan Development

A general outline has been developed (Table 3) using other management plans produced by the Department (Mallette and Schlorff 1978, Sitton 1982) and other agencies (Lehman 1977, Mowbray, et al. 1979, Pils and Martin 1978, and Tabor and Wiglet 1977). Changes from this outline should occur as the plan will be written while research is occurring and the plan will try to reflect the results of a number of studies and management objectives may change due to changes in economics or political considerations.

Past Research

Data are available (Table 1) to describe much of the biological information called for in the outline, although a substantial portion of Department-generated data is undocumented and uncompiled at this time. The taxonomic description given by

Grinnell, et al. (1937) seems valid today (Hall and Kelson 1959) and the morphometric data provided has been reinforced with data from recent Department field studies investigating the aspects of life histories of bobcats. These four studies in Siskiyou, Riverside and San Diego counties have involved the capture, marking and radio-collaring of over 125 bobcats. Variations in spatial occupancy have been well documented and density estimates for populations in three different habitat types have been made. These studies have provided little information on reproduction, but have provided good information on mortality causes and rates. The large samples in these studies have indicated the temporal and regional variations in population structure. Another Department study has monitored the commercial take of bobcats over the past three seasons by requiring each fur taker to provide, for each bobcat taken, the county and general locale of take, the sex of the bobcat, the date and method of take, and the lower jaw so that the cementum layer of the canine can be used in aging each individual bobcat harvested. This has provided quality information on population structure and dynamics for regional as well as the state-wide population of bobcats. However, interpretation of the implications provided by the information on population dynamics is unclear and the relationships between population dynamics and harvest is not known. This occurs despite records of the commercial harvest dating back 60 years.

Data Compilation

The only data compiled during this study period concerned the temporal distribution of parturition dates based on data gathered during the 1979-80 and 1980-81 seasons. Young-of-the-year bobcats were aged, using the permanent tooth eruption pattern described by Crowe (1974). Parturition dates ranged from March 3 to August 27 in 1979 and from March 20 to November 25 in 1980. The season was about two weeks later in 1980 than in 1979 and in only five of 26 areas was it earlier in 1980 (Figure 1). The season was also more compact in 1979, with smaller proportions of females not getting pregnant early in the year and recycling once or twice and birthing in July or October and November. However, most bobcats born during these two seasons were born in the nine-week period from the beginning of April through late May.

Current Research Needs

Compilation of data on home range, occupancy patterns, and population structure, as these parameters relate to density, has not occurred nor has a thorough review of information gathered on reproduction and mortality of bobcats in San Diego County study areas. Reports summarizing this information are needed.

In gathering population structure data from analysis of harvest data, it is evident that young-of-the-year are generally under-represented in the animals that are taken by trappers and hunters. In some field studies, it was noted that not all females breed each year and data on litter size is from small samples. Therefore, there is need to know the relationships between the potential number of young that could be born in any one year, the actual number born, the number of young-of-the-year which are harvested, and the number of young which survive their first year and enter the breeding segment of the population. Obviously, these relationships are vital to understand the reproductive potential of bobcats and their ability to withstand harvest pressure.

Cursory examination of the life tables of regional populations seem to indicate smaller than expected cohort size from these cohorts which were born during the

drought which occurred in California in 1976 and 1977. Environmental (climato-logical) factors affect most species of wildlife in some manner. Little has been done to link these factors to changes in population structure, changes in the dynamics of a bobcat population, and the ability of the population to withstand the effects of harvest. Research is needed to try to tie weather conditions and prey densities to changes in the population structure of bobcats.

Determining Management Objectives

Predictions of the effects of the next year's harvest have been attempted (see Job IV-7, W-54-R-13, 1982). These predictions were made by making subjective evaluation of current and recent trends in the parameters used to evaluate population dynamics and harvest data. Results were disappointing in that only predictions on the conditions on those populations that were in extremely poor or extremely good condition held true. A predictive model which considers environmental variables would probably help in predicting future trends. The creation of such a model was recommended at a recent workshop attended by bobcat biologists from the western United States and deemed feasible by a group of bobcat biologists and population modelers who met just to review the applicability of current research knowledge to an environmental model.

ANALYSIS:

Little work on the plan actually has been accomplished. Coordination of efforts with other states was accomplished to minimize the potential duplication of research. Minimal compilation of available data occurred. However, next fiscal year's schedule includes jobs designed to collate and present data on research that has been done already. Work on the management plan is scheduled in fiscal year W-54-R-15 (1982-83) when a draft plan should be able to be written.

LITERATURE CITED:

- Crowe, D.M. 1974. Some aspects of reproduction and population dynamics of bobcats in Wyoming. Ph.D. Thesis. Univ. of Wyoming. 191 pp.
- Grinnell, J., J.S. Dixon and J.M. Linsdale. 1937. Fur-bearing mammals of California. Univ. Calif. Press, Berkeley. 2:590-625.
- Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. Ronald Press, New York. 2:968-972.
- Lehman, L.E. 1977. Population Ecology of the Raccoon on the Jasper-Pulaski Wildlife Study Area. Indiana Dept. Nat. Res., Pittman-Robertson Proj. W-26-R, Bull. No. 9. 97 pp.
- Mowbray, E.D., D. Pursley and J.A. Chapman. 1979. The status, population characteristics and harvest of the river otter in Maryland. Maryland Wildl. Admin. Pittman-Robertson Proj. W-59-R. 16 pp.
- Pils, C.M. and M.A. Martin. 1978. Population dynamics, predator-prey relationships and management of the red fox in Wisconsin. Dept. Nat. Res., Madison, WI, Tech. Bull. No. 105. 56 pp.


Sitton, L. 1982. The black bear in California. Calif. Dept. Fish and Game, Pittman-Robertson Proj. W-51-R. 85 pp.

Tabor, J.E. and H.M. Wight. 1977. Population status of river otter in western Oregon. J. Wildl. Manage. 41(4):692-699.

RECOMMENDATIONS:

1. Continue work necessary to compile available data and prepare the plan.
2. Direct what field efforts that can be made towards those areas identified as research needs in drafting the Bobcat Management Plan.

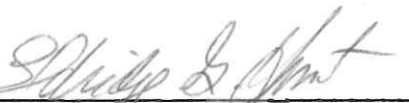
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Table 1. Chronological list of papers reporting research results on bobcat studies in California since 1976.

- Grippi, R. 1976. Bobcat Distribution and Abundance in Fresno County, California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-8, Job IV-1.1, 11 pp. + v
- Gould, G. I., Jr. 1977. Estimated Hunter Take of Bobcat in California During 1976. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-9, Job IV-1.0, 9 pp.
- Gould, G. I., Jr. 1977. Bobcat Distribution in Northeastern California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-9, Job IV-1.2, 10 pp.
- Gould, G. I., Jr. 1977. Bobcat Distribution and Abundance in Northeastern California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Job Progress Report, Project W-54-R-9, Job IV-1.2, 2 pp.
- Lee, R. C. 1978. Status of the Bobcat in California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-10, Job IV-1.6, 6 pp.
- Belluomini, L. 1978. Estimated Hunter Take of Bobcat in California During 1977. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-10, Job IV-1.6, 12 pp.
- Gould, G. I., Jr. 1978. Bobcat Study and Survey. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-10, Job IV-1.6, 8 pp.
- Zezulak, D. S. 1978. DRAFT-Northeastern California Bobcat Study. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project E-W-2, Job IV-1.6, 19 pp.
- Gould, G. I., Jr. 1978. Status of the Bobcat in Northeastern California. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., Progress Report, Project E-W-2, Job IV-1.6, 2 pp.
- Gould, J. I., Jr. 1978. Biological Information Requested by the E.S.S.A. for Approval of the International Export of Bobcat from California During the 1978-79 Season. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., 6 pp.
- Lembeck, M. 1978. Bobcat Study, San Diego County, California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project E-W-2, Job IV-1.7, 22 pp.
- Gould, G. I., Jr. 1979. Bobcat Study, San Diego County, California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project E-W-2, Job IV-1.7, 3 pp.

- Gould, G. I., Jr. 1979. Information Requested by the E.S.S.A. for Approval of the International Export of Bobcat from California During the 1979-80 Season. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., 11 pp.
- Gould, G. I., Jr. 1979. Desert Bobcat Study. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-11, Job IV-1.6.1, 3 pp.
- Gould, G. I., Jr. 1980. Bobcat Study and Survey. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-11, Job IV-1.6, 8 pp.
- Zezulak, D. S. and R. G. Schwab. 1980. Bobcat Biology in a Mohave Desert Community. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Project W-54-R-12, Job IV-4, 25 pp.
- Gould, G. I., Jr. 1980. Information Requested by the Fish and Wildlife Service for Approval of the International Export of Bobcat from California During the 1980-81 Season. Calif. Dept. of Fish & Game, Nongame Wildl. Invest. 14 pp.
- Gould, G. I., Jr. 1980. Bobcat Study, San Diego County, California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Final Report, Project E-W-3, Job IV-1.7, 12 pp.
- Gould, G. I., Jr. 1981. Density and Population Dynamics of Bobcats - Lava Beds National Monument. Calif. Dept. Fish & Game, Nongame Wildl. Invest., Final Report, Project W-54-R-12, Job IV-3, 4 pp.
- Gould, G. I., Jr. 1981. Density and Population Dynamics of Bobcats - San Diego County. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-12, Job IV-5, 3 pp.
- Gould, G. I., Jr. 1981. Bobcat Harvest Assessment. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-12, Job IV-6, 15 pp.
- Gould, G. I., Jr. 1981. Age and Sex Structure of Bobcats in California. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-12, Job IV-7, 11 pp.
- Zezulak, D. S. 1980. Northeastern California Bobcat Study. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Final Report, Project E-W-2, Job IV-1.6, 34 pp.
- Gould, G. I., Jr. 1981. Bobcat Study in San Diego County. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., Final Report, Project E-W-4, Job IV-13.1, 4 pp.
- Gould, G. I., Jr. 1981. Information Requested by the Q.S.A., U.S.F.&W.S. for Approval of the International Export of Bobcats from California During the 1981-82 Season. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., 18 pp. + appen.

- Gould, G. I., Jr. 1982. Density and Population Dynamics of Bobcats - San Diego County. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Final Report, Project W-54-R-13, Job IV-5, 3 pp.
- Gould, G. I., Jr. 1982. Age and Sex Structure of Bobcats in California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-13, Job IV-7, 13 pp.
- Gould, G. I., Jr. 1982. Bobcat Harvest Assessment. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-13, Job IV-6, 21 pp.
- Biberdorf, A. 1982. Status of the Bobcat in California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-14, Job I-8, 9 pp.
- Gould, G. I., Jr. 1982. Information Requested by the O.S.A., U.S.F.&W.S., for Approval of the International Export of Bobcats from California During the 1982-83 Season. Calif. Dept. of Fish and Game, Nongame Wildl. Invest., 18 pp.
- Gould, G. I., Jr. 1982. Bobcat Harvest Assessment. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-14, Job IV-6, 20 pp.
- Gould, G. I., Jr. 1982. Age and Sex Structure of Bobcats in California. Calif. Dept. of Fish & Game, Nongame Wildl. Invest., Progress Report, Project W-54-R-14, Job IV-7, 15 pp.

Table 2. Summary of Changes in Laws and Regulations Governing the Take of Bobcats

<u>Year</u>	<u>Action</u>
1971	-Bobcat classified as a nongame animal by California Legislature
1974	-Six month harvest season established by Fish and Game Commission
1976	-Season reduced to standard 3½ month furbearer season
1977	-Shipping tag required for export of bobcat pelts from California
1978	-A quota of 6,000 export tags established
1978-79	-Season closed one month early due to reaching quota
1979	-Biological information necessary in order to purchase shipping tag -Season reduced to 2½ months
1979-80	-Season closed one month early due to reaching quota
1980	-Bobcat sport hunting tags were required; each hunter limited to 2 -State split into 3 zones, with season lengths of 3, 6½ and 9 weeks
1981	-Quota of 6,000 tags lifted -Season length in the 2 zones with longer seasons was increased by one week
1982	-Season length in northeastern California increased by one week -Season length for sport hunting extended 2 weeks in 7 counties

Table 3. Proposed Outline for Bobcat Management Plan

I. INTRODUCTION - General history of bobcat resource use, plan objective, management objectives, scope and time frame of plan

II. METHODS

- A. Field Research - Life history studies, reproductive rate studies, age and sex structure analyses
- B. Harvest Monitoring - Bobcat tagging program, annual trapper report, annual hunter survey, depredation reports

III. BIOLOGICAL INFORMATION

- A. Taxonomy and Morphology
- B. Distribution - State-wide, habitat use
- C. Spatial Occupancy - Density, home range size and use
- D. Population Estimate - Available habitat, local and state-wide population size
- E. Population Structure - Age and sex structure, geographic and temporal variations
- F. Reproduction - Age at maturity, breeding season chronology, litter size, portion of breeding females
- G. Movements - Dispersal of young, transients
- H. Mortality - Causes, age and sex specific rates, variations due to individual states
- I. Population Dynamics - Life table, average life expectancy, intrinsic rates of population growth, geographical variations, trends, predictability
- J. Predator - Prey Relationships - Food habits, trends in prey populations, competition for food, the bobcat as prey
- K. Harvest - Sex-age specific vulnerability, commercial trapping and hunting, sport hunting, depredation control

IV. MANAGEMENT IMPLICATIONS

- A. Present Condition of Bobcat Populations
- B. Comparing Present Conditions with Management Objectives
- C. Predictive Capabilities - Determining population trends due to harvest, future of fur market

V. MANAGEMENT PROCEDURES

- A. Habitat Alteration
- B. Monitoring Population Structure
- C. Harvest Demand
- D. Harvest Regulations

VI. RESEARCH NEEDS

- A. Adequacy of Current Information
- B. Population Modeling
- C. Calculating the Effect of Climate Variables
- D. Variability Among Different Geographic Populations

Figure 1. Parturition dates of bobcats in California, 1979-1980.

(Single-width lines represent duration of parturition of 80% of bobcats in sample; double-width lines represent 50%; vertical "tick" represents median parturition date; * indicates only part of county)

