Alaska Department of Fish and Game
Division of Wildlife Conservation

Development and Testing of a General Predator-Prey Computer Model for Use in Making Management Decisions

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This is a progress report on continuing research. Information may be refined at a later date.
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RESEARCH PROGRESS REPORT

STATE: Alaska **STUDY NO.:** 1.46

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GRANT NO.: W-24-4

STUDY TITLE: Development and Testing of a General Predator-Prey Computer Model for Use in Making Management Decisions

PERIOD: 1 July 1995-30 June 1996

SUMMARY

A prototype of a general predator-prey model was completed in 1993 using Lotus 1-2-3 software. The model estimates ungulate population size and allowable harvests and allows the user to select a number of alternate predator and prey management scenarios. In September 1993 the principal investigator was assigned to other duties, and no progress was made on this project between October 1993 and May 1996. However, work was reinitiated in June 1996. Model function has been modified to accommodate greater flexibility by the user, the assumptions of the model have been updated based on recent findings in predator-prey relationships, and the model is being converted to take advantage of the graphics and spreadsheet options of Microsoft Excel software. A final report will be submitted by 31 January 1997.

Key words: Excel, harvest, Lotus, model, predator-prey interactions, ungulate, wolf.

CONTENTS

BACKGROUND

In 1991 a comprehensive wolf (*Canis lupus*) management planning process stimulated increased public involvement in management of Alaska's big game species. Public requests to intensively manage for sustained high harvests of moose (*Alces alces*), caribou (*Rangifer tarandus*), and Dall sheep (*Ovis dalli*) from manipulated predator-prey systems were countered by public requests for lower, "natural" yields of big game from unmanipulated predator-prey systems. Those conflicting public values placed additional responsibilities on managers to more clearly predict consequences of proposed management programs.

In response to past controversy over predator-prey management, biologists in Alaska, other northern states, and the Yukon conducted significant research into the general behavior of large ungulate-large carnivore ecological systems. Those advances in large prey-predator ecological research, and the wide availability and use of personal computers, have created an opportunity to develop additional tools for management decisions.

Many of the predator-prey relationships investigated in intensive predator-prey studies have proven to be consistent throughout Alaska and northern Canada (McNay 1993). Those relationships can be combined to model wolf predation rates, wolf population response to changing ungulate densities, and, conversely, ungulate population responses to changing wolf densities. Predation rates by bears (*Ursus* sp) on ungulates, while not as predictable as those by wolves, can be estimated from predation rates observed in studies of systems similar to those being modeled. In addition, responses of ungulate populations to extreme weather can be modeled using data describing thresholds of critical weather such as described for moose by Coady (1974). Historical weather records could be used to produce probability estimates for the occurrence of severe weather events.

STUDY OBJECTIVES

Develop a computer model to assist Alaskan wildlife managers in making annual management decisions regarding big game predator-prey systems and verify the effectiveness and sensitivity of that model by modeling predator-prey systems that have been intensively studied and/or manipulated.

JOB OBJECTIVES

- Review literature of predator-prey studies to identify basic relationships of Alaskan predator-prey systems.
- Construct a general predator-prey model compatible with Lotus 1-2-3 and Microsoft Excel software.
- Write a manual describing model function and basis for model assumptions, including guidelines for model use.
- Compile and analyze predator-prey data for western Unit 20B for the period 1984-1989. Prepare a report describing predator-prey dynamics in western Unit 20B.
- Validate and refine model functions to simulate known dynamics of intensively studied predator-prey systems.
- Train area biologists in use of the model and its application to current management problems.
- Write final report and prepare presentations for public and scientific meetings.

RESULTS

A prototype of a general predator-prey model using Lotus 1-2-3 software was completed. The model uses inputs estimated from routine survey and inventory activities, or extrapolated from intensive predator-prey studies. The model will be useful to management biologists to estimate 1) trends in ungulate and wolf population size, 2) annual allowable ungulate harvests to meet management objectives, 3) efficacy of proposed predator reduction programs, 4) potential interactive effects of severe weather and predation on ungulate populations, and 5) population dynamics of ungulate-predator systems containing more than 1 ungulate prey species and more than 1 predator species.

During July and August 1993, an initial draft user's manual was prepared and a progress report detailing work accomplished during the 1 July 1992-30 June 1993 period was completed and submitted (McNay 1993). The principal investigator was assigned to other projects beginning in September 1993 and did not make further progress on refinement of the prototype model or on the draft user's manual until June 1996.

In June 1996 the principal investigator began an update of the prototype model that reflects recent findings in predator-prey relationships (Schwartz 1993, Boyce 1995, Messier 1995, Seip 1995, Vales and Peek 1995, Boertje et al. 1996). In addition, the model is being converted to operate with the graphics and spreadsheet features of Microsoft Excel software. That software package is in common use and provides advantages over the original Lotus 1-2-3 format. A final report will be submitted by 31 January 1997.

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