New Hampshire
Fish and Game Department

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Web site: www.WildNH.com

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Glenn Normandeau
Executive Director

April 9, 2020

His Excellency, Governor Christopher T. Sununu
  And the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the New Hampshire Fish and Game Department to amend an existing Sole Source Cooperative Project Agreement (CPA) Contract #6001502)) with the University of New Hampshire (VC# 177867) to conduct a research project in support of moose management by increasing the price limitation of the CPA by $79,378 from $1,192,773 to $1,272,151 and by extending the completion date from June 30, 2020 to August 30, 2021 effective upon Governor and Council approval. The original CPA was approved by Governor and Council on July 24, 2013, Item #38, and most recently amended by Governor and Council on March 22, 2017, Consent Item C. 100% Federal Funds.

Funding is available in account, Game Management, as follows;

03 75 75 751520-21580000 – Wildlife Program – Game Management

20-07500-21580000-304-500841 Research and Management

FY 21
$79,378

EXPLANATION

As previously stated, the original CPA was approved by Governor and Council on July 24, 2013, Item #38. It was then subsequently amended with Governor and Council approval on September 16, 2015, Item #55, and on March 22, 2017, Consent Item C. This submittal is a request for a final year's extension and modification of an existing Sole Source Cooperative Project Agreement related to moose research and management. All previous goals and objectives of this CPA have been met. This request is intended to further assess and develop approaches and techniques related to the direct management of New Hampshire's moose population, which are an invaluable and iconic ecological, economic, and recreational public resource in New Hampshire. As such, this request is intended to facilitate the development and refinement of management tools based on research already completed under this CPA with additional analysis of existing data sets and minimal additional data collection.

Winter ticks are a major limiting factor of moose populations in northern NH. The 5 objectives of this amendment are interrelated and focus on data and measurements intended to help us develop useful management tools to evaluate and predict the impact of winter ticks on our moose population. Specifically, this amendment is designed to: 1) develop and assess a predictive model to estimate tick infestation rates using several previously established tick indices; 2) assess the feasibility of using winter calf urine samples to predict spring calf mortality rates and to test the value of the predictive model; 3) assess the relationship between January calf weights, January tick infestation rates, and winter calf survival in 3 distinct geographic regions; 4) analyze existing regional camera trap data sets to estimate regional moose abundance and to identify the number of calves per cow moose; and 5) assess habitat use by cows using available telemetry data sets, under different forest management regimes in 3 distinct geographic regions where calf survival rates are known to differ.

Respectfully submitted,

Glenn Normandeau
Executive Director

Kathy Ann LaBonte, Chief
Business Division

AMENDMENT #03 to
COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, **Department of Fish and Game**
and the
University of New Hampshire of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

The Cooperative Project Agreement, approved by the State of New Hampshire Governor and Executive Council on **7/24/13**, item # **38**, for the Project titled "**Productivity and Mortality of Moose in Northern New Hampshire,**" Campus Project Director, **Dr. Peter Pekins**, is and all subsequent properly approved amendments are hereby modified by mutual consent of both parties for the reason(s) described below:

Purpose of Amendment (Choose all applicable items):

☐ Extend the Project Agreement and Project Period end date, at no additional cost to the State.

☒ Provide additional funding from the State for expansion of the Scope of Work under the Cooperative Project Agreement.

☐ Other:

Therefore, the Cooperative Project Agreement is and/or its subsequent properly approved amendments are amended as follows (Complete only the applicable items):

- Article A. is revised to replace the State Department name of   with   and/or USNH campus from   to   .

- Article B. is revised to replace the Project End Date of **06/30/20** with the revised Project End Date of **08/30/21**, and Exhibit A, article B is revised to replace the Project Period of **08/01/13 – 06/30/20** with **08/01/13 – 08/30/21**.

- Article C. is amended to expand the scope as included in attached Exhibit A.

- Article D. is amended to change the State Project Administrator to   and/or the Campus Project Administrator to   .

- Article E. is amended to change the State Project Director to **Daniel Bergeron** and/or the Campus Project Director to   .

- Article F. is amended to add funds in the amount of **$79,378** and will read:

  Total State funds in the amount of **$1,272,151** have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.

- Article F. is amended to change the cost share requirement and will read:

  Campus will cost-share   % of total costs during the amended term of this Project Agreement.

- Article F. is amended to change the source of Federal funds paid to Campus and will read:

  Federal funds paid to Campus under this Project Agreement as amended are from Grant/Contract/Cooperative Agreement No.   from   under CFDA#   . Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New

Campus Authorized Official **KJ**
Date **4/3/20**

Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as **revised** Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

- Article G. is exercised to amend Article(s)   of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, as follows:

  Article   is amended in its entirety to read as follows:
  Article   is amended in its entirety to read as follows:

- Article H. is amended such that:

  ☐ State has chosen **not to take** possession of equipment purchased under this Project Agreement.
  ☐ State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

- ☒ Exhibit A is amended as attached.

- ☐ Exhibit B is amended as attached.

All other terms and conditions of the Cooperative Project Agreement remain unchanged.

This Amendment, all previous Amendments, the Cooperative Project Agreement, and the Master Agreement constitute the entire agreement between State and Campus regarding the Cooperative Project Agreement, and supersede and replace any previously existing arrangements, oral and written; further changes herein must be made by written amendment and executed for.the parties by their authorized officials.

This Amendment and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire or other authorized officials approve this Amendment to the Cooperative Project Agreement.

IN WITNESS WHEREOF, the following parties agree to this **Amendment #03** to the Cooperative Project Agreement.

By An Authorized Official of:	By An Authorized Official of:
University of New Hampshire	**Department of Fish and Game**
Name: Karen Jensen	Name: Glenn Normandeau
Title: Director, Pre-award	Title: Executive Director
Signature and Date: *Karen Jensen* 4/3/20	Signature and Date: _____ 4/13/2020

By An Authorized Official of: the New	By An Authorized'Official of: the New
Hampshire Office of the Attorney General	Hampshire Governor & Executive Council
Name: _Joshua Harrison_	Name:
Title: _Assistant Attorney General_	Title:
Signature and Date: _____ 4/15/2020	Signature and Date:

Campus Authorized Official _KJ_
Date _4/3/20_

A. Project Title: Productivity and Mortality of Moose in Northern New Hampshire

B. Project Period: August 1, 2013 - August 30, 2021

C. Objectives: The objective of this 1-year project extension is to further assess and develop approaches and techniques related directly to management of New Hampshire's moose population. The project will expand upon a number of analyses and conclusions from the just completed field-based project with radio-collared animals. The 5 objectives are interrelated and focus on data and measurements that should help develop useful methods to evaluate and predict the impact of winter ticks on moose. Specifically, it is designed to develop and assess:

1) A predictive model to estimate the final tick infestation on moose from 3 measurements: infestations measured on harvested moose, length of questing period, and the infestation rate;

2) Tthe feasibility of collecting snow urine from random calves in March to predict their spring mortality rate and to test Objective 1;

3) The relationship between January calf weight, January infestation, and survival in 3 management/geographic zones (i.e., northern New Hampshire, western Maine, and northern Maine) to test Objective 1;

4) The use of regional camera trap data in New Hampshire as a proxy to estimate moose abundance/density and to identify cow:calf ratios; and

5) Habitat use by cow moose relative to timber harvesting technique, specifically use of clear-cuts versus partial harvests in northern New Hampshire/western Maine and northern Maine, where calf survival rate differs.

D. Scope of Work:

Objective 1: Predicting final infestation of winter ticks

The final infestation level (post-questing period) of winter ticks on calf moose is related directly to the probability of calf survival (Ellingwood 2018; see Objective 3). A critical management challenge is to develop a method to predict the final infestation from accessible and replicated data because this value cannot be measured directly other than on January-captured moose. Predicting the final infestation is theoretically possible by integrating 3 factors: 1) the infestation on harvested moose at a known date in October, 2) assuming a stable infestation rate on moose throughout the questing period, and 3) assigning the length of the questing period based on environmental conditions (Powers and Pekins 2020).

Previous field research indicates that tick abundance (or infestation risk) was constant for 6 weeks until a snow event disrupted abundance and eventually terminated the questing period (Powers and Pekins 2020). Further, New Hampshire and Maine measure tick infestation on harvested moose in October, and previous analyses indicated that a value of ~37 ticks was the threshold for predicting 50% calf mortality the following spring (Dunfey-Ball 2017). However, the harvest infestation is not equal to the final infestation which is largely influenced by the length of the questing period that can extend to late November-early December (Dunfey-Ball 2017); this is the primary influence of

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Date __4/3/20__

climate change on the annual infestation level. The length of the questing period can be predicted from weather/ground conditions known to terminate activity of winter ticks (Bergeron and Pekins 2014, Holmes et al. 2018, Powers and Pekins 2020).

This analysis/model will combine temporal data related to tick abundance, measured infestation on harvested moose, and weather/ground conditions in autumn that terminate the questing period of winter ticks. For example, a final infestation could be calculated by assuming a questing initiation date (1 September), a constant daily infestation rate (ticks/day) calculated from the harvest infestation and number of days since the initiation date, and adding that daily infestation rate to the harvest infestation until a weather event (snow cover) terminates questing. Harvest infestation data are available from harvested moose in northern New Hampshire and western Maine, and weather/snow cover data are available from NOAA archives for 2014-2018. To test the reliability of these predicted final infestation values, they will be compared with the final infestation rates and known fates of captured calves in January 2014-2018 in New Hampshire and western Maine.

Objective 2: Snow urine analysis
Urea nitrogen:creatinine ratios measured in snow urine collected in mid-March are indicative of nutritional restriction and predictive of calf mortality (Ellingwood et al. 2019). The remaining 15-20 radio-marked adult cows in the Berlin study area will be used to evaluate the feasibility of collecting > 20 snow urine samples from unmarked calves in mid-March 2021 in the general study area. Locations of these radio-marked cows will be used to identify local wintering areas which will be searched by snowmobile and snowshoe to identify radio-marked and unmarked cows with calves. Snow urine samples are readily distinguished in a cow-calf pair by the size of tracks and bed nearest to the sample.

The most concentrated portion of snow urine will be collected in plastic bags using rubber gloves to avoid contamination. Thawed 2 mL aliquots will be submitted to BiovetUSA (Burnsville, Minnesota) to measure urea nitrogen (UN) and urinary creatinine (C) content (mg/dL). These data will be expressed as a ratio (UN:C) to correct for the dilution of each caused by snow (DelGiudice et al. 1988), and then compared to the threshold survival ratio of "3.5" above which calf mortality occurs (Ellingwood et al. 2019). Because no radio-collared calves will be available in northern New Hampshire for direct comparison, the ratios will be compared with the known mortality rate of radio-marked calves in western Maine to assess the relative accuracy in predicting population-level mortality. The rate of late winter calf mortality associated with winter ticks has been similar in northern New Hampshire and western Maine in past years (Jones et al. 2019). Further, a smaller data set (n = 15 snow urine samples) collected in March 2019 and an additional sample to be collected in March 2020 will be compared with known rates of calf mortality in northeastern Vermont (2019) and western Maine (2019, 2020, 2021).

Objective 3: Predicting regional calf mortality from body weight and final infestation
The final infestation measured on January-captured calves was the primary determinant of their survival in northern New Hampshire. Body weight has a counter-balancing effect as heavier calves (> 174 kg) expressed a degree of resistance to mortality, and heavier calves with similar tick loads had higher survival in northern Maine (Ellingwood 2018). Further, measurements of snow urine from these same calves in March were predictive of mortality relative to infestation (Ellingwood et al. 2019). Calf survival is a function of balancing the energy and protein costs associated with blood loss and available endogenous resources reflected in body weight.

Multiple years of data exist for January-captured calves of known fate in northern New Hampshire, western Maine, and northern Maine to further expand and evaluate relationships between final infestation, body weight, and survival. This analysis will incorporate 4 principal parameters

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measured at capture and at death: final infestation at capture, body weight at capture, body weight at death, and date of death. The proportional and absolute (mortal) weight loss and daily rate of weight loss will be calculated from the two body weight measurements and date of death. The capture body weight and final infestation will be used to create statistical relationships and predictive survival curves by year and region based on the known fates of calves as in Ellingwood (2018). Across a range of calf body weight, a bioenergetic model will be constructed to evaluate the absolute and temporal impacts of a range of infestation levels on the endogenous resources (body fat and protein) and body weight of calves due to blood loss associated with feeding nymphs and adult female ticks. In combination, these analyses combine multiple parameters associated with Objectives 1, 2, and 5 to identify the relative importance of measuring and/or predicting critical parameters associated with calf survival, and to further explain differences in weather, environmental conditions, and/or habitat that influence local, regional, and annual population responses to winter tick infestation in the northeast.

Objective 4: Using regional camera trap data to estimate key demographic parameters
To evaluate a cost-effective method for monitoring moose, remote camera data will be compared with radio-telemetry and demographic data collected during the same time frame (2014–2019) in northern New Hampshire. The camera data were collected from 160 sites that were operating continuously from 9 January 2014 – 27 July 2019 and distributed over a broad latitudinal (42.9–45.3°N) and elevational (3–1,451 m) gradient (Fig. 1). To maximize sampling and detectability, cameras were spaced in non-overlapping 2x2 km grids and programmed to take 1–3 consecutive pictures every 1–10 sec when triggered, depending on the camera brand/model. Each site included a remote camera positioned facing north on a tree, 1–2 m above the ground/snow surface and pointed at a slight downward angle towards a stake positioned 3–5 m from the camera (Fig. 1, inset). A GPS unit (Garmin GPS 62/64s, Garmin International, Olathe, KS, USA) was used to mark the location of each site when position error was <10 m. Commercial skunk (Mephitis mephitis) lure and wild turkey (Meleagris gallopavo) feathers were used as attractants and placed directly on the snow stakes. Cameras were checked on average 3 (range = 1–9) times each year to download data, refresh attractants, and to ensure cameras were working properly.

To determine if data from camera surveys can be used to index moose density, two hierarchical modeling approaches will be used. The first approach will be to evaluate the relationship between occurrence and density (i.e., the O-D relationship; Linden et al. 2017). Site occupancy models will be used to generate annual estimates of occurrence based on abiotic and biotic factors that best explain moose distribution in the region (snow duration and early- to mid-regenerating boreal forest biomass). Accordingly, to evaluate the O-D relationship, these estimates will be compared with spatial capture-recapture (SCR) estimates of density from capture and telemetry data collected over the same time frame using linear regression.

The second approach will be similar, except that count models (Royle-Nichols; Linden et al. 2017) will be used in lieu of occupancy models to determine the relationship between relative density and true density, the latter of which will be derived from SCR estimates. The best performing models of each approach will be evaluated for bias, precision, and the ability to track populations over time based on environmental covariates (e.g., snow duration) and habitat change. Of utmost importance, a comparison of cost and effort will be made among existing methods, including cameras, aerial counts, and hunter observations to determine the most cost effective and efficient method for New Hampshire Fish and Game Department to monitor moose.

Camera data will also be used to estimate reproduction and recruitment and compared with estimates derived from data collected during the concurrent radio-telemetry study (Ellingwood 2018, Jones et al. 2019, Powers 2019). This approach was successfully used to estimate reproduction, recruitment,

Campus Authorized Official KJ
Date 4/3/20

and survival of white-tailed deer in the Carolinas (Chitwood et al. 2017) and Florida (Chandler et al. 2018). The authors of the former study attributed their success to the large sample size (nearly 40,000 photographs of deer over a 6-year period). Interestingly, the sample size of moose detections from the camera project-in New Hampshire is higher (over 60,000 photographs over a 6-year period) and contains thousands of pictures of cows with calves, including documentation of twinning on numerous occasions. Briefly, the camera-based estimates of recruitment (calf:cow ratio) can be used as a predictor of radio-tagged estimates of survival. This approach was successfully used to track trends in deer survival with high predictive power ($R2 = 0.758$; Chitwood et al. 2017). Additionally, because yearlings are easy to identify in pictures, this information can be used to calibrate estimates of recruitment. Finally, because environmental data (e.g., leaf phenology, snow duration) and the relative body condition of animals are also visible in photographs, these data can be used to understand the effects of abiotic and biotic factors on reproduction and survival.

Objective 5: Identifying the direct and indirect effects of habitat and climate on winter tick infestation rates on moose

Location data of adult cow moose (n > 100) collected from 2014–2019 in northern New Hampshire and western Maine (unpublished data; P. J. Pekins, University of New Hampshire and L. Kantar, Maine Department of Inland Fisheries and Wildlife) and data from winter tick abundance surveys (2008–2009, 2018) from northern New Hampshire (Bergeron and Pekins 2014, Powers 2019) will be used to evaluate the direct and indirect effects of habitat (with a focus on clear-cut vs. partial harvest) and climate on winter tick infestation rates and epizootics on moose.

A combination of modeling approaches will be used to identify the influence of habitat and climate on moose habitat use and winter tick infestation rates. First, high resolution land cover and imagery data will be used to classify the differences between management regimes, including unmanaged, partial harvest, and clear-cut forest. Models will be verified from stands with known management and accuracy will be estimated with commonly used statistics (Area Under the Curve, Receiver Operating Characteristic). To determine the spatiotemporal use of stands, data from the telemetry studies in New Hampshire and Maine will be used within a multi-scale resource selection framework (McGarigal et al. 2016) that allows use to change over time (e.g., Shirk et al. 2014). For all analyses, the repeated measurements of individuals will be the sampling unit (i.e., a Design III study; Manly et al. 2002) and generalized linear mixed effects models will be used to evaluate differences in use between habitat types over time. Alternative approaches that account for the temporal component of movements (e.g., Brownian bridges) and contagion risk will also be considered (Dougherty et al. 2018). These analyses will incorporate abundances of winter ticks associated with specific habitat types (unmanaged, clear-cut, and partial harvest forests) to identify which habitat types contribute towards high re-infestation rates and perpetuate epizootics. Further, the influence of winter weather (e.g., snow depth) will also be incorporated to understand how this abiotic factor influences moose movements and habitat use.

E. **Deliverables Schedule:** Campus Project Director shall provide the State Project Director with brief, interim progress reports by the following dates: October 30, 2020, January 30, 2021, April 30, 2021. A final report in a format acceptable to NHFG that addresses analysis and findings for each objective shall be due no later than 60 days after the project ends. Payment of final invoice shall be contingent upon reciept of final report.

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Date__4/3/20__

F. Budget and Invoicing Instructions: No change to invoicing instructions, budget increase of

Budget Items	State Funding	Cost Sharing	Total
1. Salaries & Wages	48,000	10,405	58,405
2. Employee Fringe Benefits	21,024	4,568	25,592
3. Travel	0	0	0
4. Supplies and Services	0	0	0
5. Equipment	0	0	0
6. Facilities & Admin Costs	10,354	3,893	14,247
Subtotals	79,378	18,866	98,244
Unrecovered F&A		7,592	7,592
Total Project Costs:			105,836

Campus Authorized Official _KJ_
Date _4/3/20_

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Glenn Normandeau
Executive Director

woo 9809110
Governor & Council Approved
Date: _9-16-15_
Item #: _55_

FY 16 RQ 15988 4

FY 16 PO 600150d 100%

August 14, 2015

Her Excellency, Governor Margaret Wood Hassan
   and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the New Hampshire Fish and Game Department to amend an existing Sole Source Cooperative Project Agreement (CPA) with the University of New Hampshire (Vendor No. 177867) to conduct a research project in support of moose management by increasing the amount of the CPA by $497,773 from $695,000 to $1,192,773 and by extending the project end date from June 30, 2017 to December 31, 2018. This CPA was originally approved by Governor and Council on July 24, 2013, Item# 38. 100% Federal Funds.

Funds to support this request are available in the following account in State FY 2016, State FY 2017, and State FY 2018 upon the availability and continued appropriation of funds in the future operating budget, with the ability to adjust encumbrances between State Fiscal Years through the Budget Office, if needed and justified."

03 75 75 751520-21580000 - Wildlife Program Management Program - Game Management

20-75000-21580000-304-500841 Research and Management	FY16	FY17	FY18
	$166,950	$265,378	$65,445

EXPLANATION

This is a continuation of an original Sole Source Cooperative Project Agreement. Moose are an invaluable ecological, economic, and recreational resource in New Hampshire. Moose productivity and mortality has not been formally assessed in New Hampshire since 2005. Understanding these population metrics is essential to science-based population management. This project provides the Department with current data on moose productivity and mortality rates through the intensive tracking of radio collared cow moose and calves. These data are essential to New Hampshire's moose management program. They will provide information necessary to make informed management decisions regarding regional moose population declines; they will facilitate more precise achievement of moose population objectives through moose permit issuance and; they will potentially provide a methodology for predicting and mitigating high mortality events in the future.

In January of 2014 and 2015 a total of 87 moose were captured and collared (49 calves and 38 cows). Subsequent monitoring has indicated relatively high calf mortality in the spring of both 2014 and 2015. The vast majority of this mortality was consistent with severe infestation of winter tick. Since a key objective of this project is to assess the impacts of weather on tick abundance and moose mortality, a range of fall, winter and spring weather conditions as well as their hypothesized effect on ticks and moose is essential to evaluate these relationships. This request seeks to extend the research project from its original ending date (June 30, 2017) to December 31, 2018. This would permit 2 additional years of moose capture and collaring in the winters of 2016 and 2017 as well as subsequent monitoring. Extension of this research will significantly increase the sample size for monitoring moose mortality and productivity. It will also serve to increase the range of variation of the weather related and other factors which are believed to influence tick abundance and moose mortality, aiding in the development of models to predict future winter tick related mortality.

Respectfully submitted,

Glenn Normandeau
Executive Director

Kathy Ann LaBonte, Chief
Business Division

New Hampshire
Fish and Game Department

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Glenn Normandeau
Executive Director

February 14, 2017

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the New Hampshire Fish and Game Department to amend an existing Sole Source Cooperative Project Agreement (CPA) with the University of New Hampshire (Vendor No. 177867) to conduct a research project in support of moose management by extending the project end date from December 31, 2018 to June 30, 2020 at no additional cost to the state. This CPA was originally approved by Governor and Council on July 24, 2013, item #38, and amended by Governor and Council on September 16, 2015, item #55. Funding 100% federal.

EXPLANATION

Moose are an invaluable ecological, economic, and recreational resource in New Hampshire. Understanding these population metrics is essential to science-based population management. This project provides the Department with current data on moose productivity and mortality rates through the intensive tracking of radio collared cow moose and calves. These data are essential to New Hampshire's moose management program. They will provide information necessary to make informed management decisions regarding regional moose population declines; they will facilitate more precise achievement of moose population objectives through moose permit issuance and; they will potentially provide a methodology for predicting and mitigating high mortality events in the future.

During the past 4 winters (2014-2017) a total of 182 moose were captured and collared (122 calves and 60 cows). Subsequent monitoring has continued to indicate relatively high calf mortality. The vast majority of this mortality has been consistent with severe infestation of winter tick. Since a key objective of this project is to assess the impacts of weather on tick abundance and moose mortality, a range of fall, winter and spring weather conditions as well as their hypothesized effect on ticks and moose is essential to evaluate these relationships. This request seeks to extend the research project from its current ending date (December 30, 2018) to June 30, 2020. Cost savings associated with reduced capture and collaring costs and the availability of University sponsored student assistantships have made it possible to extend these research efforts at no additional cost to the state. This would permit 1 additional year of moose capture and collaring in the winter of 2018 as well as subsequent monitoring. Extension of this research will increase the sample sizes and serve to increase the range of variation of the factors which are believed to influence tick abundance and moose mortality aiding in the development of models to predict future winter tick related mortality and productivity impacts.

Respectfully submitted,

Glenn Normandeau
Executive Director

Kathy Ann LaBonte, Chief
Business Division

New Hampshire
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Glenn Normandeau
Executive Director

2nd FY 16 = RQ 160214

$62,500

July 8, 2013

FY 15 = RQ PO 6001502

149832

FY 16 = RQ 159211 50%

$62,500
WD 2416233
WD 2807963

Her Excellency, Governor Margaret Wood Hassan
   and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the New Hampshire Fish and Game Department to enter into a Sole Source
Cooperative Project Agreement with the University of New Hampshire (Vendor No. 177867) to
conduct a research project in support of moose management in the amount of $695,000 from the date
of Governor and Executive Council approval through June 30, 2017. 100% Federal Funds.

Funding is available in account, Game Management, with authority to adjust encumbrances
in each of the state fiscal years through the Budget Office if needed and justified:

03 75 75 751520-21580000 - Wildlife Program Management Program - Game Management
                                        Unr (illegible)
20-75000-21580000-304-500841 Research and Management

FY14	FY15	FY16*	FY17*
$240,000	$320,000	$125,000	$10,000

*Pending State Budget Approval

EXPLANATION

Moose are an invaluable ecological, economic, and recreational resource in New Hampshire.
The annual estimated economic expenditure associated with New Hampshire wildlife-watching
exceeds $250 million. Because much wildlife-watching and ecotourism in New Hampshire centers on
moose, it is imperative to sustain this important resource and to manage it consistent with its unique
ecological, economic and recreational values. Moose are also of significant economic importance to
the Fish and Game Department, generating over $300,000 per year in direct revenue which is used for
wildlife management, law enforcement and department staffing.

Currently, multiple moose populations across their southern range are in decline including
those of Minnesota, New Hampshire, and Vermont. Moose productivity and mortality has not been
formally assessed in New Hampshire since 2005. Understanding these population metrics is essential
to science-based population management. Given that productivity appears to have changed
measurably in the past decade and that the population has declined concurrently, a precise assessment
of present-day productivity and mortality and the factors driving them, is a high priority for the Fish
and Game Department.
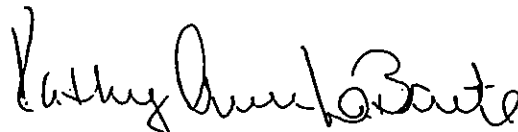
This project will provide the Department with current data on moose productivity and mortality rates through the intensive tracking of 80 to 100 radio collared moose cows and calves. These data are essential to New Hampshire's moose management program. They will provide information necessary to make informed management decisions regarding regional moose population declines; they will facilitate more precise achievement of moose population objectives through moose permit issuance and; they will potentially provide a methodology for predicting and mitigating high mortality events in the future.

Respectfully submitted,

Glenn Normandeau
Executive Director

Kathy Ann LaBonte
Chief, Business Division