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New Hampshire
Fish and Game Department

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Scott R. Mason
Executive Director

April 4, 2022

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 enter into a **Sole Source** Cooperative Project Agreement with the University of New Hampshire (Vendor No. 315187), Durham, NH, in the amount of $224,074 to conduct a research project in support of furbearer management effective upon Governor and Council approval through June 30, 2025. 100% Federal Funds.

Funds are available in the following account for Fiscal Years 2022 and 2023, and are anticipated to be available in Fiscal Years 2024 and 2025, upon the continued appropriation of funds in the future operating budget with the authority to adjust encumbrances between fiscal years within the price limitation through the Budget Office, if needed and justified:

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

	FY2022	FY2023	FY2024	FY2025
20-7500-21580000-304-500841 Research and Management	$18,300	$31,839	$80,284	$93,651

EXPLANATION

The Department proposes to enter into a Cooperative Project Agreement with the University of New Hampshire to conduct this research. Sole source is requested because of the University's past experience and success conducting furbearer research and working with the Department. The University will be conducting the work as a sub-recipient under an approved federal award from the Fish and Wildlife Service and is contributing the required non-federal matching funds for the federal funding received.

New Hampshire hosts a diverse community of terrestrial furbearer species. These species are an integral part of a functioning ecosystem and provide substantial social, cultural, and economic value to multiple stakeholders in NH. Many furbearer species are widely distributed through the state and their populations are managed through varying harvest techniques. Furbearer trapping and hunting are important social and cultural activities in NH. Moreover, these activities can help maintain populations at socially and biologically desirable levels and are viewed as a critical tool in wildlife management.

Trapper activity has declined across the U.S. over the past several decades but has been relatively stable in NH in recent years. While public support for trapping is relatively high nationwide (i.e., approval ratings >

to-event models (Moeller et al. 2018, Loonam et al. 2021), will also be considered if they offer equivalent or better accuracy compared with the REST model.

In addition, a protocol will be developed for data analysis that will enable efficient image data processing for monitoring wildlife beyond the timeframe of this proposal using programs such as Timelapse (https://saul.cpsc.ucalgary.ca/timelapse) and the Microsoft Megadetector artificial intelligence program (https://github.com/microsoft/CameraTraps). This protocol will include analysis scripts written in the R programming language that can fit population density models to the processed camera trap image data (R Core Team 2017).

Objective 2. To quantify furbearer-habitat relationships and use them to build species-specific predictive maps of population density.

The REST model density estimates will be analyzed as a function of habitat variables developed within a Geographic Information System (GIS) consisting of remote-sensing products across the study area. This GIS will consist of data related to i) habitat cover types such as those delineated by the 2015 New Hampshire Wildlife Action Plan (NHFG 2015); and ii) forest and urban development land classifications as mapped by remote sensing layers such as the National Land Cover Database (Homer et al. 2015). These variables will include compositional metrics related to the proportion and type of forest surrounding study sites (Hesselbarth et al. 2019). Environmental covariates will also be considered in the models, including mean annual snow depth (NOHRSC 2004) and elevation. Site latitude and longitude will also be incorporated into the models to account for potential spatial autocorrelation and to help ensure that model independence assumptions are met (Rota et al. 2016). These furbearer-habitat relationships will be quantified by analyzing the REST model in a hierarchical Bayesian framework using Markov Chain Monte Carlo simulation (Kéry and Royle 2015, Moll et al. 2020a). Bayesian indicator variables will be used to determine, for each species, which combinations of habitat variables most strongly predict and explain density (Kuo and Mallick 1998). The resultant coefficients for those habitat variables will be then used to create predictive maps of species density across the study area.

Objective 3. To compare density estimates from Objectives 1 and 2 with previously established methods for estimating the relative abundance and occurrence of furbearers across the full extent of New Hampshire.

The density estimates from the REST model described above will be compared with two previously established methods for estimating relative abundance and occurrence using images collected from camera traps. The first of these is the Royle-Nichols model, which uses the frequency of detections for each species at each camera site to provide an estimate of relative abundance (Royle and Nichols 2003, Kéry and Royle 2015). The second method uses occupancy models, which account for imperfect detection (i.e., a species uses the area around a site but is not captured on camera) to estimate species occurrence in a hierarchical probabilistic framework (MacKenzie et al. 2002, Moll et al. 2016). The three estimates from the three modeling approaches (REST, Royle-Nichols, and occupancy) will be compared using correlation analysis across the full extent of New Hampshire. The outcome of this analysis will inform which of these methods would be most efficacious for evaluating the accuracy of CPUE trends and the most efficient approach for future furbearer monitoring.

Objective 4. To compare density estimates for furbearer species to current population monitoring methods.

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The density estimates from the REST model will be used to evaluate the accuracy of current furbearer monitoring methods using CPUE from trapper-provided data. Specifically, the mean densities for each of the five focal species will be calculated for each of the five furbearer management regions in each year of this study (NHFG 2020). Mean density estimates from the 2020-2021 sites in WMUs L and M will also be calculated. These density estimates will then be used in a linear model to determine, for each species, the degree to which CPUE estimates correlate to population density, as indicated by model R2 values. If needed, non-linear or generalized additive models will be used to capture potential non-linear relationships between density and CPUE (Wood 2017).

E. Deliverables Schedule: Campus shall submit quarterly progress reports in a format acceptable to the State and due within 30 days of the end of each calendar year quarter. Reports shall include a comparison of actual accomplishments during the reporting period against the established project objectives, and include any significant developments that either result in problems, delays, or adverse conditions or which favorably impact the project. Campus shall submit an overall final report detailing activities and results of the project no later than 60 days after the Project Period end date (06/30/25). GIS layers depicting probabilistic estimates of furbearer populations for each species shall be provided with the final report. Campus shall also provide the State with a copy of any graduate thesis or doctoral disertation completed as a result of the project no later than 1 year after the Project Period end date (06/30/25). Any articles, publications, or media regarding the project and project results shall reference the funding support provided by the New Hampshire Fish and Game Department and the Wildlife Restoration program under federal grant F22AF00995 (NH W-113-R-1).

F. Budget and Invoicing Instructions: Campus will submit invoices to State on regular Campus invoice forms no more frequently than monthly and no less frequently than quarterly. Invoices will be based on actual project expenses incurred during the invoicing period, and shall show current and cumulative expenses by major cost categories. Invoices shall also document eligible cost share recorded during the period by category (e.g. PI salary, fringe, and cost share portion of F&A), as well as cumulative cost share through the end of the invoicing period. Campus shall provide supporting documentation for the amount of any invoiced payment requests and matching costs upon request by State, which may include invoices for supplies, equipment, or services, and reports of personnel, travel, and Facilities and Administration (indirect) costs. State will pay Campus within 30 days of receipt of each invoice. Campus will submit its final invoice not later than 60 days after the Project Period end date. Payment of final invoice shall be contingent upon receipt of deliverables and the final report.

Budget Items	State Funding	Cost Sharing	Total
1. Salaries & Wages	104,048	38,339	142,387
2. Employee Fringe Benefits	2,863	5,571	8,434
3. Travel	15,000	0	15,000
4. Supplies and Services	27,509	7,724	35,233
5. Equipment	0	0	0
6. Facilities & Admin Costs	74,654	23,125	97,779
Subtotals	224,074	74,759	298,833
Total Project Costs:			298,833

Budget Narrative

1. Salaries and Wages: $104,048
The budget includes 0.25 months per year of summer support for Dr. Moll to support field and logistical duties during the summer.

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The budget supports two academic years and three and a half summers for a Ph.D. student who will be responsible for conducting the proposed work under the supervision of the PI Dr. Remington Moll. The graduate student stipend is based upon the current University of New Hampshire Rate Sheet .

In each year, the budget provides for the equivalent of one undergraduate research technician to assist with field and laboratory effort assuming 40 hours per week for 12.5 weeks at a rate of $12/hr for year 1 and an inflation rate of 3.0% per year thereafter.

2. Fringe Benefits: $2,863
Fringe benefits will be charged according to UNH's current federally-approved benefits rates for the project period, at the "partial fringe benefits" rate for faculty and graduate student summer salary, and at the "full fringe benefits" rate for other full-time staff. Rates are 37.6% for full benefits, and 7.9% for partial benefits.

3. Travel: $15,000
The budget covers travel required to visit study sites to conduct field work, calculated at approximately 7,700 miles per year to visit all sites twice annually at the current UNH mileage rate of $0.585/mile . The budget also includes $1,500 total to offset costs associated with graduate student travel and accommodation professional conferences.

4. Supplies & Services: $27,509
The budget provides for 45 camera traps (at a rate of $170 per camera) and associated supplies, including batteries, lock boxes, and locks (at a rate of $70 per site). The budget also provides for $2,500 camera upkeep and potential replacement (e.g., due to damage) in each of years 2 and 3. The budget also includes $1,200 of support for required field supplies associated with camera deployment and upkeep (e.g., shims, screws, etc.).

The budget includes $1,500 total to offset costs for page charges for peer-reviewed publications.

The proposed tuition covers costs for credit hours, health care, and fees for a graduate student for two years based upon the current University of New Hampshire Rate Sheet. $4,501 in year 2 and $4,508 in year 3.

5. Equipment: $0

6. Facilities and Administrative Costs: $74,654
Facilities & Administrative (indirect) costs are calculated according to UNH's current negotiated rate agreement with the Federal government. For the proposed budget, an on-campus rate with a Modified Total Direct Costs base is applied. The applicable fiscal year rates, as shown on our Federal agreement are 51.5% (7/1/21-6/30/22), 52.5% (7/1/22-6/30/23), and 53.5% (7/1/23-until amended). As this project crosses fiscal years a composite rate is applied. The US Department of Health and Human Services is UNH's cognizant federal agency. Total requested $74,654.

Matching funds are provided via 0.52 months/year of the PI's academic year salary and 0.25 months summer salary in years 1 and 2 plus UNH fringe and will include applicable F&A rates. One academic year of a graduate research assistantship and associated tuition costs will also be provided as match. $7,724 in year one.

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EXHIBIT B

This Project Agreement is funded under a Grant/Contract/Cooperative Agreement to State from the Federal sponsor specified in Project Agreement article F. All applicable requirements, regulations, provisions, terms and conditions of this Federal Grant/Contract/Cooperative Agreement are hereby adopted in full force and effect to the relationship between State and Campus, except that wherever such requirements, regulations, provisions and terms and conditions differ for INSTITUTIONS OF HIGHER EDUCATION, the appropriate requirements should be substituted (e.g., OMB Circulars A-21 and A-110, rather than OMB Circulars A-87 and A-102). References to Contractor or Recipient in the Federal language will be taken to mean Campus; references to the Government or Federal Awarding Agency will be taken to mean Government/Federal Awarding Agency or State or both, as appropriate.

Special Federal provisions are listed here: ☐ None or **Uniform Requirements for Federal Awards issued by the Office of Management and Budget (OMB) at 2 CFR Part 200 in lieu of Circulars listed in paragraph above. The federal regulations applicable to Department of Interior, Fish and Wildlife Service recipients, subrecipients and contracors are incorporated by reference and are listed by recipient type in the Service Financial Award Terms and Conditions posted on the Internet at http://www.fws.gov/grants/.**

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