Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-296

Proposal Title: Integrated Population Modeling for Trumpeter Swans

Project Manager Information

Name: Todd Arnold

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: We will compile all available data for Minnesota Trumpeter Swans and use these sources to model historical population abundance and predict future population dynamics.

Funds Requested: $180,000

Proposed Project Completion: December 31, 2026

LCCMR Funding Category: Small Projects (H)
       Secondary Category: Foundational Natural Resource Data and Information (A)

Project Location

What is the best scale for describing where your work will take place?
       Statewide

What is the best scale to describe the area impacted by your work?
       Statewide

When will the work impact occur?
       During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Trumpeter swans are a large, charismatic waterfowl species that are highly valued by Minnesotans. Extirpated from Minnesota, then reintroduced using special taxpayer-funded efforts, Trumpeter Swans are now relatively common and breed throughout Minnesota, though they are still considered a species of special concern by MN DNR.

Insufficient resources have been allocated to survey and monitor the growth and population trajectory of Trumpeter Swans in Minnesota. Population indices from auxiliary waterfowl surveys suggest abundance is rapidly growing, but incomplete spatial coverage prevents these estimates from representing an accurate count of Trumpeter Swans in Minnesota. Other swan-specific surveys were historically conducted by USFWS every 5 years, but have been discontinued.

As well as abundance, an understanding of population dynamics are necessary for best conservation practices. Managers do not currently have reliable estimates of the current rate of Trumpeter Swan population growth, whether it is approaching a plateau in the near future, and which vital rates (e.g., survival, fecundity) are most important to population dynamics. We also do not have the ability to forecast population conditions in the future to predict population trajectory over time. These info gaps preclude the ability to set the most informed conservation policies for Trumpeter Swans in

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

We will construct an integrated population model (IPM) to provide a unified statistical framework for concurrently analyzing all available datasets for Trumpeter Swan populations in Minnesota. The IPM will use historical and current data sources to estimate population abundance, survival and fecundity rates, and relative contribution of survival and fecundity to overall population dynamics. Analyzing multiple datasets with IPMs can improve estimates of population abundance and growth, and also provide information on the most important vital rates for managers to focus on in order to better conserve Trumpeter Swan populations within Minnesota. Integrated population models have been used to successfully guide wildlife management plans for a variety of species, including Trumpeter Swans in Iowa.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

Our project fills a critical gap in the knowledge of Trumpeter Swans in Minnesota, a species that has shifted from rare to relatively common in the last 20 years. Will population growth slow now that they are more widespread and abundant, or will their population continue to grow exponentially until swan numbers in Minnesota are comparable to species such as Giant Canada Geese, a species so abundant it's considered a 'nuisance' in some situations? Model results will provide reliable estimates of population abundance and allow prediction of population trajectories into the future, including the ability to estimate potential carrying capacity.

Activities and Milestones

Activity 1: Data Acquisition
Activity Budget: $24,020

Activity Description:
We will acquire all relevant datasets that provide information on trumpeter swans (i.e., banding, resighting, survival, and abundance) from a variety of agencies, filter out data errors, and build a database suitable for statistical analysis.

Activity Milestones:

Description	Approximate Completion Date
1. Acquire banding, resighting, and recovery data from USGS BBL, USFWS, MN DNR.	April 30, 2025
Acquire survey data from MN DNR, USFWS, USGS BBL, and eBird.	April 30, 2025

Activity 2: Develop and test the integrated population model
Activity Budget: $45,681

Activity Description:
Using the acquired datasets, we will build each sub-model component that will make up the IPM (i.e. models of population abundance, annual fecundity, and annual survival). We will fit a Bayesian state-space model to all historical survey data (MN DNR annual waterfowl surveys and 5-yr USFWS swan surveys) to produce more precise estimates of annual abundance. We will use banding and encounter data from 1970-present, as well as telemetry data from an ongoing LCCMR project (Trumpeter Swan Migration Ecology and Conservation), to estimate annual survival rates. We will use nest-monitoring data from Minnesota and Iowa to estimate annual fecundity rates.

Activity Milestones:

Description	Approximate Completion Date
Estimate population counts from the multiple survey datasets	September 30, 2025
Estimate annual survival rates from telemetry data and USGS BBL data	September 30, 2025
Estimate annual fecundity rates from MN nest monitoring and other studies	September 30, 2025

Activity 3: Develop and test the integrated population model
Activity Budget: $110,299

Activity Description:
We will combine demographic rates from the sub-model components into a mechanistic analytical framework using a Bayesian age/stage-structured model. The model will allow us to use data from individual Trumpeter Swans to create population-level inference about which factors have contributed most strongly to historical population growth. We can then use this model to make predictions about future population growth under different management frameworks.

Activity Milestones:

Description	Approximate Completion Date
Develop integrated population model combining count, survival, and fecundity data	May 31, 2026
Conduct simulations to verify model predictions and test performance	July 31, 2026
Prepare final report; disseminate formal results to managers and general public	December 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
David Wolfson	University of Minnesota	Post-Doc	Yes
Steve Cordts	Minnesota Department of Natural Resources	Support with data acquisition and waterfowl population ecology.	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

This project represents a needed tool for stakeholders to have accurate information on Trumpeter Swan populations in Minnesota. Wildlife biologists at the MN DNR will be able to use this IPM to better monitor Trumpeter Swans in Minnesota without a big investment across the state in expensive aerial surveys and banding efforts. Additionally, any efforts that are taken in the future to monitor Trumpeter Swans will be able to feed directly into the IPM framework, thus improving model performance going forward.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Minnesota Trumpeter Swan Migration Ecology and Conservation	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03d	$300,000

Project Manager and Organization Qualifications

Project Manager Name: Todd Arnold

Job Title: Professor

Provide description of the project manager's qualifications to manage the proposed project.

Todd Arnold (Ph.D., Zoology, University of Western Ontario, 1990) is a Professor in the Department of Fisheries, Wildlife and Conservation Biology at the University of Minnesota. Prior to that, he was Senior Scientist at Ducks Unlimited Canada (1999-2002) and Scientific Director at Delta Waterfowl Foundation (1997-1999). He has authored over 120 scientific publications and has decades of experience working with waterfowl species and population modeling techniques. He will be responsible for overall project coordination and will supervise a postdoctoral researcher in all stages of data acquisition, analysis, and writing.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The University of Minnesota is Minnesota's flagship, land grant university. It has a strong tradition of excellence in education, research, and outreach.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Principle Investigator		Oversee project and mentor post-doc			36.8%	0.16		$31,311
Post-doc		Summarized data, conducts analysis, prepares papers and final reports. Disseminates research.			25.7%	2		$144,121
							Sub Total	**$175,432**
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Conference registration: $500 Mileage: 642 miles @ $0.655/mi = $420.50 Lodging: 3 nights @ 147/night = $441 Meal per diem: $44.25/ first & last, $59/day (44.25 +59+59+44.25)= $206.50	We will present research findings at the MN TWS Annual Meeting					$1,568
							Sub Total	**$1,568**
Travel Outside Minnesota								

-							**Sub Total**	-
Printing and Publication								
	Publication	1 open-access journal article publication	Disseminate research findings to the professional community					$3,000
							Sub Total	**$3,000**
Other Expenses								
-							**Sub Total**	-
							Grand Total	**$180,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
-			**State Sub Total**	-
Non-State				
-			**Non State Sub Total**	-
-			**Funds Total**	-

Attachments

Required Attachments
Visual Component
File: [674c8b0a-bc2.pdf](674c8b0a-bc2.pdf)

Alternate Text for Visual Component
This visual component displays the problem, solution, and project outcome, as well as a visual representation of the analytical workflow...

Optional Attachments
Support Letter, Photos, Media, Other

Title	File
SPA Approval letter	[8d6352ab-fa1.pdf](8d6352ab-fa1.pdf)

Administrative Use

Does your project include restoration or acquisition of land rights?
> No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?
> No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?
> N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?
> N/A

Does your project include original, hypothesis-driven research?
> Yes

Does the organization have a fiscal agent for this project?
> No

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?
> No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services, as defined in Minnesota Statutes section 299C.61 Subd.7?
> No