A generic web application to visualize and understand movements of tagged animals

CDI FY19 Statement of Interest

Lead PI Information

PI Name: Ben Letcher
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PI Organization: Leetown Science Center
PI Mission Area: Ecosystems
PI City, State: Turners Falls, MA

Financial Information

Total Requested Funds: 48125
In-Kind Matching Funds: 20000

Project Information

Project Description: Animal movement data from tagged individuals can be hard to summarize with existing models, but interactive movement visualizations can help users identify and understand details of movement patterns. We will extend an existing custom-made web application for visualizing movements of tagged fish (http://pitdata.ecosheds.org/fish-movements/) to provide a generic visualization tool for user-uploaded tagging data.
List of Anticipated Deliverables: Web application, tagging database, manuscript
SSF Element 1: Applications
SSF Element 2: Science Project Support
SSF Element 3: Data Management

Collaborators

	Name	City	State	Organization
Collaborator	Jeff Walker	Brunswick	ME	Walker Environmental Research
Collaborator	Theodore Castro-Santos	Turners Falls	MA	USGS, LCS
Collaborator	Evan Childress	Klamath Falls	OR	USFWS

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Project Narrative
Information from tagged animals forms the basis of many ecological models. Tagged individuals provide information on key vital rates including survival, body growth and movement. Depending on the tag type, data density can be very high for either the number of reads/individual or the number of individuals. This data density can lead to robust estimates of growth and survival using standard models. Movement data, however, can be harder to summarize with existing models because animal movements can be highly skewed and context-dependent.

Researchers who study animal movement can benefit from interactive visualizations that show locations of tagged individuals over time. Effective visualizations will help researchers uncover patterns in the data. For example, we have developed a visualization for tagged individuals in a stream network (pitdata.ecosheds.org/fish-movements/, Letcher et al. 2018). Users of the tool can follow individuals (dots on the screen) as they move throughout the stream network. Seeing how the fish move can lead to insights about the timing, direction, and extent of individual movements. Subsetting the data based on location, species, age, family membership and other traits allows formation of hypotheses about movement. Further, showing environmental data during movement intervals and summary data on movements provides context for evaluating observed movements.

We have received numerous requests to adapt the movement visualization to other systems. While this is certainly possible, at this point, we need to custom-build new applications. To make it easier for users to gain access to movement visualizations, we propose to develop the algorithms and platform to allow users to upload their own data. This will involve defining the habitat, setting the timestep and uploading the tagging data. To work through issues related to different datasets, in addition to our stream network, we will use four test cases that cover a range of habitat, timestep and tag data types – suckers (fish) in a lake system, horseshoe crabs in a coastal system, grizzly bears in 2-dimensional mountainous habitat and right whales in a 3-dimensional ocean habitat. Each dataset will provide unique challenges that will allow us to develop and test the algorithms across a broad range of situations. The overarching goal will be to develop algorithms that are flexible enough to accommodate any animal tagging data, and friendly and useful enough to use that people are encouraged to use them.

This proposal addresses the following new CDI themes ‘Producing FAIR data and tools’, and ‘Reusing or repurposing modular tools’, focusses on ‘knowledge delivery’, and will be used across regions. In theory, the general approach could be used for any particle tracking dataset, so the project may have eventual utility across mission areas as well.

Reference

Letcher, B. H., J. D. Walker, M. J. O’Donnell, A. R. Whiteley, K. H. Nislow, and J. A. Coombs. 2018. Three Visualization Approaches for Communicating and Exploring Passive Integrated Transponder Tag Data. Fisheries 43(5):241–248.

Estimated budget table

Budget Category	Federal Funding "Requested"	Matching Funds "Proposed"
1. PERSONNEL (SALARIES including benefits):		
Federal Personnel Total:	7,500	$
Contract/Collaborator Personnel Total:	28,000	20000
Total Salaries:	$35,500	$20,000
2. TRAVEL EXPENSES:		
Travel Total (Per Diem, Airfare, Mileage/Shuttle) **x** # of Trips:	3,000	$
Other Expenses (e.g. Registration Fees):	$	$
Total Travel Expenses:	$3,000	$0
3. OTHER DIRECT COSTS: (itemize)		
Equipment (including software, hardware, purchases/rentals):	$	$
Publication Costs:	$	$
Office Supplies, Training, Other Expenses (specify):	$	$
Total Other Direct Costs:	$0	$0
Total Direct Costs:	$38,500	$20,000
Indirect Costs (%):	$9,625	$0
GRAND TOTAL:	$48,125	$20,000