MOTUS
Tracking wildlife and environmental change

Migratory animals are an essential component of the earth's ecosystem and help support all life on the planet as pollinators, seed distributors, and food for other animals. Studying migratory animals is crucial in providing insight into the health of this ecosystem and the environmental changes that affect us all.

Until recently, studies on most smaller migratory animals were very restrictive – usually localized, species-specific, and painstakingly manual, providing a limited snapshot at best. Infrastructure was costly in terms of both human and technical inputs – a GPS tracking system could cost thousands of dollars for a single subject. Moreover, the sensors required for cellular or satellite technology to work were too large for small animals and insects. A new international collaborative research network called the Motus Wildlife Tracking System is changing all that.

Motus is an innovative, automated radio-telemetry system for tracking the movements of animals such as birds, bats, and large insects throughout the continent. It works by outfitting animals as small as monarch butterflies with miniature radio transmitters that broadcast signals every few seconds to a network of receiving stations that scan for signals 24 hours a day.

With a focus on at-risk species, Motus can track the positions of thousands of individual insects in real time. When results from many stations are combined, the system can track animals across a diversity of landscapes covering thousands of kilometers through seasonal residencies and migrations, providing a wealth of scientific data on species habit and health, as well as on the causes, correlations, and threats to species in decline or at risk.

Metadata for meta-analysis

While the concept of radio telemetry is not new, this research platform uniquely facilitates a complete data flow from receiving station to users that includes the management, archiving, analysis, visualization, and dissemination of data. Its 800-plus in-field

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receivers automatically capture signals up to 20 kilometres away and this data is uniquely stored in a centralized database that can be accessed through the platform.

Built-in automations, a massive dataset, and a centralized database support meta-analysis that was not possible before. For example, researchers can now look at the survivability of a species based on its migration patterns across the continent, death rates, and other data from multiple projects on the same species across a large sample size.

A collaborative approach

Conceptual development for Motus began in 2008 with support from the University of Guelph, Western University, and Acadia University. Today it is a program of Birds Canada in partnership with hundreds of collaborating researchers and organizations.

The group openly shares its data in order to expand international research dedicated to increasing education, knowledge, and research on migratory species. Over 300 projects have been registered to date.

CANARIE's Research Software Program funded the development of the Motus platform. In turn, Motus has introduced new software to CANARIE's ever-growing Research Software Service Registry, including application programming interfaces (APIs), sensor software, and a data manipulation library that is useful for handling big data research in other disciplines. These software tools are now available at not cost to all researchers, helping maximize the impact and reach of publicly funded research.

Platform: Motus

Description	An automated radio-telemetry system for tracking the local, regional and continental movements of animals such as birds, bats and insects. Motus facilitates the complete data flow from receiving station through to users, including the management, archiving, analysis, exploration and dissemination of data for researchers and the general public.
Contributor(s)	Birds Canada
Research Subject	Animal Biology
Portal	https://motus.org
Portal Access	Guests, Principal Investigators, Collaborators
Supports Separate Projects	Yes
Citizen Science	Yes
Software Licence	Open source/source code available upon request
Other Canadian Content	Sensor Gnome (sensorgnome.org)
To Learn More	https://science.canarie.ca/res/123