

Savaloja Grant Report: Migratory Bird Tracking in the St Croix Valley with MOTUS

Recipient: Carpenter St. Croix Valley Nature Center

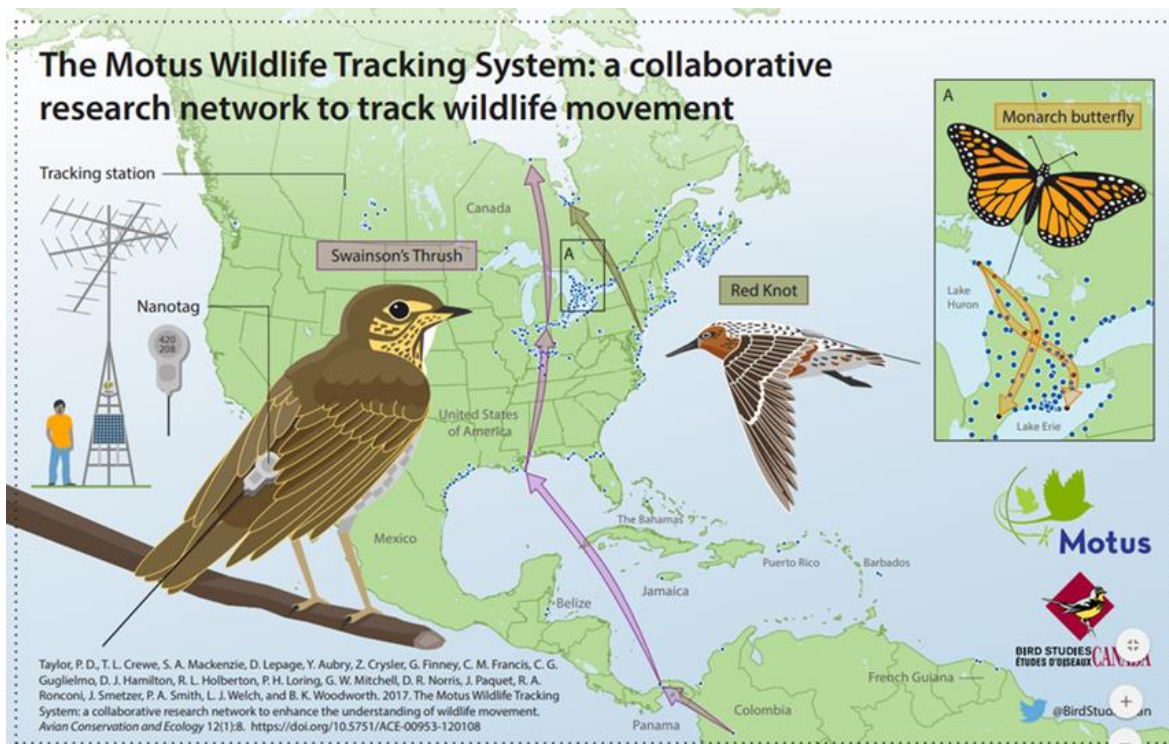
Project Leader: Jennifer Vieth

Grant award amount: \$2,900

Award Year: Spring 2019

PROJECT DESCRIPTION, OBJECTIVES AND GOALS FROM GRANT APPLICATION:

Carpenter Nature Center (CNC) will install a MOTUS Tower (MOTUS.ORG.) on 425 acres of habitat in South Washington County at the Confluence of the Mississippi and St. Croix Rivers. MOTUS is a collaborative, international automated radio telemetry array. The goal of Carpenter Nature Center's Motus Tower project is to increase knowledge of bird movements throughout the St. Croix Valley, Mississippi Flyway and North America which will increase the effectiveness of species conservation plans. The location of CNC's Minnesota Campus, along the Mississippi Flyway at which it connects to the Nationally-designated Wild & Scenic St. Croix River, provides a significant opportunity to encounter MOTUS-tracked birds from researchers throughout North America. The data will provide information on the timing of migration and migratory routes of bird species that travel through the Flyway and St. Croix River Valley. Data gathered will aid in bird conservation efforts that extend across international borders. Carpenter Nature Center's research and teaching team will also incorporate an education component to this work with the hopes of inspiring future conservationists and bird researchers.



PERSONNEL

Jennifer Vieth is the Responsible Individual for the Nature Center's Master Station Banding Permit and she will be the primary coordinator of this project.

Physical tower installation was performed by Carpenter Nature Center's Maintenance Team, Marty Lynch and Todd DeRosier with help from the roofing company, Four Corners.

Initial project materials acquisition was performed by Natural Resources intern, Anders Santelman with assistance from Craig Santelman.

Technical expertise, data collection and interpretation post-installation has been performed by CNC volunteer Benjamin Douglas.

All media communications and future educational programming will be created by Jennifer and the bird banding team, with input from the Nature Center's naturalists, Mayme Johnson, Jessie Eckroad, Abbey Holden and Alan Maloney.

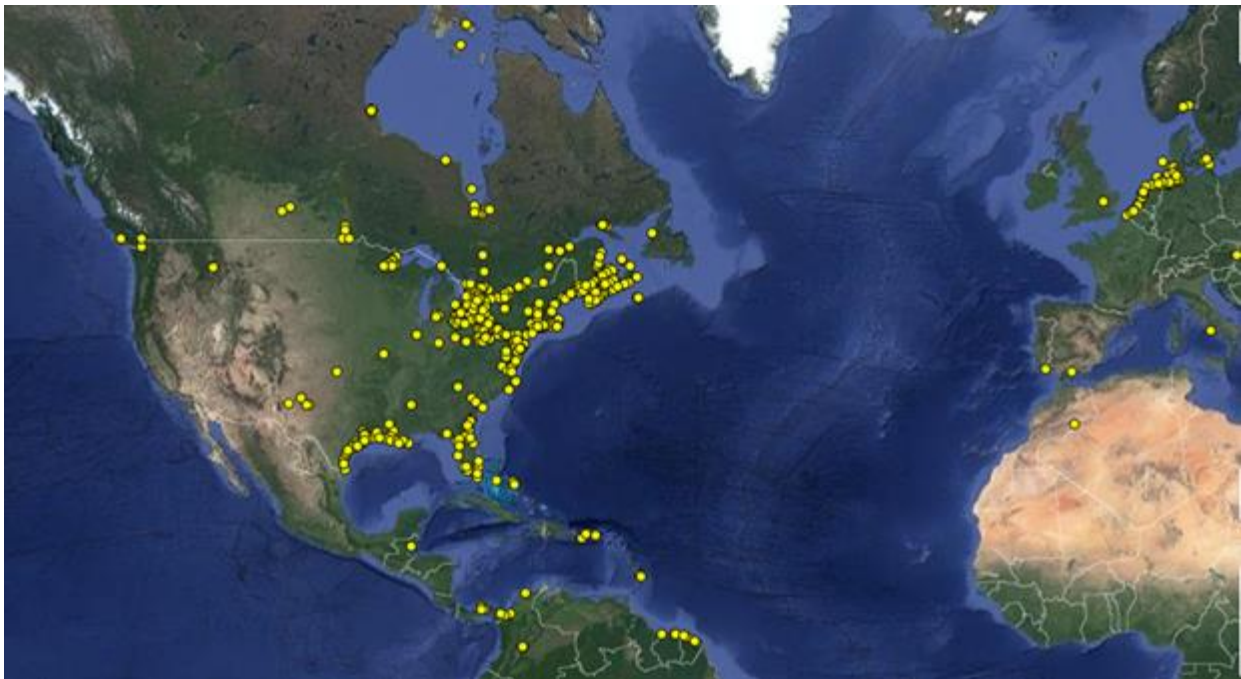
Throughout the process Alexis Grinde from NRRI, staff at MOTUS, WI DNR staff and MN DNR staff have all been helpful working through challenges with the installation of this complex system. One of the challenges of Motus, is that the project is gaining ground very rapidly around the globe, and the amount of support for new stations is minimal for such a complex technology. It's a great win for bird conservation globally, but until training capacity can catch up, and more stations work out the kinks and can help the next new stations, it's a VERY steep learning curve for the early adopters.

LOCATION

The Motus Tower was installed on the roof of Carpenter Nature Center's Administration Building, located at 12805 St Croix Trail S., Hastings, Minnesota located in Denmark Township, Washington County.

METHODS SUMMARY:

Carpenter Nature Center's wild bird research team began looking into the Motus system in 2016-2017 after reading about a team on the East Coast of Canada using an array of towers to monitoring migrating Northern Saw-whet Owls. The East Coast Motus network is relatively well developed, but the Midwest was relatively devoid of towers. The MOTUS system is an international collaborative network that uses an automated radio telemetry array to track the movements of flying creatures ranging in size from large birds, to insects as small as dragonflies. The individual organisms are affixed with digitally-encoded radio transmitters, whose signals are detected by the telemetry stations. These stations scan for signals 24 hours a day year-round. MOTUS coordinates, disseminates, and archives detections and associated metadata in a central repository.



In 2018 NRRI installed a small number of MOTUS towers in Northern Minnesota indicated by the yellow dots along southern Lake Superior on map above. Through discussions with both MOTUS and NRRI, Carpenter Nature Center's team developed a project materials list and applied for funding to install a Motus Tower on the Nature Center's Interpretive Building (a high

location with clear sight lines for best reception). The Savaloja grant from the Minnesota Ornithologists' Union was awarded to Carpenter Nature Center in the early spring of 2019.

CNC's Natural Resource intern, Anders Santelman was put in charge of researching materials and tower installation, and ordering the components of the tower as part of his summer internship project. Anders, and his tech-savvy father Craig, secured the materials and performed the adjustments necessary, including soldering, to get the Raspberry Pi ready to install. Anders completed his internship in August 2019. This was a terrific double-win. Not only does the Motus project move ahead, but an intern got experience managing a complex project.



At this point the project hit a wall, as the roof of the Interpretive Building needed urgent replacing. The other likely structure on which to install the tower, the Administration Building, also needed a new roof. The old shingles tested positive for asbestos. Raising \$3,000 for a Motus tower paled in comparison to the costs involved in re-roofing two historic 1940's buildings. Fundraising for the project, asbestos mitigation and roof installation delays resulted in the tower structure finally being installed in March 2020. The Motus antenna was affixed to the Administration Building roof the week of March 11. CNC recruited local birder/CNC volunteer/technology expert Benjamin Douglas to assist with the next phase of the Motus project.

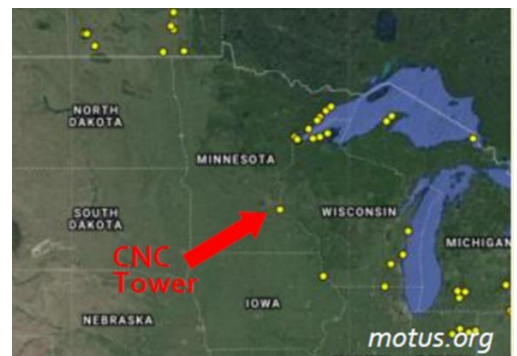




The CNC Motus tower is comprised of a metal vertical mast with three long 10' antenna extending horizontally from the center. The whole system needs a GPS dongle with a clear open air view of the sky that provides continuous location information. Each arm of the antenna also needs exact measurements of the height from ground and the antenna's geographic cardinal direction. Each antenna sends signal to its own FUNCube Dongle that detects the passing of any activated Nano transmitter through receiving the radio signal the transmitter emits. Each Nano transmitter has a unique radio signature created by the signal pattern and repetition. These data points are continuously fed back via cables to a Raspberry Pi,

which is a tiny computer that records the information onto a micro SD card. At intervals the data must be downloaded from the SD card and uploaded to Bird Studies Canada. All this complex data is recorded in a computer language called R.

As the COVID-19 pandemic hit, and CNC facilities closed for the safer-at-home effort, the system was active for the first time. We hoped it was listening. Once the restrictions lifted, Ben downloaded the data, cleaned up any interference, spent hours researching the R language, and interpreted the findings. He didn't even need to upload it to the Motus.org website hosted by Bird Studies Canada as unfortunately we had weeks of static GPS readings, but no data from the antenna. More volunteer hours for Ben in Motus chat groups provided some insights to the problem. Fixes were installed on July 19 and we listened in anticipation. To ensure we had at least one true Nano transmitter detection, we asked CNC friend, Kristin Hall from the MN DNR, to drive around the area with an activated Nano transmitter from their American Kestrel research project. Finally on August 8, 2020 we received the confirmed report from Bird Studies Canada that the system was working, it accurately recorded Kristin's test tag, just in time for fall migration. It was a joyful moment to see CNC's active Motus tower on maps in presentations at the North American Ornithologists



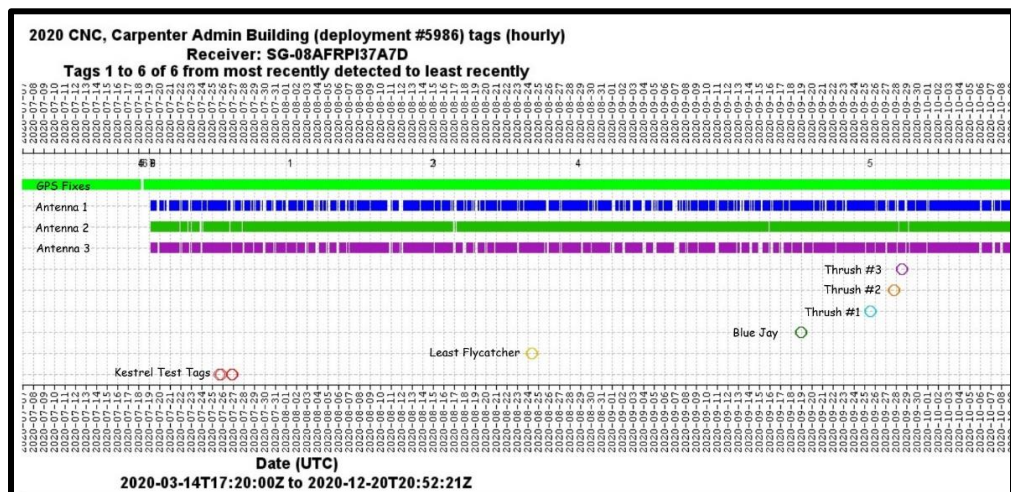
Conference attended virtually by more than 3,000 people from around the world!

RESULTS

Fast forward from the successful structural installation in March 2020 to fall migration in the St. Croix Valley. Ben’s personal birding challenges included doing migration point counts on the bluffs of CNC’s Minnesota Campus. After his point count on September 25, he pulled the Motus Tower data and found CNC had recorded THREE nano-tagged birds passing over the site since August 8th. The three birds were from two different research teams in two countries. Two tags were from NRRI in Northern Minnesota, a Least Flycatcher and a Blue Jay. However, in late December 2020 we learned directly from Alexis Grinde at NRRI that the Blue Jay detection was a “false positive”. The third tagged bird was a Swainson’s Thrush from a research project in inland British Columbia. The WI DNR Motus team had their towers pinged by migrating thrushes as well. This long distance, cross continent migration route is similar to that CNC had documented through band returns over the past few decades. CNC’s banding records include a Dark-eyed Junco re-encountered in Alaska, and Northern Saw-whet Owls banded at CNC re-encountered in Prince Albert, Saskatchewan. As well as an owl banded in Prince Albert that was re-encountered at CNC.

On October 31st Ben did another data pull and recorded TWO more nano-tags passing through the confluence of the St Croix and Mississippi Rivers! One of these thrushes passed over CNC at 4 a.m. before the public Hawk/Migration Count event. It would never have been detected during the bird banding efforts. The following charts were taken directly from the Motus.org website in late December 2020. The Blue Jay data still appears in all the reports on their website, but we anticipate that the team at Bird Studies Canada will update this information during 2021. The chart below shows blue, green and purple lines when the antennas/Motus monitoring system went live in June. The “pings”, or nanotag detections, are indicated by colored circles on the chart.

CNC staff superimposed the species names on the chart.



The second chart shows the tag deployment date and the subsequent detection date at Carpenter Nature Center.

Detection date	Tag deployment	Species	Date deployed	Latitude	Longitude
2020-08-24	ESPM#173:8.9 M.46083	Least Flycatcher	2020-06-29	47.1992	93.2366
2020-09-18	LakeSuperiorMig#39:5.1 M.38798	Blue Jay	2020-09-04	47.7437	90.3678
2020-09-25	thrushes#5:25.1 M.48406	Swainson's Thrush	2020-09-05	50.220346	-122.884819
2020-09-27	thrushes#38:11.3 M.48295	Swainson's Thrush	2020-09-02	50.298821	-122.760547
2020-09-28	thrushes#12:25.1 M.48415	Swainson's Thrush	2020-09-04	50.220346	-122.884819

The Motus Tower project has inspired a number of media hits including a mention in a big article in the Pioneer Press in December 2020, a full story in the St Croix Valley digital publication St. Croix 360, to a feature in the cover story of Carpenter Nature Center's St Croix Current Sept-Dec 2020 issue. The project has inspired additional donations for the addition of a Motus Tower for Carpenter Nature Center's Wisconsin Campus, just south of Highway 94. Installation of that tower is expected by spring 2021. There is still about \$700 left to raise to fund that project completely.

Due to the pandemic, the public education component of this project was not as robust as hoped. The project was promoted in multiple venues, from print media, social media, virtual programs, etc. However, we look forward to sharing the technology with visitors attending programs in person at the nature center in the future. The Education Team also plans to involve future Natural Resources interns in the process of data collection, data clean up, uploading data to Bird Studies Canada Motus database and interpreting the results as part of their internship experience. The amount of publicity that was generated by this project will add to the establishment of more robust Motus network in Minnesota. Already one of Carpenter Nature Center's partners is submitting a proposal to a grant-maker to install towers in the west metro and has consulted with the CNC team.

FINAL THOUGHTS

What is the future of this project? As the final kinks seem to have been worked out of the system, the CNC team is getting to work on purchasing the components for a second tower on the nature center's 300-acre Wisconsin Campus, just south of Hudson. The hope is to have that tower operational in time for early northern migration of Saw-whet Owls. Already most of the

funding has been secured through a \$1,000 grant from Tropical Wings, a gift from the St Croix Valley Bird Club and some additional gifts from local bird conservation enthusiasts. Once that tower is operational, the team will turn our efforts to securing funding to purchasing nanotags for part of a species specific research project.

Why is the investment in the Motus monitoring system important?

From data acquired through 40 years of weekly songbird monitoring at CNC, including collaborative projects such as the GPS Geolocators study of Wood Thrush migration with the Smithsonian Institute, the message is loud and clear. Our birds connect us to the rest of the world. Birds banded at CNC, at the confluence of the St. Croix and Mississippi Rivers, have been encountered from Alaska, to Nova Scotia, to Arkansas to Venezuela. Their journeys are mind boggling. Then to find a Wood Thrush dead in early spring beneath a strip mall window is heart breaking. My hope is that our generation, and those to come, can use our great knowledge and ingenuity to protect our birds on their breeding grounds, their wintering grounds, and migratory stopover sites, so that hundreds of years from now, our ancestors can enjoy the haunting songs of thrush floating across the Minnesota landscape.

The Motus system helps improve our knowledge of birds' full life cycles, not just the breeding grounds or the wintering grounds. Just in monitoring one migration season, CNC's Motus results show the condensed timing of Swainson's Thrush migration from Inland British Columbia. The three thrushes detected by CNC's system, which were originally tagged in the same Canadian research project, migrated past the nature center within a window of only four days. By learning more about the migratory routes, migratory stopovers and migration timing, conservation efforts can be designed to have the maximum impact on our birds.

MOU's Savaloja Grant program has been a blessing for CNC's bird conservation research, as without this program, we'd never have been able to make our bird conservation projects move ahead. Thank you to everyone involved in funding the program. It takes a village.

BUDGET RECONCILIATION

Typical Motus Tower installations range from \$3,000-\$10,000 depending on how much additional technology is needed to supply power to the tower and how complicated the structure needs to be for the site. The original CNC Motus Tower project budget was estimated at \$3,250. The MOU grant award was for \$2,900 (80% distributed upon award, 20% upon project completion and receipt of grant report). There were a few factors which helped keep the project from running over budget, including placing the tower on a building where power was easily accessible and the technology could be located indoors in a climate controlled site.

The first savings resulted from the coincidence that CNC's summer Natural Resources intern had a father with experience in computers, including Raspberry Pi technology so this technical expertise did not need to be contracted. The other savings was the terrific amount of time Ben Douglas was able to contribute to the project as a volunteer. His technological expertise and donations of time towards this project is likely in excess of 60 hours, when multiplied by \$27.20*, results in a contribution of \$1,632.

Expense categories

Contractors/contracted equipment

Rental of equipment: Lift: estimated at \$260/day 260.00

Labor:

Ben Douglas: estimated at 60 hours x \$27.20*/hr. =\$1,632.00 DONATION
(Troubleshooting, data analysis, process documentation)

Intern time: estimated at 80 hours (weekly reimbursement \$150/week) CNC
(Materials procurement, system set up)

Staff time (project management): 40 hours: expensed by CNC CNC

Staff time (maintenance dept.): 4 hours x 2: expensed by CNC CNC

Materials:

SmartQ USB 6.99

Adafruit, Micro SDHC, Raspberry Pi motherboard, Raspberry Pi equip. 117.48

GPS antenna 16.81

10' antennas, mast, etc. 2,180.39

Specialized welded brackets for anchoring to chimney 100.00

Additional installation materials incl. grounding wire, cinch straps 97.00

Technology components	77.94
Technology components	91.00
Technology components	19.79
TOTAL	\$2,967.40

national annual published valuation of one volunteer hour by Independent Sector