South Carolina Department of Natural Resources



Robert Boyles Deputy Director for Marine Resources

Christopher Hernandez Fish and Wildlife Biologist - Coastal Program US Fish & Wildlife Service 176 Croghan Spur Road, Suite 200 Charleston, SC 29407

December 20th 2018

Dear Mr. Hernandez,

I am writing to you regarding Grant Agreement Award No. F15AC00656, provided to the South Carolina Department of Natural Resources through the U.S. Fish and Wildlife Service's CFDA Program 16.630, entitled *"Cooperative Winter Tagging Study of Migratory Monarch Butterflies in South Carolina"*.

This cover letter serves as confirmation that we are submitting the final performance and financial reports, that we have completed the proposed work (as described in the attached report) and will have spent all of the funding (\$10,500) within the timeframe of the award (October 1st 2015 through September 30th 2018).

Please do not hesitate to contact me if you have any questions.

Sincerely,

Michael R. Kendrick

Michael Kendrick, Ph.D. Assistant Marine Scientist, Crustacean Research and Monitoring Section Marine Resources Research Institute South Carolina Department of Natural Resources 217 Ft. Johnson Rd / P.O. Box 12559 Charleston SC 29412 843-953-6457 (Office) 843-953-9820 (Fax) Email: kendrickm@dnr.sc.gov

RECIPIENT NAME:	South Carolina Department of Natural Resources
Principal Investigator:	Dr. Michael Kendrick, Assistant Marine Scientist
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	South Carolina Department of Natural Resources (SCDNR)
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	Tel. No.: 843-953-6457
Collaborating Investigator:	Mr. Billy McCord, Wildlife Biologist

AGREEMENT NUMBER: F15AC00656

PROJECT TITLE: Cooperative Winter Tagging Study of Migratory Monarch Butterflies in South Carolina

REPORT TYPE: Final

PERIOD COVERED: October 1st 2015 – September 30th 2018

Project Narrative

1. Comparison of actual accomplishments with the goals and objectives of the award

The goals and objectives of the original award were completed thoroughly and as outlined in the proposal, including:

- a) Recruit and train a network of volunteers
 - The project was successful in recruiting and training 16 volunteers over the course of the project.
- b) Coordinate winter tagging efforts
 - A total of 5,003 Monarchs were captured and tagged between the November and March time period across the 3 year study.
- c) Ensure appropriate permits and authorizations are obtained prior to work
 - Appropriate authorizations were sought for all collection locations, as necessary.
- d) Coordinate closely with Service's project manager
 - Project Manager Christopher Hernandez was frequently updated by Mr. Billy McCord who coordinated tagging activities by volunteers
- e) Provide performance schedule to project manager
 - Performance schedules were provided to project manager Christopher Hernandez.
- f) Submit period progress reports
 - Progress reports were provided to project manager Hernandez on-time.

- g) Provide a summary of tagging and tag recovery efforts to the Service.
 - This report provides a comprehensive overview of the tagging and tag recovery efforts conducted as part of this project. These accomplishments are outlined in detail in this final report.

2. Reasons why established goals were not met, if appropriate

All established project goals were met

3. Project results

The Cooperative Winter Tagging Study of Migratory Monarch Butterflies in South Carolina (hereafter, Cooperative Winter Monarch Tagging Project) was designed to collect information on the winter occurrence of the monarch butterfly along the South Carolina coast in order to better determine the winter distribution of the monarch in South Carolina. Another goal of the project was to gain information, through recoveries of tagged monarchs by project participants or by members of the general public, on movements of monarchs during winter and as wintering monarchs disperse for breeding during the spring. Results of the three-year Cooperative Winter Monarch Tagging Project provide substantial evidence that the South Carolina coast regularly supports winter populations of Monarchs.

Project logistics:

A designated employee of the South Carolina Department of Natural Resources (SCDNR) and of the US Fish and Wildlife Service (USFWS) participated in the Cooperative Winter Monarch Tagging Project during all three tagging seasons. John W. McCord of the SCDNR led field and analytical components of the project and was the primary SCDNR participant because of his 20 prior years of tagging research on the monarch, mostly within the central coastal area of Charleston County, SC (see McCord and Davis 2010). Also, Christopher Hernandez, an employee of the US Fish and Wildlife Service Coastal Program office in Charleston, SC participated in monarch tagging activities each season. However, the project relied heavily upon the participation of 16 volunteer individuals, some of whom formed teams by enlisting the help of additional volunteers. The selection of volunteers was based upon Mr. McCord's desire to have a distribution of tagging participants along much of the South Carolina coast. Most volunteers were found through contacts with instructors for the South Carolina Master Naturalist Program, with the hope of enlisting volunteers who would participate in the project with the diligence necessary to collect information reflective of the winter and early spring distribution of monarchs along the South Carolina coast. Volunteers were trained for monarch tagging by Mr. McCord, and volunteers were provided with printed instructions and supplies needed for capturing and processing monarchs. Volunteers for the three periods of fieldwork were distributed from North Myrtle Beach, Horry County, SC (the most northerly site) to Hilton Head Island, Beaufort County, SC (the most southerly site). One volunteer who participated in the

2015 - 2016 tagging period was dropped from the volunteer ranks for the following tagging periods because of extreme difficulty in getting tagging records from this individual for the 2015 - 2016 tagging period. Furthermore, several of the individuals who participated as volunteers declined invitations to participate in one or more ensuing tagging periods. Attempts to find replacement volunteers for some of these areas were unsuccessful.

The field-work portion of the project was designed to cover the period of November 16 through April 15 of the following calendar year, and is defined as the 'winter' period for the purposes of this project. Three tagging periods included in this study refer to the 2015-2016, 2016-2017, and 2017-2018 winter time periods. Based upon Mr. McCord's years of research, very few monarchs tagged near the South Carolina coast during fall, and through mid-November, remain in the area for winter. All of the distant recoveries that have been reported from sites south of South Carolina from Mr. McCord's 22 years of tagging (1996-97 through 2017-18) were monarchs that had been tagged prior to 3 November. Mr. McCord has found that there is a much higher probability that monarchs tagged near the South Carolina coast in late November and through winter will remain in the area through early spring, when warming weather conditions presumably promote the dispersal of monarchs for breeding.

Specialized, self-adhesive, disc-shaped, polypropylene tags for marking monarch butterflies were procured from Monarch Watch, a monarch migration research program affiliated with the University of Kansas. Each tag is marked with a distinctive code (three letters and three numbers) and with both a toll-free phone number and an email address for the Monarch Watch program at the University of Kansas. Tags were ordered from the Monarch Watch program at the University of Kansas well in advance of the fieldwork start date for each of the three tagging seasons. Tags were received and distributed to project participants prior to the 16 November tagging start date for the first two tagging seasons but tags were not received from Monarch Watch until late November 2016. Accordingly, tags were not distributed to project participants until early December 2016. Mr. McCord was the only project participant who began tagging in the second half of November 2016, since he had tags that he had previously ordered for his personal monarch tagging.

Fate of Monarchs tagged during winter

A total of 5,003 individual monarchs were released with tags by project participants during the three winter tagging periods. Mr. McCord preferred to focus tagging on wild adult monarchs, the vast majority of which likely migrated into coastal South Carolina from points well north or northwest of coastal South Carolina. Such migratory monarchs have lipids stored in their bodies, which are accumulated from feeding on flower nectar during weeks of migration. These lipid reserves supply energy and insulation needed by the butterflies to survive periods of winter weather when weather conditions are unsuitable for the monarchs to forage for nectar (Brower et

al. 2006). Monarchs produced locally from larvae during late fall and winter likely do not have the accumulated lipid reserves needed to survive winter. Wild, migratory monarchs, however, assimilate lipid reserves during the period of fall migration and are presumably better suited to winter survival. Also, the behavior of monarchs produced locally in late fall and winter may differ from that of migratory monarchs. Monarchs produced from larvae on Tropical Milkweed during Dec-Feb in coastal South Carolina are produced outside of the natural breeding season for monarchs in this region. Native milkweeds and closely related plants in coastal South Carolina are perennial plants that generally defoliate by late fall or early winter and sprout new growth the following spring. In the spring, female monarchs that survived winter in the region would oviposit on native milkweeds and closely related plants.

Of the 5,003 monarchs tagged during the winter period, 4,916 were collected from the natural environment as adults and are considered 'wild'. The remaining 87 tagged monarchs that are not considered 'wild' were collected as larvae and reared to adults under controlled conditions before being tagged and released back into the natural environment.

For the 4,916 wild monarchs tagged over the course of the project, 495 individuals (10%) were recovered by project participants (Table 1). One hundred fourteen (23%) of these 495 monarchs were recaptured on at least two dates, and one was recaptured on eight different dates. Twenty-four reported recoveries were received from members of the public who were not participants in tagging activities. Thirteen of these recoveries were reported directly to project participants, allowing determinations of days since tagging and release, distance and direction moved, and condition of the monarch at recovery for these recovered monarchs. Eleven of such public recoveries were reported to Mr. McCord by the Monarch Watch program. Unfortunately, reports from Monarch Watch did not include specific recovery site information. Two wild individuals were found dead near their sites of tagging. Based upon Mr. McCord's two decades of monarch are automobile strikes, spider bites, and praying mantis attacks, with praying mantis attacks characterized by the dismemberment of the butterflies.

During the first two winter periods four project-tagged monarchs were recovered by persons not directly associated with the project. However, 12 tagged monarchs from the 2017 - 2018 tagging season were recovered by persons not directly associated with the project. The increase in tag recoveries for winter 2017 - 2018 by members of the public not affiliated with the project was likely facilitated by two factors. Firstly, many more monarchs were tagged during the 2017 - 2018 project period than during the previous two tagging seasons. Mr. McCord alone released 2,413 tagged monarchs during the 2017 - 2018 tagging season. For the 2015 - 2016 and 2016 - 2017 tagging seasons, Mr. McCord released 530 and 655 tagged monarchs, respectively. Secondly, many monarchs were killed in early January 2018 by a mix of freezing rain, sleet, and snow deposited along the entire South Carolina coast by Winter Storm Grayson during 3 and 4 January 2018. Several monarchs recovered by people not directly associated with the Winter Monarch Project who reported having found dead monarchs at ground level and in or on a mix of

ice and snow. It seems likely that other reported tagged monarchs that were found after 4 January 2018 were likely killed as a result of Winter Storm Grayson.

Winter Movement patterns

Movement patterns of Monarchs as revealed through recoveries of tagged Monarchs do not suggest systematic movement, but rather suggest that they move equally between North and South Directions. Twenty-six of the 5,003 monarchs released during winter periods were recovered by a project participant at a site different from the location of first capture (Table 1). Tagged monarchs were recorded moving both generally to the north of the release site (14 individuals) and to the south of the release site (12 individuals). The number of days between release of tagged monarchs and recapture for these winter-tagged monarchs ranged 1 - 90 days. Miles moved by this cohort ranged from 2.2 - 45.2 miles.

No monarch tagged during the winter period was recovered outside of the South Carolina Coastal Zone, which is defined as that area of the South Carolina Coastal Plain that lies seaward of US Highway 17. This includes the 3 winter periods associated with this project, as well as Mr. McCords observations prior to 2015. A monarch that Mr. McCord tagged at Folly Beach on 24 November 2017 was recovered dead at Murrells Inlet, Georgetown Co., SC on 4 January 2018 by an individual not associated with the project. This monarch traveled a minimum of ~77.5 miles NNE over 41days. The most distant reported recoveries to the southwest were three tagged monarchs that were recovered at Fripp Island by a project participant. These monarchs had moved a minimum of 40-45 miles over 10-32 day period. It seems plausible that at least some monarchs that are wintering along the South Carolina coast may move about as they search for more suitable wintering microhabitats. Perhaps such monarchs are in search of sites which may potentially provide better access to quality nectar sources and/or better protection from potential harsh winter weather conditions. While one of the goals of this project was to assess dispersal during early-spring, the low recoveries of tagged Monarchs during this period prevented any conclusive findings. Only one monarch that Mr. McCord tagged and released at Folly Beach on 10 April 2017 was recovered by Mr. McCord at Ft. Johnson, ~5.3 miles N of the tagging site, and only one day later.

One might expect that monarchs residing on other barrier islands in central Charleston County, SC should behave similarly to those at Folly Beach. During the 2016 – 2017 project period, a team of volunteers captured monarchs on eight different days during the project period on Kiawah Island, another barrier island in central Charleston County. The island is similar in upland landmass to Folly Beach, and the island is also similar to Folly Beach in that it is primarily subdivided into private home-sites. Both islands also have some protected natural areas. The volunteers on the Kiawah Island captured monarchs from three addresses, with a combined area of perhaps five acres. The volunteer group recorded a total of 22 capture incidents, including the initial winter capture of 16 individual monarchs and six recapture incidents. Five monarchs were recaptured at least one day after their initial winter capture, one

was recaptured on multiple dates. Only one was recaptured at an address different from that at which it was first tagged. All recapture incidents for any individual were made within 0.2 mile of the address at which the monarch was first released, and recaptures were made from one to 11 days after the monarchs had been initially captured. Due to the relatively few sampling locations used on this island, it is difficult to infer any potential within-island movement patterns.

In total, fourteen project participants other than Mr. McCord recorded at least one recapture incident over the three winter periods. Cumulatively, these project participants recovered 92 monarchs that had been released at least one day before the day of recapture. One of these recovered individuals was dead. The number of days between the date of first release and the last recapture incident ranged 1 - 44, and the average number of days from the initial capture to the last recapture incident was 10.40. The maximum distance between the original release "address" (an area of ≤ 0.5 acre) and the recapture "address" for any of these monarchs was ~1.4 miles, and the average straight-path distance moved was ~0.08 mile. Most of these project participants captured monarchs at one to four different "addresses" that were located less than a mile from any different "address".

Four hundred sixty-nine of the 495 "wild" individuals (94.7%) were recovered by project participants at the site (i.e. within the same zip-code) of the monarch's release and at least one day after the day of each butterfly's release. The number of days until recovery for these monarchs ranged from one to 98. The remaining 26 live recoveries made by project participants were made away from the tagging site (Table 1). One monarch tagged at Ft. Johnson, James Island, Charleston County, SC on 21 November 2016 was recovered at Folly Beach on 19 February 2017, 90 days after it was tagged and released. This butterfly had moved a minimum of ~7.0 miles SSW of the tagging site. Another monarch tagged and released at Patriots Point was recovered at Folly Beach on 18 January 2017, 55 days after it was tagged and released. This monarch had moved a minimum of ~8.2 miles SSW of the tagging site. Yet another monarch tagged and released at Folly Beach on 26 November 2016 was recovered at Isle of Palms, Charleston County, SC on 12 January 2017, 47 days after it was tagged and released. It had moved a minimum of ~13.1 miles NNE of the tagging site.

Recapture results for intensively sampled areas of Folly Beach and Ft. Johnson show that monarchs can move several miles during winter. Over the three-year project, for example, nine monarchs tagged and released at Ft. Johnson were recovered at other sites, with seven recovered at Folly Beach and one each at Patriots Point, Mt. Pleasant and Sullivans Island (Table 1). Mr. McCord has recorded similar movements for monarchs at Folly Beach and Ft. Johnson during winter over his 20 prior years of monarch tagging activity.

Fate of Monarchs tagged outside of winter

Mr. McCord captured and processed a total of 4,922 monarchs outside of the winter study period. This includes 4,330 monarchs at Folly Beach, Charleston County, SC tagged before the start of the winter period (tagged late August through 15 November in 2015, 2016, and 2017). Seventy-seven of these butterflies were recovered by Mr. McCord at Folly Beach during the winter period. Mr. McCord also tagged 46 monarchs at Patriots Point, Mt. Pleasant, Charleston County, SC before the start of the winter period, and recovered five of these butterflies at Patriots Point during the winter period. Mr. McCord tagged 504 monarchs at James Island prior to start of the winter period. Of the 4,922 monarchs tagged outside of the winter period, 341 were tagged between 1 August and 17 October and none of these were recovered during the winter study period, all Monarchs recovered during the winter period had been tagged after 17 October (Table 1).

Mr. McCord had anticipated that some of the 4,922 monarchs that he tagged and released along the South Carolina coast prior to the winter periods would be recovered by project volunteers during the project period. However, none of these monarchs tagged prior to the winter study period were recovered by any project participant other than Mr. McCord. Mr. McCord recovered 356 of these monarchs 1-88 days after tagging and ~0.0-10.1 miles from the tagging site.

Thirty of the 4,922 monarchs released by Mr. McCord before the winter period were reported as recovered by someone other than Mr. McCord, but only by members of the general public who were not project participants. Sixteen of these (13 at Folly Beach, one at Ft. Johnson, and two at Kiawah Island) were recovered within a week of the tagging date and a maximum of 7.1 miles from the tagging site. The other 14 were recovered in: Savannah, Georgia (~79 miles SSW in 21 days; Cedar Key, FL (~302.2 mi SSW in 47 and 51 days); Little Gasparilla Island, FL (~451.1 mi SSW in 18 days); and Daphne, AL (~489.9 mi WSW in 12 days). Prior to this research project, 7 monarchs tagged in SC were recovered in areas to the south or southwest (Florida: 5; Georgia: 1; Mexico: 1; Billy McCord). None of these distant recoveries were for the 1,482 monarchs tagged and released after 2 November.

Mr. McCord continued to capture and tag monarchs from 16 April through May in 2017 and 2018. During this period in 2017, Mr. McCord continued to search for monarchs and/or monarch larvae at sites on James Island and Folly Beach that he had searched during the project tagging period. He processed 48 monarchs during this period, but only 12 of these individuals were captured as adults (remaining 36 were raised from larvae). Three of these had been tagged during the project tagging period (one tagged 28 March and two tagged 13 April). These three monarchs were males, and all were recaptured on 17 April. One of these recaptured males was captured as it displayed territorial aggression toward another of the males. This is a likely indication of pre-mating aggression. One wild female monarch was first captured on 5 May as it

oviposited on Tropical Milkweed. She was recaptured at the same site on 8 May as she displayed the same activity. Monarchs captured 16-April-May were primarily drab and/or tattered, suggesting that these individuals had survived the winter and initiated reproductive behavior.

During 16 April – 31 May 2018, Mr. McCord expanded his searches to natural areas at Folly Beach and at two other natural areas in coastal South Carolina. He processed 221 monarchs, three of which were first captured in early April. Mr. McCord did document spring breeding at Folly Beach by monarchs on both Tropical Milkweed and Gulf Coast Swallow-wort (*Seutera angustifolia*), a native milkweed of the coastal Southeast that is common in coastal South Carolina grasslands with brackish soil that occur very near tidal saltmarshes. Additionally, Mr. McCord recorded oviposition activity for 10 of 34 wild female monarch capture incidents and captured another female as a member of a mating pair. Thirty-six of 156 capture incidents recorded for wild male monarchs were for individuals displaying aggressive behavior toward other male monarchs and/or toward other butterflies or other insects. During summer 2018 (June through August), Mr. McCord observed monarch larvae on other milkweeds native to the South Carolina Coastal Plain. Monarch larvae were found using Butterfly Milkweed (*Asclepias tuberosa*), Pinewoods Milkweed (*Asclepias humistrata*), Clasping Milkweed (*Asclepias amplexicaulis*), and Longleaf Milkweed (*Asclepias longifolia*).

Mr. McCord also recorded adult monarchs and larvae at Bulow County Park in Charleston County just southwest of Charleston and at several sites in the Francis Marion National Forest (sites in both Berkeley and Charleston Counties) during spring 2018, where the larval host-plant is Aquatic Milkweed (*Asclepias perennis*). Monarchs larvae were observed at these sites during summer 2018 and into fall as well. Surveys conducted in summer through late-fall 2018 show that this native milkweed can be extremely prevalent in forested wetland areas of the Francis Marion Forest. These observations suggest that native milkweeds are frequently used by coastal monarchs in South Carolina.

Tagging and recovery of reared Monarchs

Some monarch larvae were retained by project participants and reared into adult monarchs. Ten (11.5%) of the 87 reared monarchs that were tagged by project participants were recaptured at least one day after tagging and release. Two of these individuals were recaptured on five dates. Days after tagging and release for these recoveries ranged from one to 85. The individual that was recaptured after 85 days had been tagged and released on Nov 26, 2016, and it was last recaptured on February 19, 2017. This reared monarch had survived through much of the winter. All recoveries for reared monarchs were made within 0.2 mile of the tagging site, suggesting that these monarchs move very little.

Based on Mr. McCord's experience, monarch larvae are typically not available for rearing during winters when there is frost or freeze in late fall (late November) or early December. Winter survival of monarch larvae is dependent upon the availability of milkweed foliage, which is generally only provided in winter by the presence of surviving Tropical Milkweed (*Asclepias curassavica*), which has become a popular planting in coastal South Carolina. This neotropical, tender, perennial is not particularly cold-hardy, as plants (unless protected) are typically killed by freeze or frost. Accordingly, in most winters, McCord has not tagged and released reared monarchs at Folly Beach because larvae were not present. Milkweeds native to South Carolina (e.g. *A. perennis*) are also perennials and undergo fall senescence, generally losing their foliage by late fall or early winter.

Mr. McCord had tagged and released a total of 18 reared monarchs at Folly Beach during the "heart" of winter (Dec 16 through Feb) during his prior years of tagging (2009-2010, 2011-2012, and 2013-2014 only). These winters all had at least eight to ten nights with freezing temperatures, with winter 2013-2014 having 17 nights of freeze and three nights with temperatures 19-23 °F. Only one (5.5%) of these monarchs was recovered, and it was recovered only once and at the site of its release after only two days. In comparison, Mr. McCord released 18 tagged monarchs during December 16, 2016 through February 28, 2017 at Folly Beach. He recovered six (33.3%) of these individuals, all from 18 to 69 days after their initial winter release. Several of these individuals were recovered on multiple dates (a total of 13 recovery incidents), and all recovery incidents were made within 0.02 mi. from any winter release site. The mild 2016-2017 winter in coastal South Carolina (only five freezing nights, with only two nights below 30 °F and the coldest temperature of 27 °F at Folly Beach and for much of the SC coast) likely increased the rate of potential survival for reared monarchs and for those that were potentially produced "naturally" on Tropical Milkweed or Aquatic Milkweed near the South Carolina coast during late fall and winter (out of the natural periodicity of adult brooding due to the availability of "milkweed" foliage as supplied by surviving Tropical Milkweed). For this project, these data, though limited, suggest that reared monarchs (and likely as well as any late fall and winter adult monarchs that are "naturally" produced) are not well suited to survive typical winter conditions (multiple nights of freezing temperatures) along much of coastal South Carolina. The limited data also suggest that reared monarchs released in winter tend to remain near their sites of release, as indicated by a maximum distance moved by reared monarchs from the tagging and release site during this three-season project of just 0.2 miles.

Conclusions

The Cooperative Winter Monarch Tagging Project provided much needed information on the distribution of monarchs along the South Carolina coast from the second half of November through early spring. During the three project winter periods, monarchs were captured from as far north as North Myrtle Beach, Georgetown County, SC to as far south as Hilton Head Island,

Beaufort County, SC. Monarchs were documented along ~96% of the South Carolina Atlantic coastline for the winter tagging period . Results of the three-year Cooperative Winter Monarch Tagging Project provide very useful information that revealed the winter presence of monarchs along practically all of the South Carolina coast. Additional tagging in the future would further clarify the life history of the monarch in coastal South Carolina.

References

- Brower, L. P., Fink, L. S., & Walford, P. (2006). Fueling the fall migration of the monarch butterfly. *Integrative and Comparative Biology*, *46*(6), 1123-1142.
- McCord, J. W., & Davis, A. K. (2010). Biological observations of monarch butterfly behavior at a migratory stopover site: results from a long-term tagging study in coastal South Carolina. *Journal of Insect Behavior*, 23(6), 405-418.

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r each of the . County	COMINY	Horry		Charleston	Charleston	Charleston	Charleston	Charleston	Berkeley	Charleston	Charleston	Charleston	Charleston	Charleston	Charleston	Colleton	Beaufort	Beaufort	Beaurort	Beaufort	Beaufort	Beaufort	Beaufort	Beaufort		is the project tagg in or include any 1 ing site (specific al wing been recept) wing been recept) wing been recept. Thesis and the sites, with most h and sites, with most h days, "-7.0 mi SSV days, "-8.0 mi SSV days, "-7.0	l: 10 days, ~40.6 r	: Johnson, James ni NW; Sol Legare	ing the project tag	y Plantation, Edis	an ice and snow . A report of ~20	ed to have been l
Table 1. Results of tagging efforts for Site	2116	North Myrtle Beach	Hobcaw Barony, Georgetown		Isle of Palms	Sullivans Island	Mt. Pleasant	Patriots Point, Mt. Pleasant	Hannahan	James Island ⁷	Folly Beach	Johns Island	Kiawah Island	Seabrook Island	Botany Bay Plantation	Edisto Beach	Dataw Island	Harbor Island	Fripp Island Bacis Island	Callawassie Island	Spring Island	Bluffton	Hilton Head Island	Daufuskie Island	Totals	NOCES: Includes monarchs that were recaptured durin The number of individuals released by site does includes only monarchs recaptured at the taggi and the maximum mills moved by monarchs the threade 5 monarchs that were recaptured durin three monarchs could not be d Firree monarchs could not be d of solid senon-ranks to pattered at all James fincludes monarchs could not be d for ould smonarchs to pattered at all James three monarchs could not be d for ould smonarchs to pattered at all James three monarchs to pattered at all James Liand Provides monarchs solution to vide d through a monarchs to pattered at all James Liand Provides monarchs solution and the section of the during the seaser 1-3 days, "-5 m IN Protor Pattore Patt, which Beacht, 35 days, "-5 m IN Protore Patt, which Beacht, 35 days, "-5 m IN Protore Patt, which Beacht, 35 days, "-5 m IN Protore Patt, which Pattore was already in houldes t'7 monarchs that were receptured during thread at the gas att, "-775 m IN E, Isle of P, Undertumately, information provided by Monarch All the morarch as found dated on the ground All the morarch was releaded thread on the ground and solve and convint with remined for experiment	¹⁵ Fripp Island: 30 days, ~40.9 mi SW; Fripp Island	Ft. Johnson, James Island: 1 day, ~5.3 mi NE; F. Sol Legare Island, James Island: 14 days, ~2.5 n	Folly Beach: 8 days, ~16.1 mi ENE ¹⁷ Includes 4 monarchs that were recaptured during ¹⁷ Includes 7 monarchs that were recaptured du	¹⁸ Fripp Island: 66 days, ~13.3 mi SSW; Botany Ba	¹⁴ This monarch was found dead on the ground ir An ice and snow mix remained for several days	²⁰ Kiawah Island: 18 days; ~19.0 mi NE ²¹ This monarch was found dead and was presum ²² and was presum

Table 2. Individuals Captured during winter periods (16 Nov - 15 Apr)													
Site	County	2015-2016	2016-2017	2017-2018	Totals								
N. Myrtle Beach	Horry	14	0	0	14								
Hobcaw Barony	Georgetown	3	0	0	3								
McClellanville	Charleston	6	0	4	10								
Dewees Island	Charleston	7	7	15	29								
Isle of Palms	Charleston	28	7 ¹	0	35								
Sullivans Island	Charleston	41	10	169 ¹	220								
Mt. Pleasant	Charleston	0	1	8	9								
Patriots Point	Charleston	123 ¹	244	594 ¹	961								
Hannahan	Berkeley	0	0	1	1								
Charleston	Charleston	0	0	3	3								
James Island	Charleston	8	24	105^{2}	137								
Ft. Johnson	Charleston	94 ³	47 ¹	358 ¹	499								
Folly Beach	Charleston	308 ⁻¹	340	1330 ⁴	1978								
Johns Island	Charleston	0	7	159	166								
Kiawah Island	Charleston	22	15	28^{1}	65								
Seabrook Island	Charleston	64	12	5	81								
Botany Bay Plantation	Charleston	119	44	21	184								
Edisto Beach	Colleton	44	16	177	237								
Dataw Island	Beaufort	44	10	3	57								
Harbor Island	Beaufort	1	0	14	15								
Parris Island	Beaufort	11	0	0	11								
Bluffton	Beaufort	12	0	4	16								
Callawassie Island	Beaufort	0	0	2	2								
Spring Island	9	17											
Fripp Island	Beaufort	85	45	137 5	267								
Hilton Head Island	Beaufort	6	1	1	8								
Totals		1048	830	3147	5003								
Notes:													
¹ Includes 1 individual that were first captured & tagged at another project tagging site													
² Includes 6 individuals that were first captured & tagged at another project tagging site													
³ Includes 2 individuals that were first captured & tagged at another project tagging site													
⁴ Includes 3 individuals that were first captured & tagged at another project tagging site													
⁵ 22 individuals were captured at two s	tes												