

Winter Site Fidelity and Over-wintering Site Persistence of a Northern Shrike, *Lanius borealis*, in Maryland

Daniel M. Small

Chester River Field Research Station, Washington College,
210 South Cross Street, Chestertown, MD 21620
dsmall2@washcoll.edu

Abstract: Observations were made of a single adult Northern Shrike (*Lanius borealis*) over a four-year period during the winters of 2007–2008 to 2011–2012 on the Eastern Shore of Maryland. A new record early arrival date of 13 October and a record late last occurrence date of 16 April were established for the state. Average annual residence time was 155 days \pm 13.9 SE. Average home range size was 71.7 ha \pm 23.1 SE (177.1 ac \pm 57.1 SE) using the minimum convex polygon method and 69.1 ha \pm 17.7 SE (170.5 ac \pm 43.7 SE) using the kernel density estimate for 95% percent volume contours. Average core home range or 50% percent volume contours was 13.7 ha \pm 5.49 SE (33.9 ac \pm 13.6 SE). Each winter's home range was comprised of multiple habitat types, but native grasslands and early successional shrub-scrub habitat annually dominated the core home range.

Northern Shrikes (*Lanius borealis*) are Nearctic breeders that migrate to southern Canada and northern United States annually, but distance and timing vary greatly between individuals and across years (Paruk et al. 2017). Numbers of migrating Northern Shrikes fluctuate annually throughout the winter range (Atkinson 1995, Rimmer and Darmstadt 1996), and the species is not recorded annually in Maryland. When present in the State, only one or two individuals are typically found, four individuals have been banded, but were either captured while migrating, or if wintering, did not remain in the area after release, so actual residency of individuals has been unknown. Apparent lengths of time birds were observed are highly variable, but I found no published documentation of Northern Shrike winter site fidelity or site persistence in Maryland. Here, I present the first observations of one site-faithful individual Northern Shrike (Figure 1) made during four consecutive winters (2007–2008 to 2010–2011) in Maryland, and I describe its habitat use and winter home range persistence.



Figure 1. Northern Shrike (*Lanius borealis*). Chino Farms, Queen Anne's County, Maryland; 18 December 2009.

METHODS

Area Description

All observations took place on Chino Farms (39.231022° , -76.005853°) in northern Queen Anne's County, Maryland. Chino Farms is one of the largest commercial farms in Maryland and is typical of most farms in the area in its planting a crop rotation of corn (*Zea mays* L.), soybeans (*Glycine max* [L.] Merr.), and cereal grains (Poaceae spp.). The overall landscape is typical of the upper Eastern Shore of Maryland with the area dominated by row crop agricultural land, deciduous woodlots of varying size, and close proximity to creeks and rivers. A major exception is the 91.7 ha (226.6 ac) Chester River Field Research Station (CRFRS) grassland planted with native warm season grasses with scattered islands of woody habitat. The grasslands were enrolled in the United States Department of Agriculture (USDA) Conservation Reserve Program (CRP) in 1999 and planted in an experimental design. For more information on the experimental design, species planted, and initial research, see

Gill et al. (2006). Currently the grasslands are dominated by two species of tall grass, big bluestem (*Andropogon gerardii* Vitman) and switchgrass (*Panicum virgatum* L.) with numerous 1.5 m–4.6 m (5–15 ft) saplings of multiple species and large areas dominated by winged sumac (*Rhus copallina* L.).

Data Collection

Location data were gathered both opportunistically and systematically throughout the winter from February through April for years 2009–2012.

Location data were not gathered in the 2007–2008 winter period, when the bird first appeared on site but remained unbanded. The majority of observations used to define this individual's home range were obtained by the author, other observers reporting the shrike were contacted and locations of their observations were included when possible. Efforts were made to locate the bird bi-weekly, though locations were recorded more frequently when time allowed, and searches were increased during late March to determine accurate departure dates. Shrike locations were delineated on field maps and Global Positioning System (GPS, Garmin XP) points were taken at a later date when the bird was not occupying the immediate area. GPS data were transferred to ArcMAP 10.3 (Esri 2014) and digitized.

Home range estimates for each year were established using minimum convex polygon (MCP) criteria (Anderson 1982), and kernel density estimates (KDE) were developed for each year's home range and refined using an ad hoc approach (Kie 2013). A MCP is the smallest polygon that can be drawn that will enclose the area an individual has been recorded using and a KDE analysis allows researchers to see how an individual uses different areas within the home range based on the density of location data recorded (MacLeod 2013). After KDEs were created for each year, 50% and 95% percent volume contours (PVC) were added following MacLeod (2013). PVCs are enclosed areas defined by a specific density threshold that contain a proportion of the location data, for example a 50% PVC will contain 50% of the location data for an individual (MacLeod 2013). After the MCP and PVC home ranges were delineated, area calculations were obtained and landscape attributes within each year's home range were mapped. Five landscape attributes, agricultural land (including field margins), cool season grass areas or lanes, early successional shrub/scrub habitat, tree and hedge rows, and warm season grass fields were selected due to their importance for Northern Shrikes winter home ranges previously mentioned in the literature (Atkinson 1993, Paruk et al. 2017) and personal observations.

RESULTS

The Northern Shrike was first observed on the afternoon of 3 November 2007 perched on a tree along Kibler Road. It was identified as an adult (i.e., at least one year of age), due to the lack of any brown juvenal plumage. In addition,

feather plumage consistent with an adult shrike included: white throat; white breast with thin crisp gray feather edging; solid light gray back, nape, and top of head; solid jet black mask; and small pink area on the lower mandible (Pyle 1997). One distinguishing feature of this individual, which allowed us to be certain we were observing the same individual throughout the winter, was the overall size of the black mask. The length and width of the black mask were extensive and uniquely identified this individual (Figure 1). Photographs confirmed the same bird was observed many times throughout the winter of 2007–2008, although no GPS location data were obtained.

An adult shrike was seen on 6 November 2008 in the same general area of the 2007–2008 sightings. All plumage features were consistent with those of the 2007 shrike, including the extensive black mask which convinced us that the 2007 shrike had returned. I began collecting location data for the shrike in February 2009 (Table 1) and continued detailed observations each successive winter it was present. Hereafter I refer to this bird as the “Chino” shrike.

Table 1. Winter territory size and minimum residency time for the Chino Northern Shrike, Queen Anne’s County, Maryland.

Year	Number of Relocations (GPS) points				Minimum Residence		
		100% MCP ¹ (ha)	95% PVC ² (ha)	50% PVC (ha)	Time (days)	First Observation	Last Observation
2008–2009	63	139.36	117.28	29.06	162	6 November	16 April
2009–2010	65	43.24	52.73	11.40	171	13 October	1 April
2010–2011	77	63.23	71.11	11.47	173	20 October	10 April
2011–2012	42	40.79	35.08	2.95	114	21 October	11 February

¹minimum convex polygons

²percent volume contours

On 18 December 2009, I captured the “Chino” shrike using a Bal-Chatri trap modified with the addition of a Potter trap placed on top and baited with a Deer Mouse (*Peromyscus maniculatus* [Wagner]). I banded the bird with a United States Geological Survey (USGS) metal band (1292-53802) and released it unharmed. The shrike was aged after-second-year (Pyle 1997) with a wing chord of 108 mm (~4.3 in). Plumage characteristics were consistent with those described by Brady et al. (2009) for adult male Northern Shrikes, although I was not able to definitively determine the bird’s sex. The “Chino” shrike was never heard singing, although Northern Shrikes have been recorded singing during the winter period (Atkinson 1993). After banding, the “Chino” shrike remained in the area throughout the rest of the 2009–2010 winter period and the subsequent two winters, we continued to confidently identify this bird with each encounter

as the same individual due to the identical plumage features and the band on the left leg.

Minimum home range sizes varied across years and ranged from 43.24 to 139.36 ha ($\bar{x} = 71.66$ ha ± 23.12 SE) [106.85 to 344.37 ac ($\bar{x} = 177.07$ ac ± 57.1 SE)] for the MCP estimates (Table 1). Ninety-five and 50% percent PVCs constructed after running a Kernel Density Analysis varied across years. Ninety-five percent PVCs ranged from 35.08 to 117.28 ha ($\bar{x} = 69.05$ ha ± 17.68 SE) [86.68 to 289.81 ac ($\bar{x} = 170.5$ ac ± 43.7 SE)], while the 50% PVC or the area most heavily used, considered the core home range, ranged from 2.95 to 29.06 ha ($\bar{x} = 13.72$ ha ± 5.49 SE [7.28 to 71.81 ac ($\bar{x} = 33.90$ ac ± 13.6 SE)]) (Table 1). The location of the “Chino” shrike’s core range was remarkably consistent across years with considerable overlap, the average centroid (center of territory) distance ranged from 73.56 to 335.73 m ($\bar{x} = 167.26$ m ± 84.41 SE) [241.35 to 1101.46 ft ($\bar{x} = 548.75$ ft ± 276.94 SE)] away from the 2008–2009 winter when location data were first taken. Across years, 93.1% (range 85.8%–98.8%) of the area within each core range was made up of the native warm season grassland and early successional habitat (Table 2). Minimum residence time or home range occupancy varied little between the first three winters during which location data were collected, ranging from 114 to 172 days ($\bar{x} = 155$ days ± 13.87), but was noticeably shorter in its final winter.

Table 2. Descriptive statistics for percent and total hectares of five landscape attributes of each home range held by the Chino Northern Shrike, Queen Anne’s County, Maryland.

Year	Home Range Types	Habitat Type									
		Agricultural Land		Cool Season Grass		Early Successional		Tree Row		Warm Season Grass	
		# ¹	% ²	#	%	#	%	#	%	#	%
2008-2009	50% PVC ³	0.5	1.71	0.32	1.09	4.06	13.98	-	-	23.64	81.36
	95% PVC	28.46	24.27	2.16	18.5	11.21	9.55	2.03	1.73	59.74	50.94
	MCP ⁴	60.42	43.35	1.95	1.4	9.89	7.1	3.19	2.29	55.24	36.64
2009-2010	50% PVC	0.7	6.16	-	-	3.33	29.22	0.09	0.78	6.42	56.3
	95% PVC	11.16	21.17	0.74	1.4	7.01	13.29	1.33	2.52	29.41	55.79
	MCP	13.82	31.97	0.6	1.39	29.41	55.79	0.81	1.87	19.84	45.89
2010-2011	50% PVC	0.42	3.66	-	-	3.79	33.07	-	-	6.84	59.63
	95% PVC	7.95	11.19	1.23	1.72	7.2	10.13	1.37	71.14	50.59	71.14
	MCP	4.82	7.62	0.59	0.93	6.2	9.8	0.18	0.29	50.14	79.3
2011-2012	50% PVC	-	-	-	-	1.89	64.03	-	-	1.03	34.81
	95% PVC	5.83	16.63	0.29	0.83	5.8	16.54	0.06	0.17	22.21	63.31
	MCP	18.6	45.61	0.08	0.2	5.7	13.96	0.4	0.97	15.08	36.96

¹number of hectares used within territory

²percent of hectares within territory

³percent volume contours

⁴minimum convex polygons

DISCUSSION

This is the first Northern Shrike documented to have shown winter site fidelity in Maryland. The bird returned for five consecutive winters and is one of only a handful of other documented cases of winter site fidelity for Northern Shrikes in North America (Rimmer and Darmstadt 1996, eBird 2013, Ryan Brady, in litt.). There are only five locations in Maryland that have multiple records of Northern Shrikes: Assateague Island National Seashore in Worcester County, Finzel Swamp and Russell Road in Garrett County, Chesapeake Bay Environmental Center in Queen Anne's County, and Chino Farms (eBird 2017). Only Finzel Swamp has records for consecutive years—2012, 2013, 2014—though there is no way to know if these represent the same individual (Bob Ringler, in litt.). In addition to being the first documented Northern Shrike to show site fidelity in Maryland, the “Chino” shrike also set record early and late observation dates for the state. The earliest previous detection for the species occurred on 26 October (Iliff et al. 1996), while the latest previously known date of occurrence was 9 April (eBird 2017).

Including the 2009 Chino bird, five Northern Shrikes have been banded in Maryland (Danny Bystrak, in litt.): one in 1970 in Caroline County, one in 1988 at Patuxent Research Refuge in Anne Arundel County, and the remaining three on Chino Farms in 2000, 2007, and 2009 (the bird reported here). With the exception of the 2009 “Chino” shrike (Table 1), none of these individuals were subsequently encountered, and no Northern Shrikes banded elsewhere have been encountered in Maryland (Danny Bystrak, in litt.).

North American Northern Shrikes, recently split from the Great Grey Shrike (*L. excubitor*) by the American Ornithological Society (Chesser et al. 2017), occupy considerably larger estimated home ranges than Great Grey Shrikes that have home ranges similar to the “Chino” shrike. Winter home range estimates of Great Grey Shrikes varied in size regionally, averaging 72 and 150 ha (178 and 371 ac) in two southern Swedish studies (Olsson 1984) and ranging between 20–100 ha (49–247 ac) in Germany (Cramp et al. 1993) compared with 72 ha (178 ac) average for the “Chino” shrike. Winter home range data from North America are sparse: nine Northern Shrikes in Idaho occupied an average estimated home range estimate of 215.7 ha (533.0 ac) (100% MCP method, Atkinson 1993), while 11 birds in Wisconsin had highly variable home ranges that averaged 554.7 ha (1370.7 ac) in 2009 and 53.0 ha (131.0 ac) in 2010 (Paruk et al. 2017). Habitat type and prey densities most likely drive home range sizes; productive habitats with high prey densities would allow shrikes to occupy smaller home ranges than less productive habitats like shrub-steppe areas of western North America (Atkinson 1993, Paruk et al. 2017). Average core home range or 50% PVC estimates for the “Chino” shrike over four winters was 13.3 ha (32.9 ac), considerably smaller than the 53.4 ha (132.0 ac) estimated for Northern Shrikes

in Idaho (Atkinson 1993). The “Chino” shrike was occasionally seen outside of its mapped MCP home range in several years, as far away as 2.7 km (1.7 mi) from the center of the home range. Due to the infrequency of sightings from this area I did not incorporate these locations into home range estimates, as I suspect this distant location most likely was an area occasionally used and only for short periods of time. This area was along a frequently travelled county road with limited perch locations and the “Chino” shrike would have been observed if it had utilized this area more frequently or the areas between here and the CRFRS grasslands (pers. obs.). Due to prey abundance and fluctuations in winter weather, Northern Shrikes can change their territories over the course of the winter (Paruk et al. 2017); in this case, it appears that the “Chino” shrike visited this location infrequently and it was not part of its core range or a permanent territory change.

The 155-day average minimum residence time of the “Chino” shrike was considerably longer than the mean minimum residence time of 77 days for nine Northern Shrikes wintering in Idaho (Atkinson 1993), but consistent with, albeit shorter than, the 169 days of Great Grey Shrikes in Sweden (Olsson 1984). This variation could be due to regional differences in winter severity and duration between wintering areas, or inter-annual differences in prey abundance or differences in migration timing between male and females. Differences between sexes or the possibility that birds were en route to other winter locations could have accounted for the variation in minimum residence time for Northern Shrikes wintering in Idaho, which stayed between 11 days and 120 days (Atkinson 1993), though more study is needed to confirm this and determine other possible reasons for this variation. The “Chino” shrike’s inter-annual residence time showed little variation in the first three winters, but was remarkably shorter in the final year it was present. The winter of 2011–2012 had the highest average temperature and the least amount of snow accumulation (Weather Underground 2017) so weather may not have played a role in the shorter residence time. Two possible explanations for the shorter residence time are lower than normal prey availability (though we did not measure prey abundance) or the “Chino” shrike was killed by a predator.

Within each year’s home range, amounts of discrete habitat type varied across the years (Table 2), but several habitat types were consistent within each home range and thus were likely important for this individual and were consistent with observations of winter home ranges for Northern Shrikes in other geographic areas (Atkinson 1993). The five habitat types were consistent in one way; they all had copious perches from which to hunt (pers. obs.). Northern Shrikes are “sit and wait predators”, typically sitting atop a prominent perch, scanning the immediate environment, and flying down to the ground to catch insects or rodents, or to pursue birds (Atkinson 1993, Paruk et al. 2017). Habitat edges and ecotones are important to Northern Shrikes (Atkinson 1993). For example,

agricultural land comprised a large portion of the “Chino” shrike’s winter home range in 2008–2009 at 43.35% (Table 2), however the bird was not found in the middle of the agricultural fields, but invariably occupied edges where there are perch locations (Figure 2), in the same manner that American Kestrels, *Falco sparverius*, use road edges surrounding agricultural land with perches such as utility wires or trees (Smallwood and Bird 2002). A large portion of the core range, and apparently highly important to this individual, consisted of native warm season grasses and early successional shrub-scrub (four-year average 58% and 35%, respectively). Both habitats potentially harbor high prey densities of small rodents and passerine birds, as well as providing protective herbaceous cover (Atkinson 1993). These habitats were not uniform in nature, varying in structure and vegetative composition, and provided many hunting opportunities, especially along the short grass lanes throughout the CRFRS grassland (pers. obs.).

High quality habitat is important to birds throughout the year, but is particularly critical during the non-breeding season (Marra et al. 1998). Early successional habitat is limited on the Delmarva Peninsula and is one of the main causes for dramatic declines in grassland species that depend on it, including the Loggerhead Shrike (*Lanius ludovicianus*). Northern Shrikes require similar habitat types as Loggerhead Shrikes (Bent 1950, Atkinson and Cade 1993, Atkinson 1995), albeit in the winter, and thus much of the Delmarva Peninsula is no longer suitable for these species. Among migratory species, carryover effects from occupying a poor winter territory or home range can negatively affect subsequent breeding performance (Marra et al. 1998). If site fidelity is a measure of assessing winter habitat quality, then we surmise that this small area of Maryland with grassland and early successional shrub-scrub provided high quality habitat for this Northern Shrike.

ACKNOWLEDGMENTS

I thank Henry Sears, M.D., the owner of Chino Farms, for his vision and dedication to preserving grassland habitat for the benefit of those declining species that depend on this limited habitat; Greg Cole and Henry Davis (both of Chino Farms) for help with management; Tim Carney and Bob Ringler (both of the Maryland Ornithological Society) for help in gathering and sharing historical data; Danny Bystrak (Bird Banding Laboratory, Patuxent Wildlife Research Center, USGS) for providing banding information; and Ryan Brady (Bureau of Wildlife Management, Wisconsin Department of Natural Resources) for information on ageing shrikes. Maren Gimpel (CRFRS, Center for Environment and Society, Washington College), Doug Gill (Department of Biology, University of Maryland College Park), Eric Atkinson (Biology Department, Northwest College), Chris Rimmer (Vermont Center for Ecosystem Studies), and an anonymous reviewer’s edits, suggestions, and comments greatly improved this manuscript.



Figure 2. Home ranges for a single Northern Shrike throughout four winters on Chino Farms, Queen Anne's County, Maryland. The maps depict GPS locations (black dots), minimum convex polygons (dashed black line), 50% percent volume contours (thick solid black line), 95% percent volume contours (solid red line), kernel density estimate analysis (blue shading), and the Chester River Field Research Station grasslands (thin solid black line).

LITERATURE CITED

- Anderson, D.J. 1982. The home range: A new non-parametric estimation technique. *Ecology* 63(1):103–112.
- Atkinson, E.C. 1993. Winter territories and night roosts of Northern Shrikes in Idaho. *The Condor* 95(3):515–527.
- Atkinson, E.C. 1995. Northern Shrikes (*Lanius excubitor*) wintering in North America: a Christmas Bird Count analysis of trends, cycles, and interspecific interactions. Pages 39–44 in R. Yosef and F.E. Lohrer (Editors) *Shrikes (Laniidae) of the World: Biology and conservation*. Proceedings of the First International Shrike Symposium. *Proceedings, Western Foundation of Vertebrate Zoology* 6(1). 343 pp.
- Atkinson, E.C., and T.J. Cade. 1993. Winter foraging and diet composition of Northern Shrikes in Idaho. *The Condor* 95(3):528–535.
- Bent, A.C. 1950. *Life Histories of North America Wagtails, Shrikes, Vireos, and Their Allies*. United States National Museum Bulletin 197. 411 pp.
- Brady, R.S., J.D. Paruk, and A.J. Kern. 2009. Sexing adult Northern Shrikes using DNA, morphometrics, and plumage. *Journal of Field Ornithology* 80(2):198–205.
- Chesser, R.T., K.J. Burns, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, D.F. Stotz, and K. Winker. 2017. Fifty-eighth supplement to the American Ornithological Society's Check-list of North American Birds. *The Auk* 134(3):751–773.
- Cramp, S., C.M. Perrins, and D.J. Brooks. 1993. *Handbook of the Birds of Europe, the Middle East, and North Africa: Birds of the Western Palearctic, Volume 7: Flycatchers to Shrikes*. Oxford University Press, Oxford, UK. 700 pp.
- eBird. 2013. eBird: An online database of bird distribution and abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available at: <http://ebird.org/content/wi/news/the-oldest-northern-shrike-in-north-america/>. Accessed 18 March 2017.
- eBird. 2017. eBird: An online database of bird distribution and abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available at: <http://www.ebird.org>. Accessed 1 March 2017.
- Esri. 2014. ArcGIS Desktop: Release 10. Redlands, CA.

- Gill, D.E., P. Blank, J. Parks, J.B. Guerard, B. Lohr, E. Schwartzman, J.G. Gruber, G. Dodge, C.A. Rewa, and H.F. Sears. 2006. Plants and breeding bird response on a managed Conservation Reserve Program grassland in Maryland. *Wildlife Society Bulletin* 34(4):944–956.
- Iliiff, M.J., R.F. Ringler, and J.L. Stasz. 1996. *Field List of the Birds of Maryland*, Third Edition. Maryland Avifauna Number 2. Maryland Ornithological Society, Baltimore, MD. 53 pp.
- Kie, J.G. 2013. A rule-based *ad hoc* method for selecting a bandwidth in kernel home-range analyses. *Animal Biotelemetry* 1(13):1–11.
- MacLeod, C.D. 2013. *An Introduction to using GIS in Marine Biology: Supplementary Workbook Four: Investigating Home Ranges of Individual Animals*. Pictish Beast Publications, Glasgow, UK. 132 pp.
- Marra, P.P., K.A. Hobson, and R.T. Holmes. 1998. Linking winter and summer events in a migratory bird using stable-carbon isotopes. *Science* 282(5395):1884–1886.
- Olsson, V. 1984. Varfågelns *Lanius excubitor* vintervanor. II. Revir. *Vår Fågenvärld* 43:199–210.
- Paruk, J.D., T.J. Cade., E.C. Atkinson, P. Pyle, and M.A. Patten. 2017. Northern Shrike (*Lanius excubitor*), The Birds of North America (P.G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY. Available at: <https://birdsna.org/Species-Account/bna/species/norshr>. Accessed 21 July 2017.
- Pyle, P. 1997. *Identification Guide to North American Birds, Part 1: Columbidae to Ploceidae*. Slate Creek Press, Bolinas, CA. 732 pp.
- Rimmer, C.C., and C.H. Darmstadt. 1996. Non-breeding site fidelity in Northern Shrikes. *Journal of Field Ornithology* 67(3):360–366.
- Smallwood, J.A., and D.M. Bird. 2002. American Kestrel (*Falco sparverius*), The Birds of North America (P.G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY. Available at: <https://birdsna.org/Species-Account/bna/species/amekes>. Accessed 18 March 2017.
- Weather Underground. 2017. Weather Underground, Baltimore, MD, Baltimore-Washington International, Weather History for KBWI, From November 1, 2011 To March 31, 2012. Available at: https://www.wunderground.com/history/airport/KBWI/2011/11/1/CustomHistory.html?dayend=31&monthend=3&yearend=2012&req_city=&req_state=&req_statename=&reqdb.zip=&reqdb.magic=&reqdb.wmo. Accessed 21 July 2017.