Five Years of Mist Netting at Litzsinger Road Ecology Center

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INTRODUCTION

Mist netting and bird banding are valuable techniques used worldwide for studying survival, behavior and migration of birds (USGS Patuxent Wildlife Research Center 2009). Mist netting data is useful in research and management projects because marking individual birds with bands makes it possible to study their dispersal, migration, behavior and social structure, life-span, survival rate, reproductive success, and population trends (USGS Patuxent Wildlife Research Center 2009). Mist netting is also helpful in capturing and counting those secretive and quiet birds that may be overlooked during census periods (Remsen and Good 1996).

Litzsinger Road Ecology Center, (LREC) under the direction of the Missouri Botanical Garden, has been restoring 12 acres of tallgrass prairie in St. Louis County since 1989 through planting native prairie forbs and grasses and periodic burns to manage non-native plants. The goals of mist netting at LREC have been to: 1) document the variety and abundance of birds found on the prairie, noting the quantity of spring and fall migrating birds, as well as those species breeding on the site, 2) document the frequency with which previously banded birds are recaptured, 3) compare the ratio of adult and juvenile birds caught in the nets, and 4) monitor the productivity of the mist nets in the prairie, prairie fire break and prairie-woodland edge.

St. Louis lies within the Mississippi Flyway, the longest migration route in the Western Hemisphere. For more than 3000 miles, from the mouth of the Mackenzie to the delta of the Mississippi, this route is uninterrupted by mountains and the greatest elevation above sea level is less than 2000 feet. Because the Flyway contains forested and wetland habitat, the entire region is ideal for many species of migrating birds. The two rivers that define the flyway, the Mackenzie emptying on the Arctic coast and the Mississippi in the Gulf of Mexico, have a general north-and-south direction, another factor in determining the importance of this route which is used by large numbers of ducks, geese, shorebirds, blackbirds, sparrows, warbler and thrushes (Birdnature.com). The diversity of migrating birds captured in the mist nets gives us an idea of the importance of the habitat Litzsinger provides both as a stopover point and a breeding habitat.

Birds recaptured in the mist nets give us an idea of the annual survival rate of territorial breeding birds (Nadav et. al 2004). This in turn allows us to estimate the proportions of birds detected, determine whether or not the

proportions are constant over time and if the prescribed burn management affects populations (Kendall et. al 2004). The number of hatch year birds captured during the summer provides a good index of local productivity (DuFeu et. al 2004; Dunn and John, 2004).

Monitoring the number of hatch year birds, coupled with looking at the overall productivity of the nets will help us in the long-term to determine if the Litzsinger prairie habitat is a population source or sink. Fragmented landscapes are usually subdivided into population "sources" and "sinks". Small fragments and areas near edges may be unable to support enough reproduction of offspring to offset mortality and thus would be considered population sinks. Larger tracts where predation and parasitism levels are lower would be population sources that produce surplus offspring that can disperse and help maintain sink populations located elsewhere (Trine 1998). Mist netting is one tool that would aid in evaluating habitat quality and source-sink threshold.

PROCEDURE

The study took place from 2008 – 2012 on the North Prairie and South Prairie at LREC (N 38.6213540° W 90.3741410°). LREC is located 10 miles west of downtown St. Louis and sits on 34 acres of combined bottomland forest, restored prairie and suburban creek (Litzsinger Road Ecology Center 2012).

Mist netting involved placing up to three 12-meter nets at the SE prairie/woodland edge of the South Prairie and three 12-meter nets in the fire break between the North Prairie and South Prairie and up to two 12-meter nets within the prairies. Nets 1 and 2 were moved at the start of the 2010 season, an additional net was added to the North Prairie in 2010. In 2012, nets 1 and 2 were resurrected and placed in the South Prairie and edge (Map 1). All of the nets were 2.6x12 meters in length and 2.6 meters in height; three had 38mm mesh and two of the nets had 30mm mesh.

The mist netting season usually began the second week in May and ran through August. Each session began at dawn during the peak of bird activity and lasted approximately 4 hours. Sessions were cancelled in the event of rain or excessive heat. The nets were checked every 15-30 minutes depending on the volume of birds at the nets. Each bird was identified to species, aged, sexed, checked for molt and parasites, and banded with a federal band.

Birds were categorized as Migrating, Resident, and Summer species. Migrating birds are defined as those birds that stop in St. Louis for a brief time in the spring before resuming their trek to their breeding grounds or in the fall returning to their wintering grounds. Resident species are those birds found in the St. Louis area year round. Summer species are those birds that breed and raise their young in St. Louis during the summer months but travel to

a different location for the winter. If a bird species fell under both Resident and Summer categories, such as the American Robin, they were counted as a Resident species.

A hatch year (HY) bird is defined as a bird in its first calendar year of life (Pyle 1997). A bird older than a HY is referred to as after hatch year (AHY). A bird that has been previously banded and caught again is termed a recapture or recap.

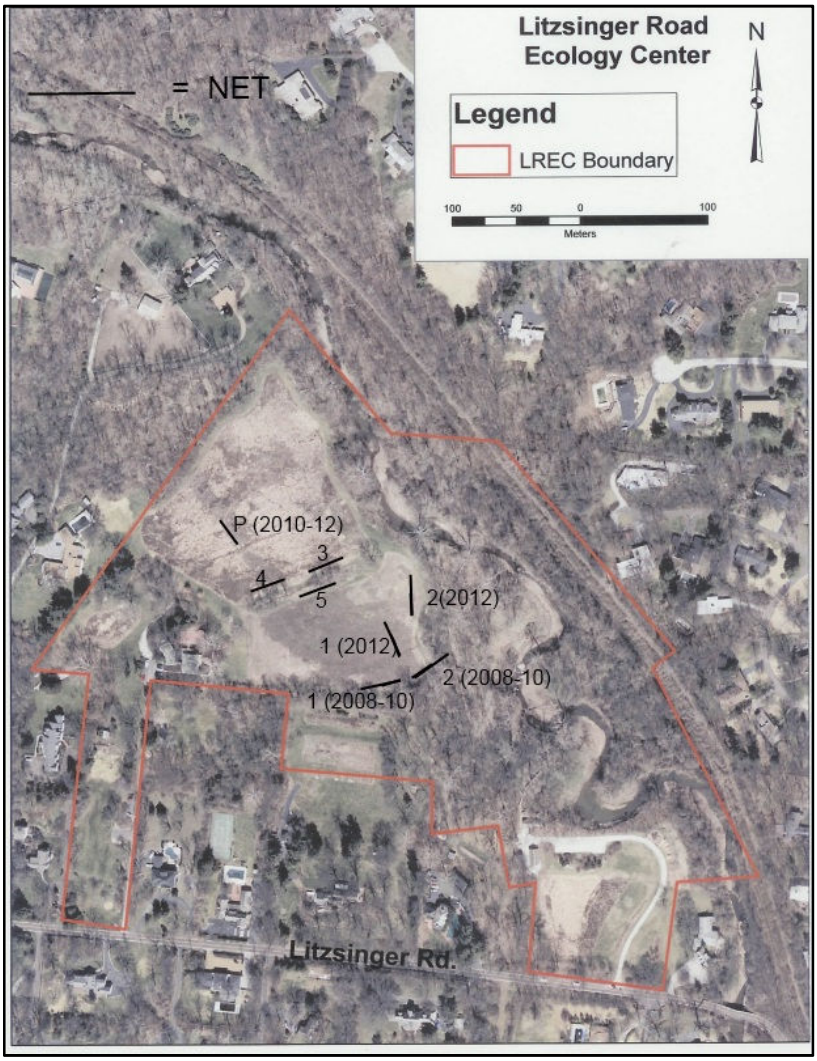

Figure 1

RESULTS

Overall, the mist nets are catching more birds with each passing summer, although the recapture rate has been consistently low (Table 2). There have been a few notable recaptures over the years (Table 3). A Common Yellowthroat (band 7859) originally banded Sept 2008 was recaptured in June 2009 and again in May 2010. Another frequently caught individual bird was a Song Sparrow (6102). This bird, originally banded May 10, 2010, was captured again on May 17, 2010, and again in June 2012. An Indigo Bunting (1416) banded in May 2008 was caught again four years later in June 2012. The recapture rates of these birds demonstrate site fidelity and are good examples that the LREC prairie does provide adequate resources for these species.

Over the last 5 years, 567 birds have been captured, of which 448 were AHY, 119 were HY, and 36 birds were recaptured (Table1). The ratio of AHY to HY captured has varied widely (Table 1). The most commonly caught species were Resident birds American Goldfinch (n=160) and Song Sparrow (n=94). The Summer species Indigo Bunting (n=61) was another commonly caught species (Table 4). The numbers for the summer species Common Yellowthroat, was consistent 2008 – 2010, but dropped sharply in 2011 and 2012. The number of Migrant species captured varied year to year, although 2008, 2010 and 2012 captured the highest number of migrant species. 2008 saw 10 migrants in the nets, 2009 only 2 species were captured, 2010 there were 11 species, 2011 had 3 migrant species, and 2012 captured 10 migrant species. In terms of consistent abundance, there was no commonly caught migrant bird species, although the Least Flycatcher was captured every year except 2010 and the Lincoln Sparrow was caught every year 2010 through 2012 (Table 4). The nets on the prairie edge experienced a steady decline in the number of birds captured since the pilot of the study in 2008 while the nets in the prairie firebreak progressively caught more birds with each passing year. An additional net was erected in the fire break on June 22, 2009 and brought additional birds to the 2009 tally. A net was set up in the North Prairie on June 28, 2010 and added birds to that year's total (Table 2). A mist net on the prairie edge was reinstated, although in a different location, during the 2012 season.

	2008	2009	2010	2011	2012
AHY	51	68	137	78	107
HY	0	34	25	29	24
AHY : HY		2.0 : 1	5.6 : 1	2.7 : 1	4.5 : 1
RECAP	4	11	8	9	8

Table 1– Age classes and numbers of recaptures of birds captured at LREC.

	2008			2009			2010			2011			2012		
	hours	birds	b/hr	hours	birds	b/hr	hours	birds	b/hr	hours	birds	b/hr	hours	birds	b/hr
prairie	0	0	NA	0	0	NA	48	16	.33	47.5	17	.36	52	15	.29
prairie edge	86	40	.47	96	25	.26	92	10	.11	0	0	NA	33.5	9	.27
fire break	86	70	.81	128	81	.64	138	137	.99	142.5	91	.64	156	114	.73
total	172	110	.64	224	106	.47	278	163	.59	190	108	.57	241.5	138	.57

Table2– Relationship of birds captured at LREC to the habitat and to the level of effort.

DISCUSSION

Mist netting at the Ecology Center is part of a larger project surveying the avian community on the prairie. Used in conjunction with census, mist netting is a useful tool in monitoring the long term trends of breeding and migrating birds on the prairie as well as the longevity of individual birds and survivorship of HY birds through recapture. This paper reviews the results from the last 5 years of mist netting at LREC.

As of the end of the 2012 season, this project has tallied 1105.5 net hours. The number of the years, coupled with the total net hours ensures that the study adequately represents the diversity of bird species inhabiting the prairie during the spring and summer months (Whitman 2004). Mist netting only reflects the indices of birds on the prairie and not the total number. Capture rates depend on weather, vegetation, bird species (Dunn and John 2004), age of the birds and proximity of the nets to active nests (Nadav et. al 2004), as well as net mesh size and spacing of nets in relation to one another (Whitman 2004).

Regarding the population dynamics of individual species, although no studies could be found on precipitation or rainfall in relation to Common Yellowthroat abundance, the decline in their capture rate coincided with the record driest years of 2011 and 2012. 2008 – 2010 had above average rainfall (NOAA Climactic Data Center 2012). Temperatures for the years 2008 – 2010 ranged from much below average to much above average while 2011 and 2012 had temperatures that were much above normal to record heat (NOAA Climactic Data Center 2012).

Although low, the recapture rates for the last 5 years were consistent and are a good indication that Litzsinger is a territory held by many birds. One study (Nadav et. al 2004) revealed that yearly survival rates of territory-holding birds ranged from 17-82% with survival estimates increasing with the age of the bird. To date,

birds recaptured on site were not recaptured more than twice but additional years of this study could increase the recapture rates of individual birds.

Capturing HY birds was an index of productivity rather than a complete inventory of juvenile birds on the site. The capture frequency of young birds varied widely from year to year at Litzsinger. The juveniles accounted for roughly a third of birds captured in 2009 and 2011. Bird species, fledging and dispersal rates (DuFeu and McMeeking 2004) are but a few reasons for the irregular number of young birds caught each year. This study did

SPECIES	TYPE	DATE BANDED	LAST 4 DIGITS OF BAND	DATE RECAPTURED
NORTHERN CARDINAL	R	5/17/2010	1086	8/30/2010
SWAMP SPARROW	M	5/5/2008	1411	5/12/2008
INDIGO BUNTING	S	5/12/2008	1412	6/23/2008
INDIGO BUNTING	S	5/12/2008	1416	6/11/2012
INDIGO BUNTING	S	6/2/2008	1430	6/9/2008
INDIGO BUNTING	S	6/2/2008	1430	7/20/2009
INDIGO BUNTING	S	6/16/2008	1437	6/16/2008
EURASIAN TREE SPARROW	R,S	6/30/2008	1443	5/11/2009
INDIGO BUNTING	S	6/30/2008	1445	6/8/2009
INDIGO BUNTING	S	6/18/2012	3201	7/23/2012
EURASIAN TREE SPARROW	R,S	5/14/2012	3224	6/4/2012
SONG SPARROW	R,S	6/4/2012	4713	6/11/2012
SONG SPARROW	R,S	6/4/2012	4715	6/11/2012
AMERICAN ROBIN	R,S	8/3/2009	4941	8/3/2009
INDIGO BUNTING	S	5/16/2011	5343	7/25/2011
INDIGO BUNTING	S	5/23/2011	5344	6/11/2011
INDIGO BUNTING	S	5/23/2011	5345	8/15/2011
INDIGO BUNTING	S	7/25/2011	5366	7/25/2011
INDIGO BUNTING	S	7/25/2011	5366	7/16/2012
INDIGO BUNTING	S	5/24/2010	5679	5/23/2011
SONG SPARROW	R,S	5/18/2009	5911	6/22/2009
SONG SPARROW	R,S	6/29/2009	5952	6/29/2009
SONG SPARROW	R,S	5/10/2010	6102	5/17/2010
SONG SPARROW	R,S	5/10/2010	6102	6/11/2012
SONG SPARROW	R,S	5/17/2010	6110	6/13/2011
SONG SPARROW	R,S	5/17/2010	6111	5/24/2010
SONG SPARROW	R,S	7/12/2010	6135	7/19/2010
COMMON YELLOWTHROAT	S	5/11/2009	7248	6/1/2009
HOUSE WREN	S	8/17/2009	7288	8/24/2009
NORTHERN CARDINAL	R,S	7/27/2009	7484	6/7/2010
CAROLINA CHICKADEE	R,S	8/2/2010	7748	9/12/2011
AMERICAN GOLDFINCH	R,S	6/16/2008	7833	8/24/2009
COMMON YELLOWTHROAT	S	9/22/2008	7859	6/22/2009
COMMON YELLOWTHROAT	S	9/22/2008	7859	5/24/2010
COMMON YELLOWTHROAT	S	5/5/2008	7978	8/24/2009
COMMON YELLOWTHROAT	S	7/25/2011	8127	6/11/2012
AMERICAN GOLDFINCH	R,S	8/23/2011	8211	8/23/2010
COMMON YELLOWTHROAT	S	6/28/2010	8301	8/9/2010
COMMON YELLOWTHROAT	S	6/28/2010	8301	7/18/2011
AMERICAN GOLDFINCH	R,S	5/6/2011	8379	7/25/2011

Table 3 – Recaptures at the Litzsinger Road Ecology Center (M=Migrant, R=Resident, S=Summer).

not include nest searching to calculate HY numbers or the distance from which a juvenile was caught from a nest, although these factors could be the basis for a future study.

The productivity of the prairie edge nets has steadily declined since 2008. There are several hypotheses to account for the drop in birds caught each year. There was habitat alteration near these nets in 2008 and 2009, potentially removing nesting and foraging sites for the birds. In September 2008, a cold front stalled over the central Midwest, dropping a profuse amount of rain prior to the arrival of Hurricane Ike from the Texas coast. The cold front and remnants of Hurricane Ike resulted in 2 days of record-setting rain, flash floods and damaging winds. From September 12-14th, St. Louis received 4.58" of rain and wind gusts of up to 43mph (NOAA 2010). Deer Creek flooded across LREC property, greatly altering portions of the woodland habitat in its wake. Per personal communication with Danelle Haake, restoration ecologist at LREC, the staff removed downed brush and woody vegetation in the woodland section behind the mist nets during fall 2009. Major storms in April 2012 caused downing of large amounts of woody debris in the same area. Another possible reason for the decline in birds caught are the birds foraging and nesting in this area learned to avoid the nets (Remsen and Good 1996) although that does not account for the activity at the remaining nets. Using only 2 mesh net sizes could have also biased the results from the last 5 years (Whitman 2004). Karr (1981) suggests using 36-mm nets for birds 8 – 100g, although this size will only capture up to 50% or fewer individuals of the smaller bird species (<20g) than will 30-mm nets. However, the nets located in the prairie firebreak progressively caught more birds with each passing summer (Table 1).

Whitman (2004) found that spacing nets over 50 m apart may increase the number of different species captured and placing nets along a transect will cross more habitat. The nets for this study were all within a prairie habitat. The nets near the fire break (3, 4, 5) were placed within 3.5 meters from each other with nets 2 and P placed 5 – 7 meters from the fire break nets. There was no standardized practice in regards to a consistent number of nets established each year, or the locations to be sampled, potentially altering the number of birds captured from year to year. However, when the number of net-hours per year across all net locations is totaled, it becomes apparent that the number of birds captured per unit of effort each year is surprisingly consistent.

Sample size and statistical efficiency is also a limiting factor in determining AHY to HY ratios and recapture rate, but nonetheless, mist netting provided a good snapshot of the species diversity on the prairie and shown that the site does have adequate resources to support a diverse avian community.

CONCLUSION

With the aid of the mist nets, each year brings new species to a growing list of birds inhabiting the Litzsinger prairies, provides a way of monitoring longevity through band recapture, presents the means to estimate the reproductive success from the ratio of HY bird to total net captures (Silkey et. al 1999) and will continue to be useful in observing the trends of species abundance and diversity. The number of birds caught in each net was recorded every year and played an important role in deciding whether or not to add or move nets each summer. However, the suggested method to accurately assess species density on the site is to standardize the mist netting practice by setting the same number of nets, (Pardieck and Waide 1992), in the same location for the same length of time (Jenni et. al 1996). Therefore, no additional nets will be placed up on the site in the ensuing years of this study. Surveys may detect bird species better than mist netting, but mist netting is not affected by observer bias and may yield greater counts of individuals for some species, making it a good supplement to census (Whitman et. al 1997, 2004).

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SPECIES	M,R,S	2008	2009	2010	2011	2012
Acadian Flycatcher	S	3	0	0	0	2
American Redstart	S	0	0	0	1	0
American Golfinch	R,S	7	17	63	39	34
American Robin	R,S	1	7	3	3	0
Black-and-White Warber	S	0	0	2	0	2
Blue-gray Gnatcatcher	S	0	0	3	0	1
Brown-headed Cowbird	S	0	1	0	1	1
Brown Thrasher	R,S	0	0	1	0	1
Carolina Chickadee	R,S	0	0	1	3	5
Carolina Wren	R,S	2	0	0	0	3
Cedar Waxwing	S	0	0	0	0	2
Chipping Sparrow	S	0	0	0	0	1
Common Yellowthroat	S	2	13	11	2	3
Chestnut-sided Warbler	M	0	1	0	0	0
Downy Woodpecker	R,S	0	0	1	0	1
Eastern Phoebe	S	0	4	4	4	8
Eurasian Tree Sparrow	R,S	4	12	7	13	16
Eastern Wood Peewee	S	2	0	2	0	3
Field Sparrow	S	0	0	0	1	0
Great Crested Flycatcher	S	0	0	1	3	0
Gray Catbird	R,S	0	3	1	0	0
House Finch	R,S	0	0	1	0	0
House Wren	S	6	7	6	1	3
Indigo Bunting	S	10	8	11	16	16
Least Flycatcher	M	5	1	0	1	1
Lincoln's Sparrow	M	0	0	2	1	2
MAWA	M	0	0	0	0	1
Mourning Warbler	M	0	0	1	0	1
Northern Cardinal	R,S	0	4	3	4	1
Northern Waterthrush	M	0	0	0	0	1
Orange-crowned Warbler	M	0	0	0	0	1
Palm Warbler	M	1	0	0	0	0
Prairie Warbler	S	1	0	0	0	0
Red-eyed Vireo	S	2	0	0	0	0
Swamp Sparrow	M	4	0	6	0	0
Song Sparrow	R,S	0	21	30	11	32
Trail's Flycatcher	S	0	0	0	0	3
Tufted Titmouse	R,S	0	1	0	2	0
White Crowned Sparrow	M	1	0	0	0	0
White-eyed Vireo	S	0	0	1	0	0
Wilson's Warbler	M	0	0	1	1	0
Yellow Warbler	S	0	2	0	0	0
		51	102	162	107	145

Table 4 – Bird species captured at Litzsinger Road Ecology Center
NOTE: M = Migrant, R = Resident (species present year-round), S = Summer

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APPENDIX

A list of birds captured in the mist nets from 2008-2012. Acadian Flycatcher (*Empidonax virescens*); American Goldfinch (*Spinus tristis*); American Redstart (*Setophaga ruticilla*); American Robin (*Turdus migratorius*); Black-and-white Warbler (*Mniotilta varia*); Blue-gray Gnatcatcher (*Polioptila caerulea*); Brown Thrasher (*Toxostoma rufum*); Brown-headed Cowbird (*Molothrus ater*); Carolina Chickadee (*Poecile carolinesis*); Carolina Wren (*Thryothorus ludovicianus*); Cedar Waxwing (*Bombycilla cedrorun*); Chestnut-sided Warbler (*Dendroica pensylvanica*); Chipping Sparrow (*Spizella passerina*); Common Yellowthroat (*Geothlypis trichas*); Downy Woodpeckeer (*Picoides pubescens*); Eastern Phoebe (*Sayornis phoebe*); Eastern Wood-Peewee (*Contopus virens*); Eurasian Tree Sparrow (*Passer montanus*); Gray Catbird (*Dumetella carolinensis*); Great Crested Flycatcher (*Myiarchus crinitus*); House Finch (*Carpodacus mexicanus*); House Wren (*Troglodyte aeodon*); Indigo Bunting (*Passerina cyanea*); Least Flycatcher (*Empidonax minimus*); Lincoln's Sparrow (*Melospiza lincolnii*); Magnolia Warbler (*Setophaga magnolia*); Mourning Warbler (*Oporornis Philadelphia*); Northern Cardinal (*Cardinalis cardinalis*); Northern Waterthrush (*Parkesia noveboracensis*); Palm Warbler (*Dendroica palmarum*); Prairie Warbler (*Dendroica discolor*); Orange-crowned Warbler (*Oreothlypis celata*); Red-eyed Vireo (*Vireo olivaceus*); Song Sparrow (*Melospiza melodia*); Swamp Sparrow (*Melospiza georgiana*); Tennessee Warbler (*Vermivora peregrina*); Tufted Titmouse (*Baeolophus bicolor*); White-crowned Sparrow (*Zonotrichia leucophrys*); White-eyed Vireo (*Vireo griseus*); Wilson's Warbler (*Wilsonia pusilla*).