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Author(s):	Thompson, Brent E. Hathcock, Charles Dean
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Title: **Los Alamos National Laboratory Fall Avian Migration Monitoring Report 2010–2015**

Author(s): Brent E. Thompson
Chuck D. Hathcock

Los Alamos NATIONAL LABORATORY EST. 1943

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ACRONYMS

DOE	(U.S.) Department of Energy
EH	Shannon's equitability estimate
H	Shannon's diversity index
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
MBTA	Migratory Bird Treaty Act of 1918
MOU	Memorandum of Understanding
NNSA	National Nuclear Security Administration
NRDA	Natural Resource Damage Assessment
PSDI	Palmer Drought Severity Index
TA	Technical Area
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

During the fall of 2015, Los Alamos National Security, LLC (LANS) biologists completed the sixth year of monitoring fall migration passerines (songbirds) at Los Alamos National Laboratory (LANL). Songbirds were captured at a mist-netting station located in a large wetland/riparian complex in Technical Area (TA) 36 on the north side of Pajarito Road in Los Alamos County. Captured birds were identified, measured, and banded with a United States (U.S.) Fish and Wildlife Service (USFWS) migratory bird band. Banding operations took place between August 12 and October 14, 2015, with the completion of a total of 10 mist-netting sessions. This project was conducted as part of implementation of the Biological Resources Management Plan and is in compliance with the 2013 Memorandum of Understanding between the USFWS and the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA) and Executive Order 13186.

In 2015, 383 birds representing 51 species were banded. Broad-tailed, Black-chinned, Calliope, and Rufous hummingbirds were also captured in August and September but are not analyzed as part of this project. Between 2010 and 2015 the overall number of birds captured was variable; in 2015 the number of captures decreased slightly compared to 2014. The majority of the birds captured are grouped into three different guilds; species of these guilds tend to fluctuate from year to year. However, warbler numbers remained significantly down from 2010. The variability in bird populations is likely driven by regional climatic factors, but more years of data are needed.

INTRODUCTION

In 2015, LANS biologists completed the sixth year of a monitoring effort to document fall migration patterns of passerines (songbirds) at LANL. Counts and captures of spring and fall migrants can generate useful information on the status and trends of the source populations (Hussell and Ralph 2005). Birds were captured and banded with USFWS migratory bird bands. Banding operations took place between August 12 and October 14, 2015, with the completion of a total of 10 mist-netting sessions.

LAWS AND RESTRICTIONS

The Migratory Bird Treaty Act of 1918 (MBTA) is the primary driver for protection of migratory birds in the U.S. The original 1918 statute implemented the 1916 Convention between the U.S. and Great Britain (for Canada) for the protection of migratory birds. Later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Soviet Union (now Russia). Under the MBTA, migratory birds are defined as all native birds in the U.S., except for species such as quail and turkey, which are managed by individual states.

In 2001, Executive Order 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds* was signed. Under Executive Order 13186, the USFWS issued Director's Order 172 on Service Guidance to Conserve Migratory Birds. Identifying goals for federal program activities, the USFWS highlighted the need to identify means and measures to avoid and/or minimize potential for take of migratory birds, eggs, and active nests.

In support of Executive Order 13186, on August 1, 2006, a Memorandum of Understanding (MOU) was finalized between the USFWS and the DOE regarding the implementation of the MBTA at DOE facilities. Under the MOU, subject to the availability of appropriations and in harmony with the DOE/NNSA missions and capabilities, the DOE agreed to several actions. A new MOU was finalized on September 12, 2013; the full MOU can be found in the appendix.

The MOU drives LANL's monitoring activities under the Biological Resources Management Plan (LANL 2007). Additionally, the *Migratory Bird Best Management Practices Source Document for Los Alamos National Laboratory*, revised November 2011 (LANL 2011), addresses how LANS mitigates impacts to migratory birds at an institutional level and also identifies the need to monitor migratory birds to detect trends in populations at LANL.

PERMITS

The principal investigator has a master banding permit from the Federal Bird Banding Laboratory in Maryland, a federal permit from the USFWS that covers incidental banding of migrant Willow Flycatchers, a state permit from the New Mexico Department of Game and Fish authorizing birds to be banded in New Mexico, and an approved Institutional Animal Care and Use Committee protocol at LANL to ensure compliance with the Animal Welfare Act. LANS biologists report their banding data to the Federal Bird Banding Laboratory and results to New Mexico Department of Game and Fish each year.

SITE LOCATION

The fall migration monitoring banding site at LANL is comprised of 14 mist nets deployed in the upper end of the Pajarito wetlands complex. The wetlands complex is on the north side of Pajarito Road in TA-36 along the dirt road built when regional monitoring well R-54 was installed in 2009. The 14 mist nets are placed on the northern side of the wetlands, away from Pajarito Road (Figure 1). This wetlands complex is comprised of primarily narrowleaf cottonwood (*Populus angustifolia* James), narrowleaf willow (*Salix exigua* Nutt.), and broadleaf cattail (*Typha latifolia* L.) (Figure 2).

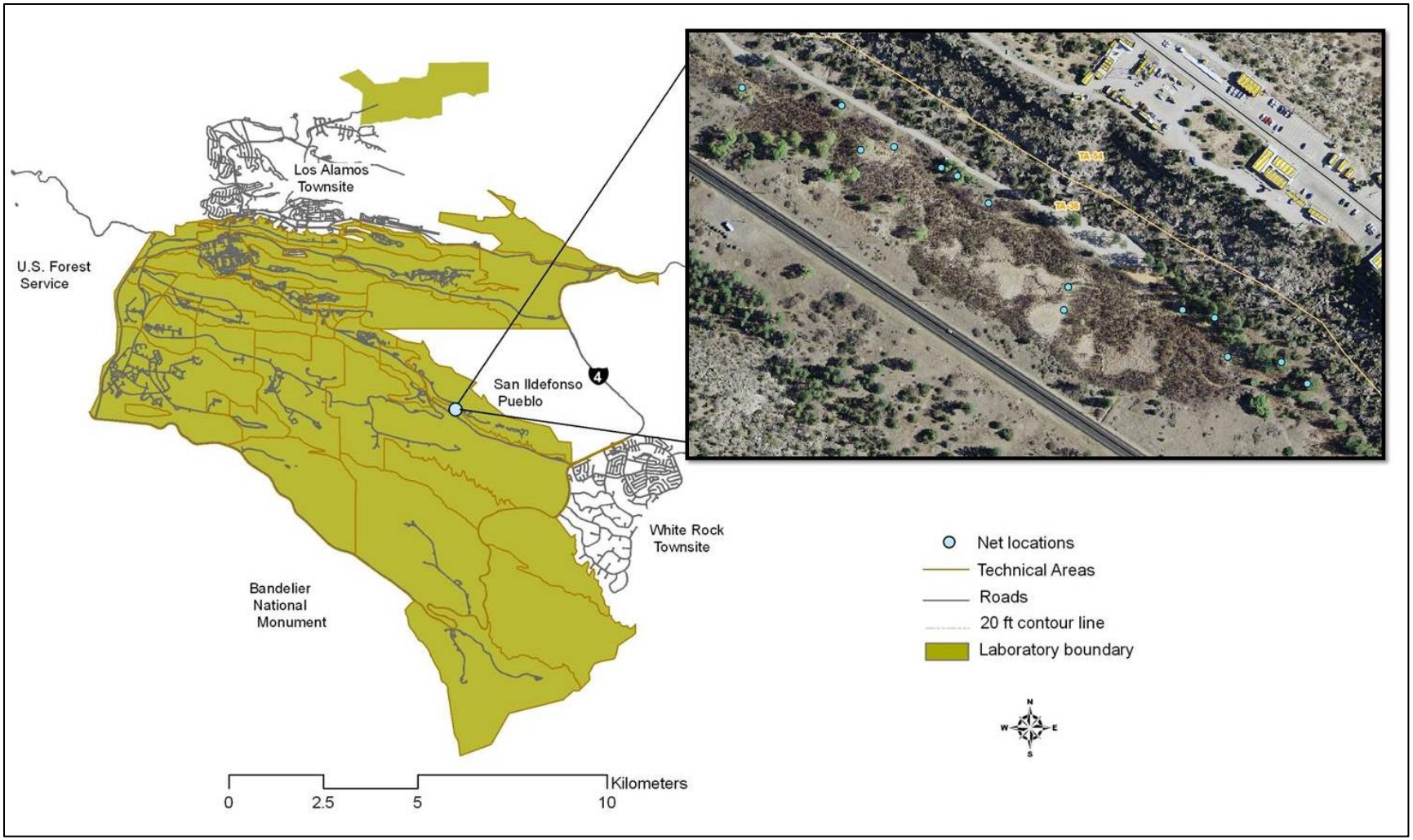


Figure 1. Location of the fall migration monitoring banding site at LANL.

Figure 2. Photograph of the wetlands where the banding site is located, looking east.

METHODS

The banding station used 14 mist nets that were 12 meters long with 30-millimeter mesh (Figure 3). Net locations were placed strategically to maximize the number of birds captured. Methods for net placement are available in Bub (1996). A standard USFWS numbered band was put on each bird. The size of the band followed the requirements in the Bird Banding Manual (Gustafson et al. 1997). All birds were identified, aged, sexed, weighed, measured, fat scored, and checked for signs of molt. The aging and sexing criteria were based on Pyle (1997). The times that the nets were opened and closed and the weather conditions at opening and closing were also recorded. The safety and welfare of personnel and the birds was of primary importance.

Figure 3. An open mist net.

Bird captures were summarized by date. A "net hour" is a unit of measure used to calculate the amount of time that nets are open; one net that is open for one hour is equal to one net hour. The daily birds per net hour was calculated by taking the number of birds per day and dividing it by the total net hours per day. The total birds per net hour for the entire fall monitoring period was also calculated.

Abundance values for the top 10 species in total number captured were calculated. The abundance value is a number that will reflect the status of a selected species at a particular location in comparison with other years (Woodward and Woodward 1977).

$$\text{Abundance} = \frac{\text{Total number of individuals for the selected species, including returns}}{\text{Total number of net hours for the period of occurrence of a selected species}}$$

To obtain a whole number it is necessary to multiply the results by 100 to equal the abundance of birds per 100 net hours.

The Shannon's diversity index (H) (Shannon 1948) was used to examine species diversity by year. This diversity index is a popular measure in ecology that is used to describe both the species richness and relative abundance of each species in a community. The Shannon's H can range from 0.0 to 4.6, where larger values represent increasing diversity. H is calculated using the following formula:

$$H = -1 [pi (ln (pi))]$$

Where pi is a percentage value of a specific species in the total population and ln is the natural log.

Another useful measure is the Shannon's equitability estimate (EH) which is a measure of evenness in the population. This measure ranges from 0 to 1 where one represents a completely even community in which all of the species' abundances are equal. The Shannon's EH is calculated using the following formula:

$$EH = H/lnS$$

Where S is species count, ln is the natural log, and H is the Shannon's diversity index.

The Shannon's indices between years were compared using bootstrapping techniques with a 1,000 sample permutation.

The data are maintained by LANS biologists.

RESULTS

Banding operations took place on 10 mornings between August 12 and October 14, 2015. The dates were August 12, 19, 26, September 2, 10, 17, 23, 29 and October 7 and 14, 2015. The nets were opened before sunrise and closed between noon and 1:00 p.m. The total net hours for this year's fall migration monitoring project were 714.0 net hours. A total of 383 birds representing 51 species were banded. Broad-tailed, Black-chinned, Calliope, and Rufous Hummingbirds were also captured and banded in August and September, but are not analyzed as part of this project. The number of birds banded per net hour for the project was 0.53. Table 1 details the numbers of species. The top five species in total number banded in 2015 are Wilson's Warbler, Orange-crowned Warbler, Ruby-crowned Kinglet, Oregon Junco, and Spotted Towhee. Table 2 lists the top 10 species in total number over the history of the project along with the abundance in 2015, percent of the birds aged as hatch-year in 2015, the 2015 arrival date and departure date.

The percentage of hatch-year birds for the site was 70%. This was the second year in a row that migrating birds captured at this site contained young birds at this percentage. The overall percentage of hatch-year birds for the 2010 to 2014 sampling period was 57%, 56%, 57%, 48%, and 70%, respectively.

Table 1. Summary of Birds Banded in 2015

Common Name	Scientific Name	Number Banded in 2015
American Robin	*Turdus migratorius*	2
Audubon's Warbler	*Setophaga coronata auduboni*	18
Bewick's Wren	*Thryomanes bewickii*	10
Black-headed Grosbeak	*Pheucticus melanocephalus*	7
Blue Grosbeak	*Passerina caerulea*	2
Brewer's Sparrow	*(Spizella breweri*	2
Bushtit	*(Psaltriparus minimus*	15
Canyon Towhee	*Melozone fusca*	6
Cassin's Vireo	*Vireo cassinii*	1
Chipping Sparrow	*Spizella passerina*	3
Downy Woodpecker	*Picoides pubescens*	1
Dusky Flycatcher	*Empidonax oberholseri*	3
Gambel's White-crowned Sparrow	*Zonotrichia leucophrys gambelii*	14
Gray-headed Junco	*Junco hyemalis caniceps*	3
Gray Catbird	*Dumetella carolinensis*	1
Green-tailed Towhee	*Pipilo chlorurus*	6
Hammond's Flycatcher	*Empidonax hammondii*	1
Hepatic Tanager	*Piranga flava*	1
Hermit Thrush	*Catharus guttatus*	2
House Finch	*Haemorhous mexicanus*	3
House Wren	*Troglodytes aedon*	5
Juniper Titmouse	*Baeolophus ridgwayi*	3
Lazuli Bunting	*Passerina amoena*	5
Lesser Goldfinch	*Spinus psaltria*	16
Lincoln's Sparrow	*Melospiza lincolnii*	4

Common Name	Scientific Name	Number Banded in 2015
MacGillivray's Warbler	*Geothlypis tolmiei*	14
Mountain Chickadee	*Poecile gambeli*	2
Northern Waterthrush	*Parkesia noveboracensis*	4
Orange-crowned Warbler	*Oreothlypis celata*	31
Oregon Junco	*Junco hyemalis oreganus*	22
Olive-sided Flycatcher	*Contopus cooperi*	1
Plumbeous Vireo	*Vireo plumbeus*	2
Pygmy Nuthatch	*Sitta pygmaea*	1
Ruby-crowned Kinglet	*Regulus calendula*	27
Red-naped Sapsucker	*Sphyrapicus nuchalis*	3
Red-shafted Flicker	*Colaptes auratus cafer*	2
Song Sparrow	*Melospiza melodia*	2
Spotted Towhee	*Pipilo maculatus*	22
Townsend's Solitaire	*Myadestes townsendi*	1
Townsend's Warbler	*Setophaga townsendi*	2
Virginia's Warbler	*Oreothlypis virginiae*	21
White-breasted Nuthatch	*Sitta carolinensis*	3
Western Bluebird	*Sialia mexicana*	3
Western Flycatcher	*Empidonax difficilis/occidentalis*	1
Western Scrub-Jay	*Aphelocoma californica*	1
Western Tanager	*Piranga ludoviciana*	4
Western Wood-Pewee	*Contopus sordidulus*	3
Williamson's Sapsucker	*Sphyrapicus thyroideus*	3
Wilson's Warbler	*Cardellina pusilla*	56
Yellow-breasted Chat	*Icteria virens*	7
Yellow Warbler	*Setophaga petechial*	11

Table 2. Top 10 Species in Number Banded Across All Years

Species	2010 Total	2011 Total	2012 Total	2013 Total	2014 Total	2015 Total	2015 Abundance per 100 Net Hours	2015 Percent Hatch Year	2015 Arrival Date	2015 Departure Date
Lesser Goldfinch	23	20	98	11	28	16	2.24%	31%	Year-round[1]	Year-round[1]
Wilson's Warbler	32	11	27	14	29	56	7.84%	91%	12-Aug	Mid-late Oct
Orange-crowned Warbler	44	8	6	19	60	31	4.34%	61%	12-Aug	Mid-late Oct
Audubon's Warbler	119	5	3	6	14	18	2.52%	83%	8-Sep	Mid-late Oct
Virginia's Warbler	58	10	15	13	39	21	2.94%	23%	12-Aug	Mid-late Sept
Ruby-crowned Kinglet	40	4	28	7	36	27	3.78%	81%	23-Sep	Year-round[1]
Oregon Junco	1	1	25	4	46	22	3.08%	50%	29-Sep	On-going[2]
Chipping Sparrow	4	9	10	8	61	3	0.40%	66%	17-Sep	Mid-late Oct
Bushtit	0	12	38	8	14	15	2.10%	46%	Year-round[1]	Year-round[1]
Spotted Towhee	7	3	14	9	15	22	3.08%	86%	Year-round[1]	Year-round[1]

[1] Year-round: Known to occur at this site year-round.
[2] Ongoing: Observed at this site after the project completion.
[3] Starting in 2013, the White-crowned Sparrows were broken up into their two races: Gambel's and Mountain. For this table they are grouped.

In 2015, the percentage of birds captured with fat scores of 3 or greater (on a scale of 0–5) was 28% for the site overall, with many of the migratory species having large fat deposits. This is the highest percentage to date for this study. This is indicative of birds in transit. The sex of the birds was recorded when it was apparent, however, slightly less than half of the birds were sexed as unknown. In the fall, many of the sexual characteristics used to determine the sex of birds have diminished and plumage characteristics in hatch-year birds are often not distinctive enough to determine sex.

Migration peaked on October 7 with the banding of 51 birds. This date and capture total tends to illustrate the drop in numbers of neo-tropical migrant warblers and the influx of latitudinal-migrant sparrows. The arrival of wintering species appeared comparable to past years.

The Shannon diversity index showed diversity on a relative increase over the six years with values of 2.764, 3.005, 3.123, 3.297, 3.106, and 3.316 for 2010, 2011, 2012, 2013, 2014, and 2015, respectively. The Shannon's equitability showed that the evenness of the bird communities was similar across the six years, 0.739, 0.875, 0.802, 0.897, 0.831, and 0.843. Bootstrap permutations were used to compare the diversity indices between the six years as shown in Table 3.

Table 3. Comparison of Diversity Indices between Years

Statistical Significance of Diversity Between Years	2011	2012	2013	2014	2015
2010	0.14	0.001*	0.001*	0.001*	0.001*
2011		0.53	0.009*	0.607	0.03*
2012			0.297	0.803	0.017*
2013				0.198	0.916
2014					0.006*

* p value <0.05

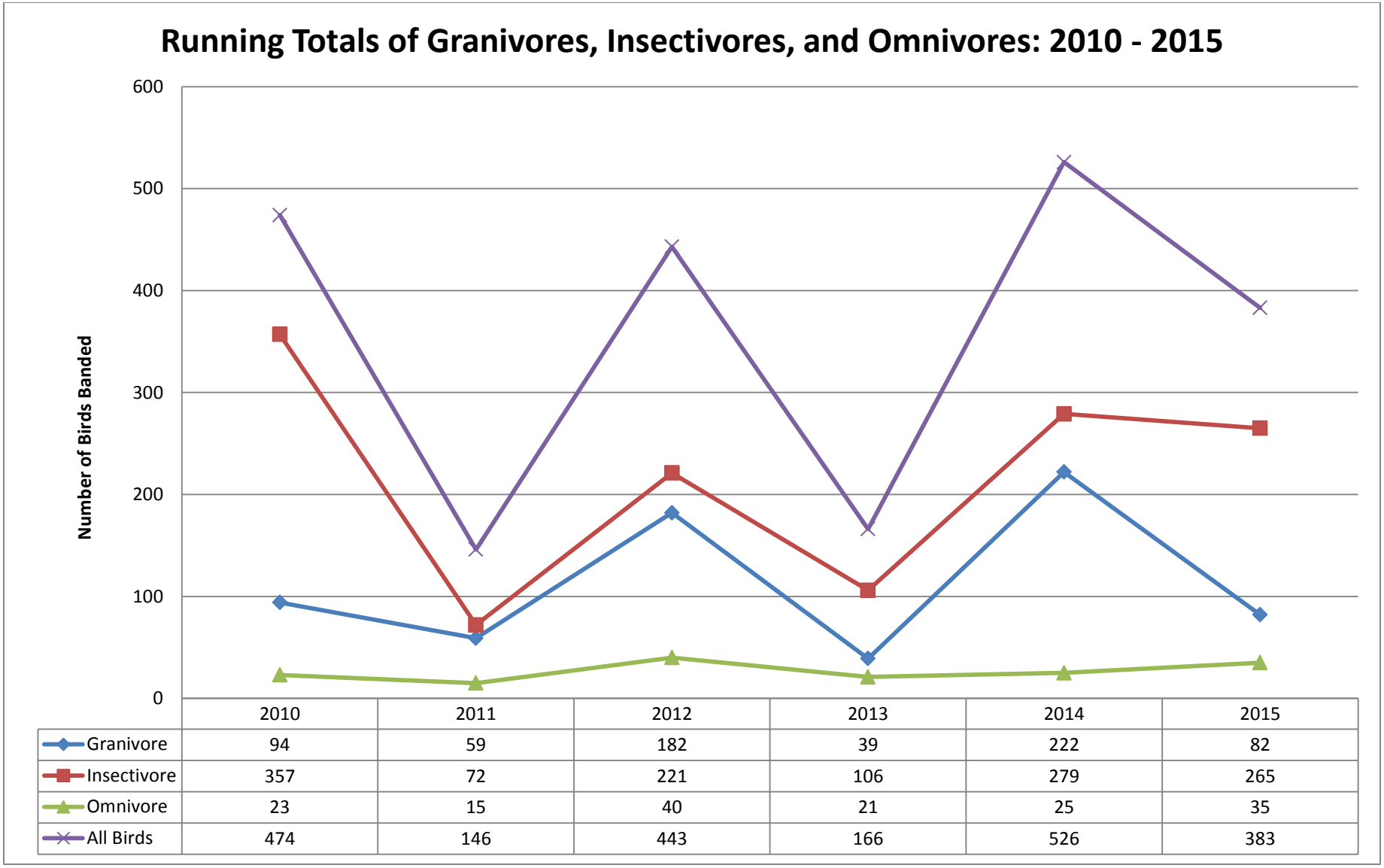
DISCUSSION

All 383 birds captured and banded during this project are protected under the MBTA. Additionally, several species captured at the banding site are considered Birds of Conservation Concern from region 16, the Southern Rockies/Colorado Plateau region (USFWS 2008), including the Willow Flycatcher, Juniper Titmouse, Grace's Warbler, and Brewer's Sparrow. The primary statutory authority for Birds of Conservation Concern is the Fish and Wildlife Conservation Act of 1980. Another conservation tool used in migratory bird management is the Birder's Conservation Handbook (Wells 2007), a list of the top 100 birds most at risk in North America. Two bird species captured during this project are in the Birder's Conservation Handbook: the Rufous Hummingbird and Virginia's Warbler. Several other species on this list are frequently seen in this wetlands complex or have been captured in previous years.

Bird captures in 2015 were the fourth highest to date, trailing the years of 2014, 2010, and 2012, respectively (Hathcock et al. 2012). Warbler captures increased by five birds compared to 2014. However, warblers continue to be the hardest hit group and their numbers were still significantly lower than 2010 levels (Figure 4). The percentage of birds that are hatch-year (young) birds during migration is important to examine because it provides estimates of annual nesting success. Kelley and Finch's (2000) work showed that sample variation of age ratios resulting from the sampling methodology decreases as the number of days of effort increases. Because this project was only 10 days of effort, inferences on age ratios are not as robust, and thus have a higher amount of variation. However, year-to-year comparisons can still be made. Birds were grouped into one of three diet classifications for further analysis. The classifications were based on life history information available from Cornell's *The Birds of North America Online* (BNA 2012). The three groups were 1) granivores, where diet consists primarily of seeds; 2) insectivores, where diet consists primarily of insects; and 3) omnivores, where the diet is split evenly between the two. After grouping birds into these classifications, we determined the percentage of each classification for 2015 (Figure 5). Granivores accounted for 21%, insectivores 69%, and omnivores at 9%. Compared with 2014, the granivores decreased in overall percentage while the insectivores increased. This may be due to the increase in localized precipitation that likely contributed to an increase in insect availability.

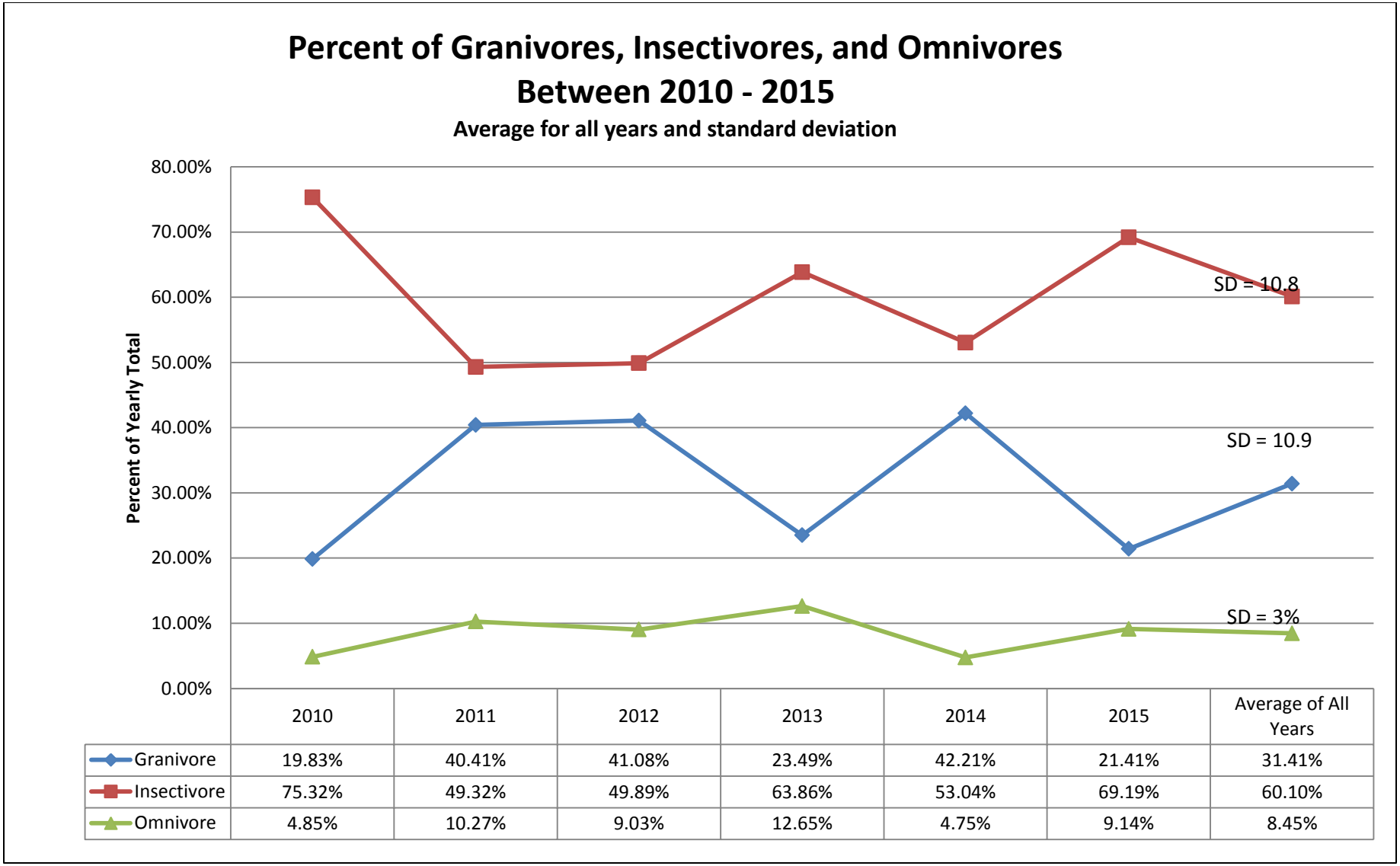
The percent of hatch-year birds in 2015 indicated the highest rates to date. A three-year study conducted within a riparian forest in central New Mexico had hatch-year capture rates of 58%, examining a species that we also capture at our site (Yong et al. 1998). Possible explanations for this increase in hatch-year birds include increased net-hours, local and regional climatic conditions, local and regional fecundity rates, hatch-year survival rate, ongoing environmental factors such as post-fire vegetation changes and drought in the southwestern U.S. Because available data is limited, more study is needed.

The Palmer Drought Severity Index (PDSI) uses a combination of temperature and precipitation data over several months as indicators of long-term meteorological drought. This index is determined using cumulative values, where negative numbers indicate overall drought stress (low precipitation and high temperature) and positive numbers indicate a lack of stress from drought (high precipitation and low temperatures). In New Mexico, the PDSI values based on a four-month average (May to August) in climate division 2 from 2010 to 2015 were -0.74, -4.97, -5.76, -6.69, -3.04, and 2.10 (NOAA 2015). May to August 2013 was the driest period on record in the last 121 years. This continued drought severity would account for a large reduction in food sources (plants and insects). Plants are also affected by drought. However, it takes a longer time for seed production to be affected by drought compared to the more immediate effect on insects. Insect populations often respond rapidly and dramatically to changes in climatic condition (Rouault 2006). Whether the driver is global or cyclic regional drought, the trend towards hotter, drier summers over the period of record is apparent.



	2010	2011	2012	2013	2014	2015
Granivore	94	59	182	39	222	82
Insectivore	357	72	221	106	279	265
Omnivore	23	15	40	21	25	35
All Birds	474	146	443	166	526	383

Figure 4. Population trends by bird type from 2010–2015.



	2010	2011	2012	2013	2014	2015	Average of All Years
Granivore	19.83%	40.41%	41.08%	23.49%	42.21%	21.41%	31.41%
Insectivore	75.32%	49.32%	49.89%	63.86%	53.04%	69.19%	60.10%
Omnivore	4.85%	10.27%	9.03%	12.65%	4.75%	9.14%	8.45%

Figure 5. Population trends by diet classification from 2010–2015.

In *Birds and Climate Change: Ecological Disruption in Motion*, the Audubon Society notes a shift in bird populations over the last century (Audubon 2009). Their analysis of annual Christmas Bird Count Data reveals both a 35-mile northward trend of birds seen in North America and a positive statistical correlation between annual species location and temperature (Audubon 2009). As temperature increases on a continental scale, both northern latitudes and higher elevations have become warmer, and thus more suitable for species that would have been deterred by cooler temperatures a century ago (Walther et al. 2002). In the case of birds, earlier onset of spring due to warmer temperatures can result in earlier breeding and arrival of migrants (Walther et al. 2002). However, if the increase in temperature is not coupled with an increase in precipitation, traditional sources of food may not be available, causing birds to either leave or not breed in order to conserve energy. The impact on food sources as a result of hotter, drier summers could explain a decrease in songbird presence in this study. Long-distance migrants would perhaps be most sensitive to changes in timing of food sources, wherein breeding would be impacted by the lack of seasonal food availability (Both et al. 2010).

Increases in the frequency, duration, and/or severity of drought and heat stress associated with climate change could fundamentally alter the composition, structure, and biogeography of forests in many regions (Allen et al. 2010). The Jemez Mountains in particular are considered vulnerable to effects of ongoing climate change (Enquist et al. 2008).

FISCAL YEAR 2016 RECOMMENDATIONS

Continued operation of this fall avian migration monitoring station will provide LANS with a long-term dataset on ecological health of LANL's biota, contribute to the DOE's obligations under the MBTA and the MOU, and assist in meeting national goals in avian conservation monitoring and research.

Over the last couple decades, more studies have been conducted assessing the importance of stopover sites to migrating birds (Hutto 1998, Yong et al. 1998, Ruth et al. 2012). It may be important to the overall body of migratory bird research to operate a spring migration-period at this site to assess en-route use by age and sex classes. Operation of a twice-a-week schedule would also allow us to track stopover length at a more finite level.

LANS personnel are currently engaged in the Natural Resource Damage Assessment (NRDA) process under the Comprehensive Environmental Response, Compensation, and Liability Act. The NRDA evaluates to what extent natural resources have been injured as a result of releases of hazardous substances from historical or current work at LANL. An important part of the damage assessment process is analyzing baseline ecological data. The continued operation of fall avian migration monitoring will provide important baseline data on avian population levels and habitat use at LANL.

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APPENDIX – MOU BETWEEN DOE AND THE USFWS

MEMORANDUM OF UNDERSTANDING
between
THE UNITED STATES DEPARTMENT OF ENERGY
and
THE UNITED STATES FISH AND WILDLIFE SERVICE
Regarding Implementation of Executive Order 13186,
"Responsibilities of Federal Agencies to Protect Migratory Birds"

Prepared by:
United States Department of Energy
and
United States Fish and Wildlife Service
September 12, 2013

This Memorandum of Understanding (MOU) is entered into by and between the United States Department of Energy (DOE or the Department) and the United States Department of the Interior, Fish and Wildlife Service (FWS), herein collectively referred to as the Parties.

A. Purpose and Scope
This MOU meets the requirements under Section 3 of Executive Order 13186, (66 FR 3853, January 17, 2001), concerning the responsibilities of Federal agencies to promote the conservation of migratory bird populations. The purpose of this MOU is to strengthen migratory bird conservation through enhanced collaboration between DOE and the FWS, in coordination with state, tribal, and local governments. This MOU does not remove the Parties' legal requirements under the Migratory Bird Treaty Act (MBTA) and other pertinent statutes; thus it does not authorize the take of migratory birds. This MOU identifies specific areas in which cooperation between the Parties will substantially contribute to the conservation and management of migratory birds and their habitats. This MOU replaces the previous 2006 MOU between DOE and the FWS.

B. Authorities
This MOU is entered under the provisions of the following laws and other authorities available to the Parties:
• Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d) (Eagle Act)
• Department of Energy Organization Act of 1977, as amended (42 U.S.C. § 7256)
• Endangered Species Act of 1973, as amended (16 U.S.C. §§ 1531-1544) (ESA)
• Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, 2001 (66 FR 3853) (EO 13186)
• Executive Order 13112, Invasive Species, 1999 (64 FR 6183) (EO 13112)
• Fish and Wildlife Coordination Act of 1934, as amended (16 U.S.C. §§ 661-666c) (FWCA)

• Migratory Bird Conservation Act of 1929, as amended (16 U.S. C. §§ 715-715s) (MBCA)
• Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-711) (MBTA)
• National Environmental Policy Act of 1969, as amended (42 U.S.C. §§ 4321-4347) (NEPA)

C. Missions of Both Parties
DOE
The mission of DOE is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. DOE contributes to the future of the Nation by fostering energy efficiency and the development of clean and renewable energy technologies; enhancing nuclear security through defense and nonproliferation efforts; and advancing innovation and discovery in science and technology. The Department, including the National Nuclear Security Administration (NNSA), operates 24 preeminent research laboratories and sites (collectively DOE Sites or sites), four power marketing administrations (Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA), and Western Area Power Administration (WAPA)), as well as undertakes remediation of the environmental legacy of Cold War activities at DOE sites across the country. All components of DOE - including NNSA and the four power marketing administrations - are covered by this MOU.

The NNSA is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA Federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials, and carry out other missions supporting the national security.

The BPA mission is to create and deliver the best value for customers and constituents in concert with others to assure the Pacific Northwest has an adequate, efficient, economical and reliable power supply; a transmission system that is adequate to the task of integrating and transmitting power from Federal and non-Federal generating units; and mitigation of the Federal Columbia River Power System's impacts on fish and wildlife.

The SEPA is responsible for marketing electric power and energy generated at reservoirs operated by the U.S. Army Corps of Engineers. Southeastern does not own transmission facilities and must contract with other utilities to provide transmission, or "wheeling" services, for the Federal power.

The SWPA markets hydroelectric power from U.S. Army Corps of Engineers multipurpose dams. Southwestern operates and maintains 1,380 miles of high-voltage transmission lines, substations, and a communications system.

WAPA markets and delivers reliable, renewable, cost-based hydroelectric power and related services from 56 power plants operated mainly by the Bureau of Reclamation and U.S. Army Corps of Engineers. Western operates and maintains the transmission system from its four regional offices.

FWS

As a Federal agency within the U.S. Department of the Interior, the mission of the FWS is to work with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The FWS Division of Migratory Bird Management serves as a focal point in the United States for policy development and strategic planning, program implementation, and evaluation of actions designed to conserve migratory birds and their habitats. The FWS is legally mandated to implement the conservation provisions of the MBTA, which includes responsibilities for managing migratory bird populations, domestic and international coordination, and the development and enforcement of regulations that govern the take of migratory birds. The MBCA and the FWCA mandate migratory bird habitat conservation, including protection through acquisition, enhancement, and/or management to avoid and minimize adverse impacts.

FWS programs that involve bird conservation activities include:

1. The Division of Migratory Bird Management and the Migratory Bird Programs in the FWS Regional Offices serve as focal points for policy development and strategic planning. These offices develop and implement monitoring and management initiatives that help maintain healthy populations of migratory birds and their habitats and provide continued opportunities for citizens to enjoy bird-related recreation.
2. The Division of Bird Habitat Conservation is instrumental in supporting habitat conservation partnerships through the administration of bird conservation grant programs and development of Joint Ventures that serve as major vehicles for implementing the various bird conservation plans across the country.
3. Ecological Services Field Offices across the country serve as the primary contacts for technical assistance and environmental reviews involving migratory bird issues. The Field Offices coordinate with the Regional Migratory Bird Offices, as necessary, regarding MBTA and Eagle Act permits and overall migratory bird conservation.
4. The Office of Law Enforcement is the principal FWS program that enforces the legal provisions of the MBTA, Eagle Act, ESA, and other laws pertaining to migratory bird conservation.
5. The National Wildlife Refuge System manages National Wildlife Refuges (NWRs) and Waterfowl Production Areas across the country, many of which were established to protect and conserve migratory birds. NWRs not only protect important bird habitat, but also focus on monitoring migratory bird populations and restoring and maintaining native habitats.
6. The Science Applications program works with other Service programs and partners to ensure that the necessary science and tools are available for planning and implementing the most efficient and effective conservation actions to protect fish and wildlife including migratory birds. They facilitate regional self-directed science management partnerships called Landscape Conservation Cooperatives to develop and apply shared science capacity to conservation.

D. Statement of Mutual Interest and Benefit

DOE manages approximately 2.28 million acres of land, of which a substantial amount is undeveloped and includes wetlands, shrub-steppe, shortgrass prairie, desert, and forested areas. Much of these lands provide habitat for a variety of wildlife, including many species of migratory birds. DOE takes its environmental stewardship role seriously and advocates an environmental management system (EMS) approach, conforming to the ISO 14001:2004 (E)

International Standard, towards compliance with applicable environmental laws and regulations and preservation of natural and cultural resources. Migratory birds are a part of the natural and human-made environment at DOE sites, and proper management of migratory birds and their habitats on DOE lands fosters vigorous and diverse species groupings. DOE recognizes that some of its activities have the potential to affect migratory birds (e.g., transmission lines, power poles, invasive weed-control, and various construction and deconstruction activities). To lessen the adverse effects on migratory birds, whenever appropriate and feasible, DOE components currently:

1. Use bird-friendly transmission lines, insulators, and power poles designed to minimize bird collisions and electrocutions, as suggested by the Avian Power Line Interaction Committee (APLIC).
2. Sponsor workshops with Federal and private entities on minimizing electrocutions of birds and bird collisions with electric utility structures.
3. Collaborate with public and private entities on research related to the conservation of migratory birds and their habitats.
4. Monitor environmental cleanups and construction and deconstruction activities, and, when necessary and feasible, use conservation measures such as netting or noise devices to discourage migratory bird nesting or schedule such activities to avoid nesting seasons;
5. Use invasive weed management practices that pose minimal risks to migratory birds; reseed areas with appropriate native plant species to encourage migratory bird use.
6. Operate according to habitat management plans developed by DOE for various bird species such as the bald eagle, Mexican spotted owl, wood stork and southwestern willow flycatcher, and other FWS Birds of Conservation Concern.
7. Restore and enhance the habitat of migratory birds, as practicable.

Pursuant to *E.O. 13423, Strengthening Federal Environmental, Energy, and Transportation Management, and E.O. 13514, Federal Leadership in Environmental, Energy, and Economic Performance,* DOE components will continue to use EMSs at all DOE sites as a systematic and structured approach to identify and address the environmental consequences of operations and mission activities. In addition, DOE routinely uses the NEPA process to evaluate the potential environmental effects of proposed Federal actions such as those carried out by the renewable energy financial assistance and loan guarantee programs, including potentially significant effects to migratory birds, and to consider reasonable alternatives to those actions.

Environmental Impact Statements will consider the means to mitigate adverse environmental impacts from those actions as required by 40 CFR § 1502.16. Federal environmental laws such as the ESA, Eagle Act, and the MBTA also apply to DOE, including DOE activities involving funding of third parties. In cooperation with applicants, DOE prepares environmental review documents, consults with relevant Federal, State, local, and Tribal agencies, and oversees public involvement in the environmental review of DOE's proposed actions.

DOE has a long history of collaboration on issues related to migratory birds. For example, DOE has for many years sought to address adverse environmental effects of energy technologies through interagency collaboration and research and development activities, such as serving on the FWS's Wind Turbine Siting Guidelines Federal Advisory Committee, co-leading the Solar Energy Development Programmatic Environmental Impact Statement with the U.S. Department of the Interior, Bureau of Land Management, and developing monitoring, avoidance and

minimization technologies through partnerships such as the Bats and Wind Energy Cooperative. Both Parties have interests and responsibilities in the conservation and management of America's natural heritage and natural resources. The Parties agree that migratory birds are important components of biological diversity, and that their conservation and management will help to sustain ecological integrity and will serve the growing public demand for outdoor recreation, conservation education, wildlife viewing, and hunting opportunities. Further, the Parties mutually agree that it is important to: 1) conserve migratory birds and their habitats; 2) recognize that actions that may provide long-term benefits to migratory bird populations may have short-term effects on individual birds or local populations; and 3) recognize that restoration of migratory bird populations and habitats can be a long-term endeavor. It is in the interests of both Parties that potential adverse effects, direct and indirect, are assessed, and then avoided or minimized, to the extent practicable and within each Agency's authority to do so. In consideration of these premises, the Parties agree as follows.

E. Responsibilities of Both Parties

To the extent allowed by law, subject to the availability of appropriations and within Administration budgetary limits, and in accord with DOE and the FWS missions and capabilities, both Parties shall:

1. Protect, enhance, and manage habitats of migratory birds, to the extent practicable. This includes:

a. Implementing management practices that avoid or minimize adverse effects on migratory bird populations and their nesting, foraging, migration, staging or wintering habitats. Examples include:

(1)When designing new projects, ensuring that they avoid important migratory bird habitats and otherwise avoid or minimize direct and indirect effects of new projects on migratory birds and their habitats, and when practicable and appropriate, restore and enhance bird habitat.

(2) Instituting management practices for controlling non-native plants and animals to protect migratory birds and their habitats.

(3) Using effective techniques to minimize the risk of collisions with structures including power lines, buildings, and communication devices.

(4) Shielding night lights at facilities that might attract night-flying migrant.

(5) Constructing or utilizing engineered constraint systems to prevent migratory birds from nesting or roosting in areas of recognized hazard.

b. Working collaboratively with Federal and State agencies, Tribal Nations and other interested non-governmental entities to identify, protect, restore, enhance, monitor and manage important migratory bird areas.

c. Preventing or abating the pollution detrimental to migratory birds and their habitats.

2. Promote monitoring, research, and information exchange related to migratory bird conservation and program actions that may affect migratory birds, and provide access to information on environmental contaminants and other avian stressors that are relevant to the conservation of migratory birds. This includes:

a. As practicable and compatible with other study needs and program mandates, collaborating on warranted studies: (1) on migratory bird species that may be affected by agency actions, infrastructure, or facilities; and (2) to identify habitat conditions essential to sustain migratory bird populations.

b. Sharing inventory, monitoring, and research results with other Federal and State agencies and Tribal Nations, as appropriate, and among DOE elements, as practicable, and with national repositories such as the Avian Knowledge Network.
c. Developing partnerships with other agencies and non-Federal entities to further bird conservation, as practicable.
3. Identify and pursue training opportunities for appropriate DOE and DOE contractor employees in appropriate methods and techniques to: 1) inventory and monitor migratory birds; 2) assess population status of migratory birds; 3) assess temporal and spatial bird use within project areas; 4) evaluate effects of projects on migratory birds; and 5) develop management practices that avoid or minimize adverse effects and promote beneficial proactive approaches to migratory bird conservation.
4. Participate annually, or as appropriate, in the interagency Council for the Conservation of Migratory Birds. As identified in its charter, the duties of the Council include the following:
a. Sharing the latest resource information to assist in the conservation and management of migratory birds.
b. Developing an annual report of accomplishments and recommendations related to E.O. 13186.
c. Fostering partnerships to further the goals of E.O. 13186.
d. Selecting an annual recipient of a Presidential Migratory Bird Federal Stewardship Award for contributions to the protection of migratory birds.
5. Periodically evaluate the measures taken under this MOU, which may include those measures listed in sec. E.1.a, to protect, restore and enhance migratory birds, including avoiding or minimizing the take of migratory birds, to determine whether the most effective conservation measures are employed. These efforts will be coordinated through the FWS's Division of Migratory Birds.
6. Support efforts to promote the ecological, economic, and recreational values of migratory birds by supporting outreach and educational activities and materials, as appropriate.

F. Responsibilities of the DOE
To the extent allowed by law, subject to the availability of appropriations and within Administration budgetary limits, and in accord with the Department's missions and capabilities, the DOE shall:
1. In keeping with the MBTA and Eagle Act, and other applicable laws, engage the FWS for coordination regarding proposed actions that may have direct and indirect adverse effects on migratory birds or their habitats. This will typically be accomplished through DOE's continued use of the NEPA process to analyze the potential environmental effects of proposed actions, including potentially significant effects to migratory birds, and to consider reasonable alternatives to those actions including potential means to address adverse environmental effects. Environmental Impact Statements will consider the means to mitigate adverse environmental effects from those actions as required by 40 CFR 1502.16. DOE will evaluate information provided by the FWS on specific and programmatic actions, including Federally funded energy projects, concerning the presence, effects on, and conservation of migratory birds, and consider recommendations provided by the FWS with regard to those birds in departmental decision-making. When appropriate, recipients of financial assistance will be notified to contact the FWS to discuss compliance with appropriate laws protecting migratory birds, independent of DOE's funding decision. In such instances, DOE will direct the recipients to the appropriate FWS Regional Migratory Bird Permit Office.

2. Engage the FWS for coordination prior to DOE operations and activities with significant adverse effects on migratory birds and their habitats, to initiate appropriate actions to avoid or minimize the take of migratory birds. Identification of potential impacts will be accomplished through DOE's continued use of EMS as the management framework that DOE components use at DOE sites for compliance with applicable environmental laws and regulations. This may include the establishment of programs with objectives and targets to improve the conservation of migratory birds and, where appropriate, restore and/or enhance bird habitats at each DOE site. This may also result in the development of site-specific, species-specific conservation plans that describe conservation opportunities to avoid or minimize facility- and project-related effects for migratory birds and their habitat.
3. Engage the FWS on the development and implementation of strategies to continually improve the conservation of migratory birds and their habitats in the conduct of environmental cleanup activities at DOE sites. Statutory authorities on the protection of migratory birds and their habitats are recognized as potential ARARs1 in project plans, developed by DOE and approved by the U.S. Environmental Protection Agency, for environmental legacy cleanup being conducted at DOE sites under the Comprehensive Environmental Response, Compensation, and Liability Act. For example, the environmental cleanup of the DOE Hanford site in Richland, Washington, includes monitoring of bird populations and habitats, as appropriate and feasible, to facilitate decisions about the need for, and effectiveness of, conservation efforts. DOE will continue to make information relevant to migratory bird conservation at its environmental cleanup sites available to the FWS.
4. Engage the FWS on the development and implementation of strategies to improve or enhance the conservation of migratory birds and their habitats at the following National Environmental Research Parks and other ecological resource preservation areas established across the DOE Complex:
• Hanford Site, Richland, WA
• Idaho National Laboratory, Idaho Falls, ID
• Fermilab, Batavia, IL
• Nevada National Security Site, near Las Vegas, NV
• Los Alamos National Laboratory, Los Alamos, NM
• Savannah River Site, Aiken, SC
• Oak Ridge Site, Oak Ridge, TN
Ecological Resource Preservation Areas have been established at:
• Brookhaven National Laboratory, Upton, NY
• Lawrence Livermore National Laboratory, Livermore, CA
• Sandia National Laboratories, Albuquerque, NM
• Sandia National Laboratories, Livermore, CA (wildlife reserve)
At these parks and preservation areas, DOE evaluates the environmental consequences of energy use and development as well as strategies to mitigate these effects. DOE may conduct research, among other activities at these DOE sites, to develop strategies for the 1 Applicable or Relevant and Appropriate Requirements (ARARs) preservation and enhancement of habitat for migratory birds; maintenance of bird populations; restoration of populations that have been reduced or extirpated by human activities; and minimization of human impacts on native species.
5. Engage the FWS on the development and implementation of strategies to improve or enhance the conservation of migratory birds and their habitats at water impoundment structures (e.g., dams and retention ponds) at the following DOE sites:

• Savannah River Site, Aiken, SC
• Oak Ridge Site, Oak Ridge, TN
• Fermilab, Batavia, IL

6. Engage the FWS on the exchange of best available scientific information regarding current and emerging technological measures and practices to avoid or minimize adverse effects of energy technologies on migratory birds through such forums as the National Wind Coordinating Collaborative biennial Wind-Wildlife Research Meeting. Another mechanism for information sharing is the National Renewable Energy Laboratory (NREL)-administered Wind-Wildlife Impacts Literature Database (WILD), which can be found at http://www.nrel.gov/wind/wild/. WILD is a publicly available, online, searchable bibliographic database of documents, including journal articles, conference proceedings, government publications, books, utility company reports, etc., that focuses on the effects of wind energy development on wildlife. NREL also maintains an online listing of NREL-published documents and reports on avian issues available at http://www.nrel.gov/wind/avian_reports.html.
7. Consider FWS recommendations and suggested practices regarding energy development to avoid or minimize direct and indirect effects on migratory birds and their habitats.
8. Advise private parties and landowners seeking to interconnect electricity generating sources to DOE owned power transmission grids, to coordinate with the servicing FWS Regional Office to determine applicable conservation requirements under the MBTA.
9. Advise the public of this MOU through a notice published in the *Federal Register*.

G. Responsibilities of the FWS

Unless otherwise specified, the following activities will be coordinated through the appropriate Regional Migratory Bird Programs. To the extent permitted by law and subject to the availability of appropriations and Administration budgetary limits, and to the extent that the following obligations are in accord with agency missions and capabilities, the FWS shall:
1. Work to identify special migratory bird habitats (e.g., migration corridors, stopover habitats, nesting habitats) under the stewardship of DOE.
2. Provide assistance to identify particular species and habitats that would benefit most from agency land management decisions.
3. Initiate new or provide greater support for long-term research and monitoring programs for birds on DOE and adjacent lands, as funding and appropriate opportunities allow.
4. Through the FWS Division of Migratory Birds, keep DOE informed of the latest directions in bird conservation that might affect DOE activities, lands or policies by providing information on:
a. Changes to the MBTA and its regulations and procedures, or other acts and their regulations affecting migratory birds;
b. Population trends of species that might be affected by activities on DOE lands;
c. Changes to the list of Birds of Conservation Concern;
d. Changes in, updates to, or additions to national and regional bird conservation plans (e.g., Partners in Flight bird conservation plans, United States Shorebird Conservation Plan, North American Waterbird Conservation Plan, and the North American Waterfowl Management Plan); and
e. Updated protection measures for reducing human-caused bird mortality as new information becomes available.

H. Definitions

Action - a program, activity, project, official policy (such as a rule or regulation), or formal plan directly carried out by a Federal agency.

Avian Knowledge Network (AKN) - is an international network of governmental and non-governmental institutions and individuals linking avian conservation, monitoring and science through efficient data management and coordinated development of useful solutions using best-science practices based on the data. With data collections covering North, Central and South America and all migratory bird flyways, AKNs collective knowledge and best practices to answer conservation information needs are growing through common data structure and collaborative problem-solving. http://www.avianknowledge.net/

Birds of Conservation Concern - published by the Fish and Wildlife Services' Division of Migratory Bird Management, refers to the list of migratory and non-migratory birds of the United States and its Territories that are of conservation concern. The most current version of the list, Birds of Conservation Concern 2008, is available at: (http://www.fws.gov/migratorybirds).

CFR - Code of Federal Regulations.

Effects - a change or changes to natural resources and the components, structures, and functioning of affected ecosystems.

Energy facilities - power generation or energy transmission infrastructure.

Incidental take – see Take.

Intentional take – see Take.

Migratory bird - an individual of any species protected by the Migratory Bird Treaty Act. A list of migratory birds can be found in 50 CFR § 10.13: http://www.gpo.gov/fdsys/pkg/CFR-2002-title50-vol1/pdf/CFR-2002-title50-vol1-sec10-13.pdf.

North American Waterbird Conservation Plan (NAWCP) - a coalition of Federal and State government agencies, non-governmental organizations, and private interests focusing on the conservation of waterbirds, primarily marsh birds and colonial waterbirds: http://www.waterbirdconservation.org/nawcp.html.

North American Waterfowl Management Plan (NAWMP) - a coalition of Federal and State government agencies, non-governmental organizations, and private interests focusing on the conservation of waterfowl: (http://www.fws.gov/birdhabitat/NAWMP/files/ImplementationFramework.pdf).

National Environmental Policy Act (NEPA) - requires Federal agencies to prepare a detailed analysis of the environmental impacts of their proposal and alternatives and to include public involvement in the decision making process for actions significantly affecting the quality of the human environment.

Partners in Flight (PIF) - a cooperative effort involving partnerships among Federal and State government agencies, non-governmental organizations, conservation groups, foundations, universities, and industry focusing on the conservation of land birds (www.partnersinflight.org).

DOE site - refers to the location where DOE or related contractors, organizations or other entities conduct operations. These include contractor-operated DOE owned or leased facilities at discrete locations across the U.S. In the case of Government Owned Government Operated (GOGO**)** facilities (including Power Administrations), it refers to the DOE operating organization. See site descriptions at DOE National Laboratories and Technology Centers at http://energy.gov/organization/labs-techcenters.htm and at NNSA at http://www.nnsa.energy.gov/aboutus/ourlocations.

Species of Concern – refers to several categories of birds including: 1) species listed in the periodic report, Birds of Conservation Concern, published by the FWS Division of Migratory Bird Management (http://www.fws.gov/migratorybirds); 2) priority migratory bird species documented in the comprehensive bird conservation plans (North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans); 3) species or populations of waterfowl identified as high, or moderately high, continental priority in the North American Waterfowl Management Plan; 4) listed threatened and endangered bird species in 50 CFR § 17.11; and 5) MBTA-listed gamebirds of management concern (as listed in the Birds of Management Concern list (http://www.fws.gov/migratorybirds).
Take – to pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to pursue, hunt, wound, kill, trap, capture or collect (50 CFR § 10.12). The Executive Order further defines "take" to include intentional take, meaning take that is the purpose of the activity in question, and unintentional (incidental) take, meaning take that results from, but is not the purpose of, the activity in question. Intentional and unintentional take constitute take as defined by the MBTA. The regulations implementing the Eagle Act define take to mean pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb bald and golden eagles (50 CFR § 22.3).
Unintentional take – See Take.
United States Shorebird Conservation Plan (USSCP) - an effort undertaken by a partnership of Federal and State government agencies, non-governmental organizations, and private entities to ensure stable and self-sustaining populations of all shorebird species are restored and protected (http://www.fws.gov/shorebirdplan/USShorebird.htm).

I. Dispute Resolution

Prevention of potential conflicts or resolutions of disagreements between the Parties will be attempted first at staff levels and elevated through the respective organizational levels if necessary. Conflict prevention or traditional Alternative Dispute Resolution processes will be used to attempt to achieve consensus.

Collaborative processes, including informal meetings or negotiations, will be used to avoid or minimize a dispute. If the dispute already has developed, more traditional processes may be appropriate, such as mediation or a negotiation assisted by a neutral third party. Notification of potential conflict or a dispute by either Party must be put in writing and attempts to resolve the matter at the Field level should occur within 30 days of the date of written notification. If there is no resolution at this level within 30 days, either Party may elevate the issue to the appropriate officials.

J. Agreement

It is mutually agreed and understood that:
1. This MOU in no way alters or diminishes any Party's responsibilities under any statute or other legal authority.
2. Either Party may terminate this MOU, in whole or in part, at any time before the date of expiration by providing the other Party 30 day's written notice to that effect.
3. Changes to this MOU shall be made by means of written modification(s) bilaterally executed by the Parties. This instrument in no way alters a Party's obligations to conduct environmental analyses, including compliance with NEPA requirements. Modification of this MOU may be made by the issuance of a written amendment(s) signed and dated by the signatories.

4. This MOU in no way restricts either Party from participating in similar activities with other public or private agencies, governments, organizations, or individuals.
5. Documents furnished to a Party under this MOU may be subject to the Freedom of Information Act (FOIA, 5 U.S.C. § 552). A Party shall not release documents originating in the other Party to a FOIA requester. Rather, the Party shall forward such document(s) to the originating Party for review, determination, and response directly to the requester.
6. This is not a binding contract but is an MOU, which broadly states basic understandings between the Parties hereto of the tasks and methods for performing the tasks, described herein. The details of the levels of support to be furnished one organization by the other with respect to funding shall be developed in specific interagency agreements or other agreements, subject to the availability of funds. This MOU shall not be used to obligate or commit funds or as the basis for the transfer of funds. This instrument does not establish authority for noncompetitive award of any contract or other agreement. Any contract or agreement for training or other service must fully comply with all applicable requirements for competition.
7. Any press releases that reference this MOU, or the relationship established between the Parties of this MOU, shall have prior approval of both Parties.
8. Periodic meetings of the Parties shall be scheduled to review progress and identify opportunities for advancing the understandings in this MOU. Collaboration under this MOU shall be in accordance with the applicable statutes and regulations governing the respective Patties.
9. This MOU does not require changes to current contracts, permits or other third-party agreements. The MOU recognizes that DOE may not be able to implement some elements of the MOU until such time as DOE has successfully included them in formal planning processes.
10. This MOU is intended only to improve the internal management of the Executive Branch of the Federal Government and does not create any right or benefit, substantive or procedural, separately enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.
11. This MOU takes effect upon the signature of DOE and FWS and shall remain in effect for five years from the date of execution. This MOU may be extended or amended upon written request of either DOE or FWS and the subsequent written concurrence of the other Party.
12. The principal contacts for this MOU are as follows:

Josh Silverman
Director, Office of Sustainability Support
Office of Health, Safety, and Security
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Brad Bortner
Chief, Division of Migratory Bird Management
U.S. Fish and Wildlife Service
U.S. Department of the Interior
4401 N. Fairfax Drive, MS 4107
Arlington, VA 22203