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Authors: Fernández-Ordóñez, Juan Carlos, and Albert, Steven K.

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A CENTURY OF BIRD BAND RECOVERIES IN VENEZUELA YIELD INSIGHTS INTO MIGRATORY ECOLOGY

JUAN CARLOS FERNÁNDEZ-ORDÓÑEZ* AND STEVEN K. ALBERT

Programa de Anillamiento de Aves en Venezuela (PAAVe), Apartado Postal 94, 2201 San Carlos, Cojedes, Venezuela (JCFO)
The Institute for Bird Populations, P.O. Box 518, Petaluma, CA 94953 (SKA)
**Correspondent: paave.venezuela@gmail.com*

ABSTRACT—Numerous species of long-distance, Nearctic–Neotropical migratory birds use Venezuela as a nonbreeding or migratory stopover site. We examined band recovery data (recaptures or dead-recoveries) in Venezuela from 1926 to 2017. The band recovery data included 1,891 individual birds, representing 42 species from 17 families. Banding countries or islands of origin included Argentina, French Guiana, Aruba, Barbuda, the United States (U.S.) Virgin Islands, Trinidad, the continental United States, and Canada. Blue-winged teal (*Spatula discors*; 1,432 of 1,891 total recoveries, 75.7%), royal tern (*Thalasseus maximus*; 117/1,891, 6.2%), osprey (*Pandion haliaetus*; 93/1,891, 4.9%), common tern (*Sterna hirundo*; 88/1,891, 4.7%), and bobolink (*Dolichonyx oryzivorus*; 27/1,891, 1.4%) were the most common banded birds in our assessment. Despite ongoing banding efforts, other bird species banded in Venezuela have not been recovered or recaptured in the Western Hemisphere. Despite significant social and political challenges that impede scientific research in Venezuela, the bird-banding community in Venezuela is growing, and this growth will likely facilitate our understanding of the annual cycle of numerous avifauna.

RESUMEN—Numerosas de especies de aves migratorias neárticas–neotropicales de larga distancia utilizan Venezuela como hábitat durante la temporada no reproductiva, o como sitio de parada durante la migración. Examinamos los datos de anillamiento (recapturas o recapturas muertas) en Venezuela entre 1926–2017. Los datos de aves anilladas recuperadas incluyeron 1,891 aves de 42 especies y 17 familias. Los países o islas de origen de los marcajes incluyeron Argentina, Guayana Francesa, Aruba, Barbuda, las Islas Vírgenes Estadounidenses, Trinidad, Estados Unidas continental y Canadá. Las especies más comunes fueron *Spatula discors* (1,432 de 1,891 total, 75.7%), *Thalasseus maximus* (117/1,891, 6.2%), *Pandion haliaetus* (93/1,891, 4.9%), *Sterna hirundo* (88/1,891, 4.7%) y *Dolichonyx oryzivorus* (27/1,891, 1.4%). A pesar de esfuerzos para seguir anillando, otras especies de aves anilladas en Venezuela no se han recuperado en el hemisferio oeste. A pesar de los importantes desafíos sociales y políticos para llevar a cabo la investigación científica en Venezuela, el anillamiento de aves está creciendo en el país, y este crecimiento probablemente facilitará nuestra comprensión del ciclo anual de numerosa avifauna.

Anecdotal information about resighting of marked birds has been documented since the time of Ancient Rome and the Middle Ages. Systematic banding and auxiliary marking techniques have been used for >100 years by professionals from numerous countries to study long- and short-distance migrations, residency, survival, longevity, and general ecology of birds. In the Americas, the earliest systematic tagging of birds was conducted by John James Audubon in the United States (U.S.) and Ernest Seton in Canada. Audubon marked his first birds in 1804 when, using small pieces of string, he banded five eastern phoebe (*Sayornis phoebe*) chicks, two of which he recaptured a year later near the site of their original marking. The modern bird band, as we recognize it today, dates to the end of the 19th century. In Europe, Danish professor Hans Mortensen, often considered the father of scientific bird-banding, banded several European starlings (*Sturnus vulgaris*) in 1899 using bands engraved with a numerical code in addition to his name and address (Preuss, 2001). In the United States, Paul Bartsch marked 100 black-crowned night herons (*Nycticorax nycticorax*; Lincoln and Baldwin, 1929; Gustafson et al., 1997) with the Smithsonian Institute in 1902. Systematic banding spread rapidly, and by the middle of the 20th century, was implemented in ~22 countries (Pinilla, 2000).

Mark–recapture–resighting data via bands and other auxiliary markers has yielded insights into many aspects of the ecology of birds, including connections between breeding, migration or stopover, and nonbreeding areas; longevity; survival; timing of molt and reproduction; social habits; and causes of mortality (Jenni and Winkler, 1994; Pyle, 1997; Lentino et al., 2003; Jahn et al., 2013*b*; Bravo et al., 2017; Brown et al., 2017). In addition, numerous contemporary studies that use modern band-

ing and auxiliary markers have shown surprising movements by birds (do Nascimento et al., 2000; Bairlein, 2001; Capllonch et al., 2009; Jahn et al., 2013*a*; Ruiz-Gutierrez et al., 2016; Siegel et al., 2016), and these new data have real implications in context of understanding the full annual cycle conservation of these species.

Bird Banding in Venezuela—Within North America and the northern Neotropics, Canada, the United States, Costa Rica, Peru, and Brazil have official in-country bird banding programs. Venezuela has one of the most diverse avifaunas in the world, ranking seventh in number of bird species (1,393), despite its relatively small size (882,050 km^2). Yet, there is currently no government agency that oversees scientific banding of birds within the country, although the use of bird banding has increased among the scientific community, bird enthusiasts, and the citizens of Venezuela. During the second half of the 20th century, birds were banded as part of several projects in the country and some nongovernmental entities and researchers now regularly band birds both seasonally and year-round at a few locations. The longest-running project was begun in 1990 by the Audubon Conservation Society of Venezuela and the Friends of Henri Pittier National Park Scientific Society, and this program is currently under the direction of Dr. Miguel Lentino of the Phelps Ornithological Collection. The original goal of this project was to describe bird movements in the National Park and obtain other information via bird banding (Lentino, 2016). Other foreign and Venezuelan national researchers have contributed knowledge of Venezuelan resident and migratory birds through their own banding studies (Table 1).

In 2013, the ARA MACAO Scientific Foundation, a Venezuelan nonprofit research organization, started a systematic bird banding study within the mainland of the country as well as numerous Venezuelan islands. The organization collaborated with the Institute for Bird Populations to initiate the first Venezuelan banding station in the Monitoreo de Sobrevivencia Invernal (MoSI) program, an initiative designed to study the nonbreeding-season ecology and survival of Nearctic–Neotropical migratory land birds (DeSante et al., 2005). As part of this initiative, researchers from ARA MACAO and other organizations began to formalize and conduct bird-banding instruction courses, with the goal of training the next cohort of avian researchers. The Venezuelan Bird Banding Program (PAAVe) was launched by ARA MACAO, numerous other groups (AveZona, VerAves Falcón, Fundación Guáquira, Fundación Esfera, and Asociación Venezolana de Cetrería y Conservación de Aves de Presa), and individual researchers to accomplish three major objectives: (1) conduct ornithological research, (2) coordinate banding efforts, and (3) train researchers to band birds ethically, safely, and scientifically.

To fill the need for bands and a centralized banding system, the use of U.S.- and Canadian-stamped bird bands has been relatively widespread throughout the northern Neotropics. However, the lack of a single, coordinated system throughout the hemisphere has limited the flow of information and data sharing on band returns. In some instances, throughout the hemisphere, workers that recover a band are unsure of where the bird was banded and whom to contact. Some groups, such as the Western Hemisphere Bird Banding Network (Moreno et al., 2011) and the Western Hemisphere Migratory Species Initiative (Murillo et al., 2008) have made significant strides to facilitate coordination among partners for migratory bird research and management, but a bird banding system has not yet emerged. Social media platforms and email chains are at times used to track down information on bands or other sighted markers, but these efforts are limited, not centralized, and used irregularly, further underscoring the need for a centralized system.

General Migration Patterns from North America to Venezuela—Avifauna that stopover or winter in Venezuela generally use one of two migratory routes (Fig. 1).

(1) The Caribbean route is used by birds that cross the western Atlantic Ocean from eastern North America, or the Antilles Islands, to reach the Venezuelan coast, where birds often stop or stage before crossing the Coastal Range at locations such as Paso Portachuelo, and continue to the interior South American Llanos, Amazonia, and southern South America. The Venezuelan coast is an important route for migratory species in September and October. Resightings and/or recaptures of migrants are rare in spring, implying migrants may use the Caribbean route less frequently on their return trip to North America (Sainz-Borgo et al., 2020).

(2) The Andean route in the migratory pathway where avifauna from North America, Central America, and the Lake Maracaibo Basin cross the lower passes of the Andes Mountains. For example, band recovery data suggest migrants pass through Paso de Mucubají, a low pass in the Andes, to get to the Llanos Region of interior South America. Species may use variations on these routes, and it is certainly possible to recapture or recover migratory birds at other locations within Venezuela, especially between September and May when large pulses of birds are present in September–October and April–May because of migration (Phelps and Meyer de Schauensee, 1994; Hilty, 2003; Ascanio et al., 2017).

Band recoveries and radar surveillance suggest that most North American–breeding waterfowl that reach Venezuela migrate through Florida, and then across the Caribbean Sea (Alerstam, 1993; Brown et al., 2017; Whitaker et al., 2018; Witynski and Bonter, 2018; United States Bird Banding Laboratory, 2020). However, some waterfowl may reach Venezuela as vagrants, being carried by strong ocean winds in the Caribbean. This phenomenon likely accounts for the irregular appearance of the several North American ducks considered rare in Vene-

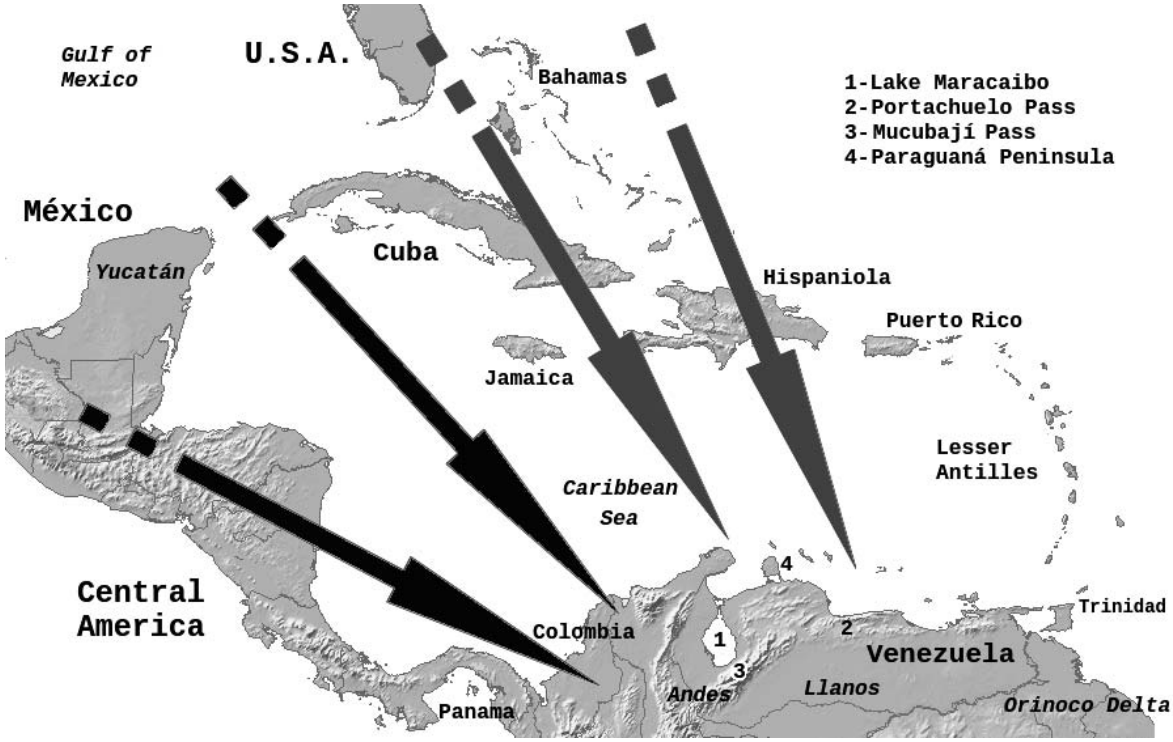

FIG. 1—Generalized major migration routes of birds reaching Venezuela from North America. Black arrows are routes of birds generally from the Pacific and Mississippi Flyways; gray arrows are routes of birds from Central and Atlantic Flyways.

zuela (Gómez-Dallmeier and Cringan, 1989). Band recoveries also indicate that many tropical-breeding species show significant intratropical movements through Venezuela. For example, both boreal- and austral-breeding species migrate to nonbreeding areas in Brazil, Colombia, and Venezuela before moving again to other areas within the tropics (Alves, 2007; Capllonch et al., 2009). In Venezuela, little information exists on intratropical movements or other places of seasonal residence. Some Austral migrant fork-tailed flycatchers (*Tyrannus savana savana*) depart from their breeding areas in Argentina for the Amazon Basin regions of Bolivia and Brazil, then later use second wintering sites in Colombia and Venezuela before returning to Argentina to breed (Jahn et al., 2013*a*). Band recovery data indicate there are numerous migratory routes through Venezuela, but there is currently a dearth of information pertaining to the frequency of recapture or resighting of banded birds in the country.

The objectives of this article are to (1) summarize information related to band returns from the long-distance movements of migratory birds captured or banded in Venezuela, (2) draw inferences about movement patterns, and (3) assess the implications for conservation given the results from objectives 1 and 2. Although many important banding studies have shed light on aspects of the ecology of resident and migrant species in Venezuela, the focus in this article is specific to band recoveries of long-distance migrants from North America.

METHODS—We contacted domestic and foreign researchers and institutions involved in banding and marking birds to collect information on band number, species, date, and banding location for birds banded or recaptured or recovered in Venezuela. We obtained information on birds that were banded in the United States, Canada, and other countries that were recaptured or observed in Venezuela, and Venezuelan-banded birds recovered in the United States, Canada, and elsewhere. We also (1) conducted a search of Venezuelan ornithological literature in both Spanish and English, (2) accessed public databases, web sites, blogs, social network, and Facebook groups, and (3) contacted the United States Bird Banding Laboratory and the Canadian Bird Banding Office for available records. We compiled data in an Excel spreadsheet.

RESULTS—*Band Recoveries in Venezuela from Birds Banded Elsewhere*—We compiled records of 1,891 band recoveries in Venezuela between 1926 and 2017 from birds banded in North America, the Antilles, and other countries in South America (Table 2). The two oldest recoveries were from two common terns (*Sterna hirundo*) harvested in 1926 and 1929, the first from the Venezuelan coast near Sucre State, and the second from an unspecified location. Both birds were banded in Massachusetts, 1925 and 1929, respectively (United States Bird Banding Laboratory, 2020).

The species with the most recoveries was blue-winged teal (*Spatula discors*) with 1,432 band recoveries. We

TABLE 1—A selection of past and ongoing studies (1926–2017) of birds in Venezuela that have incorporated banding.

Years	Taxa banded	Summary	Selected references
1946	Dickcissel (*Spiza americana*)	Study on the negative impacts of an agricultural seed predator.	Ron, 1947
1965–1968	Northern waterthrush (*Parkesia noveboracensis*), American redstart (*Setophaga ruticilla*), spotted sandpiper (*Actitis macularius*)	Thorn-forest bird communities near Cumaná, Sucre State. Boreal migratory species in the Chiguana lagoon, Sucre State.	McNeil, 1970; Tarroux and McNeil, 2003
1969	Audubon's shearwater (*Puffinus lherminieri*)	In a study of homing abilities, 26 birds were banded in Cayo Espenquí and released at Isla Pelona, 16 km away; San Juan de los Cayos, Falcón State, 194 km away; and Anaco, Anzoátegui State, 368 km away.	Hatch, 1974
1974–1993	Stripe-backed wren (*Campylorhynchus nuchalis*)	In Hato Masaguaral, Guárico State, considerable work has been done with this species in a series of long-term studies.	Rabenold et al., 1990; Piper and Slater, 1993; Piper, 1994; Price, 1999
1981–1984	Black-bellied whistling duck (*Dendrocygna autumnalis*)	15,233 birds were banded at Hato El Frío, Apure State. 54 bands were recovered by hunters between 16 and 416 km away, and 64 were recaptured at the banding site in succeeding years.	Chang et al., 1985; Correa-Viana, 1994
1984–1987	Northern Waterthrush, prothonotary warbler (*Protonotaria citrea*), American redstart	A general ecology study of three species of Nearctic–Neotropical migratory warblers in the coastal mangroves of Sucre State.	Lefebvre et al., 1992
1985–1988	Northern waterthrush, prothonotary warbler, western sandpiper (*Calidris mauri*)	Ecological study of resident and migratory bird communities of Refugio Fauna Silvestre Cuare, Falcón State.	F. Espinoza, pers. comm.
1985–present	Green-rumped parrolets (*Forpus passerinus*)	Long-term ecology study of this species in Hato Masaguaral, Guárico State led by Steven Beissinger. More than 7,500 individuals have been banded and >100 artificial nests have been installed.	Beissinger, 2008; Siegel et al., 1999; Budden and Beissinger, 2009; Bonebrake and Beissinger, 2010; Blanco, 2010
1987–present	Barn owl (*Tyto alba*)	A population dynamics study in Guárico State to encourage natural predation of rodents that cause damage to rice crops.	Díaz, 1989; López, 1989; Castillo et al., 1991; Poleo et al., 2001, 2003, 2013
1990–present	Hundreds of resident species and 28 migrant landbirds	The Paso Potachuelo site has banded thousands of migratory and resident landbirds for studies on migration ecology, longevity, and other aspects of species ecology.	Verea et al., 1999; Lentino et al., 2003; Lentino, 2016, 2018
1992–present	Harpy eagle (*Harpia harpyja*)	The harpy eagle conservation program has been banding in the Guyana Shield area since 1992 to study their reproductive and general ecology.	Blanco and Álvarez, 2007
1993–2001	Andean condor (*Vultur gryphus*)	14 wing- and radiotagged condors were released in Mérida State in a failed attempt to establish a new breeding population.	Torres, 1993; Sharpe et al., 2015
1994–present	Ground doves and other species	Several studies of reproductive, molt, and general ecology of Columbina ground doves and other species.	Bosque et al., 2004
1996–present	Yellow-shouldered Amazon (*Amazona barbadensis*)	The NGO PROVITA has been banding chicks for many years on Isla Margarita.	Lora, 2013; Rojas-Suárez, 2014

Table 1—Continued.

Years	Taxa banded	Summary	Selected references
1999–2000	Northern waterthrush, mourning warbler (*Geothlypis philadelphia*)	Study of the understory bird community structure in a cacao plantation in Cumboto, Aragua State.	Verea and Solórzano, 2005
1999–2001	Caribbean flamingo (*Phoenicopterus ruber*)	301 juveniles banded in the Ciénaga de los Olivitos, Zulia State.	F. Espinoza, pers. comm.
2000–2007	Migratory swallows and many species of resident birds	The University of the Andes in Mérida State has been banding birds in the Mucubají Pass and in La Mucuy Bird Banding Stations.	Rengifo et al., 2000; Hobson et al., 2014
2002–2008	Yellow-legged thrush (*Turdus flavipes*), black-hooded thrush (*T. olivater*), glossy-black thrush (*T. serranus*), and other resident species	A study of the reproductive biology of various species in primary and secondary tropical rain forests of Yacambú National Park, Lara State.	Martin et al., 2017; Boyce and Martin, 2017
2003	Crested bobwhite (*Colinus cristatus*)	Study of habitat use and daily distances traveled at La Iguana Experimental Station, Guárico State.	Trejo et al., 2008
2006–2012	Turkey vulture (*Cathartes aura*)	442 North American-breeding birds were wing-tagged at the Zulia Metropolitan Zoo. By 2013, at least 60 sightings of wing markers were reported from Venezuela in Kansas, Missouri, and Minnesota.	Hedlin et al., 2013; A. Naveda-Rodríguez, pers. comm.
2010–2012	Brown-chested martin (*Progne tapera fusca*)	The Ornithological Research Group has banded southern wintering migratory swallows and other species in the city of Ciudad Guayana, Bolívar State.	Rangel and González, 2011; Valero et al., 2012
2010–2015	Plain-flanked rail (*Rallus wetmorei*)	As part of a project on ecology and genetics, 19 birds were banded in coastal locations in the states of Falcón, Carabobo, and Aragua.	Rodríguez-Ferraro et al., 2015
2011–present	Tyrant flycatchers and a variety of resident and migrant species.	The ARA MACAO Scientific Foundation has several programs studying the distribution and biometrics of flycatchers and other migratory and resident species.	Fernández-Ordóñez, 2016*a*, 2018
2011–present	American redstart, yellow warbler (*Setophaga aestiva*), and other species	The UNELLEZ University in Guanare, Portuguesa State, has undertaken a series of banding projects.	Araujo et al., 2012; Araujo-Quintero et al., 2015
2012–present	Mainly resident species	Researchers from Simón Bolívar Univ. have banded birds for several general ecology studies in the Arboretum Experimental Station, Caracas.	Sainz-Borgo, 2015
2012–present	Mainly resident species	A study of desertification on the Macanao Peninsula, Margarita Island, Nueva Esparta State.	V. Sanz and G. Angelozzi, pers. comm.
2012–present	Land- and seabirds, mainly resident species	The ARA MACAO Scientific Foundation has been monitoring and/or banding birds at Los Roques archipelago, Federal Dependencies.	Fernández-Ordóñez, 2018
2013	Handsome fruiteater (*Pipreola formosa*)	A study of the ecology and natural history of this species in Henri Pittier National Park, Aragua State.	Ayala, 2014
2013–2015	Swainson's thrush (*Catharus ustulatus*) and other resident species	The Venezuelan Institute for Scientific Research (IVIC) in Miranda State has carried out a few research projects involving banding.	Rodríguez-García et al., 2016
2015–present	Migratory swallows and a few species of resident birds	The ARA MACAO Scientific Foundation has been banding birds in the Mucubají Pass Banding Station, Mérida State.	Fernández-Ordóñez, 2015, 2016*b*
2016–present	Nearctic–Neotropical migrants and many species of resident birds	Constant effort, passive mist-netting, and banding of Neotropical–Nearctic migrant landbirds in affiliation with the MoSI program.	Fundación Guáquira, 2016; The Institute for Bird Populations, 2020

TABLE 2—Overall summary of Venezuelan band recoveries compiled among Venezuelan ornithological literature in both Spanish and English, accessed public databases, web sites, blogs, social network, Facebook groups, and data from the United States (U.S.). Bird Banding Laboratory and the Canadian Bird Banding Office, 1927–2017. Birds are listed in standard American Ornithological Society taxonomic order, from presumed oldest to newest taxa, with like species grouped together.

Scientific name	Common name	Provenance	No. of records	% of total
Birds banded in North America				
Spatula discors	Blue-winged teal	Canada	718	38.0
S. discors	Blue-winged teal	U.S.	714	37.8
S. cyanoptera	Cinnamon teal	U.S.	1	<0.1
Mareca americana	American wigeon	Canada	2	0.1
Anas acuta	Northern pintail	Canada	1	<0.1
A. crecca	Green-winged teal	Canada	1	<0.1
Aythya affinis	Lesser scaup	U.S.	1	<0.1
Fregata magnificens	Magnificent frigatebird	Barbuda	8	0.4
Sula leucogaster	Brown booby	U.S. Virgin Islands	2	0.1
Agamia agami	Agami heron	French Guyana	1	<0.1
Egretta thula	Snowy egret	U.S.	2	0.1
E. caerulea	Little blue heron	U.S.	4	0.2
E. tricolor	Tricolored heron	U.S.	3	0.2
Eudocimus ruber	Scarlet ibis	Trinidad	1	<0.1
Cathartes aura	Turkey vulture	Canada	9	0.5
Pandion haliaetus	Osprey	Canada	1	<0.1
P. haliaetus	Osprey	U.S.	92	4.9
Buteo platypterus	Broad-winged hawk	U.S.	2	0.1
B. swainsoni	Swainson's hawk	U.S.	2	0.1
Charadrius semipalmatus	Semipalmated plover	U.S.	2	0.1
C. semipalmatus	Semipalmated plover	Canada	2	0.1
C. wilsonia	Wilson's plover	U.S.	1	<0.1
Bartramia longicauda	Upland sandpiper	U.S.	2	0.1
Numenius phaeopus	Whimbrel	U.S.	1	<0.1
Limosa haemastica	Hudsonian godwit	U.S.	1	<0.1
Arenaria interpres	Ruddy turnstone	U.S.	9	0.5
Calidris canutus	Red knot	U.S.	3	0.2
C. himantopus	Stilt sandpiper	Canada	1	<0.1
C. minutilla	Least sandpiper	U.S.	1	<0.1
C. pusilla	Semipalmated sandpiper	Canada	2	0.1
Gallinago delicata	Wilson's snipe	Canada	2	0.1
G. delicata	Wilson's snipe	U.S.	1	<0.1
Onychoprion fuscatus	Sooty tern	U.S.	2	0.1
Hydroprogne caspia	Caspian tern	Canada	6	0.3
H. caspia	Caspian tern	U.S.	3	0.2
Sterna hirundo	Common tern	Canada	3	0.2
S. hirundo	Common tern	U.S.	85	4.5
S. dougallii	Roseate tern	U.S.	5	0.3
Thalasseus sandvicensis	Sandwich tern (Nearctic)	U.S.	1	<0.1
T. sandvicensis	Sandwich tern (Neotropical)	Aruba	4	0.2
T. maximus	Royal tern	U.S.	117	6.2
Falco columbarius	Merlin	U.S.	1	<0.1
F. peregrinus	Peregrine falcon	Canada	2	0.10
F. peregrinus	Peregrine falcon	U.S.	7	0.4
Tyrannus savana savana	Fork-tailed flycatcher	Argentina	5	0.3
Progne subis	Purple martin	U.S.	1	<0.1
Catharus fuscescens	Veery	U.S.	1	<0.1
Pheucticus ludovicianus	Rose-breasted grosbeak	U.S.	1	<0.1
Parkesia noveboracensis	Northern waterthrush	U.S.	4	0.2
Dolichonyx oryzivorus	Bobolink	U.S.	27	1.4
Total			1,861	100

Scientific name	Common name	Recovery site	No. of records	% of total
Birds banded in Venezuela				
Dendrocygna autumnalis	Black-bellied whistling duck	Casanare, Colombia	3	23
Cathartes aura meridionalis	Turkey vulture	MO, KS, MN, USA	3	23
Calidris fuscicollis	White-rumped sandpiper	TX, KS (2), USA	3	23
Parkesia noveboracensis	Northern waterthrush	NJ, USA	4	31
Total			13	100

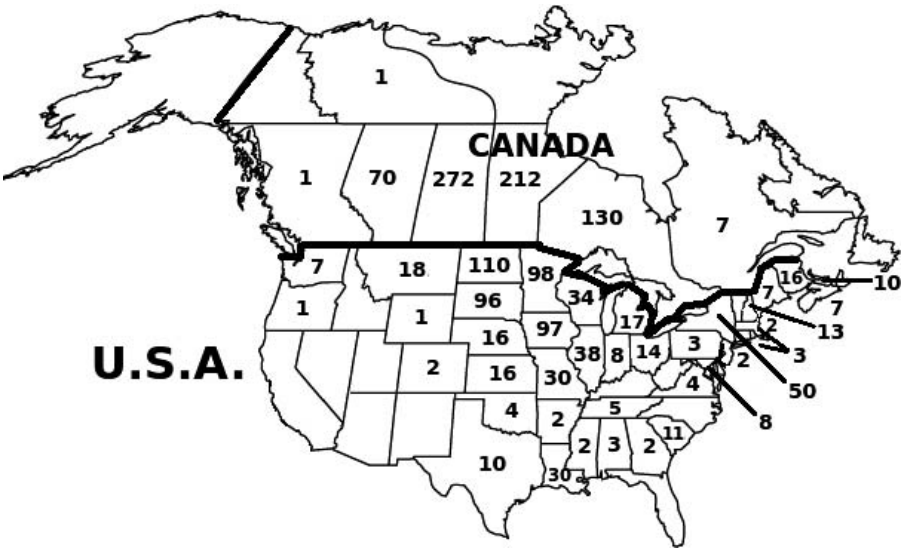

FIG. 2—Canadian provinces and U.S. states of origin for 1,432 banded blue-winged teal recovered in Venezuela from 1926 to 2017.

recovered 714 (49.9%) blue-winged teal banded in Canada and 718 (50.1%) banded in the United States (Fig. 2). The recovery locations were distributed throughout Venezuela (Table 3; Fig. 3). The majority of the blue-winged teal (1,261, 88%) were recovered via hunter harvest. The fastest recovery (i.e., time between banded and recovered) was from a blue-winged teal banded in Illinois in summer of 1941 and recovered 19 days later in the Venezuelan state of Zulia. The longest-lived, and also the farthest-distance, migrant was a blue-winged teal banded in Alberta, Canada, in 1944 and recovered in Zulia, 2,339 days later and 6,254 km from the location where it was banded. The Canadian provinces of Saskatchewan, Manitoba, and Ontario were the origin of 40.0% of the blue-winged teal specimens, and the four U.S. States—North Dakota, South Dakota, Minnesota, and Iowa—accounted for an additional 26.5% of blue-winged teal band recoveries. The remaining birds were banded in the central and eastern areas of North America (Fig. 2). These data have similar recovery locations, time between banding and recovery, and original banding locations to others of the same species, including birds recovered elsewhere in the Neotropics (e.g., The Bahamas [Buden, 1991], Colombia [Botero and Rusch, 1988; Botero et al., 2012], and Guatemala [Eisermann, in litt.]).

TABLE 3—Band recovery locations in Venezuela of blue-winged teal banded in North America, 1927–2017.

State	No. of recaptures	% of total
Zulia	567	39.6
Falcón	135	9.4
Carabobo	86	6.0
Aragua	57	4.0
Guárico	40	2.8
Trujillo	32	2.2
Apure	28	2.0
Monagas	26	1.8
Mérida	25	1.7
Anzoátegui	21	1.5
Portuguesa	15	1.0
Cojedes	14	1.0
Bolívar	12	0.8
Delta Amacuro	12	0.8
Lara	12	0.8
Táchira	12	0.8
Nueva Esparta	11	0.8
Barinas	10	0.7
Miranda	10	0.7
Sucre	4	0.3
Yaracuy	3	0.2
Federal dependencies	1	0.1
Unspecified state	299	20.9
	1,432	100.0

The second most recovered bird was the royal tern (*Thalasseus maximus*), with 117 records, all from birds banded in the United States. The majority (60.7%) of the recovery locations in Venezuela were in the state of Zulia, with the remaining recoveries spread throughout the northern portion of the country (Table 4). The majority of recoveries for royal terns came from birds tangled in fishing gear (21 specimens, 18%) or were hunter-harvested (19, 16%). (Royal terns are not legal game in Venezuela, but enforcement is spotty.) The fastest recovery (i.e., time between banded and recovered) was five royal terns banded in the United States (three in North Carolina, two in Virginia), and recovered 153 days later in Venezuela; one each in the states of Anzoátegui and Sucre, and one from an unspecified area; and two recoveries in Zulia. The longest-lived royal tern was a bird that was banded on 29 June 1988 in North Carolina and shot on 10 August 2011 after 8,442 days (23 years, 1 month, 10 days) on the La Guajira Peninsula, Zulia. The longevity record for this royal terns is 28.6 years (Buckley

Fig. 3—Recovery locations of 1,432 blue-winged teal in Venezuela, 1926–2017. All birds were banded in North America.

and Buckley, 2002). The farthest recorded migrant was a royal tern banded in June 1976 in the U.S. state of Maryland and harvested 3,328 km away in the Venezuelan state of Sucre in February 1977. Nearly all (99%) royal terns were banded on the East Coast of the United States; 65 (55.6%) were banded in the U.S. state of North Carolina, 37 (31.6%) in Virginia, 10 (8.6%) in South Carolina, and 4 (3.4%) in Maryland. Only one individual (<1%) was not banded on the East Coast, and this individual was banded on the U.S. Gulf Coast in Mississippi. These states of original banding correspond roughly with band recoveries from The Bahamas (Buden, 1991) and Colombia (Casas, 2012).

The third and fourth most recovered species were osprey and common tern, with 93 and 88 recoveries, respectively. Of the 93 osprey recovered, only 1.0% were banded in Canada; the rest were banded in the United States. Principal means of recovery were that birds were found dead (28, 30.1%) or shot (22, 23.7%). The longest-lived osprey was a bird that was banded on 9 June 1975 in Water View, Virginia (USA), and found dead on 1 June 1997 after 8,028 days (21 years, 11 months, 21 days) in the Portuguesa state. The farthest and fastest recorded migrant was an osprey banded on 8 July 1989 in Hillman, Michigan, and found dead 4,945 km away in the Venezuelan state of Amazonas in October 1989 after 86 days. From 88 common terns recovered, 3 birds (3.4%) were banded in Canada, and the rest (85, 96.6%) were banded in the United States. The longest-lived common tern was a bird that was banded on 9 July 1992 in Great Gull Island, New York (USA), and caught by hand on 16 October 2011 after 7,038 days (19 years, 3 months, 7 days)

TABLE 4—Band recovery locations in Venezuela for royal terns (*Thalasseus maximus*) banded in the United States, 1927–2017. NC = North Carolina; SC = South Carolina; MD = Maryland; MS = Mississippi; VA = Virginia; — = no data.

Venezuelan state of recovery	Total no. of band recoveries	% of total recovery	U.S. state where banded				
			NC	SC	MD	MS	VA
Zulia	71	60.7	44	7	1	—	19
Sucre	16	13.7	8	1	2	—	5
Falcón	10	8.5	3	1	—	—	6
Anzoátegui	7	6	2	—	—	—	5
Carabobo	3	2.6	1	—	—	—	2
Nueva Esparta	2	1.7	1	1	—	—	—
Federal Dependencies	1	0.9	1	—	—	—	—
Unspecified State	4	3.4	4	—	—	—	—
Aragua	1	0.9	1	—	—	—	—
La Guaira (former Vargas)	1	0.9	—	—	—	1	—
Monagas	1	0.9	—	—	1	—	—
Total	117	100	65	10	4	1	37

in the coastal Mochima National Park (Anzoátegui state). The farthest recorded migrant was a common tern banded in 2 July 1970 in Alpena, Michigan, and caught as a result of injuries 4,256 km away in the Venezuelan state of Sucre on 31 August 1971. The fastest recovery was a common tern banded on 15 August 1968 in Suffolk, New York, and caught as a result of collision with a motor vehicle on 2 October 1968 in La Guaira state (former Vargas state) 48 days later.

In addition to the 4 aforementioned species, information on Venezuelan band recoveries includes 38 other species from 14 families. These recoveries include birds banded in Canada, the U.S. mainland, Argentina, Aruba, Barbuda, the U.S. Virgin Islands, Trinidad, and French Guiana (Table 2). Despite the large number of passerines (order Passeriformes) that migrate to, or through, Venezuela from North America, only 7 (16.7%) of 42 passerine band recoveries have been reported to date: 1 veery (*Catharus fuscescens*; 2.4% of the total), 4 northern waterthrush (*Parkesia noveboracensis*; 9.5%), 1 purple martin (*Progne subis*; 2.4%), and 1 rose-breasted grosbeak (*Pheucticus ludovicianus*; 2.4%). In addition, 5 fork-tailed flycatchers banded at known breeding austral locations in Argentina have been recovered on the species' wintering grounds in Venezuela (Jahn et al., 2013*a*).

Recoveries of Birds Banded in Venezuela—Fewer records exist for birds banded or tagged in Venezuela and recovered elsewhere (Table 2). Three black-bellied whistling ducks (*Dendrocygna autumnalis*) banded at Hato el El Frío in Apure State in January 1982 were harvested in 1983 in the Casanare Department, Colombia, between 346 and 416 km distant (Chang et al., 1985; Correa-Viana, 1994). Three white-rumped sandpipers (*Calidris fuscicollis*), banded and marked with black flags in Hato Masaguaral in Guárico State in April 1984 were observed a few weeks later in the U.S. states of Texas and Kansas (Thomas, 1987). In Kansas, Minnesota, and Missouri, there were approximately three sightings of turkey vultures (*Cathartes aura*) that were marked with patagium tags in Zulia Metropolitan Zoological Park, Maracaibo, Zulia State (Hedlin et al., 2013; United States Bird Banding Laboratory, 2020).

DISCUSSION—Bird banding, though a relatively old scientific technique, is still valuable for documenting the movements and longevity of many species. Our compilation of band returns from birds banded or recovered in Venezuela demonstrates diverse movement and migration strategies for numerous avifauna. The majority of the band recovery data in our study indicated migrating North American– and Caribbean-breeding passerines (order Passeriformes), shorebirds (order Charadriiformes), seabirds (orders Procellariiformes and Pelicaniformes), and waterfowl (order Anseriformes) traveled thousands of kilometers and either stopped-over, or wintered, in Venezuela. These data highlight the importance of maintaining habitat on the southern coast of the Caribbean Sea in Venezuela. Apparently significant proportions of the populations of several species, including blue-winged teal, royal tern, common tern, osprey, and six species of passerines are regular annual visitors to the Venezuela coast.

Approximately 75% of birds either banded in, or recovered in, Venezuela were from migration or stopover sites near the north coast of the country. We acknowledge these data may be biased as a result of the large concentration of band returns from hunted birds that stop-over or winter on the north coast. Researchers in other areas have reported varying degrees of philopatry at migration or stopover sites vis-à-vis breeding sites, some indicating generally lower philopatry (Winker et al., 1991), and some reporting philopatry consistent with breeding sites philopatry reported in other studies (Cantos and Tellería, 1994; Rimmer and Darmstadt, 1996). Catry et al. (2004) argued that passerines should have lower stopover site fidelity than do geese and waders,

and site faithfulness decreases as distance from either end of the migratory journey increases. Given the relatively long distances covered by most North American–breeding migratory species that stopover in Venezuela, we expected relatively low philopatry, and concomitantly low band returns, at migration stopover sites. Between 1990 and 2017, researchers at the Paso Portachuelo site, located on the north coast of Venezuela, have captured and banded 7,175 individuals of 28 species of Nearctic–Neotropical migrants, but with relatively few between-year band recoveries (4 birds, 0.06%; Lentino, 2018). In addition, relatively few researchers are actively banding in Venezuela, although the number is growing with the formation of the PAAVe, the Monitoring Overwinter Survival (MoSI), and other programs and organizations. These data suggest the current number of band returns reported herein are conservative, and subsequently underestimate Venezuela's role as an important migratory stopover location and wintering location for Nearctic–Neotropical migrants.

The conservation of Nearctic–Neotropical migratory birds is, by necessity, an international collaborative effort because they conduct their annual life cycle among numerous countries. Venezuela provides crucial habitat both as a wintering location for numerous species, and as a migration stopover point for North American–breeding birds that winter farther south in South America. Understanding the movement patterns, migratory connectivity, and full annual cycle of Nearctic–Neotropical migratory birds is a key component in any conservation strategy. Although a century of band returns has provided important information for some species, especially blue-winged teal, royal tern, common tern, and osprey, data on other avifauna are lacking. Venezuelan field biologists and researchers are a critical component to acquire data that complete information gaps, but the funding and infrastructure necessary to facilitate a large-scale banding effort in Venezuela are lacking. Complicating matters, political, social, and economic conditions in Venezuela are barriers that prevent successful implementation of field research. Through the efforts of several researchers, bird banding is still a valued scientific technique in Venezuela and the practice is expanding with several new initiatives.

Venezuela has a rich and diverse avifauna of tropical resident, Neotropical migrant, and Austral migrant species. Taxa reflected in recoveries are heavily skewed toward birds recovered along coastal area, where the human population is most concentrated, access is easier, and sighting banded birds, such as shorebirds, is easier. We recommend the initiation of a government- or privately sponsored systematic country-wide program of bird banding, similar to the MoSI or Monitoring Avian Productivity and Survivorship (MAPS) or programs of passive mist-netting and monitoring in the United States, and coordination among all entities to establish standardized methods, bird bands, reporting, and tracking of band use and recoveries. We also recommend expanding efforts inland into harder-to-reach areas, where a wider diversity of bird taxa could be studied, banded, and monitored.

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