Florida Field Naturalist 47(3):105-112, 2019.

NEW HOST RECORDS AND RANGE EXTENSIONS FOR HELMINTH PARASITES FROM WADING BIRDS IN SOUTHEASTERN FLORIDA

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Abstract: Six species of wading birds collected from wildlife centers throughout South Florida were dissected for parasites. Twenty-six species of parasites represent new host records and five parasite species represent new geographic range extensions.

Key words: Acanthocephalans, nematodes, trematodes, Ardeidae, Threskiornithidae.

Wading birds feed on a variety of food including other birds (particularly chicks), small mammals, and a wide range of aquatic food items that include fish, amphibians, and invertebrates. The majority of wading bird species are associated with aquatic or semi-aquatic habitats that range from freshwater marshes and meadows to the shores of marine environments (Brooke and Birkhead 1991; Schreiber and Burger 2001; Lovette and Fitzpatrick 2016). In southeastern Florida, wading birds are ubiquitous and can be found using a wide range of habitats ranging from the Everglades to the islands of the Florida Keys. Consequently, these bird species can provide valuable information on foraging ecology across a wide geographic scope.

The intent of this study was to assess the endoparasite diversity of common wading birds in southeastern Florida. We examined Great Egrets (*Ardea alba*), Great Blue Herons (*Ardea herodias*), Green Herons (*Butorides virescens*), Yellow-crowned Night-Herons (*Nyctanassa violacea*), Black-crowned Night-Herons (*Nycticorax nycticorax*), and White Ibis (*Eudocimus albus*).

Materials and Methods

Bird specimens were collected frozen (-10° C) from four wildlife rehabilitation centers in Florida: South Florida Wildlife Center in Fort Lauderdale, Pelican Harbor Seabird Station in Miami, Florida Keys Wild Bird Rehabilitation Center in Tavernier, and Key West Wildlife Center in Key West (Table 1). The bird host specimens either died while receiving treatment at the rehabilitation centers or were euthanized upon admittance.

Table 1. Total number of each wading bird species dissected for this study and the number of specimens obtained from each wildlife center.

Species	n	South Florida Wildlife Center	Pelican Harbor Seabird Station	Florida Keys Wild Bird Center	Key West Wildlife Center
Great Egret	18	6	1	11	[none]
Great Blue Heron	27	6	2	17	2
Green Heron	9	[none]	1	8	[none]
Yellow-crowned Night-Heron	4	4	[none]	[none]	[none]
Black-crowned Night-Heron	3	[none]	[none]	3	[none]
White Ibis	21	7	3	10	1

Individual birds were thawed in a 4° C refrigerator. Specimens were dissected following protocols adapted from McLaughlin (2001). The dissection process began by cutting through the sternum and removing internal organs for visual endoparasite examination. The trachea, esophagus, proventriculus, liver, kidneys, and intestines were examined for parasites. Organs for endoparasite examination were removed from the body cavity. The proventriculus and intestines were separated from other organs and were cut open to remove any parasites or food particles using a stir-rinse-repeat cycle, in which they were agitated in glass jars filled with tap water, any supernatant poured off, and the cycle repeated until a majority of the food particles were removed. The remaining contents were examined for parasites. All organs were pressed between two glass plates for examination under a stereomicroscope. Parasites were quantified and the location in which they were observed was recorded.

Non-nematode parasites were stained with an acetocarmine/70% ethanol solution, dehydrated through a 70%-95%-100%-100% ethanol series, cleared in clove oil and mounted in Permount (Fischer Scientific). Nematodes were placed in an 70% ethanol/30% glycerol solution for a minimum of two weeks to allow the ethanol to evaporate and then mounted in glycerine (Pritchard and Kruse 1982, McLaughlin 2001). Dichotomous keys and descriptions of new parasites were used to identify parasites to the lowest possible taxonomic level. Dichotomous keys used included McDonald (1981), Schell (1985), McDonald (1988), Amin (1998), Gibson et al. (2002), Jones et al. (2005), Anderson et al. (2009), and Gibbons (2010).

Results

Parasites were found in 73 of the 82 bird host specimens examined. The majority of parasites were collected from the intestines (71 out of 82 birds), followed in decreasing order by the proventriculus (38 birds), esophagus (14 birds), and trachea (1 bird). There were no endoparasites found in any examined bird species from the kidneys or liver. New host records and new geographic range extensions for parasite species are listed in Tables 2a-c.

Great Egrets had the greatest number of new host records (eight), followed by the Green Herons (six). New host records for the Great Egret include: *Plagiorhynchus* sp., Lühe, 1911, *Hexaglandula corynosoma*, Travassos, 1915, *Ibirhynchus dimorpha*, Schmidt, 1973, *Polymorphus*

Table 2a. New host records (*) for acanthocephalans found in wading birds collected from southeastern Florida. Eighty-two individual birds were examined that represented six species of wading birds.

Parasite	# of birds infected	Bird host species	Location in host	Geographic location
Plagiorhynchus sp. Lühe, 1911	1	Great Egret*	intestines	Fort Lauderdale
Hexaglandula corynosoma Travassos, 1915	1	Great Egret*	intestines	Fort Lauderdale
Ibirhynchus dimorpha Schmidt, 1973	6	Great Egret*	intestines	Tavernier
		Green Heron*	intestines	Tavernier
		Black-crowned Night-Heron*	intestines	Tavernier
		Great Egret*	intestines	Tavernier
Polymorphus obtusus Van Cleave, 1918	5	Yellow-crowned Night-Heron*	intestines	Fort Lauderdale
		Black-crowned Night-Heron*	intestines	Tavernier
Southwellina hispida Van Cleave, 1925	1	Great Egret*	intestines	Tavernier

Table 2b. New host records (*) for endoparasitic nematodes found in wading birds collected from southeastern Florida. Eighty-two individual birds were examined that represented six species of wading birds.

Parasite	# of birds infected	Bird host species	Location in host	Geographic location
Chabaudacuaria multispinosa Pérez Vigueras, 1938	1	Black-crowned Night-Heron*	esophagus	Tavernier
Paracuaria adunca Creplin, 1846	3	Yellow-crowned Night-Heron*	proventriculus	Fort Lauderdale
		Black-crowned Night-Heron*	proventriculus	Tavernier
Contracaecum multipapillatum Drasche, 1882	1	Green Heron*	proventriculus	Tavernier
Tetrameres ardamericanus Boyd, 1966	5	Great Egret*	intestines, proventriculus	Fort Lauderdale, Miami, Tavernier

Table 2c. New host records (*) and new geographic range extensions (+) for endoparasitic trematodes found in wading birds collected from southeastern Florida. Eighty-two individual birds were examined that represented six species of wading birds.

Parasite	# of birds infected	Bird host species	Location in host	Geographic location
Ribeiroia sp. Travassos, 1939	1	White Ibis*	intestines	Fort Lauderdale
Stephanoprora denticulata Rudolphi, 1802	1	Green Heron*	intestines	Tavernier
Cathaemasia nycticoracis Olsen 1940	1	Green Heron*+	intestines	Tavernier
Ascocotyle diminuta Stunkard et Haviland, 1924	15	Great Blue Heron*	intestines	Fort Lauderdale, Tavernier, Key West
		Green Heron*	intestines	Tavernier
Ascocotyle gemina Font, Heard et Overstreet, 1984	1	Green Heron*	intestines	Tavernier
Apatemon sp. Szidat, 1928	4	Great Blue Heron*	intestines	Fort Lauderdale
		Great Egret*	intestines	Fort Lauderdale, Miami
Parastrigea cincta Brandes, 1888; Szidat, 1928	6	White Ibis+	intestines	Fort Lauderdale, Tavernier
Parastrigea mexicanus Coil, 1957	5	Great Egret*+	intestines	Fort Lauderdale
		Great Blue Heron*+	intestines	Fort Lauderdale
		White Ibis*+	intestines	Fort Lauderdale
Pseudoapatemon sp.	2	Great Blue Heron*+	intestines	Fort Lauderdale, Miami
Strigea pseudibis Odening, 1962	6	Great Egret+	intestines	Fort Lauderdale, Miami, Tavernier
		White Ibis*+	intestines	Miami

obtusus, Van Cleave, 1918, *Southwellina hispida*, Van Cleave, 1925, *Tetrameres ardamericanus*, Boyd, 1966, *Apatemon* sp., Szidat, 1928, and *Parastrigea mexicanus*, Coil, 1957. New host records for the Green Heron are: *Ibirhynchis dimorpha*, Schmidt, 1973, *Contracaecum multipapillatum*, Drasche, 1882, *Stephanoprora denticulata*, Rudolphi, 1802, *Cathaemasia nycticoracis*, Olsen, 1940, *Ascocotyle diminuta*, Stunkard et Haviland, 1924, and *Ascocotyle gemina*, Font, Heard et Overstreet, 1984.

The White Ibis had the highest number of new geographic range extensions (three). In the White Ibis, *Parastrigea cincta*, Brandes, 1888, Szidat, 1928, has been previously reported in Mexico, and *Parastrigea mexicanus*, Coil, 1957, has been previously described in Cuba and Texas (Dubois and Macko 1972, Hinojos and Canaris 1988, Sepúlveda et al. 1999, Ortega-Olivares et al. 2011).

We also identified strigeids from White Ibis and Great Egrets that morphologically most closely resembled *Strigea pseudibis*, Odening, 1962; this report should probably be taken with some caution, as *S. pseudibis* has previously been described only from ibises and egrets captured in Asia and housed in a German zoo (Odening 1962).

Manuscript specimens are being submitted to the parasite collection at the National Museum of Natural History (Washington, D.C.)

DISCUSSION

The current study updates the inventory of helminth fauna for this complex of wading bird species; the previous comprehensive examination of helminth parasites of wading birds in Florida was conducted in the review of all bird species in the state by Forrester and Spalding (2003). The sample sizes provided in comprehensive examinations, such as the review directed by Forrester and Spalding (2003), should be taken under advisement as some of the studies did not provide a sample size or have a minimal sample size.

Only trematode parasites were found to have range extensions within this species complex; this may be due to an array of reasons. As trematodes are difficult to identify, it is likely that prior endoparasite studies missed the presence of these parasites. It is also plausible that the geographic ranges of intermediate host species, such as gastropods, are also shifting; but this data is rarely available. Additionally, the impacts of climate change will have an effect on the distribution of parasite species (Dobson and Carper 1992, Marcogliese 2001, Marcogliese 2008). Although it is difficult to predict how a particular species of parasite will respond to changes in climate; typically longer growing seasons and higher temperatures will lend to more generations

of parasites and more occurrences of disease resulting from increased transmission rates (Marcogliese 2001, Hudson et al. 2006, Marcogliese 2008).

The large number of new host records and geographic range extensions discovered in this study may be due to the diverse range of habitats in southeastern Florida. Schomer and Drew (1982) provided an ecological description of the lower Everglades, Florida Bay, and the Florida Keys and used a conceptual model identifying four major ecological zones; 1) terrestrial and freshwater wetlands, 2) estuarine and saltwater wetlands, 3) Florida Bay and mangrove islands and 4) the Florida Keys. The wading birds examined in this study are present in all of these ecological zones. This allows for a diverse parasite community to exist within this wading bird species complex.

In addition to habitat diversity, migratory behavior may have had an impact on the large number of new host records and geographic range extensions. All wading bird species in this study are known to have both migratory and resident populations. Due to southeastern Florida's location on the Atlantic Flyway, these migratory birds are exposed to various environments. Figuerola and Green (2000) investigated the idea that migratory species are exposed to a more diverse parasite community by analyzing the diversity and prevalence of infections by haematozoan parasites in waterfowl in relation to host migration patterns. They determined that migratory birds are more susceptible or are exposed to a more diverse parasite faunal assemblage. The two concepts of one, different ecological zones found in southeast Florida, and two, the effect of migratory behavior on parasite diversity, may both have impacted the sizeable number of new host records and geographic range extensions determined by this study.

Acknowledgments

We thank the Florida Keys Wild Bird Center, South Florida Wildlife Center, Pelican Harbor Seabird Station, and the Key West Wildlife Center for their assistance. Bird specimens were collected under FFWCC permits LSSC-12-00075 and LSSC-18-00062, USFWS permit MB8290-A-0, and a USFWS LOA to D. W. Kerstetter. We are pleased to thank Valerie Shearn-Bochsler for suggestions that improved the manuscript.

Supplemental Material

A full literature review of the endoparasites found within Great Egrets, Great Blue Herons, Green Herons, Yellow-crowned Night-Herons, Black-crowned Night-Herons, and White Ibis has been permanently archived at <https://nsuworks.nova.edu/occ_fac-datasets/8/>.

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