

Pre-season duck banding in Ontario, 1918-2014 and distribution of hunter recoveries

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Introduction

Research and management of native migratory game birds are important requirements to ensure the protection of those birds listed under the *Migratory Birds Convention Act*, to set sustainable hunting regulations and to maintain biodiversity. To fulfill these requirements, both government and non-government organizations collect data on various bird species. These data are vital to informing policies and setting regulations related to the conservation and management of migratory birds in Ontario. In particular, the monitoring of migratory game birds is important because population, survival and harvest data are used to set policy and regulations that ensure sustainable harvest and support the reduction of species populations that are causing environmental or economic damage. For example, the policy related to the issuance of nest management permits in urban areas (i.e., Damage/Danger Permits) and the decision to liberalize hunting regulations for temperate breeding Canada Geese (*Brantha canadensis*) are directly informed by population and banding data.

To properly manage a game species, data regarding its abundance and distribution are required with habitat use and survival also providing key information. Bird banding is one monitoring tool that provides data for each of these information needs. As popular game birds in North America, ducks are specifically monitored with intensive annual banding efforts during the pre-hunting season (hereafter pre-season). The pre-season is defined as the period of time after ducks finish breeding in July and before the hunting season begins in September; pre-season banding is especially important to determine annual harvest and survival rates related to hunting.

The objective of this paper is to summarize pre-season duck banding efforts in Ontario between 1918 and 2014 and hunter recoveries of those banded birds. We present information regarding banding locations, the number and species banded and large scale trends in the distribution of hunter recoveries. Lastly, we highlight some interesting hunter recoveries.



American Black Ducks. *Barry Kent MacKay*

Methods

In Ontario, ducks are banded by government agencies, (primarily the Ontario Ministry of Natural Resources and Forestry (OMNRF, formerly the Department of Lands and Forest, 1920-1972 and Ontario Ministry of Natural Resources 1972-2014) and Environment and Climate Change Canada's Canadian Wildlife Service (CWS)), environmental non-government organizations (ENGOS), Conservation Authorities (CAs), avocational banders and government and academic researchers. Ducks are typically captured during the pre-season by using bait traps; however, other methods include airboats, drive traps, mist nets and cannon and rocket and pneumatic nets (Canadian Wildlife Service Waterfowl

Committee 2013). Once captured, ducks are retrieved and typically placed in holding boxes where they are held until banding begins. After all of the ducks are confined, they are removed one by one and their plumage (body, wing and tail feathers) and bill are used to identify species, age and sex; a cloacal examination is sometimes also used to determine age and sex. Recorded data include band number, species, age, sex, banding location and date. A band is then placed around the duck's leg and crimped shut. Depending on the study, a number of different auxiliary markers (e.g., coloured tarsal bands, neck collars, patagial wing tags) may then also be placed on the bird before it is released. Once all of the banding has been

completed, the data are submitted to the Bird Banding Office for inclusion in an international Bird Banding Laboratory (BBL) database.

Once banded and released, a duck becomes available on the landscape for an encounter. By far the most frequent encounter is a bird shot and reported by a hunter (i.e., hunter recovery) but other encounters include recaptures during banding operations, sight records (i.e., a band number or auxiliary marker is sometimes read with binoculars or a spotting scope), dead birds (e.g., found on a beach), birds collected under authority of a scientific permit and birds captured after striking a human structure (e.g., building, car). For this paper, we focused on hunter recoveries because they are the most frequent encounter type thereby providing the most data (e.g., 91% of Mallard (*Anas platyrhynchos*) encounters are reported as recovered by hunters) and also likely provide the most unbiased sample. For example, recoveries from either dead birds or birds collected under a scientific permit may not represent normal bird behaviour and, until recently, not all recapture data have been included in the BBL database. Banding and encounter data for all ducks banded in Ontario from 1918 to 2014 were extracted from GameBirds (USGS BBL 2015). The pre-season timeframe was defined as the period between 1 July and 30 September. Although there is the potential overlap between pre-season banding and the opening of the hunting season in mid-to-late-September in some years, this end date was chosen because of the difficulty in verifying that pre-season duck banding finished in all areas in

all years before the duck hunting season commenced. For example, the duck hunting season has started as early as 15 September in 2012, with the introduction of a Waterfowler Heritage Day, and as late as 15 October in 1949 in Southern Ontario. Moreover, excluding pre-season bands from September would remove 44.1% of all pre-season banding data from the analyses. Hunter recoveries were not limited to any specific month because open duck hunting season dates were not available for all areas (e.g., South America, Caribbean Islands, etc.) and represent both direct (i.e., recovery during the period before, during or immediately following the first period of migratory movement following banding) and indirect (i.e., during the second migration period following banding or later) recoveries. Hunter recovery data were then summarized for all ducks but recovery density distribution maps were only created for those species with at least 500 recoveries. Recovery densities were calculated based on the proportions of all band recoveries for each species at each geographical location and therefore represent a relative density for each species. Banding locations and recovery density locations were analyzed using ArcMap 10.1 software. Recovery data were analyzed using the kriging tool to interpolate species-specific recovery densities.

Results

Banding

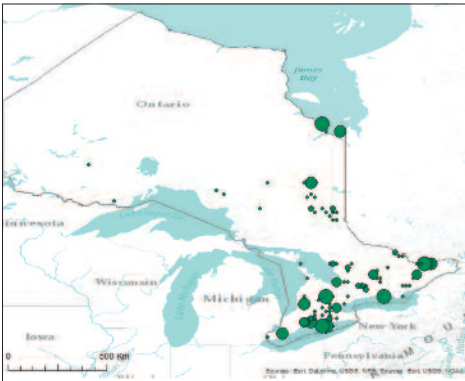
Overall, the distribution of pre-season duck banding locations in Ontario has covered much of the province; however, there has been noticeable geographic variation in the distribution over time with



Locations Pre 1966



Locations 1966 to 1975



Locations 1976 to 1985



Locations 1986 to 1995



Locations 1996 to 2005



Locations Post 2005

Figure 1. Temporal changes in pre-season duck banding locations and numbers banded in Ontario.

Bands Deployed: < 200 200-500 500-1000 1000-2000 >2000

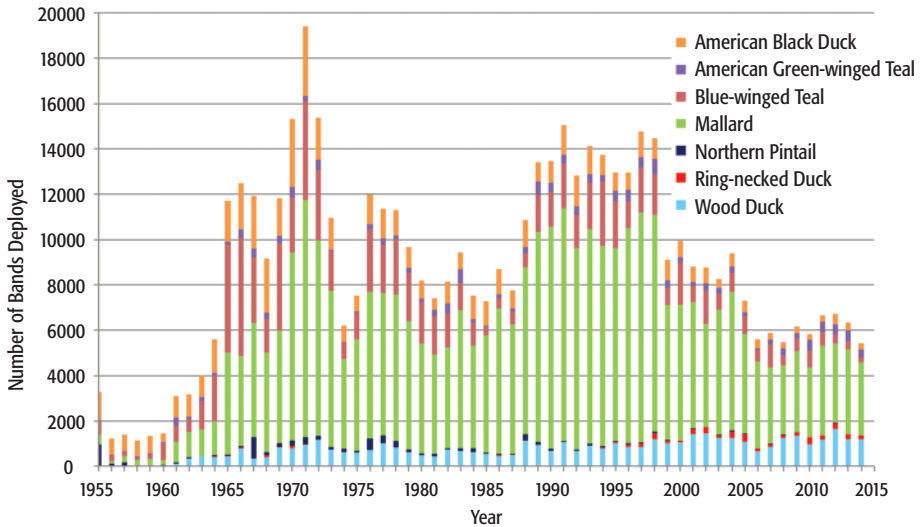


Figure 2. Number of ducks banded by species by year during pre-season banding (1 July to 30 September) in Ontario, 1955 to 2014. Only 7,281 total ducks were banded between 1918 and 1954, 2,760 of which were banded in 1954.

long-term banding efforts focused near populated areas in central and southern Ontario that are easily accessible (Figure 1). Between 1918 and 2014, 548,974 ducks of 24 species (including Barrow's Goldeneye (*Bucephala islandica*), a species at risk) were banded during the pre-season by 182 authorized permit holders at these sites (Table 1). The most ducks banded in any year was 19,586 in 1971 (Figure 2). An average of 13,720 (1988 to 1998) and 6,742 (2004 to 2014) ducks was banded per year during the pre-season in Ontario (Figure 2).

Recoveries

Of the 548,974 ducks banded between 1918 and 2014, 82,220 individuals (~15%) of 19 species and one hybrid, were reported as hunter recoveries. Of these, 41.4% were in Canada with 91.9%

and 2.5% of those occurring in Ontario and Quebec, respectively (Table 1). Outside Canada, ducks from Ontario were most frequently reported from U.S. states in the Mississippi Flyway (31.9%), followed by the Atlantic Flyway (24.2%) and the Central Flyway (1.3%) (Table 1). Within North America, hunters recovered Ontario-banded ducks in the Caribbean Islands (0.6%, mostly Blue-winged Teal, *Anas discors*), the Pacific Flyway (0.08%, mostly Mallards), Central America (0.04%, mostly Blue-winged Teal) and Alaska (0.002%). Of the remaining birds (0.5%), two Northern Pintails (*Anas acuta*, henceforth pintail) were recovered in Russia and one Blue-winged Teal was recovered in Europe; the remaining 98 recoveries did not have a specific location attributed to them (Table 1).

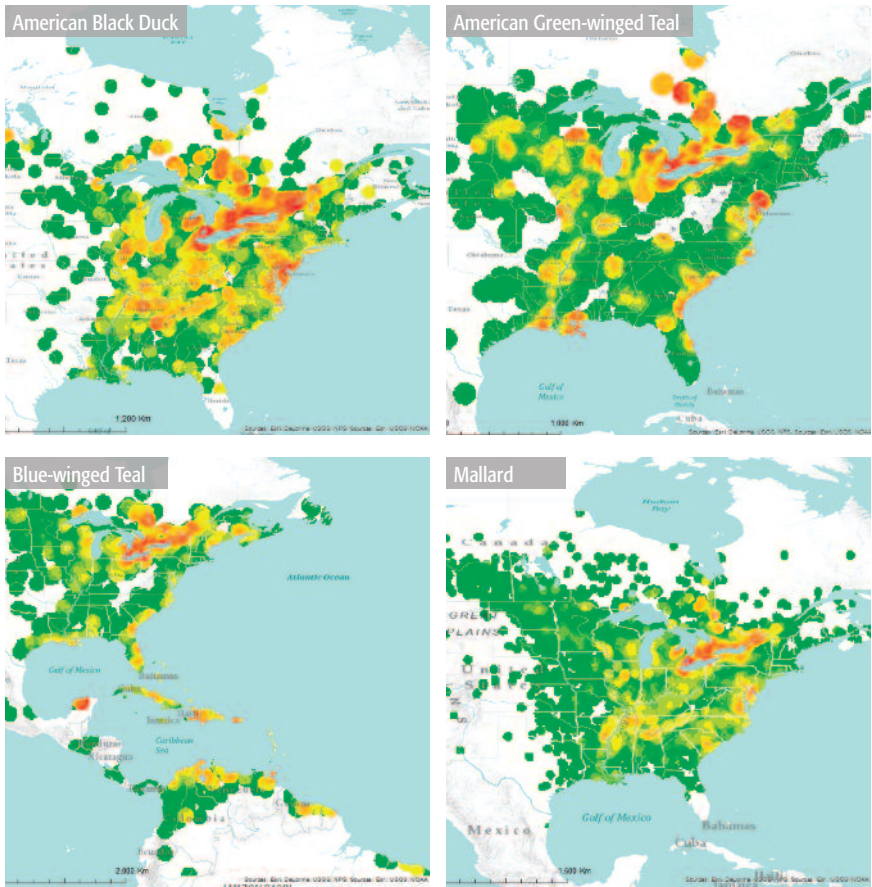


Figure 3A. Relative density of hunter recoveries for select duck species banded during pre-season banding (1 July to 30 September) in Ontario, 1918 to 2014. Species-specific relative densities: Lowest relative density = dark green; medium relative density = yellow; highest relative density = red.

The top five species reported by hunters were Mallard, American Black Duck (*Anas rubripes*, henceforth black duck), Wood Duck (*Aix sponsa*), Blue-winged Teal and American Green-winged Teal (*Anas carolinensis*, henceforth green-winged teal) (Table 1). Three species have only been reported once by a hunter over this timeframe, namely Black Scoter (*Melanitta americana*), Canvasback (*Aythya valisineria*) and Greater Scaup (*Aythya marila*). No hunter recoveries have been reported for Barrow's Goldeneye, Bufflehead (*Bucephala albeola*), Common Eider (*Somateria mollissima*), Red-breasted Merganser (*Mergus serrator*) or White-winged Scoter (*Melanitta fusca*) although fewer than 10 individuals have been banded for each of these species.

Table 1. Number of ducks banded during the pre-season in Ontario and hunter recoveries by location from 1918 to 2014. Species in bold have more than 500 hunter recoveries.

Species	Total Banded	Alaska	Atlantic Flyway	Total	Canada ON	QC
American Black Duck	64,137		2,937	4,948	4,499	412
American Black Duck Dominant X Mallard Hybrid	30		1	2	2	
American Wigeon	2,092		131	124	106	15
Barrow's Goldeneye	1					
Black Scoter	4			1	1	
Blue-winged Teal	89,208		563	2,561	2,162	308
Bufflehead	7					
Canvasback	7			1	1	
Common Eider	1					
Common Goldeneye	1,280		31	123	115	7
Common Merganser	65			1	1	
Gadwall	363		20	27	25	2
Greater Scaup	16		1			
American Green-winged Teal	16,315		437	392	359	28
Hooded Merganser	3,120		223	129	128	1
Lesser Scaup	79		7	7	7	
Mallard	310,518	1	12,325	22,604	20,986	1,086
Mallard Dominant X American Black Duck Hybrid	19		1		171	10
Mallard X American Black Duck Hybrid	2,827		134	186	2	
Mallard X American Black Duck Intermediate	15		1	2		
Northern Pintail	7,305	1	299	289	211	71
Northern Shoveler	173		6	12	6	6
Red-breasted Merganser	6					
Redhead	729		15	58	51	7
Ring-necked Duck	4,430		391	245	234	7
Ruddy Duck	41		1	1	1	
White-winged Scoter	1					
Wood Duck	46,185		2,348	2,357	2,241	112
GRAND TOTAL	548,974	2	19,872	34,070	31,309	2,072

Carribbean	Central Flyway	Central America	Mississippi Flyway	Other	Pacific Flyway	South America	GRAND TOTAL
	16		2,820	12			10,733
			1				4
1	2		73				331
							0
							1
500	70	28	753	5	1	265	4,746
							0
							1
							0
	1		21				176
			1				2
			7				54
							1
	62	5	886	1	15		1,798
	1		48				401
							14
	860	1	19,958	73	50		55,872
							1
	2		151				473
			1				4
6	28		216	3	7	2	851
			11				29
							0
	2		23				98
1	5		86				728
			2				4
							0
	42		1,144	7			5,898
508	1,091	34	26,202	101	73	267	82,220

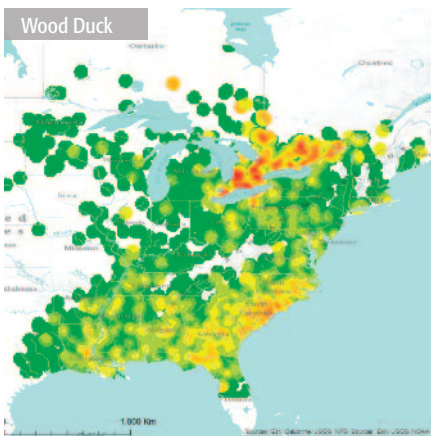
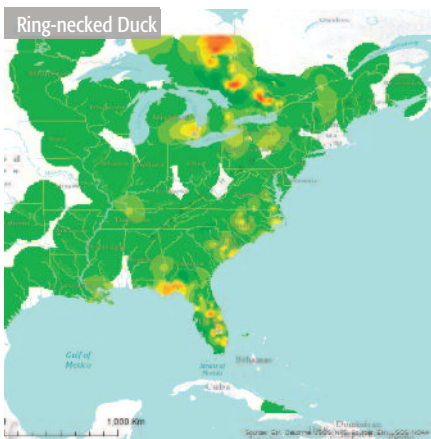
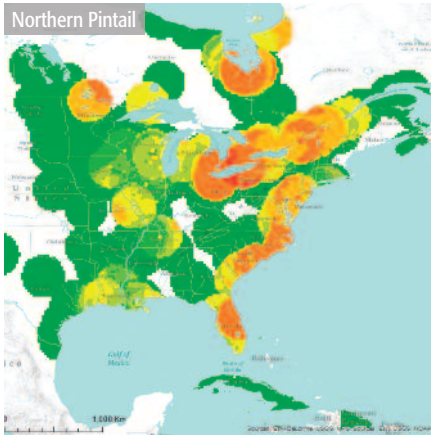


Figure 3B. Relative density of hunter recoveries for select duck species banded during the pre-season (1 July to 30 September) in Ontario, 1918 to 2014. Lowest relative density = dark green; medium relative density = yellow; highest relative density = red.

With respect to the distribution of those species with more than 500 reported recoveries, namely black duck, green-winged teal, Blue-Winged Teal, Mallard, pintail, Ring-necked Duck (*Aythya collaris*) and Wood Duck, areas with consistently high species-specific recovery density are evident. The lower Great Lakes and the Atlantic coast represent areas with high recovery density for all species, except Ring-necked Ducks (Figures 3A, 3B). Concentrations of recoveries for Ontario pintails, Blue-winged Teal, green-winged teal, Wood Ducks and Ring-necked Ducks were also reported from Florida and Blue-winged Teal were reported as far south as Brazil. Recovery densities for black duck and green-winged teal were high in both the Mississippi and Atlantic Flyways. Within Canada, areas along the Hudson-James Bay coastline had a high recovery density for pintail while Mallards, black ducks and green-winged teal showed high recovery densities along the lower Great Lakes (Figures 3A, 3B). Black ducks and Blue-winged Teal showed low recovery densities in Quebec and the Maritime Provinces while green-winged teal, Ring-necked Duck and black duck recovery densities were high in the boreal forest of Ontario.

Discussion

Distribution of Pre-Season Banding Locations

Over the years, there has been an impressive effort to band ducks in Ontario during the pre-season. OMNRF and CWS, in conjunction with biologists at Conservation Authorities, the United States Fish and Wildlife Service (USFWS), state agencies and ENGOs along with members of the public have played an important role in this effort. The OMNRF, however, has been vital to the success of pre-season duck banding in the province since the 1950s. Numerous OMNRF district and area offices had well-established duck banding programs beginning in the 1960s and continuing into the mid-2000s, resulting in a widespread effort throughout much of Ontario, including the north (Figure 1). During this period, over 267,000 ducks were banded by these district OMNRF offices. Declining levels of support, however, resulted in the loss of local banding programs over time and hence, changes in the distribution of banding efforts occurred. OMNRF continues to operate some district duck banding stations (e.g., Temagami, North Bay and Kemptville) and administers a contract banding program, with financial support from the Atlantic and Mississippi Flyway Councils, which helps to fund banding efforts by local banders throughout the province. Furthermore, OMNRF established an airboat banding program in 1996 with support from both Councils. This program operates throughout southern and northeastern Ontario and has averaged over 2,700 ducks banded per year since 2010 (Buchanan *et al.*

2014). The airboat also enables banding of species that are not generally captured using bait traps; since 2012, the airboat program has banded over 95% of all green-winged teal, Blue-winged Teal and Ring-necked Ducks banded in Ontario.

The majority of pre-season duck banding effort has been centered in southern Ontario or near more populated areas in northern Ontario, but there have been targeted efforts to band ducks in the boreal region of northern Ontario, which includes the Hudson Bay Lowlands (Figure 1). Beginning in the 1950s, provincial, federal and US state biologists began banding ducks in the Lowlands. Early efforts were sporadic, but by 1965, OMNRF was conducting annual duck banding operations along the southern James Bay coastline; occasional banding was attempted along the Hudson Bay coastline. Annual banding efforts in the Lowlands continued until 1990 and resulted in about 12,000 ducks banded in the region and accounts for approximately 58% of all pintails ever banded in Ontario. In addition to efforts in the Lowlands, the USFWS conducted banding operations in northwestern Ontario from 1989-1998 near Weagamow Lake (52° 56' 13" N, -91° 18' 45" W) which, in part, explains the increase in total ducks banded during this period. Although the OMNRF airboat program continues to band annually in the boreal region, and a few banding stations remain there, no duck banding has occurred in the remoter areas of the region since 1998 and no ducks have been banded in the Lowlands since 1990. While banding in this region is logistically and financially challenging,

renewing efforts should be considered given that this is a region of continental importance for many species (Abraham 2014) and there may be a possible re-distribution of species farther north with a changing climate.

Diversity of Banded Species

Mallards, black ducks and Wood Ducks were three of the four most frequently banded species. All of these species are abundant breeders in Ontario and comprise a large percentage of the total observations during waterfowl breeding pair surveys (Canadian Wildlife Service Waterfowl Committee 2015). Pre-season banding programs also regularly target these three species because they represent the bulk of the duck harvest in Ontario (Canadian Wildlife Service Waterfowl Committee 2015), are easily captured using conventional techniques (e.g., bait trap and air boat) and are often conservation priority species (Environment Canada 2014).

While the proportion of Mallards, Wood Ducks and Green-winged Teal in the banded sample has remained relatively constant over time, the proportions of other species have varied substantially. Blue-winged Teal, for instance, is the second most banded species in Ontario since 1918 (Table 1), however, its numbers in the banding sample have dropped off substantially since the mid-1990s (Figure 2). Although the mechanism for the decrease in banded Blue-winged Teal is unclear, it seems reasonable to assume that it is linked to the dramatic decline in the breeding population in Ontario. The breeding Blue-winged Teal population has declined 5.9% per year since

1971, with the most dramatic decline occurring between 1971 and 1995 (Ross 2007, Canadian Wildlife Service Waterfowl Committee 2015). Although Blue-winged Teal are thriving in the Canadian Prairies (Dooley *et al.* 2015) and Prairie teal do migrate through Ontario (Bellrose 1976), it is unclear what proportion of Blue-winged Teal banded during the pre-season in Ontario are Prairie versus Ontario natal teal. Answering this question, in addition to identifying the proportion of Prairie versus Ontario natal Blue-winged Teal harvested by hunters, would help direct future conservation initiatives aimed at reversing the population decline of Blue-winged Teal breeding in Ontario.

Changes in pintail banding have been primarily affected by banding effort. The Hudson Bay Lowlands represent the primary breeding area for pintail in Ontario (Gendron 2007). As a result, when efforts were made to band ducks in the Lowlands, the number of pintails banded annually increased markedly, with peak numbers reaching over 900 (Figure 2). Since 1990, however, an average of only 22 pintails have been banded per year in Ontario, which also coincides with the last year of banding in the Lowlands. While Prairie pintails have shown a considerable population decline (Canadian Wildlife Service Waterfowl Committee 2015), pintails in the Lowlands in Ontario continue to do well (Gendron 2007). As a result, renewing banding efforts in the Lowlands may be advantageous in determining why these two populations are experiencing different population trajectories.

The increased use of airboats for capturing ducks has resulted in more Ring-necked Ducks and Hooded Mergansers (*Lophodytes cucullatus*) being banded since 1996 than in the past. Bait trapping is not conducive to the capture of these species due to their preference to forage on aquatic vegetation, invertebrates and fish by diving. As a result, they tend to use more open deep water areas compared to dabbling ducks; these areas are often unsuitable for bait trapping operations because of water depth. Because an airboat is highly mobile and does not rely on birds to concentrate in a specific area prior to capture, it is much more efficient at targeting these ducks than bait trapping. Prior to the airboat program, fewer than 20 Ring-necked Ducks and five Hooded Mergansers were banded annually, on average, in Ontario; since the airboat was introduced this average has increased to 180 and 162 ducks banded per year, respectively. This improvement, particularly for Ring-necked Ducks, has provided data for continental monitoring and managing harvest of this species. This is important because the Ring-necked Duck is consistently one of the top five duck species harvested in Eastern Canada (Leckie 2007) and Ontario has banded over 50% of all Ring-necked Ducks banded in Eastern North America since 2005.

In addition to the focal species mentioned above, the high diversity of ducks (e.g., 24 species of dabblers, divers and sea ducks) banded during the pre-season in Ontario was somewhat unexpected (Table 1). While many of these less common species were likely captured as by-catch in traps targeting other species or

captured opportunistically, some species may be targeted in small scale projects focussing on species of conservation concern or local interest. Although the total number of banded ducks was often fewer than ten per species, it was surprising that species such as Barrow's Goldeneye, Bufflehead, Common Eider, Red-breasted Merganser, White-winged Scoter and Black Scoter have been banded in Ontario during the pre-season. Not only are some of these species rare in accessible parts of Ontario, especially from August to September, but many are also difficult to catch due to their tendency to use inaccessible offshore areas.

Distribution of Recoveries

Mallards, black ducks and Wood Ducks are the species with the most recoveries which is not surprising as they are often the focus of banding efforts and are highly sought after by hunters. (Canadian Wildlife Service Waterfowl Committee 2015, Raftovich *et al.* 2015). The high availability of banded birds on the landscape undoubtedly explains the relatively high species-specific recoveries in many local areas as well as in/around Ontario. At a local scale, most ducks tend to remain in the area where they were banded well into the hunting season as birds mature and/or deposit fat reserves for migration. Then, as autumn progresses, flights begin to occur with species demonstrating different migration phenology. For example, Ring-necked Ducks and Wood Ducks tend to migrate earlier than Mallards and black ducks with most leaving Ontario by mid-November; many Mallards and black ducks remain in Ontario or northern US

states throughout the entire winter. As a result, there is a relatively high proportion of banded birds in Ontario well into the hunting season and, depending on the species' migration phenology, some of these banded birds may never be available to hunters further south. This explains, in part, why a large proportion of Ontario pre-season banded ducks are harvested in Ontario and around the lower Great Lakes in general, compared to mid- and lower US states (Figures 3A, 3B). Other differences in recovery distribution are also affected by species-specific migration phenology. For example, hunter recoveries for Mallards that were banded during the pre-season in Ontario show a declining trend with latitude within the Mississippi Flyway: Michigan (total = 22%), Ohio (13%), Tennessee (15%), Mississippi (5%), Alabama (5%) and Louisiana (3%). Conversely, proportionally more Ontario Wood Ducks were harvested in Louisiana (23%), Alabama (21%) and Mississippi (15%) compared to Michigan (8%), Ohio (8%) and Tennessee (6%). Roy *et al.* (2015) also showed a high band recovery for ducks in southern Ontario and Iverson *et al.* (2014) showed a similar result for Canada geese banded in Ontario.

Changes in the distribution and population of duck species, duck banding stations and banding effort have resulted in shifts in the proportion of Ontario ducks recovered in the Mississippi and Atlantic Flyways. Since 1920, the Mississippi Flyway has accounted for approximately 57% of all recoveries between the Mississippi and Atlantic Flyways (Table 1). This proportion, however, has varied considerably over the last



50 years. For example, during the 1966 to 1975 and 1976 to 1985 decades, the Mississippi Flyway accounted for approximately 49% of hunter recoveries. Then, from 1986 to 2005, the proportion increased to approximately 64% with some years reaching 68% and 69% of total recoveries. Since 2006, the proportion of recoveries has declined back to 53%. Undoubtedly, some of these changes correspond to changes in the breeding population of ducks in Ontario as species such as Mallards and Wood Ducks have increased dramatically from the 1970s (Canadian Wildlife Service



A typical pre-season bait trap at Thunder Bay, Ontario. *Photo: Dan Bascello*

Waterfowl Committee 2015). However, changes in the distribution of banding stations over time have also resulted in changes in the composition of species banded, which, in turn, may influence the distribution of recoveries (Figure 2). For example, the proportion of Mallards banded in Ontario increased significantly from 1986 to 2005; many of these ducks were banded in southwestern Ontario in areas west of Toronto and, therefore, were more likely to travel down the Mississippi Flyway. Before then, black ducks and Blue-winged Teal comprised a higher proportion in the banded species

composition (Figure 2). Ontario banded Blue-winged Teal tend to use the Atlantic Flyway more than the Mississippi Flyway (Figure 3A) and over 30% of the black ducks were banded in Eastern Ontario (e.g., Cornwall) pre-1986. Since 2006, banding stations in western and north-eastern Ontario have closed while new stations have opened further east (e.g., Ottawa); other stations (e.g., Lake St. Clair) have been unable to band as many ducks, mainly Mallards, during the pre-season in some years because of lake water levels. All of these changes undoubtedly affect flyway hunter recoveries as ducks

in southwestern Ontario and northeastern Ontario tend to use the Mississippi River valley while those further east travel south through the Atlantic Flyway (Zimpfer and Conroy 2010, Baldassarre 2014).

As evident from the recovery density distribution maps (Figures 3A, 3B), many Ontario banded ducks used the mid-to southern Atlantic coast states during fall and overwintered in these locations. For species such as the black duck, this is not unusual given the high historical and current overwintering use of this area. For example, data from the USFWS Mid-Winter Waterfowl Survey (MWS) for the Atlantic Flyway show that on average between 2012 and 2015 approximately 240,000 black ducks overwintered in this area with approximately 45% using New Jersey (USFWS 2015). Baldassarre (2014) also summarized the importance of the area between Long Island, New York, and North Carolina for wintering black ducks. In fact, the black duck is one of the focal species for major conservation initiatives (e.g., Chesapeake Bay Program, Atlantic Coast Joint Venture) and refuge management (e.g., Edwin B. Forsythe National Wildlife Refuge) in this area. Similarly, southern Atlantic coast states, particularly North Carolina and South Carolina, respectively, had on average approximately 70% and 16% of all overwintering green-winged teal and 76% and 11% of all overwintering pintails in the Atlantic Flyway between 2012 and 2015 (MWS \bar{x} = 106,000 green-winged teal and 85,000 pintails in the Atlantic Flyway) (USFWS 2015). Clearly, this area is important to many ducks from Ontario.

The Clay Belt of northeastern Ontario, which extends from approximately Lake Timiskaming near New Liskeard, north to Cochrane and west to Hearst, represents an important area for breeding and migrating ducks. Ross *et al.* (2002) found that the Clay Belt had a higher density of breeding waterfowl compared to surrounding boreal areas with Mallard, Ring-necked Duck, black duck and Common Goldeneye (*Bucephala clangula*) being the most common ducks detected during waterfowl breeding pair surveys (see also Cadman *et al.* 2007, Baldassarre 2014). The area is also important to autumn migrating ducks. Specifically, black duck, green-winged teal and Ring-necked Duck had a high recovery density in this area. This is, in part, not surprising given the concentrated banding effort in this area (Figure 1), resulting in a high availability of banded ducks as well as a proportionately large hunting population in the area. Although it is part of the Canadian Shield, the Clay Belt contains relatively productive clay soil with high water tables and, therefore, intensive large scale agricultural operations are common within this area (Abraham 2014). With continuing land conversion of forest and wetlands to agriculture within the Clay Belt, there is some concern that land use change may be negatively affecting some duck species (e.g., black duck) while benefiting others (e.g., Mallard). Future banding in this area should shed light on possible changes in species distribution and abundance over time.

The Blue-winged Teal was, by far, the longest distance migrant of all ducks banded during the pre-season in Ontario. Hunter recoveries of these ducks were reported from British Columbia to Newfoundland and as far south as the Caribbean Islands, Columbia, Venezuela, Peru and Brazil. Various accounts show that the Blue-winged Teal is a long distance migrant (Rohwer *et al.* 2002, Baldassarre 2014) and our results confirm this observation. Interestingly, our recovery density figure for Blue-winged Teal also confirms Bellrose's (1976) migration map that shows a sizeable segment of these teal migrate directly east to as far as the Maritimes and then south. This supports the hypothesis that Blue-winged Teal from the Canadian Prairie are being banded in Ontario. Interestingly, many of the distant recoveries of several species are drakes which likely are pairing up with females on the wintering grounds and then dispersing with them back to their natal grounds. For example, of the banded Mallards, three were reported near Great Slave Lake in the Northwest Territories (two of these were males, one was unknown), 17 were reported in California (12 males and five females), one male was reported in Mexico and one female was reported in Alaska. Five green-winged teal (four females and 1 male) and 17 Blue-winged Teal (15 males and two females) were recovered in Mexico. In Cuba, five pintails (four females and one male), one female Ring-necked Duck and one female American Wigeon (*Anas americana*) were recovered. Other pintails have

been recovered as far away as Russia ($n=2$), California ($n=5$) and Venezuela ($n=1$). One Blue-winged Teal was recovered in Europe in 1971 (Azores, Portugal) and two extralimital Wood Ducks were recovered, one in Colorado and one along the James Bay coastline in Ontario.

Results from this paper show that significant effort has gone into delivering a successful pre-season duck banding program in Ontario. Recovery maps show many high density areas, many of which have been corroborated by various waterfowl surveys (e.g., MWS, CWS Great Lakes Decadal Waterfowl Survey [Smith *et al.* 2013], waterfowl breeding pair surveys). It must be realized, however, that the main purpose of pre-season duck banding in Ontario (and elsewhere) is to provide information for harvest management for many species. Documenting the proportion of recovered bands by species in relation to the total number of annual available bands on the landscape for that species is fundamental in determining how much harvest pressure is occurring on a population of migratory game birds. This, combined with population monitoring, determines how hunting regulations are changed to allow sustainable harvest. Lastly, identifying migration patterns and important overwintering areas from recoveries helps link breeding population monitoring efforts to wintering areas (i.e. migratory connectivity), as well as encouraging local habitat management initiatives in those areas (e.g., refuge management), in order to ultimately, conserve those species.

Acknowledgements

We thank all of the duck banders in Ontario and hunters who report banded birds; their support provides data to inform the conservation and management of migratory game birds. We thank the OMNRE, particularly J. Chris Davies, for their support in migratory bird conservation and management as well as the Atlantic and Mississippi Flyway Councils for funding duck banding programs in Ontario. Courtney Young provided preliminary summaries for this paper.

Thank you to Barry Kent Mackay for the generous use of his American Black Duck illustration.

Lastly, Tina Knezevic, Brigitte Collins, Jack Hughes and the editors provided comments that improved this paper.

Literature Cited

Abraham, K.F. 2014. Waterfowl in Ontario's Boreal Region: Looking Back, Looking Forward. Report prepared for Ducks Unlimited Canada. Kingston, ON. 97 pp.

Baldassarre, G. 2014. Ducks, Geese, and Swans of North America. Volume 1. John Hopkins University Press, Baltimore, MD. 565 pp.

Bellrose, F.C. 1976. Ducks, Geese & Swans of North America. Stackpole Books, Harrisburg, PA. 540 pp.

Buchanan, T., M. Purvis, C. Davies, K. Bennett, S. Bennett, I. Hebert, L. Nituch, G. Meadows, S. Mills and A. Orton. 2014. Ontario Duck Banding Program – 2014. Ontario Ministry of Natural Resources and Forestry. Peterborough, ON. 7 pp.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2006. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. Toronto, xxii + 706 pp.

Canadian Wildlife Service Waterfowl Committee. 2013. Capture of Waterfowl and Waterbirds Using Common Traps and Techniques. Canadian Wildlife Service, Ottawa, ON. 24 pp.

Canadian Wildlife Service Waterfowl Committee. 2015. Population Status of Migratory Game Birds in Canada: November 2015. CWS Migratory Birds Regulatory Report Number 45. 242 pp. <http://www.ec.gc.ca/rcom-mbhr/default.asp?lang=En&n=762C28AB-1>

Dooley J., K. Fleming, P. Garrettson, W. Rhodes and N. Zimpfer. 2015. USFWS Waterfowl Population Status, 2015. USFWS, Division of Migratory Bird Management, Laurel, MD. <http://www.fws.gov/birds/surveys-and-data/reports-and-publications.php>. 82 pp.



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- Environment Canada.** 2014. Bird Conservation Strategy for Bird Conservation Region 13 in Ontario Region: Lower Great Lakes/St. Lawrence Plain. Canadian Wildlife Service, Environment Canada, Ottawa, ON. 197 pp + appendices.
- Gendron, M.** 2007. Northern Pintail, pp. 84-85 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2006. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. Toronto, xxii + 706 pp.
- Iverson, S. A., E.T. Reed, R.J. Hughes and M.R. Forbes.** 2014. Age and breeding stage related variation in the survival and harvest of temperate breeding Canada geese in Ontario. *The Journal of Wildlife Management* 78:24-34.
- Leckie, S.** 2007. Ring-necked Duck, pp. 92-93 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2006. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. Toronto, xxii + 706 pp.
- Raftovich, R.V., S.C. Chandler and K.A. Wilkins.** 2015. Migratory bird hunting activity and harvest during the 2013-14 and 2014-15 hunting seasons. U.S. Fish and Wildlife Service, Laurel, MD, USA. 68 pp. <http://www.fws.gov/birds/surveys-and-data/reports-and-publications/hunting-activity-and-harvest.php>.
- Rohwer, F.C., W.P. Johnson and E.R. Loos.** 2002. Blue-winged Teal (*Anas discors*), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/625>
- Ross, R.K.** 2007. Blue-winged Teal, pp. 80-81 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2006. Bird Studies Canada,
- Ross, R.K., K.F. Abraham, T.R. Gadawski, R.S. Rempel, T.S. Gabor and R. Maher.** 2002. Abundance and distribution of breeding waterfowl in the Great Clay Belt of northern Ontario. *Canadian Field-Naturalist* 116:42-50.
- Roy, C., S.G. Cumming and E.J.B. McIntire.** 2015. Spatial and temporal variation in harvest probabilities for American black duck. *Ecology and Evolution* 5(10):1992-2004.
- Smith, P., S.S. Badzinski and S.W. Meyer.** 2013. Migrant Waterfowl use of the Ontario Shorelines of the Southern Great Lakes. Canadian Wildlife Service. Unpublished report. 64 pp. Ottawa, ON.
- United States Fish and Wildlife Service.** 2015. Mid-Winter Waterfowl Survey. https://migbirdapps.fws.gov/mbdc/databases/mwi/aboutmwi_allflyways.htm
- United States Geological Survey, Bird Banding Laboratory.** 2015. Gamebirds software (Version 22). Laurel, MD.
- Zimpfer, N.L. and M.J. Conroy.** 2010. Modeling Movement and Fidelity of American Black Ducks. *The Journal of Wildlife Management* 70(6):1770-1777.

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