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Distribution of American Black Duck and Mallard in northern Ontario

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Introduction

The province of Ontario contains the major zone of range overlap for the Mallard *Anas platyrhynchos* and the closely related American Black Duck *A. rubripes*. Both of these very important game species have, in recent years, undergone declines in numbers that are of considerable concern (Canadian Wildlife Service/U.S. Fish and Wildlife Service 1986). Mallard numbers have dropped substantially on their major breeding grounds in the Canadian Prairies, due in part to the prolonged drought there during the 1980s, whereas numbers of American Black Duck have been declining for more than 30 years on their wintering areas in the United States. The range of these species in Ontario has been documented in the Atlas of Breeding Birds of Ontario (Cadman et al. 1987), based on their presence or absence on blocks with 50-km sides. In southern Ontario, the American Black Duck has been reduced to very low population levels while the Mallard has increased substantially, so that the total density of the two species has remained largely constant (Dennis et al. 1989); this suggests that introgression by the genetically dominant Mallard has contributed greatly to the decline of the American Black Duck phenotype (Ankney et al. 1987).

In northern Ontario, the status of both duck species has been examined in parts of the area only (Hansen et al. 1949; Kaczynski and Chamberlain 1968; Dennis 1974; Dennis and North 1984; U.S. Fish and Wildlife Service Breeding Population Survey). In the past, extensive aerial surveys of breeding density have presented problems (Chamberlain and Kaczynski 1965), particularly for the American Black Duck, given the vast area of its range, its generally low breeding density, and low survey efficiencies from fixed-wing aircraft. To improve this situation, an extensive survey of waterfowl breeding distribution was started in northern Ontario in 1980, employing helicopter-based counts of waterfowl found on fixed plots (Ross 1987); initial coverage was completed in 1988. This report presents information from that survey on American Black Duck and Mallard distributions throughout northern Ontario, together with some initial results of the special American Black Duck survey currently under way in northeastern Ontario. Comparisons have been made with earlier information where appropriate.

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Methods

The extensive waterfowl breeding pair survey program described by Ross (1987) is based on survey plots (2 × 2 km each) located in a systematic pattern, 25 plots to a block with 100-km sides, in a two-stage sampling scheme derived from the Universal Transverse Mercator (UTM) mapping grid. Twenty-two such blocks were located systematically across northern Ontario (north of the French and Mattawa rivers), and each was surveyed at least once between 1980 and 1988. Data on all waterfowl plus loons were collected by means of single-visit helicopter surveys during the period for nest initiation for most species (Ross 1985); only results for the American Black Duck and Mallard are presented here. For the sexually dimorphic Mallard, breeding density, expressed as the number of indicated pairs per 100 km^2, was estimated from the totals of lone males, pairs, and males in flocks of five males or less (Dzubin 1969). For the American Black Duck, whose sexes are more difficult to distinguish in the field, breeding densities were determined using an indirect method (Ross 1987) based on the sex ratio of the closely related Mallard (Dennis 1974). The following multiple regression was developed using all breeding pair survey data available for Ontario wetlands where Mallards were found (up to 1984):

$$Y = 0.0700 + 0.632\,X_1 + 1.1166\,X_2 + 0.7398\,X_3$$
$$R^2 = 0.9577,\ P < 0.00001$$

where Y = number of indicated pairs of Mallards
X_1 = number of lone Mallards
X_2 = number of flocks of two Mallards
X_3 = number of Mallards in flocks between three and 10

Indicated pair estimates for American Black Ducks can then be generated by substituting American Black Duck sighting information for that of Mallards in the equation. Wetlands that had no American Black Ducks were assumed to have no indicated pairs; in other words, the equation was not used under those circumstances. Note that the larger flock size allowed by this multiple regression equation was used to accommodate the possible presence of females; American Black Duck flocks of more than five birds were encountered extremely rarely.

In 1987 and 1988, every effort was made to identify the sex of American Black Ducks in the field so that indicated pair estimates could be calculated directly as for Mallards. This practice proved much easier than anticipated due to the propensity of American Black Ducks to flush near the helicopter. Bill colour was easily determined in good light; as well, the smaller size, lighter and duller plumage, and smaller speculum of the female were evident in mixed flocks. The buffy tips of the scapular feathers of the male were also a useful field mark. Comparison of results from the direct and the indirect calculations indicates that the latter method tended to underestimate population den-

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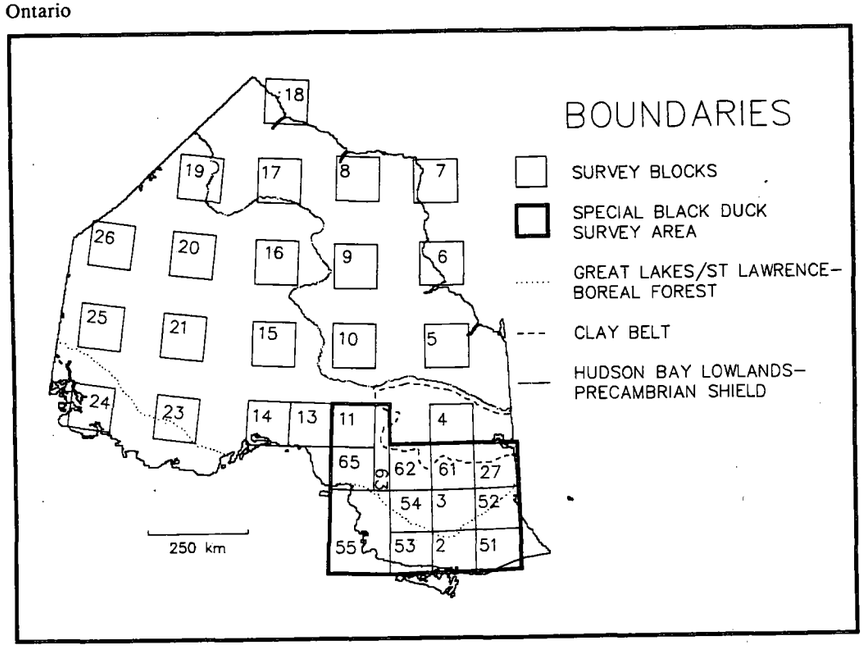
sities, usually by between 5 and 10%. This observation should be borne in mind when interpreting the results of this study, given that densities based on the indirect calculation were used to allow comparison with results prior to 1987. A new regression model based on the recent American Black Duck sighting information is currently being developed.

Along with the extensive survey throughout northern Ontario, a more intensive survey was initiated specifically to monitor the American Black Duck population in northeastern Ontario (Fig. 1). This survey employed a methodology similar to that used in the extensive survey: 2 × 2 km plots were spaced in a grid pattern throughout the study area, which was delimited by UTM block boundaries and the Great Lakes coast. To facilitate summarizing survey data, this area was divided into the standard UTM blocks with 100-km sides; the irregularly shaped blocks, Blocks 55 and 63 (Fig. 1), resulted from the combining of a number of partial blocks along a convergence. Within each block, a survey plot was laid out in the southwest corner and then every 20 km to the north and east for a total of 25 plots per block; in the convergence blocks, plots were selected that had the same easting and northing designations as those of a normal block. Only those plots falling on the mainland were covered. In 1987 and 1988, two survey teams were employed, one covering the two southerly tiers of blocks (170 plots) and the other covering the remainder to the north (144 plots); only the southern sector was covered in 1985. The timing of surveys was as follows: 10–18 May 1985, 4–14 May 1987, and 10–17 May 1988. The early start in 1987 was due to a particularly warm spring, estimated to be climatically 10 days in advance of normal. The phenological shift in nest initiation plus the accelerated leafing of the trees necessitated an earlier start.

Waterfowl breeding density values calculated for each block have, for the purposes of mapping, been assigned to the point location at the geographic centre of the land portion of that block. Contour maps of breeding density have been generated through the POTMAP routine of the SPANS spatial analysis system program.

Habitat data were collected through airphoto interpretation of all water bodies surveyed in the Precambrian Shield as part of either the extensive survey or the special American Black Duck survey (see Ross 1987 for definition of water bodies). Water bodies were divided into three categories: bodies of standing water, large rivers (> 10 m wide), and streams (< 10 m wide). For each, area of open water and shoreline perimeter length were measured, plus the length of shoreline characterized by well-developed littoral zone (graminoid marsh or ericaceous shrub). Development of comparable habitat measures for the Hudson Bay Lowlands blocks is currently under way.

Figure 1
Habitat boundaries and location of survey blocks in northern Ontario



Results and discussion

Contour distribution maps of Mallards and American Black Ducks (Figs. 2 and 3) have been generated using summarized survey block data from both the 1988 American Black Duck survey and the extensive survey of the remainder of northern Ontario. The maps agree in general configuration with those of the Atlas of Breeding Birds of Ontario (Cadman et al. 1987); this was not unexpected, as our early data were used in the atlas. Figures 2 and 3 present reasonably detailed depictions of the distributions. However, because the data points were up to 200 km apart for much of northern Ontario, it is urged that caution be used when interpreting local detail.

The American Black Duck (Fig. 2) demonstrates a wide range of breeding densities over northern Ontario, from effectively zero in the far northwest and the Lake-of-the-Woods area to a peak count of 70.8 pairs per 100 km^2 at Cape Henrietta Maria (Block 7). This peak value should be viewed with caution, as there remains the possibility that some migrants heading farther north or post-breeding males from the south may have been included, even though breeding densities there and in the Fort Severn area (Block 18) were substantial, with many obviously paired birds being seen. The overall trend indicates a generally declining density from east to west. The distribution of abundance effectively forms two lobes branching out from a source in northeastern Ontario: one lobe extends across the more southerly exposed Precambrian Shield as far as southern Manitoba and covers an area mostly characterized by boreal forest or by Great Lakes–St. Lawrence forest with strong boreal elements; the second lobe extends north across the Great Clay Belt through the eastern Hudson Bay Lowlands and along the James Bay and Hudson Bay coasts. The habitat is largely dominated by peatland systems, although areas with highest breeding densities have extensive mineral soil influences from ancient beach ridges lying inland from the coast. It is debatable whether the maritime situation plays a role in the distribution of the American Black Duck here, as it does along the Atlantic coast.

In comparison with the American Black Duck, Mallards are more evenly distributed (Fig. 3), occurring in at least low to moderate numbers throughout the province. The highest densities are found around the perimeter of northern Ontario (Lake-of-the-Woods area, James Bay and Hudson Bay coastal zone, and Lake Nipissing area) and decrease towards the centre of the region. Superimposed on this is a declining trend in density from west to east. In general, high densities are associated with more open habitat, due either to agricultural activity, as in the Lake-of-the-Woods and the Lake Nipissing areas, or to the open muskeg and subarctic tundra of the James Bay and Hudson Bay coasts. The first two areas are also adjacent to very high concentrations of Mallards in the Prairies and southern Ontario, respectively.

Comparison of the two distributions shows little correlation in the abundance of the two species, except for the overall trend of the Mallard to increase and the American Black Duck to decrease towards the west. Other than the Lake-of-the-Woods area, where the Mallard is common and the American Black Duck is largely absent, the sectors of highest relative abundance for the two species coincide in the James Bay and Hudson Bay coastal zone and in the Lake Nipissing area (Block 52). Predominance by American Black Ducks occurs only in northeastern Ontario and around Cape Henrietta Maria. In the far eastern part of northern Ontario, predominance by Mallards is found only in the Clay Belt (Blocks 4 and 27) and the extreme southeast (Blocks 2, 51, and 55). This limited distributional correlation suggests a degree of ecological separation of the two species, which can also be inferred from analysis of co-occurrence. Detrended correspondence analysis of plot data (TWINSPAN; Hill 1979) assigns the species to different subgroups (McNicol et al. 1987; Ross 1987). In northern Ontario, the American Black Duck uses a wider range of habitats and tends to co-occur more frequently with the Ring-necked Duck *Aythya collaris*. To further examine ecological segregation, we compared the size of wetlands in the exposed Precambrian Shield on which each species occurs (Table 1). Only those wetlands with complete coverage were used. Mallards occupy significantly smaller water bodies ($P < 0.05$, Mann-Whitney U-test), based on all plots with sufficient densities of the two species to allow meaningful comparisons. The actual role of wetland size was not investigated, and it may in fact be a correlate of some other more important factor, such as wetland fertility.

Figure 2
Breeding distribution of the American Black Duck in northern Ontario

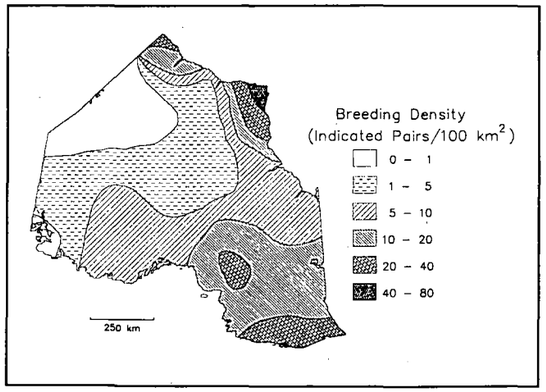
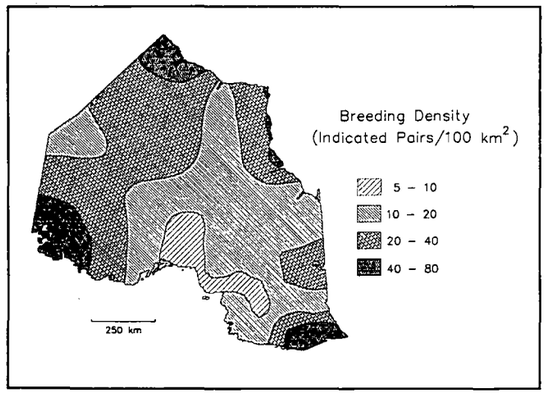


Figure 3
Breeding distribution of the Mallard in northern Ontario



Although Figures 2 and 3 present composites of the species' distributions over a nine-year period, these breeding densities should not be considered static. Repeat counts in various parts of northern Ontario suggest considerable shifts in breeding abundance over time. In northeastern Ontario, the special American Black Duck survey area was established in 1987 to monitor population changes during a period of restrictive bag limits; the southern blocks of this area had also been surveyed in 1985. Results for blocks sampled more than twice are presented in Table 2. For the seven blocks with coverage in 1985, 1987, and 1988, time series of American Black Duck and Mallard densities show numerically positive mean slopes, although these were not statistically significant. In the case of the American Black Duck, slopes for the four southernmost blocks were larger in all cases than those for the three northern blocks ($P < 0.05$, Mann-Whitney U-test). Two other northern blocks (11 and 27) that were surveyed in the early 1980s also showed little change in American Black Duck numbers over time. This may suggest some relatively local geographic component of the population trend for the American Black Duck.

Table 1
Mean sizes of lakes (by survey block) on which indicated pairs of American Black Ducks and Mallards were observed[a]

Ecological region	Block name	Block No.	Mean area in hectares (no. of wetlands) American Black Duck	Mallard	Mallard and American Black Duck
Precambrian Shield	Nipissing	51	3.49 (11)	2.24 (20)	4.50 (5)
	New Liskeard	52	6.31 (8)	1.30 (2)	1.20 (1)
	Killarney	2	2.10 (10)	0.98 (7)	1.27 (2)
	Gogama	3	5.08 (13)	1.00 (2)	- (0)
	Elliot Lake	53	4.50 (1)	4.50 (1)	4.50 (1)
	Wakami Sault Ste. Marie	54	2.13 (10)	3.93 (3)	3.70 (2)
		55	2.74 (7)	4.70 (1)	4.70 (1)
	Hornepayne	11	2.63 (6)	0.30 (1)	- (0)
	Manitouwadge	13	6.90 (5)	0.70 (1)	- (0)
	Fort Hope	15	9.80 (1)	2.13 (3)	- (0)
	Atikokan	23	8.46 (10)	4.53 (6)	15.20 (1)
Clay Belt	Kirkland Lake	27	1.02 (5)	2.16 (8)	1.55 (2)
	Cochrane	4	3.90 (5)	4.45 (6)	6.20 (3)
Overall mean sizes			4.24	2.95	4.43

[a] Note that mean lake areas for the individual species also include those wetlands where the two species co-occurred.

Table 2
Interyear comparison of American Black Duck and Mallard survey results (indicated pairs per 100 km²) for nine survey blocks in northeastern Ontario

Block name	Block No.	Species[a]	Year 1980	1981	1983	1985	1987	1988
Nipissing	51	Black	-	-	-	16.4	20.4	23.8
		Mallard	-	-	-	52.0	68.0	61.0
New Liskeard	52	Black	-	-	-	16.8	21.2	13.8
		Mallard	-	-	-	9.0	12.0	4.0
Kirkland Lake	27	Black	-	-	12.4	-	9.0	13.8
		Mallard	-	-	18.0	-	32.0	28.0
Killarney	2	Black	-	12.4	-	12.6	35.2	24.6
		Mallard	-	18.0	-	26.1	54.4	47.8
Gogama	3	Black	-	19.4	-	18.6	21.2	17.8
		Mallard	-	6.0	-	6.0	5.0	12.0
Elliot Lake	53	Black	-	-	-	5.5	32.4	26.1
		Mallard	-	-	-	17.1	11.8	6.5
Wakami	54	Black	-	-	-	12.0	20.8	10.6
		Mallard	-	-	-	6.0	4.0	3.0
Sault Ste. Marie	55	Black	-	-	-	9.6	21.2	16.6
		Mallard	-	-	-	6.3	22.3	19.6
Hornepayne	11	Black	23.8	-	-	-	22.4	22.2
		Mallard	7.0	-	-	-	21.0	18.0

[a] Hybrids have been included with Mallards.

No such trend, however, is evident for the Mallard. Plot surveys of breeding waterfowl were also undertaken in 1973 (Dennis 1974). Although these were ground surveys using a different sampling regime, it is useful to compare the results with those from appropriate blocks from the present surveys (Blocks 52, 53, 62, 63, 65, and 11 for the Precambrian Shield sector and Blocks 4 and 27 for the Clay Belt). Data from the 1988 survey were used, except for Block 4, which was covered only in 1982. Table 2 suggests that Mallard densities in these mostly boreal areas remained largely similar over the 15-year period, whereas American Black Duck counts declined considerably, particularly in the Clay Belt.

Population trend information also exists for northwestern Ontario in the form of aerial transect survey data from Stratum 50 of the Waterfowl Breeding Population Survey. This survey was run from 1955 to 1973 and from 1986 until the present. Results show considerable annual variability, making conclusions difficult; however, the two highest peak counts of Mallards (in 1962 and 1988) coincide with Prairie droughts and may reflect the presence of displaced birds from that habitat. American Black Duck counts were erratic, and little can be said about population trends given that the 1988 value was only 8.6% greater than the average value from 1955 to 1973. Interestingly, for that earlier period, the peak American Black Duck count coincided with the peak Mallard count in 1962, and survey counts for the two species showed significant positive correlation (Boyd 1984); the values for the two species for the surveys from 1986 to 1988 showed the same sequential rise. Whether this reflects similarities in productivity of the two species or is an artifact of survey technique is not known. Changes in the counts of the two species were also similar in the American Black Duck survey area in northeastern Ontario; both showed numerical increases between 1985 and 1987 and decreases from 1987 to 1988.

Conclusions

In summary, American Black Ducks and Mallards show largely unrelated distributions in northern Ontario; both distributions are consistent with those of species that are towards the edges of their ranges. American Black Ducks decline in breeding densities from the main population centre to the east, whereas Mallard densities decrease from population centres in the west and south. High densities in the James Bay and Hudson Bay coastal zone are common to both species. A degree of ecological segregation of the two species is evidenced through detrended correspondence analysis, which places each species in a different subgroup. As well, based on indicated pair locations, Mallards are found on significantly smaller wetlands than American Black Ducks, at least on the exposed Precambrian Shield. Trend data suggest that American Black Duck breeding densities have declined considerably since the early 1970s, and possibly before that (Chamberlain and Kaczynski 1965), in the eastern part of northern Ontario, particularly in the Clay Belt. Present surveys in northeastern Ontario suggest a rise in American Black Duck numbers, especially in the southern Precambrian Shield. Mallard counts appear to have remained fairly stable there throughout this period, although they, too, may be rising at present. In northwestern Ontario, Mallard densities based on Stratum 50 counts are much more variable, with high counts being associated with drought conditions on the Prairies. Because of the substantial variability, no real trend could be inferred from the American Black Duck counts in the northwest. A significant correlation occurs between American Black Duck and Mallard counts in northwestern Ontario, based on data from 1955 to 1973, and this is also suggested in the special American Black Duck survey data for northeastern Ontario. Further investigation of this relationship would be useful.

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