CHRISTMAS BIRD COUNT DATA CONFIRM NORTHWARD CONTRACTION OF THE NONBREEDING RANGE OF THE WHITE-WINGED SCOTER

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ABSTRACT: Analysis of 50 years (1974/75–2023/24) of 123 Christmas Bird Counts along the east and west coasts of North America and in the Great Lakes region reveals a substantial decline of the White-winged Scoter (*Melanitta deglandi*) along the more southern segments of its winter range. All 16 of the California count circles examined showed a decline, which from Sonoma County south averaged 8.5% per year over the 50 years. The segment from Washington to northwestern California saw a smaller but still significant decline of 2.2% per year, while on counts in British Columbia and Alaska White-winged Scoter numbers increased slightly, at rate of 1.4% per year. On the east coast, from New Jersey south to Florida, White-winged Scoter numbers declined 5.8% per year, as well as in 18 of the 22 count circles in that segment. The northern and central segments of the east coast showed smaller but significant declines of 1.4 and 0.6% per year, respectively. The Great Lakes host fewer wintering White-winged Scoters than does either coast; Christmas Bird Count data from that region showed no clear trend. It is unclear whether our findings reflect a decline in the White-winged Scoter's population rangewide, a northward shift in the coastal nonbreeding range into areas not well surveyed by Christmas Bird Counts, or combination of the two. The increase in sea-surface temperatures on both coasts of approximately 1° C since the 1970s may be a factor.

Christmas Bird Count (CBC) data can reveal information about changes in the nonbreeding status and distribution of birds on large geographic and temporal scales. For species that are difficult to census in their breeding range, such as the White-winged Scoter (*Melanitta deglandi*), CBC data can provide information about population changes otherwise unavailable. The White-winged Scoter breeds across a wide swath of the boreal region of North America from Alaska east through the Yukon, Northwest Territories, much of northern Manitoba, Saskatchewan, and Ontario to northernmost Quebec (Brown and Fredrickson 2020, Bianchini et al. 2023). The species winters mainly along both North American coasts south through California in the west and south to Florida in the east (Brown and Fredrickson 2020). Smaller numbers winter in the Great Lakes, and a few birds winter along the coast of the Gulf of Mexico from Florida to Texas (Brown and Fredrickson 2020). Wintering White-winged Scoters are also found occasionally on other large lakes, but such occurrences are uncommon to rare. There are few CBCs in the northernmost portions of the winter range, but in the U.S. both coasts are well surveyed by large numbers of count circles, many of which have been covered regularly for several decades.

Brown and Fredrickson (2020) concluded that the available data are "inadequate to determine an overall population trend" for the White-winged Scoter. Data from regional surveys on the breeding grounds, migration counts, and numbers taken by hunters (Bellrose 1980, Krementz et al. 1997, NAWMP 2004, Nisbet et al. 2013, Birds Canada 2024) suggest a decline, which has been variously described as "moderate" (Birds Canada 2024) to "steep" (NAWMP 2004). Nisbet et al. (2013) noted that the numbers of wintering White-winged Scoters reported on CBCs from the Bay of Fundy south to Florida from 1967 to 2004 were much lower than those reported by older sources. On the west coast winter numbers have also been reported to have decreased since the early 1970s in several California counties, including Humboldt (Harris 2005), Sonoma (Bolander and Parmeter 2000), Monterey (Roberson 2002), Orange (Hamilton and Willick 1996), and San Diego (Unitt 2004). Along the Oregon coast, however, Marshall et al. (2003) did not note any decline in wintering White-winged Scoters. Combined counts for all scoter species in Washington state decreased from the late 1970s to the 1990s (Wahl et al. 2005), but no separate data for the White-winged Scoter were reported.

Although local and largely anecdotal reports suggest a decline in the winter population of this species at the southern ends of its range, no thorough review of the White-winged Scoter's winter status and distribution has been published. To address this question, we reviewed 50 years of CBC data from the west and east coasts of North America and the Great Lakes region.

METHODS

CBC data can be useful for detecting avian population trends and changes in distribution, but factors such as inconsistent observer effort must be considered (Sauer and Link 2002). The usual approach to normalizing CBC data uses party-hours as a proxy for effort and assumes a positive relationship between total party-hours and the probability of detections of the target species (Bock and Root 1981, Butcher and McCullock 1988, Sauer and Link 2002). This method can provide useful trend estimates for species that are relatively common and broadly distributed within a count circle, such as the Red-tailed Hawk (*Buteo jamaicensis*; Sauer and Link 2002). For species that are restricted to specific areas within a circle, however, the probability of detection may be unrelated to total party hours because even a single party may be able to detect all individuals observable within any given CBC circle (Bock and Root 1981, Butcher and McCulloch 1988), provided the specific habitat is surveyed. The White-winged Scoter is an example of the latter type of species, because of its restriction to coastal habitats near shore. Each count circle that includes such habitats may have only one or a few specific locations where this species can be observed. Therefore, we chose to use the total number of White-winged Scoters detected within a CBC count circle for our analyses without attempting to normalize the data for survey effort.

We chose to begin our 50-year analysis period with the CBC's year 75 (winter 1974–75) because during this interval the number of counts repeated consistently was sufficient to provide good coverage of most of the White-winged Scoter's winter range on both the U.S. and southern Canadian coasts. To ensure we were using CBC circles within the species' regular core winter range, we used only circles that averaged 10 or more White-winged Scoters per year for at least one of the five decades covered by our 50-year dataset. To ensure we were using counts that had been run consistently over the entire period, we restricted our analysis to those conducted in at least 6 of the 10 years during each of the five decades our study period encompassed. Nearly all of the circles we used (118 of 123; 96%) had a count in at least 45 of the 50 years. Following these criteria, we were able to analyze data from 123 CBC circles in three regions of the species' winter range: the eastern and western coasts of Canada and the U.S. and the Great Lakes (Figures 1 and 2). The names and codes of each count circle used in each region and subregion are in Table 1.

To evaluate trends and compare regional differences, we first divided each set of coastal counts into three subregions (north, central, and south), to which we allocated roughly equal numbers of count circles (see Figures 1

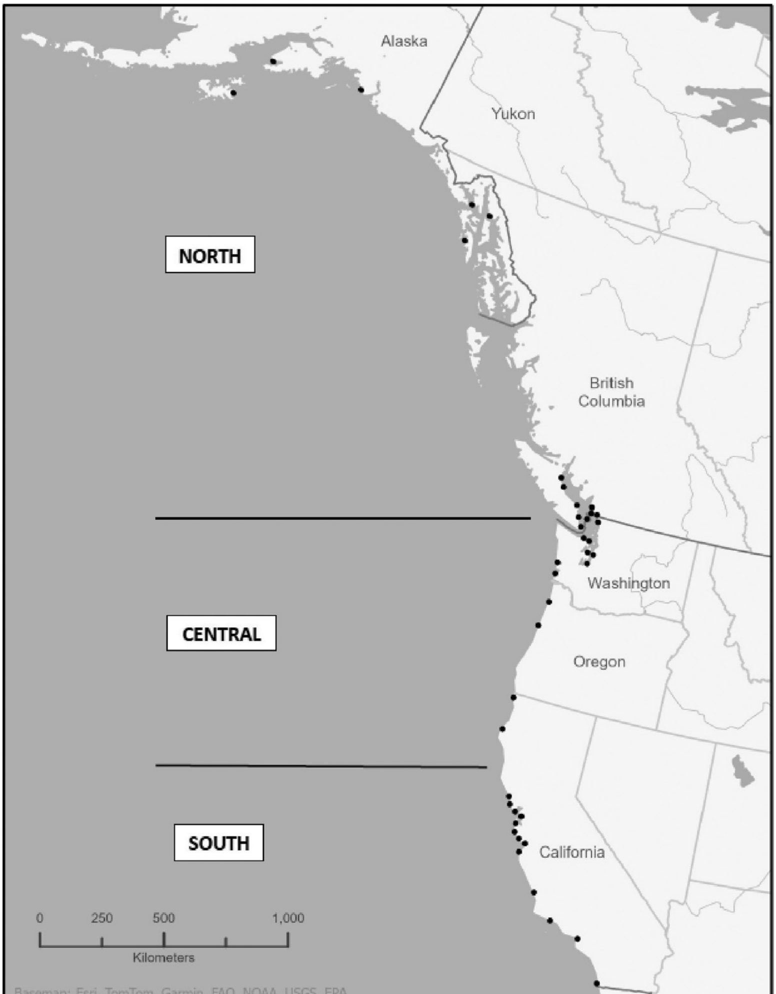

FIGURE 1. Locations of Christmas Bird Count circles analyzed for trends in the White-winged Scoter along the west coast of North America. Circles are shown to scale.

Table 1 Christmas Bird Count Circles Analyzed for Trends in the White-winged Scoter[a]

North		Central		South	
Code	Name	Code	Name	Code	Name
West coast[b]					
AKCO	Cordova	BCDU	Duncan	CAWS	Western Sonoma County
AKHO	Homer	BCVI	Victoria	CAPR	Point Reyes Peninsula
AKGB	Glacier Bay	WASD	Sequim-Dungeness	CAMC	Marin County (south)
AKJU	Juneau	WAPT	Port Townsend	CAOA	Oakland
AKKO	Kodiak	WAKC	Kitsap County	CACS	Crystal Springs
AKSI	Sitka	WASE	Seattle	CAAN	Año Nuevo
BCCR	Campbell River	WATA	Tacoma	CASC	Santa Cruz County
BCCO	Comox	WAGH	Grays Harbor	CAMD	Moss Landing
BCVA	Vancouver	WALP	Leadbetter Point	CAMP	Monterey Peninsula
BCNN	Nanaimo	ORTB	Tillamook Bay	CAMR	Morro Bay
BCWR	White Rock-Surrey-Langley	ORYB	Yaquina Bay	CASB	Santa Barbara
BCLA	Ladner	CADN	Del Norte County	CALA	Los Angeles
BCPI	Pender Islands	CACB	Centerville Beach to King Salmon	CAOC	Orange County (coastal)
WABG	Bellingham			CASD	San Diego
East coast[b]					
NLCR	Cape Race	RINC	Newport County-Westport	NJSH	Sandy Hook
NBCT	Cape Tormentine	RISK	South Kingstown	NJLB	Long Branch
NSKI	Kingston	MAMV	Martha's Vineyard	NJLA	Lakehurst
MEEA	Eastport	CTNL	New London	NJBA	Barnegat
MESP	Schoodic Point	CTNH	New Haven	NJOC	Oceanville
MEMD	Mount Desert Island	CTOL	Old Lyme-Saybrook	NJMA	Marmora
NSBI	Brier Island	MANA	Nantucket	MDLK	Lower Kent County
NSBC	Broad Cove	MATI	Tuckernuck Islands	NJCM	Cape May
NSYA	Yarmouth	RIBI	Block Island	DECH	Cape Henlopen-Prime Hook
MEPA	Greater Portland	CTSM	Stratford-Milford	MDST	St. Michaels
MEBK	Biddeford-Kennebunkport	CTWE	Westport	DERE	Rehoboth
MEYC	York County	NYOR	L.I.: Orient	MDOC	Ocean City
NHCS	Coastal New Hampshire	CTGS	Greenwich-Stamford	MDPL	Point Lookout
MANE	Newburyport	NYMK	L.I.: Montauk	VACI	Chincoteague N.W.R.
MACA	Cape Ann	NYSM	L.I.: Smithtown	VAWP	Wachapreague
MAGB	Greater Boston	NYBW	Bronx-Westchester Region	VAMA	Mathews
MAQU	Quincy	NYNN	L.I.: Northern Nassau County	VACC	Cape Charles
MAMA	Marshfield	NYQW	L.I.: Quogue-Watermill	VANN	Newport News
MAPL	Plymouth	NYCS	L.I.: Central Suffolk County	VALC	Little Creek
MACC	Cape Cod	NYCA	L.I.: Captree	VABB	Back Bay N.W.R.
MABB	Buzzards Bay	NYSN	L.I.: Southern Nassau County	NCBP	Bodie-Pea Island

(*continued*)

North		Central		South	
Code	Name	Code	Name	Code	Name
MANF	New Bedford	NYBR	L.I.: Brooklyn	SCHH	Hilton Head Island
Great Lakes[c]					
ILEN	Evanston (north shore)	ONBP	Bruce Peninsula N.P.	ONPE	Prince Edward Point
INID	Indiana Dunes State Park	ONHA	Hamilton	ONPH	Peel-Halton Counties
MIBE	Beulah	ONKP	Kettle Point	ONTO	Toronto
MIMU	Muskegon	ONNF	Niagara Falls	PAER	Erie
WIMI	Milwaukee	ONOW	Oshawa	NYRH	Rochester
ONBL	Blenheim				

[a]The first two letters of each code (assigned by the National Audubon Society) specify the state or province.
[b]Circles listed north to south for each subregion.
[c]Circles listed from west to east.

and 2 for the regions and Table 1 for the count circles included in each region). We then examined the trend for each subregion by using the average number of White-winged Scoters per count circle (total White-winged Scoters for a given year divided by number of circles counted that year) as the response variable, and year as the independent variable. Then, because the data are nonparametric, we analyzed the trends by Poisson (log-linear) regression with XLSTAT (www.xlstat.com/).

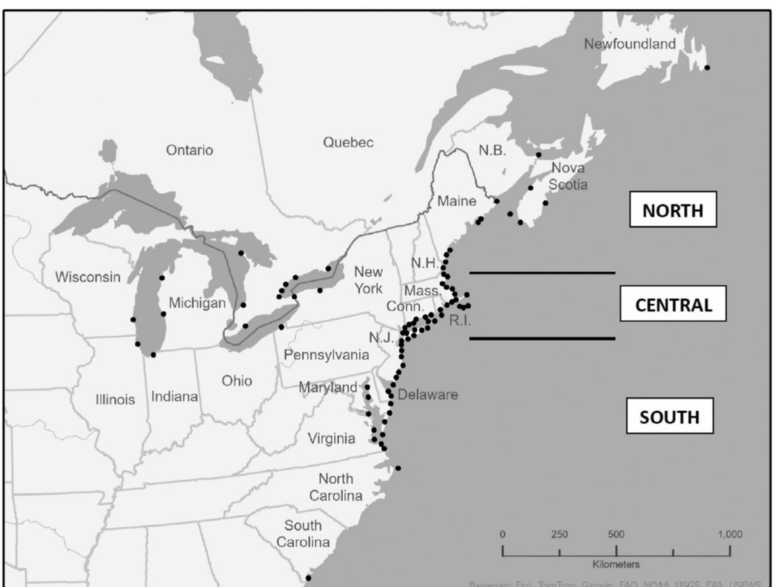

Figure 2. Locations of Christmas Bird Count circles analyzed for trends in the White-winged Scoter along the east coast of North America and around the Great Lakes. Circles are shown to scale.

We also compared data for each individual circle for the first half of the 50-year period (1974/75 through 1998/99) to the second half of the period (1999/2000 through 2023/24).

RESULTS

Christmas Bird Count data for the west coast showed a substantial decline in the number of White-winged Scoters in the southern portion of the nonbreeding range, a smaller but still significant decline in the central portion, and a slight increase in the northern portion (Table 2 and Figure 3). The declines on California counts (which compose all of the west coast southern subregion and two in the central region), were the most dramatic. Each of the 16 California count circles also showed a decrease in scoter numbers from the first to the second half of the period, and those declines ranged from 75 to 98%.

We saw a similar pattern on the east coast with the largest declines in the southern regions (Table 3 and Figure 4). Of the 22 count circles south of New York (i.e., the southern subregion), 19 showed declines in White-winged Scoters between the first and second halves of the 50-year period. The central and northern portions also showed significant declines, but these were not as substantial as those in the southern portion.

Results from counts on the Great Lakes showed no clear trend. It appeared that White-winged Scoter numbers were generally higher in the mid-1990s, as the four highest tallies for the 50-year period fell between 1993 and 1997 (Figure 5).

DISCUSSION

Our results confirm that over the past 50 years the White-winged Scoter has declined in the southern portions of its range along both coasts. Along the west coast, the species has nearly disappeared as a regular wintering species in southern California. It has also declined along the east coast, most steeply south of New York. Increased numbers on the British Columbia and Alaska CBCs may be an indication of a northward shift in the nonbreeding range, but that region has only a few widely scattered CBCs. The lack of intensive CBC coverage along the northern portions of both coasts makes it impossible to confirm if our findings represent a decline in the overall population of the species, a shift of the winter range, or a combination of both factors.

A decline in winter numbers in the Great Lakes in the 1970s (Bellrose 1980) was followed by an increase (Brown and Fredrickson 2020), which may have been linked to an increase in the non-native Zebra (*Dreissena polymorpha*)

Table 2 Annual Percent Change in Numbers of the White-winged Scoter on West Coast Christmas Bird Counts, 1974/75–2023/24[a]

Region	Trend	Lower limit 95% CI	Upper limit 95% CI	r^2	*p*
North	1.4%	1.3%	1.5%	0.32	<0.0001
Central	−2.2%	−2.3%	−2.0%	0.34	<0.0001
South	−8.5%	−8.9%	−8.1%	0.67	<0.0001

[a]By Poisson regression analysis.

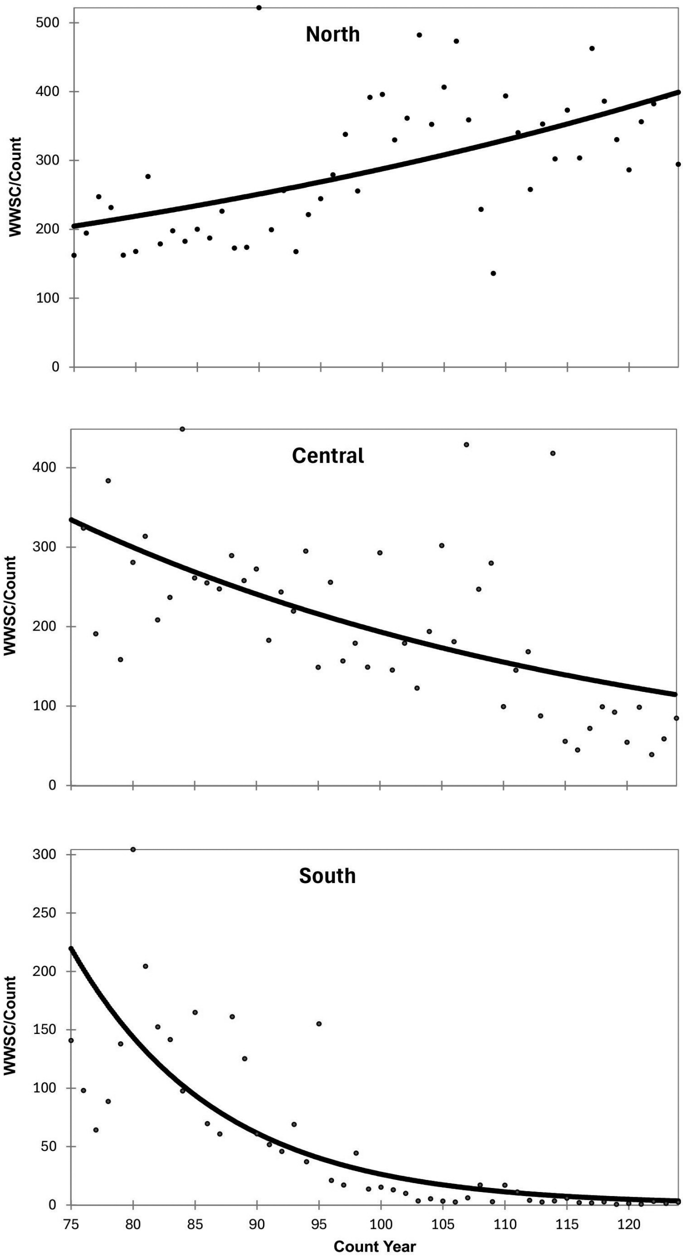

Figure 3. Numbers of the White-winged Scoter on west coast Christmas Bird Count circles with the Poisson regression trend line.

Table 3 Annual Percent Change in Numbers of the White-winged Scoter on East Coast Christmas Bird Counts, 1974/75–2023/24[a]

Region	Trend	Lower limit 95% CI	Upper limit 95% CI	r^2	p
North	−0.6%	−0.7%	−0.4%	0.05	<0.0001
Central	−1.4%	−1.5%	−1.3%	0.17	<0.0001
South	−5.8%	−6.2%	−5.5%	0.51	<0.0001

[a]By Poisson regression analysis.

and Quagga (*D. bugenis*) mussels invading the Great Lakes region (Brown and Fredrickson 2020). The peak on CBCs around the Great Lakes in the mid-1990s is roughly consistent with the observations of Brown and Fredrickson (2020).

Although Nisbet et al. (2013) and Brown and Fredrickson (2020) speculated that the decline along the east coast may be related to excessive hunting, other factors may be important. A rapidly growing body of research confirms that many bird species are shifting their breeding and/or nonbreeding ranges poleward (e.g., Hitch and Leberg 2007, La Sorte and Jetz 2010, Meehan et al. 2019), with shifts in nonbreeding ranges typically happening faster than those in breeding ranges (Lehikoinen et al. 2021). Sea-surface temperatures have risen nearly 2° C in both the Atlantic and Pacific oceans since the start of the 20th century, and those increases in temperature have been particularly dramatic since the 1970s (EPA 2024). Perhaps this warming trend has made the southern edge of the White-winged Scoter's nonbreeding range less attractive, either directly or indirectly by reducing its prey.

It is also possible that the changes on CBCs reflect changes in the breeding range of the White-winged Scoters that winter the farthest south. Existing research (Houston and Brown 1983, Gurney et al. 2014, Meattey et al. 2018, Brown and Fredrickson 2020, Lepage et al. 2020, Bianchini et al. 2023) suggests that scoters breeding east from Saskatchewan winter in the Atlantic, whereas those breeding from central Saskatchewan west to Alaska winter in the Pacific. None of these studies, however, distinguished the breeding ranges of the birds wintering farthest north vs. farthest south along each coast. Thus we cannot compare the breeding ranges of subsets of the White-winged Scoter by latitude of wintering. Research on the species' migration strategy (chain vs. leap-frog migration) is needed before this question can be addressed.

Pollution is another factor to consider. The White-winged Scoter preys on mussels and other mollusks and invertebrates that often concentrate environmental contaminants (Goldberg 1975, Beyer et al. 2017). Pollution could thus depress scoter numbers either through direct effects on the birds or indirectly through effects on their prey. The coastal regions that saw the largest decline in the number of wintering White-winged Scoters (California and the southern segment of the eastern seaboard) are also the areas with the highest concentrations of human development and might also have the highest concentrations of such toxins. There have been a few studies of toxic contaminants in the White-winged Scoter (Wayland et al. 2008, Gurney et al. 2014, Brown and Fredrickson 2020 and citations therein); however, none has yet shown a clear link between burden of toxins and fitness or survival of the scoters. These studies analyzed birds from two sites in the breeding range (northern Northwest Territories and

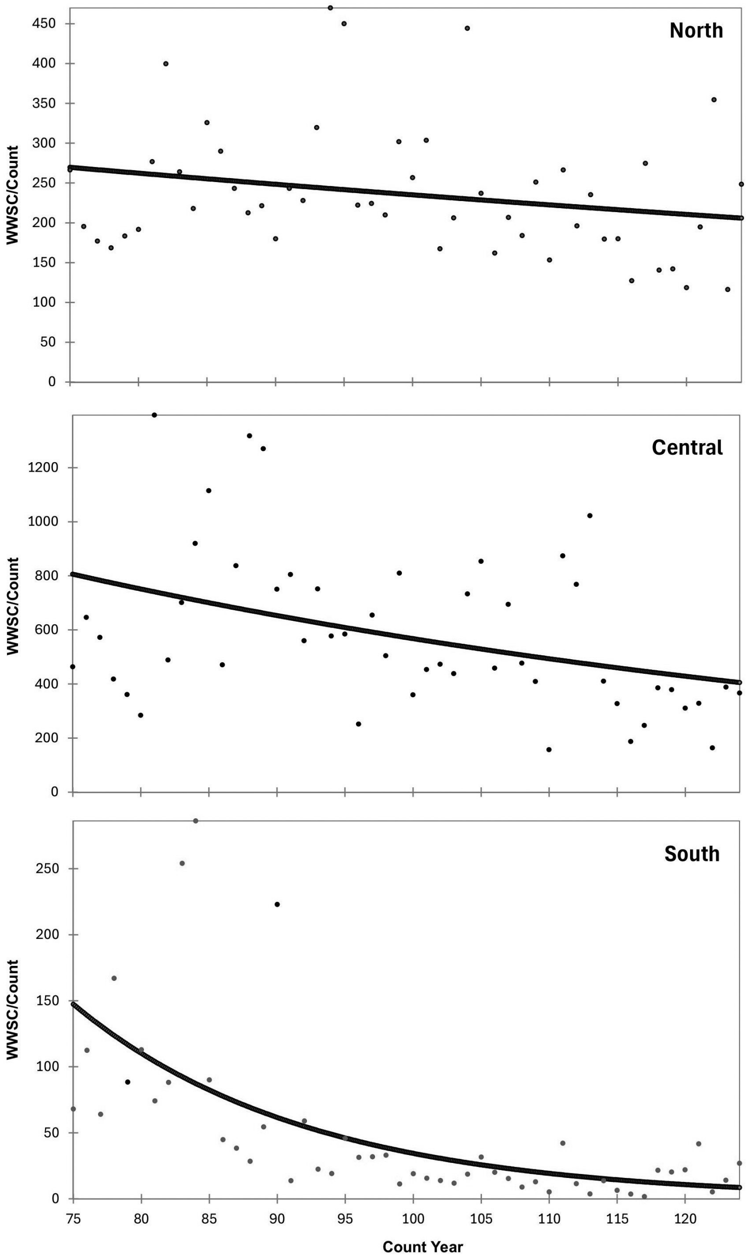

Figure 4. Numbers of the White-winged Scoter on east coast Christmas Bird Count circles with the Poisson regression trend line.

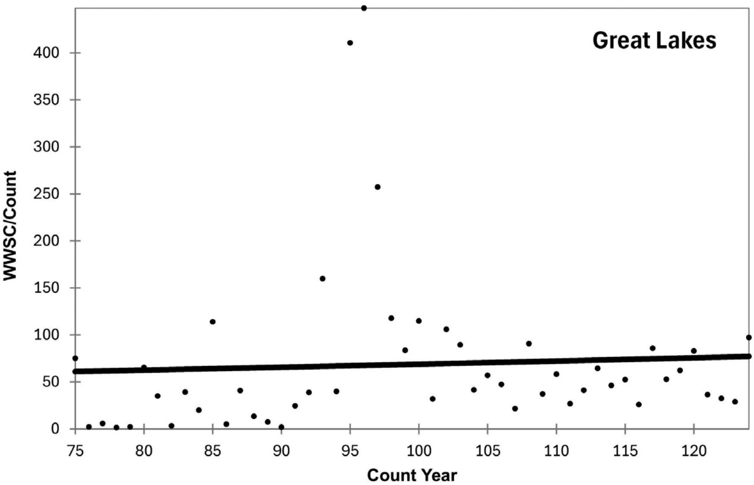

FIGURE 5. Numbers of the White-winged Scoter on Great Lakes Christmas Bird Count circles with the Poisson regression trend line.

south-central Saskatchewan, from which most breeding scoters are believed to migrate to the Pacific coast), and two sites in the winter range, Chesapeake Bay and Lake Ontario. Gurney et al. (2014) found levels of some heavy metals higher in the scoters wintering in the Atlantic than in those wintering in the Pacific, but much more study is needed to know if pollution is an important factor in the White-winged Scoter's declines.

It is important to be cautious about extrapolating results from a set of CBCs to the entire population of any species. Geographic coverage by CBCs is far from complete, and the circles are not randomly distributed. The nonrandom nature of the locations means that one cannot be certain that the habitat surveyed is representative of all available habitat. In each coastal circle, access to areas where a species such this scoter may be observed is limited to some degree. Although CBC circles are relatively plentiful along both the coasts of the conterminous United States, there are very few along either Canadian coast or in Alaska. It is also possible that some of the wintering scoters may be too far from shore to be easily observed. However, data from satellite-tracked White-winged Scoters in the east (Meattey 2018, Meattey et al. 2018) and anecdotal reports from the west (Harris 2005, eBird data from pelagic trips) suggest that the great majority are found near the coast, as one would expect for a species that forages largely on mollusks and other invertebrates taken from hard surfaces in shallow water (Brown and Fredrickson 2020). Nonetheless, when CBC data from a large number of circles over a long period show dramatic changes, these changes should not be discounted.

The most plausible hypothesis to explain these concurrent declines on both coasts at the southern edges of the nonbreeding range appears to be the increase in sea-surface temperatures. Nevertheless, more work is needed to understand the effects of toxic contaminants, as well as the locations of the breeding ranges of the most southerly wintering White-winged Scoters.

During first two decades of our analyses the data show wide year-to-year variations in the numbers of wintering White-winged Scoters in the southern regions of both coasts, and these variations are supported by anecdotal observations (J. Morlan, P. Unitt, pers. comm.). It would be interesting to look for correlation between annual sea-surface temperatures and those fluctuations. A strong correlation might reveal the key temperature threshold above which the habitat becomes less attractive to these scoters.

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