A probable extralimital post-breeding assembly of Bufflehead *Bucephala albeola* in southcentral North Dakota, USA, 1994-2002

L.D. Igl

U.S. Geological Survey, Northern Prairie Wildlife Research Center, 8711 37th Street S.E., Jamestown, North Dakota 58401, USA.
larry_igl@usgs.gov

The Bufflehead *Bucephala albeola* breeds predominantly in Canada and Alaska (USA). Evidence suggests that the species may have recently expanded its breeding range southward into central and south central North Dakota. This paper presents data on observations of Buffleheads during the breeding season in Kidder County, North Dakota, 1994-2002, and discusses the possibility that the species has not expanded its breeding range but rather has established an extralimital post-breeding staging area south of its typical breeding range.

Key Words: *Bucephala albeola*, Bufflehead, distribution, post-breeding, Prairie Pothole Region, precipitation, North Dakota

The Bufflehead *Bucephala albeola* is a small, cavity-nesting duck that breeds predominantly in the boreal forest and aspen parkland regions of northern North America (Erskine 1972; Gauthier 1993 and references therein). The species's primary breeding range occurs in Canada and Alaska and extends southward into the conterminous United States in North Dakota, Montana and Washington. About two-thirds of the breeding population occurs in British Columbia and Alberta. Isolated breeding populations also occur or formerly occurred in California, Colorado, Idaho, Montana, Oregon, Washington and Wyoming.

In North Dakota, the breeding range of the Bufflehead is restricted largely to the fresh or slightly brackish, tree-bordered, semi-permanent and permanent wetlands in the Turtle Mountain region (Stewart 1975). This small region in extreme north central North Dakota (and southwestern Manitoba) covers about 0.6% (1,010km^2) of the

total area of North Dakota (**Figure 1**). The region is named for its hummocky and irregular topography that formed from the collapse of superglacial sediment (Bluemle 1991). The forests of this region closely resemble the fire sub-climax forest communities in the boreal region toward the north in Canada (Stewart 1975).

Stewart (1975) listed the breeding status of the Bufflehead as uncommon in the Turtle Mountain region of North Dakota. Elsewhere in North Dakota, the species is a common migrant, with only a few non-breeding stragglers lingering into the breeding season. Nesting records outside the Turtle Mountains in North Dakota have been historically rare (two records: Schroeder 1966; Stewart 1975; R.E. Martin, North Dakota Birding Society, pers. comm.), because landscapes outside the Turtle Mountains are largely dominated by agriculture and grasslands and mostly devoid of suitable nesting habitat and nest sites.

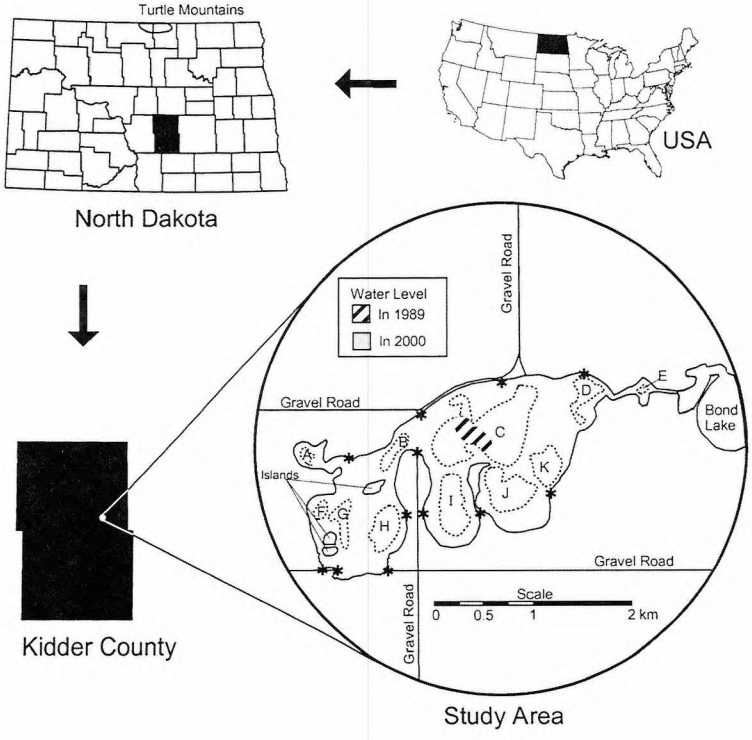

Figure 1. Amalgamated wetland in central Kidder County, North Dakota, that was used by post-breeding assemblies of Bufflehead in late June and early July 1994-2002. Dashed lines indicate original eleven wetland basins. The cross-hatched area in wetland C indicates the extent of water in 1989, and the shaded area shows the extent of water in 2000. The maximum water depth within this cross-hatched area was 15.2cm in 1989 and 487.7cm in 2000. Water began flowing from Bond Lake to the amalgamated wetland in 1994 and ceased in September 2000.

Data from the North American Breeding Bird Survey (BBS) indicated that Bufflehead populations in the Turtle Mountain region increased significantly between 1981 and 2002 (Sauer *et al.* 2003), and the species is now considered common in that region (R.E. Martin, pers. comm.). The North American BBS is a programme of standardised roadside surveys conducted once each year between late May and early July. Breeding Bird Surveys have been conducted annually in North Dakota since 1967, and there are currently 44 active BBS routes throughout the state. Prior to 1994, Buffleheads were recorded only on the BBS route in the Turtle Mountain region in North Dakota (Sauer *et al.* 2003). Between 1994 and 2002, BBS observers recorded Buffleheads on five additional survey routes in North Dakota, which extended the species's current breeding range to south central North Dakota (Sauer *et al.* 2003). In 1994, during grassland breeding bird surveys in adjacent upland habitats (Johnson & Igl 1995, 2001), Buffleheads were noted in several wetlands in south central North Dakota in late June and early July, when Buffleheads are assumed to be nesting. To gain a better understanding of the status of the Bufflehead in this region during the breeding season, the numbers of Buffleheads using one large wetland that bordered (or inundated) three focal grassland fields were examined during a nine-year period, 1994-2002.

Methods

Study area

Kidder County is located in the Prairie Pothole Region of south central North Dakota (**Figure 1**). Land use in the county is dominated by annual crops, livestock production and perennial grassland cover established under the Conservation Reserve Program. Woody vegetation is limited primarily to scattered linear tree plantings around farmsteads and some agricultural fields and small natural wooded draws on slopes. The climate of Kidder County is semi-arid, and annual precipitation averages 43cm (Seelig & Gulsvig 1985). Precipitation, however, can be highly variable from one year to the next. For example, the period between 1988 and mid-1993 was the second driest period in North Dakota during the twentieth century, whereas annual precipitation between mid-1993 and 1999 may have been the wettest period in North Dakota during the past 130-500 years (NOAA 1988-2002; Williams-Sether *et al.* 1994; Williams-Sether 1999; Winter & Rosenberry 1998).

The landscape of Kidder County is dotted with numerous wetland basins. These depressional wetlands, called prairie potholes, contain water for various lengths of time in most years (Kantrud *et al.* 1989). Their size, permanence, hydrology, water chemistry, plant associations and invertebrate communities vary widely among wetlands and, within a basin, over time

(Kantrud *et al.* 1989). Between 1994 and 2002, Buffleheads were surveyed on one large, slightly brackish wetland (99°39'W, 47°5'N) that formed after flooding (generated by above-average precipitation, run-off and overflow from the adjacent Bond Lake) inundated and coalesced 11 temporary, seasonal and semi-permanent wetland basins and adjacent upland habitat (**Figure 1**). During the drought in the late 1980s and early 1990s, most of the original 11 basins dried up or were greatly reduced in size (H.F. Duebbert, pers. comm.). In 1989, only one of the 11 wetlands contained surface water, with a maximum water depth of 15.2cm and area of 6.7ha. By 2000, the maximum water depth at the same approximate location was 487.7cm, and the overall wetland size was 321 ha (excluding Bond Lake). One of the focal grassland fields was partially inundated with water in 1994, and by 2000 consisted of two small islands of grassland in the southwest corner of the amalgamated wetland. A second field was partially inundated with water from the wetland, beginning in 1999 and continuing into 2002. The rapid rise in water level drowned out most emergent vegetation in the amalgamated wetland, and the wetland currently functions as an open-water lake.

Description of Bufflehead surveys

Buffleheads were surveyed by using binoculars or a spotting scope at 12 vantage points (denoted by * in **Figure 1**) around the amalgamated wetland (excluding Bond Lake). The same observation points were used each year, and the distribution of observation points and surrounding topography permitted coverage of the entire amalgamated wetland basin. Adult drakes were tallied separately from females and subadults. Females, subadult males, and subadult females were tallied together because at long distances yearling males and females are generally indistinguishable from adult females (Gauthier 1993). Care was taken to avoid flushing birds or duplicating counts. Available time and personnel limited the surveys to a single count on one day each year in late June or early July, corresponding to the day of the grassland bird surveys in the adjacent upland grassland habitats. However, in 1999, Buffleheads were also surveyed in the focal wetland at approximately monthly intervals (average 30.3 days between surveys) from 2 April to 30 October. The wetland was not surveyed 30 days before or after this period because the wetland surface was frozen. The numbers of Buffleheads that were visible on nearby wetlands were also recorded while the observer was travelling by vehicle between vantage points, but there was no attempt to count all the Buffleheads in the area. In addition, on 3 July 2001, a roadside survey was conducted on 25.7km of gravel roads within 3.2km of the centre of the focal wetland and the total numbers of Bufflehead males and females/subadults were counted within 400m of either side of the road (not including the focal wetland).

Results

In late June to early July 1994-2002, 16 to 284 (average: 99.3) Buffleheads were observed on annual counts on the amalgamated wetland. Most (86%) of these observations were of adult males, although females/subadults were observed in each year (**Table 1**). The birds were observed swimming, foraging/diving, loafing on shore, resting on water, preening or performing other comfort behaviours (eg upward stretch, wing-flapping; see McKinney 1965; Erskine 1972). No Bufflehead broods were recorded, nor was there strong evidence of pair-forming or pair-maintaining behaviours (see Erskine 1972), when males and females/subadults were observed together. Individual birds were dispersed throughout the amalgamated wetland; occasionally birds occurred together in loose flocks (up to 22 birds). Many adult males sported their alternate (nuptial) plumage, but many appeared to have undergone some degree of body and head moult. Several Buffleheads were observed flying, indicating that at least some of the birds were capable of flight and were not yet undergoing wing moult.

In 1999, the focal wetland was visited at approximately 30-day intervals (**Table 2**). Adult males and female/subadults showed similar

Table 1. Observations of Buffleheads in an amalgamated wetland in Kidder County, North Dakota, in late June and early July, 1994-2002.

Date	No. of adult males	No. of adult females and subadults	No. of Buffleheads observed incidentally in other wetlands
29 June 1994	25	3	1
29 June 1995	44	7	16
29 June 1996	77	19	16
26 June 1997	72	15	3
25 June 1998	92	21	23
6 July 1999	281	22	27
4 July 2000	14	2	44
2 July 2001	107	17	72[1]
27 June 2002	74	12	70
Total	776	118	272[2]
Average/year	86.2	13.1	30.2

[1]On 3 July 2001, 1092 (952 males and 140 females/subadult) Buffleheads were counted during a roadside survey conducted on 25.7km of gravel roads in the vicinity of the focal wetland (focal wetland was not surveyed on this date).

[2]231 adult males and 41 females/subadults.

peaks during spring (after ice-thaw) and autumn (before freeze-up) migration, but adult males were most abundant during early summer.

It is important to note that Bufflehead observations were not limited to the focal wetland. In every year, Buffleheads also were noted in other nearby wetlands, although there was no attempt to count all of them; observations ranged from single birds through small groups of 2-5 birds to cohesive flocks of 24-63 birds (**Table 1**). During the roadside survey in 2001, 1,092 Buffleheads were recorded, including 952 adult males and 140 females/subadults. Observations ranged from single birds to a cohesive flock of 58 birds.

Discussion

The annual cycle of migratory waterfowl can be divided into four major periods: breeding, post-breeding, migration and wintering (Hohman *et al.* 1992). The early-summer observations of Buffleheads in south central North Dakota more closely coincide with the species's nesting or brood-rearing periods and the early post-breeding period than with the species's spring and fall migration periods (see Gauthier 1993). The Bufflehead is an early-spring and a late-autumn migrant (Gauthier 1993). Spring migration in North Dakota for adult Buffleheads typically begins between late March and early April, when the first wetlands become ice-free (median

Table 2. Monthly observations of Buffleheads in an amalgamated wetland in central Kidder County, North Dakota, in 1999.

Date	No. of adult males	No. of adult females and subadults	No. of Buffleheads observed incidentally in other wetlands
1 March[1]	0	0	0
2 April	22	17	63
3 May	2	12	0
3 June	1	0	0
6 July	281	22	27
5 August	40	1	10
3 September	4	0	1
1 October	10	12	16
30 October	9	3	32
1 December[1]	0	0	0

[1]Water surface frozen.

first arrival date in study area, 1965-2002: 7 April; L.D. Igl, unpublished data). Adults begin appearing on their breeding grounds in Canada from early April in the southern portion of their breeding range to early May in the northern breeding areas (Gauthier 1993). Subadults migrate to their northern summering areas several weeks later than adults, usually in early May, although some might linger in southern areas into early June (Erskine 1972). Fall migration generally begins in mid-October during the onset of winter conditions in the breeding areas and proceeds rapidly toward the south (Erskine 1972; Gauthier 1993).

Although spring arrival and breeding occur later at the northern edge of the species's range (Gauthier 1993), nearly all breeding begins within a month after Buffleheads arrive on their breeding grounds (Erskine 1972). For nesting habitat, female Buffleheads favour old tree cavities, usually those excavated by the Northern Flicker *Colaptes auratus* (Gauthier 1993), a medium-sized woodpecker that commonly breeds in North Dakota (Igl & Johnson 1997; Igl *et al.* 1999) and throughout much of North America (Moore 1995). The presence of *Populus* near water is a frequent feature of Bufflehead breeding habitat (Gauthier 1993), and Erskine (1972) reported that most Bufflehead nest cavities are usually within 200m of water. The lack of broods and breeding pairs during the late June/early July surveys in Kidder County and the absence of *Populus* stands near most wetlands in the area indicate that this is not an established nesting area.

Erskine (1972) suggested that there was no evidence of a breeding range expansion for this species during the last century and that the breeding distribution has probably contracted along its southern margin, especially in the northern prairie regions. Intensification of agricultural practices in prairie regions in Canada has reduced the amount of suitable nesting habitat for Buffleheads, and Buffleheads are rarely observed breeding south of the closed forest in Saskatchewan in central Canada. The species also appears to be declining in the boreal fringe of western Canada due primarily to recent habitat losses resulting from forest clearing, wetland drainage and agricultural development (eg Cumming *et al.* 2001). Whitt (1999), however, implied that the high water levels during the recent wet period may have increased the number of dead and dying trees in South Dakota (which also occurs in the Prairie Pothole Region), thus providing increased nesting opportunities for the Bufflehead outside its usual nesting areas. Although the recent wet period in North Dakota reduced stands of emergent vegetation and killed peripheral trees in many wetlands in the region, including this wetland (L.D. Igl, pers. obs.), suitable nesting habitat is still limited in the study area and most of North Dakota. There have been no records of Bufflehead nesting outside the Turtle Mountain region in North

Dakota since 1994, when the wet period began (R.E. Martin, pers. comm.). Thus, the species does not appear to be expanding its nesting range southward into south central North Dakota in response to the increase in wetland area, water depth or nesting trees.

The preponderance of adult males in the focal wetland and surrounding wetlands, the lack of evidence of breeding and the timing of the observations suggest that this area is being used as an early post-breeding staging area, mostly by adult males but also by some females or subadults. Hohman *et al.* (1992, p.155) defined post-breeding migration or moult migration as "a regular seasonal movement of individuals that occurs in a time frame between breeding and fall migration, typically involving movement from breeding areas to special sites where wing molt occurs". When adult female Buffleheads begin incubation in June and July, adult males leave their territories and gather in staging areas on favoured lakes with other post-breeding drakes (Munro 1942; Erskine 1972; Gauthier 1993). The adult males are later joined by non-breeding subadults, unsuccessful females and females that have abandoned their broods. Small assemblies of post-breeding Bufflehead drakes have been observed as early as late May in Canada, but details of post-breeding movements and moulting areas of Buffleheads are poorly known (Munro 1937, 1942; Erskine 1972; Gauthier 1993). Munro (1937, 1942) reported that most Bufflehead drakes leave their breeding areas in British Columbia in June, but the locations of their moulting areas are largely unknown. Moulting males have been observed in small groups on large lakes close to nesting areas (Erskine 1972; Gauthier 1993). Munro (1942) found that adult and yearling males were absent from breeding areas for 4-6 weeks during the peak of the moult in British Columbia. Drakes of several diving duck species in North America are known to move northward at the end of breeding and gather to moult in large flocks on lakes in the southern boreal forest region (Bailey 1983). Because adult male Buffleheads reappear on the breeding grounds before fall migration, Erskine (1972) speculated that males do not leave the interior of Canada to moult on the coast or south of the U.S.-Canada border. Observations of staging Buffleheads in south central North Dakota in late June/early July suggest that at least some individuals may move south of their usual nesting areas during the post-breeding period. Origins and destinations of these birds were not known, but breeding locations were almost certainly north of south central North Dakota. Similarly, R.E. Martin (pers. comm.) observed 135 Buffleheads on a wetland in Ramsey County, North Dakota, southeast of the Turtle Mountains on 30 June 2002. Hohman *et al.* (1992) indicated that post-breeding movements of Buffleheads were typically less than 100 km from their breeding sites. The

observations of staging Buffleheads in south central North Dakota were about 180km south of the Turtle Mountains (**Figure 1**), the closest breeding population in the region.

In general, Buffleheads exhibit strong site fidelity. Adult Buffleheads are highly tenacious to former breeding and wintering sites (Erskine 1961, 1972; Limpert 1980; Gauthier 1990, 1993), subadult females are strongly philopatric to natal sites (Erskine 1961), and adult females will often re-use nest sites in subsequent years (Erskine 1972). The extent of site fidelity to post-breeding areas is unknown for most waterfowl species, although some wetlands are traditionally used by post-breeding flocks (Hohman *et al.* 1992). Although it is unknown whether the same individuals returned in subsequent years to this post-breeding staging area in south central North Dakota, use of this extralimital area in consecutive years indicates that at least some individuals might have had previous knowledge or experience with this site and suggests that the species might develop a certain degree of fidelity to post-breeding staging areas. Hohman *et al.* (1992) hypothesised that it would be advantageous for waterfowl to exhibit strong site fidelity to post-breeding areas given the potential benefits accrued by returning to familiar sites. Admittedly, it is unknown whether this post-breeding staging area in south central North Dakota was ever used during previous wet periods, but it is known that concentrations of Buffleheads were not observed in this area during the previous 2.5 decades of BBS surveys (Sauer *et al.* 2003).

The recent assembly of post-breeding Buffleheads in North Dakota probably resulted from a combination of factors, including the recent wet cycle and the concomitant changes in wetlands and food resources. Wetlands selected by post-breeding waterfowl generally have two common features: 1) semi-permanently or permanently flooded water regime, and 2) open water throughout the post-breeding period (Hohman *et al.* 1992). Habitat use by post-breeding waterfowl has been related to the distribution and abundance of food resources (Nilsson 1972; Stott & Olson 1973; Bailey & Titman 1984). Bailey & Titman (1984) speculated that variable water conditions in North American prairies may affect the distribution of suitable post-breeding habitat for waterfowl through changes in food resources. During the breeding season, Buffleheads feed primarily on aquatic invertebrates (insects, amphipods, crustaceans, molluscs) in open water (usually less than 3m deep) (Erskine 1972; Gauthier 1993), but nothing is known about the species's diet during the post-breeding period. The species might have responded to the increase in wetland numbers and wetland area (**Figure 2**; USFWS 2002a,b) and the build-up of aquatic invertebrates that typically occurs after the inundation of dry wetland basins (Euliss *et al.* 1999). Other bird species in North Dakota exhibited short-term, cli-

mate-related shifts in distribution and abundance (Igl & Johnson 1999) and in reproductive behaviour (Krapu *et al.* 2001) during the recent wet period. Given the large fluctuations in water conditions in this area in recent years and historically, the recent use of this post-breeding staging area is probably temporary. High annual variation in the use of traditional post-breeding areas has been documented in other species of waterfowl (eg Bartonek 1965; Bailey & Titman 1984).

In summary, data from surveys in Kidder County, North Dakota, indicate that 1) Buffleheads do not appear to be expanding their breeding range southward into south central North Dakota, 2) Buffleheads may move south of the U.S.-Canada border during the post-breeding period, 3) Bufflehead post-breeding assemblies can occur farther than 100km from breeding areas, 4) Bufflehead post-breeding staging areas may be used in more than one year, and 5) Buffleheads may be opportunistic in their selection of post-breed-

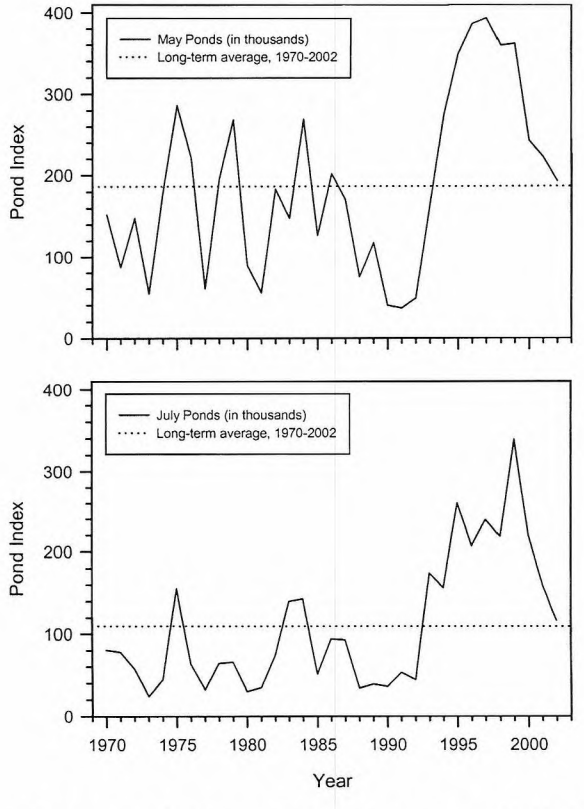

Figure 2. Estimates (in thousands) of May and July ponds in stratum 46, 1970-2002, of the Annual Pond survey conducted by the U.S. Fish & Wildlife Service (2002a,b).

ing staging areas. The remote nature of this post-breeding area in a prairie landscape is noteworthy, making this region an appealing candidate for a telemetry study on post-breeding movements of Bufflehead or a study on the factors that might contribute to post-breeding assemblies of Buffleheads. Advances in radio- and satellite-telemetry have provided recent insights into moult migrations and documented previously unknown moulting areas for several other species of Mergini (eg Barrow's Goldeneye *Bucephala islandica*; Robert *et al.* 2002).

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