The Prairie Naturalist Great Plains Natural Science Society

12-2009

A Partial Inventory of Islands in North Dakota: Potential for Breeding Waterfowl Management

Michael L. Szymanski

A Partial Inventory of Islands in North Dakota: Potential for Breeding Waterfowl Management

MICHAEL L. SZYMANSKI[1]

North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501, USA

ABSTRACT Islands can provide secure nesting habitat for ducks and other waterbirds, especially in agriculturally dominated landscapes. I inventoried natural and man-made islands in the portion of North Dakota covered by the Prairie Pothole Joint Venture (PPJV). I mapped 1,305 islands in this area; up to 46% of which could provide enhanced nest success with management (e.g., predator removal or establishment of brushy cover). Management of islands for breeding ducks may be an important method for achieving desired reproductive rates in the PPJV as substantial areas of perennial grass cover are lost from federal conservation programs, primarily the Conservation Reserve Program (CRP).

KEY WORDS *Anas platyrhynchos*, *Anas strepera*, *Aythya affinis*, duck nesting, nesting habitat, nesting island, North Dakota, predator management

Ducks nesting on islands often exceed reproductive levels needed for population maintenance (Duebbert 1966, 1982, Giroux 1981, Lokemoen et al. 1984, Cowardin et al. 1985, Klett et al. 1988, Aufforth et al. 1990, Lokemoen and Woodward 1992, Shaffer et al. 2006). Lokemoen and Woodward (1992) reported that duck nest success on natural islands increased approximately four-fold compared to nests in surrounding uplands. In addition to increased nest success, ducks occasionally nest on islands at exceptionally high densities (e.g. 585 nests/ha; Lokemoen et al. 1984, and 2,652 nests/ha; Dahl et al. 1999), especially in brushy cover comprised of western snowberry (*Symphoricarpos occidentalis*) or Wood's Rose (*Rosa woodsii*). Most nests are composed of species that are important to overall duck harvest or of special management concern (i.e., mallard [*Anas platyrhychos*], gadwall [*Anas strepera*] and lesser scaup [*Aythya affinis*]).

Maintaining predator-free islands during the nesting season generally requires little management (Duebbert et al. 1983). Lokemoen and Woodward (1992) recommended islands constructed for duck production should be >100 m from shore to deter visitation by nest predators and that resident predators could be controlled on islands >1.5 ha in size. Giroux (1981) recommended that islands be constructed at distances >170 m from shore for this same reason. Managing islands for duck production is one strategy for achieving target reproductive rates for several species of ducks breeding in agriculturally dominated landscapes (Dixon and Hollevoet 2005).

Lokemoen and Woodward (1992) evaluated use of natural islands and subsequent nest success by breeding waterfowl and other water birds. Because island creation can be expensive, they suggested the use of remote sensing technology to determine locations of natural islands that may benefit waterfowl production with further management.

My objectives were to map man-made and natural islands that would provide opportunity for waterfowl management in North Dakota, quantify numbers of islands by physiographic region, size, distance from shore, and accessibility to breeding ducks, describe a partial inventory of islands in the Prairie Pothole Joint Venture (PPJV) portion of North Dakota, and define criteria to select islands for predator removal.

METHODS

I detected islands in the PPJV of North Dakota by visually scanning the digital National Agriculture Imagery Program (NAIP) photos for North Dakota (U.S. Department of Agriculture (USDA) Farm Services Agency 2004). I scanned all photos at a scale of approximately 9,150 m and used a Geographic Information System (GIS) to delineate islands. These photos had a resolution of 2 m and were taken in August 2004, a year with average numbers of wetlands during 1989 to 2006 (Wangler and Reynolds 2007). I checked detection rates with a sample (n = 45) of small (0.11–1.09 ha), man-made islands with known locations (Dahl et al. 1999). I did not have a representative sample of islands larger than 1.09 ha with known locations to test detection rates, but I assumed that their detection probability was 1.

For the purpose of this inventory, I defined islands as any landmass completely surrounded by water during the inventory, ≥0.04 yet <64.5 ha in size (Lokemoen and Woodward 1992). I did not include islands that were embedded in stands of emergent vegetation that covered 50–100% of the area between the island and mainland. These islands were generally <100 m from shore, and more likely to be inhabited by transient mink (*Mustela vison*), thus reducing their benefit to nesting waterfowl (Aufforth e al. 1990, Willms and Crawford 1989, Lokemoen an

[1]Corresponding author. Email: mszymanski@nd.gov

Messmer 1994). Finally, islands were selected based solely on size and distance from shore; I did not account for groupings of islands that may result in "island hopping" by nest predators, assuming that islands within a group would either all be trapped or not trapped.

Upon detection of an island, I mapped vegetated portions of islands to exclude bare soil near the water's edge and represent potential nesting habitat. All islands were digitized at a scale of 305–1,830 m, depending on size. I also extracted approximately 200 islands from an existing GIS layer for meandered lakes in North Dakota. After digitizing, I calculated minimum distance (m) to mainland as determined by the water's edge on the NAIP photo, and determined whether islands were naturally occurring or man-made based on shape (random shape vs kidney bean, grouped and circular, rectangular, tear-drop, or peninsula cut-off). I determined waterfowl accessibility (number of breeding duck pairs/2.56 km^2) using the U.S. Fish and Wildlife Service Region 6 Habitat and Populations Evaluation Team (USFWS R6 HAPET) Breeding Duck Pair Accessibility GIS layer (see Reynolds et al. 2006 for its derivation) with data updated to 2007 (R. E. Reynolds, USFWS R6 HAPET, personal communication). I then calculated island size (ha) in the GIS, and assigned islands to physiographic regions (Fig. 1; adapted by USFWS R6 HAPET from Bluemle 1977).

Criteria for Predator Removal

I classified islands for their suitability for predator removal inferred from size and distance from shore based on recommendations by Lokemoen and Woodward (1992), Lokemoen and Messmer (1994), and Dahl et al. (1999). Relatively small islands (0.1–1.49 ha) at intermediate distances to shore (50–199 m) and larger islands (>1.5 ha) at distances >199 m from shore have the greatest potential to benefit from predator removal. Nest predators are less likely to be resident on islands <1.5 ha (Lokemoen and Woodward 1992) or visit islands at distances >199 m from shore (Lokemoen and Messmer 1994), eliminating the need to remove predators from small islands far from shore. The above criteria excluded very small islands (<0.1 ha). Moreover, larger islands (>1.49 ha) that are <200 m from shore may not be worthwhile for managers to trap as they may be frequently visited by transient nest predators and large enough to limit their likelihood of capture given brief periods of visitation.

RESULTS

I delineated 1,305 islands in the PPJV portion of North Dakota, totaling 1691 ha and ranging in size from 0.04 ha to 62.41 ha (Table 1). My detection rate for small, man-made islands was 0.84 ± 0.05 (SE). Based on island shape and distribution, I determined that 165 islands (138 ha) were man-made, representing 13% of all islands and 8% of the total island area; the Coteau Slope contained 36% of all man-made islands while the Drift Prairie had the greatest number of islands (n = 554; Table 1). However, the Turtle Mountains had the highest density of islands at 0.04 islands/km^2, followed by the Missouri Coteau (0.02 islands/km^2), Drift Prairie (0.01 islands/km^2), Coteau Slope (0.01 islands/km^2), and Red River Valley (0.001 islands/km^2).

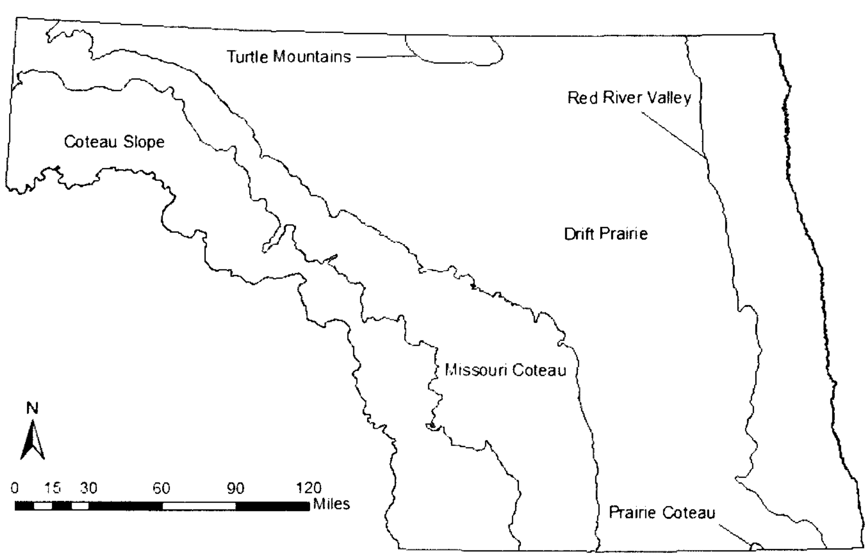

Figure 1. Physiographic regions within the Prairie Pothole Joint Venture portion of North Dakota.

Table 1. Frequencies of man-made (M) and natural (N) islands in the PPJV portion of North Dakota by physiographic region, size (ha) and minimum distance to shore (m). Shaded cells represent islands in scenarios that may be suitable for predator removal during the nesting season, based on size and distance from shore.

			Minimum Distance to Shore (m)					
Region	Type	ha	<50	50–99	100–199	200–499	>499	Total
Coteau Slope	M	<0.1	2	0	0	0	0	2
		0.1–0.49	4	9	16	21	2	52
		0.5–0.99	2	1	0	0	0	3
		3–9.99	0	2	0	0	0	2
		Total	8	12	16	21	2	59
Coteau Slope	N	<0.1	5	3	1	4	1	14
		0.1–0.49	7	10	9	7	9	42
		0.5–0.99	4	1	7	9	1	22
		1–1.49	1	4	2	2	3	12
		1.5–2.99	2	2	2	4	4	14
		3–9.99	2	4	1	4	5	16
		10–19.99	0	0	0	3	0	3
		>19.99	0	0	0	1	1	2
		Total	21	24	22	34	24	125
Drift Prairie	M	<0.1	0	1	8	4	0	13
		0.1–0.49	0	4	10	3	0	17

Table 1. Continued.

			Minimum Distance to Shore (m)					
Region	Type	ha	<50	50–99	100–199	200–499	>499	Total
Drift Prairie	M	0.5–0.99	0	1	0	1	0	2
		1–1.49	0	1	0	0	0	1
		3–9.99	1	3	2	0	0	6
		10–19.99	0	0	2	0	0	2
		Total	1	10	22	8	0	41
Drift Prairie	N	<0.1	27	21	11	4	0	63
		0.1–0.49	67	99	43	11	1	221
		0.5–0.99	31	26	14	8	6	85
		1–1.49	11	8	10	1	4	34
		1.5–2.99	8	11	19	10	7	55
		3–9.99	6	7	7	14	10	44
		10–19.99	1	2	0	1	2	6
		>19.99	0	0	0	2	3	5
		Total	151	174	104	51	33	513
Missouri Coteau	M	<0.1	6	5	7	0	0	18
		0.1–0.49	1	6	20	7	0	34
		0.5–0.99	1	1	3	1	0	6

Table 1. Continued.

Region	Type	ha	Minimum Distance to Shore (m)					Total
			<50	50–99	100–199	200–499	>499	
Missouri Coteau	M	1.5–2.99	0	1	0	0	0	1
		3–9.99	0	2	1	0	0	3
		Total	8	15	31	8	0	62
Missouri Coteau	N	<0.1	28	21	8	0	0	57
		0.1–0.49	92	85	38	9	0	224
		0.5–0.99	28	23	14	4	0	69
		1–1.49	10	7	9	0	0	26
		1.5–2.99	15	16	6	4	1	42
		3–9.99	4	7	6	5	0	22
		10–19.99	1	1	0	1	0	3
		>19.99	0	2	0	0	0	2
		Total	178	162	81	23	1	445
Red River Valley	M	0.1–0.49	0	1	2	0	0	3
		Total	0	1	2	0	0	3
Red River Valley	N	<0.1	2	0	2	0	0	4
		0.1–0.49	5	4	3	0	0	12

Table 1. Continued.

			Minimum Distance to Shore (m)					
Region	Type	ha	<50	50–99	100–199	200–499	>499	Total
Red River Valley	N	1–1.49	0	1	0	0	0	1
		1.5–2.99	0	0	1	0	0	1
		3–9.99	1	0	1	0	0	2
		Total	8	5	7	0	0	20
Turtle Mountains	N	<0.1	0	1	0	0	0	1
		0.1–0.49	3	6	5	2	0	16
		0.5–0.99	2	3	2	1	0	8
		1–1.49	0	4	1	0	0	5
		1.5–2.99	2	0	1	0	0	3
		3–9.99	1	1	1	1	0	4
		Total	8	15	10	4	0	37

Management of Islands

Based on size and distance from shore, nest success on 606 (46%) islands representing 862 ha, or 51% of all island area, in the PPJV portion of North Dakota may be improved by conducting predator removal during the nesting season. Furthermore, use of these islands by nesting ducks may be increased by establishment of brushy cover. Island densities benefiting from predator removal or brushy cover establishment followed similar trends among physiographic regions as total island densities (Table 1). According to the breeding pair accessibility map produced by the USFWS R6 HAPET office, 87% of all islands are accessible to relatively high densities of breeding pairs (>40 breeding pairs/2.56 km^2; Table 2).

DISCUSSION

I conducted this inventory using imagery from a year with average numbers of wetlands (Wangler and Reynolds 2007), however some former islands appeared to be submerged from record high waters of the late 1990s. Also, some former islands became peninsulas under 2004 conditions, and others were not mapped because they were in dry basins. However, given wetland conditions represented in the NAIP photography used, this inventory should account for most islands in the PPJV portion of North Dakota in most years, and provide reasonable estimates of their size and distance from shore.

Table 2. Frequencies of islands in the PPJV portion of North Dakota by number of breeding pairs of ducks/2.56 km^2, size (ha) and minimum distance to shore (m). Shaded cells represent islands in scenarios that may be suitable for predator removal during the nesting season, based on size and distance from shore.

		Minimum Distance to Shore (m)					
Pairs/2.56 km^2	ha	<50	50–99	100–199	200–499	>499	Total
<20	<0.1	3	0	2	0	0	5
	0.1–0.49	6	3	0	0	0	9
	0.5–0.99	5	0	0	0	0	5
	1–1.49	2	1	0	0	0	3
	1.5–2.99	1	0	0	1	0	2
	3–9.99	0	0	1	0	0	1
	Total	17	4	3	1	0	25
20–39	<0.1	10	4	2	0	1	17
	0.1–0.49	8	13	15	3	7	46
	0.5–0.99	4	2	6	8	2	22
	1–1.49	0	4	2	2	3	11
	1.5–2.99	2	0	3	5	6	16
	3–9.99	3	5	4	6	6	24
	10–19.99	0	0	2	2	0	4
	>19.99	0	0	0	1	0	1
	Total	27	28	34	26	26	141

Table 2. Continued.

		Minimum Distance to Shore (m)					
Pairs/2.56 km^2	ha	<50	50–99	100–199	200–499	>499	Total
40-59	<0.1	10	5	6	6	0	27
	0.1–0.49	20	38	29	13	3	103
	0.5–0.99	13	8	4	6	3	34
	1–1.49	6	6	1	1	3	17
	1.5–2.99	2	5	5	5	4	21
	3–9.99	4	6	3	5	5	23
	10–19.99	0	1	0	1	2	4
	>19.99	0	0	0	3	3	6
	Total	55	69	48	40	23	235
60–79	<0.1	13	13	9	2	0	37
	0.1–0.49	44	40	48	34	2	168
	0.5–0.99	18	12	8	4	1	43
	1–1.49	1	4	8	0	0	13
	1.5–2.99	6	5	10	4	1	26
	3–9.99	2	5	5	8	2	22
	10–19.99	0	2	0	2	0	4
	>19.99	0	0	0	1	0	1
	Total	84	81	88	54	6	313

Table 2. Continued.

		Minimum Distance to Shore (m)					
Pairs/2.56 km^2	ha	<50	50–99	100–199	200–499	>499	Total
80–100	<0.1	14	14	12	3	0	43
	0.1–0.49	44	67	30	6	0	147
	0.5–0.99	15	17	17	3	1	53
	1–1.49	6	8	10	0	0	24
	1.5–2.99	9	10	6	2	1	28
	3–9.99	6	4	5	3	2	20
	>19.99	0	1	0	0	0	1
	Total	95	121	80	17	4	317
>100	<0.1	20	16	6	1	0	43
	0.1–0.49	57	63	24	4	0	148
	0.5–0.99	13	17	5	3	0	38
	1–1.49	7	2	1	0	1	11
	1.5–2.99	7	10	5	1	0	23
	3–9.99	0	6	1	2	0	9
	10–19.99	1	0	0	0	0	1
	Total	105	115	42	11	1	274

High wetland densities are important for brood dispersal, and therefore an important factor when considering island management (Lokemoen and Woodward 1992). Proximity of seasonal (Talent et al. 1982, Krapu et al. 2000) and semipermanent (Raven et al. 2007) wetlands to nesting habitats can be an important factor in determining survival rates of ducklings. Considering landscape context, proximity of other seasonal or semipermanent wetlands may increase management efficiency through increases in duckling survival and subsequent increases in recruitment rates. Numbers of nesting ducks using islands is unrelated to local breeding duck pair densities (Shaffer et al. 2006); however, areas with high breeding duck pair densities generally have abundant and diverse wetland communities.

Therefore, islands in areas with high breeding duck pair densities are likely best suited for predator removal or other habitat enhancements to increase recruitment rates. The PPJV Implementation Plan states a recruitment rate (defined as females fledging/adult female in the breeding population) objective of 0.6 units during average conditions (Ringelman et al. 2005), and the Step-down plan states a nest-success objective of 40% in areas with >40 breeding duck pairs/2.56 km^2 (Dixon and Hollevoet 2005). Reynolds et al. (2001) estimated that recruitment rates for upland nesting ducks in the Dakotas and extreme northeastern Montana would have been approximately 30% lower during 1992–1997 without perennial upland cover provided by the Conservation Reserve Program (CRP). Recruitment rate goals will become more difficult to achieve in the future, pending substantial losses of perennial upland cover, especially from lands currently enrolled in USDA conservation programs, such as the CRP.

Agriculturally dominated regions must incorporate enhancement techniques either through predator removal/exclusion or habitat enhancements (plantings or rejuvenation). Unfortunately, agriculturally dominated regions generally lack opportunities for habitat enhancements. Shaffer et al. (2006) determined mallards and gadwalls nested preferentially on islands associated with surrounding landscapes that had limited perennial grass. Given the extensive use of brushy cover by ducks nesting on islands (Lokemoen et al. 1984, Dahl et al. 1999), efforts to create brushy cover on islands lacking nesting habitat may be an efficient way to enhance island use by breeding ducks.

This study was not designed to provide a complete inventory of islands in North Dakota, but rather identify a sub-set of habitats available to waterfowl managers in most years for enhancements to duck recruitment in North Dakota. I assumed my estimates of island size and distance from shore were adequate for making these management decisions. Moreover, my determinations of island type (man-made vs. natural) were provided for descriptive purposes and to show relative contributions of each type to island habitats within regions. Managers often are faced with decisions for resource allocation, thus, man-made islands constructed to enhance duck production should receive priority for management over natural islands.

MANAGEMENT IMPLICATIONS

If perennial grass cover continues to decline across the PPJV, managing natural islands could be a powerful tool for maintaining regional recruitment objectives. Future investigations on management efficacy should focus on natural islands, specifically examining how predator removal, brushy cover establishment, island size, and distance from shore affect duck nest densities and abundance, nest success, and duckling survival rates. Net gains in waterfowl recruitment through island management also must incorporate updated land cover imagery to account for future losses in perennial upland grass cover.

ACKNOWLEDGMENTS

B. M. Hosek provided technical assistance. C. N. Jacques, M. A. Johnson, D. H. Kim, R. E. Reynolds, T. L. Shaffer, and an anonymous reviewer provided valuable comments on earlier drafts of this manuscript.

LITERATURE CITED

Aufforth, A. D., H. Goetz, and K. F. Higgins. 1990. Duck nesting on islands at J. Clark Salyer Refuge in North Dakota, 1983–1984. Prairie Naturalist 22:1–12.

Bluemle, J. P. 1977. The face of North Dakota – The geologic story. North Dakota Geologic Survey. Educational Series Report 11. Grand Forks, North Dakota, USA.

Cowardin, L. M., D. S. Gilmer, and C. W. Shaiffer. 1985. Mallard recruitment in the agricultural environment of North Dakota. Wildlife Monographs 92:1–37.

Dahl, A. L., K. L. Baer, T. L. Shaffer, G. A. Sargeant, M. A. Johnson, and R. E. Reynolds. 1999. The relation of mallard nest numbers on constructed islands to upland habitat and mallard breeding pairs in North Dakota. North Dakota Game and Fish Department, Bismarck, North Dakota, USA.

Dixon, C., and R. Hollevoet. 2005. Ground nesting bird management on cropland dominated landscapes within the Prairie Pothole Region of North and South Dakota – A step down plan from the Prairie Pothole Joint Venture. U.S. Fish and Wildlife Service, Devils Lake, North Dakota, USA.

Duebbert, H. F. 1966. Island nesting of the gadwall in North Dakota. Wilson Bulletin 78:12–25.

Duebbert, H. F. 1982. Nesting of waterfowl on islands in Lake Audubon, North Dakota. Wildlife Society Bulletin 10:232–237.

Duebbert, H. F., J. T. Lokemoen, and D. E. Sharp. 1983. Concentrated nesting of mallards and gadwalls on Miller Lake Island. Journal of Wildlife Management 47:729–740.

Giroux, J. F. 1981. Use of artificial islands by nesting waterfowl in southeastern Alberta. Journal of Wildlife Management 45:669–679.

Klett, A. T., T. L. Shaffer, and D. H. Johnson. 1988. Duck nest success in the Prairie Pothole Region. Journal of Wildlife Management 52:431–440.

Krapu, G. L., P. J. Pietz, D. A. Brandt, and R. R. Cox, Jr. 2000. Factors limiting mallard brood survival in prairie pothole landscapes. Journal of Wildlife Management 64:553–561.

Lokemoen, J. T., H. F. Duebbert, and D. E. Sharp. 1984. Nest spacing, habitat selection, and behavior of waterfowl on Miller Lake Island, North Dakota. Journal of Wildlife Management 48:309–321.

Lokemoen, J. T., and R. O. Woodward. 1992. Nesting waterfowl and water birds on natural islands in the Dakotas and Montana. Wildlife Society Bulletin 20:163–171.

Lokemoen, J. T. and T. A. Messmer. 1994. Locating, constructing, and managing islands for nesting waterfowl. U.S. Fish and Wildlife Service, Branch of Extension and Publications, Arlington, Virginia, and The Berryman Institute, Logan, Utah, USA.

Raven, G. H., T. W. Arnold, D. W. Howerter, and L. M. Armstrong. 2007. Mallard brood movements in the Canadian Prairie Parklands. Prairie Naturalist 39:1–13.

Reynolds, R. E., T. L. Shaffer, R. W. Renner, W. E. Newton, and B. D. J. Batt. 2001. Impact of the Conservation Reserve Program on duck recruitment in the U.S. Prairie Pothole Region. Journal of Wildlife Management 65:765–780.

Reynolds, R. E., T. L. Shaffer, C. R. Loesch, and R. R. Cox, Jr. 2006. The Farm Bill and duck production in the Prairie Pothole Region: Increasing the benefits. Wildlife Society Bulletin 34:963–974.

Ringelman, J. K., R. E. Reynolds, R. R. Johnson. 2005. Prairie Pothole Joint Venture Implementation Plan: Section II – Waterfowl Plan. <http://ppjv.org/PPJV_presentations/2005_PPJV/7_Section2_Waterfowl_Plan.pdf>. Accessed 5 May 2008.

Shaffer, T. L., A. L. Dahl, R. E. Reynolds, K. L. Baer, M. A. Johnson, and G. A. Sargeant. 2006. Determinants of mallard and gadwall nesting on constructed islands in North Dakota. Journal of Wildlife Management 70:129–137.

Talent, L. G., G. L. Krapu, and R. L. Jarvis. 1982. Habitat use by mallard broods in south central North Dakota. Journal of Wildlife Management 46:629–635.

USDA-FSA Aerial Photography Field Office. 2004. National Agriculture Imagery Program. USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah, USA.

Wangler, B., and R. E. Reynolds. 2007. Results of the four square mile waterfowl population survey in the Prairie Pothole Joint Venture area of North Dakota, South Dakota, and northeast Montana. U.S. Fish and Wildlife Service, Bismarck, North Dakota, USA.

Willms, M. A., and R. D. Crawford. 1989. Use of earthen islands by nesting ducks in North Dakota. Journal of Wildlife Management 53:411–417.

Submitted 2 June 2008. Accepted 12 July 2009.
Associate Editor was Daniel H. Kim.