

OCCURRENCE OF CLARK'S GREBES AND THEIR HYBRIDS WITH WESTERN GREBES IN PRAIRIE CANADA

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Abstract

A survey of Clark's Grebes and intermediates with Western Grebes in southern Saskatchewan and Manitoba in the spring of 2008 revealed that the proportion of Clark's Grebes could currently be limited to 1% or less. The influx of Clark's Grebes noticed during the 1990s that contributed to their increase up to 4% appears to have been of limited duration. Intermediates between both species made up about 3% of all grebes encountered. Observations in the nesting area of Pelican Lake, Manitoba, and of courtship displays confirmed that the rare Clark's Grebes and the hybrids have difficulties finding mates.

Introduction

In 1985, the American Ornithologists' Union (AOU) followed the suggestions of Ratti,¹⁴ Nuechterlein,⁸ and Nuechterlein and Storer¹¹ and separated the Western Grebe into two species, the Western Grebe and the Clark's Grebe.² The genetic distance between the two grebe species based on DNA analysis is comparable to such distances in other closely related species.¹ The results of recent ecological studies predict that more closely related species produce more hybrids.¹³ However, in mixed populations of Western and Clark's Grebes, assortative mating has been demonstrated,^{7,8,9,10,11,14} and differences in the advertising call between species are critical to reproductive isolation.^{9,10} According to Mayr (1942, tested by Randler¹³), species with common ranges hybridize

to a lesser extent than those that overlap infrequently. Reproductive isolating mechanisms between Western and Clark's Grebes possibly work better in areas where both species are common.⁸ Nuechterlein and Buitron suggested that interbreeding might be limited to late courting individuals with limited mate choice.¹⁰

Historically, light-phase birds (Clark's Grebes) were rare at the northern border of their range and represented less than 1% of the population in Canada.¹⁷ Clark's Grebes were rare in Saskatchewan, although recent investigations found them to breed regularly at the northern and southern ends of Last Mountain Lake, at Reed Lake, and probably at Turtle Lake.¹⁶ The earliest mention of a record of light-phase birds in Canada was by Nero (cited by Palmer¹⁴), who observed five of them in a colony of 500 grebes at Old Wives Lake, Saskatchewan. The first confirmed nesting of a pair of Clark's Grebes in Canada was reported from Pelican Lake, Manitoba, in 1986.⁴ In 1973-1974, Nuechterlein observed no Clark's Grebes at Delta Marsh, Manitoba, where Eichhorst and Parkin found a total of 18 Clark's Grebes in June 1989, representing 1.2 to 1.8% of the grebe population there.⁴ They suspected a recent influx of Clark's Grebes in the area, and in the early 1990s, up to 4% of 3,000 breeding pairs surveyed were Clark's Grebes.¹⁰ As the local Western Grebes could lack experience to deal with the sudden presence of their sibling species, and

being given the scarcity of Clark's Grebes in Canada, pairing could have been more random and may have provoked an increase of mixed pairings. Since the resulting hybrids have been proven to be fertile^{4,9} and are expected to display high viability and fertility themselves,¹³ the number of intermediates should then have increased.

In this study, I searched for Clark's Grebes and intermediates on select bodies of water in Manitoba and Saskatchewan. My objective was to determine whether Clark's Grebes increased in numbers and to what extent a possible increase could have affected the occurrence of intermediates.

Materials and Methods

Study Sites and Grebe Observations in 2008: Last Mountain Lake (LML) is located midway between Saskatoon and Regina in south-central Saskatchewan. The northern end of this 233-km² lake is the Last Mountain Lake National Wildlife Area and Migratory Bird Sanctuary, which is designated a Ramsar Wetland of International Importance. Wetlands cover 21% of the protected area totaling over 15,600 hectares.⁵ Grebe observations were conducted at two locations on the western shore of LML. Sailor's Bay, inside of the National Wildlife Area opposite the town of Imperial, was visited on 26 and 27 May 2008, and the grebes passing in front of a fixed observation point during a 6-hour period were scrutinized and photographed. On Triple T Beach, ca. 15 km south of the protected area near the village of Liberty, the same procedure was applied on 26 and 28 May 2008 during 4 hours of observation.

Buffalo Pound Lake (BPL), about 30 km northeast of Moose Jaw, is a prairie lake situated near the headwaters of the Qu'Appelle River. This eutrophic lake has

a surface area of 29.5 km², and provincial Highway 2 divides its northern end.⁶ The lake was visited on 28 May 2008 for 4 hours, and grebes present close to the new and the abandoned course of Highway 2 were scrutinized and photographed. A count of grebes present at the northern end of the lake was performed, using both highway courses and driving down for 6 km on the eastern shore.

Pelican Lake (PL), part of the Pembina River System, is 52.8 km² (22 km long and 2.4 km wide) and is located near the town of Ninette, south of Brandon, Manitoba. Its northern end was searched from 29 May to 1 June 2008 for 20 hours. Observations were conducted from a car along provincial Highway 23, and by walking along the pathway adjacent to it, as well as on the elevated eastern shoreline north of the highway. Additional observations were performed from provincial Highway 18 near the nesting area of grebes at the extreme north of the lake.

All sites visited were scrutinized from the shore, using a car as a blind where possible, and with the help of Zeiss binoculars (10×25). I took electronic pictures of grebes using a Konica Minolta Dynax 7D camera and a Sigma AF 800-mm lens. The photos were later analyzed on a computer using the program PhotoImpact (Ulead Systems Inc.).

Delta Marsh Surveys in 2005: H. den Haan (Field Station, University of Manitoba) kindly provided me with the results of two surveys executed at Delta Marsh, Manitoba, in 2005 in areas where Clark's Grebes were reported to increase in the 1990s.

Identification of Grebe Species (Western vs. Clark's): Species identification relied on bill color and differences in facial

pattern (Fig. 1, see inside cover). A subdivision of diverging areas of the face into lores, above eye, behind eye, and below eye was used.¹⁷ Individuals were classified as Clark's Grebes if they had an orange-yellow bill with a sharply defined black culmen, white lores, and the white of the side of the head extending to above the eyes.¹⁸ The thin line of bare skin that extends from the base of the upper mandible to the eye was orange.⁴ Individuals were classified as Western Grebes if they had a dull yellowish-green bill and the black of the crown extended to below the eyes.¹⁸ The bare skin line below the lores was dark green.⁴ It is noteworthy that in Clark's Grebes the extent of the white margin visible above the eye may vary, for instance during behavioral interactions, depending on whether crest feathers are erect or relaxed.¹⁵

All grebes not entirely conforming to the descriptions of Western Grebes above were assessed against the non-breeding and immature plumages of known individuals. Once immature and non-breeding status could be ruled out, these grebes were categorized as intermediates. Grebes were sexed using the criterion of bill size dimorphism.¹⁷ The activity of Clark's Grebes and intermediates was recorded whenever possible, and the relevant field notes are summarized.

Results

Occurrence of Clark's Grebes and intermediates in 2008: All occurrences of Clark's Grebes and individuals intermediate in coloration and their field characteristics are summarized in Table 1. For all three locations combined (LML, BPL, and PL), of 556 grebes identified, four (0.7%) were Clark's Grebes and 16-19 or 2.9-3.4% were intermediates.

LML: I observed 113 grebes in total on LML (80 at Sailor's Bay and 33 at

Triple T Beach). Only one Clark's Grebe (LMS 01) was seen on 26 May 2008 at Sailor's Bay and none at Triple T Beach, while five intermediates occurred at Sailor's Bay and one at Triple T Beach. Thus, Clark's Grebes made up 0.9% of all grebes encountered at LML, while intermediates made up 4.4-5.3%, depending on whether one intermediate, LMS 05, was included. This bird (LMS 05) with light gray coloration at the loreal area, above, behind and below the eye could possibly have been a Western Grebe still in molt. All intermediates had rather greenish-yellow bills except for LMS 01, which had a bill of intermediate coloration. For three out of five birds, the black crown came down to the center of the eye, for one it ended at the upper eye, and for one at the lower eye. The lores were either white or partially light gray (Table 2). In spite of their greenish bills and bare loreal skin lines, which would indicate Western Grebes, two of the intermediates appeared to have more orange-yellow bare eye rings, and even in LMS 05, the eye ring appeared more orange. Eichhorst and Parkin did not provide information on the color of the eye ring, but they did state that Clark's Grebes have a more orange-yellow and Western Grebes a more greenish-yellow bare line between the mandible and the eye.⁴ It is perhaps reasonable that this criterion is also valid for the eye ring. In 37 of my Western Grebe photographs where the color of the eye ring could be identified, only one had a more orange color while all others were greenish yellow.

BPL: At BPL, I observed a total of 168 grebes at locations ranging from north of old Highway 2 to 6 km south along the lake. However, only 80 grebes came close enough for identification. One Clark's Grebe (BPL 01) and one intermediate with an orange yellow lower mandible and its crown coming down

to reach the lower eye were recorded. Thus, Clark's Grebes and intermediates each represented about 1.2% of the grebes identified.

PL: In the northern part of PL, I counted a total of 363 grebes. Two of the 363 (0.6%) were likely Clark's Grebes. Nine individuals (2.5%) were clearly intermediate in coloration. Five of them had orange and two had green bills. The remaining two were more greenish in the upper, but clearly orange in the lower mandible. All had white feathers below the eyes, but their lore color was white (three individuals), light gray (four individuals), or even dark gray (two individuals). The black crown intersected the center of the eye in five cases (although this was only true for the left side in PEL 02) and reached the lower eye in three cases. In the remaining bird, the coloration behind the eye was too diffuse to clearly define the point of intersection. Two birds (PEL 11 and PEL 13) could still have been in molt and might have been Western Grebes.

Delta Marsh: Counts in June 2005 by T. Underwood and J. Rasmussen found close to 400 grebe nests but only one Clark's Grebe. A survey at eight sites in July 2005 by R. Bazin, J. Hopkins, L. Beaudoin, and D. Wrubelski recorded 160 nests, but had no record of Clark's Grebes (communication by H. den Haan). Both surveys were executed in the parts also visited by Eichhorst and Parkin in 1989.⁴

Evidence for pair-bonding status of Clark's Grebes and intermediates: At LML, most birds observed were in twos that appeared to be pairs. The Clark's Grebe observed at Sailor's Bay (LMS 01) was on its own, and it is unlikely that it had a partner waiting at one of the few active nests, because after foraging it remained on the open water surface. Intermediates were observed either

alone or in groups, and only one of them was engaged in courtship, whereby it bob-preened with a Western Grebe. The intermediate from Triple T Beach (LMT 01) was not observed to have a partner during my study. The Clark's Grebe observed at BPL (BPL 01) was foraging alone, but it quickly moved out of view. The only intermediate observed was involved in ratchet-pointing and dip-shaking with two Western Grebes followed by rushing.

Both Clark's Grebes observed on PL were engaged in courtship. PEL 01 was first seen advertising without success, but later it was rushing in the company of a Western Grebe. PEL12 appeared to be more strongly tied as it was observed on two different days with the same partner, an intermediate (PEL 02). The pair was also engaged in displays that occur later in pair-bonding, namely arch-clucking and bob-preening, before moving into sparse vegetation. Two additional intermediates could have gained Western Grebes as partners: after weed dancing, PEL 10 was moving in the company of its partner in the direction of the breeding area, and PEL 06 was engaged in arch-clucking. The remaining intermediates were not yet paired (PEL 03, PEL 05, PEL 08) or were engaged in early pair-bonding displays (PEL 04, PEL 07, PEL 09) with Western Grebes. It is noteworthy that no Clark's Grebes or intermediates were observed directly inside the northern breeding area, but the greater distance of birds to the observer there made it difficult to identify individuals.

In summary, from all four Clark's Grebes, three were either unpaired or in the phase of pair-bond initiation while the fourth, a female, was paired to an intermediate. From 16 intermediates (including LMS05), seven appeared unpaired (five males, one female, one unsexed), four were engaged in early

courtship displays (two males, two females), one male was paired to a Clark's Grebe, two males were paired to Western Grebes, and the pair-bond status of two birds (one male, one female) remained unclear.

Discussion

The present study confirms the limited presence of Clark's Grebes in Canadian populations that could still be in the range of 1% or even less. This also seems to hold true for Delta Marsh, where an influx of Clark's Grebes was noted in the 1990s. Several scenarios could explain the decrease in numbers of Clark's Grebes: (1) the influx phenomenon was of limited duration, for instance depending on temporarily bad habitat conditions in the region of origin; (2) no additional influx occurred in the following years, and the Clark's Grebes present either did not (intra)breed successfully or their offspring emigrated to the south; (3) no additional influx occurred in successive years, and Clark's Grebes interbred with Western Grebes producing numerous intermediates; or (4) yearly numbers of Clark's Grebes in Canada are generally more fluctuating and are dependent on habitat conditions elsewhere.

In the first scenario, not too many intermediates should have resulted, and as a consequence of backcrosses with Western Grebes, these could be difficult to identify in the field. It does not seem likely that pairs with both partners being Clark's Grebes would all have bred unsuccessfully, or that all of their offspring emigrated, as stipulated in the second scenario. It would be more logical that both grebe species interbred as foreseen by the third scenario and more hybrids resulted that perhaps remain identifiable today. The fourth scenario could lead to rather low percentages of intermediates in the Canadian populations.

Genetically, the term "hybrid" denotes a first-generation product, in our case a cross between purebred Western and Clark's Grebe individuals. However, in practice, it is impossible to distinguish such individuals from later-generation hybrids.³ In addition, the numbers of hybrids of any bird species recorded in the field may be biased by their detectability, which is a function of the plumage differences between the hybridizing species.¹² Both grebe species studied here look rather similar, and trying to include backcrosses (hybrids mating with purebreds of either species) in determining the frequency of intermediates further complicates the situation. In this study, I did not differentiate between different degrees of hybrids, and the color patterns of intermediates observed covered all possible stages intermediate between those of Western and Clark's Grebes. Depending on how the distinction between both purebred species and hybrids is defined, the results will change.

Historical data from Delta Marsh indicate that intermediates were extremely rare around 1980 and in the early 1990s. Breeding birds with intermediate plumage or bill color, presumably hybrids, represented less than 4%.¹⁰ Unfortunately, the surveys at Delta Marsh in 2005 did not record intermediates so that we cannot assess the evolution of their numbers there. I found intermediates to represent about 3% of all grebes scrutinized, and this figure also applies to Pelican Lake, where the survey was fairly complete. Considering that the influx of Clark's Grebes in the 1990s reached Pelican Lake, this low percentage would speak in favor of the third scenario above.

Eichhorst and Parkin gave a fairly complete description of intermediates and stated that all of them had some

orange on the lower mandible, mainly on the ventral surface near the base.⁴ The color of the thin patch of bare skin between upper mandible and eye varied between dark green and orange. The description is generally confirmed here, except that not all birds classified as intermediate had yellow-orange visible on their lower mandible, which could simply be a consequence of poor light conditions. On most yellow-orange bills of intermediates, a more bright reddish color was identifiable mainly at the base of the lower mandible. This pattern was only observed in one bird classified as a purebred Western Grebe. Although the color of the bare skin surrounding the eye was not always clearly visible, I suspect that it follows the same pattern as the bare bridle line and is more orange in Clark's Grebes, more greenish in Western Grebes, and variable in intermediates.

With respect to indications of assortative mating, I found that all male Clark's Grebes seemed to be unpaired. Females could be better off, as the only female found was paired to an intermediate, but it might be premature to judge from just this one example. More intermediate males than females appeared unpaired; however, the total sample contained more males than females. To some extent, intermediates seemed to prefer purebred partners, which could be a sign for imprinting to play an important role in partner selection. In addition, no Clark's Grebes or intermediates were observed directly inside the northern breeding area at Pelican Lake. The findings basically confirm that the rare Clark's Grebes and the intermediates have difficulties obtaining a mate and that in Manitoba, birds with intermediate plumage are especially frequent in late-season courting groups.^{8, 10}

To conclude, it would be desirable to execute regular checks of the occurrence of Clark's Grebes to find out to what extent their presence in prairie Canada could be more permanent or more cyclic, perhaps depending on habitat conditions farther south. It should also be investigated to what extent the rarer Clark's Grebes interbreed successfully or simply migrate to other places so that they disappear from Canadian populations later in the season or/and in successive years. Surveys should look out for intermediates between both species of grebes and should analyze to what extent they are able to pair early in the season and identify the "species" of their partners. Such data would provide useful information about the role of imprinting on purebred parents in preventing the offspring from pairing with hybrids. Such regular work would also contribute to better indications about the fitness of hybrids and their descendants.

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Table 1. List of observed Clark's Grebes and grebes with intermediate characteristics. The first three letters in the numbering indicate the location of the sighting; BPL = Buffalo Pound Lake, LMS = Sailor's Bay at Last Mountain Lake, LMT = Triple T Beach at Last Mountain Lake, PEL: Pelican Lake. Sex: M = male, F = female. Abbreviations used for colors: B = black, DG = dark gray, GG = intermediate gray, G = greenish yellow, LG = light gray, O = orange yellow, W = white. Crown intersection: U = at upper eye, C = at the center of the eye, L = at lower eye, N = no intersection. Species: CG = Clark's Grebe, (CG) = possibly a Clark's Grebe, I = intermediate and possible hybrid, (WG) = possibly a Western Grebe

Number	Sex	Bill color	Lore color	Above eye color	Behind eye color	Below eye color	Crown intersection	Bridle line	Eye ring	Species
BPL 01	M	O	W	W	W	W	N		O	CG
BPL 02	F	O*	LG	B	B	W	L			I
LMS 01	M	O	W	W	W	W	N		O	CG
LMS 02	F	G	LG*	B	LG	W*	C	G	O°	I
LMS 03	M	G	W*	B	W*	W*	C*			I
LMS 04		G	W	B	W*	W*	U			I
LMS 05	F	G	LG*	B	LG*	LG*	N	G	O	(WG)
LMS 06	M	G	LG*	B	DG	W	L	G	O	I
LMT 01		G*	W	B	LG	W	C			I
PEL 01	M	O	W	W*	W	W	N			(CG)
PEL 02	M	O*	LG	DG	DG	W	C/L*	G	G	I
PEL 03	M	O*	W*	B	LG	W	L*			I
PEL 04	M	O	LG	B	DG	W	C		O	I
PEL 05	M	O	LG	B	B	W	L	O	O	I
PEL 06	M	O	DG	B	B	W	C			I
PEL 07	M	O	DG	B	B	W	C			I
PEL 08		O*	LG	B	DG	W	L		O°	I
PEL 09	F	G	W	B	W	W	C	G	G	I
PEL 10	M	G	W	B	LG*	W	U*			I
PEL 11	F	G	LG*	B	LG*	LG*	*	G	G	(WG)
PEL 12	F	O	W	W*	W	W	N		O	(CG)
PEL 13	F	G	LG	LG	LG	LG*	N			(WG)

* see Table 2 for additional remarks ° color identification not unequivocal

Table 2. Summary of characteristics of Clark's Grebes and intermediates recorded in Table 1.

Number	Remarks regarding characteristics
BPL 02	Upper mandible more greenish
LMS 02	Thin light gray line directly above beak, then white and again dark gray in upper lore; more blurred white below eye
LMS 03	White directly above beak, but central and upper lore gray; white behind and washy white below eye, but both areas separated by gray line that intersects central eye
LMS 04	Partially diffuse gray behind eye and mostly washy white below eye
LMS 05	All light gray parts are washy, even washy light gray above central upper mandible
LMS 06	Washy light gray to white at lore region
LMT 01	Very light bill color, more intermediate
PEL 01	Black crown reaches down nearly touching the eye
PEL 02	Upper mandible greenish, but lower mandible orange; crown comes down to central eye on left side of face, but reaches farther down on right
PEL 03	Orange of beak not very bright; washy light gray around bridle line; light gray reaches lower eye
PEL 08	Lower mandible orange, but upper mandible greenish except for lower rim that is orange
PEL 10	Whitish patch behind eye leaves room for interpretation of where the crown intersects the eye
PEL 11	In lore region, behind and below eye diffuse light gray with small white spot at lore and behind eye; intersection of crown therefore difficult to define
PEL 12	Diffuse light grayish spot above eye
PEL 13	Partially washy white below eye



TWO PLUS ONE

In the quiet dusk of springtime,
 strolling past a row of maples
 on our old deserted farmyard,
 I disturbed a rough grouse feeding
 mid the weed stalks at a field's edge;
 saw her act with greatest caution.
 Craning out her neck she eyed me,
 crest raised high and wings aquiver—
 all alerted were her senses.
 I, in turn, stopped short my ramble,
 stood there while she looked
 and listened,
 paused there long and so outlasted
 her instinctive hesitation
 to resume her own meal-taking.

All the while a brownish rabbit,
 crouching nearby in the open,
 gave no heed to grouse or human,
 just reposed there still and stone-like,
 twitching neither ears nor whiskers;
 sat on feet yet white and furry,
 last to molt from a cold winter,
 hiding them from all onlookers.
 Such was his instinctive knowledge
 that he gave no thought to fleeing,
 immobility his byword.
 So I stole away and left them,
 feeding grouse and stolid rabbit,
 in the quiet dusk of springtime.

-Victor C. Friesen