A LENGTHY NESTING PERIOD OF WESTERN AND CLARK'S GREBES, SAN CARLOS LAKE, 2023-2024

BY DOUG JENNESS, 4375 E. ROLLINS RD., TUCSON, AZ 85739, DOUGJENNESS@GMAIL.COM

Western (*Aechmophorus occidentalis*; Figure 1) and Clark's (*A. clarkii*) Grebes nest infrequently and irregularly at San Carlos Lake in east central Arizona. This is due to abrupt changes in water level and the difficulties of finding emergent and/or seasonally flooded vegetation for constructing and anchoring nests. Nesting of these 2 grebe species has been reported previously at the lake only in 3 years—2005, 2015, and 2017 (Jenness 2020). In 2023 and 2024, the water level was unusually high for a period of 19 months, creating relatively stable conditions for nesting. This note will describe the longest known period of nesting at this reservoir, including the first reported *Aechmophorus* grebe nests in velvet mesquite (*Neltuma velutina*).

Figure 1. Western Grebe, male (l), female (r), 29 November 2023. Photo by Tim DeJonghe

On 12 visits between 22 August 2023 and 13 August 2024, several colleagues and I observed dozens of juvenile *Aechmophorus* grebes, from downy young to nearly full-grown immature birds (Table 1). The actual number of young grebes present was likely greater as much of this 13 km-long reservoir could not be viewed. Most of the immature grebes were observed at several locations along a 6.4 km-mile stretch of the southern shore in Pinal County. Others were seen near the mouth of the San Carlos River at the northeast corner of the lake in Gila County. No immature grebes were found on follow-up visits on 16 September 2024 and 11 November 2024.

Table 1. Number and estimated age of immature grebes

Date	Species	No.	Age Range (weeks)
22-Aug-23	WEGR	12	3 to 8
	CLGR	2	6
7-Sep-23	WEGR	12	4 to 10
	CLGR	3	3 to 5
	Unknown	1	?
8-Sep-23	WEGR	1	8
	CLGR	5	4 to 10
25-Oct-23	CLGR	6	6 to 10
29-Nov-23	CLGR	4	4 to 10
27-Dec-23	WEGR	4	6 to 8
	CLGR	9	6 to 10
25-Jan-24	WEGR	4	8 to 10
	CLGR	1	8
	Unknown	2	10
18-Feb-24	None		
3-Apr-24	None		
14-May-24	CLGR	14	3 to 5
1-2 Jul- 24	None		
13-Aug-24	CLGR	2	5 to 6
16-Sep-24	None		

The presence of immature grebes of varying ages observed over more than 13 months confirms a nesting period of at least 15 months. The approximate date when eggs were laid can be determined by subtracting (in number of days) the estimated age of young from the date observed. Although no single guide to aging immature *Aechmophorus* grebes exists, Ratti (1979, 1981) provides useful assistance. Black crown color begins to show on Western chicks at 10 to15 days of age but does not emerge on Clark's chicks until 50 to 60 days of age. Between 20 and 50 days of age, Clark's chicks appear generally snowy white (Figure 2), while Western chicks show charcoal-colored backs and have a much darker appearance. Bill color is black for both species during the first 40 days, at which time the respective bill colors (dull yellow for Western and bright yellow to yellow orange for Clark's) slowly begin to emerge. By 80 days of age, bill color closely resembles that of adults (Figure 3).

Primary feathers appear at approximately 40 days of age for both species. Adult grebes abandon the nests within 1 to 5 hours after the last egg is hatched carrying their young on their backs and may back brood until the chicks are about 4 weeks old (Nuechterlein 1988, LaPorte 2012, LaPorte et al. 2020).

The immature grebes estimated to be 8 weeks old on 22 August 2023 would have hatched in the last week of June from eggs laid in the first week of June. Those observed on the backs of adults on 22 August likely hatched no earlier than 25 July from eggs laid around 1 July. The mean time for incubation is 24 days (Lindvall and Low 1982). The young grebes observed 25 January 2024 likely hatched in late November 2023 and incubation began in early November. The downy Clark's Grebes observed on 13 August 2024 were estimated to have hatched around 8 July from eggs laid the first week of June.

Our discovery of 16 nests, left high and dry by receding water, could possibly offer more evidence for the length of the nesting period (Figure 4). The nests were in 2 areas along the south shore of the lake, about 1.0 km apart. Twelve were in a 0.2-ha area and the other 4 in an area of similar size. Constructed of sticks with a soft padding of vegetation in the center, the mean diameter of the nests was 40 cm, and the distance between those in the larger group ranged from 25 to 50 m, and up to 100 m in the smaller group. Those in the larger group were 1.2 to 1.5 m above the ground in velvet mesquite trees, all about 3 m tall. All the trees and shrubs in the area were covered by algae, leaving a benchmark for the water's highest level, which was during the last week of April 2023 (USGS 2024). The algae were 0.8 to 1.0 m above the top of the nests (Figure 5). The nests were up to 3 m above the ground. and water levels were about a meter lower during the last week of March and again the first week of June (USGS 2024). From 1 June to 15 July the water level was dropping but was relatively more stable than in March and April, suggesting that there was sufficient time for grebes to construct the nests at these locations and incubate eggs—at least a month. Where grebes can nest in cattails or bulrushes, including many locations in Arizona (Wise-Gervais 2005), their nests are partially floating and able to drop or rise as water levels change. However, when nests are placed in tamarisk, as previously observed at San Carlos (and in this recent nesting in mesquite), they are rigid and not likely to remain afloat as water levels rise and fall.

Nesting in all seasons as occurred in 2023 and 2024 is not exceptional. Parmelee and Parmelee (1997) showed that in regions where large bodies of water do not freeze over in

Figure 2. Juvenile Clark's Grebe, 5 to 6 weeks old, 22 August 2023 Photo by Tim DeJonghe

Figure 3. Adult Clark's Grebe with juvenile 9 to 10 weeks old showing yellow bill, 25 January 2024. Photo by Paul Heveran

Figure 4. Grebe nest left high and dry in velvet mesquite when water subsided, 7 September 2023. Photo by Doug Jenness

Figure 5. Algae well above a grebe nest that has started to fall, 14 May 2024. Photo by Doug Jenness

the winter, such as those with desert climates, *Aechmophorus* grebes may utilize favorable foraging opportunities at any time of the year to nest. Although nesting in Arizona typically occurs between April and August (Wise-Gervais 2005), previous reports have confirmed its occurrence in the state in the winter (Rosenberg et al. 1991, Stevenson and Rosenberg 2006, Corman and Burger 2011). It is possible that water levels stabilize in late fall when water needs for agriculture downstream are less demanding (plus influx of some prior monsoon inflows), allow for successful winter nesting attempts. These later attempts could be of those that failed during the spring and early summer, before water levels would begin to drop too steadily leaving nests in tamarisk and mesquite to become out of reach for successful incubation.

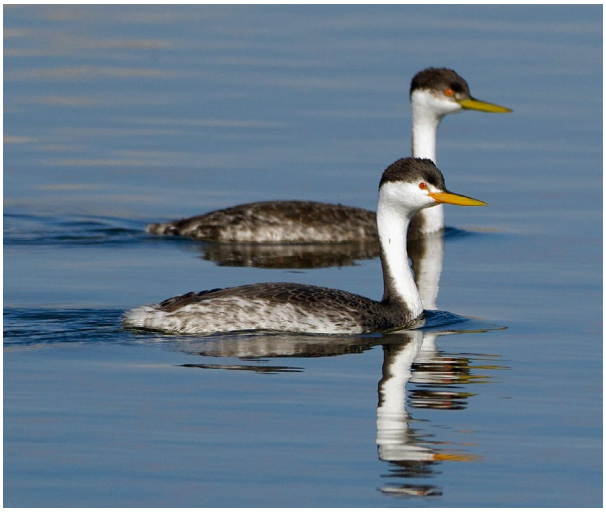

Figure 6. Western Grebe male (back), Clark's Grebe female (front). 29 November 2023. Photo by Tim DeJonghe

Lindvall and Low (1982) found that the average clutch size of *Aechmophorus* grebes was 2.6 and ranged from 1 to 4. The number of young in broods reported in previous nesting years at San Carlos was 1 or 2, with the exception of a brood of Western Grebes with 3 in 2005 (Jenness 2020). During the 2023 to 2024 nesting, we observed 6 clutches of 3 and 2 clutches of 4 young Clark's Grebes. Possibly one reason no Western Grebe broods were seen with >2 young is that this species tends to feed in deeper water farther from shore at San Carlos Lake (Jenness 2020), and young birds may have been missed. Also, chicks of both species leave the nest immediately after hatching and quickly become more elusive. After they are several weeks old, the parents may separate and split the brood, making it even more difficult to accurately assess brood size at this stage (LaPorte et al. 2020). As all of our observations were of chicks away from the nest, the clutch sizes are rough estimates. We did not identify any immature birds as hybrids, but hybridization between the 2 species is known to occur at the lake and elsewhere (Jenness 2020), and we did observe a mixed pair (Figure 6). A consideration in the apparent greater productivity in the 2023 to 2024 period is that the San Carlos Recreation and Wildlife Department (SCRWD) stocked the lake with 20,000 black crappie (*Pomoxis nigromaculatus*) and 30,000 channel catfish (*Ictalurus punctatus*) in May 2023. This was the first release of fish into the lake in many years (SCRWD 2023). The lake is totally within the San Carlos Apache reservation, and its wildlife is managed by SCRWD.

The unusually extended nesting period for the lake was created by extraordinarily high-water levels. The U. S. Geological Survey data for water volume is measured in acre-feet. One acre-foot is equal to 1,233.5 m^3. This can best be pictured by imagining a football field covered with 1 foot of water. For 19 months, from 8 January 2023 to early 5 August 2024, the water level at the lake did not go below 308.37-million m^3, and much of the time was much higher. From 26 March 2023 to 5 June 2023 the level was above 616.42-million m^3, reaching a high of 651.28-million m^3 on 27 April 2023 (Figure 7). The last time it was above 308-million m^3 was briefly in 2010. The recent level was the longest sustained high-water level at the lake in this century. One of the consequences is that much vegetation along the shores was flooded and created favorable nesting conditions for *Aechmophorus* grebes.

This exceptional water level is even more dramatic considering that the lake had virtually dried up in mid-2022. From 1 May to 5 August 2022, the water level never got higher than 3.7-million m^3 and went virtually empty in May reaching a low of 2,000 m^3, which was a puddle about the size of 1.5 football fields. Two weather events were responsible for raising the water level from such a low level to a 21st Century high. The 2022 summer monsoon was the wettest since 2006 and ranked as the ninth wettest on record for the Southwest region (NWS 2022). This was followed by an unusually high snowfall in the western New Mexican mountains and Arizona's eastern White Mountains, January through March 2023. These mountains are in the Gila River watershed, and the melting snowpack in April and May swelled the Gila River, which is blocked by the Coolidge Dam, forming the San Carlos reservoir (NWS 2023).

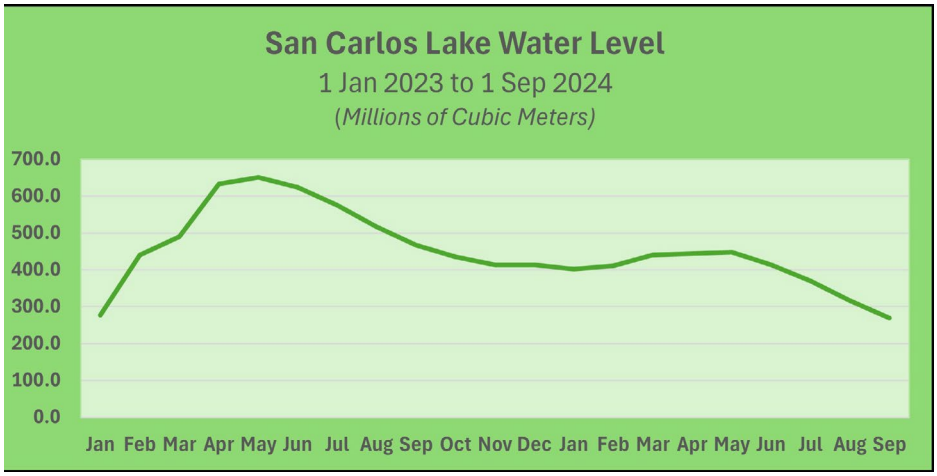

Figure 7. Water level at San Carlos Lake as of the first of the month for 20 months between 1 January 2023 and 1 September 2024. Credit: USGS 2023, 2024

Tamarisk (*Tamarisk* spp.) typically grows along much of the lake's shoreline and is often subjected to the normal ups and downs of the water level. Mature plants can withstand flooding for 70 days while root crowns can withstand flooding for 98 days (MFG 2024). Previous nesting at the lake by *Aechmophorus* grebes has been observed in flooded tamarisk (Jenness 2020). However, in the 2023-2024 period, water rose much higher, engulfing vegetation well above the normally high shoreline, including velvet mesquite. As previously noted, in at least 2 areas, grebes constructed nests on submerged mesquites, which is the first reported nesting using this substrate. However, we were unable to determine if these nests were successful. Unlike the tamarisk, the mesquites will not soon recover. Even though this tree is particularly partial to flood plains in the Sonoran and Chihuahuan deserts, it does not tolerate sustained flooding of 1 to 3 months (Walters et al. 1980).

San Carlos's water level fluctuates more drastically than most Arizona reservoirs. Although the lake is entirely on the San Carlos Apache tribal lands, the dam is operated by the San Carlos Irrigation Project administered by the Bureau of Indian Affairs. Most of the water is reserved for farmers from Coolidge and Florence to Sacaton and Casa Grande. In years when precipitation is low, agricultural consumption severely reduces the water supply. The significant release of water for irrigation in the summer of 2024 combined with a lower-than-average rainfall from the summer monsoon caused the water level to drop sharply. Between 1 July and 14 September, the average daily drop was 1.6 million m^3 (USGS 2024), creating an unstable situation for grebes to nest and ending the unusually long period of nesting.

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