Trends in Wintering Canvasback Populations at Catahoula Lake, Louisiana

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Abstract: Aerial survey data (1968–1989) and water gauge readings (1958–1989) were examined to determine trends in and relationships between canvasback (*Aythya valisineria*) populations and water levels at Catahoula Lake, Louisiana. Wintering canvasback populations at Catahoula Lake have increased over the past 21 years. A peak population estimate of 78,000 canvasbacks was recorded in January 1988. There was a significant relationship between increases in wintering canvasback numbers and increased November water levels. No significant changes in December or January water levels nor relationships between wintering canvasback numbers and December or January water levels could be detected. In recent years, Catahoula Lake has become one of the most important canvasback wintering areas in North America. We conclude that the increased availability of open water feeding habitat has been a major factor in the increased usage of Catahoula Lake by canvasbacks.

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Catahoula Lake has a long history as a major wintering and staging area for waterfowl in the Mississippi Flyway. Early settlers reported immense flocks of waterfowl wintering on the lake (Wills 1965, Wills and Glasgow 1964). From 1949 to 1960 annual recorded usage of Catahoula Lake averaged 11,348,700 duck days (La Dep. Wild. and Fish. [LDWF], unpubl. files). In recent years, peak numbers have exceeded 400,000 ducks (LDWF, unpubl. files). Historically, dabbling ducks were the predominant type of waterfowl using the lake. Mallards (*Anas platyrhynchos*), northern pintails (*A. acuta*), and blue-winged teal (*A. discors*) were the species of greatest abundance. Canvasbacks were present, but reported as being in limited numbers (Wills 1965, Wycoff et al. 1971). Systematic counts of canvasbacks at Catahoula Lake were not conducted prior to 1968; however, annual peak popula-

tions of canvasbacks recorded in aerial surveys of central Louisiana, including Catahoula Lake, during 1963 to 1967 ranged from 500 to 3,500 birds (LDWF, unpubl. files).

Since that time, numbers of wintering canvasbacks using Catahoula Lake have apparently increased. Peak numbers of up to 78,000 canvasbacks have been recorded using the lake. In some winters, canvasbacks are the most abundant waterfowl species on the lake during January and February surveys (LDWF, unpubl. files). This increase in canvasback numbers at Catahoula Lake has occurred during a period when continental canvasback populations levels have been stable (U.S. Fish and Wildl. Serv. [FWS] and Can. Wildl. Serv. 1986).

Our objective was to document trends in wintering canvasback abundance at Catahoula Lake and to examine how water levels may have influenced such changes.

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Methods

Catahoula Lake is a shallow, 12,150-ha basin situated in the Mississippi River floodplain in central Louisiana. The lake is fed by local drainages and receives backwater from the Mississippi River and associated tributaries. Historically, the lake basin followed an annual pattern of being almost completely dry during the summer and filling during late fall and winter from rainfall and runoff. Lake levels generally peaked in spring and then receded in July. This cycle of drying and reflooding produced lush growths of moist soil plant foods that were used by large concentrations of wintering waterfowl (Wills 1972). During the 1960s, a diversion canal and water control structure were built to prevent permanent inundation of the lake from a nearby water development project. Water levels have been managed since 1972 under a joint agreement among the LDWF, FWS, and U.S. Army Corps of Engineers (USACE). Under this agreement, the lake is dewatered in the summer to stimulate plant growth and then flooded in the fall to provide waterfowl habitat and hunting opportunity. Water levels are further increased after waterfowl hunting season to discourage waterfowl use and thereby reduce waterfowl exposure to lead poisoning (Zwank et al. 1985). However, water control capabilities at Catahoula Lake are limited. Local rainfall or flooding of the Mississippi River may produce abrupt changes in lake levels. For example, during winter 1987–88 lake levels increased 3.9 m in 4 days following local heavy rains.

Waterelm (*Planera aquatica*) and swamp privet (*Forestiera angustifolia*) grow in dense stands around the perimeter of the lake. Habitat features within the lake bed are dominated by 3 vegetative associations occurring in concentric zones that relate to bottom contour and associated hydroperiod (Wills and Glasgow 1964). Chufa flatsedge (*Cyperus esculentus*) dominates the shallowest vegetation zone on

the lake. The intermediate zone consists of a mixture of moist soil plants such as bearded sprangle-top (*Leptochloa fasciularis*), teal grass (*Eragrostis hypnoides*), and millet (*Echinochloa sp.*). Deeper portions of the lake are covered by stands of aquatic plants such as common arrowhead (*Sagittaria latifolia*) and scatter water hyssop (*Bacopa rotundifolia*). Chufa flatsedge dominates 50% of the basin, while mixed moist soil and aquatic vegetation zones each occupy approximately 25% of the basin (Wills 1965). There is a 1.1-m difference in elevation between the basin perimeter and the lowest portion of the lake (approximately 7.9 m above mean sea level [m.s.l.]). All 3 vegetation zones are inundated from November through June. Forested areas beyond the basin perimeter are flooded through much of that period.

Canvasback numbers have been estimated at Catahoula Lake by aerial survey since 1968. The LDWF conducted biweekly surveys from October to February during winters 1968–69 to 1986–87, and monthly from November to January during winters 1987–88 and 1988–89. Canvasback surveys were conducted monthly by the FWS from November to February during winters 1986–87 to 1988–89.

We recognized inherent biases associated with aerial survey data (Martinson and Kaczynski 1967, Stott and Olson 1972). Attempts were made to reduce variability of estimates by using experienced observers and minimizing personnel changes. In addition, problems with accuracy of estimation, often encountered in larger scale surveys, were reduced by the relatively small number of birds encountered through much of the survey period, the open water habitat, and the small survey area. Photographic count data during the winters of highest canvasback population levels (1987–88 and 1988–89) were used to verify ocular estimates.

Data on water levels were obtained from USACE (1958–1971) and Catahoula National Wildlife Refuge (1972–1989) water gauge records. These consisted of daily readings of water stages above m.s.l (± 30.4 mm [original data recorded ± 0.1 ft.]) taken from a permanent water gauge located on Little River near the French Fork outlet of Catahoula Lake.

Rank correlation tests (Conover 1971) were applied to annual peak (Nov–Mar) and annual mean (Dec–Jan) canvasback population estimates to determine trends over time from 1968 to 1989. Mean population estimates for December–January were tested to avoid including any canvasbacks that were not wintering at Catahoula Lake but simply moving through on northward migration during February and March. Differences in water levels (all water levels are expressed as height above m.s.l.) prior to and after operation of the diversion canal water structure were examined by comparing water gauge readings for 1958–1971 and 1972–1989 using Mann-Whitney U tests (Zar 1974). Rank correlation tests were applied to annual maximum and mean monthly water levels (Nov, Dec, Jan) and maximum winter water levels (Nov–Feb) to determine trends over time during the period of aerial surveys (1968 to 1989). The influence of water levels on canvasback numbers at Catahoula Lake was analyzed with regression analysis using the general linear model procedure of the Statistical Analysis System (SAS Institute, Inc. 1987). Data from winter 1974–75 were excluded from analysis because extreme flooding prevented recording water levels and moved all ducks off the lake.

Results

Survey data indicated that canvasbacks generally arrived at Catahoula Lake in late October/early November, peaked in numbers during January, and were present through mid-March. Canvasback numbers on the lake increased over the 21-year period (Table 1; annual peak: $r_s = 0.60$, df = 18, $P = 0.003$; Dec–Jan mean: $r_s = 0.64$, df = 18, $P = 0.001$).

Lake levels fluctuated widely but followed a general pattern of low water in early November with increasingly higher levels through the winter because of storms and water management (after 1972) after the waterfowl hunting season. Recorded winter water levels (Nov–Mar) ranged from 7.3 m to 16.2 m between 1958 to 1989. Higher levels probably occurred during winter 1974–75 when extreme flood conditions prevented collection of water-level data. Mean ($\bar{x} \pm$ SE = 8.4 ± 0.54 m) and maximum (8.9 ± 0.65 m) November water levels for 1958–1971 were lower ($P < 0.05$) than mean (9.3 ± 1.96 m) and maximum (10.0 ± 5.58 m) November water levels during 1972–1988. We detected no differences in December nor January water levels between the periods 1958–1971 and 1972–1989.

Recorded water levels ranged from 8.2 m to 15.1 m during the 1968–1989

Table 1. Peak winter and mean December-January population of canvasbacks at Catahoula Lake during 1968–1989 as determined from aerial surveys.

	Peak population		Mean Dec–Jan population	
Winter	Estimate	Month	Estimate	*N* surveys
1968–69	7,000	Feb	3,000	1
1969–70	500	Dec	500	1
1970–71	18,000	Feb	11,000	2
1971–72	10,000	Jan	6,000	2
1972–73	13,000	Jan	10,500	2
1973–74	2,500	Dec	2,500	1
1974–75	*[a]		*[a]	
1975–76	3,000	Jan	1,300	3
1976–77	3,000	Jan	2,300	2
1977–78	17,000	Mar	5,500	2
1978–79	14,000	Jan	9,500	2
1979–80	7,000	Jan	7,000	1
1980–81	1,200	Dec	600	3
1981–82	9,300	Jan	4,800	3
1982–83	4,000	Dec	3,500	2
1983–84	18,000	Jan	10,800	2
1984–85	16,000	Dec	15,500	2
1985–86	39,000	Jan	28,500	2
1986–87	48,000	Dec	23,900	5
1987–88	78,000	Jan	55,600	3
1988–89	67,300	Dec	64,400	4

[a]Extreme high water levels precluded use of Catahoula Lake by waterfowl.

aerial survey period. There was an increase over the 21-year period in mean (9.2 ± 1.91 m) and maximum (9.8 ± 5.24 m) water levels during November (mean: r_s = 0.47, df = 19, P = 0.02; max: r_s = 0.46, df = 19, P = 0.02). No trends of change over time for mean and maximum water levels during December (mean: 10.2 ± 6.92 m; max: 11.1 ± 12.48 m) and January (mean: 11.1 ± 12.78 m; max: 11.8 ± 11.62 m) could be detected ($P > 0.05$). Annual peak winter water levels ranged from 10.6 m to 15.1 m but exhibited no trends over time ($r_s = -0.16$, df = 18, P = 0.25). We found a significant relationship between increased canvasback numbers at Catahoula Lake during 1968–1989 and increases in mean and maximum November water levels (mean: $R^2 = 0.52$, $F = 4.54$, df = 1, $P = 0.05$; max: $R^2 = 0.55$, F = 9.03, df = 1, $P = 0.01$). No relationships between December or January water levels and canvasback numbers were detected ($P > 0.05$).

Discussion

During the past 21 years, Catahoula Lake has changed from a relatively minor canvasback use area to one of the most important wintering areas for canvasbacks in North America. In recent years, counts at Catahoula Lake have accounted for as much as 26% of the total canvasback population recorded in annual FWS Midwinter Inventories (FWS, Off. Migratory Bird Manage. [OMBM], unpubl. files). Most of this increase has occurred since 1984. In winters 1968–69 through 1982–83, peak canvasback counts at Catahoula Lake averaged 7,800 but from winters 1983–84 to 1988–89 they averaged 44,400. The increasing importance of Catahoula Lake is further illustrated by comparison with other major canvasback wintering areas. Historically, Chesapeake Bay and San Francisco Bay have been considered the principal canvasback wintering areas in North America (Stewart et al. 1958, Bellrose 1980). However, canvasback numbers at both Chesapeake Bay and San Francisco Bay have decreased recently (FWS, OMBM unpubl. files). Peak numbers of canvasbacks recorded at Catahoula Lake in winters 1987–88 (78,000) and 1988–89 (67,300) exceeded counts from Chesapeake Bay (60,900 and 40,100, respectively, [FWS, OMBM unpubl. files]) and San Francisco Bay (20,200 and 21,400, respectively, [J. Takekawa, FWS, unpubl. data]).

Reasons for the magnitude of the increases in wintering canvasback numbers at Catahoula Lake remain unclear. These changes have occurred following a period of major shifts in fall and winter distribution patterns of the eastern segment of the continental canvasback population. During the mid-1950s to mid-1960s, canvasback use of traditional fall staging areas in Minnesota, Wisconsin, Michigan, and Illinois declined sharply while use of the upper Mississippi River near LaCrosse, Wisconsin (navigational pools 7 and 8), and Keokuk, Iowa (Pool 19), increased (Bellrose 1980, Serie et al. 1983). Trauger and Serie (1974) suggested that these shifts in use of major staging areas have influenced winter distribution of canvasbacks in the Atlantic and Mississippi Flyways. A high proportion of the canvasbacks staging at Pool 19 continue a southward migration to the lower Mississippi Valley and Gulf Coast (Serie et al. 1983). It is unknown whether canvasbacks now occurring at Catahoula

Lake represent the population that traditionally wintered in the Mississippi Flyway or include birds that may have shifted wintering areas at the time when changes in staging areas occurred. Nichols and Haramis (1982) found a strong flyway fidelity in canvasbacks in the Atlantic Flyway, and Serie et al. (1983) could determine no shifts between flyways in wintering distribution of canvasbacks banded at Pool 19 during 1973–1975. Therefore, it seems unlikely that increases at Catahoula Lake are a result of gradual shifting of canvasbacks that formerly wintered in the Atlantic Flyway. However, large aggregations of canvasbacks wintering in the lower Mississippi Valley appear to be a relatively recent phenomenon (Serie et al 1983, A. R. Brazda, FWS, unpubl. data).

Clearly, the changes in winter water levels at Catahoula Lake have created highly attractive habitat for canvasbacks. Prior to operation of the diversion canal water control structure, water levels during November and early December were generally less than 9.0 m above m.s.l. This created large expanses of shallow flooded habitat (<0.3 m depth) with standing vegetation throughout much of the lake. Such habitat was heavily used by dabbling ducks foraging for seeds and subterranean tubers. Canvasback use of the lake was reported as low, sporadic, and usually occurring in late winter after the lake was deeply flooded (LDWF, unpubl. files). Since 1972, the water management plant for Catahoula Lake has entailed flooding the lake to 8.8–9.0 m between 10–15 November and maintaining those levels through the hunting season (mid-Jan). However, because the ability to control water levels at Catahoula Lake is limited once fall and winter rains begin, water levels during November and the rest of the winter generally have exceeded 9.0 m. Given the bottom contours and height of the lake bed vegetation, lake levels exceeding 9.0 m overtop the emergent vegetation and provide open water habitat over most of the lake.

Although canvasback numbers at Catahoula Lake generally peak in December or January, birds arrive throughout November. Survey data and ground observations indicate that large influxes of canvasbacks occur in late November–early December. The increased November water levels since 1972 have provided a predictable open water habitat with high-quality food resources (i.e., chufa flatsedge tubers). Cody (1974) suggested that distribution patterns of many species are affected by predictability of food resources. Trauger and Serie (1974) attributed development of annual concentrations of staging canvasbacks at navigational pools 7, 8, and 19 to successional changes which produced habitat favorable to diving ducks. Work by Thompson (1973) and Korschgen et al. (1988) demonstrated the importance of predictable food resources to maintaining canvasback use of those staging areas. In the case of Catahoula Lake, predictable food resources were already present but increased water depth created habitat conditions more suitable to diving ducks. We conclude that the increased predictability of available open water habitat during November has been a major factor in establishing a tradition of canvasback use of Catahoula Lake.

The increasing numbers of wintering canvasbacks at Catahoula Lake underscores the importance of this area to management of the continental canvasback population. Canvasback numbers are currently below management goals established

in the North American Management Plan (U.S. FWS and Can. Wildl. Serv. 1986). Knowledge of the wintering ecology and survival of canvasbacks will be important components in efforts to attain population goals. Studies on canvasback feeding ecology, body condition, habitat use, and population structure are currently being conducted at Catahoula Lake (W. L. Hohman and D. W. Woolington, FWS, unpubl. data).

At present, little is understood about canvasback survival patterns at Catahoula Lake. For example, lead toxicosis in waterfowl, including canvasbacks, at Catahoula Lake is well documented (Yancey 1953, Wills and Glasgow 1964, Shealy 1982, Zwank et al. 1985). Lead shot ingestion rates of canvasbacks at Catahoula Lake have been assessed (R. Helm, LDWF, unpubl. data). However, the magnitude of direct mortality and sublethal impacts on the canvasback population there has not been quantified. In addition, oil production platforms and pipelines are adjacent to and present on the lake bed. Canvasbacks are highly susceptible to oil spills (Clapp et al. 1982); however, the actual risk to the birds at Catahoula Lake has not been assessed. Given the increasing importance of Catahoula Lake to wintering canvasbacks, we urge that additional research be initiated there to assess the factors affecting the physical condition and survival rates of wintering canvasbacks at Catahoula Lake.

Literature Cited

Bellrose, F. C. 1980. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, Pa. 540pp.

Clapp, R. B., D. Morgan-Jacobs and R. C. Banks. 1982. Marine birds of the southeastern United States and Gulf of Mexico. Part II Anseriformes. U.S. Fish Wildl. Serv., Off. Biol. Serv. FWS/OBS-82/20. 492pp.

Cody, M. L. 1974. Competition and the structure of bird communities. Princeton Univ. Press, Princeton, N.J. 318pp.

Conover, W. J. 1971. Practical nonparametric statistics. John Wiley and Sons, Inc., New York, N.Y. 462pp.

Korschgen, C. E., L. L. George and W. L. Green. 1988. Feeding ecology of canvasbacks staging on Pool 7 of the Upper Mississippi River. Pages 237–249 *in* M. W. Weller, ed. Waterfowl in winter. Univ. Minn. Press, Minneapolis.

Martinson, K. R. and C. F. Kaczynski. 1967. Factors influencing waterfowl counts or aerial surveys, 1961–66. U.S. Fish and Wildl. Serv. Spec. Sci. Rep. Wildl. 105.

Nichols, J. D. and G. M. Haramis. 1982. Sex-specific differences in winter distribution patterns of canvasbacks. Condor 82:406–416.

SAS Institute, Inc. 1987. SAS/STAT guide to personal computers, Version 6 ed. SAS Institute, Inc., Cary, N.C. 1028pp.

Serie, J. R., D. L. Trauger and D. E. Sharp. 1983. Migration and winter distributions of canvasbacks staging in the Upper Mississippi River. J. Wildl. Manage. 47:741–753.

Shealy, P. M. 1982. A lead toxicity study of waterfowl on Catahoula Lake and Lacassine National Wildlife Refuge. M.S. Thesis. La. State Univ., Baton Rouge. 89pp.

Stewart, R. E., A. D. Geis and C. D. Evans. 1958. Distribution of population and hunting kill of the canvasback. J. Wildl. Manage. 22:333–370.

Stott, R. S. and D. P. Olson. 1972. An evaluation of waterfowl surveys on the New Hampshire Coastline. J. Wildl. Manage. 36:467–477.

Thompson, D. 1973. Feeding ecology of diving ducks on Keokuk Pool, Mississippi River. J. Wildl. Manage. 37:367–381.

Trauger, D. L. and J. R. Serie. 1974. Looking out for the canvasback. Part III. Ducks Unlimited 38:44–45, 60, 64, 71–72.

U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1986. North American waterfowl management plan. U.S. Fish Wildl. Serv. Washington, D.C. 33pp.

Wills, D. W. 1965. An investigation of some factors affecting waterfowl and waterfowl habitat on Catahoula Lake. M.S. Thesis, La. State Univ., Baton Rouge. 81pp.

———. 1972. Food habit study of mallards and pintails on Catahoula Lake, Louisiana, with notes of food habits and other species. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 25:289–294.

——— and L. L. Glasgow. 1964. Lead shot on Catahoula Lake and its management implications. Proc. Annu. Conf. Southeast. Game and Fish Comm. 18:90–105.

Wycoff, R. G., D. W. Wills and L. L. Glasgow. 1971. An evaluation of recovery data from artificially seeded lead shot on Catahoula Lake, LaSalle Parish, Louisiana. Proc. Annu. Conf. Southeast. Game and Fish Comm. 25:245–254.

Yancey, R. K. 1953. Lead poisoning on Catahoula Lake. La. Cons. 5:2–5.

Zar, J. H. 1974. Biostatistical analysis. Prentice-Hall, Inc., Englewood Cliffs, N.J. 620pp.

Zwank, P. J., V. L. Wright, P. M. Shealy and J. D. Newsom. 1985. Lead toxicosis in waterfowl on two major wintering areas in Louisiana. Wildl. Soc. Bul. 13:17–26.