

NEBRASKA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT  
UNIVERSITY OF NEBRASKA – LINCOLN

AND

NEBRASKA GAME AND PARKS COMMISSION  
FISHERIES DIVISION

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Performance Report

Study I

Angler behavior in response to management actions on Nebraska reservoirs

Job 1

Angler behavior in response to management actions on Nebraska reservoirs

1 January 2009 through 31 December 2009

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## PERFORMANCE REPORT

State: Nebraska

Project No: F-182-R

Study Number: I

Segment Number: 1

Project Title: Angler behavior in response to management actions on Nebraska reservoirs

Period Covered: 1 January 2009 through 31 December 2009

### Study Title and Objectives:

Angler behavior in response to management actions on Nebraska reservoirs

1. Document the current participation levels of anglers in Nebraska's lentic systems (as assessed by in-person interviews at specific water bodies) and describe differences in participation levels and associated harvests among water bodies and among generic angling groups.

Introduction: Angling is the most important factor structuring fish populations (Hilborn and Walters 1992; Murawski and Idoine 1992; Mather et al. 1995; Cox 2000), especially in areas with intensive fishing pressure. For example, populations of largemouth bass and walleye frequently exhibit "stockpiling" of fish just below the minimum length limit (Anderson 1976; Eder 1984; Novinger 1984; Munger 2002). Even so, inland fishery biologists rarely incorporate spatial and temporal patterns in angler participation into management strategies (Radomski et al. 2001), possibly because little is understood about angler decisions to participate in the sport. Anglers are influenced by numerous factors when selecting fishing sites (Hunt and Ditton 1997). For example, angler effort may be related directly to fish densities within any one lake and influenced by the regulation strategy in place on that lake (Carpenter et al. 1994; Beard 2002; Carpenter and Brock 2004). Furthermore, fish densities and angling participation are dynamic (i.e., vary from year to year and from lake to lake). Variability in fish recruitment among lakes should increase dispersion in densities of fish across a region (Hilborn and Walters 1992),

whereas movement of anglers among lakes should decrease dispersion in densities of fish across a region (Cox 2000).

Managers desire to better understand patterns in angler participation and their associated causes in inland fisheries. However, incorporation of spatial and temporal patterns in angler participation into fishery management likely will require a shift in focus from lake-specific management to regional management. This shift in focus would be facilitated by the development of regional models for angler participation. Such models would help managers better determine appropriate lake-specific management objectives given the dynamic nature of angler participation.

(1) Job Objective I-1:

Document the current participation levels of anglers in Nebraska's lentic systems (as assessed by in-person interviews at specific water bodies) and describe differences in participation levels and associated harvests among water bodies and among generic angling groups.

(a) Activity.

*Statewide Survey* – A roving count and interview survey design was employed to document angler participation patterns, fishing pressure, catch and harvest at Calamus Reservoir, Harlan County Reservoir, Lake Maloney, Lake McConaughy, Lake Ogallala, Lewis and Clark Lake, Merritt Reservoir and Sherman Reservoir between 1 April and 31 October 2009 (Table 1). Creel surveys followed a stratified multi-stage probability sampling regime (Malvestuto 1983, 1996; Newcomb 1992) designed using computer programs produced by the Nebraska Game and

Parks Commission (NGPC). A total of 10 to 20 days was surveyed per month at each water body depending on logistics and lake grouping. Surveys were stratified by day-type ranging from six weekdays and four weekend/holiday days per month to 14 weekdays and six weekend/holiday days per month (Table 2). Each creel day was further stratified into two (sunrise to zenith [morning], and zenith to sunset [afternoon]) survey periods. Roving effort counts were conducted from vehicles and/or high point observations one time during each survey period. Effort counts included angler effort as well as other water-based recreational effort (e.g., water skiing, pleasure boating, sun bathing, etc.). Interview information gathered from anglers at multiple access points included fishing effort, method of angling (boat vs. bank), species and number of fish caught and harvested and angler perceptions on the quality of their fishing experience.

*Salt Valley Survey* – An access-point count and interview survey design was employed to document angler participation patterns, fishing pressure, catch and harvest at seven water bodies in the Salt Valley watershed in southeastern Nebraska between 1 April and 31 December 2009 (Table 1). Creel surveys followed a stratified multi-stage probability sampling regime (Malvestuto 1983, 1996; Newcomb 1992). A total of 12 days were surveyed per month at each water body pair (i.e., two water bodies were paired together for sampling purposes, and counts and interviews were conducted at both reservoirs during a shift). Surveys were stratified by day-type with six weekdays and six weekend/holiday days per month. Each creel day was further stratified into three (00:00 – 08:00 [early], 08:00 – 16:00[mid], and 16:00 – 00:00[late]) survey periods. The sampling design consisted of two samples from each survey period/day-type

combination (i.e., two weekend-early shifts, two weekday-late shifts, etc.). Effort counts were conducted from vehicles and/or high point observations two times at each reservoir during each survey period. Effort counts included angler effort as well as other water-based recreational effort (e.g., water skiing, pleasure boating, sun bathing, etc.). Interview information gathered from anglers at multiple access points included fishing effort, method of angling (boat vs. bank), species and number of fish caught and harvested and angler perceptions on the quality of their fishing experience. Information was also gathered on potential substitute sites that anglers would choose to fish at if the specific water body they were interviewed at was closed on that day.

Additional pressure counts were also conducted at those seven water bodies and 12 additional water bodies within the Salt Valley to obtain angler effort estimates. These water bodies were sampled twelve times per month using the same sampling design as the full creel survey (see above). During each sample period, a bus-route method was used to conduct pressure-counts at each water body. A random start direction, start location, and start time (within the first 2 hours of the sampling period) were selected for each pressure count.

*Sexual Dimorphism* – Information was collected from angler-harvested walleye, white bass, white crappie, and channel catfish via fish cleaning stations at Calamus Reservoir and Sherman Reservoir during April – July 2009. All fish were measured for total length (TL; mm) and weighed (g); sagittal otoliths were removed, and sex was determined by visual inspection of gonads. Gonads and liver were excised and weighed (0.1 g). In addition to collections from angler harvest, samples were collected from walleye, white bass, and white crappie from NGPC annual population surveys at Calamus and Sherman reservoirs. Similarly, all fish were measured

for total length (TL; mm) and weighed (g); sagittal otoliths were removed, and sex was determined by visual inspection of gonads. Gonads and liver were excised and weighed (0.1 g).

(b) Target Date for Achievement:

Data gathered from statewide surveys will be combined with historic data already collected by NGPC and used to quantify long-term (12-15 years) patterns in angler participation at specific water bodies. This information will also be used to assess responses of anglers to changes in regulations. For example, we will determine whether (and for how long) changes in angler participation and harvest are detectable in response to changes in regulations.

Data gathered from Salt Valley surveys using the 24-hour sampling protocol will be used to model short-term (4 years) spatial (water bodies) and temporal (monthly) patterns in angler participation within a region. This will provide information on the response of participation by anglers to changes in fish populations and management actions within this region. Data from NGPC standardized fish surveys will be used to quantify metrics (dynamics and size structure) of fish populations. Additionally, data gathered in this study following the 24-hour sampling protocol will be used to quantify effort and harvest by catfish anglers (a group of anglers that are likely underrepresented in creel surveys completed only during daytime) to determine what information, if any, is gained with a 24-hour sampling period over a daytime sampling period.

Information gathered from angler-harvested fish at Calamus Reservoir and Sherman Reservoir will be used to model potential effects of angler harvest on population dynamics of fishes that exhibit sexual dimorphism and are managed with different length limits. Further, this information will enable biologist to assess the potential impacts of different harvest regulations

on the primary brood-stocks of walleye that are used in Nebraska for production purposes (i.e., stocking).

Surveys will be conducted year-round at randomly selected Salt Valley reservoirs through 31 December 2012 (Table 1). Surveys will be conducted at statewide reservoirs (1 April – 31 October) through 31 October 2013 (Table 1). Information on angler-harvested fish will also be collected at Calamus Reservoir and Sherman Reservoir April through July 2010.

(c) Date of Accomplishment:

Activities are proceeding on schedule.

(d) Significant Deviations:

None.

(e) Remarks:

*Statewide Survey* – Data have been summarized for five reservoirs: Merritt Reservoir, Calamus Reservoir, Lewis and Clark Lake, Sherman Reservoir and Harlan County Reservoir. Data analysis and summarization is currently being conducted for the remaining statewide reservoirs surveyed during 2009.

Totals of 637 counts (Table 3) and 5,018 interviews (Table 4) were conducted at the five reservoirs during 2009. Total angler effort ranged from 75,912 to 130,984 hours (Table 5). When accounting for reservoir size, angler effort ranged from 2.9 to 46 hours per acre (Table 5).

Merritt Reservoir had the most hours of anglers seeking walleye, whereas crappie anglers spent the most time at Sherman Reservoir (Table 5). Harlan County Reservoir had the greatest channel catfish and white bass fishing effort (Table 5).

Total catch estimates ranged from 38,233 to 93,547 fish (all species) at the five reservoirs (Table 6). Walleye catch (74,034) and harvest (28,231) was greatest at Merritt Reservoir. Channel catfish catch (11,115) and harvest (7,497) was greatest at Harlan County Reservoir. The greatest white bass (32,291) and crappie (21,759) catch estimates were at Calamus Reservoir and Sherman Reservoir, respectively.

*Salt Valley Survey* – Total angler effort ranged from 2,048 to 122,758 hours at the reservoirs of the Salt Valley watershed (Table 7). When accounting for reservoir size, angler effort ranged from 32 to 1,228 hours per acre. Effort was greatest in May and June in the Salt Valley (Table 7).

There were 779 interviews conducted at the seven reservoirs surveyed during 2009 (Table 8). Harvest rates were low across all reservoirs (i.e., 9.5% of parties interviewed harvested fish). Harvest rates were greatest at Red Cedar (12.5% of parties interviewed harvested fish); however the number of interviews was substantially lower than at other reservoirs in the Salt Valley (Table 8).

*Sexual Dimorphism* – A total of 1,017 fish was sampled at Calamus and Sherman Reservoirs during April – July 2009. At Calamus Reservoir, information was collected from 387 walleye (Figure 1), 87 white bass (Figure 2), and 10 channel catfish. At Sherman Reservoir,

information was collected from 193 walleye (Figure 3), 160 white bass (Figure 4), 169 white crappie (Figure 5), and 6 channel catfish.

(f) Recommendations:

None.

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Table 1. Creel survey schedule for Nebraska water bodies (2009 – 2013). An “X” indicates that a water body will be sampled 1 April through 31 October during the respective year with daytime sampling stratified into two periods; A “Y” indicates that a water body will be sampled year-round with daytime and nighttime sampling stratified into three periods.

Water Body	2009	2010	2011	2012	2013
Calamus	X	X	X	X	X
Harlan County	X	X	X	X	X
McConaughy, Ogallala	X	X	X	X	X
Merritt	X	X	X	X	X
Sherman	X	X	X	X	X
Lewis and Clark	X	X	X	X	X
Maloney & Canal	X				
Fremont SRA		X	X	X	X
Red Willow, Medicine Creek		X			
Swanson, Enders		X			
Willow Creek, Skyview, Ta Ha Zouka		X			
Johnson			X	X	
Cottonmill, Yanney					X
<i>Salt Valley Water Bodies</i>					
Bluestem		Y		Y	
Branched Oak	Y	Y	Y	Y	
Conestoga	Y				
Holmes	Y		Y		
Olive Creek				Y	
Pawnee	Y	Y			
Stagecoach	Y	Y			
Wagon Train			Y	Y	
Yankee Hill			Y		
Cottontail		Y			
Meadowlark				Y	
Killdeer				Y	
Merganser		Y	Y		
Red Cedar	Y				
Timber Point	Y				
Wild Plum			Y		
Wildwood		Y	Y	Y	

Table 2. Stratified day-type schedule (week days/weekend and holiday days per month) for statewide survey reservoirs.

Water Body	2009	2010	2011	2012	2013
Calamus	14/6	14/6	14/6	14/6	14/6
Harlan County	14/6	14/6	14/6	14/6	14/6
McConaughy, Ogallala	6/4 , 6/4	6/4 , 6/4	6/4 , 6/4	6/4 , 6/4	6/4 , 6/4
Merritt	14/6	14/6	14/6	14/6	14/6
Sherman	14/6	14/6	14/6	14/6	14/6
Lewis and Clark	10/5	TBA	TBA	TBA	TBA
Maloney & Canal	14/6				
Fremont SRA		TBA	TBA	TBA	TBA
Red Willow, Medicine Creek		6/4 , 6/4			
Swanson, Enders		6/4 , 6/4			
Willow Creek, Skyview & Ta Ha Zouka		6/4 , 6/4			
Johnson			TBA	TBA	
Cottonmill, Yanney					TBA

Table 3. Raw count data including days in survey period, days surveyed, counts conducted, total anglers, and mean anglers per day for Merritt Reservoir, Calamus Reservoir, Lewis and Clark Lake, Sherman Reservoir and Harlan County Reservoir during 2009 (1 April – 31 October).

Reservoir	Merritt*	Calamus	Lewis and Clark	Sherman	Harlan
Days in survey period	184	214	214	214	214
Days surveyed	114	140	104	138	140
Counts conducted	114	140	104	139	140
Total anglers	5563	4738	3207	2687	3727
Bank	360	881	589	182	296
Boat	5203	3857	2618	2505	3431
Mean anglers per day	48.8	33.9	30.9	43.9	26.6
Bank	3.2	6.3	5.7	9.9	2.1
Boat	45.6	27.6	25.2	34.0	24.5

\*Merritt Reservoir survey period: 1 May – 31 October

Table 4. Raw interview data including parties interviewed, anglers interviewed and interview catch totals for Merritt Reservoir, Calamus Reservoir, Lewis and Clark Lake, Sherman Reservoir and Harlan County Reservoir during 2009 (1 April – 31 October).

Reservoir	Merritt*	Calamus	Lewis and Clark	Sherman	Harlan
Parties interviewed	715	1476	732	1117	978
Total anglers interviewed	1712	3354	1466	2366	2111
Bank	141	1047	536	1322	382
Boat	574	2307	930	1044	1729
Interview catch totals (all species)	6437	14337	5405	5520	4205
Harvest	2717	5298	2144	2137	2534
Release	3720	9039	3261	3383	1671

\*Merritt Reservoir survey period 1 May – 31 October

Table 5. Total angler effort estimates and angler effort estimates by species sought for Merritt Reservoir, Calamus Reservoir, Lewis and Clark Lake, Sherman Reservoir and Harlan County Reservoir during 2009 (1 April – 31 October).

Reservoir	Merritt*	Calamus	Lewis and Clark	Sherman	Harlan
Hours (±SE)	125776 (5825)	104057 (9485)	87147 (4362)	130984 (6071)	75912 (4230)
Bank (±SE)	8629 (799)	19108 (991)	15987 (965)	29629 (1517)	6182 (439)
Boat (±SE)	117147 (5349)	84949 (8818)	71160 (3765)	101354 (5109)	69730 (3907)
Hours/Acre	43.3	20.3	2.9	46.0	5.6
Bank	3.0	3.7	0.5	10.4	0.5
Boat	40.3	16.6	2.4	35.6	5.2
Anglers	20343	21064	16781	24855	19679
Bank	1396	3868	3078	5622	1602
Boat	18947	17196	13702	19233	18076
Anglers/Acre	7.0	4.1	0.6	8.7	1.5
Bank	0.5	0.8	0.1	2.0	0.1
Boat	6.5	3.4	0.5	6.8	1.3
Walleye Sought					
Hrs	102997	69865	62743	51074	14596
Anglers	16658	14142	12081	9692	3784
Channel Catfish Sought					
Hrs	1922	5109	7291	13525	17157
Anglers	311	1034	1404	2566	4448
White Bass Sought					
Hrs	0	12843	1123	8942	32589
Anglers	0	2600	216	1697	8448
Crappie Sought					
Hrs	719	215	1146	24450	286
Anglers	8	44	221	4640	74

\*Merritt Reservoir survey period 1 May – 31 October

Table 6. Total catch estimates and catch estimates by species for Merritt Reservoir, Calamus Reservoir, Lewis and Clark Lake, Sherman Reservoir and Harlan County Reservoir during 2009 (1 April – 31 October).

Reservoir	Merritt*		Calamus		Lewis and Clark		Sherman		Harlan	
Total catch estimates										
Total Catch ( $\pm$ SE)	93547	(5685)	88870	(9303)	75166	(5520)	82994	(5199)	38233	(2176)
CPUE	0.69		0.93		0.91		0.67		0.51	
Harvest ( $\pm$ SE)	39232	(2277)	33809	(3656)	27833	(1989)	33813	(2222)	23076	(1769)
CPUE	0.30		0.38		0.34		0.30		0.30	
Release ( $\pm$ SE)	54315	(4267)	55061	(5859)	47333	(3873)	49181	(3777)	15157	(881)
CPUE	0.39		0.55		0.57		0.36		0.22	
Walleye catch estimates										
Total Catch ( $\pm$ SE)	74034	(5392)	25994	(4203)	37838		26773	(2634)	1165	(122)
CPUE	0.59		0.27		0.63		0.38		0.06	
Harvest ( $\pm$ SE)	28231	(1816)	15864	(2568)	13990		5467	(535)	871	(112)
CPUE	0.24		0.18		0.24		0.09		0.05	
Release ( $\pm$ SE)	45803	(4224)	10130	(1886)	23849		21306	(2194)	294	(42)
CPUE	0.35		0.09		0.39		0.30		0.01	
Channel Catfish catch estimates										
Total Catch ( $\pm$ SE)	784	(76)	2936	(349)	3582	(478)	8340	(1290)	11115	(827)
CPUE	0.04		0.20		0.31		0.31		0.60	
Harvest ( $\pm$ SE)	482	(69)	888	(107)	2619	(375)	6252	(1278)	7497	(535)
CPUE	0.04		0.07		0.23		0.27		0.53	
Release ( $\pm$ SE)	302	(41)	2049	(308)	963	(165)	2088	(185)	3617	(431)
CPUE	0		0.12		0.08		0.03		0.08	

\*Merritt Reservoir survey period 1 May – 31 October

Table 6. (continued)

Reservoir	Merritt*		Calamus		Lewis and Clark		Sherman		Harlan	
White Bass catch estimates										
Total Catch ( $\pm$ SE)	607	(161)	32291	(2964)	17747	(1955)	11654	(1210)	21128	(1336)
CPUE	0		2.17		0.36		0.97		0.53	
Harvest ( $\pm$ SE)	560	(161)	10775	(1306)	6281	(968)	8180	(1082)	11622	(1059)
CPUE	0		1.38		0.20		0.80		0.27	
Release ( $\pm$ SE)	47	(10)	21516	(2004)	11467	(1372)	3474	(369)	9506	(585)
CPUE	0		0.80		0.17		0.17		0.26	
Crappie catch estimates										
Total Catch ( $\pm$ SE)	1620	(171)	400	(78)	2907	(607)	21759	(1563)	305	(52)
CPUE	0.10		0.004		0.31		1.00		0.22	
Harvest ( $\pm$ SE)	846	(110)	293	(65)	1604	(320)	11285	(799)	283	(51)
CPUE	0.10		0.004		0.20		0.33		0.22	
Release ( $\pm$ SE)	774	(137)	107	(25)	1303	(364)	10473	(1064)	21	(10)
CPUE	0		0		0.11		0.67		0	

\*Merritt Reservoir survey period 1 May – 31 October

Table 7. Angler effort by month during 2009 for 19 reservoirs in the Salt Valley watershed.

Reservoir	April	May	June	July	August	September	October	November	December
Bluestem	630	2719	2756	2303	1543	305	36	0	0
Bowling	.	.	4493	3618	890	1018	393	461	0
Branched Oak	3725	23826	9616	12457	6109	3200	218	970	0
Conestoga	962	8852	6877	4380	3059	3113	667	0	0
Cottontail	0	259	663	739	162	73	73	81	0
East Twin	1271	9147	4032	3632	2618	1004	327	0	0
Holmes	7058	21319	37770	23085	17042	8655	1937	4921	971
Killdeer	420	1384	97	537	453	44	0	162	0
Meadowlark	129	1798	679	1164	493	87	0	0	0
Merganser	0	687	388	1665	40	73	0	40	0
Olive Creek	1220	4800	5422	3785	4586	1222	218	404	0
Pawnee	2667	14065	10675	12129	6909	4873	469	283	0
Red Cedar	0	1111	937	477	412	0	36	0	0
Stagecoach	3160	11972	9406	4618	4081	2618	667	81	0
Timber Point	121	2093	1810	1547	1111	1076	36	81	89
Wagon Train	1463	11778	9770	13661	6327	7084	1253	566	267
Wild Plum	89	937	493	162	81	553	0	0	0
Wildwood	1253	9135	5754	6521	4162	2284	364	525	339
Yankee Hill	1648	6473	6012	2949	1984	960	327	0	0



Table 8. Number of interviews conducted at reservoirs in the Salt Valley watershed and number of interviews in which fish were harvested.

Reservoir	Interviews	Interviews with harvest
Branched Oak	187	20
Conestoga	116	11
Pawnee	126	13
Timber Point	64	3
Red Cedar	8	1
Holmes	189	17
Stagecoach	89	9
Total	779	74

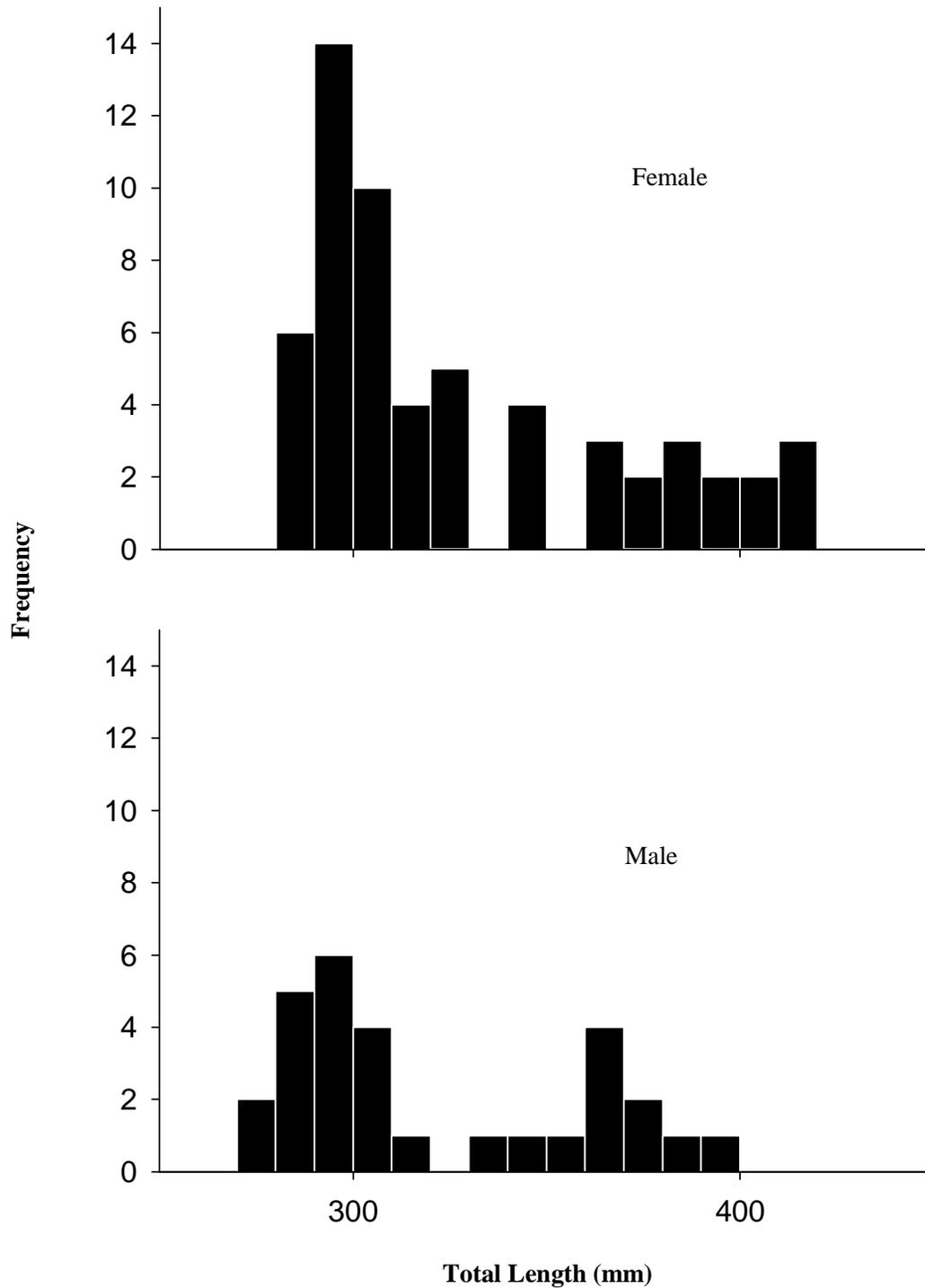


Figure 1. Length-frequency histogram of walleye (female and male) sampled at Calamus Reservoir during May – July 2009.

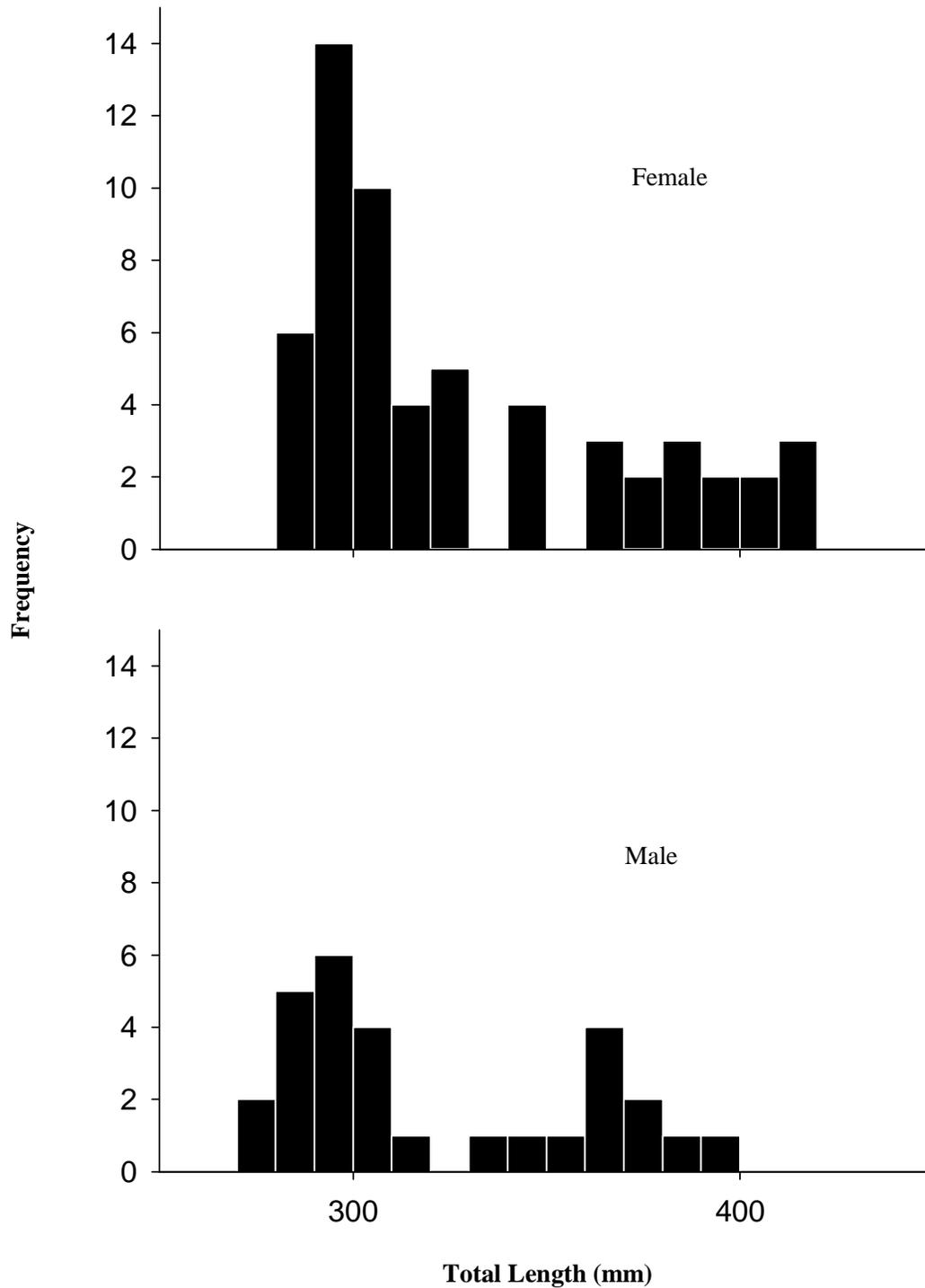


Figure 2. Length-frequency histogram of white bass (female and male) sampled at Calamus Reservoir during May – July 2009.

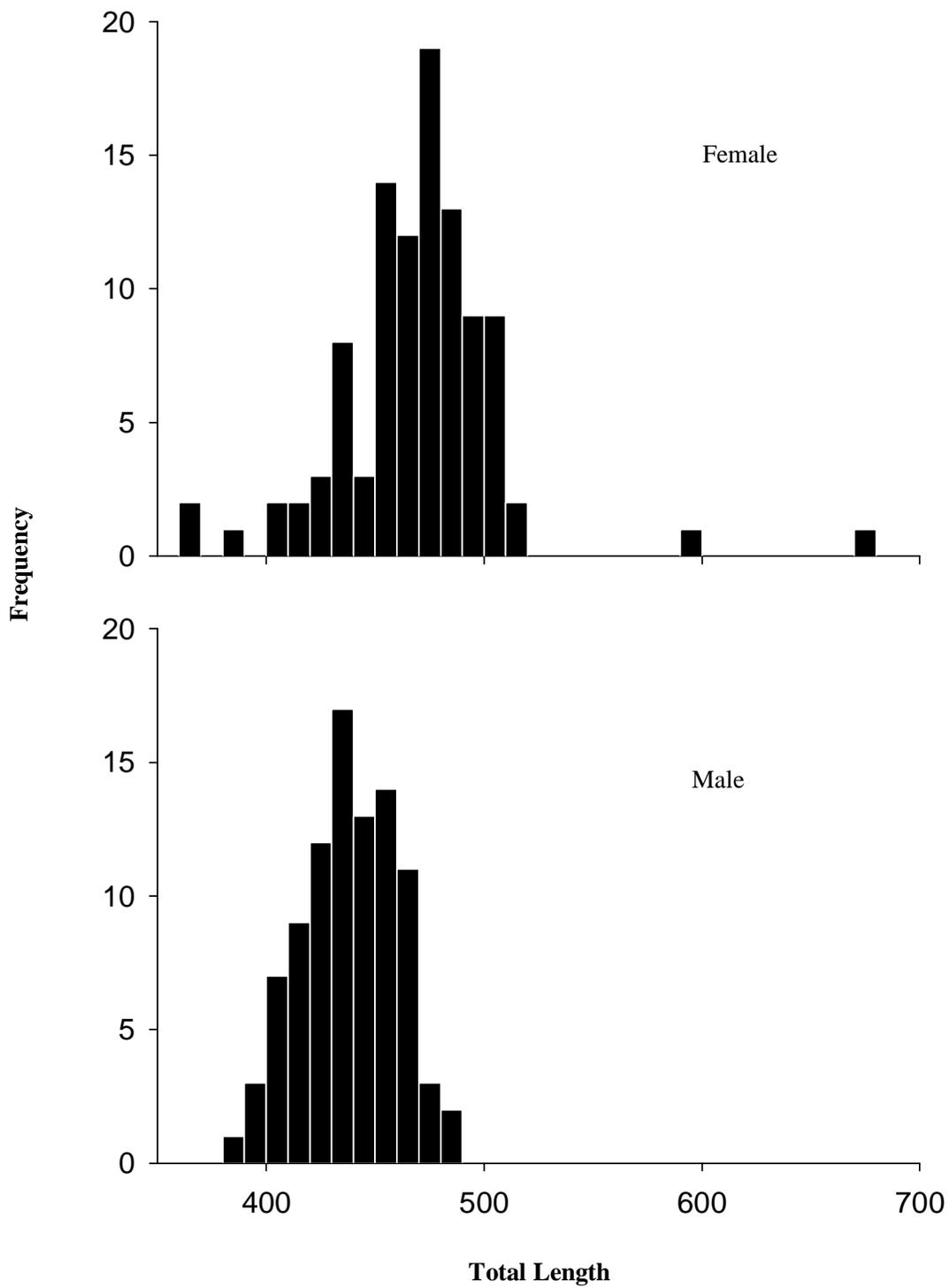


Figure 3. Length-frequency histogram of walleye (female and male) sampled at Sherman Reservoir during April – July 2009.

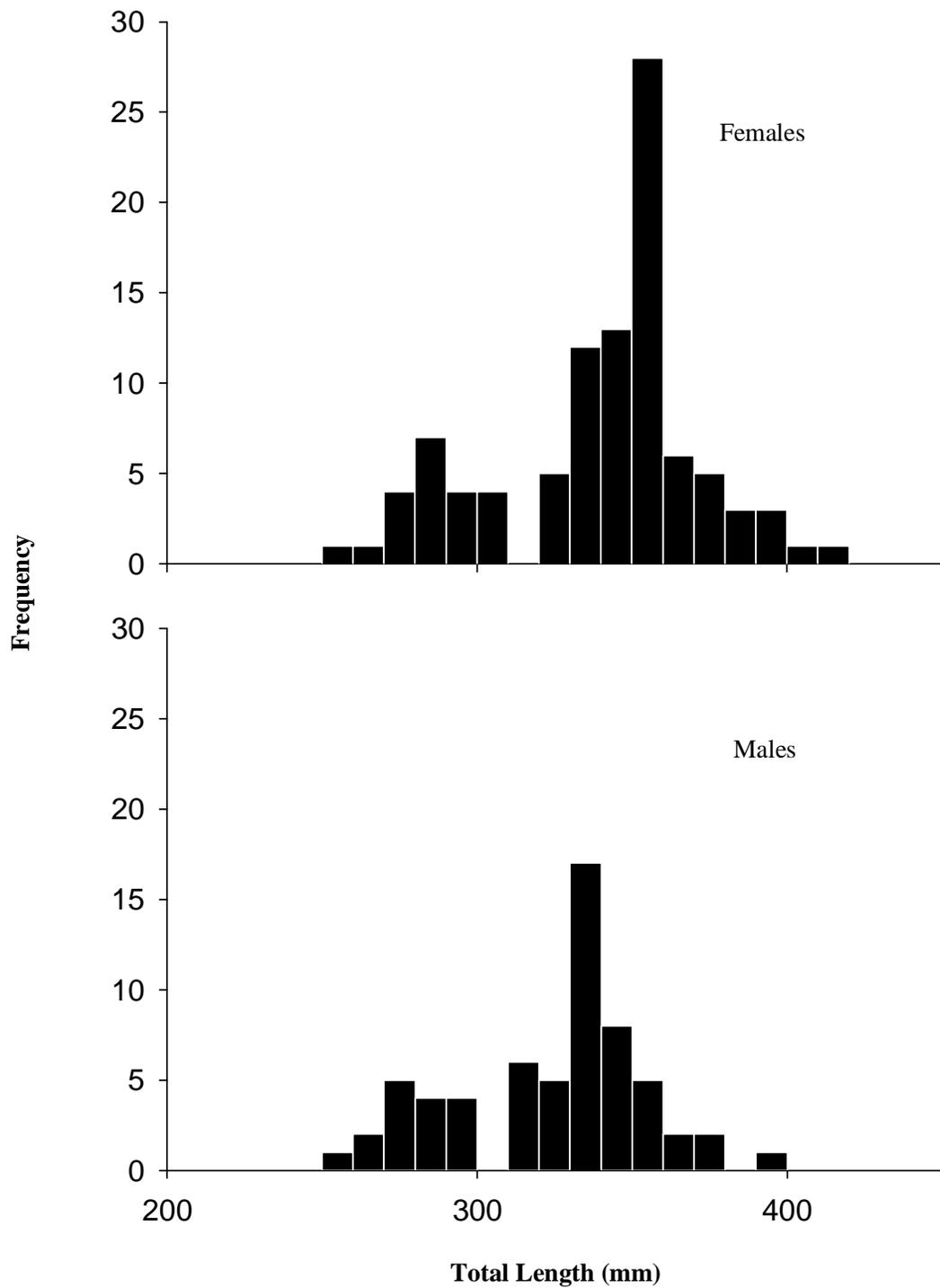


Figure 4. Length-frequency histogram of white bass (female and male) sampled at Sherman Reservoir during April – July 2009.

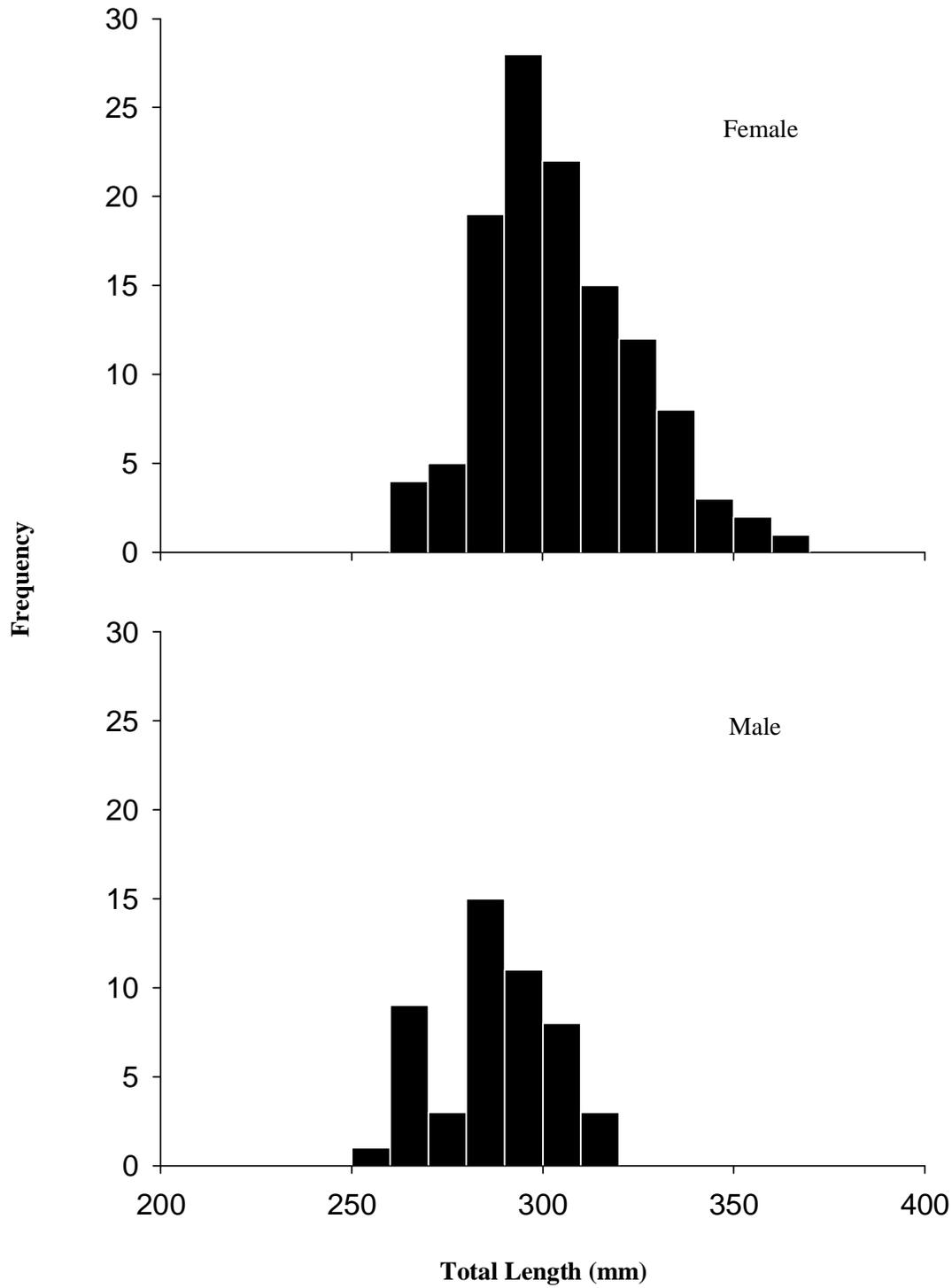


Figure 5. Length-frequency histogram of white crappie (female and male) sampled at Sherman Reservoir during April – July 2009.