LAKE FRANCES CREEL CENSUS

MAY 1989 - MAY 1990

FINAL REPORT

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SUMMARY

A survey of fishing pressure and harvest was conducted on Lake Frances, a 5,000-acre irrigation reservoir located in northcentral Montana. A total of 470 total counts of anglers were made by creel clerks during May 1989 through May 1990. An average of 2.9 shore anglers and 8.6 fishing boats were observed during summer period counts and an average of 18.3 anglers were observed on weekend counts during the ice fishing season. Total estimated fishing pressure was 70,765 angler-hours or 11,830 angler-days for the period May 1989 through April 1990. This equates to 14.1 hours/acre or 2.4 angler-days/acre. Fishing pressure estimates were similar to those obtained by a concurrent statewide mail survey. Approximately 83% of total annual fishing pressure occurred during the summer period (April through September). Boat anglers accounted for 87% of summer period fishing pressure.

A total of 1050 parties of anglers were interviewed (962 in summer and 88 in winter). Nearly three-quarters of summer anglers and more than 90% of winter anglers came from local areas within a 75-mile radius of the reservoir. Summer anglers mostly targeted walleye (59% of parties interviewed) while a few (9%) fished specifically for northern pike. In contrast, most winter anglers fished specifically for northern pike (60% of parties) and only 8% of winter parties targeted walleye. Walleye catch rate averaged 0.35/hour during the summer and only 0.001/hour in winter. Northern pike catch rate was similar in summer and winter, averaging 0.11 and 0.14/hour respectively. Less than 1% of summer anglers fished specifically for yellow perch yet perch accounted for 34% of fish harvested in summer.

Approximately 25,000 fish weighing 32,000 pounds were harvested during May 1989 through April 1990. This total was comprised of 11,494 walleye, 8362 yellow perch, 5602 northern pike, and 36 burbot. Total estimated yield was 6.4 pounds per acre with walleye and northern pike comprising 86% of annual yield. Approximately 78% of northern pike and 99-100% of the walleye and yellow perch harvest occurred in the summer period. Northern pike was the only species harvested in significant numbers during the winter period but winter fishing accounted for only 22% of total estimated annual northern pike harvest. Harvested walleye, northern pike, and yellow perch averaged 14.5, 21.7, and 9.4 inches total length respectively. Harvest by anglers using setlines or spears was negligible. Harvest by night anglers was low because only 5% of interviewed parties reported fishing at night and hourly harvest rates for nighttime anglers were similar to daytime rates. Harvest of walleye during their spawning period was negligible.

The summer period walleye catch rate on Lake Frances was similar to or higher than other Montana walleye reservoirs and was rated good when compared to walleye lakes in other states and provinces. Lake

Frances fishing pressure per unit of surface area was very high when compared to other Montana and northeastern Alberta walleye lakes, but was lower than most walleye waters in Wisconsin, Nebraska, and Minnesota. The average size of walleye caught in Lake Frances was smaller than walleye from other Montana reservoirs but somewhat larger than walleye from Wisconsin lakes. Lake Frances walleye yield (pounds/acre) was much higher than other Montana reservoirs and lakes in northeastern Alberta. Walleye yield was somewhat higher than the Wisconsin average but similar to the median value for 24 Minnesota lakes. Northern pike yield from Lake Frances was much higher than other Montana walleye reservoirs but only slightly higher than lakes in northeastern Alberta.

Approximately 47% of parties did not catch a walleye and 57% did not catch a northern pike in a complete day of fishing. Only 4% of parties harvested a daily limit of five walleyes/angler but these groups accounted for nearly 17% of total walleye harvested. Only 12% of parties harvested more than three walleyes per angler but these groups were responsible for 52% of total estimated walleye harvest. Only one of 505 complete trip parties interviewed had harvested more than four northern pike per angler, despite a 10-fish legal daily limit. As was the case for walleye, a relatively small percentage of parties (13%) accounted for a large percentage (65%) of estimated total northern pike harvest.

It was estimated that a four-walleye daily bag limit would reduce harvest by 5%, a 3-fish limit would reduce harvest by 14%, a 2-fish limit would cause a 27% reduction, and reducing the walleye limit to one fish daily would decrease harvest by 55%. Reducing the bag limit on northern pike would have little effect on harvest since few parties kept more than one northern per angler.

Voluntary angler tag returns and observations of fin clipped walleye in Lake Frances angler creels indicated exploitation rates by anglers are probably within an acceptable range for maintaining a healthy walleye population with good size distribution. Angler exploitation on northern pike may be high enough to affect numbers of larger sized fish available to anglers. These methods of determining exploitation have some limitations, primarily because they rely on voluntary tag returns, and results should be verified. The Lake Frances sport fishery should be carefully monitored because it has relatively high use, high yield, and small average size of walleye compared to other major Montana walleye reservoirs. All biological and harvest information on Lake Frances walleye and northern pike should be compiled and analyzed using a computerized fish population model to determine if bag and/or size limit changes are warranted.

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INTRODUCTION

Interest in walleye fishing has increased throughout Montana in recent years and Lake Frances is one of the most popular destinations for the states' walleye anglers. As interest has increased, there have been demands for improved walleye fishing opportunities and concern about potential overharvest. In contrast to many of the state's major trout resources, relatively little is known about the characteristics of Montana's walleye fisheries. Good information on fishing pressure and harvest is essential to properly manage fishery resources and determine if overharvest is occurring. The purpose of this study was to determine angler characteristics, fishing pressure, catch rates, and harvest by sport anglers from Lake Frances during the period May 1, 1989 through April, 1990.

STUDY AREA

Lake Frances is an off-stream irrigation storage reservoir located in northcentral Montana approximately 45 miles southeast of Glacier National Park and 50 miles south of the Canadian border. Water is diverted into Lake Frances from Dupuyer creek, which passes within five miles of the reservoir. Water is also supplied to the reservoir from Birch Creek via an inter-basin transfer to Dupuyer Creek. The reservoir has 5,000 surface acres and a maximum depth of 45 feet at full pool elevation of 3815 feet above mean sea level (Figure 1). Water level fluctuations average approximately 6-8 vertical feet annually. The reservoir has a maximum volume of 112,000 acre-feet and is operated by the Pondera County Canal and Reservoir Company. Walleye, northern pike, yellow perch, and burbot are the principal game and sport species present. White sucker, spottail shiner, and mottled sculpin are the main nongame and forage species. All species reproduce naturally, with no annual stocking program. The reservoir is located on the outskirts of the town of Valier which has a population of 640 people. Other cities and towns within a 75-mile radius have populations ranging from around 350 to 57,000 (Table 1).

Standard Central Fishing District daily and possession limits applied to Lake Frances during this study. The walleye limit was five fish and the northern pike limit was 10 fish daily and in possession with no size limits on either species. There were no limits on yellow perch or burbot. The lake was open to the use of two lines with two hooks per line year around except six lines could be used through the ice. Spearing of northern pike, walleye, burbot and nongame species was allowed through the ice only. Use of live minnows other than sculpins (Cottus) for bait was illegal. Interviews of anglers indicated live sculpins were rarely used as bait.

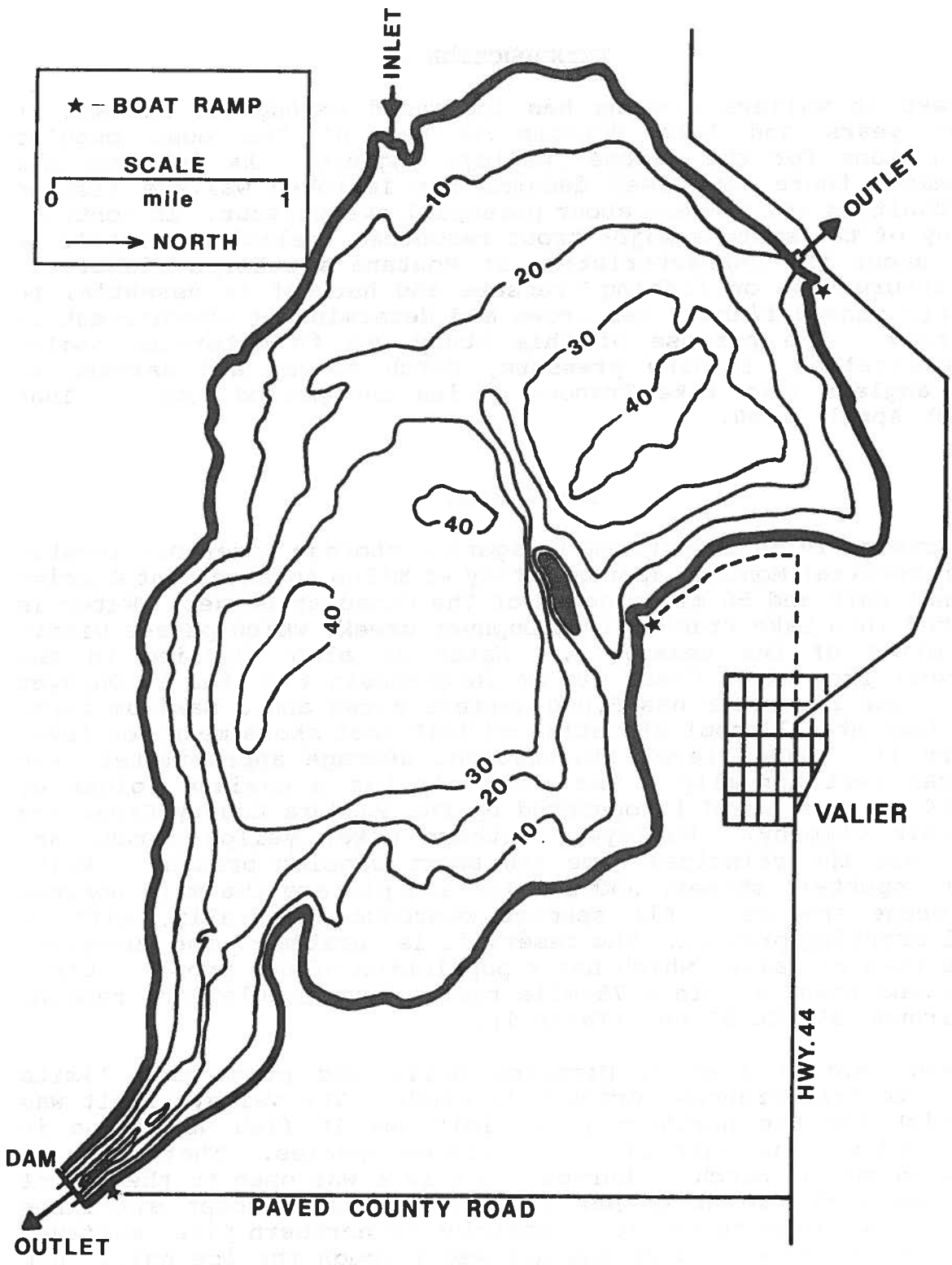


Figure 1. Map of Lake Frances with 10-foot depth contours.

Table 1. Population of cities and towns in the vicinity of Lake Frances (1980 population census).

Distance from Lake Frances					
25-mile radius	50-mile radius	75-mile radius	100-mile radius		Population
Valier					640
Conrad					3,074
Shelby					3,142
Cut Bank					3,688
				Sub	(10,544)
	Browning				1,226
	Choteau				1,798
	Dutton				359
	Sunburst				476
				Sub	(3,859)
		Augusta			700
		Chester			963
		Great Falls			56,725
				Sub	(58,388)
			Kalispell		10,648
			Lethbridge, Alta		70,000
			Fort Benton		1,693
			Belt		825
				Sub	(83,166)
					155,957

METHODS

Fishing pressure estimates were derived from total angler counts made four times each census day from selected shoreline vantage points. During each count the technician tallied all fishing boats and shore or ice anglers observed. Only anglers who were actually fishing or preparing to fish were counted. Counts were made on half the weekdays and half the weekend days and holidays selected randomly in each month from May through September of 1989 and in April and May of 1990. Counts were made on half the weekend days each month during the "winter" period; October 1989 through March 1990. Weekdays were not surveyed during the winter period.

The time of the first count on each day was randomly selected on an hourly basis beginning at sunrise. Subsequent counts on each day were made at two hour intervals. Starting times were selected randomly without replacement for two week periods. Counts were considered instantaneous since a complete count of anglers on the entire lake typically required less than 45 minutes to complete (Neuhold and Lu 1957). Catch rates, catch composition, fishing techniques, angler and trip characteristics, and biological information on harvested fish were determined by direct angler interviews. Pressure and harvest estimates were derived using the MDFWP creel census program run on IBM-compatible micro-computers. The creel census program uses procedures and formulae from Neuhold and Lu (1957).

Standard 125 x 6 foot experimental gill nets; 4 x 6 foot frame traps with 1-inch mesh; and night electrofishing were used to capture walleye and northern pike for tagging in April and May of 1989. Walleye longer than 14 inches total length were tagged with Floy cinch-up tags and those under 14 inches were marked with fin clips. Northern pike longer than 16 inches total length were tagged with Floy anchor tags. Representative samples of angler-caught fish were measured to the nearest tenth of an inch total length and weighed to the nearest hundredth of a pound. Scale samples were collected from representative samples for age determination.

RESULTS

For comparative purposes, data presented in this report will frequently be divided into two time periods. The "summer" period includes the months of May through September 1989 and the month of April 1990. Data for May 1990 are presented occasionally but are not included in seasonal fishing pressure or harvest totals. The "winter" period includes the months of October 1989 through March 1990. The reservoir began freezing in late November 1989 and ice cover was complete by December 17, 1989. Iceout began in mid-March and was complete on April 9 during the spring of 1990. Iceout occurred in mid-April during the spring of 1989.

Angler Characteristics

Data on angler characteristics and trip parameters are summarized in Table 2. A total of 1050 parties of anglers were interviewed during the entire study with nearly 92% of the interviews conducted during the summer period. Average party size ranged from 2.0-2.3 anglers in both summer and winter. Length of completed trips for parties fishing from boats was higher than for parties fishing from the shore during the summer period (5.3 vs. 3.6 hours). Length per completed trip for boat and shore and/or ice fishing parties was similar during winter. Boat and shore anglers used 1.0-1.2 lines per angler on average during the summer period and when open water existed during the winter period. Apparently, most anglers did not take advantage of the opportunity to use two lines during open water periods. However, anglers used an average of 5.1 lines per angler during the ice fishing season when it was legal to use six lines.

Nearly three quarters of summer anglers were local, coming from within a 75-mile radius of the reservoir. Seventeen percent of summer anglers travelled from Montana west of the Continental Divide, while only 3% were nonresidents. Nearly all (92%) of winter anglers came from the local area. Most anglers used lures with bait or bait alone during the summer. Bait alone was used predominantly in the winter. Most anglers fished specifically for walleye during the summer (59%) while only 9% of summer anglers fished specifically for northern pike. The reverse was true during the winter when 60% of anglers targeted northern pike and only 8% fished for walleye. Anglers rarely fished specifically for yellow perch, even though perch comprised a substantial portion of the summer harvest.

Fishing Pressure

A total of 470 counts of anglers were made by creel clerks during the study with 366 of these made during the summer period. Up to 18 shore anglers were observed in individual counts during the summer period, with an average of 2.9 shore anglers per count. The average number of fishing boats observed was 8.6 per count during the summer period, with a maximum of 42 fishing boats observed during a count on 20 August 1989. As many as 10 non-fishing boats were observed during summer period counts, with an average of 1.5 non-fishing boats per count. Some of the boats recorded as "non-fishing" probably contained anglers travelling to or from their fishing area while the counts were being made or contained anglers who were simply not fishing when the count was being made.

Conditions were suitable for ice fishing from mid-December through mid-March. The greatest number of anglers observed on the ice during any count was 48 on 3 February 1990. The average number of

Table 2. Characteristics of anglers and fishing trips on Lake Frances during the period 1 May 1989 through 30 April 1990.

Parameter	Time Period	
	Summer	Winter
No. parties interviewed		
Boat	750	7
Shore/ice	212	81
Total	962	88
Ave. party size		
Boat	2.3	2.3
Shore/ice	2.0	2.3
No. completed trip interviews		
Boat parties	394	7
Shore/ice parties	39	25
Ave. hrs/completed trip		
Boat anglers	5.31	3.89
Shore/ice anglers	3.55	3.74
Ave. # attended lines		
Boat anglers	1.1	1.0
Shore anglers	1.2	1.2
Ice anglers	-	5.1
Angler origin		
Local (75-mile radius)	71%	92%
Western MT	17%	5%
Other MT	10%	3%
Non-resident	3%	0%
Angling method		
Lures	14%	5%
Bait	34%	72%
Lures & bait	52%	19%
Other	0%	4%

anglers per count was 18.3 on weekends during the ice fishing season.

Total estimated fishing pressure was 70,765 angler-hours or 11,830 angler-days for the period May 1989 through April 1990 (Table 3). This equates to 14.1 hours or 2.37 angler-days per surface acre. Approximately 83% of total annual fishing pressure occurred during the summer period (April through September). Fishing pressure was highest in the months of June, July and August (Figure 2). These three months accounted for two-thirds of total annual pressure expressed in angler-hours (Table A1). Boat anglers accounted for 87% of total fishing pressure during the summer period but comprised only 12% of angling pressure during the winter period (Table A2). Eighty-eight percent of fishing pressure during the winter occurred through the ice or from shore. Boat angling during the winter period was restricted to the months of October and March when the reservoir was unfrozen or partly covered with ice.

Total fishing pressure for the winter period could not be precisely estimated because the survey was only conducted on weekends. Fishing pressure for winter weekdays was indirectly estimated by applying the ratio of weekday:weekend fishing pressure observed during the summer. Weekday pressure was 1.056 times weekend pressure (in hours) for the summer period (Table 3). Applying this ratio to the estimate of 5713 angler-hours for winter weekends resulted in an estimated 6033 hours of angling on winter weekdays. Results indicated winter fishing pressure (11,746 hours) was only about one-sixth of summer use and accounted for about 17% of total annual fishing pressure (Table 3).

Angler Success

Anglers interviewed during the summer period reported fishing a total of 9342 hours and those interviewed in winter fished 785 hours. Consequently, creel clerks directly censused approximately 16% of estimated summer fishing use, 7% of winter use and 14% of total annual fishing use. Walleye catch rate averaged nearly 0.35 fish per hour during summer but was only 0.001 per hour during winter (Table 4). Northern pike catch rate was similar in summer and winter, averaging 0.107 and 0.141 per hour, respectively. Catch rates for walleye and yellow perch peaked at slightly more than 0.8 fish per hour in August prior to declining to very low levels during the winter months (Figure 3). Northern pike catch rates were more stable on a seasonal basis (Figure 3). Monthly catch rates for all species are summarized in Table A3.

Anglers kept 50% of walleye, 64% of northern pike, and 46% of yellow perch caught during the summer period (Table A4). Lowest percentages of walleye kept by anglers corresponded with peak walleye catch rates observed in June and August. Boat anglers caught more than 80% of the walleye, northern pike and yellow perch

Table 3. Fishing pressure estimates for Lake Frances during the period May 1989 through April 1990. Eighty percent confidence intervals in parenthesis.

Period	Fishing Pressure Angler-days	Angler-hours
Summer		
Weekends	5,463	28,705
Weekdays	6,367	30,314
Total	11,830	59,109 (± 3500)
Winter		
Weekends	1,525	5,713 (± 761)
Weekdays	1,611*	6,033*
Total	3,136	11,746
Grand Total	14,966	70,765

* Indirect estimate - see text.

Table 4. Seasonal angler success on Lake Frances during the period May 1989 through April 1990.

	Walleye	N. Pike	Y. Perch	Burbot
Catch rate (fish/hr)				
Summer	0.347	0.107	0.291	0.001
Winter	0.001	0.141	0.011	0.005
Harvest rate (fish/hr)				
Summer	0.169	0.071	0.123	0.001
Winter	0.001	0.106	0.005	0.004
Percent of summer harvest				
Boat anglers	88%	86%	97%	-
Shore anglers	12%	14%	3%	-
Percent of winter harvest				
Boat anglers	0%	18%	35%	-
Shore anglers	0%	0%	0%	-
Ice anglers	100	82%	65%	-

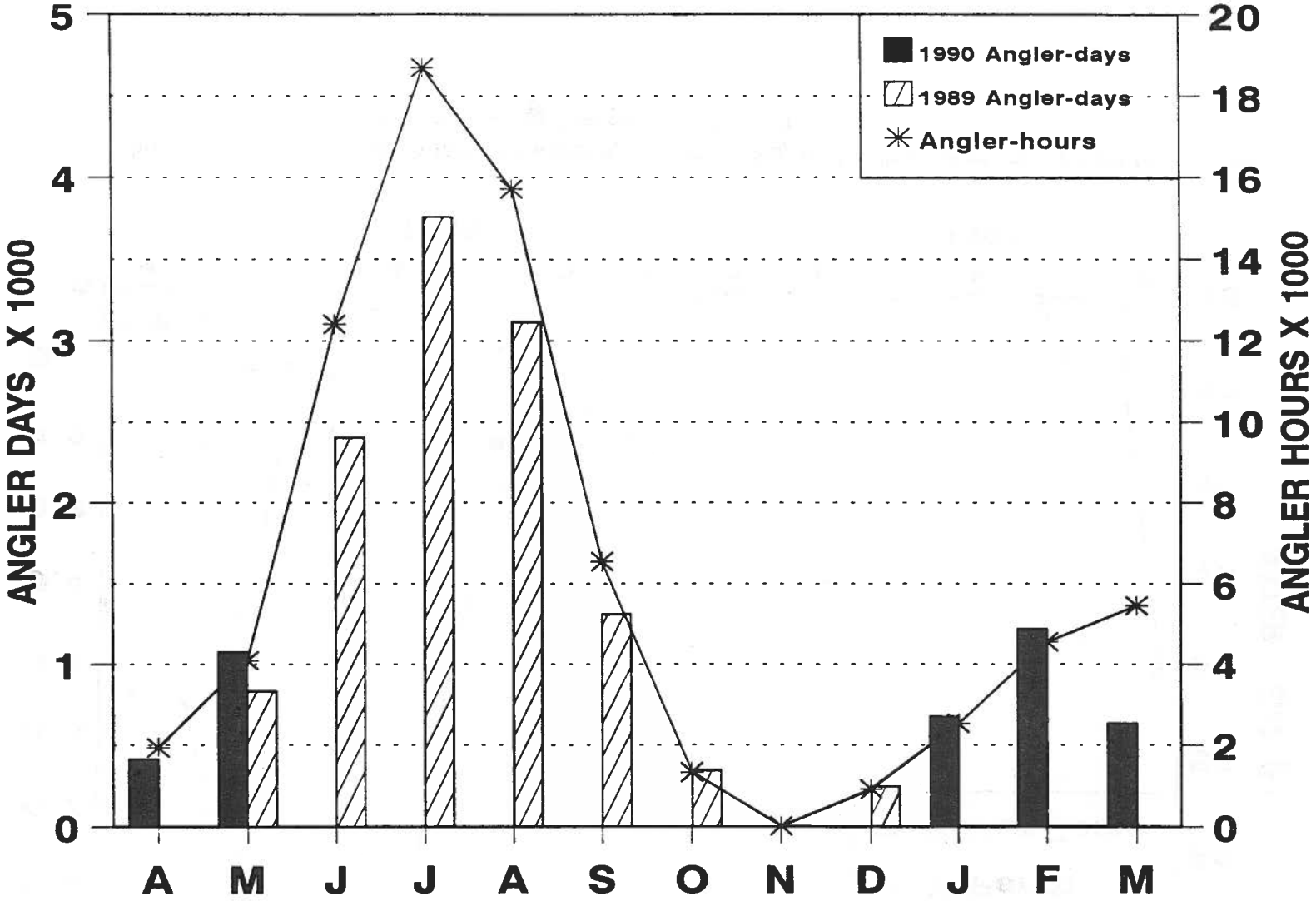


Figure 2. Estimated monthly fishing pressure on Lake Frances during May 1989 through May 1990.

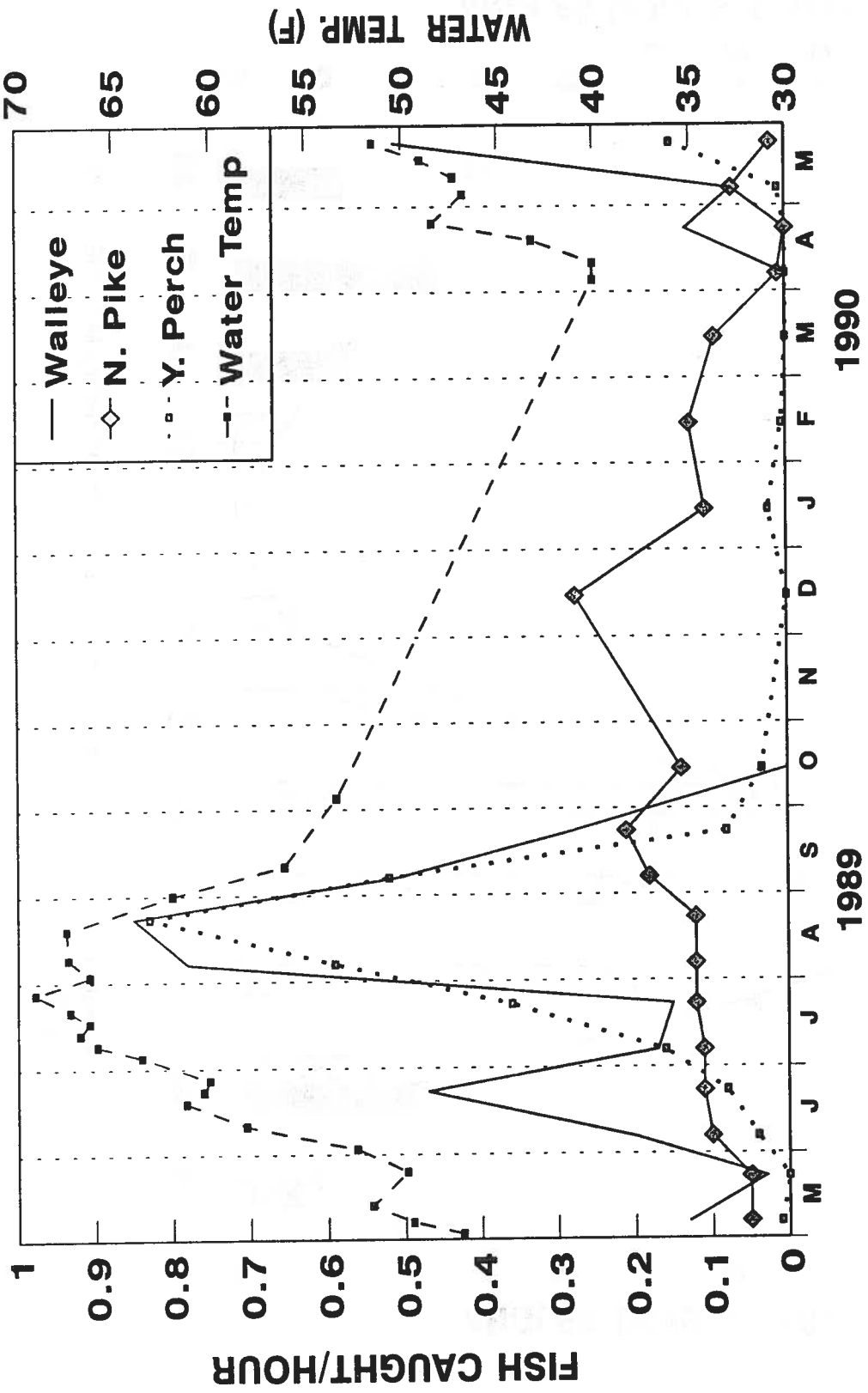


Figure 3. Seasonal catch rates of walleye, northern pike, and yellow perch compared to average water temperature in Lake Frances, 1989-1990.

harvested during summer (Table 4). Ice anglers accounted for most of the harvest of these species during winter. Winter anglers kept 78% of northern pike, 44% of yellow perch, 75% of burbot and 100% of walleye they caught.

Anglers who used two fishing lines caught 18-50% more walleye, northern pike and perch than those who used only one line during the summer. However, "two-pole" anglers also released higher percentages of their catch (Table 5). Lure anglers had lowest walleye catch rates and highest catch rate for northern pike compared to anglers who used other methods. Boat anglers enjoyed higher catch rates for walleye and perch than did shore anglers while northern pike catch rates were identical. Night anglers experienced substantially higher walleye catch rates (0.70 per hour on average) but kept the lowest percentage of their catch (Table 5).

Nearly 60% of summer period anglers fished specifically for walleye which comprised 48% of the summer harvest (Figure 4). Only 9% of anglers fished specifically for northern pike during summer yet pike accounted for 18% of summer harvest. Less than 1% of anglers fished for yellow perch in the summer period yet perch contributed 34% of the summer harvest. Angler emphasis and species composition differed markedly in the winter period (Figure 4). Sixty percent of winter anglers fished specifically for northern pike and pike dominated the winter harvest (92%). Eight percent of winter anglers targeted walleye, but exceedingly few were caught and walleye comprised only 1% of the winter harvest.

Anglers fishing specifically for walleye had substantially higher catch rates for walleye than anglers who targeted northern pike, a combination of walleye and northerns, or fished for "any fish" (Table 6). Northern pike catch rates were relatively similar among groups, regardless of which species was targeted. Anglers who fished specifically for northern pike, walleye/northern, or "any fish" kept about 20% more of the northerns they caught than did walleye anglers. Yellow perch were caught most frequently by walleye anglers, probably because walleye fishing techniques tended to favor the incidental catch of perch.

Harvest

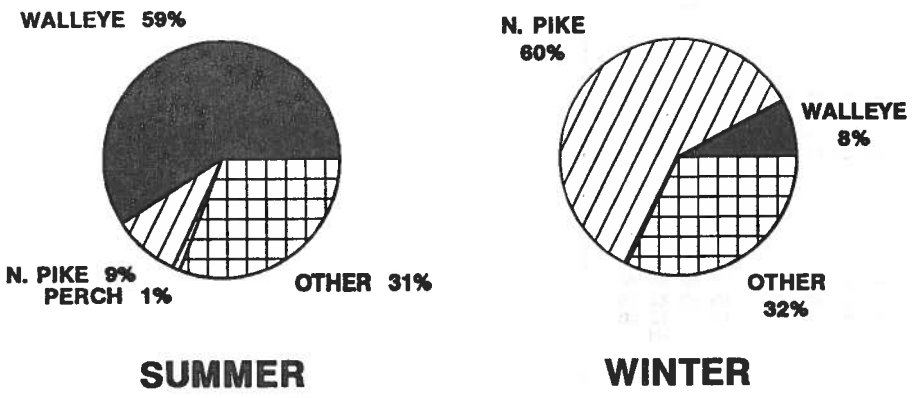
Approximately 25,000 fish weighing 32,000 pounds were harvested from Lake Frances during May 1989 through April 1990 (Table 7). Total yield was estimated to be 6.4 pounds per acre with walleye and northern pike comprising 86% of annual yield. Northern pike and walleye yields were similar even though twice as many walleye were harvested.

Anglers harvested an estimated 11,494 walleye, 8362 yellow perch, 5602 northern pike and 36 burbot from Lake Frances during the

Table 5. Catch rate comparisons for various angler groups and fishing techniques on Lake Frances, May-September 1989. Catch rate includes fish released as well as those kept.

Angler type	No. Parties interviewed	Walleye		N. Pike		Y. Perch	
		Fish/hr	% kept	Fish/hr	% kept	Fish/hr	% kept
One line/angler	718	0.34	51	0.10	68	0.28	47
Two lines/angler	126	0.40	38	0.15	56	0.50	49
Lure anglers	139	0.21	63	0.18	72	0.05	26
Bait anglers	312	0.36	51	0.07	63	0.27	46
Lure/bait anglers	467	0.39	48	0.12	62	0.38	46
Boat anglers	731	0.39	49	0.11	63	0.33	47
Shore anglers	203	0.15	68	0.11	73	0.17	27
Night anglers	44	0.70	32	0.11	67	0.03	33

TARGET SPECIES



SPECIES HARVESTED

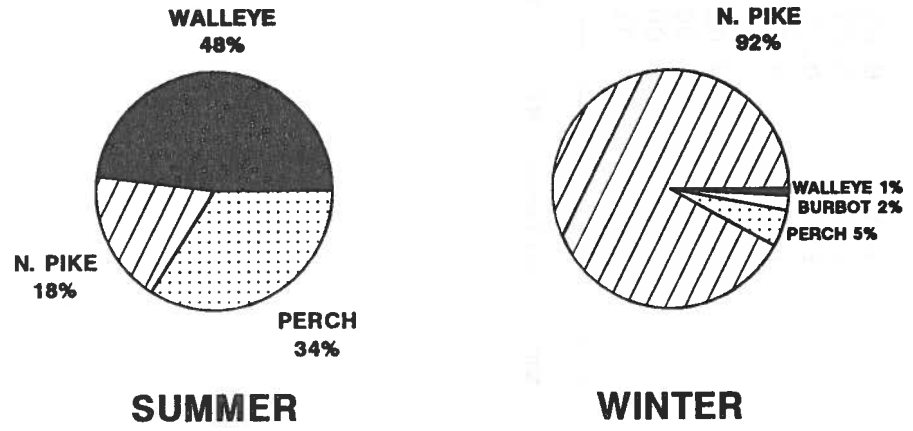


Figure 4. Fish species sought and seasonal harvest composition on Lake Frances during May 1989 - April 1990. "Other" includes anglers having no species preference and those seeking walleye and northern pike in combination.

Table 6. Seasonal comparisons of catch rate and harvest of walleye, northern pike and yellow perch by anglers specifically targeting various species on Lake Frances during the period May 1989 through April 1990.

Time period	Species targeted[a]	No. parties interviewed	Walleye catch		N. pike catch		Y. perch catch	
			Fish/hr	% kept	Fish/hr	% kept	Fish/hr	% kept
Summer	WE	590	0.45	48%	0.10	57%	0.34	44%
	NP	106	0.07	48%	0.16	77%	0.20	21%
	WE/NP	148	0.15	62%	0.13	76%	0.03	25%
	Any fish	134	0.18	59%	0.08	76%	0.14	81%
Winter	WE	7	0.00	0%	0.18	75%	0.09	17%
	NP	49	0.00	0%	0.13	75%	0.04	100%
	WE/NP	4	0.00	0%	0.04	100%	0.00	0%
	Any fish	20	0.01	100%	0.19	82%	0.00	0%

[a] Abbreviations: WE = Walleye, NP = Northern pike

Table 7. Estimated harvest of fish from Lake Frances during the period May 1989 through April 1990. Eighty percent confidence intervals in parentheses.

Time period	Species	No. harvested	Total pounds[a]	Pounds per acre
Summer - total	Walleye	11,480 (± 1131)	13,087	2.6
	N. pike	4,389 (± 457)	11,192	2.2
	Y. perch	8,298 (± 1193)	4,348	0.9
	Burbot	3 (± 3)	-	-
Winter - weekends	Walleye	7 (± 9)	-	-
	N. pike	614 (± 161)	1,566	0.3
	Y. Perch	33 (± 26)	-	-
	Burbot	16 (± 12)	-	-
Winter - weekdays	Walleye	7	-	-
	N. pike	599	1,527	0.3
	Y. perch	31	-	-
	Burbot	17	-	-
Winter - total	Walleye	14	16	-
	N. pike	1,213	3,093	0.6
	Y. perch	64	34	-
	Burbot	33	-	-
Total annual	Walleye	11,494	13,103	2.6
	N. pike	5,602	14,285	2.9
	Y. perch	8,362	4,432	0.9
	Burbot	36	-	-
	Total	25,494	31,820	6.4

[a] Average weights: Walleye - 1.14 pounds, n. pike - 2.55 lbs, y. perch - 0.53 pounds.

survey period (Table 7). More than three quarters of the total annual northern pike harvest and 99-100% of the walleye and perch were taken during the summer period. Monthly walleye and perch harvest peaked in August, while northern pike harvest was highest in July and August (Figure 5). Forty-four percent of walleye and 43% of northern pike harvested during the summer period were taken on weekends. Monthly harvest statistics appear in Tables A5 and A7.

Total winter harvest could not be precisely determined because the survey was only conducted on weekends during the winter period. Winter weekday harvest was indirectly estimated using weekend harvest rates and an indirect estimate of weekday pressure described previously (Table A6). Northern pike was the only species harvested in significant numbers during the winter period but winter fishing accounted for only 22% of total annual northern pike harvest. Peak monthly harvest of northerns in the winter period occurred in February, corresponding with peak winter fishing pressure (Figure 5).

Complete trip interviews were obtained from 473 parties of anglers during the "summer" months of May through September 1989 and April and May of 1990. These anglers reported harvesting 993 walleyes but 53% of the parties did not harvest a walleye during their fishing day and 47% of parties did not catch a walleye in a complete day of fishing (Table 8). It was not possible to estimate precisely how many anglers were unsuccessful because interview information was collected from parties rather than individual anglers. Interpretation of party interview data revealed that at least 58% of individuals did not harvest a walleye during their fishing day. Only 4% of parties harvested a daily limit of five walleye per angler, but these groups accounted for nearly 17% of total walleye harvested (Table 8). Only 12% of the parties harvested more than three walleyes per angler but these groups were responsible for 52% of the total walleye harvest.

Only one of 505 complete trip parties interviewed harvested more than four northern pike per angler, in spite of a 10-fish daily limit (Table 9). At least 67% of parties interviewed did not harvest a northern pike and 57% did not catch a northern in a completed day of fishing. As was the case for walleye, a relatively small percentage (13%) of parties accounted for a large percentage (65%) of estimated northern pike harvest (Table 9).

Size and Age Composition of Harvest

Creel clerks measured approximately 4% of walleye, 5% of northern pike, and 2% of yellow perch that were estimated to have been harvested from Lake Frances during the study period. Harvested walleye averaged 14.5 inches long and weighed 1.14 pounds while northern pike averaged 21.7" and 2.55 pounds and perch averaged

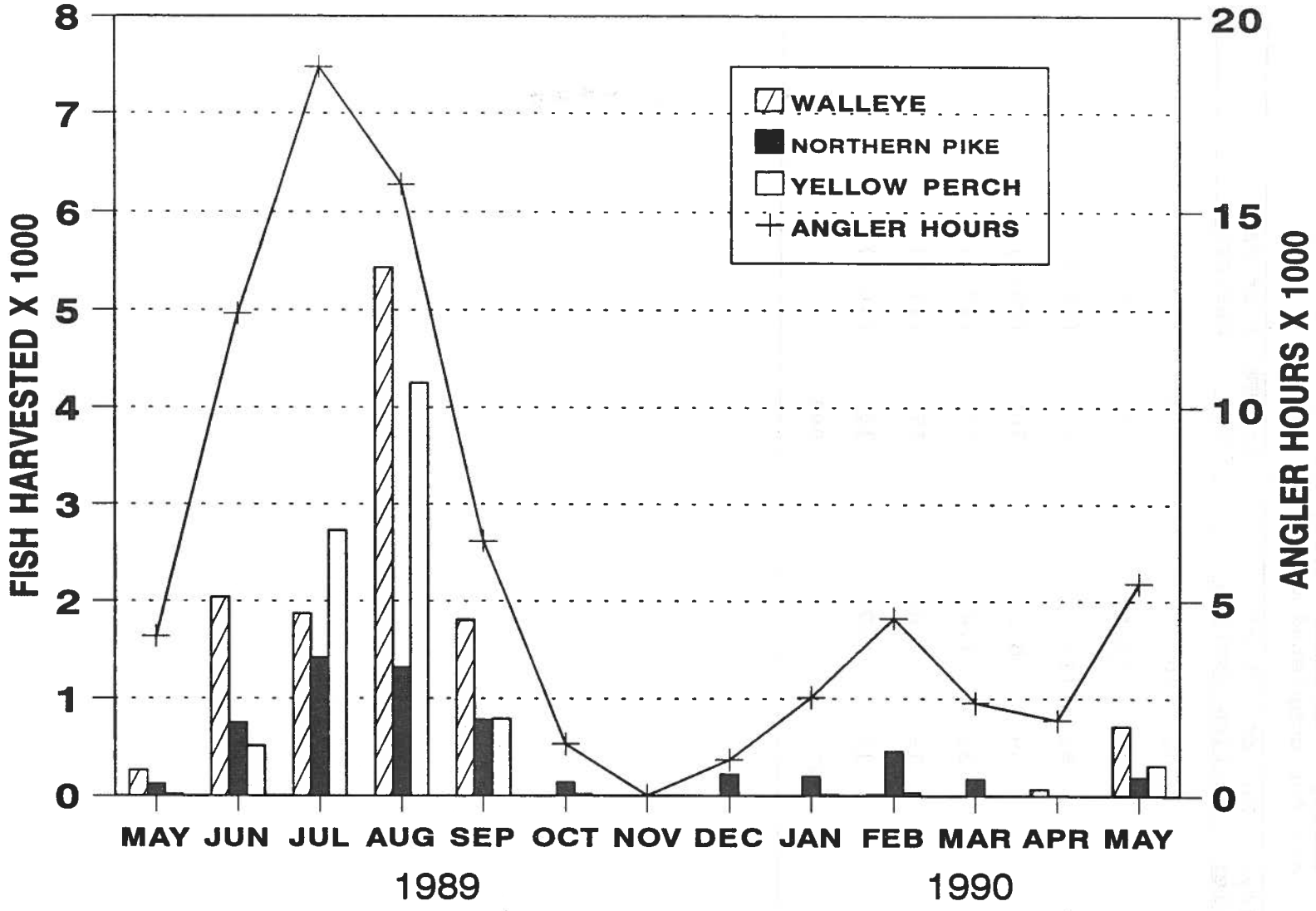


Figure 5. Estimated monthly fishing pressure (angler-hours) and harvest of walleye, northern pike, and yellow perch in Lake Frances, May 1989 - May 1990.

Table 8. Frequency of walleye (WE) harvest and percent of total harvest by parties fishing on Lake Frances during May through September, 1989, and April and May, 1990. Data are for completed day trips only.

No. walleye kept/angler	No. of parties	% of parties	No. WE kept	% of WE harvest
0	251	(53.1)	0	(0)
< 1	62	(13.1)	80	(8.1)
1-2	62	(13.1)	191	(19.2)
2-3	39	(8.2)	205	(20.6)
3-4	21	(4.4)	178	(17.9)
4-5	19	(4.0)	174	(17.5)
5	19	(4.0)	165	(16.7)
Total	473		993	

Table 9. Frequency of northern pike harvest and percent of total harvest by parties fishing on Lake Frances during May 1989 through May 1990. Data are for completed day trips only.

# N. pike kept/angler	No. parties	% of parties	# N. pike kept	% of N. pike harvest
0	337	66.7%	0	0%
< 1	102	20.2%	117	34.8%
1-2	46	9.1%	119	35.4%
2-3	15	3.0%	63	18.8%
3-4	4	0.8%	22	6.5%
4-5				
5-6				
6-7				
7-8	1	0.2%	15	4.4%
8-9				
9-10				
10				
Total	505		336	

9.4" and 0.53 pounds (Table 10). The most commonly harvested walleye were 12-13" long, while most northern pike were 19-22" and most yellow perch were 8-9" long (Figures 6-8, Table A8). The largest walleye measured was 23.5 inches long and weighed 4.1 pounds while the largest northern pike was 36 inches long and weighed 8.1 pounds. Anglers catch a few northern pike in the 15-20 pound range on Lake Frances each year but none were measured during the survey.

Length frequency of walleye and northern pike caught by anglers were compared to population size structures determined by spring netting surveys to describe angler selectivity. Netting surveys were conducted during late April and early May, when both species were spawning. Consequently, mature adult fish were probably over-represented in netting samples.

About half of the walleye captured in spring fish population surveys were taken in gill nets, with trapnets and night electrofishing each accounting for around 25% of the catch. Walleye less than 13 inches long were more common in the creel than in netting surveys (Figure 6), probably because these fish were not fully recruited to survey gear during the spring. Most walleye in Lake Frances mature at 14 inches. Walleye between 14 and 18 inches were less common in the creel than in nets, while anglers appeared to select for walleye larger than 20 inches (Figure 6).

More than 90% of the northern pike in the spring netting survey were mature fish captured in trapnets. Most northern pike in Lake Frances mature at around 16 inches, hence fish longer than that can be considered fully recruited to the survey gear. Anglers tended to avoid northerns less than 19 inches long and selected for pike between 20 and 24 inches (Figure 7). In contrast to walleye, anglers were apparently not as effective in harvesting larger-sized northern pike, i.e. those longer than approximately 32 inches.

Scales from 178 walleye and 77 northern pike were randomly collected to determine age composition of harvested fish (Table 11). The majority (40%) of walleye harvested were three year old fish averaging 12.7" long. Approximately 28% of the walleye harvest was comprised of fish five years old and older. Approximately 46% of the northern pike harvested were two years old, averaging 18.8" long. Only 17% of the northern pike harvest was comprised of fish four years and older, compared to 48% of the walleye harvest. Considerable difficulty was encountered aging older specimens of either species using scales. Use of dorsal spines to age walleye and pelvic fin rays and/or cleithra for aging northern pike is being investigated.

Table 10. Length, weight and condition factor of fish harvested from Lake Frances during May 1989 through April 1990 or captured in netting surveys during April 20-May 9, 1989 on Lake Frances.

Species	Length (inches) No. Fish	Mean	Range	Weight (pounds) No. Fish	Mean	Range	Condition Factor No. Fish	Mean	Range
Walleye:									
Creel	510	14.5	10.2-23.5	328	1.14	0.25-4.13	328	32.1	18.1-46.1
Netting surveys	368	15.2	10.4-24.6						
Northern pike:									
Creel	295	21.7	15.5-36.2	223	2.55	0.85-8.14	223	24.2	14.3-42.9
Netting surveys	430	21.2	16.0-37.0						
Yellow perch:									
Creel	140	9.4	5.9-12.5	103	0.53	0.12-1.25	103	55.6	33.9-94.8

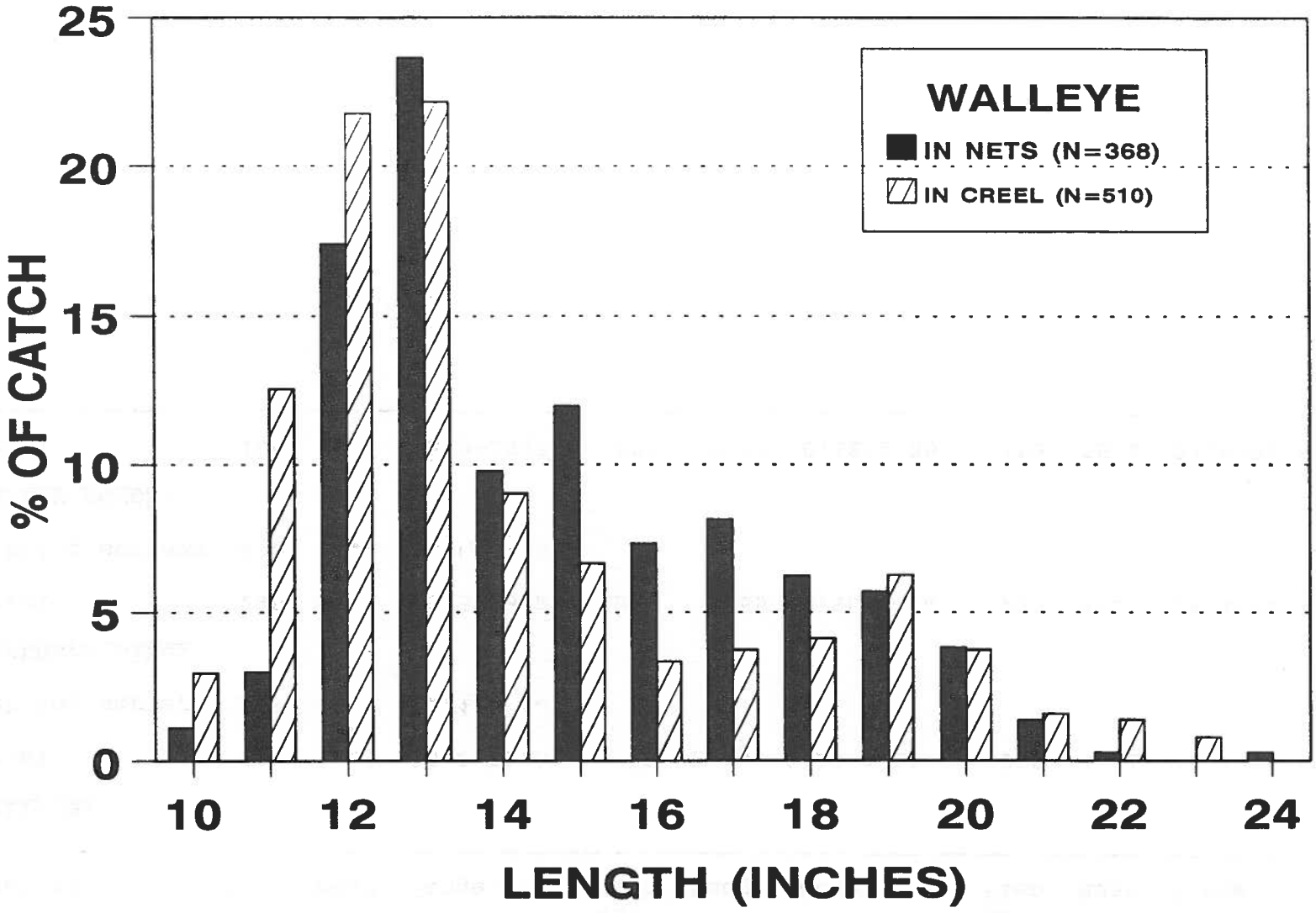


Figure 6. Length frequency of walleye harvested by anglers during May 1989 - May 1990 or caught in netting surveys during spring 1989 on Lake Frances.

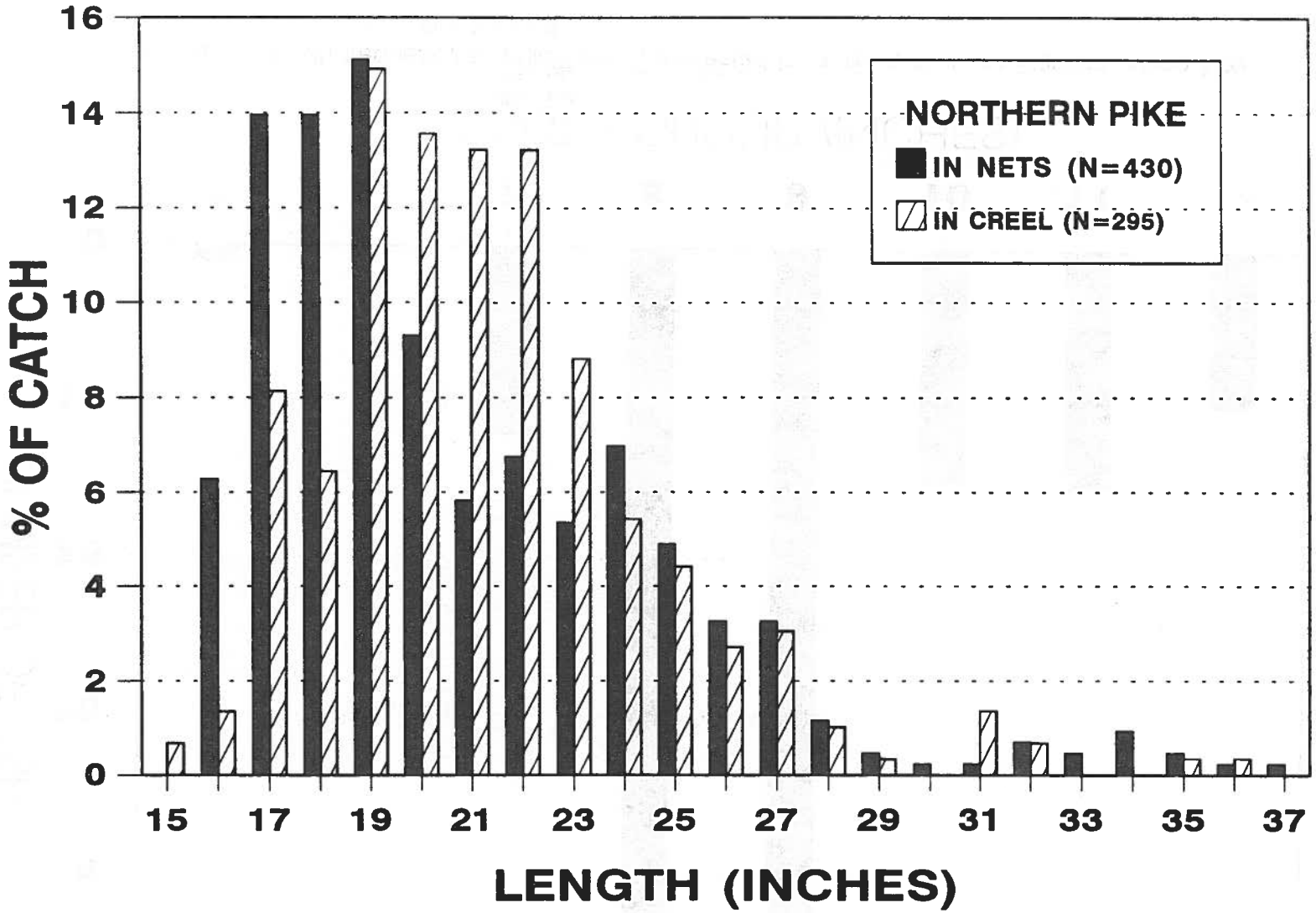


Figure 7. Length frequency of northern pike harvested by anglers during May 1989 - May 1990 or caught in netting surveys during spring 1989 on Lake Frances.

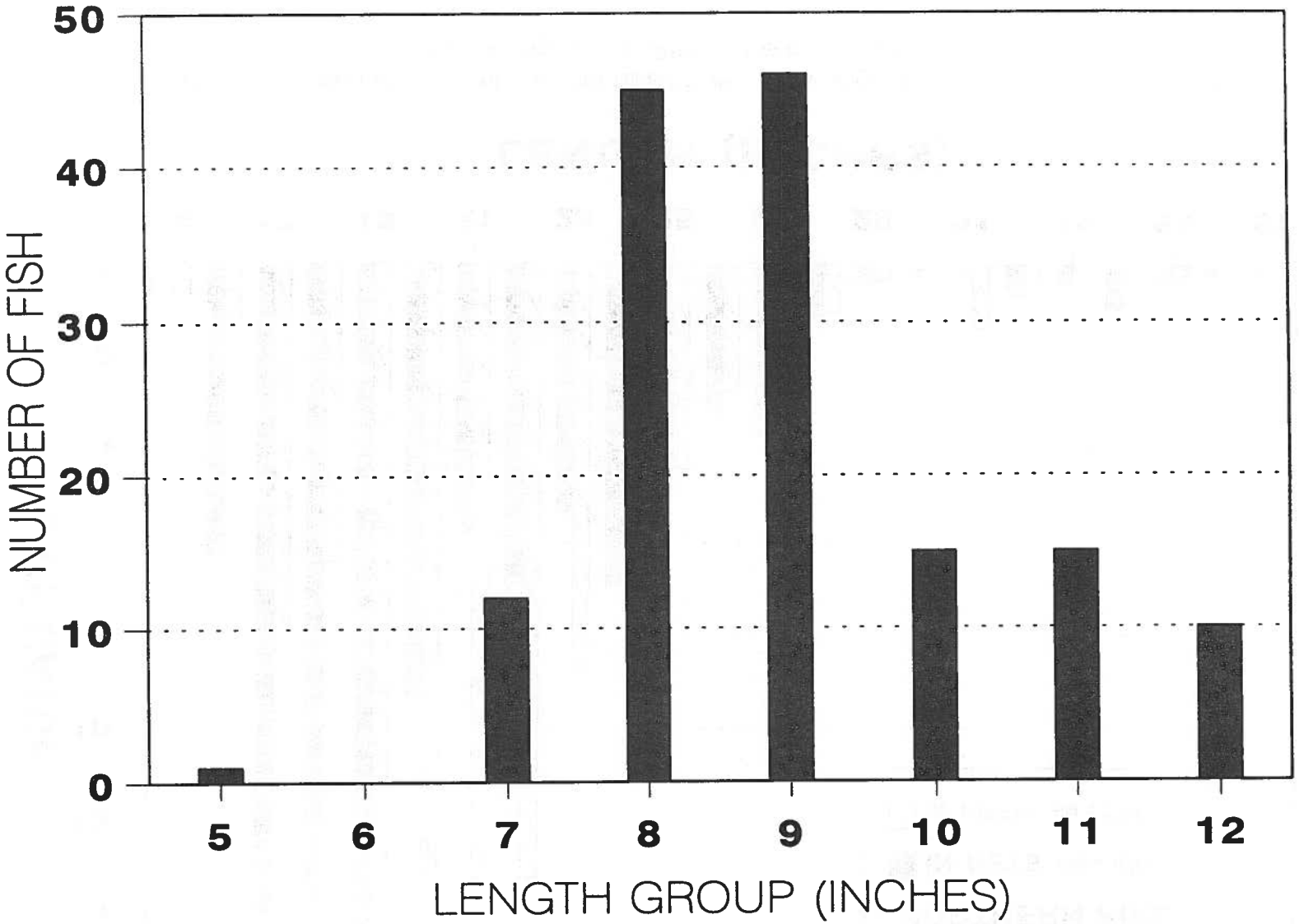


Figure 8. Length frequency of yellow perch harvested by anglers on Lake Frances during May 1989 - May 1990 (n=140).

Table 11. Age composition, size at age and estimated harvest by age group for walleye and northern pike from Lake Frances during the period May 1989 through April 1990.

Species & age class	No. of fish	Length (inches) Mean (range)	Percent of harvest	Estimated # harvested
Walleye				
II+	21	11.1 (10.2-11.8)	11.8%	1,356
III+	71	12.7 (10.6-14.9)	39.9%	4,584
IV+	37	14.0 (13.0-16.1)	20.8%	2,391
V+ & older	49	19.1 (15.8-23.5)	27.5%	3,160
Total	178			11,494
Northern pike				
II+	35	18.8 (15.5-21.0)	45.4%	2,543
III+	29	21.0 (18.6-24.8)	37.7%	2,112
IV+ & older	13	26.4 (23.5-31.0)	16.9%	947
Total	77			5,602

Exploitation

A total of 202 adult walleye longer than 14 inches were tagged and 185 walleye less than 14 inches long were fin clipped and released during April and May of 1989 to monitor exploitation rates. Tags were also attached to 432 northern pike longer than 16 inches prior to their release. Creel clerks examined 303 walleye less than 14 inches long during the survey and observed only one fin clipped fish, indicating approximately one-third of one percent of harvested walleye less than 14 inches long had fin clips. Applying this proportion to the 6829 walleye less than 14 inches long that were estimated to have been harvested during the study period suggested 23 fin clipped walleye were probably harvested. Annual exploitation on walleye under 14 inches would thus be around 12% (23 recaptures divided by 185 clipped fish at large). this exploitation estimate should be used with caution because it is based on observation of a single clipped fish in angler creels.

Tags were returned from 28 of 202 tagged adult walleye, indicating a minimum annual exploitation rate of 13.9%. Creel clerks gathered approximately 61% of the returned walleye tags. Thirty-two percent of returned walleye tags were reported by mail or phone and 7% were reported to local game wardens.

Tags were returned from 89 of 432 tagged adult northern pike, indicating a minimum annual exploitation rate of 20.6%. Sixty-one percent of the returned northern pike tags were recovered by creel clerks. Approximately 36% of recovered northern pike tags were returned by mail or phone and 3% were recovered by game wardens or through other sources. We intended to use creel clerk tag returns to roughly estimate walleye and northern pike populations. However, this was not possible because of bias introduced by non-random recording of tag returns by creel clerks.

Public Comments

Interviewed anglers were given the opportunity to comment on the management of Lake Frances. The majority of those commenting felt that the lake was well managed and efforts should be directed towards maintaining water levels (Table 12). Several commented on improving or providing additional public facilities and the need for stricter limits on the harvest of small walleye. Several anglers commented they would prefer to have the lake managed for trout.

Table 12. Comments on management of Lake Frances (through party interviews).

Comment	Number responding
Doing a good job	54
Maintain water levels	21
Improve existing and/or add more facilities	16
Limits on small fish	12
Better access	7
Rather have trout	7
More fish	4
Plant bluegills, brim, cisco	3
Close season (Winter-May)	3
Stock walleye	2
More forage	2
Outlaw jug fishing	2
Live bait should be allowed	2
Need fish cleaning facilities	1
Keep walleye	1
Lake overfished	1
Increase pike limit	1
Bigger fish	1
Increase possession limit	1
Thin small ones out	1
Fish numbers are down	1
Need more enforcement	1
Better fish tags	1

DISCUSSION

Accuracy of Survey

Results of this survey compared reasonably well with results of a periodic statewide angling pressure survey conducted by the Montana Department of Fish, Wildlife and Parks. However, the timeframes of the surveys were not identical. The most applicable statewide survey ran from March 1989 through February 1990 while the most comparable survey period for our study was May 1989 through April 1990. The statewide survey estimated annual fishing pressure at 16,886 angler-days, with an 80% confidence interval of ± 2177 angler-days. Our survey estimated 14,966 angler-days for a similar period and was within 80% confidence limits of the statewide survey. The main discrepancy during the two surveys was for the summer period (May through September 1989). The statewide survey estimated 13,759 angler-days (± 1864, 80% CI) for the summer period, compared to 11,419 angler-days estimated by this survey. Statewide survey results indicate Lake Frances fishing pressure increased substantially in 1985 and remained relatively high in subsequent years (Table 13).

Winter period estimates (October through February) corresponded closely, although the timeframes were not identical. The statewide mail survey estimated 3127 angler-days for the months March & April

Table 13. Annual fishing pressure estimates for Lake Frances derived from the Montana statewide angling mail survey conducted by Montana Department of Fish, Wildlife and Parks.

Year	Angler-days	80% confidence interval	Days per acre
1982	9,026	± 3,479	1.8
1983	5,038	± 1,897	1.0
1984	8,211	± 3,273	1.6
1985	20,597	± 12,780	4.1
1989	16,886	± 2,177	3.4
1991	17,907	± 2,100	3.6

1989 and October 1989 through February 1990. Our survey estimated 3547 angler-days for October 1989 through March 1990 plus April 1989. This suggests the indirect procedure we used to estimate winter weekday fishing pressure produced reasonable results. One way to check is to compare winter to summer pressure estimates for the mail survey and apply the results to our survey. According to the statewide survey, winter pressure was 22.7% of summer pressure. Applying that percentage to our summer estimate results in an estimated 2592 angler-days for the winter period, which is reasonably close to the statewide mail survey estimate of 3127 angler-days. Only 11% of total annual northern pike harvest was estimated to have occurred on winter weekdays and pike were the only species harvested in significant number during the winter. Consequently, potential errors in the indirect estimation procedure used to estimate pressure and harvest for winter weekdays should not significantly affect overall study results.

Harvest estimates presented above do not include potential harvest by night fishing, setline anglers, and spearing. The effects of setline fishing and spearing appear to be negligible. All parties interviewed during the survey were asked if any members were using unattended setlines and to report their catch since the previous midnight. Only five of 962 parties (less than 1%) interviewed during the summer period reported using setlines. Their total reported harvest was one northern pike. Only five of 88 parties interviewed during the winter period were spear fishing. They reported spearing no fish in 72 total hours of effort.

Harvest by anglers fishing at night is probably the largest source of error in the survey, but the percentage of night anglers appeared to be relatively low. Pressure and harvest estimates were based on the hours between sunrise and sunset, hence few night anglers were interviewed and no direct estimate of nighttime fishing pressure was made. To determine the magnitude of this potential bias, all parties interviewed were asked if they fished after dark on the night previous to the interview. Five percent of the parties interviewed during May through September reported fishing the night prior to the interview. None of the parties interviewed during October through March reported fishing at night. Summer period night anglers reported walleye catch rates that were double that of daytime anglers, but harvest rates were very similar (0.22 harvested per hour at night, versus 0.17 during daytime). Northern pike catch and harvest rates were identical for night and daytime anglers.

Comparison to Other Waters

In comparison to other Montana waters, walleye catch rate on Lake Frances was similar, fishing pressure and walleye yield per acre was relatively high, and average size of walleye was somewhat

smaller. The Lake Frances walleye fishery would be considered good in comparison to 34 Wisconsin walleye lakes and 21 lakes in northeastern Alberta (Table 14). Average fishing pressure on Wisconsin lakes was very high, but average walleye catch rate and yield was lower than on Lake Frances. Alberta lakes had lower average fishing pressure, walleye catch rates, and walleye yield than Lake Frances. Sullivan (1991) did not report length of fish harvested in Alberta lakes but reported walleye averaged 1.8 pounds, compared to 1.1 pounds for Lake Frances.

Walleye yield from Lake Frances was very close to the median for 24 Minnesota lakes while fishing pressure was lower than the Minnesota average (Colby et al. 1979). Fishing pressure per surface acre on Lake Frances was lower than on Nebraska walleye lakes and higher than most Wyoming lakes containing walleye (Table 14). Lake Frances walleye harvest rate (0.17 walleye kept per hour) was substantially higher than most Nebraska lakes. Walleye catch rate (includes fish released) on Lake Frances was about average compared to four Wyoming reservoirs.

Use of party interviews on Lake Frances versus individual angler interviews on Alberta and Wisconsin lake studies made direct comparisons difficult. However, results indicated angler success for walleye on Lake Frances was similar to Alberta lakes and higher than Wisconsin lakes. At least 21% of Lake Frances anglers kept one or more walleye and 4% of parties kept a 5-walleye daily limit in a completed fishing day. In Alberta, 18% of anglers interviewed on 21 lakes kept one or more walleye and 3% kept a 5-walleye limit in a completed day of fishing (Sullivan 1991). Only 7% of Wisconsin anglers kept one or more walleye in a completed fishing day on walleye lakes and less than 1% kept a 5-walleye daily limit (Staggs 1989). Wisconsin data are probably somewhat low because all anglers were included in the analysis, regardless of whether or not they fished specifically for walleye. Wisconsin lakes contain several species of panfish that are not common in Montana or Alberta lakes.

Northern pike yield from Lake Frances was higher than other Montana waters while catch rate and average size was similar (Table 14). Northern pike catch rates were substantially higher on Alberta lakes than on Lake Frances but average yield for these lakes was similar to Lake Frances. Angler-harvested northern pike averaged 2.4 pounds in Alberta lakes (Sullivan 1991) compared to 2.6 pounds in Lake Frances.

The virtual absence of walleye in the winter harvest from Lake Frances was somewhat surprising, considering the importance of walleye in the summer fishery. There are several possible reasons for this. First, very few anglers (only 8%) fished specifically for walleye in the winter period, compared to 59% of summer anglers. Second, winter walleye catch rates are typically much lower than summer rates on most walleye waters. Preliminary data

Table 14. Comparison of walleye sport fishery characteristics in North American waters.

Water(s)	Surface acres	Time period	Pressure (hrs/acre)	Pressure (days/acre)	Catch (#/hr)[a] WE	NP	YP[b]	Ave. length (in) WE	NP	YP	Harvest (no/acre) WE	NP	YP	Harvest (lbs/acre) WE	NP	YP	Source
Lake Frances, Montana	5,000	Apr-Sep 1989/90	11.8	2.4	.35	.11	.29	14.5	21.7	9.4	2.3	0.9	1.7	2.6	2.2	0.9	This study
Fresno Reservoir, Montana	5,000	May-Sep 1990	3.7	1.1	.50	.14	.05	14.8	19.8	10.8	1.0	0.2	0.1	1.0	0.4	0.1	Needham & Gilge, 1991
Fort Peck Res., Montana	172,000	Apr-Sep 1990	0.8	0.1	.22	.01	---	18.0	30.5	----	0.1	<.1	---	0.3	<.1	---	Weidenheft, 1991
Tiber Reservoir, Montana	17,000	Apr-Sep 1991	4.4	0.8	.34	.07	.04	15.9	22.1	---	0.8	0.1	---	0.3	<.1	---	Hill & Leathe, (in preparation)
Holter Reservoir, Montana	4,800	Mar-Sep 1989-91	44.8t 1.9d	10.9t 0.5d	<.01t .05d	--- ---	.59t .60d	18.2	----	8.9	0.1	---	19.8	0.3	---	6.9	M.Lere, Montana FWP, (personal comm.)
Nelson Reservoir, Montana	4,500	May-Sep 1984	2.8	0.6	.27	?	----	15.6	21.8	---	0.7	<.1	----	0.9	0.2	---	Needham & Gilge, 1984
Ave. 34 lakes, Wisconsin	910	May-Sep 1980-87	42.4	---	.06t .19d	---	----	14.0	----	---	1.5	---	---	----	----	---	Staggs, 1989
Ave. 21 lakes, NE Alberta	4,482[c]	May-Aug 1984-86	5.0	---	.18	.40	.89	----	---	---	0.4	0.8	4.6	0.6	1.8	1.8	Sullivan, 1991
Branched Oak L., Nebraska	1,801	May-Oct 1982-84	108.0	---	.001h	---	---				0.2	---	---	0.5	---	---	D. Ellison, Nebraska G&P (personal comm.)
Harlan Res., Nebraska	13,499	Mar-Oct 1988 & 89	22.9	---	.09h	---	---				2.1	---	---	4.3	---	---	"
Lake McConaughy, Nebraska	30,013	Apr-Oct 1981-88	15.8	---	.12h	---	---				2.0	---	---	2.7	---	---	"
Lake Minatare, Nebraska	2,157	Apr-Sep 1987 & 88	39.2	---	.02h	---	---				0.6	---	---	1.8	---	---	"
Sutherland Res., Nebraska	2,676	Jan-Dec 1981-89	18.4	---	.06h	---	---				1.2	---	---	1.9	---	---	"
Elwood Reservoir, Nebraska	1,201	Jan-Dec 1982 & 83	87.8	---	.02h	---	---				2.2	---	---	3.5	---	---	"
Grayrocks Res., Wyoming	3,547	May-Mid Sep 1989	41.9	8.4	.62	---	.12	16.2	---	10.8	18.3	---	2.9	31.7	---	1.6	Snigg, 1990
Keyhole Res., Wyoming	3,300	1985	---	1.7	.40						1.2			---	---	---	"
Seminoe Res., Wyoming	20,000	1984	---	1.1	.20						0.5			0.4	---	---	"
Boysen Res., Wyoming	19,560	1980	---	0.8	.10						0.4			0.4			"
Lake Oahe, S. Dakota	211,916	May-Oct 1991	4.3	1.2	.30			16.3			0.9						Fielder et al., 1992

[a]Catch rate includes fish released.
[b]Abbreviations: WE = walleye, NP = northern pike, YP = yellow perch.
[c]Median surface area.
t-Total for all anglers.
d-Anglers fishing specifically for walleye.
h-Harvest rate (does not include fish released).

from our Tiber Reservoir creel census indicate an average walleye catch rate of 0.34/hour during April through September, compared to 0.08/hour during November through February. Analysis of data presented by Staggs (1989) for Wisconsin lakes revealed an average walleye catch rate of 0.19/hour for 34-40 lakes during May through September for anglers fishing specifically for walleye, compared to 0.06/hour for 8-10 lakes surveyed during December through February.

Another possible reason for low winter walleye catch rate on Lake Frances is that the reservoir is closed to the use of live minnows for bait with the exception of sculpins (genus Cottus). Very few or no anglers used live sculpins, but some claim it is difficult to catch walleye in winter without using live minnows for bait. It is difficult to evaluate the effect of live minnow regulation. Summer period walleye catch rates on Lake Frances and Tiber were very similar (Table 14) even though live minnows are legal as bait year around on Tiber. Also, winter catch rates for northern pike on the two reservoirs were nearly identical.

Exploitation and Harvest Regulations

It is difficult to accurately determine percentage of fish population harvested (exploitation rate) without an estimate of population size. It has not been possible to estimate fish population size in Lake Frances because of the large area of the reservoir, relatively ineffective sampling methods, and inadequate manpower. Consequently, we have relied on voluntary tag returns by anglers from adult walleye and northern pike tagged in springtime netting surveys to monitor annual exploitation rates. This method is useful in monitoring trends but probably does not accurately estimate actual exploitation because the rate of non-reporting of tags is unknown and difficult to quantify.

Providing rewards for tags returned has been a common practice in some areas of the U.S. to facilitate tag returns from anglers. However, several studies summarized by Murphy and Taylor (1991) indicated reward incentives did not significantly increase tag-reporting rates. Their report cited two studies where only 29-39% of reward tags secretly placed on angler-caught fish were subsequently returned. Literature values on angler tag reporting rates are extremely variable but values cited by Murphy and Taylor (1991) did not exceed 70%. Weathers and Bain (1992) estimated a 64% rate of return on reward-tagged smallmouth bass.

Average minimum annual exploitation of walleye longer than 14 inches and northern pike over 16 inches was 12% and 19% per year respectively on Lake Frances during 1985-1992 based on voluntary angler tag returns (Table 15). Lake Frances walleye exploitation was similar to Tiber Reservoir while northern pike exploitation was relatively high in comparison to Tiber. Annual exploitation of walleye less than 14 inches long in Lake Frances appeared to be

Table 15. Average estimated annual exploitation of adult walleye and northern pike in Lake Frances and Tiber Reservoir. Estimates based on percentage of tags voluntarily returned by anglers from fish caught within one year of tagging date.

Year tagged	Walleye # tagged	Walleye # returns	Walleye % returns	Northern Pike # tagged	Northern Pike # returns	Northern Pike % returns
			LAKE FRANCES			
1985	125	18	4%	137	29	21%
1986	114	10	9%	212	36	17%
1988	21	4	19%	13	2	15%
1989	202	28	14%	430	87	20%
1992	242	22	9%	66	6	9%
Total	704	82	12%	858	160	19%
			TIBER RESERVOIR			
1985	294	33	11%	194	17	19%
1986	416	38	9%	279	34	12%
1987	444	50	11%	495	55	11%
1988	299	45	15%	249	25	10%
1990	271	19	7%	346	33	10%
1991	692	70	10%	314	32	10%
1992	266	14	5%	____	___	___
Total	2682	269	10%	1877	196	10%

Table 16. Estimated harvest reductions (percent) that would result from daily bag limit changes for walleye and northern pike in Lake Frances.

Daily limit	Percent reduction in walleye harvest	Percent reduction in northern pike harvest
1	55%	23%
2	27%	17%
3	14%	3%
4	5%	2%
5	Current limit	2%
6	-	1%
7	-	0%
8	-	0%
9	-	0%
10	-	Current limit

around 12% during 1989. This estimate should be used with caution because it is based on the observation of a single clipped fish in angler creels. However, the exploitation estimate for small walleye may be reasonably accurate because it was very similar to that obtained for adult walleye using voluntary tag returns.

Needham and Gilge (1984) directly estimated 27% exploitation of age 3+ and older walleye on Nelson Reservoir during May-October (three year old walleye averaged 13.7" in the springtime). Staggs et al. (1990) reported average annual exploitation of 18% for adult walleye on 35 Wisconsin lakes and considered 18% the biological optimum. Wisconsin biologists consider 20-25% annual exploitation "healthy" and 35% the maximum sustainable for most walleye populations. Staggs (personal communication) indicated one could expect some effect on walleye population size structure at 20-25% annual exploitation but effects on recruitment would be minimal.

Walleye exploitation on Lake Frances was not particularly high if anglers voluntarily reported a high percentage of tagged fish caught. Based on literature review on nonreporting of tagged fish, it is likely that Lake Frances anglers reported only around 50% of tagged walleye they harvested. If this is true, actual exploitation rate would be approximately 25%, which is acceptable by Wisconsin standards. If the same ratio applies to northern pike, annual exploitation would be near 40%, which is high. Reliability of voluntary angler tag return information on Lake Frances and Tiber reservoirs should be evaluated.

It is possible to use exploitation rates (if reliable) in conjunction with harvest estimates to estimate fish population density. Using harvest and size structure data, maximum density of adult walleye (longer than 14 inches) in Lake Frances would be around 7.2/acre at full pool, assuming 13% annual exploitation. It is probably more reasonable to assume only half of angler-caught tagged fish are returned, resulting in an adult walleye population of 3.6/acre. Use of the same procedure results in an estimate of 3.0-5.9 adult northern pike per acre. Wisconsin lakes supporting naturally reproducing walleye populations contained an average of 5.4 adult walleye per acre (Staggs et al. 1990). Data from Needham and Gilge (1984) indicated 1.8 fish/acre for age 3 and older walleye in Nelson Reservoir at full pool.

Completed trip information was used to estimate the effect of potential reduced bag limits on walleye and northern pike harvest. A four-walleye limit would only reduce harvest by 5%, a 3-fish limit would reduce harvest 14%, a 2-fish limit would cause a 27% reduction, and reducing the limit to one fish daily would reduce harvest by 55% (Table 16). These projections are nearly identical to estimates for Wisconsin lakes (Staggs 1989). Bag limit reductions would have to be fairly substantial (i.e. to two or three walleye daily) to significantly reduce harvest.

Reducing the bag limit on northern pike would have little effect on harvest since few parties kept more than one northern pike per angler (Table 16). The Central District northern pike limit was increased from five northerns daily to 10 daily in 1988 to promote harvest of smaller fish. This approach was clearly unsuccessful. Needham and Gilge (1984) reported similar failure of liberalized pike limits on Nelson Reservoir. They interviewed only one party of anglers who kept five or more pike during their May thru September census period. Size limits appear the be the only practical tool for reducing northern pike harvest on Lake Frances if harvest reduction is a desired management action.

A number of anglers expressed concern that too many mature adult walleye were being harvested prior to and during the spawning season. Data gathered during this study do not support this contention. Walleye spawn in Lake Frances from mid-April through mid-May. Only 0.6% of the total estimated annual walleye harvest occurred in April and 1.7% of annual harvest occurred in May. Walleye caught during the spawning period ranged from 11.9-22.0 inches with an average length of 14.9 inches. Seventy-eight percent of walleye caught during the spawning period were small fish, less than 16 inches long. Also, the majority of walleye harvested during the spawning period were males.

MANAGEMENT RECOMMENDATIONS

Results of this study indicate walleye harvest rates on Lake Frances are probably within an acceptable range for maintaining a healthy fishery with good size distribution. Northern pike exploitation may be high enough to affect numbers of larger-sized fish available to anglers. Several factors need further investigation before firm conclusions can be reached. First, an attempt should be made to evaluate voluntary tag return compliance. Establishment of a reward system for returned tags could be considered but published information does not confirm this to be a consistently effective method. Placement of tag reporting stations with self-addressed postage paid envelopes at key access points should be considered to inform anglers of the importance of tag returns and to facilitate returning of tags. Labor-intensive field surveys could also be used to verify tag reporting rates. Tag loss should also be evaluated because of its obvious potential effect on subsequent tag return rate.

Results of this study indicate Lake Frances is the most heavily fished of Montana's major walleye reservoirs per unit of surface area. It has a somewhat high walleye catch rate and a relatively small average size of walleye caught. Although estimated annual exploitation rates appear to be in the "safe" range, the fishery should be closely monitored to verify these results and confirm that overharvest is not occurring. Fish population surveys conducted during the past two years have indicated numbers of adult

walleye have declined. However, results also indicate a strong year class of subadult walleye will soon enter the fishery. A limited creel survey was initiated on summer weekends during 1993 to monitor angler success, satisfaction, and size and age composition of harvested fish. Information from this survey will be used in conjunction with fish population survey information to provide the basis for determining whether harvest regulations need adjustment. The weekend creel survey should continue for several years to establish trends and track walleye year classes.

Finally, all fish population and harvest information on Lake Frances walleye and northern pike should be compiled and analyzed for input into a fish population model. Several computer models exist which allow for testing potential fishing regulations to determine if changes in size and/or bag limits would significantly improve fish populations. These models are useful because they consider growth and mortality within fish populations and account for natural annual variations in recruitment over long timespans. These factors strongly influence the success of experimental fishing regulations. If this analysis identifies fishing regulation changes that could improve fish populations, alternatives could be developed and presented for public review.

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APPENDIX

Table A1. Estimated total monthly fishing pressure in Lake Frances during the period May 1989 through May 1990. Data for October through March were derived using known weekend pressure (from Table A2) and weekday:weekend pressure ratio determined for summer period.

Month	Angler hours (± 80% CI)	Angler days
1989		
May	4,092 (± 836)	832
June	12,406 (± 1781)	2404
July	18,688 (± 1707)	3755
August	15,706 (± 1970)	3114
September	6,545 (± 1156)	1311
October	1,334	345
November	12	4
December	925	247
1990		
January	2,529	676
February	4,556	1219
March	2,387	635
April	1,943 (± 499)	411
May	5,458 (± 1227)	1073

Table A2. Estimated fishing pressure on Lake Frances during the period May 1989 through May 1990. Data for October through March are for weekends only. Eighty percent confidence intervals are in parentheses.

	Angler-hours				Angler-days[a]		
Month	Shore/ice	Boat	Total	(80% CI)	Shore/ice	Boat	Total
1989							
May	652	3,440	4,092	(± 836)	184	648	832
Jun	1,457	10,589	12,046	(± 1781)	410	1,994	2,404
Jul	2,523	16,165	18,688	(± 1707)	711	3,044	3,755
Aug	1,675	14,031	15,706	(± 1970)	472	2,642	3,114
Sep	842	5,703	6,545	(± 1156)	237	1,074	1,311
Oct[b]	55	594	649	(± 346)	15	153	168
Nov[b]	6	0	6	(± 7)	2	0	2
Dec[b]	450	0	450	(± 127)	120	0	120
1990							
Jan[b]	1,230	0	1,230	(± 240)	329	0	329
Feb[b]	2,216	0	2,216	(± 385)	593	0	593
Mar[b]	1,075	86	1,161	(± 487)	287	22	309
Apr	483	1,459	1,942	(± 499)	136	275	411
May	487	4,971	5,458	(± 1227)	137	936	1,073

[a]Calculated using average trip length reported in Table 2.
[b]Data for weekends only.

Table A3. Monthly catch and harvest rates for the four principal fish species caught in Lake Frances during the period May 1989 through May 1990. Catch rate includes fish released as well as those kept.

Month	No. parties interviewed	Catch rate (fish/hr) WE	NP	YP	Burbot	Harvest rate (# kept/hr) WE	NP	YP	Burbot
1989									
May	110	.081	.048	.005	.001	.061	.025	.004	.001
Jun	202	.325	.104	.062	0	.162	.064	.044	0
Jul	329	.146	.117	.272	0	.095	.079	.130	0
Aug	207	.789	.124	.664	0	.348	.083	.275	0
Sep	73	.404	.190	.274	0	.262	.123	.126	0
Oct	9	0	.138	.034	0	0	.103	.011	0
Nov	1	0	0	0	0	0	0	0	0
Dec	12	0	.275	0	.020	0	.235	0	.020
1990									
Jan	20	0	.106	.024	.012	0	.071	.006	.006
Feb	29	.003	.126	.006	0	.003	.101	.006	0
Mar	17	0	.093	0	0	0	.072	0	0
Apr	41	.047	.004	0	0	.027	.002	0	0
May	61	.252	.045	.071	0	.103	.027	.045	0

Table A4. Biweekly catch rates (fish/hour) and percent of fish kept (in parenthesis) for walleye, northern pike and yellow perch during the summer period on Lake Frances, 1989 - 1990.

Year	Time period	Walleye	N. Pike	Y. Perch
1989	5/1 - 5/15	0.13 (70)	0.05 (32)	0.01 (67)
	5/16 - 5/31	0.03 (100)	0.05 (77)	0.00 (0)
	6/1 - 6/15	0.20 (63)	0.10 (55)	0.04 (97)
	6/16 - 6/30	0.47 (44)	0.11 (63)	0.08 (61)
	7/1 - 7/15	0.17 (63)	0.11 (63)	0.16 (68)
	7/16 - 7/31	0.15 (65)	0.12 (68)	0.36 (45)
	8/1 - 8/15	0.78 (44)	0.12 (66)	0.59 (42)
	8/16 - 8/31	0.85 (43)	0.12 (67)	0.83 (42)
	9/1 - 9/15	0.51 (63)	0.18 (65)	0.52 (48)
	9/16 - 9/30	0.28 (67)	0.21 (64)	0.08 (35)
1990	4/1 - 4/15	0.00 (0)	0.01 (50)	0.00 (0)
	4/16 - 4/30	0.13 (58)	0.00 (0)	0.00 (0)
	5/1 - 5/15	0.07 (85)	0.07 (100)	0.01 (100)
	5/16 - 5/31	0.51 (50)	0.02 (60)	0.15 (63)
	Overall	0.35 (50)	0.11 (64)	0.29 (46)

Table A5. Estimated harvest of fish from Lake Frances during the period May 1989 through May 1990. Data for October through March are for weekends only. Eighty percent confidence intervals are in parentheses.

Month	Walleye	Northern pike	Yellow perch	Burbot	Total
1989					
May	261 (± 92)	118 (± 49)	14 (± 10)	3 (± 3)	396 (± 123)
Jun	2,041 (± 422)	752 (± 189)	514 (± 238)	0	3,307 (± 663)
Jul	1,870 (± 301)	1,416 (± 212)	2,729 (± 633)	0	6,014 (± 936)
Aug	5,433 (± 876)	1,318 (± 261)	4,249 (± 881)	0	11,000 (±1,682)
Sep	1,806 (± 480)	780 (± 241)	792 (± 436)	0	3,379 (± 830)
Oct[a]	0	110 (± 108)	12 (± 15)	0	122 (± 111)
Nov[a]	0	0	0	0	0
Dec[a]	0	106 (± 46)	0	9 (± 7)	115 (± 49)
1990					
Jan[a]	0	87 (± 52)	7 (± 9)	7 (±10)	102 (± 57)
Feb[a]	7 (± 9)	224 (± 80)	14 (± 18)	0	245 (± 88)
Mar[a]	0	87 (± 55)	0	0	87 (± 55)
Apr	69 (± 63)	5 (± 6)	0	0	75 (± 64)
May	713 (± 330)	190 (± 143)	312 (± 236)	0	1,215 (± 531)

[a]Data for weekends only.

Table A6. Calculation of number of fish harvested from Lake Frances on weekdays during the winter period, October 1989 through March 1990.

Month	No. parties interviewed[a]	Harvest rate (fish/hr) WE[b]	NP	YP	Burbot	Weekday[c] angler hrs	Estimated weekday harvest WE	NP	YP	Burbot	Total
1989											
Oct	9	0	.1031	.0115	0	685	0	71	8	0	79
Nov	1	0	0	0	0	6	0	0	0	0	0
Dec	12	0	.2353	0	.0196	475	0	112	0	9	121
1990											
Jan	20	0	.0708	.0059	.0059	1229	0	92	8	8	108
Feb	29	.0032	.1009	.0063	0	2340	7	236	15	0	258
Mar	17	0	.0717	0	0	1226	0	88	0	0	88
Total	88					6031	7	599	31	17	654

[a]Winter weekend interviews.

[b]Abbreviations: WE = walleye, NP = northern pike, YP = yellow perch.

[c]Estimated by multiplying winter weekend hours (Table A2) by 1.057.

Table A7. Estimated total number of fish harvested from Lake Frances during the period May 1989 through May 1990. Eighty percent confidence intervals in parentheses.

Month	Walleye	Northern pike	Yellow perch	Burbot	Total
1989					
May	261 (± 92)	118 (± 49)	14 (± 10)	3 (± 3)	396 (± 123)
Jun	2041 (± 422)	752 (± 189)	514 (± 238)	0	3307 (± 663)
Jul	1870 (± 301)	1416 (± 212)	2729 (± 633)	0	6014 (± 936)
Aug	5433 (± 876)	1318 (± 261)	4249 (± 881)	0	11000 (±1682)
Sep	1806 (± 480)	780 (± 241)	792 (± 436)	0	3379 (± 830)
Oct[a]	0	181	20	0	201
Nov[a]	0	0	0	0	0
Dec[a]	0	218	0	18	236
1990					
Jan[a]	0	179	15	15	209
Feb[a]	14	460	29	0	503
Mar[a]	0	175	0	0	175
Apr	69 (± 63)	5 (± 6)	0	0	73 (± 64)
May	713 (± 330)	189 (± 143)	312 (± 236)	0	1215 (± 531)

[a]From Tables A5 and A6.

Table A8. Length frequencies for walleye, northern pike and yellow perch harvested from Lake Frances during the period May 1989 through May 1990.

Length (inches)	Walleye No. fish	(%)	Northern pike No. fish	(%)	Yellow perch No. fish	%
5.0 - 5.9					1	(0.7)
6.0 - 6.9					0	-
7.0 - 7.9					12	(8.3)
8.0 - 8.9					45	(31.3)
9.0 - 9.9					46	(31.9)
10.0 -10.9	15	(2.9)			15	(10.4)
11.0 -11.9	64	(12.5)			15	(10.4)
12.0 -12.9	111	(21.8)			10	(6.9)
13.0 -13.9	113	(22.2)				
14.0 -14.9	46	(9.0)				
15.0 -15.9	34	(6.7)	2	(0.7)		
16.0 -16.9	17	(3.3)	4	(1.4)		
17.0 -17.9	19	(3.7)	24	(8.1)		
18.0 -18.9	21	(4.1)	19	(6.4)		
19.0 -19.9	32	(6.3)	44	(14.9)		
20.0 -20.9	19	(3.7)	40	(13.6)		
21.0 -21.9	8	(1.6)	39	(13.2)		
22.0 -22.9	7	(1.4)	39	(13.2)		
23.0 -23.9	4	(0.8)	26	(8.8)		
24.0 -24.9			16	(5.4)		
25.0 -25.9			13	(4.4)		
26.0 -26.9			8	(2.7)		
27.0 -27.9			9	(3.1)		
28.0 -28.9			3	(1.0)		
29.0 -29.9			1	(0.3)		
30.0 -30.9			0	-		
31.0 -31.9			4	(1.4)		
32.0 -32.9			2	(0.7)		
33.0 -33.9			0	-		
34.0 -34.9			0	-		
35.0 -35.9			1	(0.3)		
36.0 -36.9			1	(0.3)		
Total	510	(100.0)	295	(99.9)	144	(99.9)