

Rush Lake

Van Buren County, T02S and T03S; R16W; S31 and S5-6
Paw Paw River Watershed; Surveyed March 2004

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Environment

Rush Lake is a 119 acre lake in Hartford and Bangor Townships, Van Buren County. Maximum depth of the lake is 57 feet with 33 acres (28% of lake depth) greater than 20 feet (Figure 1). Maximum length is 3 miles with a width of 0.25 miles. Bottom substrate is marl and sand in the nearshore areas with silt and organic material in the offshore areas. There is no inlet to the lake and only a single outlet in the southeast that flows to the Mud Lake Drain. Public access is available at a state-owned site on the south shore.

Rush Lake is located in the Mud Lake Drain sub-watershed of the Paw Paw River. This sub-watershed covers 10,054 acres of land in Van Buren County. Capac-Riddle-Selfridge (91%) soil types dominate the land surface of the sub-watershed with small amounts of Coloma-Spinks-Oshtemo (4%) and Riddles-Spinks-Oshtemo (5%) soil types. Land management for agriculture is most suited for these soil types because of their suitability for growth of field crops and good drainage. Approximately 6,204 acres (9.7 mi²) or 61.7 percent of the total land area of the sub-watershed are used for agricultural land. Forest Land (19%), water (5%), and wetlands (5%) have been greatly reduced in the area. Of the existing wetlands, forested wetland is the most abundant covering 857 acres (47%) with some emergent and scrub-shrub habitat covering 256 (16%) and 128 acres (8%), respectively, and limited to areas adjacent to lakes and streams.

History

Early creel census surveys conducted by Michigan Department of Conservation (MDOC), Institute for Fisheries Research indicated that bluegills and black crappie were the primary catch in 1953 to 1963 with limited catches of largemouth bass, yellow perch, and northern pike. The first record of a complete fish collection survey was in 1970 with a catch of bluegill, largemouth bass, black crappie, pumpkinseed, warmouth, yellow perch, grass pickerel, brown bullhead, yellow bullhead, white sucker, spotted sucker, common carp, golden shiner and lake chubsuckers. General surveys conducted in 1973 and again in 1980 confirmed a similar warmwater fish community. These surveys indicated that bluegill, yellow perch, and black crappie growth was slow and the need for a management action was apparent.

MDNR-Fisheries Division stocking records indicate that principally a single species, northern pike, has been stocked in Rush Lake beginning in 1960 and then consistently from 1984 to 1995 and again in 2003 (Table 1). Stocked pike were marked with fin clips in 1994 and 1995 to evaluate year class survival given different feeding regimes at the hatchery and contributions of hatchery reared pike to the fishery (Table 1).

The first survey targeted at evaluating survival of stocked northern pike was in 1989. This survey used four gill nets and captured five pike from 21 to 29 inches, with evidence that some fish were from

natural reproduction. Stocking evaluations continued in 1997 with the use of four trap nets for an effort of eight net lifts and two net nights. This survey captured 35 pike from 19-32 inches in length. Stocked pike from the 1994 year class reared on live minnows at the hatchery were recaptured, but no fish from the 1995 year class were caught. During this survey evidence of pike stocked at larger sizes and reared on live fish forage was apparent and survival of stocked pike to the fishery was accomplished in Rush Lake. More evidence for natural reproduction of pike was observed in the 1997 survey, but growth of bluegill and black crappie continued to increase with higher densities of pike. Therefore stocking was renewed but no pike were available until 2003.

Current Status

An equal amount of sampling effort according to lake size was applied to this lake and nearby Van Auken Lake in March, 2004. Four trap nets were used for a total effort of 12 net lifts. Northern pike were the targeted species but other fish species were captured, including black crappie, bluegill, gizzard shad, pumpkinseed, largemouth bass, white sucker, warmouth, yellow bullhead, bowfin, brown bullhead, spotted sucker, lake chubsucker, common carp, and golden shiner. Only minimum and maximum lengths were recorded during each net lift for the non-targeted species.

A total of 81 northern pike were captured for a catch per effort of 6.75 fish/net lift. All pike captured were aged during this survey. Year classes captured in the survey ranged from 1994 to 2002, with only the 1994-95 year classes representing fish that could have been from previous stocking efforts (Figure 2). Northern pike mean length and age composition data for ages 2-10 are provided in Table 2 with a modal length of 24.5 inches. Age structure of northern pike were dominated by fish at ages 3 and 4 (62% of combined catch), with a notably strong age 5 year class (16.9%). Age composition of fish older than age 6 was relatively low, although individuals greater than 30 inches and up to 38.5 inches were present. This may indicate that exploitation was high as fish larger than 24 inches are harvested from the population.

Northern pike growth was calculated using the von Bertalanffy growth model with 99% confidence limits. There were insufficient samples for individual age classes of females, so samples were combined to describe the pike population. Mean ultimate lengths at age with 99% confidence limits has been suggested to be a good estimate of growth potential for northern pike and muskellunge (Casselman 2005, personal communication). Minimum ultimate size was determined from the lower 99% confidence limit at age 10, which was 26 inches for Rush Lakes population (Figure 3). Minimum size limits based on growth biology can help sustain and even increase the size of fish while producing quality fisheries.

Catch rates during the three-day sampling effort were lower (range = 6.0 to 7.75 fish/net/day) than catch rates observed in Van Auken Lake (range = 12.5 to 15 fish/net/day), suggesting that a lower density of northern pike may exist in Rush Lake. Trap net catch rates did not show a decreasing trend from the beginning of sampling until trapping was suspended (Figure 4). Therefore, the sampling effort was not long enough to accurately describe the population status of northern pike in Rush Lake. However, some important information was captured during this survey. Catch rates between each trap net were variable with net PLA- 21 resulting in the highest average catch rate of 16.6 fish per day. This net was located in the northeast portion of the lake. Based on higher catch rates in this area of the lake this area could have been an important spawning site.

Analysis and Discussion

Recent surveys indicate the nonindigenous gizzard shad have been introduced to the natural environment of Rush Lake. Their presence was not apparent during previous surveys. Although their impact to the environment of the lake is unknown at this time, they do provide forage for northern pike.

Northern pike have been stocked in Rush Lake since 1984 (Table 1). Based on the age structure of northern pike collected during this survey, there is evidence for natural reproduction occurring in the lake. A previous survey conducted in 1997 also showed that some level of natural reproduction was occurring. The northern pike population has been sustaining itself without supplemental stocking since 1995, except for stocking in 2003 that contributed no individuals to the recent survey.

Density dependent growth has been shown to be an important factor in determining the size structure of northern pike populations (Margenau et al. 1998, and Pierce et al. 2003). Habitat variables such as extensive littoral area and turbidity have also been identified as variables that may limit pike growth and size structure. Maintaining a stocking strategy for this lake could therefore increase the density of pike and could cause a reduction in growth and size structure. The suitability of a lake's habitat to support northern pike (as influenced by the morphometry of lake basins) has strong effects on their density, which in turn has important effects on growth rates, production, and size structure. Protection of the lakes habitat and basin characteristics is important to maintain sustainability of northern pike populations.

Northern pike ecological role to structure fish communities has been studied extensively throughout their range. Diet studies of northern pike indicate opportunistic feeding strategies with some preference towards prey like yellow perch (Margenau et al. 1998) and soft-rayed fish like white suckers. Relative abundance of largemouth bass has been positively related to size structures of yellow perch and bluegills when northern pike are absent, but when populations of northern pike and largemouth bass exist these relationships are less evident and there is not a noticeable affect above what is exerted by bass. Northern pike stocking as a top-down predator technique to control the abundance of small bluegills is therefore not needed in Rush Lake.

Management Direction

The remaining riparian wetlands adjacent to Rush Lake are critically important to the health of the lakes fish community. Unwise riparian development and wetland loss could result in deterioration of the water quality and fisheries habitat. Northern pike rely on riparian wetlands for spawning and rearing purposes. For these reasons, all remaining riparian wetlands adjacent to Rush Lake should be protected. Perturbation of habitat by humans through treatment for control of aquatic plants, shoreline alteration such as filling or bulk-heading, or dredging are obstacles to protection.

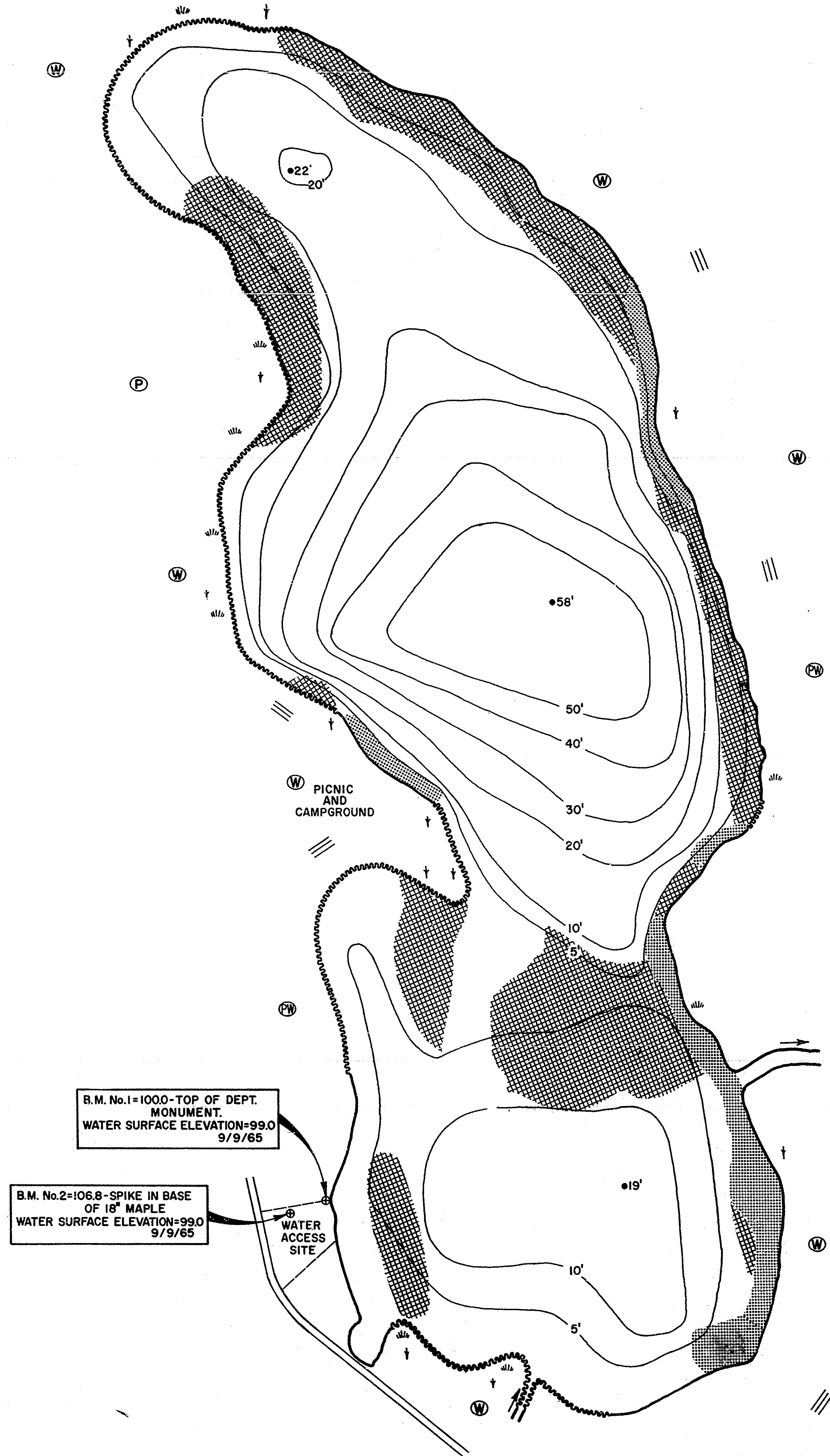
Fisheries Division management direction is to continue to maintain and protect the warmwater fish community that appears to be healthy at this time. To maintain a healthy well-balanced fish community in Rush Lake and to avoid affecting the fitness and long-term adaptability of the wild

population, I recommend discontinuing stocking northern pike. To protect the ultimate growth potential of the northern pike population from Rush Lake, minimum size limits should be adjusted to reflect regulations from similar populations in the state. Currently the state is summarizing results from "Status and Trends" sampling and this information could better direct regulations for northern pike populations. Rush Lake could be classified as a northern pike trophy fishery.

References

- Margenau, T. L., P.W. Rasmussen, and J. M. Kampa. 1998. Factors affecting growth of northern pike in small northern Wisconsin lakes. *North American Journal of Fisheries Management* 18: 625-639.
- Pierce, R.B., C. M. Tomcko, and T. L. Margenau. 2003. Density dependence in growth and size structure of northern pike populations. *North American Journal of Fisheries Management* 23: 331-339.

MICHIGAN DEPARTMENT OF CONSERVATION
RUSH LAKE
 AREA 118 ACRES
 VAN BUREN COUNTY T. 2,3 S., R. 16 W., SECS. 31, 5, 6
 SURVEY AND SOUNDINGS SEPT. 2, - SEPT. 9, 1965



B.M. No.1=100.0-TOP OF DEPT. MONUMENT.
 WATER SURFACE ELEVATION=99.0
 9/9/65

B.M. No.2=106.8-SPIKE IN BASE OF 18" MAPLE
 WATER SURFACE ELEVATION=99.0
 9/9/65



LEGEND

BOTTOM

- Sand
- Organic
- Marl

SHORE FEATURES

- Encroaching shore
- Steep slope
- Wooded
- Partly wooded
- Pasture
- Brush
- Marsh
- Boat house
- Improved road
- Inlet or outlet

Table 1. Stocking history of northern pike in Rush Lake, Van Buren County

Year	No. stocked	Avg. Length (cm)	Mark
1984	1200	9.9	
1985	2000	9	
1987	600	8.3	
1989	600	10.9	
1991	2500	5.5	
1993	1200	9.9	
1994	1200	10.7, 11.2	LV, RP
1995	600	10.7	RV
2003	459	6.5, 11.6	
Total	10359		

Table 2. Weighted mean length and age composition of northern pike captured in Rush Lake (2004).

Species / Age	No. aged	Lengthrange (in.)	State avg.length (in.)	Weightedmean len. (in.)	Weightedage freq.	Meangrowth index*
Northern pike						+0.7
Age II:	3	18.1-19.9	17.7	19.07	3.70%	0
Age III:	26	19.1-27.8	20.8	21.71	31.23%	1
Age IV:	25	20.3-31.1	23.4	24.80	30.49%	1
Age V:	13	22-27	25.5	24.48	16.91%	1
Age VI:	4	23.4-27.5	27.3	25.21	5.31%	0
Age VII:	1	29.9-29.9	29.3	29.90	1.23%	0
Age VIII:	2	32.2-35.3	31.2	33.75	2.47%	0
Age IX:	2	29-36.8		32.90	2.47%	0
Age X:	5	28.2-38.5		35.34	6.17%	0

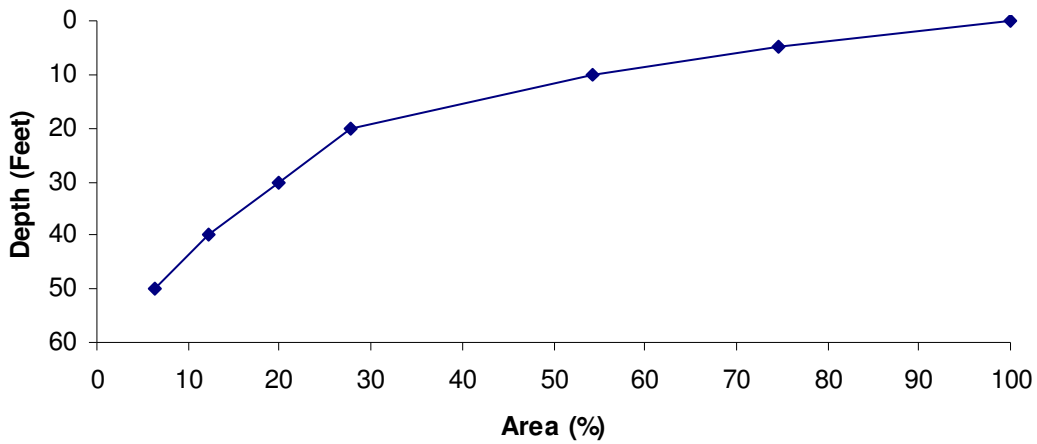


Figure 1. Percent area by depth of Rush Lake, Van Buren County. Data from MDNR Digital Water Atlas.

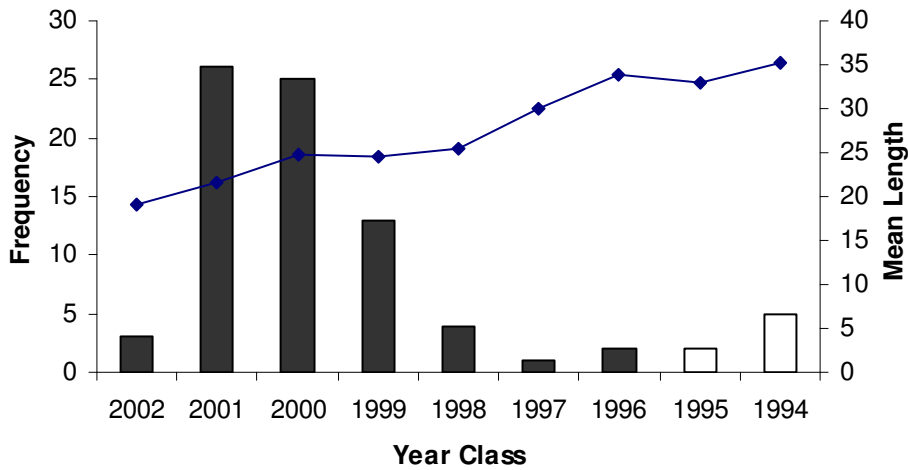


Figure 2. Year class frequency and average length at age data for captured northern pike in Rush Lake. Solid bars represent northern pike from non-stocked years while open bars represent pike from stocked years.

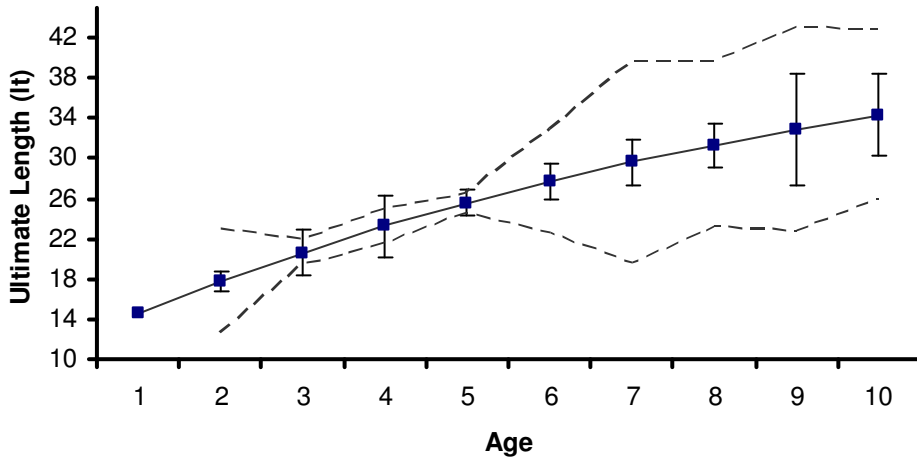


Figure 3. Ultimate length at age for northern pike in Rush Lake, Van Buren County. Dashed lines represent 99% confidence limits used to evaluate minimum size limits for growth potential.

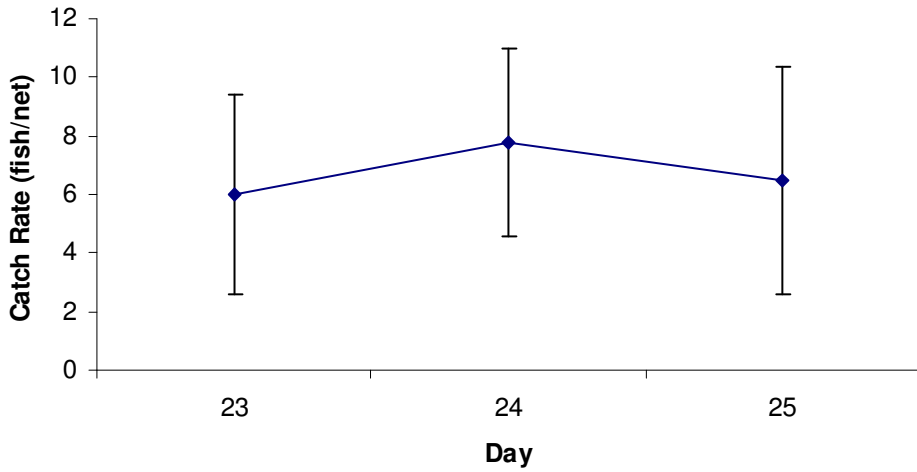


Figure 4. Average daily trap-net catch rates (\pm SE) for northern pike captured during 23-25 April, 2004 in Rush Lake.