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STATE OF NEBRASKA
GAME AND PARKS COMMISSION
DIVISION OF FISHERIES

DISTRICT II

NORTHERN PIKE MANAGEMENT IN PELICAN LAKE, CHERRY COUNTY

by Richard Peckham

June 1970

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INTRODUCTION

Pelican Lake is a 819 acre natural sandhill lake located on the Valentine National Wildlife Refuge in Cherry County. Like all sandhill lakes in this region the lake is relatively shallow having a maximum depth of only 7.5 feet.

Pelican is a light alkaline lake having a recorded pH range between 7.0 and 9.5. Total alkalinity values ranged from 185 to 360 ppm, in recent years.

Submergent vegetation is common and includes the following: sago pondweed, coontail, curlyleaf pondweed, floating leaf pondweed and milfoil. Emergents consist of hardstem bulrush, reed grass (*Phragmites*), arrowhead and cattail. Hardstem bulrush is scattered lightly throughout the entire lake, while the others are confined primarily to the margin.

In 1958 the lake was treated with toxaphene to eliminate the heavy carp and bullhead population. Northern pike, rock bass, largemouth bass and bluegill were restocked in 1960.

A 16 hour sample in May, 1961, using 2 gill nets (125 ft. variable mesh) captured 15 northern pike averaging 14.0 inches and one carp (11.4 inches). No other fish were captured.

The fish population was again sampled in July, 1962, by state and federal biologists. Six 125 foot experimental gill nets captured 28 northern pike, 5 carp, 5 bluegill and 1 largemouth bass. The northern pike averaged 19.0 inches and 1.63 pounds.

Beginning in 1963 the lake was utilized as a source of northern pike spawners. A total of 39 trap net days yielded 1,657 northern pike. The lake has been utilized each year since 1963. In the last four years (1966-69) an average of over 4,150 northern pike spawners have been utilized annually from Pelican Lake for artificial spawning purposes. A high of 4,777 were trapped in 1968.

Spawning Season

The annual northern pike spawning operation begins each year as soon as the ice has melted from the lake. This normally occurs near the middle of March, but may vary from early March to early April.

Males enter the shallows first and are joined by increasing numbers of females as the water temperature rises. The peak of the female run generally occurs when the water temperature reaches about 42 degrees to 45 degrees F. During this time (normally a 10 to 12 day period) fyke nets are set along the shoreline and spawners are trapped and removed every 24 hours. The fish are then transferred to the Valentine State Fish Hatchery where they are sorted according to sex and ripeness. Spawning is done according to the method described in a separate report entitled "Spawning Techniques for Northern Pike in Nebraska," submitted by this writer in 1968. After the required number of eggs are taken the spawners are returned to the lake.

During the past 5 years an average of over 22 million eggs have been taken. A record 25 million eggs were taken in 1967.

In addition to providing eggs for Nebraska's northern pike culture program, eggs are also provided to federal hatcheries in Kansas and South Dakota. In recent years as many as 65 per cent of the total eggs taken have gone to federal hatcheries.

Pelican Lake has been the primary source of spawners in recent years. Since the winterkill and summerkill of the Hackberry Lake fish population in 1965 and 1966, Pelican Lake has provided over 80 percent of the spawners annually.

Marking and Tagging Studies

A cooperative study involving state and federal fishery biologists was initiated in 1966 in an effort to gain insight into the northern pike population. Before the spawners were returned to Pelican Lake following the 1966 spawning operation 73 pike were tagged with a red plastic bandette and 1,260 were marked with a left pelvic fin clip (Table 1).

Table 1. Summary of Marking and Tagging of Northern Pike in Pelican Lake.

<u>Year</u>	<u>Tag or Mark</u>	<u>Number of Fish Marked</u>
1966	Red Bandette	73
1966	Left Pelvic	1,260
1967	Monel Metal	1,300
1968	Right Pelvic	Unknown*
1968	Yellow Dart	313
1969	Right Pectoral	800
1970	Dorsal Punch	2,560

*Error in recording

During the 1967 spawning operation all pike captured from Pelican Lake were examined and the number of marked fish were recorded. Of 3,721 pike examined, 364 contained the left pelvic fin clip. The point estimate at that time (1967) for the northern pike population (excluding 1966 recruitment) using the modified Peterson estimate was 12,857.

Of the 73 pike tagged with a red bandette in 1966, there was a 26.0 percent return (19 tags) in a 45 month period. It is interesting to note that during the first nine months after being tagged there were no returns. In 1967 nine tags were returned; two in 1968; and five in 1969. The date of return for three tags is unknown.

The increase in tag returns after the first year was probably a result of a tag return box and fisherman information sign (related to the tagged fish) being placed beside the trail leaving the lake. The tag return box was installed by federal personnel in early 1967 in conjunction with the cooperative (state and federal) tagging of 1,300 northern pike with a monel metal jaw tag on March 29, 1967.

During the first three months (April, May and June) after the 1,300 tagged fish were returned to the lake, 195 tags (15.0%) were returned. In the remainder of 1967 only 10 additional tags were returned. This is partially due to the normal decrease of pressure and success during July and August on sandhill lakes. In addition, the lakes on the refuge are closed to fishing during the regular duck season.

The total return for the first 12 months was 269 tags (20.7%). As shown in Table 2, there was a substantial increase in tag returns again in January and February during the ice fishing season.

There was only a 4.5% return (59 tags) during the second 12 month period bringing the total return for the first 24 months to 25.2% (328 tags).

From April through September, 1969 there were 133 tags or a 10.2% return for the period. A total of 71 tags was returned in May, 1969, and 60 during the June through September period. No breakdown per month is available for this 4 month period. There were no tags returned during the October through December period.

The total tag return for the 30 month period (April, 1967 through September, 1969) was 35.4% (461 tags). The reason for the rather sharp drop in tag returns during the second 12 month period followed by a substantial increase again in April through September, 1969 is not known. It is believed to be a reflection of fishing success and fishing pressure rather than other factors.

In April, 1968 a yellow dart tag was administered to 313 northern pike in Pelican Lake. The tag was inserted with a tagging gun into the musculature at the base of the dorsal fin. An attempt was made to insert the tag between the interneural spines, however, this was the first tagging effort using this method so proficiency was not at its best.

There were only five tag returns during the first 12 months. Four were returned in August and one in February, 1969. An increase in tag returns was realized during the April, 1969 through September, 1969 period. Fifteen tags were returned during this time to bring the total to 20 tags or a 6.4% return. The low return in the April, 1968 through March, 1969 period and the increase in returns from April, 1969 through September, 1969 compares favorably with the return of monel metal tags during the same periods.

The return of 20 tags (6.4%) in a 17 month period is a low return. This is believed to be a reflection of fishing pressure and success rather than tag loss.

During the 1969 trapping operation 37 or 11.8% of the 313 tagged pike were captured. A considerable number of pike bearing a yellow dart tag were also observed during handling in the 1970 spawning operation.

Table 2. Tag returns from 1,300 Northern Pike tagged on March 29, 1967 with a monel metal jaw tag.

<u>Date</u>	<u>Number Returned</u>	<u>Per Cent Return</u>
April, 1967	75)	5.8
May, 1967	64) 195	4.9 (15% return in
June, 1967	56)	4.3 last 3 months)

Continuation of Table 2.

<u>Date</u>	<u>Number Returned</u>	<u>Per Cent Returned</u>
July, 1967	10	
Aug-Dec., 1967	0	
Jan., 1968	21	
Feb., 1968	20	
Mar., 1968	<u>3</u>	
Total 1st 12 mo. period	269	20.7 in 12 months
April, 1968	0	
May, 1968	13	
June, 1968	7	
July, 1968	0	
Aug., 1968	20	
Sept.-Dec., 1968	0	
Jan., 1969	0	
Feb., 1969	5	
Mar., 1969	<u>14</u>	
Total 2nd 12 mo. period	59	4.5 (25.2% return in 24 months)
April, 1969	2	
May, 1969	71	
June, 1969)		
July, 1969)	60	
Aug., 1969)		
Sept., 1969)		
Oct., 1969)*		
Nov., 1969)*		
Dec., 1969)*		
Total for 6 months	133	10.2 (35.4% return in 30 months)
Grand total for 33 months	461	

*Closed to fishing during the regular duck season.

1969 Population Estimate

Before spawners from the 1969 operation were returned to Pelican Lake, 800 (400 males and 400 females) were marked with a right pectoral fin clip. These were returned to the lake on April 9, 1969. On April 28, 1969 fifteen frame nets were set in an attempt to capture enough pike to calculate a population estimate. However, only 57 pike were captured, which was far short of the estimated 1,000 needed for examination.

During May 20, 21 and 22, 1969, the state seining crew was utilized in an effort to capture the necessary numbers of pike for the population estimate.

In six seine hauls a total of 920 northern pike was examined. (Fish which were examined were given a temporary mark so that they would not be included if captured again). Of 920 pike examined 25 were found to have a right pectoral mark. The point estimate for the total northern pike population was calculated at 28,372 using the modified Petersen estimate.

Using the criteria described by Chapman (1948), the Poisson Approximation was selected as the best method to use in finding a confidence interval estimate for the population. Confidence limits at the 95 per cent level were calculated. The lower limit for the estimate is 18,279 while the upper limit is 41,532.

N = 28,372 = Point estimate (Modified Petersen)
t = 800 = Number marked
n = 920 = Number examined
s = 25 = Recaptures

95 per cent Confidence Limits from Chapman's (1948) Table 1 using the Modified Petersen Estimate.

$$\text{Lower Limit} = \underline{N} = 737,721 \times .02478 - 1 = 18,279$$

$$\text{Upper Limit} = \bar{N} = 737,721 \times .0563 - 1 = 41,532$$

1970 Population Estimate

In April, 1970, a total of 2,560 spawners was marked with a dorsal fin punch. On May 5th and 6th the state seining crew was again utilized to capture fish for a population estimate. In three seine hauls a total of 953 northern pike was examined of which 143 were marked.

Using the modified Petersen estimate the point estimate for northern pike in April, 1970, was 16,965.

Again using the criteria described by Chapman (1948) the Normal Approximation was selected as the best method to use in finding a confidence interval estimate for the population. At the 95 per cent level of confidence the lower limit for the estimate is 13,507 while the upper limit is 19,880.

Length, Weight and Growth

In the 1967 tagging effort, lengths and weights (Table 3) were obtained on the 1,487 fish (668 males and 819 females) tagged. A total of 1,300 was returned to Pelican Lake and the remainder were stocked in Offutt Air Force Base Lake by the federal biologist.

The length frequency by sex is shown in Figure 1.

Before the spawners were returned to Pelican Lake following the 1968 spawning operation 199 tagged pike (122 males and 70 females) were weighed and measured. These were fish tagged the previous year. The 122 males increased an average of 0.92 inches in total length and 0.24 pounds. The 70 females increased an average of 1.37 inches and 0.66 pounds.

1970 Normal Approximation Confidence Limits for Northern Pike

Chapman Formula 55

N = 16,965
 t = 2,560
 n = 953
 s = 143

$$(\bar{N}, \underline{N}) = \frac{nt}{s^2} \left[S + 1.9208 \pm \sqrt{(S + 1.9208)^2 - S^2 \left(1 + \frac{3.8416}{n}\right)} \right]$$

$$(\bar{N}, \underline{N}) = \frac{2,439,680}{20,449} \left[143 + 1.9208 \pm \sqrt{(143 + 1.9208)^2 - 20,449 \left(1 + \frac{3.8416}{953}\right)} \right]$$

$$119.306 \left[144.9208 \pm \sqrt{(144.9208)^2 - 20,449 (1.0040)} \right]$$

$$119.306 \left[144.9208 \pm \sqrt{21,002,0383 - 20,530.7960} \right]$$

$$119.306 \left[144.9208 \pm \sqrt{471.2423} \right]$$

$$119.306 \left[144.9208 \pm 21.7081 \right]$$

$$\bar{N} = 119.306 (166.6289)$$

$$\bar{N} = 19,880$$

$$\underline{N} = 119.306 (113.2127)$$

$$\underline{N} + 13,507$$

Table 3. Length and Weight Summary of 1,487 Northern Pike Tagged in 1967.

<u>Sex</u>	<u>Number</u>	<u>Length Range (Inches)</u>	<u>Average Length</u>	<u>Weight Range (Pounds)</u>	<u>Average Weight</u>
Male	668	13.2 - 29.2	21.10	0.6 - 5.9	2.48
Female	<u>819</u>	15.3 - 40.0	24.04	0.7 - 13.5	<u>3.48</u>
	1,487	(ave. length	22.73)	(ave. weight	3.03)

The weights in both 1967 and 1968 were recorded after the spawning operation. The weights should therefore be for spent fish, however this may not have been true in every case.

A number of individuals showed a loss in length and/or weight. Extremes in either length or weight were believed to be errors in recording or reading the tag number and therefore were not included in the averages.

Standing Crop Estimate

In the 1970 resample effort utilizing the seining crew a total of three seine hauls was made with a 1500 ft. seine. Of 953 northern pike captured, 53.2 per cent were in the yearling (8-13 inch) class. Using 0.5 pounds for 53.2 per cent of the 1970 population estimate and 3.0 pounds as the average weight for the remaining adults the total standing crop is calculated at 35.4 pounds per surface acre (800 surface acres in April, 1970).

Using the 1969 point estimate the total standing crop is calculated to be 59.2 pounds of northern pike per surface acre.

Sex Ratio of the Spawning Population

Accurate records are available for 1967 through 1969 for determination of sex ratio in the spawning population. The number of pike trapped from Pelican Lake during these years ranged from 3,721 to 4,777. The sex ratio of males to females ranged from 95.8:100 in 1969 to 216.1:100 in 1968. The average for the three years is 155.1 males per 100 females.

In 1969 when females outnumbered males in the net catches, a late ice break-up and therefore a later spawning season was apparently the reason. Both sexes became ripe at nearly the same time and the trapping operation required only four days as compared to 10 or 12 in a normal year.

The sex ratios described may not represent the true ratio of spawners since the entire spawning run is not always sampled. Early in the run males will normally outnumber females three or four to one. As the trapping operation progresses the ratio approaches a one to one ratio or the number of females may even exceed the number of males. As soon as the required number of females are captured for the spawning operation, trapping is discontinued even though the female run may be fairly strong. Not including this portion of the run would of course bias the sex ratio of the total spawning population.

Summary

Pelican Lake was renovated with toxaphene in 1958 and restocked in 1960. It has been utilized for northern pike spawners each year since 1963. During 1966-69 an average of over 4,150 northern pike annually have been trapped from the lake. In the last five years an average of over 22 million eggs have been collected from these spawners at the Valentine State Fish Hatchery.

In 1966 a marking and tagging study was initiated with information being gathered up through 1970. The study has provided information for northern pike on harvest, growth, length frequency, sex ratios, population estimate and total standing crop.

The total voluntary tag return in a 30 month period from 1,300 northern pike tagged with a metal jaw tag in 1967 was 35.4 per cent.

The population estimate conducted in 1969 provided a point estimate of 28,372 northern pike and a standing crop of 59.2 pounds per acre. The 1970 estimates were 16,965 pike and a standing crop of 35.4 pounds per acre.

Recommendations

1. Collect and analyze age and growth data in 1971.
2. Conduct studies on food habits of the northern pike at various times of the year and its relationship with other fish species in the lake.

Literature Cited

Chapman, D. G.
1948. A mathematical study of confidence limits of salmon populations calculated from sample tag ratios. International Pacific Salmon Fisheries Commission. Bulletin II, p. 69-85.

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Figure 1. Length Frequency by Sex of 1,487 Adult Northern Pike. Pelican Lake, 1967.

