Fishery Data Series No. 91-23

Stock Composition of Northern Pike Captured in Minto Flats during 1990

by

Alan Burkholder

August 1991

Alaska Department of Fish and Game

Division of Sport Fish

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ABSTRACT

Stock assessment studies of northern pike *Esox lucius* in Minto Flats were conducted in 1990. Periodic tracking of northern pike implanted with radio transmitters while at their overwintering site provided information on timing of spring migration into Goldstream Creek. Use of radio telemetry resulted in a successful sampling event that occurred in the spring in Goldstream Creek. Using fyke and hoop traps, a total of 3,752 northern pike were captured in the spring, and 264 were captured in the fall. Population estimate for northern pike in 1990 was not estimated due to insufficient numbers of fish recaptured during the fall sampling event. Length frequencies of fish sampled during the spring and fall were dissimilar. The majority of northern pike in the spring sample were in the Relative Stock Density categories of "stock" and "quality", while the majority of the fall sample was composed of larger northern pike in the "quality" and "preferred" categories. Sex was determined for 1,515 northern pike; 524 were females and 991 were males. Age 2 fish were most numerous in the sample captured during spring while fish of age 6 were most numerous in the sample collected during fall. Age 2 fish were likely fully recruited to the fishing gear in the spring. Ages 3 and age 4 fish appeared to be lacking in the spring sample. Seasonal growth was inversely related to age.

KEY WORDS: Northern pike, *Esox lucius*, Minto Flats Alaska, radio telemetry, age composition, Relative Stock Density, length-at-age, growth.

INTRODUCTION

Next to Arctic grayling *Thymallus arcticus*, northern pike *Esox lucius* are the most sought after indigenous sport fish species in interior Alaska (Holmes 1987). Between 75% and 90% of the annual harvest of northern pike in Alaska comes from interior Alaska with 65% of the harvest taking place in the Tanana River drainage (Figure 1). Minto Flats has supported the largest sport fishery for northern pike in Alaska in nine of the previous 13 years (Mills 1979-1990). From 1981-1984 the average sport harvest in Minto Flats was 2,279 northern pike. However, in 1985, a new sport fishery developed on a concentration of overwintering northern pike in the lower part of the Chatanika River (Figure 2). This fishery resulted in an increase in the estimated sport harvest from 2,349 northern pike in 1984 to 4,665 fish in 1985, and 4,903 fish in 1986. Angler reports and limited creel survey sampling (Holmes and Burkholder 1988) indicated that a large portion of the harvest from this new fishery was prespawning females.

In addition to sport harvests, there is a subsistence fishery on northern pike by the people of Minto Village and Nenana. This subsistence harvest occurs primarily in the spring and fall with gill nets and hook and line. Estimated harvest of northern pike in the subsistence fishery for the years 1983 through 1989 has been reported as high as 3,003 in 1983 (Andrews 1988) and as low as 378 in 1988[1].

Concern that increasing sport harvests combined with subsistence harvests exceeded sustainable yield prompted the Department of Fish and Game to close the winter sport fishery for northern pike by emergency order in January 1987. In the spring of 1988, two new regulations went into effect. One regulation restricted the sport fishing season to 1 June through 14 October. The other regulation reduced the bag limit from 10 northern pike (two over 760 mm or 30 in) to five northern pike a day, of which one can exceed 760 mm. Along with the new regulations, the Department initiated a stock assessment program in 1987 as part of an effort to assure present management practices are sufficient to maintain this important resource and sport fishery (Holmes and Burkholder 1988, Burkholder 1989 and 1990).

Study Area

Minto Flats is located approximately 50 km west of Fairbanks. It is a 200,000 ha area of marsh and lakes interconnected by numerous sloughs and four major rivers: the Chatanika, Goldstream, Tatalina and Tolovana (Table 1 and Figure 2). The rivers are slow flowing and meandering, and the lakes are shallow and contain large areas of dense aquatic vegetation. Actual aquatic habitat available for northern pike in Minto Flats consists of an estimated 6,000 ha of water (Holmes and Pearse 1987). Access to Minto Flats is by float equipped-aircraft, by road to Minto Village, by boat via the Tanana River, or by road via the Murphy Dome extension to the Chatanika River.

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[1] Neil Shishido; Memorandum; State of Alaska, Department of Fish and Game. 1/13/89. Subsistence Division, 565 University Ave. Fairbanks, AK.

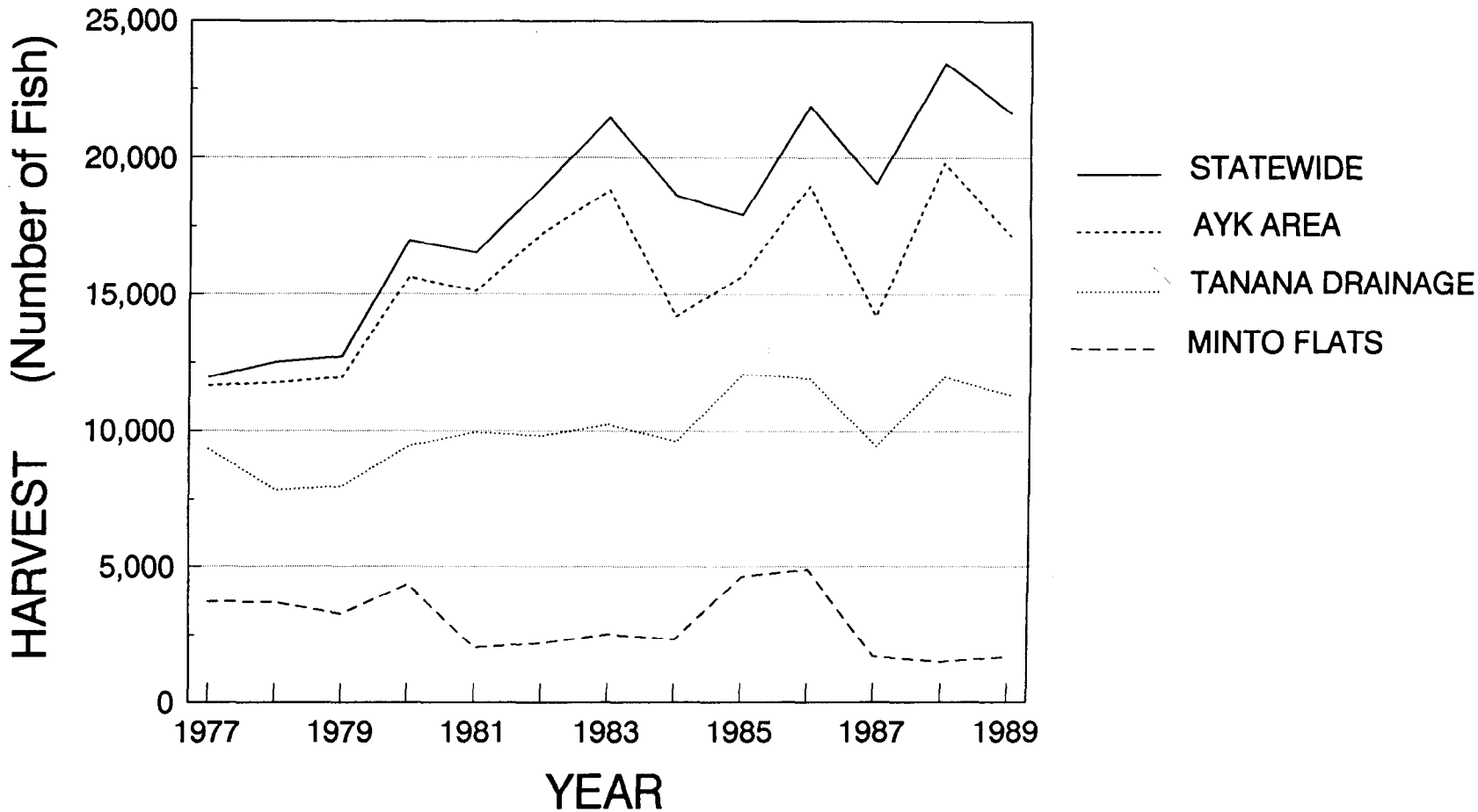

Figure 1. Estimated sport harvest of northern pike in Alaska, the Arctic-Yukon-Kuskokwim Region (AYK), the Tanana drainage, and Minto Flats, 1977 - 1989 (Mills 1979-1990).

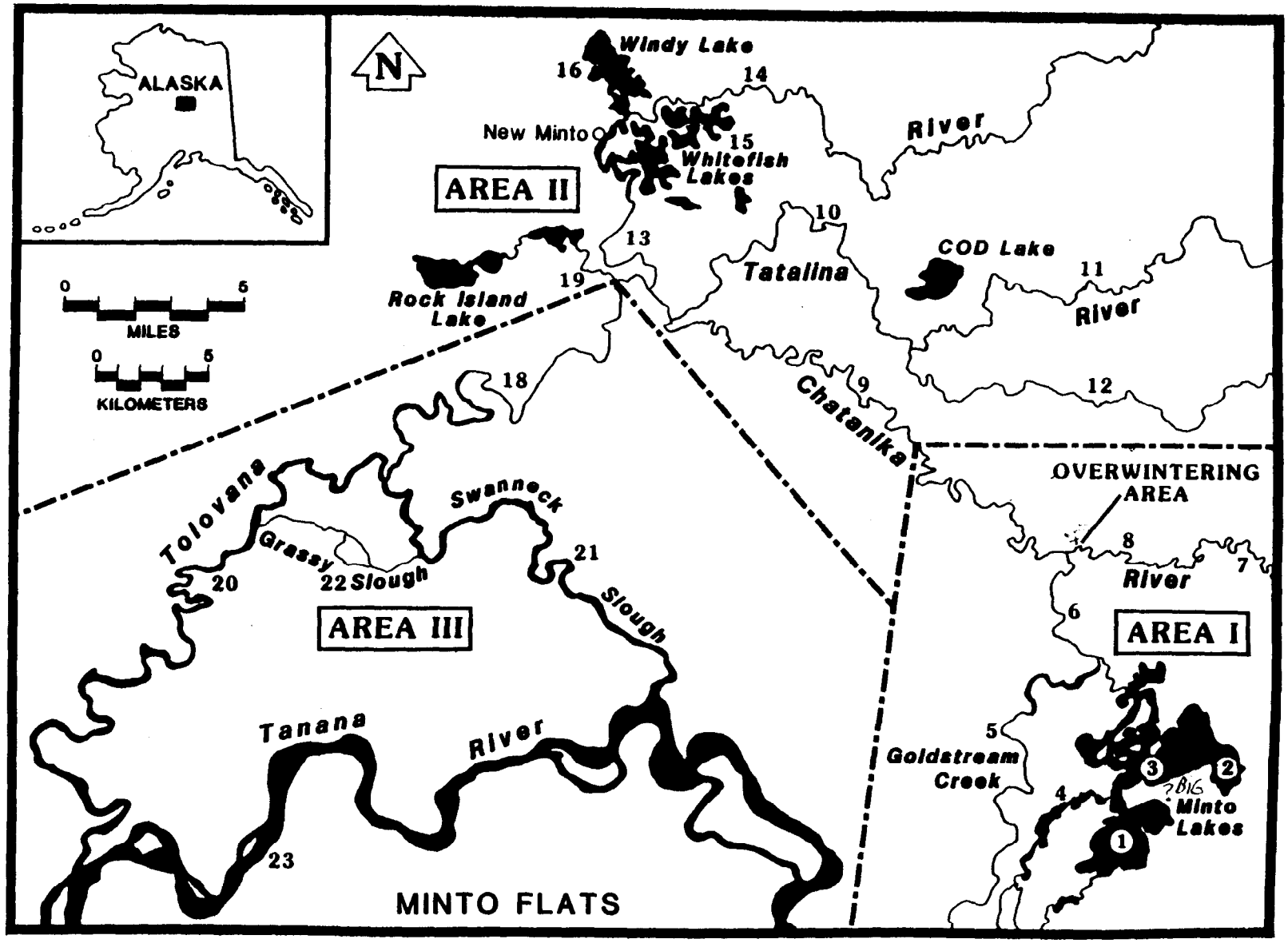

Figure 2. Minto Flats drainage and major sampling Areas.

Table 1. Sampling areas in Minto Flats.

Area	Section	Location
I	1	Upper Minto Lake
I	2	Big Minto Lake
I	3	Lake Channels to Goldstream
I	4	Rotten Slough
I	5	Goldstream (above Lake Channels)
I	6	Goldstream (below Lake Channels)
I	7	Chatanika (above Murphy Dome Road)
I	8	Chatanika (Murphy Dome Road to Goldstream)
I	9	Chatanika (Goldstream to Rock Island Slough
II	10	Tatalina (Chatanika to Forks)
II	11	Tatalina (Above Forks)
II	12	Washington Creek
II	13	Tolovana (Rock Island Slough to Minto Village)
II	14	Tolovana (above Minto Village)
II	15	Whitefish Lakes
II	16	Lakes North Of Minto
II	17	Lakes Northwest of Minto
III	18	Tolovana (Rock Island Slough to Swanneck)
III	19	Rock Island Slough
III	20	Tolovana (Swanneck Slough to Tanana)
III	21	Swanneck Slough
III	22	Grassy Slough
III	23	Tanana River

Study Objectives

Goals of this project are the stock assessment of and the investigations into the life history of northern pike in Minto Flats in an effort to improve the scientific basis of management of the sport fishery.

The objectives for 1990 were to estimate:

1. the abundance of northern pike in Area I (excluding the Chatanika River) of Minto Flats (Figure 2); and,

2. the sex, length, and age composition of northern pike in Area I of Minto Flats.

Area I was chosen for study because it is thought to be a major spawning area, and also because it is logistically feasible to sample. Objectives in the F-10-6 contract will be further addressed during sampling in May 1991. Due to concerns about injury and potential latent mortality of northern pike caught through electrofishing methodology, a moratorium was placed on this method of fishing for northern pike beginning in 1989. Due to the moratorium on electrofishing of northern pike, adequate sample sizes could not be obtained with traditional netting methodology during the fall of 1990 to complete the mark-recapture experiment. Therefore, the 1991 spring sampling event will be combined with the 1990 spring sampling event to complete the two event mark-recapture experiment.

This report summarizes data collected in 1990 for northern pike in Area I (excluding the Chatanika River) of Minto Flats and provides needed documentation required to fulfill Federal Aid contract obligations for the reporting year (Contract F-10-6; Job Number R-3-4(d)).

METHODS

Two discrete sampling events occurred during 1990 (24 April through 9 May and 12 September through 1 October). Winged fyke and hoop traps were used as primary sampling gear in 1990. Traps were fished in Goldstream Creek and some of the smaller sloughs off of the main channel that drains the upper Minto Lakes. Gill nets were used to augment catches during the spring. Only a small portion of the fish (about 200) sampled were captured using gill nets. Gill nets fished for only one day.

The spring sampling effort intercepted northern pike in Goldstream Creek as they moved from overwintering sites to spawning and summer feeding areas in the Big Minto Lakes complex (Figure 2). To determine when this movement occurred, radio transmitters were surgically implanted (Ross 1982) in nine northern pike captured in the Chatanika River overwintering site. Tracking flights were conducted from early April through early May to monitor northern pike movements. Sampling began when a radio tagged northern pike was located in Goldstream Creek. The fall sampling effort intercepted northern pike in Goldstream Creek as they moved from the Big Minto Lakes complex to their respective overwintering sites.

When northern pike were captured, they were measured to the nearest 1 mm of fork length (FL). Because sex determination using external characteristics (Casselman 1974) was found to be unreliable, sex was recorded only for northern pike extruding sexual products. A fin (specific to each sampling event) was clipped on each fish over 299 mm in length and each fish was tagged with a Floy FD-68 internal anchor tag.

A scale sample was removed from each fish greater than 299 mm for estimating age. During the first few days of the first sampling event, scales were taken from all northern pike less than 300 mm for information on length-at-age. Thereafter, scales were not taken from these smaller sized fish because sufficient samples of small fish had been achieved. Scales were taken from the preferred zone adjacent to but not on the lateral line above the pelvic fins as described by Williams (1955). Previous analysis (Peckham and Bernard 1987) indicated ages as determined from scales, sagittal otoliths, and cleithra were similar. Scales were stored in coin envelopes and later removed for cleaning and mounting on gum cards. Gum cards were used to make impressions on 20 mil acetate using a Carver press at 137,895 kPa (20,000 psi) heated to 93^{0}C for 30 s. Annuli were counted along their dorsal radius using a Micron 770 Microfiche reader. Scales, cleithra, and vertebrae were taken from all northern pike incidentally killed during capture sampling activities.

Length, Sex, and Age Composition

After a review of Gabelhouse (1984), categories for estimates of Relative Stock Density were defined as follows: "stock" size, 300 to 524 mm (FL); "quality" size, 525 to 654 mm; "preferred" size, 655 to 859 mm; "memorable" size, 860 to 1,079 mm; and "trophy" size, 1,080 mm and longer.

The proportions of the northern pike sampled corresponding to each length, sex, and age category were estimated with the following formulas (Cochran 1977):

$$\hat{p}_j = \frac{n_j}{n}; \text{ and,} \qquad (1)$$

$$\hat{V}[p_j] = \frac{\hat{p}_j(1-\hat{p}_j)}{n-1}; \qquad (2)$$

where:

n_j = the number of northern pike in the sample from group j;

n = the overall sample size; and,

$\hat{p}_j$ = the estimated fraction of the sample that was made up of group j.

Length frequency distributions by sex and time were compared graphically.

Age composition of northern pike sampled during the spring event was based on a sub-sample of 469 fish collected during the first few days. Not all northern pike less than 300 mm were scale sampled during the later portion of the first event. Therefore, to include fish less than 300 mm in estimates of age composition, the first 469 northern pike captured, scale sampled, and aged were used.

Length-at-Age

Mean length-at-age was calculated as the arithmetic mean length for each age cohort for males, females, and all northern pike scale sampled and captured from Area I of Minto Flats during the spring of 1990. Variances and standard errors for mean lengths were calculated using standard normal procedures.

RESULTS

Length, Sex, and Age Composition

During the spring sampling event, 3,752 northern pike were captured. Of these fish, 2,807 were released with marks (Floy tag and fin clip); the majority of the remaining 945 fish were less than 300 mm and were released unmarked (10 fish were killed incidentally during capture and sampling). Sex was determined for 991 males and 524 females during this sampling event. The length frequency distributions of male and female northern pike sampled during the spring event were dissimilar because females were larger (Kolmogorov Smirnov DN = 0.39, $P < 0.01$; Figure 3).

During the fall sampling event, 264 northern pike were captured. Only six of these fish had been marked during the spring sampling event. Sex could not be determined for these fish. The length distributions for northern pike captured during the spring and fall sampling events were strikingly dissimilar (Kolmogorov Smirnov DN = 0.73, $P < 0.01$; Figure 4).

No trophy northern pike were captured during either sampling event (Table 2). Stock sized northern pike accounted for almost 60% of the spring sample whereas only about 1% of the northern pike sampled during the fall were in the stock size category. The spring sample was dominated by northern pike in the stock and quality categories while the fall sample was dominated by northern pike in the quality and preferred categories (Table 2).

Age 2 fish comprised the majority (56%) of the northern pike sampled during the spring (Table 3). Age 6 fish were the most abundant age cohort (24%) of in the sample of northern pike collected during the fall (Table 3). Age 3 and age 4 fish were scarce in the sample collected in the spring. In the fall sample, northern pike in the age 2-4 cohorts were scarce.

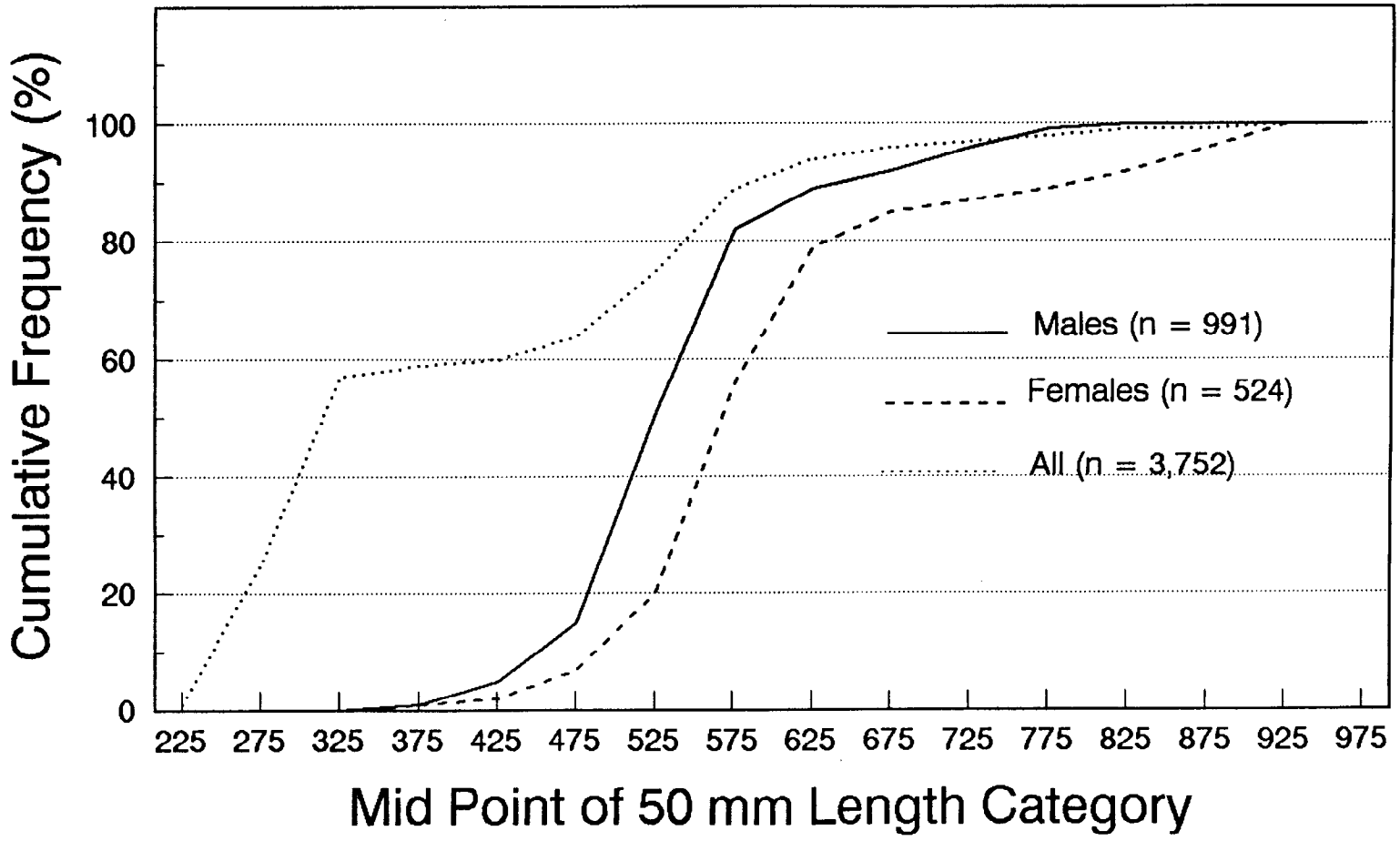

Figure 3. Cumulative length frequency of males, females, and all northern pike captured in Area I of Minto Flats during spring 1990.

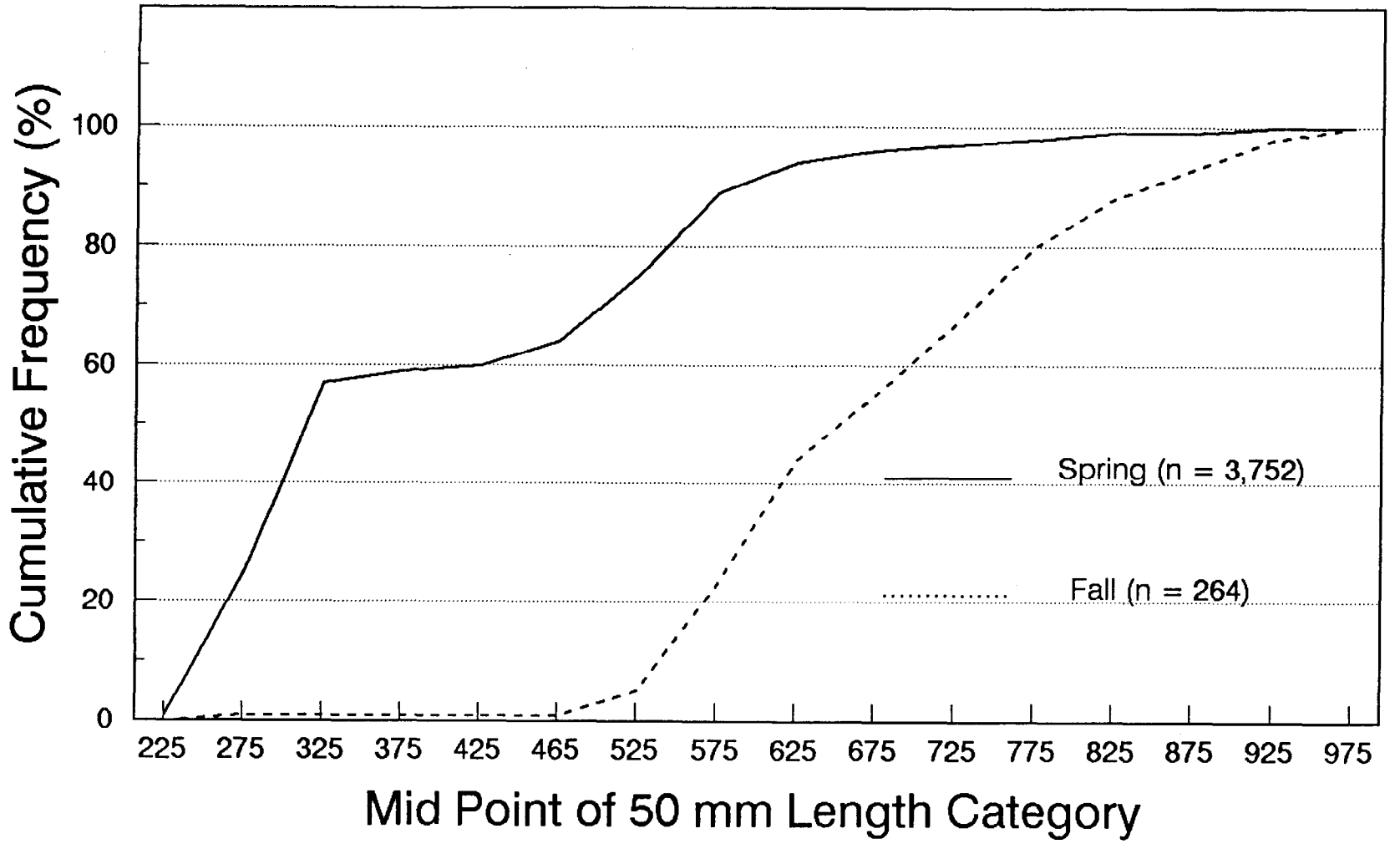

Figure 4. Cumulative length frequency of all northern pike captured in Area I of Minto Flats during spring and fall, 1990.

Table 2. Percentage of northern pike in Relative Stock Density categories by time of year, Area I of Minto Flats, 1990.

		Spring			Fall		
Category	Gabelhouse Minimum Length	Relative Stock Density[a]	SE	Sample Size	Relative Stock Density	SE	Sample Size
Stock	300 mm	58.2	0.9	1,642	1.1	0.7	3
Quality	525 mm	34.2	0.9	964	43.9	3.1	116
Preferred	655 mm	6.4	0.5	181	42.8	3.1	113
Memorable	860 mm	1.2	0.2	35	11.7	2.0	31
Trophy	1,080 mm	0.0	---	0	0.0	---	0
Total		100.0		2,822	100.0		263

[a] Relative Stock Density expressed as a percentage: categories taken from Gabelhouse (1984).

Table 3. Age compositon of northern pike sampled from Area I of Minto Flats during spring and fall, 1990.

Age Class	Spring			Fall		
	Sample Size	Sample Proportion	SE	Sample Size	Sample Proportion	SE
2	264	0.56	0.02	1	0.01	0.01
3	9	0.02	0.01	0	0.0	---
4	36	0.08	0.01	3	0.02	0.01
5	77	0.16	0.02	22	0.13	0.03
6	47	0.10	0.01	41	0.24	0.03
7	19	0.04	0.01	25	0.15	0.03
8	6	0.01	0.01	16	0.10	0.02
9	4	0.01	< 0.01	22	0.13	0.03
10	6	0.01	0.01	20	0.12	0.03
11	1	< 0.01	< 0.01	11	0.07	0.02
12	0	0.00	---	7	0.04	0.02
Total	469	1.00	---	168	1.00	---

Length-at-Age

Ages of northern pike caught during the spring ranged from 2 to 13 (Table 4) whereas age 3 through 12 northern pike were caught during the fall (Table 5). For northern pike determined to be age 3 through age 11, mean length-at-age for females was greater than mean length-at-age for males (Table 4). With the exception of age 6 and age 11 fish, the relationship between increments of growth and age appears to be inverse (Table 6).

DISCUSSION

Radio telemetry was the key to successful sampling during the spring of 1990. By initiating spring sampling as soon as there is an opening in the ice in Goldstream Creek, predicted sampling success for future work in this area is high. Based on past experience, electrofishing during September and early October is the most efficient means of sampling northern pike during the fall. Current investigations being conducted by University of Alaska staff will determine if the capture of northern pike with electrofishing methodology is an acceptable sampling technique (sampling mortality not greater than 10%). Fall sampling should begin by mid-August with various net gear if electrofishing is not used to capture northern pike.

Based on catches made during the spring 1990 sampling events, northern pike were probably fully recruited to sampling gear at age 2. More than 50% of the spring sample was comprised of age 2 fish. The lack of age 2 fish in the fall sample indicated that small fish became less liable to capture in the sampling gear. Either small fish were successful in avoiding capture due to behavioral reasons, or they were absent from the area sampled. Estimates of abundance based on spring to spring sampling or fall to fall sampling could lessen the likelihood of selectivity bias encountered during the spring and fall sampling in 1990. The lack of age 3 and age 4 fish in the spring and fall samples could be a result of poor year class strength. One potential explanation for poor year class strength of age 3 and age 4 fish in 1990 is low numbers of parent stock in 1986 and 1987 due to the increased sport harvest (winter sport fishery in the Chatanika River) during 1985 and 1986. Angler reports and limited creel survey sampling (Holmes and Burkholder 1988) indicated that a large portion of the harvest from the winter fishery was prespawning females. Concerns that increasing sport harvests combined with subsistence harvests exceeded sustainable yield prompted the Department of Fish and Game to close the winter sport fishery for northern pike by emergency order in January 1987. Sport harvests dropped dramatically after the emergency order was issued, from an estimated 4,903 fish in 1986 to 1,715 fish in 1987, 1,492 fish in 1988, and 1,692 fish in 1989.

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Table 4. Mean length-at-age of northern pike sampled from Area I of Minto Flats, spring 1990.

	Females			Males			All[a]		
Age	Sample Size	Mean Length (mm)	S.E. (mm)	Sample Size	Mean Length (mm)	S.E. (mm)	Sample Size	Mean Length (mm)	S.E. (mm)
2	2	309	3	1	345	—	684	315	1
3	9	447	9	38	437	3	59	432	4
4	39	510	5	137	498	3	188	499	2
5	132	565	3	321	539	1	464	547	1
6	135	599	3	196	562	3	336	578	2
7	51	633	6	56	616	7	109	624	5
8	14	718	15	38	696	8	55	700	7
9	11	818	11	29	740	6	40	761	8
10	23	853	11	17	762	9	41	814	10
11	13	893	10	4	804	14	17	872	13
12	5	922	6	1	926	—	6	922	5
13	2	915	15	-	—	—	2	915	15
Total	436			838			2,001		

[a] All category includes females, males, and fish for which sex was not determined.

Table 5. Mean length-at-age of northern pike sampled from Area I of Minto Flats, fall 1990.

Age	Sample Size	Mean Length (mm)	Standard Error (mm)
2	1	365	--
3	0	---	--
4	3	538	3
5	22	576	6
6	41	617	5
7	25	650	8
8	16	720	7
9	22	776	5
10	20	816	9
11	11	896	13
12	7	908	9
Total	168	---	--

Table 6. Estimated increments of growth between spring and fall of 1990 of northern pike sampled from Area I of Minto Flats based upon length-at-age analysis.

Brood Year (cohort)	Cohort Age in 1990 (years)	Mean Length-at-Age (mm)		Estimated Growth (mm)
		Spring	Fall	
1986	4	499	538	40
1985	5	547	576	29
1984	6	578	617	39
1983	7	624	650	26
1982	8	700	720	20
1981	9	761	776	15
1980	10	814	816	2
1979	11	872	896	24

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