

Fishery Data Series No. 98-34

Effect of Post-Capture Handling on Mortality in Northern Pike

by

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Alaska Department of Fish and Game

Division of Sport Fish



Symbols and Abbreviations

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Weights and measures (metric)		General	Mathematics, statistics, fisheries
centimeter	cm	All commonly accepted abbreviations.	alternate hypothesis H_A
deciliter	dL	All commonly accepted professional titles.	base of natural logarithm e
gram	g	and	catch per unit effort CPUE
hectare	ha	at	coefficient of variation CV
kilogram	kg	Compass directions:	common test statistics F, t, χ^2 , etc.
kilometer	km	east	confidence interval C.I.
liter	L	north	correlation coefficient R (multiple)
meter	m	south	correlation coefficient r (simple)
metric ton	mt	west	covariance cov
milliliter	ml	Copyright	degree (angular or temperature) $^\circ$
millimeter	mm	Corporate suffixes:	degrees of freedom df
		Company	divided by \div or / (in equations)
		Corporation	equals =
		Incorporated	expected value E
		Limited	fork length FL
		et alii (and other people)	greater than >
		et cetera (and so forth)	greater than or equal to \geq
		exempli gratia (for example)	harvest per unit effort HPUE
		id est (that is)	less than <
		latitude or longitude	less than or equal to \leq
		monetary symbols (U.S.)	logarithm (natural) ln
		months (tables and figures): first three letters	logarithm (base 10) log
		number (before a number)	logarithm (specify base) \log_2 , etc.
		pounds (after a number)	mid-eye-to-fork '
		registered trademark	minute (angular) '
		trademark	multiplied by \times
		United States (adjective)	not significant NS
		United States of America (noun)	null hypothesis H_0
		U.S. state and District of Columbia abbreviations	percent %
			probability P
			probability of a type I error (rejection of the null hypothesis when true) α
			probability of a type II error (acceptance of the null hypothesis when false) β
			second (angular) "
			standard deviation SD
			standard error SE
			standard length SL
			total length TL
			variance Var
Weights and measures (English)			
cubic feet per second	ft ³ /s		
foot	ft		
gallon	gal		
inch	in		
mile	mi		
ounce	oz		
pound	lb		
quart	qt		
yard	yd		
Spell out acre and ton.			
Time and temperature			
day	d		
degrees Celsius	$^\circ\text{C}$		
degrees Fahrenheit	$^\circ\text{F}$		
hour (spell out for 24-hour clock)	h		
minute	min		
second	s		
Spell out year, month, and week.			
Physics and chemistry			
all atomic symbols			
alternating current	AC		
ampere	A		
calorie	cal		
direct current	DC		
hertz	Hz		
horsepower	hp		
hydrogen ion activity	pH		
parts per million	ppm		
parts per thousand	ppt, ‰		
volts	V		
watts	W		

FISHERY DATA SERIES NO. 98-34

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NORTHERN PIKE**

by

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ABSTRACT

Northern pike *Esox lucius* captured with hook and line gear were subjected to one of two handling regimes to assess the effect of catch and release practices on the short term (48 h) mortality of this species. Handling regimes were selected to reflect known angler practices. Northern pike were captured in hoop nets to provide a control for the experiment. After 48 h the only observed mortality was for fish caught in hoop net gear (0.04, SE=0.04).

Key Words: Northern pike, *Esox lucius*, catch and release, handling mortality.

INTRODUCTION

Current sport fishing regulations for northern pike *Esox lucius* in many areas of the Arctic-Yukon-Kuskokwim (AYK) Region include length limits requiring that fish of certain sizes be released immediately. The proportion of northern pike released by anglers has increased in recent years throughout the Yukon drainage including the Nowitna River system. Although harvests of northern pike have stabilized or declined in recent years, the number of northern pike released has increased (Mills 1991 - 1994, Howe et al. 1995 - 1998).

Northern pike have a reputation among sport anglers as being aggressive, tough game fish. Studies that have investigated the effects of catch and release in northern pike have reported low overall¹ mortality rates (3 to 10%) (Falk and Gillman 1975, Burkholder 1992). These studies also found that there were no detectable differences in mortality rates between hook (barbed and barbless; single and treble) or lure type. Nearly all of the mortalities observed in these studies were fish that were hooked in the eyes, in the gills, or deeply hooked (gullet). Pike that were hooked in the mouth or were snagged (except eyes) showed extremely low mortality (< 2%). Each of these studies stressed careful handling of the fish, which is defined in a brochure distributed by the Department of Fish and Game as consisting of:

1. playing and releasing the fish as quickly as possible;
2. keeping the fish in water upon landing it;
3. cradling the fish gently with two hands, one supporting the belly and the other hand just ahead of and underneath the tail section;
4. using wet hands to handle the fish;
5. keeping fingers away from gills; and,
6. removing hooks with long-nosed pliers or cutting the line to deeply-placed hooks.

A concern expressed repeatedly by residents in rural Alaska is the belief that most northern pike released by anglers die as a result of the handling injury associated with catch and release fishing. During a creel survey on the Dall River project, project personnel observed some anglers fishing near the survey station who were not carefully handling all released fish (Burr and James 1996). Because northern pike released following capture comprise an increasing component of the catch, mortality associated with not carefully handling a released northern pike is of concern to fishery managers.

¹ Pooled samples of fish captured with a variety of hook and lure types.

This study was designed to test the effects of two handling methods on survival of northern pike caught with hook and line gear. The study goal was to quantify the effects of varied handling regimes on the short term mortality (48 h) of released northern pike.

RESEARCH OBJECTIVE

The project objective for 1997 was to:

1. test the null hypothesis that the proportion of northern pike that die due to harsh treatment is ≤ 0.05 such that $\alpha = 0.1$ and power is 0.79 when the true proportion is 0.12.

METHODS

SAMPLING DESIGN

The handling mortality study in the lower Nowitna River was conducted between 16 and 30 July 1997. This time frame was selected because water temperatures are generally highest during July. Experience with northern pike in other studies has shown that vulnerability to handling-induced stress increases with increasing water temperatures (M. J. Evenson, Alaska Dept. Fish and Game, Fairbanks, personal communication). The sampling area included the lower 64 km of the Nowitna River and connected off-river habitats (Figure 1).

Northern pike captured for this experiment were obtained with hook and line gear. In addition, a control group of northern pike was captured in hoop nets, a passive gear type that was assumed to be benign. Hoop nets were unbaited and set with seine leads at the mouth of a large slough area.

Hook and line fishing gear consisted of heavy spinning rod and reel fitted with 17-lb. test monofilament line. Unbaited artificial lures with either a treble hook or a large single hook were used. Barbs were removed from both hook types as is common practice for catch and release northern pike fishing. Lures consisted of a variety of spinners, spoons and plugs.

Upon landing, the lure type, hooking location, and the occurrence and severity of bleeding was recorded. Fish that were bleeding severely were not subjected to treatment and were not included in the handling experiment. Each northern pike in this experiment was then subjected to one of the two treatments outlined in Table 1. These treatments were selected to reflect the range of handling practices used by the majority of the angling public when they intend to release northern pike. Treatments were applied sequentially and were thereby determined prior to capture of the fish. Each fish was marked with an individually numbered internal anchor tag inserted at the base of the dorsal fin. Northern pike were also marked with a secondary mark identifying treatment, in case of tag loss (Table 1). Following treatment, northern pike were held in an aerated holding tank until they were transported to the holding pens.

Hoop nets were checked at 12-h intervals. Northern pike captured with hoop nets were transported in an aerated holding tank and placed in the holding pens with the fish captured by hook and line.

Captured northern pike were to be held in 1.2 x 3 m covered holding pens for 48 h, then released, if in good condition. Fish were placed in a different pen each day of the experiment, to reduce stress from crowding during the holding period. This design avoided losing the entire experiment due to environmental circumstances (e.g. oxygen deprivation, animals, wind, etc.).

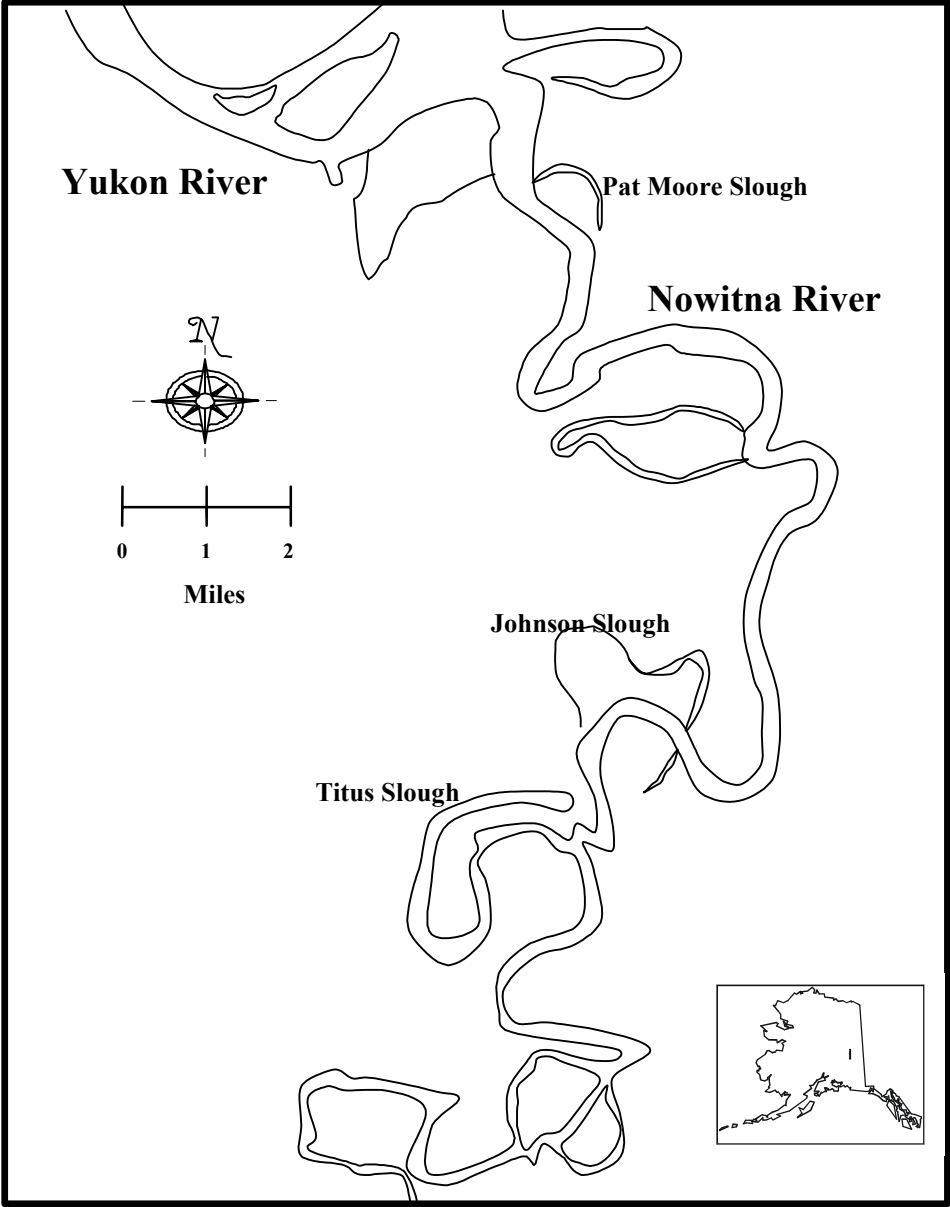


Figure 1.-Nowitna River study area.

Table 1.-Post capture handling treatments, Nowitna River northern pike study, 1997.

Activity	Treatment Type		
	I (careful handling)	II (less careful)	III (Control)
use landing net	yes	yes	yes
remove hook while fish	in water	out of water	N/A
fish in air for "photo"	no	hold up (cradle with two hands under head and tail)	no
Total time out of water	0 min	3 min	0 min
Recessitate until upright	yes	no	no
Secondary mark	Anal Punch	Dorsal Punch	None

At the time of release, the tag number, secondary mark, and fork length was to be recorded. The sex of all fish mortalities was determined by examination of gonads.

The data file for this study is NPHNDL97.XLS and is archived with RTS.

DATA ANALYSIS

The mortality rate for each treatment was calculated as follows:

$$\hat{m}_i = \frac{X_i}{n_i} \quad (1)$$

where:

\hat{m}_i = the mortality rate of fish with treatment i;

n_i = the number of fish with treatment i; and,

X_i = the number of fish with treatment i that die.

The standard error of this rate was estimated by (Zar 1984):

$$SE[\hat{m}_i] = \left[\frac{\hat{m}_i(1 - \hat{m}_i)}{(n_i - 1)} \right]^{1/2} . \quad (2)$$

The 90% upper bound (UB_{90}) was calculated as:

$$UB_{90} = \hat{m}_i + (1.28 * SE[\hat{m}_i])$$

Only the upper bound was calculated because the worst case scenario (highest level of possible mortality) was of greatest interest.

A chi square test was used to detect differences between treatment groups and between fish captured with hook and line and with hoop nets. Logistic regression was used to investigate the interaction between treatments and time to release from holding pens.

RESULTS

Between July 16 and 27, 1997, a total of 89 northern pike captured with hoop nets and with hook and line gear were used for this experiment. Twenty-eight fish ranging from 522 to 1,010 mm FL were captured with hoop nets and composed the control group. Thirty-one fish (480-1,025 mm FL) were captured with hook and line gear and were subjected to Treatment I (careful handling). Thirty fish (458-886 mm FL) were subjected to Treatment II (less careful handling).

Mortality rates for northern pike held for the prescribed 48 h period were very low. All fish captured with hook and line gear survived. Because no fish died in the two handling treatment

groups during the 48 h holding period, it is concluded that mortality did not differ between treatment groups. Four fish captured with hook and line gear were not used in the experiment because they were bleeding severely. Approximately 4% of the fish captured in hoop nets (control) and were held for 48 h or less died. Seventeen of the northern pike used in this experiment were held for a period of time that could not be precisely determined. This was due to tag loss, missed tag numbers and to escaped fish. Two of the northern pike that died from the hoop nets were in this group (Tables 2, 3).

Lengths of northern pike handled in this experiment ranged from 458 to 1,025 mm FL (19 -43 in TL, Table 3). The greatest proportion of these were between 650 and 700 mm FL (27 -29 in TL). All of the northern pike that died were less than 700 mm FL (29 in TL).

DISCUSSION

Hooking mortality studies of northern pike and other species have been criticized by some concerned anglers because they believe that fish in these studies are treated more gently than normal anglers are likely to handle fish. The goal of this study was to examine the effect of careful versus less careful handling treatments on the short term mortality of northern pike. The results of this study indicate that within the range of handling to which northern pike are likely to be subjected, they are able to sustain hook and release angling.

All mortality of northern pike in this study were for fish less than 700 mm FL . Although sample sizes of larger fish were small, the results indicate that northern pike larger than 700 mm FL are (at a minimum) no more susceptible to hook and release fishing than are smaller fish. This information is important because of the wide spread use of minimum length limits in northern pike fishing regulations with the goal of protecting a portion of a stock.

The project provided useful information that can be applied to discussions of catch and release fishing for northern pike. First, northern pike are able to sustain catch and release fishing practices even with a fairly substantial post capture stress. Secondly, northern pike appear to have a greater chance of surviving when they are released quickly following capture. Finally, this experiment suggests that hook and line capture is at least as benign as other capture techniques.

Table 2.-Number of northern pike captured by treatment group and by time held in pens, Nowitna River, 1997.

Treatment	Hours		Mortality			
	Held	Total	Number	Rate	SE	UB ₉₀
Control	24	1	0	0.00	0.00	0.00
	48	23	1	0.04	0.04	0.10
	Unknown ^a	4	2	0.50	0.29	0.87
	Total	28	3	0.11	0.06	0.18
Careful	24	4	0	0.00	0.00	0.00
	48	22	0	0.00	0.00	0.00
	Unknown	5	0	0.00	0.00	0.00
	Total	31	0	0.00	0.00	0.00
Less Careful	24	2	0	0.00	0.00	0.00
	48	20	0	0.00	0.00	0.00
	Unknown	8	0	0.00	0.00	0.00
	Total	30	0	0.00	0.00	0.00
All	24	7	0	0.00	0.00	0.00
	48	65	1	0.02	0.02	0.04
	Unknown	17	2	0.12	0.08	0.22
	Total	89	3	0.03	0.02	0.06

a Unknown - tag loss, missed tag numbers, and escaped fish. Three of the "unknown" fish in the less careful treatment group were unaccounted for and are assumed to have escaped. Other fish listed as escaped were observed escaping while emptying pens.

Table 3.-Length distribution of northern pike captured by treatment group, Nowitna River, 1997.

FL ^a (mm)	TL (inches)	Control (hoop net)				Treatment I (careful handling)				Treatment II (less careful)				All Treatments			
		All		Killed		All		Killed		All		Killed		All		Killed	
		No. ^b	p ^c	No.	p	No.	p	No.	p	No.	p	No.	p	No.	p	No.	p
425	18	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
475	20	0	0.00	0	0.00	1	0.02	0	0.00	1	0.02	0	0.00	1	0.01	0	0.00
525	22	2	0.08	0	0.00	7 (1)	0.27	0	0.00	4 (1)	0.15	0	0.00	9 (2)	0.10	0	0.00
575	24	2	0.05	1	0.14	3	0.06	0	0.00	4 (1)	0.08	0	0.00	5 (1)	0.04	1	0.06
625	26	2	0.05	0	0.00	2 (1)	0.04	0	0.00	6	0.12	0	0.00	10 (1)	0.08	0	0.00
675	28	6 (3)	0.14	2 (2)	0.29	6 (2)	0.12	0	0.00	5 (1)	0.10	0	0.00	17 (6)	0.14	2 (2)	0.13
725	30	2 (1)	0.05	0	0.00	3	0.06	0	0.00	2 (2)	0.04	0	0.00	7 (3)	0.06	0	0.00
775	32	2	0.05	0	0.00	2 (1)	0.04	0	0.00	2	0.04	0	0.00	6 (1)	0.05	0	0.00
825	34	4	0.09	0	0.00	0	0.00	0	0.00	2	0.04	0	0.00	6	0.05	0	0.00
875	36	1	0.02	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00	2	0.02	0	0.00
925	38	2	0.05	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00	3	0.02	0	0.00
975	40	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
1,025	43	1	0.02	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00	2	0.02	0	0.00
1,075	45	0	0.00		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total ^d		28		3		31		0		30		0		89		3	
Average		731				650				651				676			
Sample Var		16,997				16,272				11,001				15,677			
Min		522				480				458				458			
Max		1,010				1,025				886				1,025			

^a Mid-point of length category

^b Number of fish, number in parentheses are fish that were held for an unknown period of time, see text.

^c Proportion

^d Number of fish may not sum to total due to missing length data.

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