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The Control of Nuisance Aquatic Vegetation with Black Polyethylene Plastic

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and lake stocking began. The pond was slowly drawn down and the vegetation was cleared just ahead of the receding water line. At 10:30 a.m. on September 30, 85 muskellunge were recovered. Their length ranged from 7 to 12.5 inches. The average weight per fish was 0.25 pounds. Eighty of these fish were placed in Lansing fish distribution unit #492 and taken immediately to Clear Lake and West Okoboji Lake. Forty muskellunge, in apparent excellent condition, ranging from 9 inches to 12.5 inches were stocked in each lake. The five smallest, averaging about 7 inches in length, were retained at the Decorah Hatchery for future development and study.

Since the stockings in 1960, there have been four known recoveries. During routine pond netting operations in West Okoboji Lake, two fish taken were identified as "muskie" by Biologist, Tom Moen. One "muskie" taken on November 6, 1961, weighed 1.4 pounds and measured 19.4 inches in total length. Two were recovered at Clear Lake on September 17, 1961; one had a total length of 12.5 and the other 17 inches. The Wisconsin Age Class I muskellunge has a total length of 7.0 to 18.0 inches and weighs 0.3 pounds to 1.0 pounds (Wisconsin Conservation Department, Publication #225). The growth rate of three of these individuals compares favorably with the average growth rate in Wisconsin. Our knowledge of the growth rates and survival of this species experimentally reared and stocked in Iowa is limited.

Creel Census of Des Moines River Fishermen in Boone, Dallas, and Polk Counties, Iowa

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Abstract. Creel censuses were conducted on the Des Moines River during the open water seasons, usually April through November, from 1953 through 1961. The data indicated a relatively constant catch of fish. The rate of annual catch varied between a minimum of 0.26 and a maximum of 0.61 fish per fisherman-hour. The data were also analyzed by "proficiency categories" involving (1) all fishermen, (2) fishermen with one fish, (3) fishermen with two fish, and (4) fishermen with three or more fish. The most proficient fishermen (those with three or more fish at the time of interview) constituted 13 per cent of all anglers, and caught 65 per cent of all fish. The average length of the angler day for the census period was 2.3 hours. Channel catfish, carp, bullheads, and walleye pike, in that order, were the important fish taken. Fisherman aptitude or skill is concluded to be the significant factor related to both the catch of fish and the rate at which they are caught.

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INTRODUCTION

With 53 per cent of Iowa's 410,000 anglers fishing the streams of the state (Speaker, 1953), it becomes important to know what our flowing waters produce. For this reason creel censuses are being run in various locations in our more important streams. This paper presents creel-census information collected from the middle reaches of the Des Moines River over a 9-year period from 1953 through 1961.

The area reported upon included a 100-mile stretch of the Des Moines River flowing through Boone, Dallas and Polk counties in central Iowa. This reach is heavily used and attracts fishermen from three major cities, Des Moines, Ames, and Boone, as well as from many smaller urban communities and rural areas. The stream is readily usable, since the entire area is within reach of 1 mile by automobile. In many places auto access to the stream bank itself is provided by the 25 bridges, the four lowhead damsites, and the numerous private and public drives which run adjacent to the stream.

The method of census involves fishermen interviews in the field at frequent but irregular intervals from the start of fishing in the spring (early April) to freeze-up in the fall (late November). For the period 1953 to 1959, the creel data was collected by the writer and his aids, and in 1960 and 1961 by Conservation Officers. The information taken from each angler is recorded on census cards and includes: date, time, and place of interview; amount of time spent fishing up to the instant of contact; and kind and number of fish caught. Due to limited personnel, the press of other activities, and the physical characteristics of the study area, it was not possible to obtain total production figures. As a consequence, this creel census studies only angler success.

ANGLING SUCCESS

A common and popular method of evaluating sport fishery resources in many waters has been to consider catch-per-unit-of-effort (i. e., the number of fish caught per fisherman-hour) together with the quality of the creel. Fishery workers recognize the shortcomings of this technique, particularly the use of the rate-of-catch by *all* fishermen to reflect the potential of a given water to produce pole and line-caught fish. Many studies bear witness to the fact that a small minority of the anglers (perhaps 10 per cent) catch the bulk of the fish (up to 80 per cent or more), and in many creel censuses the number of unsuccessful fishermen outnumbers the successful.

Rupp (1961) declares the rate-of-catch by *all* fishermen to be "unsatisfactory," and suggests that fishing potential should be

based solely upon the catch of the proficient angler. This approach also contains problems; it would seem that the results would have much the same bias as a census involving *all* fishermen, but with the bias at the opposite extreme.

In consideration of the reasons for conducting creel censuses (*viz*: to provide estimates of harvest, type and quality of fishing; to detect changes in fish populations and fish success; to measure the effectiveness of management procedures; and to inform the angler what angling recreation he might expect from a given lake or stream), it seems expedient to this author to report creel census information from several "tacks." In this way administrators, public relations people, biologists, fisheries managers, and fishermen as well may glean the information pertaining directly to them and that they personally desire.

Data obtained from the Des Moines River creel census have been tabulated to show angling results as they pertain (1) to all fishermen contacted, and (2) to anglers exhibiting varying degrees of angling proficiency. Proficiency is expressed as fishermen with 1 fish, those with 2 fish, those with 3 or more fish caught at the time of contact by the census clerk. This breakdown is admittedly subjective. However, experience with many anglers during the 9-year study has demonstrated that the successful fishermen with the most fish show more knowledge of the sport than those with fewer fish. The analysis was not carried beyond anglers with three fish, because from the Des Moines River three or more fish on the stringer distinctly identify the proficient angler.

The data relating to the catch by all fishermen interviewed are compiled in Table 1 by years of census. Census clerks contacted 4,725 anglers who had fished a total of 9,676 hours and had caught a total of 4,036 fish. The average catch for the 9-year period was 0.42 fish per angling hour. Annual fishing success ranged between 0.26 and 0.61 fish per hour. The year 1956 provided the poorest fishing, and 1959 the best.

Table 1. Rate of catch by Des Moines River fishermen 1953 through 1961

Year	Number fishermen contacted	Total hours fished	Number fish caught	Fish caught per hour
1953	139	356	110	0.31
1954	260	535	312	0.57
1955	625	1,679	528	0.31
1956	597	1,283	333	0.26
1957	656	1,162	575	0.49
1958	667	1,115	496	0.44
1959	341	679	414	0.61
1960	554	917	396	0.43
1961	886	1,950	872	0.45
	4,725	9,676	4,036	0.42

These data indicate that angling success based on the catch-by-all-fishermen-interviewed remains quite stable. From the poorest to the best year, success varied a maximum of only 0.35 fish per hour, and fluctuated less than 0.2 fish per hour from the nine year average. During the nine year census, only 37 percent of the anglers interviewed caught fish.

Table 2 reveals the percentage of unsuccessful fishermen by year of census. Additionally, it shows the percentage of anglers possessing 1, 2, or 3 or more fish, and the per cent of the total catch possessed by each group.

Again the data show the Des Moines River sport fishery to remain quite constant. As a rule, about one-third of the fishermen interviewed were successful; exceptions were the years 1954 and 1959, when approximately one-half of the fishermen had fish when contacted.

The numbers of fishermen possessing 1, 2, or 3 or more fish were also relatively stable. A point of significance is that the proficient fishermen (those with three or more fish) claimed the majority of the catch. During the 9 years of study, this group comprised only 13 per cent of the anglers, but caught 65 per cent of the fish.

A measure of angling success, in addition to the possession of fish, is the rate of catch, i.e., the number of fish caught per hour. Fig. 1 shows the rate of catch per year, with categories for (1) all anglers, (2) anglers with 1 fish, (3) anglers with 2 fish, and (4) anglers with 3 or more fish. This graph also demonstrates the constantcy of the fishery and portrays the potential of the area to produce fish in accord with the talents of the fishermen. The unskilled angler who fishes sporadically or for the purpose of idling away time has very little chance for success. On the other hand, the individual who makes plans, studies the sport, and fishes accordingly, can expect the area to produce one or two fish per hour.

LENGTH (Time) of FISHING TRIP

In addition to the number of fish taken and the rate at which they are caught, the rewards of a fishing trip must also consider the value of outdoor recreation. In the present study, where only one out of three fishermen usually catch fish, the recreational aspect becomes important, because it is the only reward for the unsuccessful angler. Any technique to evaluate this side-benefit of a fishing trip is certainly subjective, and could be examined from several directions. Among the various approaches, the length of the fisherman-day (time spent fishing per trip) should reveal something of the capacity of an area to afford out-

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Table 2. Summary of angling success by categories showing the percent of unsuccessful fishermen each year together with the percent of fishermen catching 1, 2, 3 or more fish and the percent of all fish caught by each group

Year	Number fishermen	Percent unsuccessful	Percent fishermen with 1 fish	Percent of total fish caught	Percent of fishermen with 2 fish	Percent of total fish caught	Percent of fishermen with 3 or more fish	Percent of total fish caught
1953	139	64	18	22	6	15	12	64
1954	260	48	28	22	5	8	19	70
1955	625	65	18	22	6	12	11	64
1956	597	73	16	29	4	15	7	56
1957	656	65	16	18	5	12	14	70
1958	667	65	20	27	6	16	9	58
1959	341	55	22	18	7	12	16	69
1960	554	70	14	20	8	22	8	58
1961	886	64	11	12	7	14	18	73
Av.		37	18	21	6	14	13	65

Table 3. Species composition of fish caught from the Des Moines River, 1953 through 1961

Year	1953		1954		1955		1956		1957		1958		1959		1960		1961	
	No.*	Per cent**	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
C. Catfish	29	25	192	61	213	40	174	60	256	45	156	29	213	51	219	55	627	72
Carp	62	53	90	29	240	46	114	39	204	35	233	42	138	33	130	34	151	17
Walleye	12	10	12	4	4	1	1		11	2	16	3	19	5	2	1	26	3
Bullhead	1	1	2	1	10	2	1		67	12	110	20	41	10	19	5	25	3
Flathead			1	tr	7	1	1		2						4	1	5	1
Crappie	4	4	4	1	32	6	2	1	2		25	4	3	1	7	2	1	1
Sucker	8	7	3	1	5	1			19	3	9	2			5	1	26	3
Smallmouth	1	1	6	2	2				4		5	1			1		7	1
Shad					4	1									2	1		
Sheephead					4	1									1			
Sunfish					3	1									2	1		1
Quillback					1				10	2					1			3
Buffalo			1	tr	2						1				2	1		
Eel			1	tr														1
Total																		
Fish caught	117		310		527		293		575		555		414		395		873	
* Number caught			** Per cent of catch															

1962]

CREELE CENSUS

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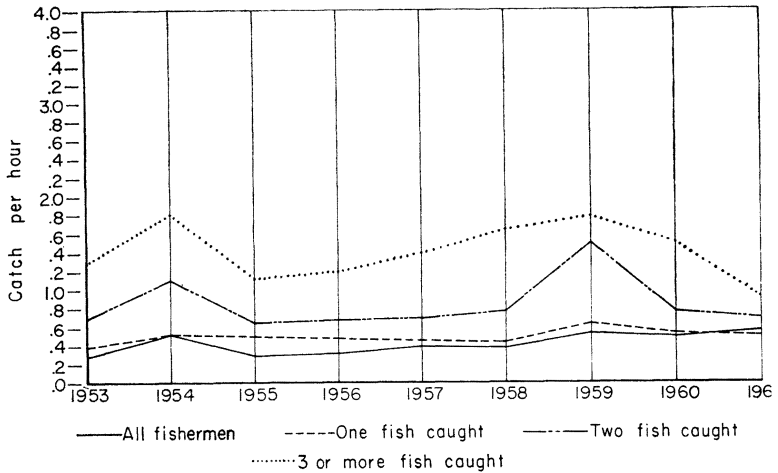


Fig. 1. Catch perhour by all fishermen and by fishermen catching one, two, or three or more fish

door recreation. An area with an assemblage of pleasing characteristics will most assuredly attract and hold people longer than a drab one.

The average length of the fisherman-day by year, beginning in 1953 and extending through 1961, was 2.6, 2.1, 2.7, 2.1, 2.8, 2.7, 2.0, 1.7, and 2.2 hours. The average length of trip for the 9-year period was 2.3 hours. Cleary (1953) found the average trip per fisherman-day for northeast Iowa streams to be 3 hours for completed trips, and Moen (personal correspondence) re-

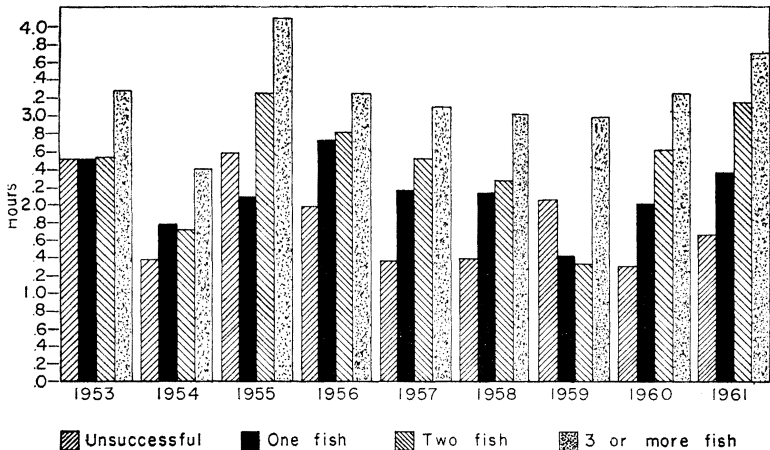


Fig. 2. Average length (time) of trip spent by unsuccessful fishermen. Fishermen with one, two, and 3 or more fish.

ports the length of the angling day for Spirit Lake and Clear Lake, two of Iowa's leading resort areas, to be approximately 5 and 4 hours respectively.

Information regarding the length of the fisherman-day is plotted in Fig. 2. In keeping with other data, trip lengths have been segregated into (1) unsuccessful fishermen and (2) fishermen having caught 1, 2, or 3, or more fish. These data show that fishermen possessing fish tend to stay at the stream longer than unsuccessful fishermen.

Over the 9 years of census, anglers with three or more fish in their possession at the time of contact fished an average of 3.2 hours per trip. The unsuccessful fished an average of 1.8 hours.

SPECIES COMPOSITION of the CATCH

Fourteen species were represented in the catch (Table 3). Of these, channel catfish, carp, bullheads, and walleye pike were the most important. Yellow and black bullheads, black and white crappies and variety of suckers are present in the river, but yellow bullhead are so few, and crappies and suckers so insignificant in the catch that no attempt was made to differentiate between the species.

During the 9-year census, the catch showed several changes in the relative abundance of the different species. These changes were only significant in the four major species named above, and are shown graphically in Fig. 3

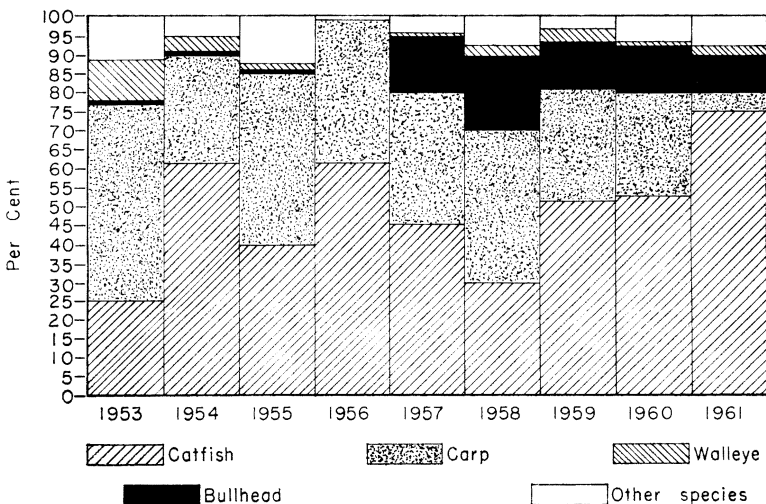


Fig. 3. Species composition - Fish caught Des Moines river.....1953-1961

The Des Moines River is considered one of the better catfish streams in Iowa. This is substantiated by the creel census. Catfish make up 49 per cent of the catch from the area during the census period. Carp was the second most abundant species caught, and comprised 36 per cent of the catch. Bullheads (predominantly black bullheads) ranked third in the creel, but did not become significant until 1957. In 1956 a severe drought, accompanied by high temperatures and stagnant waters, is believed to have favored the spawn of bullheads. These were caught in fair numbers in 1957, in larger numbers in 1958, and in declining numbers since. This decline has paralleled improved water conditions.

Walleye pike made up 3 per cent of the Des Moines River creel. This species is taken by specialists, usually in the early spring and late fall. The population of the species as revealed by surveys and by the census, remains quite constant. Water conditions in the fall seem to govern the catch of walleyes in the Des Moines River, with cool weather and clear waters making for the better catches.

DISCUSSION

The analysis of these data do not permit an estimate of either total usage by fisherman or harvest of fish, from the study area. Nevertheless, considered from the point of our sample size, and in light of other investigational work that has progressed concurrently with the creel census, some rather significant conclusions can be drawn.

The number of anglers contacted per year ranged from 139 to 886, and averaged a little over 500. This represents only a small percentage of the fishermen using the area. Schmulbach (unpublished thesis) covers a comprehensive creel census on a 7-mile reach of the Des Moines River lying within the area reported in the present paper. He found that fishing pressure could be expected to average "between 10,000 and 13,077 fishermen-hours" per mile per year. He concluded further that the mean rate of catch was "quite low, 0.38 fish per man-hour," and estimated that 3,312 pounds of fish were harvested per mile of stream in 1958. His rate of catch (0.38) was determined from more than 3,200 fishermen contacted in 1957 and 1958, and compares favorably with the rates of catch (0.49 and 0.44) obtained for the same years by the present investigations.

In relating Schmulbach's findings to this study, it should be pointed out that he worked in one of the more popular reaches of the stream. It is not, however, the most popular nor the best fishing area, ranking, in all probability, in the upper one-fourth on both counts.

Assuming that the yield of 3,312 pounds of fish per mile per annum determined by Schmulbach is fairly representative, one might suspect the relatively low rate of catch per hour to be a result of over-exploitation of the resource. Annual surveys, however, conducted during the census period do not substantiate this thought. Channel catfish and carp, the principal species caught, and a variety of suckers are always abundant, and exist in excess of several thousand per mile of stream.

Continuing low rates of catch in the Des Moines River, despite large populations of fish, are believed to be largely the result of fishing techniques employed by *each* angler. The fact that only 37 per cent of the anglers had caught fish, and that 13 per cent of the fishermen caught 65 per cent of the fish, confirm this thinking.

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