

John R. Olson

IOWA CONSERVATION COMMISSION
FISHERIES SECTION

FEDERAL AID TO FISH RESTORATION
ANNUAL PERFORMANCE REPORT
SMALL LAKES INVESTIGATIONS
PROJECT NO. F-90-R-5



Study No. 408.2 - Classification of Iowa Lakes and Their Fish Standing Stock

Job No. 2: Fish population characteristics and biomass of each
lake group

PERIOD COVERED : 1 JULY 1981 - 30 JUNE 1982

FEDERAL AID TO FISH RESTORATION
ANNUAL PERFORMANCE REPORT
SMALL LAKES INVESTIGATIONS
PROJECT NO. F-90-R-5

DEPARTMENT OF
WATER, AIR AND WASTE
MANAGEMENT

RECEIVED
86 JAN 24 PM 11 44

Study No. 408.2 - Classification of Iowa Lakes and Their Fish Standing
Stock

Job No. 2: Fish population characteristics and biomass of each
lake group

TABLE OF CONTENTS

	Page
Job No. 2 - Fish population characteristics and biomass of each lake group	
INTRODUCTION -----	2
STUDY BACKGROUND -----	2
METHODS AND PROCEDURES -----	2
FINDINGS -----	4
DISCUSSION OF FINDINGS -----	8
RECOMMENDATIONS -----	10
LITERATURE CITED -----	10

LIST OF TABLES

	Page
Table 1. Ingredients and E.P.A. Reg. No. of fish toxicant used in cove sampling -----	3
Table 2. Estimated total standing stock (lbs/ac) by length group and total standing stock of fish in Viking Lake during 1981 -----	4
Table 3. Estimated total standing stock (lbs/ac) by length group and total standing stock of fish in Lake Anita during 1981 -----	5
Table 4. Estimated total standing stock (lbs/ac) by length group and total standing stock of fish in Don Williams Lake during 1981 -----	6
Table 5. Estimated total standing stock (lbs/ac) by length group and total standing stock of fish in Manteno Lake during 1981 -----	7
Table 6. Estimated total standing stock (lbs/ac) by length group and total standing stock of fish in Arrowhead Lake during 1981 -----	7

LIST OF FIGURES

	Page
Figure 1. Total estimated and angler acceptable standing stock of fish in five study lakes during 1981 -----	9

ANNUAL PERFORMANCE REPORT

RESEARCH PROJECT SEGMENT

STATE: Iowa NAME: Classification of Iowa Lakes and
PROJECT NO.: F-90-R-5 Their Fish Standing Stock
STUDY NO.: 408.2 TITLE: Fish population characteristics
JOB NO.: 2 and biomass of each lake group

Period Covered: 1 July, 1981 through 30 June, 1982

ABSTRACT: Cove rotenone sampling was used to determine standing stocks and species composition of fish in five lakes. One lake of groups I, II, and IV plus two lakes of group V were sampled. Fish standing stocks ranged from 802 lbs/ac to 450 lbs/ac and the percent of the total standing stock acceptable to anglers was 90 to 306 lbs/ac. Group I and II lakes generally had lower total fish standing stocks but higher stocks acceptable to anglers while group V lakes had higher total fish standing stocks but lower stocks acceptable to anglers.

AUTHOR: Kay Hill
Fishery Research Biologist

DATE PREPARED: June, 1982

APPROVED BY: Don Bonneau
Fishery Research Supervisor

STUDY OBJECTIVE

To classify 107 Iowa lakes into distinct groups utilizing watershed and lake basin characteristics and determine standing stock of fish, length frequencies and size structure characteristics within each lake group.

Job 2 Objective

To determine fish population characteristics and biomass of each lake group.

INTRODUCTION

Most Iowa lakes are constructed without proper consideration for those factors that ultimately determine lake quality. Factors such as watershed area, usage and erosion potential were only recently recognized as important factors influencing lake quality. Volume development, mean depth, thermal stratification, shoreline development are also important in predicting lake quality, but seldom considered in lake construction. These factors can be altered very little once a lake is constructed but drastically affect the lake's sport fishery and cost of maintaining quality fishing. The exact relationship between the above parameters and well-being of different fish species are unknown in Iowa. An understanding of these relationships will assist in development of fish management programs for existing lakes and in describing the fisheries potential of proposed lake.

STUDY BACKGROUND

All study lakes and watersheds were described by Bachmann (1979 in Physical Survey of 107 Iowa Lakes). Parameters measured were: watershed area, soil associations, land use, description of topography in watershed, lake area, shoreline length, maximum and mean depth, volume, shoreline development, watershed/lake area ratio, annual precipitation, runoff, evaporation, and presence of thermal stratification. Chemical parameters measured included: nitrogen, total hardness, total alkalinity, dissolved oxygen, specific conductance, sulfate and chloride. A vertical profile of temperature, oxygen, phosphorus, pH and chloride was also constructed for each of the 107 Iowa lakes.

Fifty seven Iowa lakes were classified into five distinct groups using mean basin slope and adjusted siltation index, Hill (1981). The groups were formed using the following criteria: Group I, mean basin slope (\bar{S}) above 12% and adjusted siltation index (AI) 50-250; Group II, (\bar{S}) 7 to 12% and (AI) 50-250; Group III, (\bar{S}) below 7% and (AI) 50-250; Group IV, (\bar{S}) above 7% and (AI) 250-600; Group V, (\bar{S}) below 7% and/or very high (AI). Three lakes were chosen from Groups I, II, IV, and V for cove rotenone sampling of the fish populations. Two cove sampling lakes were chosen from Group III. Group I contains Iowa's best fishing lakes while the lakes in Group V provide the poorest quality fishing.

METHODS AND PROCEDURES

Morphometric maps of each lake to be sampled were studied and different coves measured. Three coves were usually chosen for rotenone sampling, but

occasionally two coves were chosen if the mouths of some coves were impossible to block off. Coves selected for sampling were measured with an alidade to accurately measure area, sample depths were taken to compute cove water volume, and selected coves were isolated from the lake with polyethylene block nets. Attempts were made to isolate one third to one half acre coves to insure a total of approximately one acre of sampling.

Coves were electrofished after isolation and attempts made to capture all fish stunned. Fish were measured and the upper half of the caudal fin removed. Marking allowed estimates of the percentage of fish by species and size recovered after rotenone application.

Rotenone used was 2½% synergized and was applied at a rate of three parts per million (ppm) (Table 1). A portion of the toxicant was pumped through a weighted perforated pipe to distribute the toxicant along the bottom, while the remainder of the toxicant was applied to the water surface with a spray. Immediately after rotenone application, fish were collected until no fish were observed. Fish were collected the application day plus the three following days. Catch for each day was sorted by species and length. Individual fish weights were taken from large fish (over 10 inches total length TL) while aggregate weights were taken from smaller fish. Recapture fish were enumerated by species and length. Standing stock was calculated by multiplying the collected weight for each species times the recovery percentage. Standing stock was adjusted by using the cove adjustment figures, Hayne et. al. (1967).

Table 1. Ingredients and E.R.A. Reg. No. of fish toxicant used in cove sampling

LIQUID-EMULSIFIABLE FISH TOXICANT	
ACTIVE INGREDIENTS:	
Rotenone -----	2.5%
Other cube extractives -----	5.0%
Piperonyl Butoxide, Technical* -----	2.5%
INERT INGREDIENTS: -----	90.0%
Total:	100%

*Equivalent to 2.0% Butylcarbityl)
(6-propylpiperonyl) ester and .5%
related compounds

EPA Reg. No. 432-550

The portion of the fish standing stock acceptable to anglers was calculated by assuming anglers would accept: bluegill and redear sunfish 6 in. TL or larger, crappie 7 in. TL or larger, largemouth bass 10 in. TL or larger, channel catfish 10 in. TL or larger and black bullhead 8 in. TL or larger. Carp, buffalo, white sucker, and grass carp were assumed non-acceptable to anglers.

FINDINGS

Lake Viking

Viking Lake, a Group I lake was sampled to determine fish biomass and population characteristics. Viking Lake is a public owned 182 acre lake located in Montgomery County, Iowa. It is surrounded by a state park and the watershed is mostly timbered. The mean slope and AI for Viking Lake is 14.3% and 110%, respectively.

The fish biomass of this lake was estimated at 489 lbs/ac (Table 2). Redear sunfish comprised 125 lbs/ac of the biomass while bluegill and largemouth bass contributed 134 lbs/ac and 95 lbs/ac, respectively. Channel catfish contributed 95 lbs/ac while crappie, green sunfish, yellow bullhead and tiger musky together contributed 40 lbs/ac. Fish acceptable to anglers totaled 306 lbs/ac or 62% of the total standing stock. Grass carp were not collected but have been stocked by fisheries management personnel. Grass carp vulnerability to cove sampling was less than acceptable because several grass carp were observed jumping the poly block net as soon as it was placed across two coves.

Most of the redear sunfish standing stock were angler acceptable while nearly one third of the bluegill biomass were larger than 6 in. TL. All the crappie collected were larger than 8 in. TL and 76% of the bass are over 10 in. TL.

Table 2. Estimated standing stock (lbs/ac) by length group and total standing stock of fish in Viking Lake during 1981.

Length Group (in)	Species							
	Lm Bass	Bluegill	Crappie	Channel Catfish	Yellow Bullhead	Redear Sunfish	Green Sunfish	Tiger Musky
1-3		3			1			
3-6	2	99			2	46	2	
6-8	13	32				61		
8-10	7		9			18		
10-12	62		22					1
12-greater	11							5
<u>Weight (lbs)</u>								
8-12				53				
12-20				38				
Total:	95	134	31	91	3	121	2	6

TOTAL: 489

Angler Acceptable: 306

Area: 137 acres

Lake Anita

Lake Anita, a group II lake is located in Lake Anita State Park, Cass County, Iowa. It is surrounded by grassland and cropland but the lake is protected from siltation by three small dams. It has a \bar{S} and AI of 8.4 and 202, respectively.

Total fish standing stock was estimated to be 466 lbs/ac and was composed of nine species (Table 3). Bluegill were the most dominant species with a biomass of 131 lbs/ac of which 50 lbs/ac were angler acceptable. Largemouth bass standing stock was 108 lbs/ac while crappie contributed 77 lbs/ac. Yellow perch contributed 57 lbs/ac while the other five species contributed 94 lbs/ac. Two hundred seventeen lbs/ac or 48% of the total biomass are acceptable to anglers. Grass carp were collected in cove samples, but no channel catfish were sampled although they are stocked annually.

Table 3. Estimated standing stock (lbs/ac) by length group and total standing stock of fish in Lake Anita during 1981.

Length Group (in)	Species								
	Lm Bass	Bluegill	Crappie	Yellow Perch	Black Bullhead	Grass Carp	Green Sunfish	Golden Shiner	Tiger Musky
0-3		11							
3-6	3	70		6	1		18		
6-8	29	50		47	4			7	
8-10	38		13	4	1			6	
10-12	24		46						1
12-greater	14		18						2
Weight (lbs)									
2-5						2			
10-20						52			
Total:	108	131	77	57	6	54	18	13	3
TOTAL:	466		Angler Acceptable:	217		Area:	182 acres		

Don Williams Lake

Don Williams Lake is a group IV lake located in Boone County, Iowa. It has an area of 148 acres and a \bar{S} and AI of 13.8 and 308, respectively. It is a public owned lake surrounded by cropland and a golf course, but the surrounding land is relatively flat which lowers the AI and ultimately the silt and nutrient loading. The lake receives 50 large fingerling channel catfish/acre annually because of a cage rearing program.

while small crappie added 84 lbs/ac. Largemouth bass and channel catfish were the only fish large enough to be acceptable to anglers. The latter added 93 lbs/ac of which 71 lbs/ac are "keepers" while the former contributed 37 lbs/ac.

Table 5. Estimated standing stock (lbs/ac) by length group and total standing stock of fish in Manteno Lake during 1981.

Length Group (in)	Species					
	Lm Bass	Bluegill	Crappie	Channel Catfish	Green Sunfish	Black Bullhead
0-3						
3-6	12	125			167	
6-8	8		18			170
8-10	10			80		
10-12	79			45		
12-greater	16					
Total:	125	125	18	125	167	170

TOTAL: 729 Angler Acceptable: 120 Area: 15 acres

Table 6. Estimated standing stock (lbs/ac) by length group and total standing stock of fish in Arrowhead Lake during 1981.

Length Group (in)	Species					
	Lm Bass	Bluegill	Crappie	Channel Catfish	Green Sunfish	Black Bullhead
0-3		4	70			7
3-6	3	530	14		43	2
6-8	5					2
8-10	10			22		
10-12	17			54		
12-14				17		
14-greater						
Total:	37	534	84	93	43	11

TOTAL: 802 Angler Acceptable: 90 Area: 14 acres

DISCUSSION OF FINDINGS

Group I, II, and IV lakes sampled in 1981 had total fish standing stocks between 450 and 489 lbs/ac and stock acceptable to anglers from 205 to 306 lbs/ac. Percentage of total estimated fish biomass which was angler acceptable was 62% for Viking Lake (Group I), 48% from Lake Anita (Group II), and 45% for Don Williams Lake (Group IV). No Group III lakes were sampled but their total standing stocks are expected to be higher than Group IV lakes but lower than Group V lakes. Group III lakes are characterized by shallow basin slopes (less than 7%) and by low AI values. Group III lakes "keeper" fish standing stocks are expected to be between those of group IV and Group V lakes.

Group I lakes had the highest percentage of fish acceptable to anglers (Figure 1). The group I lake sampled also had a high bass standing stock (95 lbs/ac) and nearly 300 lbs/ac of centrarchids. This lake type should provide the highest "quality" fishery because the steep lake basin slope (above 13%) and low siltation index 50-250. Group V lakes in contrast have shallow lake basin slopes and/or very high AI values.

Group II lakes were expected to provide "quality" fishing with minor although some fish management problems. These lakes have lower mean slopes 7 to 12% and the same AI as Group I lakes. Lake Anita had an estimated standing stock of 466 lbs/ac and 48% of this was angler acceptable. This lake has fewer small bluegills relative to large ones and a high standing stock of bass over 100 lbs/ac. Thirty eight percent of the bluegill biomass is angler acceptable in Lake Anita while this portion of the bluegill biomass is 24% in Viking Lake. Largemouth bass acceptable to anglers is 73 lbs/ac (76% of total) in Viking Lake but 38 lbs/ac (35% of total) in Lake Anita. Lake Anita has a good crappie fishery but no redear sunfish. Channel catfish weren't sampled in Lake Anita although they are stocked annually. The channel catfish population has been declining the last two years in Lake Anita because of an experimental stocking of 4-inch fingerlings (Bruce Adair, personal communications).

The Group IV lakes were expected to have fish standing stocks more desirable for angling than Group V and Group III lakes. These lakes have higher nutrient loading (AI of 250-600) but steep lake basin slopes above 7. These lakes in this group will have a shorter life than those in Groups I, II, & III because of the increased silt load, but when younger may support quality fisheries because of their basin slopes and nutrient loading. Don Williams Lake had 149 lbs/ac of bluegill of which 50% were "keepers". Nearly half of the estimated 178 lbs/ac of crappie were angler acceptable and 15% of the bass would be creelable. Nearly half of the estimated total standing stock was comprised of sport fish acceptable to anglers.

Group V lakes with shallow slopes have large shallow expanses ideal for centrarchid reproduction and/or very high nutrient loading (high AI indexes).

The two lakes sampled in this group had the highest estimated total fish standing stocks 700-800 lbs/ac and these were comprised mostly of small fish. Total standing stock in Manteno Lake was 729 lbs/ac but 350 lbs/ac was small bluegill, green sunfish and black bullheads. Sixteen percent of the total standing stock in Manteno was acceptable to anglers.

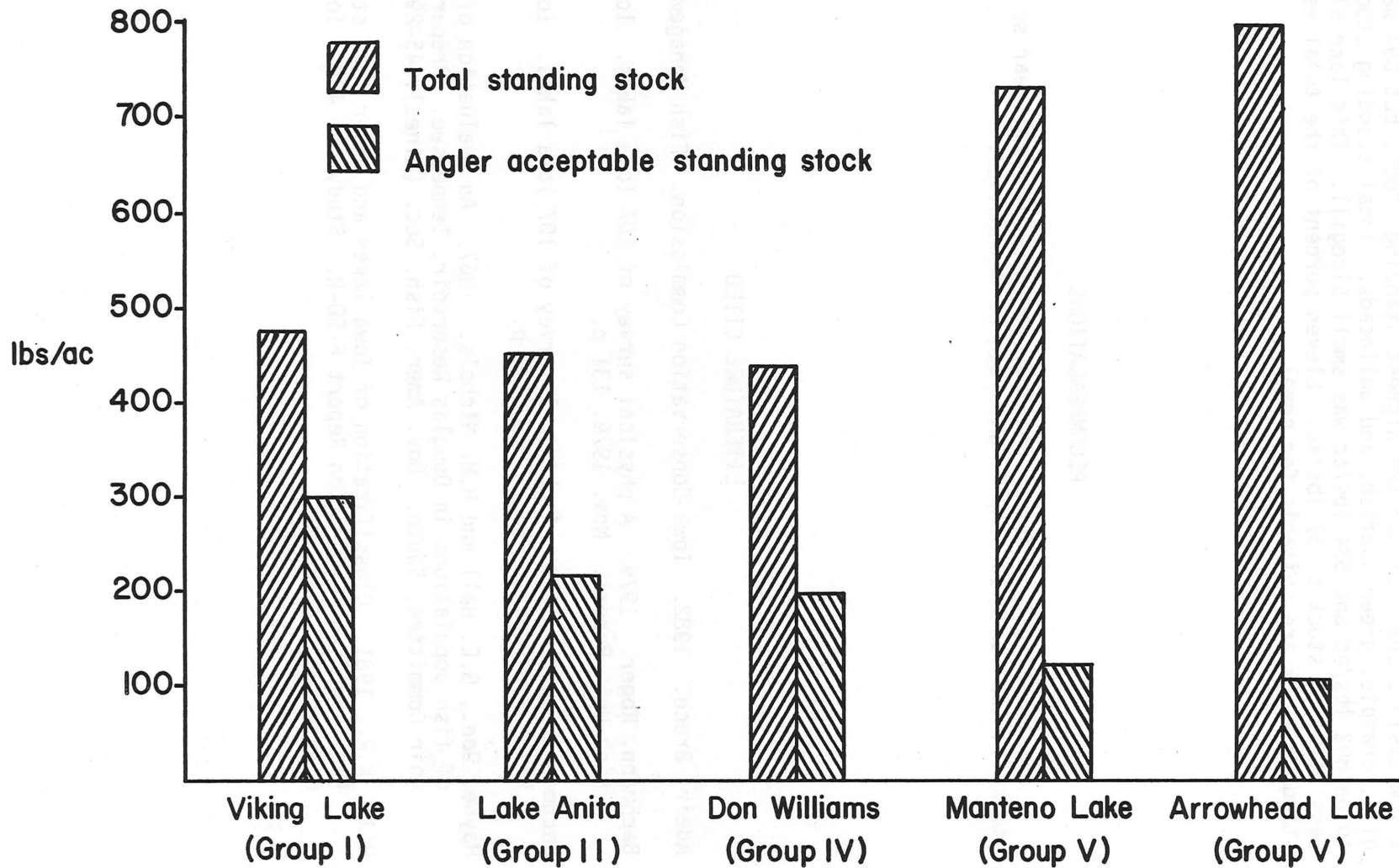


Figure 1. Total estimated and angler acceptable standing stock of fish in five study lakes during 1981.

Arrowhead Lake, (Group V lake) had the highest AI of any lake in Iowa and a low basin slope. It had the highest standing stock, but 89% was small bluegill, crappie, green sunfish, and bullheads. Total standing stock was estimated to be 802 lbs/ac and 534 lbs/ac was small bluegill. This lake also had a low bass standing stock of 37.1lbs/ac. Eleven percent of the total estimated fish standing stock are suitable for creel.

RECOMMENDATIONS

The investigation should continue for an additional year so fish standing stocks in the other 10 sample lakes can be determined.

LITERATURE CITED

- Adair, Bruce. 1982. Iowa Conservation Commission. Fish Management Biologist.
- Bachmann, Roger. 1979. A physical survey of 107 Iowa lakes. Iowa Coop. Fish Unit Report. Nov. 1979. 131 p.
- Bachmann, Roger. 1979. A chemical survey of 107 Iowa lakes. Iowa Coop. Fish Unit Report. Dec. 1979. 131 p.
- Hayne, Don., G.E. Hall and H.M. Nichols. 1967. An evaluation of cove sampling of fish populations in Douglas Reservoir, Tennessee. Prepared for Reservoir Committee, South. Div. Amer. Fish. Soc. (minea):245-297.
- Hill, K.R. 1981. Classification of Iowa lakes and their fish standing stock. Fed. Aid Fish Restoration Report F-90-R. Study No. 408. Iowa Conservation Commission, Des Moines.