SPECIAL PUBLICATION

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LARGE LAKE SAMPLING GUIDE

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Division of Fish and Wildlife

LARGE LAKE SAMPLING GUIDE

by

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PREFACE

This guide was prepared so that Managers with large lakes (>25,000 A) could be more consistent in their annual survey work. In addition, the guide provides for the systematic collection of data over a long period of time which will be invaluable in documenting trends and changes in these lakes.

The authors are indebted to the many individuals in the Section of Fisheries who took the time and effort to comment on the numerous drafts and who implemented this guide in their annual work plans. Without their assistance and willingness to implement this guide, the value of our future data bases on these waters would be restricted.

LARGE LAKE SAMPLING GUIDE

INTRODUCTION

A standardized sampling and reporting format for large walleye lakes is needed for sampling continuity so that trends valuable in identifying management needs of the individual lakes can be documented and to facilitate between lake comparisons. In addition, similar final report formats will facilitate comparisons of results between years on the same lake as well as between lakes. The recommended format is to be considered the minimum amount of work that will be completed each year on each lake. This guide is in addition to the Lake Survey Manual which is used as a basis for inventory of physical, chemical and biological characteristics of Minnesota lakes.

METHODS

I. Sampling

A. Gill netting

1. Standard 250 foot experimental gill net (5 mesh sizes)

2. Sample Stations

a. Locate station in each major bay or habitat

b. Four net sets/station

c. Set nets in any direction for 24 hours

d. Minimum 20 net sets; maximum 52 net sets/lake

e. Lake of the Woods - 52 net sets; 13 stations

Leech Lake - 32 net sets; 8 stations

Lake Mille Lacs - 32 net sets; 8 stations

Lake Winnibigoshish (including Cut Foot Sioux) - 32 net sets; 8 stations

Lake Vermillion - 20 net sets; 5 stations

Cass Lake - 20 net sets; 5 stations

Kabetogama - 20 net sets; 5 stations

Rainy Lake - 20 net sets; 5 stations

Lake Superior -

f. September or later is the month of choice as it appears to be a higher catch month (this does not preclude using a different time frame if this fits better for your lake)

3. Information to be collected

a. Measure all fish by species to nearest 0.1 inch or 1.0 mm (TL)

b. Separate data by gill net mesh size for all fish

c. Collective weight of each species (lbs. or kg)

d. Scale samples on all game fish

1) Take 10 from each 0.5 in group or 10 mm size group

a) Information on each envelope - date, species, sex, length (TL), station, lake, weight (lbs. or g), mesh size

B. Young-of-year (Y-O-Y) sampling

1. Shoreline seining (as may be pertinent)

a. Same number of sample stations for each lake as for gill netting

b. Collect and preserve 25 Y-O-Y of each game fish species from each sample station - walleye, yellow perch, etc.

1) Pertinent information on label: lake, date, method of collection and station

c. Measurements and scales from all game fish (<0+) - nearest 0.1 inch or 1.0 mm

d. Bulk counts of nongame fish - subsampling is acceptable

e. Count all game fish that are released including Y-O-Y

f. Three seine hauls/station

g. Utilize fixed pole seine method (90^{O} arc) (may have to modify)

h. 100 ft. bag seine (6' x ¼" mesh) yields an area seined of 7,850 $ft.^2$, 734 m^2, 0.18 acres or 0.0734 ha

i, Four (4) week sample period (mid July-mid August) (utilize what fits best for your lake)

j. Sample once/week - hence four (4) sample times/station

k. Light intensity should be consistent at the same station on clear water lakes (similar turbidity levels)

l. Data to be collected in the laboratory

1) Number of Y-O-Y (species)/seine haul - by species

2) Lengths of preserved Y-O-Y to nearest mm and weight (g) (blotted dry) - can only be done in metric (utilize plastic strips)

3) Identification, lengths and weights of other preserved Y-O-Y

2. Trawling (if possible)

a. Utilize for age I+ and II+ fish

b. Utilize to follow I+ year-class

c. 25' head rope, semi balloon (4-5'), 1/2 or 3/4" mesh to 1/2" in cod to 1/4" for cod liner

d. Trawl at 3.5 mph for 10 minutes (if possible). Time starts when all is in place (tension on the rope)

e. Stations: minimum - 5; maximum - 15

f. Two (2) tows/station

g. Collect measurements (weight and length) and scales of all game fish (1+)

h. Preserve all Y-O-Y game fish for length, weight and K factor measurements

i. Sample in late August (use best time for your lake)

1) Sample each station once/week for 2 successive weeks

j. Count all nongame species by species

C. Water Quality Sampling

1. Temperature and oxygen profiles during summer stagnation at each station (one time). Check hypolimnetic oxygen after 2-3 calm days during July or August.

2. Collect water samples for analysis at the Chemistry Laboratory (make arrangements prior to collecting and sending water sample)

a. Total alkalinity, total dissolved solids, total phosphorus chlorophyll "a" - early August is time of choice

3. Conductivity can be substituted for total dissolved solids

4. Oxygen (surface - sample 1 foot below and bottom - sample 1 foot above) and transparency (secchi disc) on each sample date for the other work at each sampled station

D. Creel Census

1. Access area type - completed trip (exemption by exception)

2. Probability type (always)

3. Do two (2) consecutive years on a six (6) year cycle

4. Twelve (12) month creel - Mille Lacs, Winnie and perhaps other lakes - your choice

a. Do winter creel census on the first year of the creel census on the other lakes

b. Do aerial winter house counts both years (yearly on Mille Lacs and if you need, on your lake)

c. Emphasize spearing counts so better estimates can be calculated

5. Start creel census on walleye opener

   a. Walleye opener to 20 October (minimum) - depends on lake

   b. 1 December (or ice cover) to ice out - depends on lake

6. Need number of access areas or zones for creel census - design purposes

7. Need use (probability estimate) for each access area - design purposes

8. Need start and stop dates - utilize D-5 as guideline

9. Need number of clerks available (1-4)

10. Determine if you want or need a night creel census (decide for your lake)

11. Need map of lake with access areas for counting boats landing and for interviews

12. Include Weithman-Anderson type questions (fishing quality) in creel census - as discussed at Training Sessions and handouts

13. Deal with Biometrician for design and/or redesign of your creel census

14. Measure lengths of sport fish in the creel - weights

15. Take scale samples from all fish one day/week (randomly select the day)

II. Analysis and Reporting

A. Gill netting

1. Report in number/gill net lift by species
2. Report in pounds (kg)/gill net lift by species

] calculate and report standard deviation (SD) and standard error of the mean (SE)

a. Utilize t-test on means for between years change - optional

b. Mann-Whiteney U-test or Wilcoxin test on means for between years change - optional

3. Age by species

a. Prepare age-frequencies table

b. Age distribution tables (number, percent, all years)

c. Growth rates table - male and female - by species

1) Utilize Walford transformation for aging above 5+ years

a) Graph and tabular - both should show increments

4. Size-frequency distribution (length-frequency distribution)

a. All netting by year and type (not lumped)

b. All netting by mesh size

B. Y-O-Y

1. Shoreline seine

a. Catch/unit effort = index of abundance (by species)

b. Graph with in-season growth

1) Utilize w/plastic sheet - can use same sheet

c. Same as above with yellow perch

d. Same as above with other game fish in large numbers

e. Adult game fish information only combined with gill nets for age-growth work

f. Do K-factor analysis on Y-O-Y walleye and yellow perch - optional

2. Trawling

a. Extension of seining - tail end of the growth curve for Y-O-Y

b. Adult information only combined with gill net information for growth work

c. Catch/unit effort in catch/hour (eliminates decimal)

d. Age distribution (number, percent, all years)

e. CPUE (no./hr.) by age

f. Duplicate shoreline seining information on Y-O-Y by species - see above (II.B.1.b, c. and d.)

g. Do K-factor analysis on Y-O-Y walleye and yellow perch - optional

h. Listing by number of nongame species - see II.B.I. and II.B.2. for example

C. Water quality information

1. Listing of information in tabular form

2. Isotherms and isopleths for temperature and oxygen concentrations by station and date

D. Creel census (utilize confidence intervals (SE) on all estimates)

1. Figures with sample sites for all work

2. Table with access sites and probabilities (tie in with Fig. II.D.1.)

3. Break above into launch and small boat landings - if pertinent

4. All information by period (2 periods/mo)

5. All information by season, month and year

6. Utilize figures for body and tables in Appendix

7. Quality indices - includes calculating

8. Allen's method recruitment (Ricker) - optional

III. Final Report Format

A. Introduction (after the first time this is duplicated)

1. Brief history of the lake

2. Delineate main fish communities in the lake

3. Delineate historical and most recent recreational usage

B. Methods and materials (after the first time this is duplicated unless you have made changes)

1. Refer to Large Lake Sampling Guide (reference)

2. Discuss and delineate any new methodology

C. Results

1. Break into the major areas of work - gill netting, seining, trawling, water quality, creel census and quality indices

2. Include all tables, graphs and figures

D. Discussion

1. Discuss results by section (see Results)

2. Discuss the lake as a whole, utilizing all information

a. Quality and quantity of fishing

b. Population status of the major species

3. Discuss changes in the lake since the last work and/or subtle long term changes and their significance

E. Literature cited

1. Cite text references

2. Follow format as in Appendix

F. Due date

1. Report to be edited and approved by Regional Supervisor

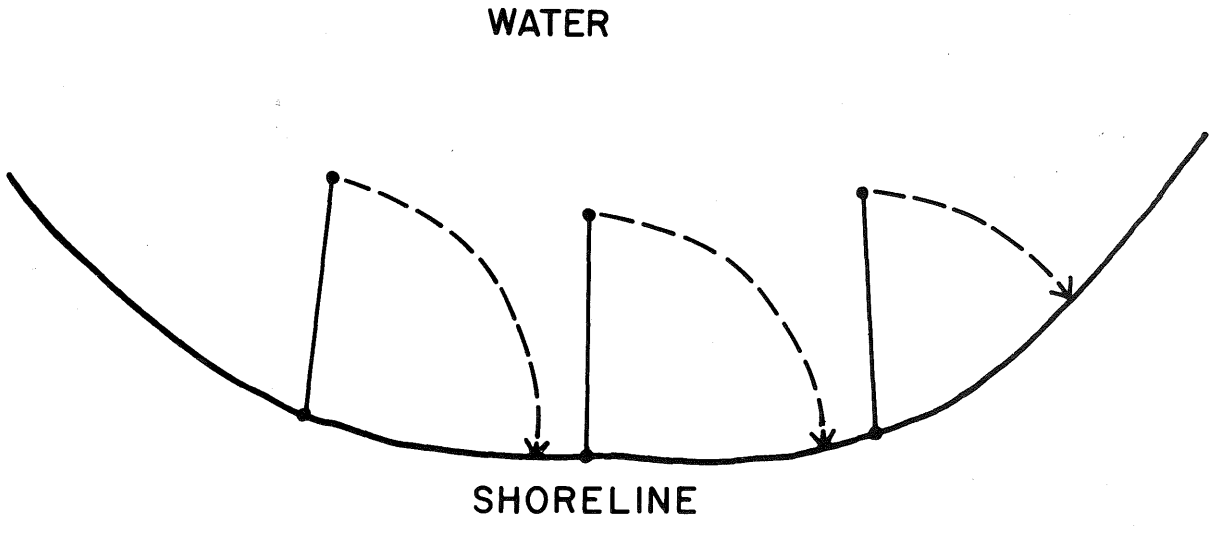
2. Final edited report to be in St. Paul by 15 February of each year

APPENDIX*

*All tables and figures are numbered in such a manner that they refer to the outline where they are discussed.

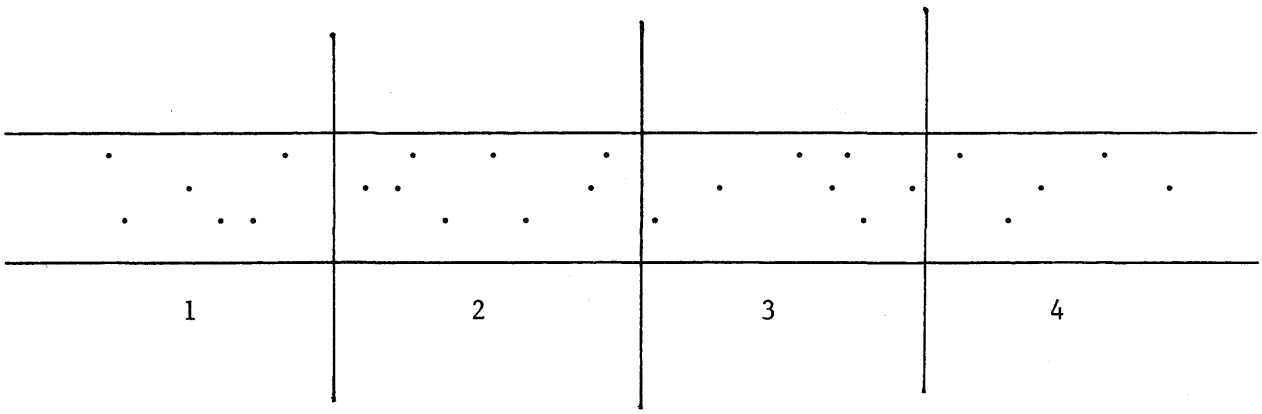
Figure I.B.1.g.

FIXED POLE SEINING METHODOLOGY



1. Perpendicular to shore line with one braille fixed on the shore and other 100 ft. into lake.
2. Move braille to shore while keeping net taut.
3. Pick net.
4. Repeat step 1 from point where seine braille hit the beach.
5. Repeat steps 2 and 3.
6. Repeat for third time.

Table I.B.1.1.2. Plastic strips for measuring Y-O-Y



Station I.

1, 2, 3 and 4 refer to sampling dates.

Lay strip on measuring board and using a dissecting needle punch a hole in the plastic to correspond to the total length of the fish. After sampling season you can record the actual measurements or better yet use a digitizing pad with a desktop computer.

Table II.A. 1 & 2. Number and pounds/standard gill net lift of walleye in Leech Lake, 1982.

Station	No. sets	No./lift(SD)	Lbs./lift(SD)
1	4	6.2	12.1
2	4	5.7	10.8
3	4	7.2	8.1
4	4	6.0	13.2
5	4	6.7	11.1
Mean		6.4	11.1

$$S.D. = \sqrt{\frac{\sum_{i=1}^{n} X_i^2 - \frac{\left(\sum_{i=1}^{n} X_i\right)^2}{n}}{n-1}}$$

Table II.A. 1 & 2. Number and pounds/standard gill net lift by species in Leech Lake, 1982.

Station	Tullibee		N. Pike		Y. Perch	
No. sets	No/lift	Lbs/lift	No/lift	Lbs/lift	No/lift	Lbs/lift
1						
2						
3						
4						
Mean (SD)						

(This table is for historical comparison)

Table II.A. Number and pounds/gill net lift Mille Lacs Lake, 1982.

	Date			
	1968	1972	1980	1982
Total lifts				
Mean catch/lift (SD)*				
Yellow perch		The species		
Walleye		should follow		
Etc.		the order in		
		the 1980 AFS publ.		
Mean lbs/lift (SD)*		on scientific and		
Yellow perch		common names		
Walleye				
Etc.				

* If available from previous work and added for current work.

You may need to turn this table 90° in order to put on all the historical data.

Table II.A.3a and II.A.4. Age-length frequency of gill netted walleye in Leech Lake, 1982.

Total length(in)	Total no.	Age I	II	III	IV	V	VI	VII	VIII
8.0-8.4	62	62							
8.5-8.9	71	70	1						
9.0-9.4									
9.5-9.9									
. . .									
14.0-14.4	47		10	12	22	3			
14.5-14.9									
Total	180	132	11	12	22	3			

A separate table will be completed by species for gill netting, trawling and seining.

Table II.A.3 b. Calculated means at each annulus and mean increments ( ) between annuli in Leech Lake, 1982.

Year class	Number of fish	Mean calculated total length (mm) at each annulus 1		2		3		4		5		6
1968	1	150	87	237	63	300	24	324	13	337	6	343
1969	19	199	83	282	47	329	25	354	11	365		
1970	29	202	88	290	38	328	21	349				
1971	24	213	90	302	45	343	11	354	19	373	42	415
1972	16	213	93	306	42	348	24	372	26	398		
1973	20	221	91	312	35	347	1	348	29	377		
1974	51	204	93	297	50	347	26	373				
1975	80	201	87	288	60	348						
1976	3	201	104	305								
1977	4	215										
Number of fish		247		228		154		97		30		2
Mean total length		205		294		341		359		370		379
Mean annual increment		205		89		44		23		15		24

Do this type table for all male and female as above and separate by male and female. Also do for other game fish species.

Table II.A.4.b. Fish by mesh size from experimental gill nets, Leech Lake, 1982.

Size group	Mesh size (in) or (mm)				
	3/4	1	1 1/4	1 1/2	2
Northern pike					
Mean size					
Standard error					
Median size					
Maximum size					
Minimum size					
TOTAL NUMBER					
Yellow perch					
Mean size					
Standard error					
Median size					
Maximum size					
Minimum size					
TOTAL NUMBER					
Walleye					
Mean size					
Standard error					
Median size					
Maximum size					
Minimum size					
TOTAL NUMBER					
GRAND TOTAL					

Table II.B.1.a. Abundance of young-of-year fish/seine haul in Mille Lacs Lake, 1982.

Species	Station 1 Mean	2 Mean	3 Mean	4 Mean	Grand Mean(SD)
Northern pike					
Yellow perch					
Walleye					
Etc.					
No. hauls					

Table II.B.2.c. Catch/hour of young-of-year fish by trawling in Mille Lacs, 1982.

Species	Station 1 Mean	2 Mean	3 Mean	4 Mean	Grand Mean(SD)
Northern pike					
Yellow perch					
Walleye					
Etc.					
No. hauls					

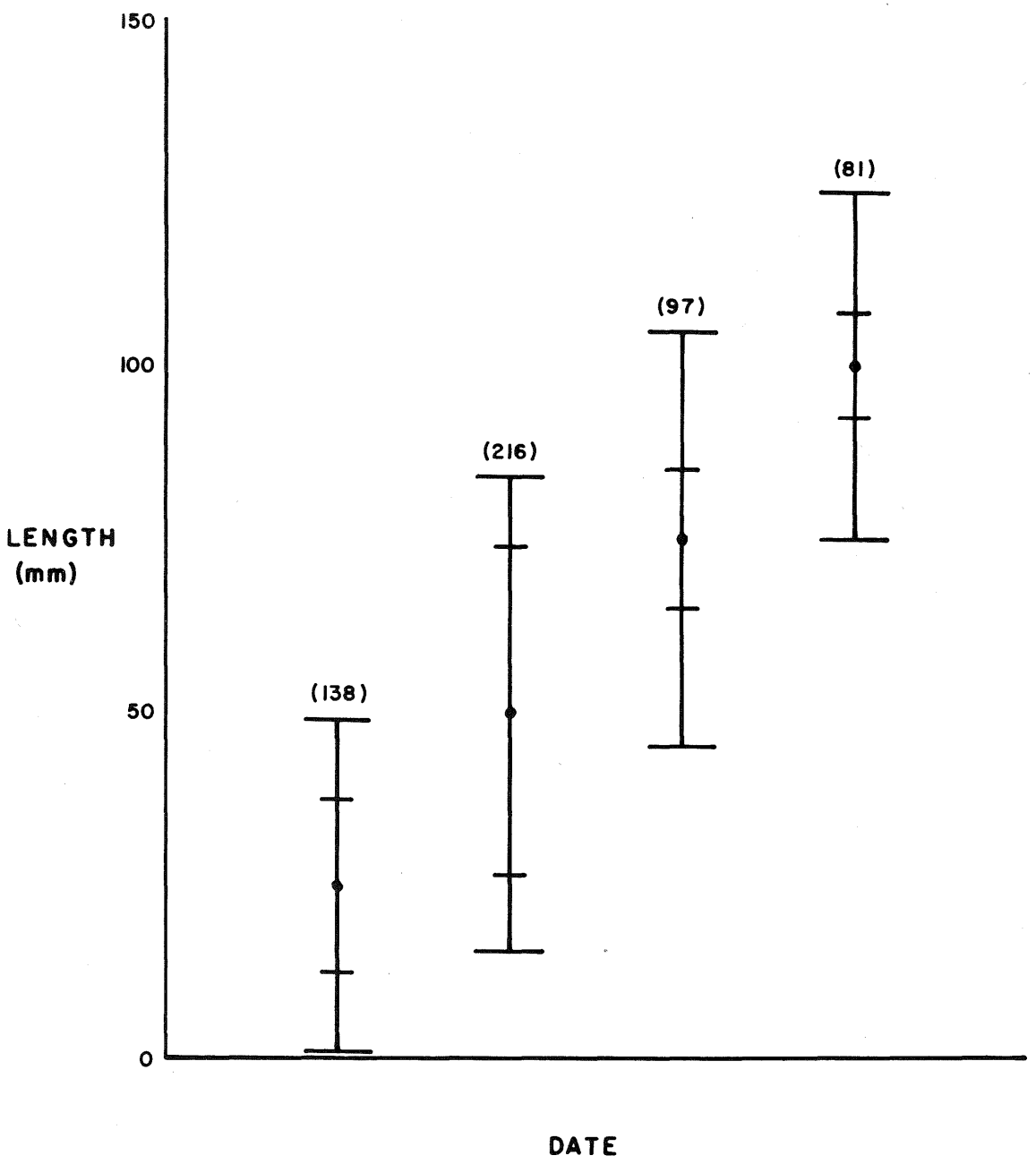


Figure II.B.1.b & c. Walleye young-of-year growth rates in Leech Lake, 1982. Number of y-o-y in parenthesis with range and one SE.

Above graph to be done with yellow perch and other major species (game and nongame)

Table II.B.1. & 2. Condition factor (K) on seine collected young-of-the-year game fish in Leech Lake, 1982. Number of fish measured after the mean.

Species	Station 1 Mean (SD)	2 Mean (SD)	3 Mean (SD)	4 Mean (SD)	Grand Mean (SD)
Yellow perch					
Walleye					
Etc.					

Do the same for trawl-collected fish.

Table II.C.1. Chemical parameters for Leech Lake, July 1982.

Parameter	Station I	II	III	IV
Total alkalinity				
Total dissolved solids (TDS)				
Total phosphorus				
Chlorophyll "a"				
Secchi disc (M)				

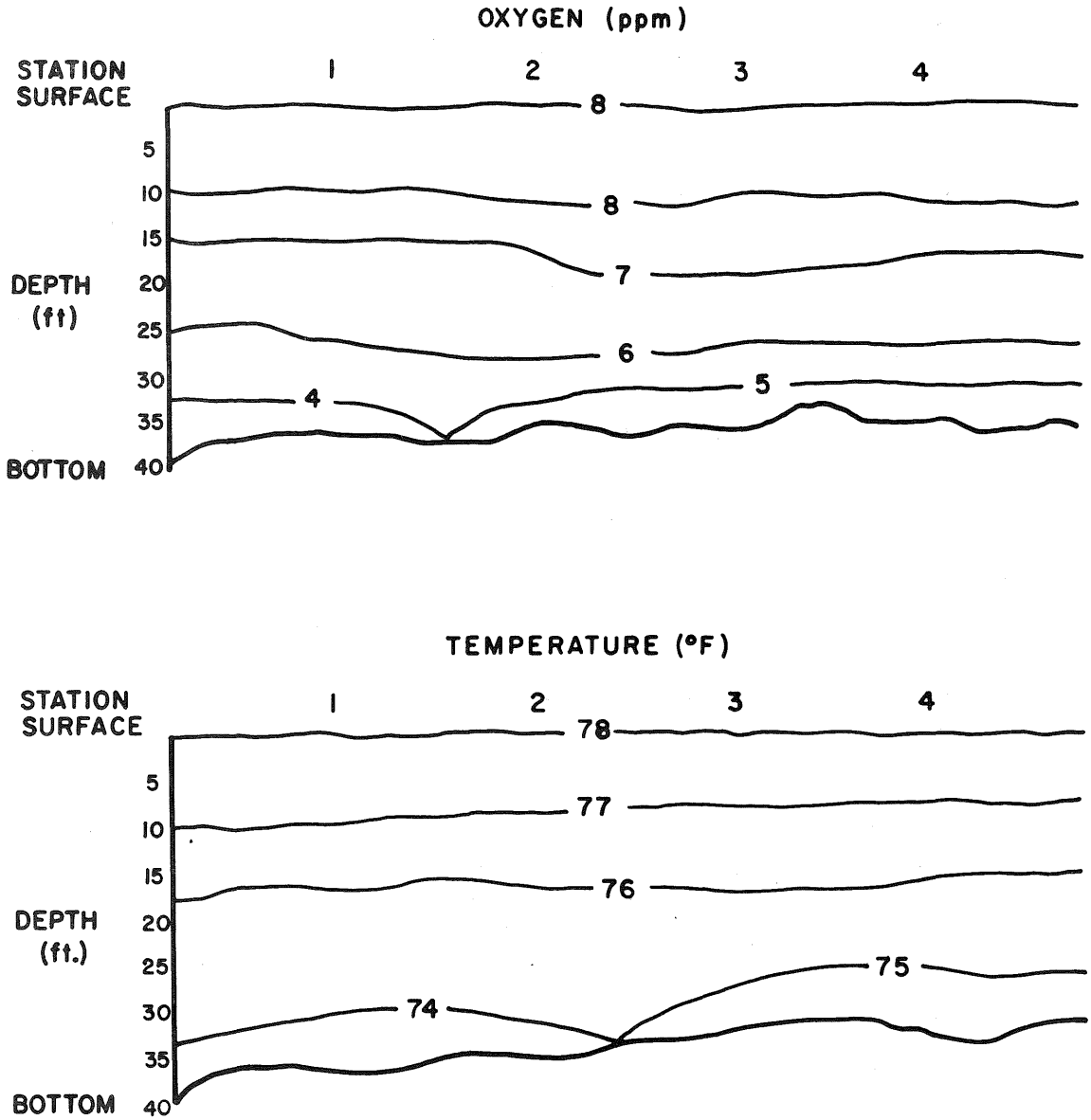


Figure II.C.2. Oxygen isopleth and temperature isotherm for Leech Lake, 15 July 1982.

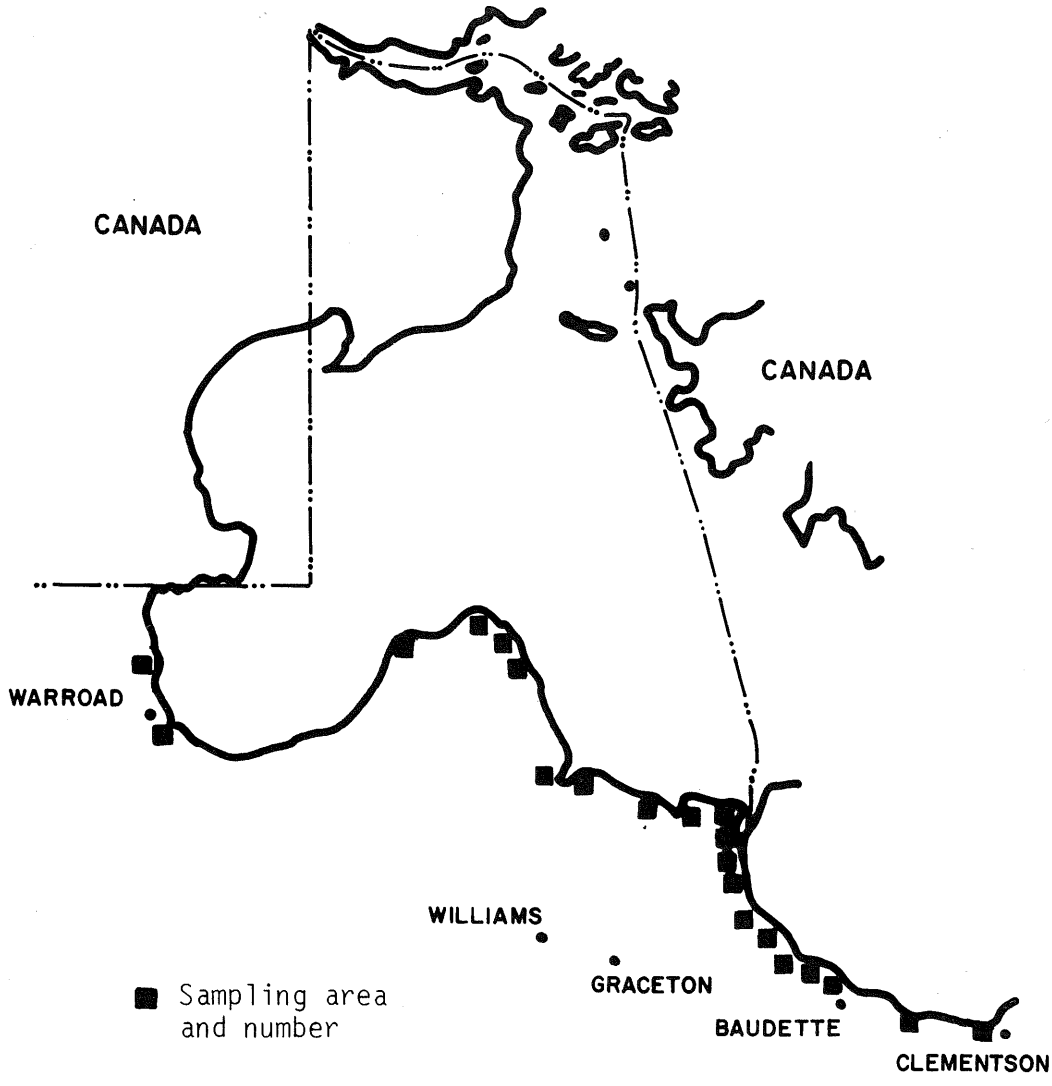


Figure II.D.1. Lake of the Woods creel census sampling areas, 1968-1970

Table II.D.2. Access sites and probabilities for the Leech Lake creel census, 1982.

Access cite	Probability
1	0.15
2	0.05
3	0.20
4	0.05
...	...

Table II.D.3. Relative fishing success by boats and charter launches expressed as fish caught per manhour of fishing Mille Lacs Lake, 1983.

Species	Boat	Launch	Total
Northern pike	0.21	0.02	0.17
Walleye	0.45	0.67	0.48
Largemouth bass			
Smallmouth bass			
Etc.			

Table II.D.5. Creel census estimates (by species), Lake of the Woods, 1968-1982.

	Year				
	1968	1969	1970	1981	1982
Total angler-trips					
Total manhours					
Total catch (N)					
by species - list		List species in order found in AFS Spec. Pub. on names			
Total catch (lbs)					
by species - list					
Catch/manhour		See Appendix for partial listing			
by species - list					
Average weight (lbs)					
by species					

SE to be listed in () below the estimate.

Table II.D.5. Creel census estimates (total) Lake of the Woods, 1968-1982.

	1968	1969	1970	1981	1982
Total man-trips					
Total manhours					
Total catch (N)					
Total harvest (lbs)					
Total catch rate (No./hr.)					

SE to be listed in () below the estimate.

Table II.D.5. Estimated fishing effort, harvest and success in Lake of the Woods, 1982.

Species	Total angler-trips	Total manhours	No./ manhour	Lbs./ manhour	Avg. size (lbs)	Total no. (N)	Total catch (lbs)
Salmonids (tullibee)							
Northern pike							
Black bass family							
Yellow perch							
Sauger							
Walleye							
List other species							
Total							

Do this type table by period, month, season and year (total).
SE to be listed in () below the estimates.

Table II.D.7. Trip quality (TQ) indices from Leech Lake creel census, 1982. Number of interviews in parentheses.

Time frame	Trip quality
17-31 May	3.0 (121)
1-15 June	2.6 (87)
16-30 June	4.1 (96)
Etc.	
Mean	

Table II.D.7. Mean fish quality (FQ) and harvest quality (HQ) values for Leech Lake, 1982.

Species	FQ	HQ
Northern pike	1.34	8.4
Largemouth bass	0.73	4.6
Walleye	0.64	3.8
Etc.		

LISTING OF GAME AND NONGAME FISH

(After AFS Sp. Pub. No. 12, 1980)

Sturgeon

Bowfin

Herring and whitefish (alphabetical order by genus and species)

Salmonids (trout, salmon, whitefish and cisco) (alphabetical order by genus)

Smelt

Mudminnows

Northern pike

Muskellunge

Carp and minnows (alphabetical order by genus and species)

Suckers (alphabetical order)

Catfish (alphabetical order)

Stickleback

Sunfish family (alphabetical order)

Perch family (alphabetical order)

Drum

To be used wherever utilize listing of species so that order is always consistent.

Literature Citations

1. Literature citations are after the form used in the CBE Style Manual or the Transactions of the American Fisheries Society.

   a. Citation of a paper in a periodical:

      Hunt, P., and O. Ziltch. 1960. Digestion ratio and food consumption of Florida gar, warmouth and largemouth bass. Trans. Am. Fish. Soc. 89:206-211.

      Note: Lower case letters in title, abbreviate name of periodical, first number is volume, second set is page location in the volume, comma after the last author name before and.

   b. Citation of a book:

      Lagler, K.L. 1956. Freshwater fishery biology. 2nd ed. Wm. C. Brown Co., Dubuque, Iowa. 421 pp.

      Note: Lower case letters of book title, include the name and location of the publisher. The Arabic numerals signify the number of pages of text. Always use initials for author(s).

   c. Citation of publication with authors and editor:

      Olson, D.E., D.H. Schupp, and V. Macins. 1978. An hypothesis of homing behavior of walleye as related to observed patterns of passive and active movement. Pages 52-57 in R.L. Kendall, ed. Selected coolwater fishes of North America. Am. Fish. Soc. Sp. Publ. No. 11, Washington, D.C.

   d. Citation of our publications:

      Olson, D.E. 1981. Experimental incubation of fish eggs in a moist-air environment. Minn. Dept. Nat. Res., Div. Fish Wildl., Sect. Fish. Invest. Rep. No. 373: 6 pp.

2. Text citations are as follows:
   a. ...(Lagler 1965)... Lagler (1954)

   b. ...(Lagler 1965; Hunt and Ziltch 1960; Olson et al. 1978).

   c. Personal communication citation:

      (D.H. Schupp, MN Dept. Nat. Res., personal communication 1982)

(Example: Approval Page)

CASS LAKE

1984

Prepared by: _____

Approved by: _____ _____
Area Supervisor Date

Approved by: _____ _____
Regional Supervisor Date

SPECIAL PUBLICATIONS*

No. 129 Fish and Wildlife Resources of the Mississippi River from Lake Itasca to Lake Winnibigoshish, by T. Kucera and A. Peterson. March 1981.

No. 130 Fish and Wildlife Resources of the Roseau River, by J. Emblom.May 1981.

No. 131 Parasites and Selected Anomalies of some Fishes of the North Central United States and Canada, by E. Wyatt and P. Economon. September 1981.

No. 132 Lake Management Planning Guide. December 1982.

No. 133 Aeration and Mixing Systems in Minnesota Lakes, by D. Pederson. December 1982.

No. 134 Biological Survey of the Red Lake River, by P. Rendard, S. Hanson and J. Enblom. June 1983.

No. 135 A Fish Management Guide for Northern Prairie Farm Ponds, by J. Schneider. August 1984.

No. 136 Water Quality Monitoring in Representative Fish Lakes 1979 and 1980, by D. Zappetillo, H. Fierstine and D. Pederson. April 1984.

No. 137 Biological Survey of the Otter Tail River, by S. Hanson, P. Renard, N. Kirsch, and J. Enbolm. June 1984.

No. 138 Indexing Minnesota Fish Lakes Relative to Potential Susceptibility to Acidic Deposition, by R. Payer. August 1984.

No. 139 Biological Survey of the Minnesota River, by P. Renard, S. Hanson, J. Enbolm and N. Kirsch. March 1985.

*Complete list of all publications in the series available from Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries, Box 12, 500 Lafayette Rd., St. Paul, Minnesota 55146.