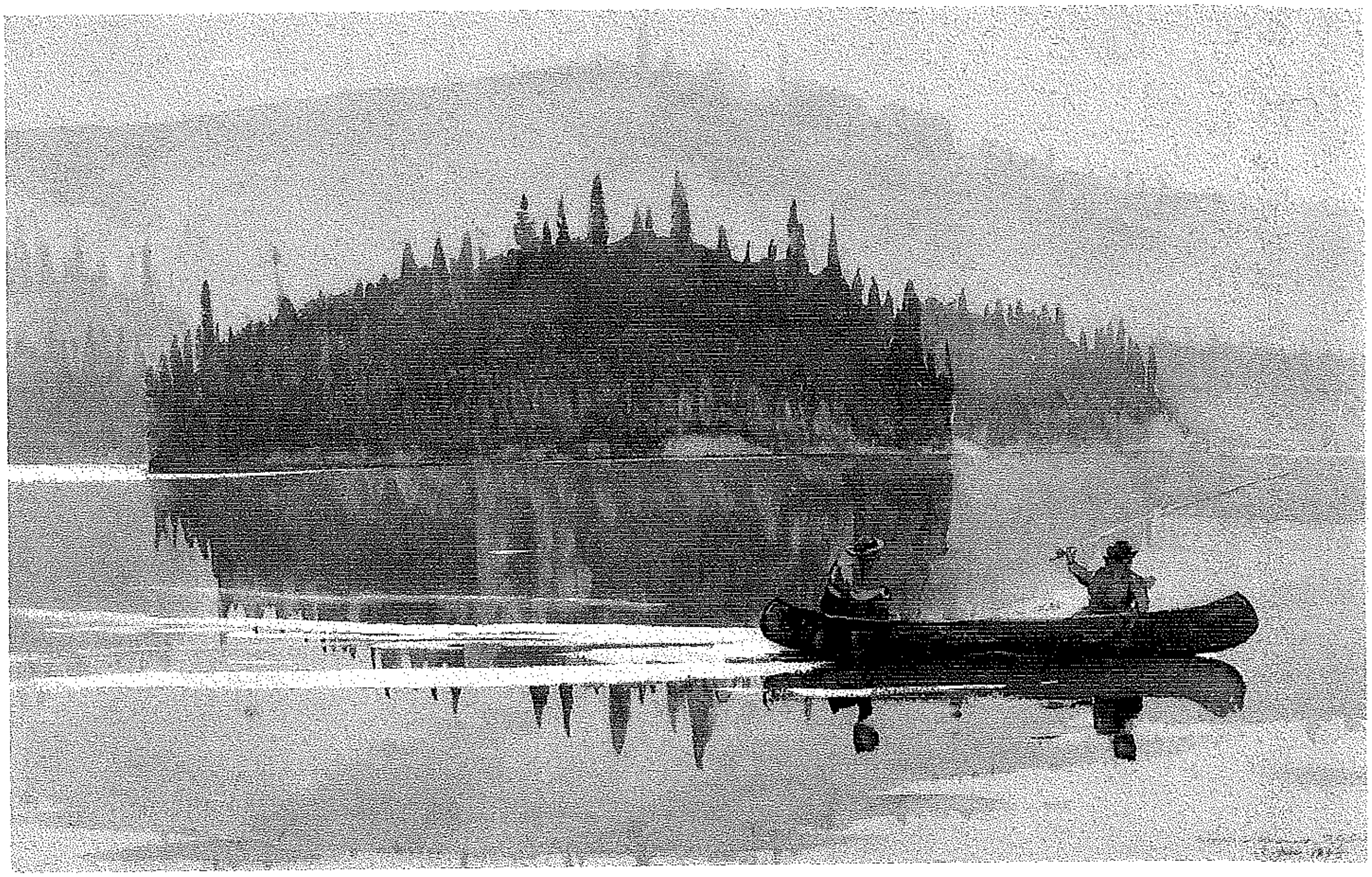

Winslow Homer: *Two Men in a Canoe*, 1895

Water Quality Report and Management Plan for Big Bearskin Lake, Oneida County, WI

July 1997

Prepared for
Big Bearskin Lake Association
Harshaw, WI

Prepared by
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Acknowledgments

Big Bearskin Lake known around the area for the big island and an abundant walleye population. This is the first comprehensive lake report prepared for Big Bearskin Lake. People who have been instrumental in getting this lake report going and/or who donated time and labor include:

Roger Soletske
David Schmit
Jack Jalinski
Robert Schlipf

Not included are names of a number of volunteers who helped with fish transfers, building cribs, and harvesting rusty crayfish.

Bob Young, WDNR lake specialist from Rhinelander was the Project Manager.

Big Bearskin Lake, Oneida County, Wisconsin

--Contents--

SUMMARY

Big Bearskin Lake is located in Oneida County, Wisconsin. A lake study sponsored by the Big Bearskin Lake Association and the WDNR as a Lake Management Planning Program was conducted in 1996. Big Bearskin Lake was sampled in June, July, and August as was Muskie Creek, the inlet to Big Bearskin.

Objectives: The goals of this project were:

- to examine existing lake conditions, specifically crayfish, algae blooms, and lack of panfish.
- to develop a lake management plan that address crayfish, algae, and fish concerns and protects, maintains, and enhances the lake's water quality.

Geology and Soils

Big Bearskin lake is a drainage lake formed during the last retreat of the Wisconsin Valley glacial lobe approximately 16,000 years ago. The soils deposited by the glacier are primarily sands and loamy sands.

Watershed Characteristics

Land use: The watershed area of Big Bearskin Lake is approximately 2,253 acres, with the direct drainage area accounting for about 553 acres, and the indirect drainage area about 1,700 acres. The land use is dominated by forest (80%), wetlands (9%), residential development (6%) and lakes (not including Big Bearskin) (5%).

Streams: Big Bearskin Lake has one major inflow and outflow. Muskie Creek, the inflow, is in fairly good condition. Summer average total phosphorus was 20 ppb and the suspended solids were less than 5 ppm.

Springs: There are at least four locations within Big Bearskin Lake that could be springs.

Lake Characteristics

Dissolved Oxygen and Temperature: Big Bearskin Lake is not strongly thermally stratified during the summer. Oxygen concentrations fall below 1 mg/l in water below about 21 ft by July.

Clarity: The secchi disc transparency decreased from a high of 20 feet in June to a low of 5.9 feet in August.

Nutrients: Phosphorus concentrations are within the range of other lakes in the Northern Lakes and Forests ecoregion. Nitrogen concentrations fall within the norms for the ecoregion also. Maintaining these low nutrient levels should be a primary goal for the Big Bearskin Lake Association.

Algae: A blue green algae, *Gloeotrichia,* is responsible for the algae blooms in Big Bearskin Lake.

Aquatic Plants: There is a variety of emergent vegetation in shallow water near the shoreline which is beneficial as a filter for nutrients and as fish and wildlife habitat. Submerged plant densities are however quite low. It is likely that rusty crayfish, a non-native crayfish, may be responsible for low submerged plant densities. Bottom coverage is about 8% of the lake bottom.

Crayfish: Big Bearskin Lake has a large population of rusty crayfish, but the best management approach for the control of them is to let nature take is course.

Fish: Big Bearskin Lake has a naturally reproducing walleye population. This reproduction and recruitment is so successful that the walleyes maybe stunted. Muskies also do well in Big Bearskin. Panfish are not common.

Lake Report Card

-Water chemistry results are comparable to Ecoregion values.

-Some degradation is noted at this time related to summer algae blooms.

-The data base does not go back far enough to examine trends, however Big Bearskin Lake has had nuisance algae blooms for nearly 50 years based on lake resident recollections.

- A lake report of "C" was assigned to Big Bearskin Lake.

What Will Big Bearskin Lake Look Like in the Future?

Conditions are stabile in the watershed at the present time, but the lake has changes occurring related to walleyes, crayfish and aquatic plants. Algae blooms will probably continue unless phosphorus in the sediments is reduced.

If phosphorus increases, algae blooms will last longer in the summer, if phosphorus decreases, summer clarity should increase.

Lake Management Projects

Recommended Projects

Watershed Projects

1. On-site system maintenance program
2. Lake shoreland projects.

Lake Projects

3. Summer Algae Bloom Reduction
4. Rusty Crayfish Control
5. Panfish Improvement Projects
6. Walleye Management
7. No Wake Zone in Bays for Plant Improvement
8. Continue a lake monitoring program.

1. Introduction and Project Setting

Big Bearskin Lake is located in Oneida County, Wisconsin (Figure 1). Big Bearskin Lake is a drainage lake of about 400 acres with an island of about 12.5 acres. Big Bearskin Lake is a borderline meso-eutrophic lake with an average total phosphorus concentration of 22 ug/l and an average secchi disc transparency of 11 feet in the summer.

Drainage lakes are lakes that receive the water from an inflowing stream and runoff.

The goals of this project were to examine existing lake conditions and to develop lake management plans to protect, maintain, and enhance lake water quality for the short term and long term.

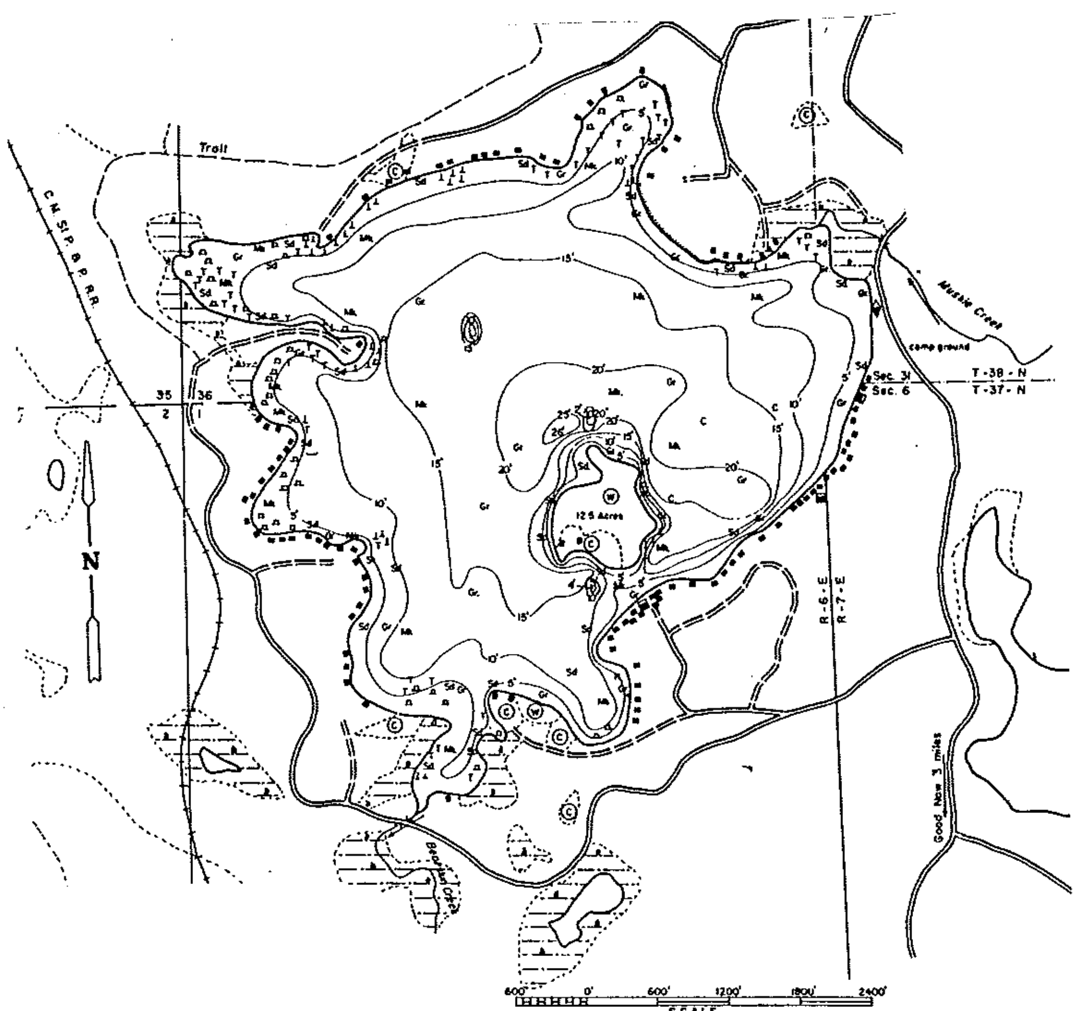


Figure 1. Lake map of Big Bearskin Lake.

2. Geology and Soils

Big Bearskin Lake was formed approximately 16,000 years ago during the last glacial retreat of the Wisconsin Valley glacial lobe (Figure 2). The soils deposited by the glacier were primarily sands and loamy-sands. Beneath these soils at depths of about 50-350 feet is Precambrian bedrock that is over one billion years old.

The soils sitting on top of glacial sands are some of the most acid (pH 5.5) and have some of the highest in available phosphorus (138 lbs/acre) of any in Wisconsin (Figure 3 and Table 1).

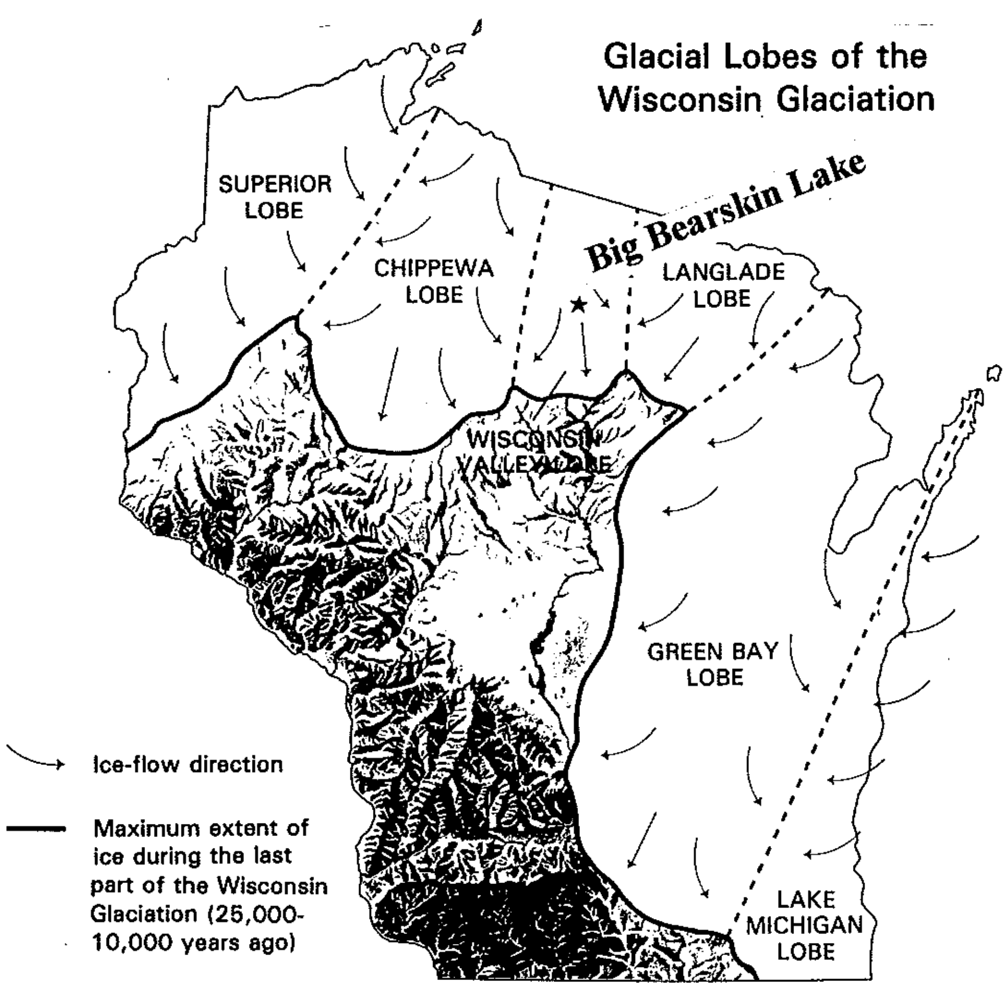


Figure 2. Big Bearskin Lake is in the Wisconsin Valley Lobe. Shown by the black star.

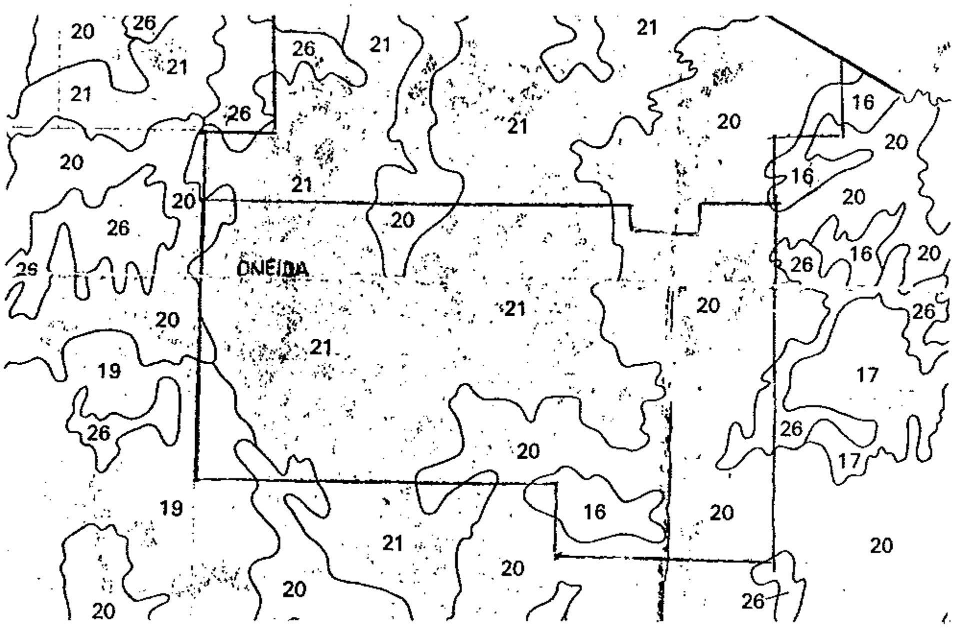


Figure 3. Big Bearskin Lake is located in soil group 21 (shown above) in Oneida County. Average available phosphorus is 138 pounds/acre (from Hole, F.A. 1970)

Table 1. Soil test data from plow layers of representative soils of Wisconsin.

	Organic matter %				Available phosphorus lbs/A				Available potassium lbs/A				Soil reaction pH				Lime req. T/A	
	Low 0-2 (% of soil tests)	Med 2-5 (% of soil tests)	High >5 (% of soil tests)	Av.	Low 0-50 (% of soil tests)	Med 51-100 (% of soil tests)	High 101-200+ (% of soil tests)	Av.	Low 0-200 (% of soil tests)	Med 201-400 (% of soil tests)	High 400+ (% of soil tests)	Av.	Low 4.5-6.5 (% of soil tests)	Med 6.5-7.5 (% of soil tests)	High 7.5+ (% of soil tests)	Av.	Av.	Representative corresponding soil names and symbols from Soils of Wisconsin color map, 1:710,000 (Hole, 1976)[2]
1	0	96	4	3.7	55	31	14	60	44	48	8	229	30	69	1	6.6	0.79	Tama, Richwood (A1, 11)
2	0	90	10	3.9	59	28	13	55	40	52	8	239	31	68	1	6.6	0.87	Dodgeville, Tell (A2, 14)
3	35	65	0	2.2	65	25	10	51	70	27	3	175	34	65	1	6.6	0.36	Fayette, Seaton (A5-8, 12)
4	28	71	1	2.3	68	21	11	50	69	28	3	183	37	62	1	6.8	0.36	Dubuque, Palsgrove (A3, 4, 6, 9, 10, 13)
5	4	87	9	3.8	45	45	10	71	49	45	6	222	27	71	2	6.6	0.72	Plano, Ringwood (B5, 21-22, 32)
6	0	75	25	4.5	62	26	12	53	43	54	3	224	55	45	0	6.4	1.55	Varna, Elliott, Ashkum (B20)
7	35	65	0	2.2	44	37	19	70	63	35	2	138	29	69	2	6.7	0.28	Lapeer, Miami, Fox (B1, 3, 6-8, 10-18, 23-31, 33, 34)
8	20	79	1	2.4	63	27	10	52	61	37	2	188	54	45	1	6.4	1.16	Morley, Blount (B9, 19)
9	50	45	5	2.7	34	39	27	87	63	34	3	184	44	55	1	6.4	0.55	Casco, Rodman, Hochheim (B2, 4, 12)
10	94	6	0	1.5	24	33	43	102	76	23	1	146	60	39	1	6.2	0.38	Sparta, Dakota (C5, 8, 9, 16)
11	87	10	3	1.5	16	39	45	107	84	16	0	136	69	31	0	6.0	0.53	Plainfield, Nekoosa, Boone, (C1-7, 10-18)
12	42	55	3	1.7	48	31	21	56	73	24	3	156	53	46	1	6.8	1.05	Norden, Hixton, Gale (D1-7, 9, 10)
13	52	46	2	1.8	33	38	29	87	76	21	3	162	57	43	0	6.3	0.92	Elm Lake, Merrillan, Kert (D8, 11-13)
14	6	80	14	3.7	58	25	17	57	73	22	5	175	15	60	25	6.9	0.80	Emmet, Onaway, Longrie, Shawano (E1-13)
15	2	90	8	4.1	50	25	25	65	70	29	1	118	53	46	1	6.2	0.55	Jewett, Pillot (F8)
16	3	84	13	3.8	65	20	15	54	67	29	4	176	54	45	1	6.3	2.08	Santiago, Freer, Norrie (F1-7)
17	28	72	0	3.8	28	26	46	113	56	36	8	201	61	39	0	6.2	0.92	Antigo, Fenwood, Stambaugh (F10-17, 24, 25)
18	16	82	2	2.9	55	31	14	59	81	18	1	145	59	41	0	6.2	1.70	Spencer, Almena, Poskin (F21, 22, 26)
19	3	95	2	3.2	64	26	10	52	70	28	2	163	59	46	1	6.3	2.50	Clifford, Withee, Dolph (F9, 18-20, 23)
20	68	32	0	1.7	35	18	47	114	63	28	9	149	46	46	8	6.0	1.52	Iron River, Milaca, Kennan, Pence (G1-28)
21	33	55	12	2.9	29	8	63	138	76	23	1	170	81	19	0	5.5	1.94	Vilas, Omega, Pence (H1-7)
22	2	81	17	4.0	73	19	8	39	67	30	3	184	1	70	29	7.3	0.04	Kewaunee, Hortonville, Oshkosh (I3-6, 10-17, 20, 21)
23	9	83	8	3.6	96	3	1	19	59	40	1	190	67	33	0	6.3	2.09	Hibbing, Ontonagon, Superior (I1, 2, 7, 8, 18, 19, 22)
24	2	68	30	5.0	29	40	31	90	35	55	10	250	4	70	26	7.2	0.10	Arenzville, alluvial soils (J1, 2)
25	0	10	90	7.0	67	24	9	50	50	46	4	214	2	42	56	7.0	0.10	Newton, Pella, Navan (J3-11)
26	0	3	97	56.2	51	23	26	96	59	20	21	200	53	39	8	6.4	0.32	Peats and Mucks (J12-15)
State Total	22	73	5	2.9	50	30	20	67	70	27	3	175	40	55	5	6.5	0.94	All soils

[1] Wisconsin State Soil and Plant Analysis Laboratory, J. J. Genson, Director, 806 S. Park St., Madison, Wisconsin, 53706
Representative data were extracted from State and County summaries of soil test data for the period 1968-1973.

[2] Hole, F. D., 1976. Soils of Wisconsin. Bul. 87, Soil Series 62. University of Wisconsin Press.

3. Watershed Characteristics

A watershed is the land area around the lake that captures rainfall and where all the drainage and runoff goes into the lake.

Land Use

General land use in the watershed is shown in Figure 4. The Big Bearskin Lake watershed encompasses approximately 2,253 acres. Direct drainage accounts for about 553 acres and indirect drainage about 1,700 acres. Of that 2,253 acres, forest lands dominate with 1,799 acres followed by 200 acres of wetlands, then 146 acres of residential lands and 108 acres of lakes (Table 2).

Table 2. Land use in the Big Bearskin Lake watershed. Both direct and indirect watershed acres are shown.

	Total Watershed		Direct Drainage		Indirect Drainage	
Land Use	**acres**	**%**	**acres**	**%**	**acres**	**%**
Lakes/Open Water	108	5	0	0	108	6
Wetlands	200	9	28	5	172	10
Urban/Residential	146	6	85	15	61	4
Forest	1,799	80	440	80	1,359	80
Total	**2,253**	**100**	**553**	**100**	**1,700**	**100**

The direct watershed acreage is where the runoff runs directly into the lake. The indirect watershed is the area that drains to a stream and then to a lake. This represents about 1,700 acres in the Big Bearskin watershed. This means that Muskie Creek delivers runoff from 1,700 acres into Big Bearskin Lake (Figure 4).

The Big Bearskin Lake watershed is approximately 2,253 acres and is dominated by forest (1,799 acres).

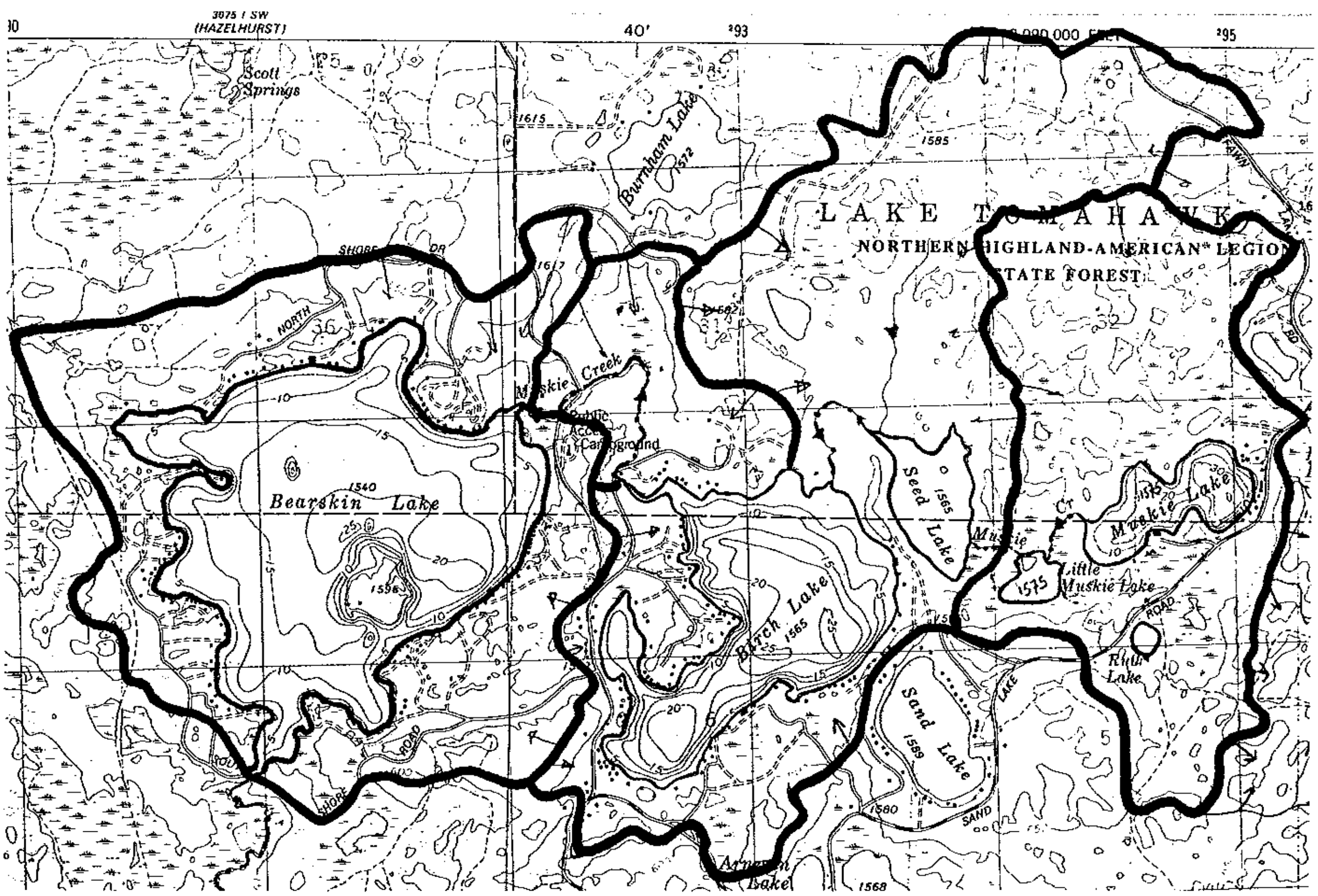


Figure 4. Watershed of Big Bearskin Lake.

Streams

Big Bearskin Lake has one major inflow and outflow. Muskie Creek, the inflow, drains four lakes within the Big Bearskin Lake watershed. The water quality from Muskie Creek is good (total phosphorus = 20 ppb average for the summer of 1996).

This is not completely unexpected. Muskie Creek originates from Muskie Lake and flows into Seed Lake and then Birch Lake. Birch Lake is in fairly good shape, so Muskie Creek is in fairly good shape also.

Table 3. Muskie Creek water quality results. Phosphorus is expressed in parts per billion and suspended solids in parts per million. Muskie Creek is the main water source to Big Bearskin Lake.

Muskie Creek Inflow - baseflow				
	June 5	July 25	August 19	Summer Average
Total Phosphorus	23	20	18	20
Suspended Solids	5	<5	<5	<5
Muskie Creek Inflow - storm flows				
		July 25	August 5	August 19
Total phosphorus		37	39	191

Figure 5. Muskie Creek is a pretty stream that flows into Big Bearskin Lake.

Springs and Onsite Systems

Specific conductance or conductivity is a measure of dissolved salts in the water. The unit of measurement is microSiemans/cm^2 or micro umhos/cm^2 ... both are used. The saltier the water the higher the conductivity. For example oceans have higher conductivity than fresh water. For the survey we used a YSI (Yellow Springs Instruments) Conductivity meter with a probe attached to the end of an eight-foot pole (Figure 6).

On Big Bearskin Lake we performed a conductivity survey around the entire shoreline of Big Bearskin Lake. The objective was to see if there was any change in conductivity. An increase or decrease would probably indicate the inflow of groundwater. The groundwater could be coming from natural flows or from septic tank drainfields.

Results are shown in Figure 7. The background or base conductivity was 90 umhos/cm^2. Several areas around Big Bearskin Lake had readings above background. Because of a lack of homes or because the homes are far removed from the lakeshore, it does not appear that the elevated conductivity is from septic leachate discharges. Rather, the results suggest that the west and north ends of Big Bearskin Lake may be receiving groundwater inflows.

On-site systems do not appear to be a major source of nutrients to Big Bearskin Lake. But they should always be maintained . . . to insure a healthy drinking water supply.

There are at least four areas that could be spring sources in Big Bearskin Lake.

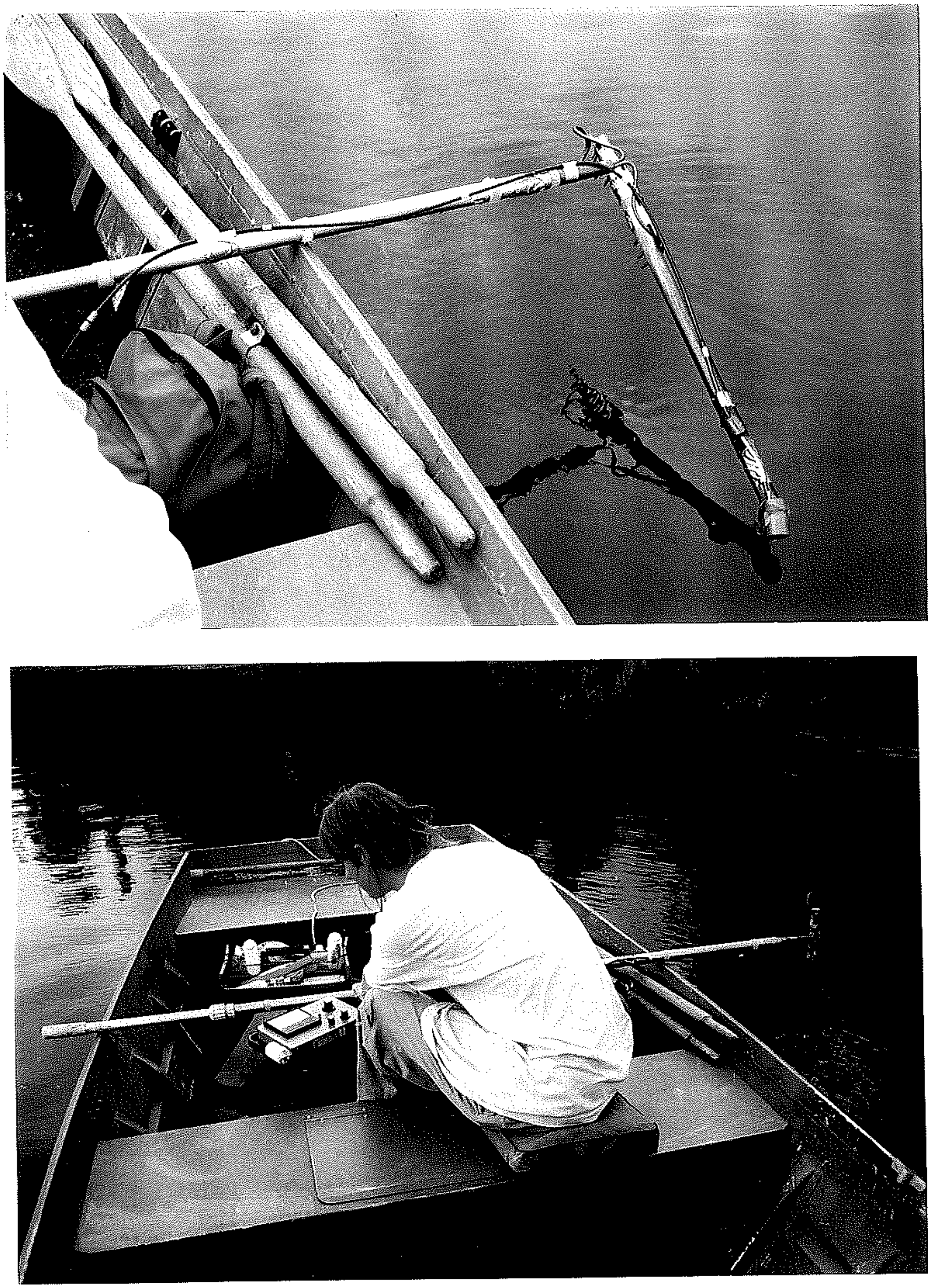


Figure 6. Conductivity survey conducted on Big Bearskin Lake with the help of a Big Bearskin Lake volunteer.

Big Bearskin Lake
Conductivity Survey
August 19, 1996

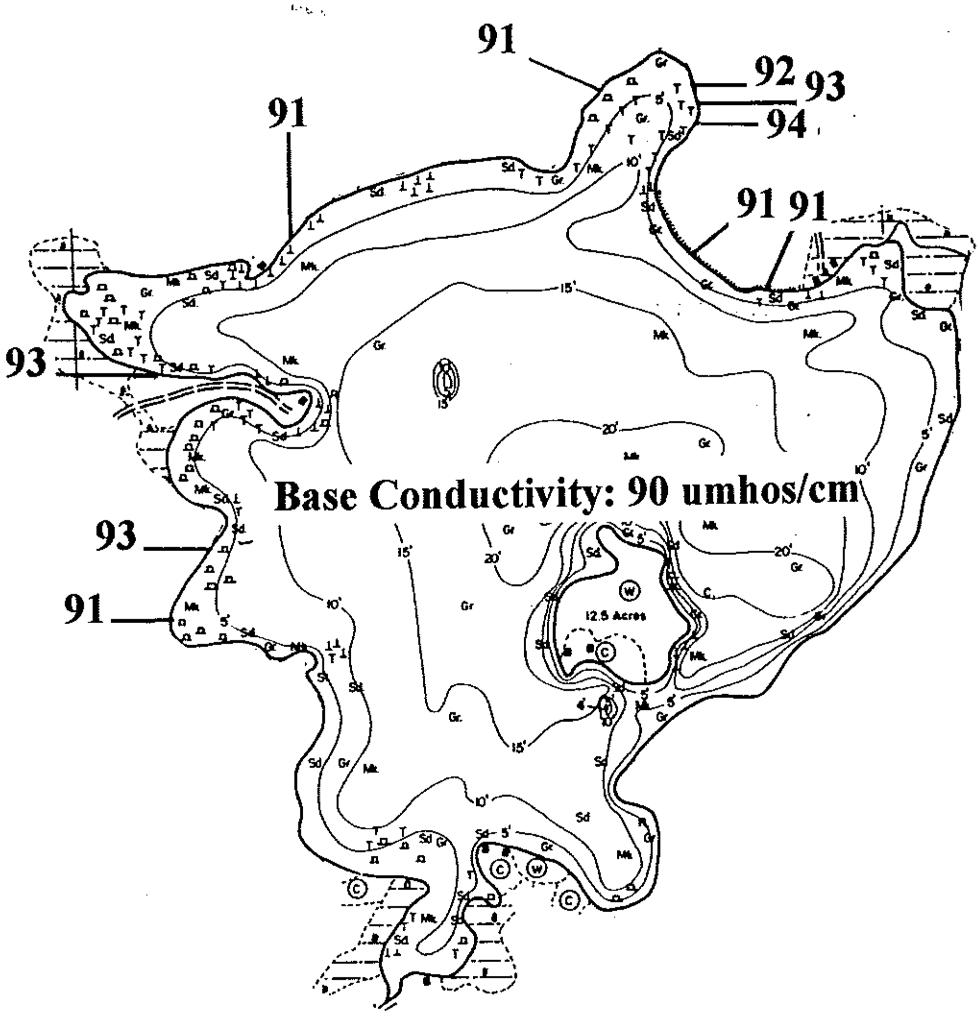
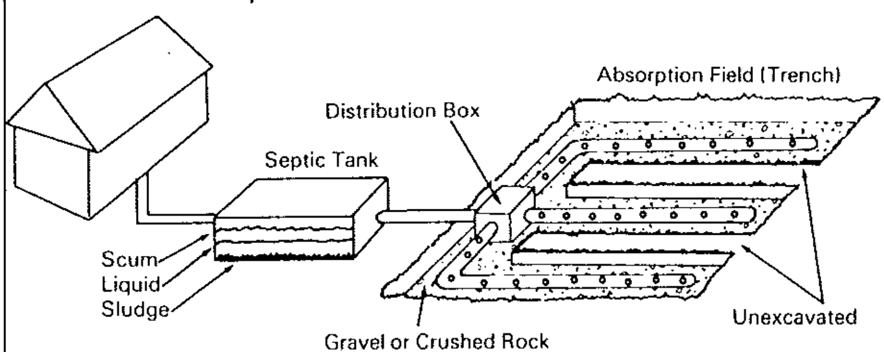


Figure 7. Conductivity survey on Big Bearskin Lake, August 19, 1996.

Sewage bacteria break up some solids in tank. Heavy solids sink to bottom as sludge. Grease & light particles float to top as scum. Liquid flows from tank through closed pipe and distribution box to perforated pipes in trenches; flows through surrounding crushed rocks or gravel and soil to ground water (underground water). Bacteria & oxygen in soil help purify liquid. Tank sludge & scum are pumped out periodically. Most common onsite system.



Septic tank and soil absorption trench. Of the conventional types of septic tank soil absorption systems, the trench-style soil absorption field is the preferred system. A typical cost is $3,000 to $4,000 for the complete system.

Figure 8. Conventional on-site wastewater treatment system.

4. Lake Characteristics

Big Bearskin Lake is approximately 400 acres in size, with a watershed of 2,253 acres. The average depth of Big Bearskin Lake is 3.5 meters (11.6 feet) with a maximum depth of 7.9 meters (26 feet) (Table 4). A lake contour map is shown in Figure 7. Big Bearskin Lake is located in an area of Oneida County that is dominated by forests. The Big Bearskin Lake watershed is 80% forest (1,799 acres), 9% wetlands (200 acres), 6 % urban (146 acres) and 5% lakes (excluding Big Bearskin Lake)(108 acres) (Table 2 and 3).

The watershed to lake ratio is 6:1, this means that Big Bearskin Lake can fit six times into the watershed.

Table 4. Big Bearskin Lake Characteristics

Area (Lake):	400.3 acres (161 ha)
Mean depth:	11.6 feet (3.5 m)
Maximum depth:	26 feet (7.9 m)
Volume:	4636 acre-feet (567 Ha-M)
Watershed area:	2,253 acres (912 ha)
Watershed: Lake surface ratio	6:1
Estimated average water residence time	1.9 years
Public accesses (#):	1
Inlets: 1	Outlets: 1

Temperature and Dissolved Oxygen in Big Bearskin

The summer dissolved oxygen (DO) and temperature profiles are shown in Figure 9 and Table 5.

A profile was obtained each month from June to August, 1996. By examining the profiles, one can learn a great deal about the condition of a lake and the habitat that is available for aquatic life.

Dissolved oxygen profiles were conducted to determine at what depth the oxygen level goes out. This is useful because gamefish will not survive under low dissolved oxygen conditions.

The profiles show that the lake was not thermally stratified in the summer of 1996. Thermally stratified means that the water column of the lake is segregated into different layers of water based on their temperature. Just as hot air rises because it is less dense than cold air, water near the surface that is warmed by the sun is less dense than the cooler water below it and it "floats" forming a layer called the *epilimnion*, or *mixed layer*. The water in the epilimnion is frequently mixed by the wind, so it is usually the same temperature and is saturated with oxygen.

Below the thermocline is the layer of cold, dense water called the *hypolimnion*. This cold layer was not found in Big Bearskin Lake. The lake does not seem to stratify. However, oxygen concentrations in the hypolimnion progressively decline due to the decomposition of plant and animal matter and respiration of benthic (bottom-dwelling) organisms.

The June 5 profile indicates that the lake is well mixed throughout the water column. By July 25, there was a steep decline in oxygen from 18 to 21 feet in the thermocline. Below 21 feet (in the hypolimnion), the water was devoid of oxygen. Most fish species have trouble tolerating oxygen concentrations less than about 4 ppm, so anglers are advised not to drop a line much lower than 20 ft in mid to late summer. The August 19 profile was quite similar to the July profile. The only slight difference was that the decline in oxygen concentrations in the metalimnion was slightly more rapid.

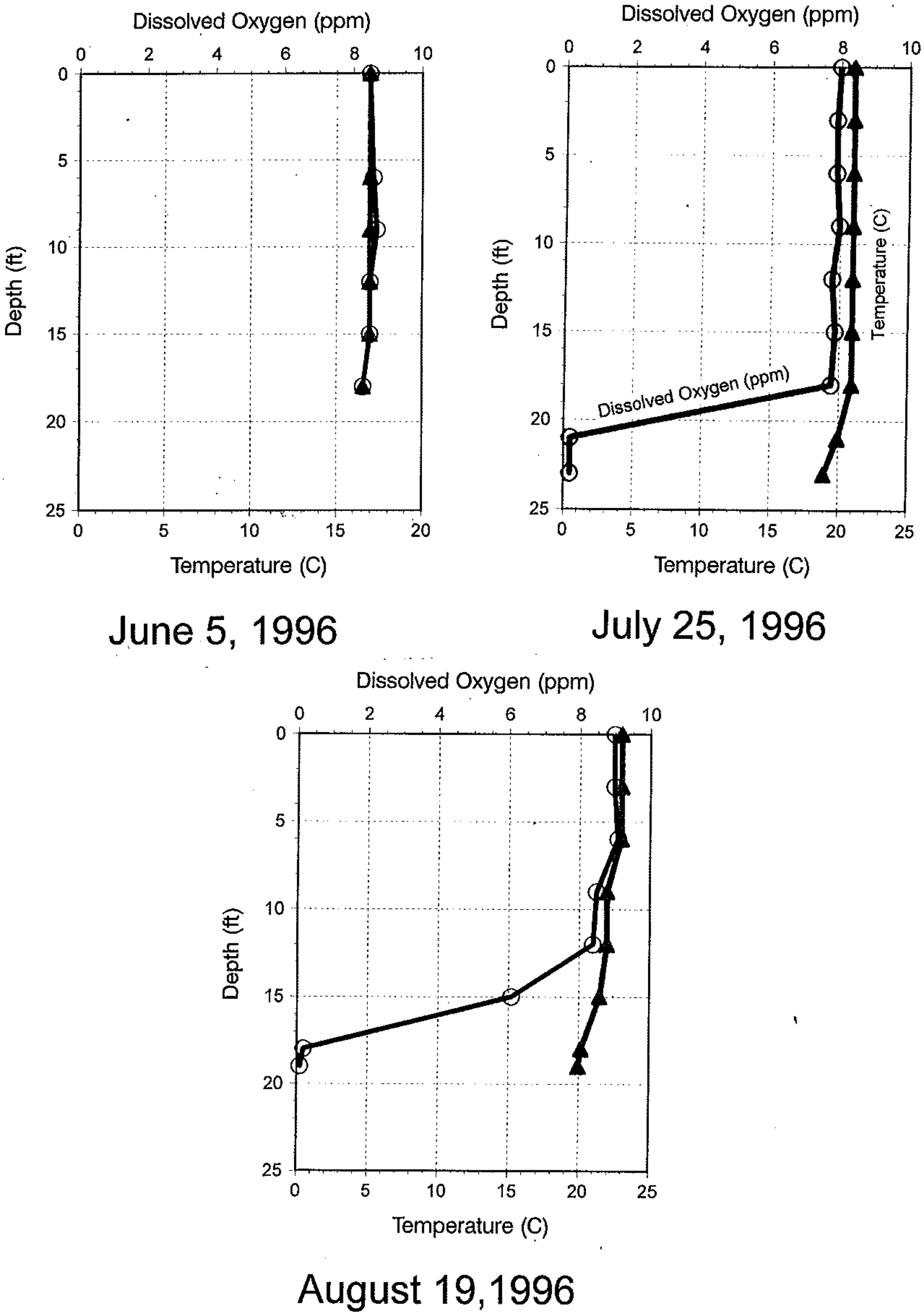
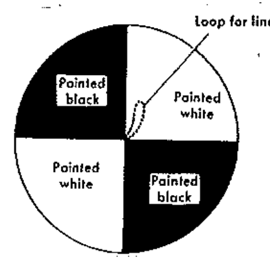


Figure 9. Dissolved oxygen/temperature profiles for the summer of 1996 for Big Bearskin Lake.

Secchi Disc Transparency

The secchi disc clarity in Big Bearskin changes dramatically over the course of the summer. From a high of 20 feet in June to under 6 feet in August. The cause of the decline in clarity is the increase in algae.



Picture of a secchi disc. A secchi disc is used to determine the water clarity in water environments. The more clear the water the greater the depth you can see the secchi disc.

Table 5. Secchi disc data dissolved oxygen and temperature profile data for the summer of 1996.

secchi disc(ft)	**June 5, 1996** 20.0		**July 25, 1996** 7.3		**August 18, 1996** 5.9	
Depth (ft)	**Temperature (°C)**	**DO (mg/l)**	**Temperature (°C)**	**DO (mg/l)**	**Temperature (°C)**	**DO (mg/l)**
0	17.0	8.5	21.0	8.0	23.0	9.0
3	17.0	8.5	21.0	7.9	23.0	9.0
6	17.0	8.6	21.0	7.9	23.0	9.1
9	17.0	8.7	21.0	8.0	22.0	8.5
12	17.0	8.5	21.0	7.8	22.0	8.4
15	17.0	8.5	21.0	7.9	21.5	6.1
18	16.6	8.3	21.0	7.8	20.2	0.2
19	--	--	--	--	20.0	0.1
21	--	--	20.0	0.2	--	--
23	--	--	19.0	0.2	--	--

Other secchi disc readings from DNR records:

July 5, 1967: 7.0 feet

No date 1983: 3.2 feet

Nutrients in Big Bearskin Lake

Summer water chemistry data collected during 1996 included secchi disc, total phosphorus (TP), chlorophyll a (Chl a), total kjeldahl nitrogen (TKN), ammonia (NH_3), nitrate (NO_3), and conductivity (Cond) (Table 6). Samples were collected at the surface and two feet off the bottom in the deepest area of Big Bearskin Lake. Total phosphorus was not much higher in the bottom water than the top water indicating there is not much phosphorus release from the bottom material (sediments or plants).

Table 6. Summer monitoring results for Big Bearskin Lake and the Muskie Creek Inlet stream

Lake Data	June 5	July 25	August 19	Summer Average
Secchi disc (ft)	20.0	7.3	5.9	11.1
Total phosphorus - top (ppb)	15	26	24	22
Total phosphorus - bottom (ppb)	14	30	34	26
Chlorophyll a (ppb)	1	14	11	9
Total kjeldahl - N (ppb)	300	400	400	366
Nitrate - N -top (ppb)	17	<10	<10	12
Nitrate - N - bottom (ppb)	11	<10	<10	<10
Conductivity (micro umhos)	78	90	91	86
Dissolved oxygen - top (ppm)	8.5	8.0	9.0	8.5
Dissolved oxygen - bottom (ppm)	8.3	7.8	0.2	5.4
Temperature - top (C)	17	21	23	20
Temperature - bottom (C)	16	21	20	19
Stream flow (Muskie Creek)				
Total phosphorus (ppb)	23	20	18	20
Suspended solids (ppm)	5	<5	<5	<5

Algae

Gloeotrichia: the Algae Bloom Culprit
Those little green blobs that perennially cloud up Big Bearskin's water during the summer have been identified.

The mysterious algae is something called *Gloeotrichia* (pronounced glee-oh-tricky-ah), a type of blue-green algae that rises from the sediments in mid- to late summer that has ball-shaped colonies up to 2 mm in diameter (almost big enough to see).

An individual *Gloeotrichia* filament is quite small, but when bound together with many others in a colony, they can be visible and can cause a significant decrease in the lake's water clarity.

Despite the fact that the phosphorus concentrations in Big Bearskin are relatively low, *Gloeotrichia* is still able to thrive because of its unique life cycle.

During the majority of the year, *Gloeotrichia* remains on the lake bottom. Phosphorus is abundant in the sediments, and this species has the ability to take up extra phosphorus from the sediments and effectively stash it away to use later when phosphorus is in short supply. This time comes in mid-summer when the *Gloeotrichia* colonies ascend into the surface waters and form the infamous algae blooms in Big Bearskin.

Once in the water column, the colonies have enough phosphorus stored to allow them to double three or four times which dramatically decreases the clarity of the water. After their phosphorus stores are depleted, the colonies shut down and return to sediments.

Examples of algae shapes found in Big Bearskin Lake in 1996 are found in Figures 10, 11, and 12.

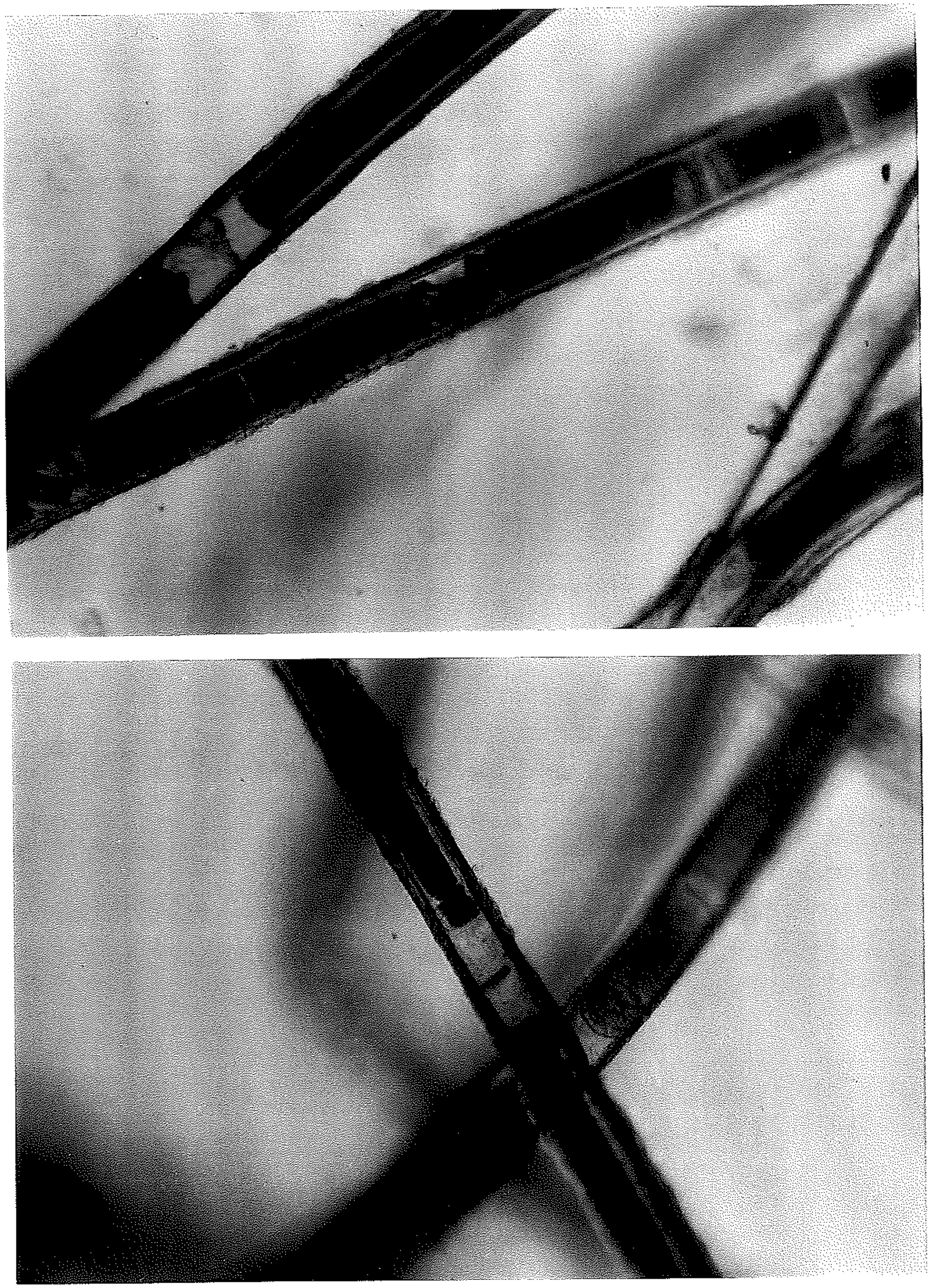


Figure 10. Filamentous algae found in Big Bearskin Lake on July 25, 1996.

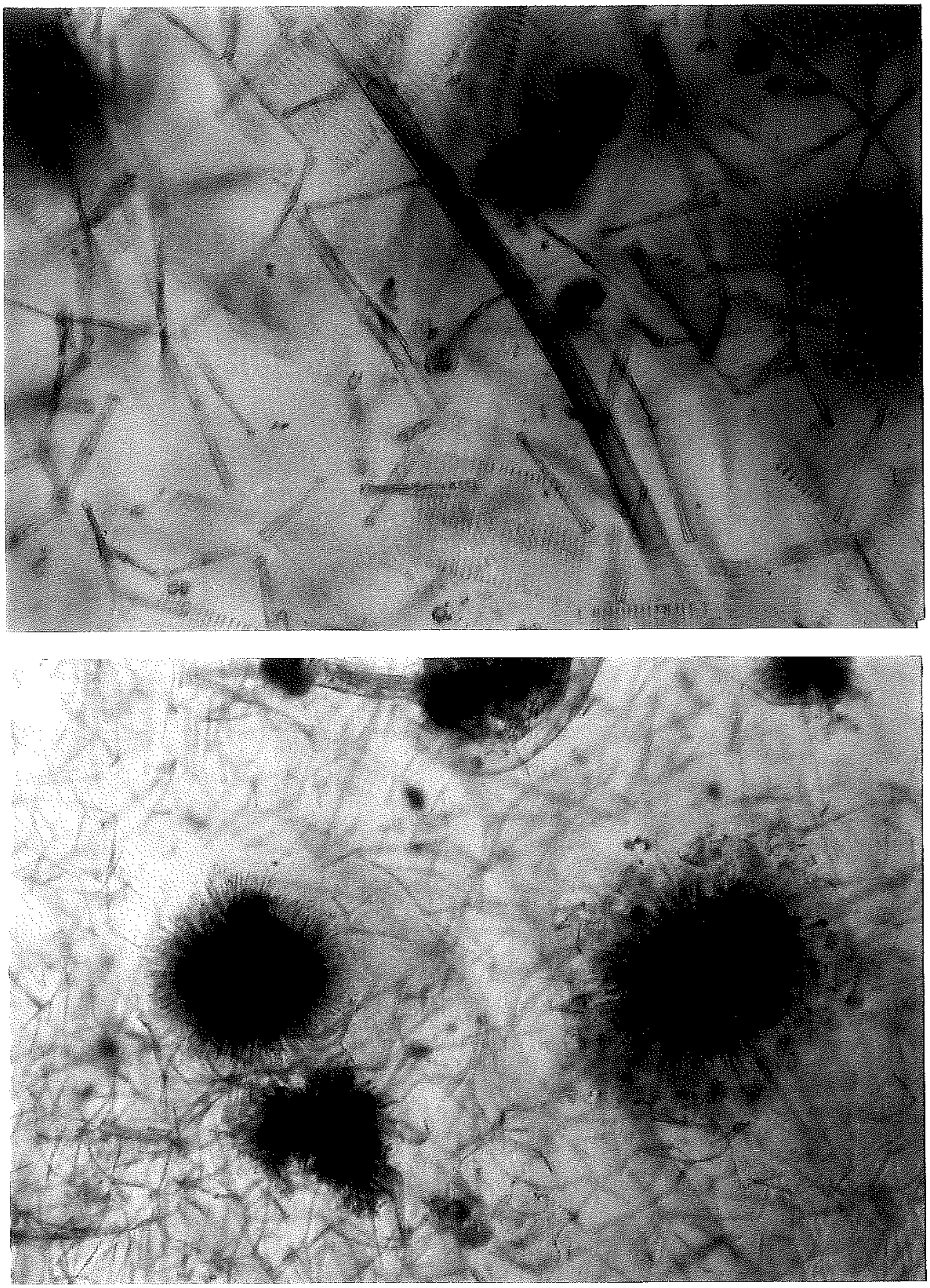


Figure 11. Algae found in Big Bearskin Lake on July 25, 1996.

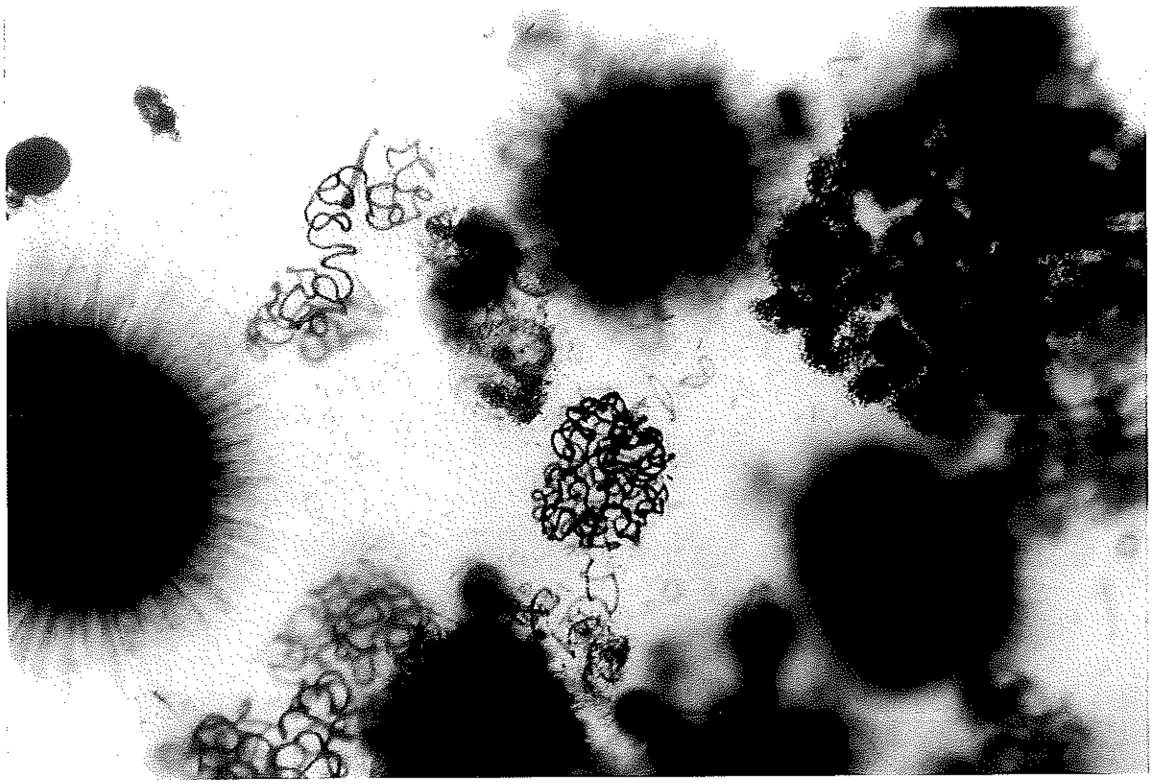


Figure 12. Gloetrichia algae found in Big Bearskin Lake on August 3, 1996.

Aquatic Plants

An aquatic plant survey was conducted on Big Bearskin Lake on July 25, 1996 and results are shown in Tables 7 and 8.

Aquatic plants coverage is about 8% of the lake bottom in Big Bearskin Lake.

Seventeen transects were run with sample points at 0-1.5 feet, 1.5-5 feet, 5-10 feet, and greater than 10 feet. Rooted plants were found sparely throughout Big Bearskin Lake. Plant coverage is shown in Figure 13. Most plant beds were found in areas with a soft bottom. Plant coverage on the bottom in 1997 is roughly 8% of the bottom area. This is a significant decrease form 1967 when plant coverage was estimated at 30% by the WDNR.

Table 7. Species list of the aquatic plants found in Big Bearskin Lake in 1996 and July 6, 7, 1967.

Plant Coverage Common Name	Scientific Name	1996 8%	1967 30%
Wild celery	*Vallisneria americana*	X	
Coontail	*Ceratophyllum demersum*	X	
Elodea	*Elodea canadensis*	X	X
Pickerel plant	*Pontederia cordata*	X	X
White lily	*Nymphaea sp*	X	X
Spatterdock	*Nuphar variegation*	X	X
Bulrush	*Scirpus sp*	X	X
Cabbage	*Potamogeton amplifolius*	X	X
Claspingleaf pondweed	*Potamogeton richardsonii*	X	X
Fern pondweed	*Potamogeton robbinsii*	X	X
Stringy pondweed	*Potamogeton sp*	X	X
Cattails	*Typha sp*	X	X
Little yellow waterlily	*Nuphar microphyllum*		X
Spikeruch	*Eleocharis palustris*		X
Arrowhead	*Sagittaria sp.*		X
Water milfoil	*Myriophyllum sp.*		X
Water buttercup	*Raniculus sp.*		X
Burreed	*Sparganium sp.*		X
Water smartweed	*Polygonum amphibium*		X

Examples of plants found in Big Bearskin are shown in Figures 14 and 15.

Table 8. Plant survey for Big Bearskin, 7.25.96

Station	Bottom	Plants
Muskie Creek	firm, peat, sand	spatterdock and white lily-scattered; few submerged plants
between T-1 - T-2		no submerged plants; spatterdock in small areas, next to white lily, pickerel plants, cattails
T-2	sand/gravel	no plants
T-2 - T-3	sand/gravel	no plants; small patch of bulrush by red boathouse; shoreline drops off fast
T-3	gravel/cobble	no plants; some spatterdock & pickerel plants
T-3 - T-4	soft sediments start at 9-10 ft	no plants; filamentous algae found 7-10 feet
T-4		no plants
T-4 - T-5		no plants
T-5	peaty, soft bottom	some emergent pickerel plants and spatterdock; some elodea, coontail, small sprouting cabbage 7' = peaty; patches of cabbage - surface 7' = elodea patches - surfaced; bay is shallow, with very soft peat (light brown); white lilies, filamentous algae lot of lily roots are uprooted, must be muskrat; claspingleaf, water celery, fern pondweed, stringy pondweed, when sand starts, plants disappear a lot of filamentous algae
T-6	gravel	no plants; nice bulrush bed
T-6 - T-7	gravel	no plants; heavy filamentous algae
T-7	sand/gravel	spatterdock, pickerel plants, filamentous algae
T-8	soft sediment	filamentous algae, pickerel plant, white lily
T-9	gravel	no plants; filamentous algae
T-10	gravel	no plants; filamentous algae
T-11	peat	no filamentous algae; elodea (5') surfaced, pickerel plants and spatterdock
T-12		bay- deep, no plants
T-13 - T-14 (ISLAND)		no plants, some pickerel on southeast side
T-15, T-16, and T-17	sand/ gravel	no plants

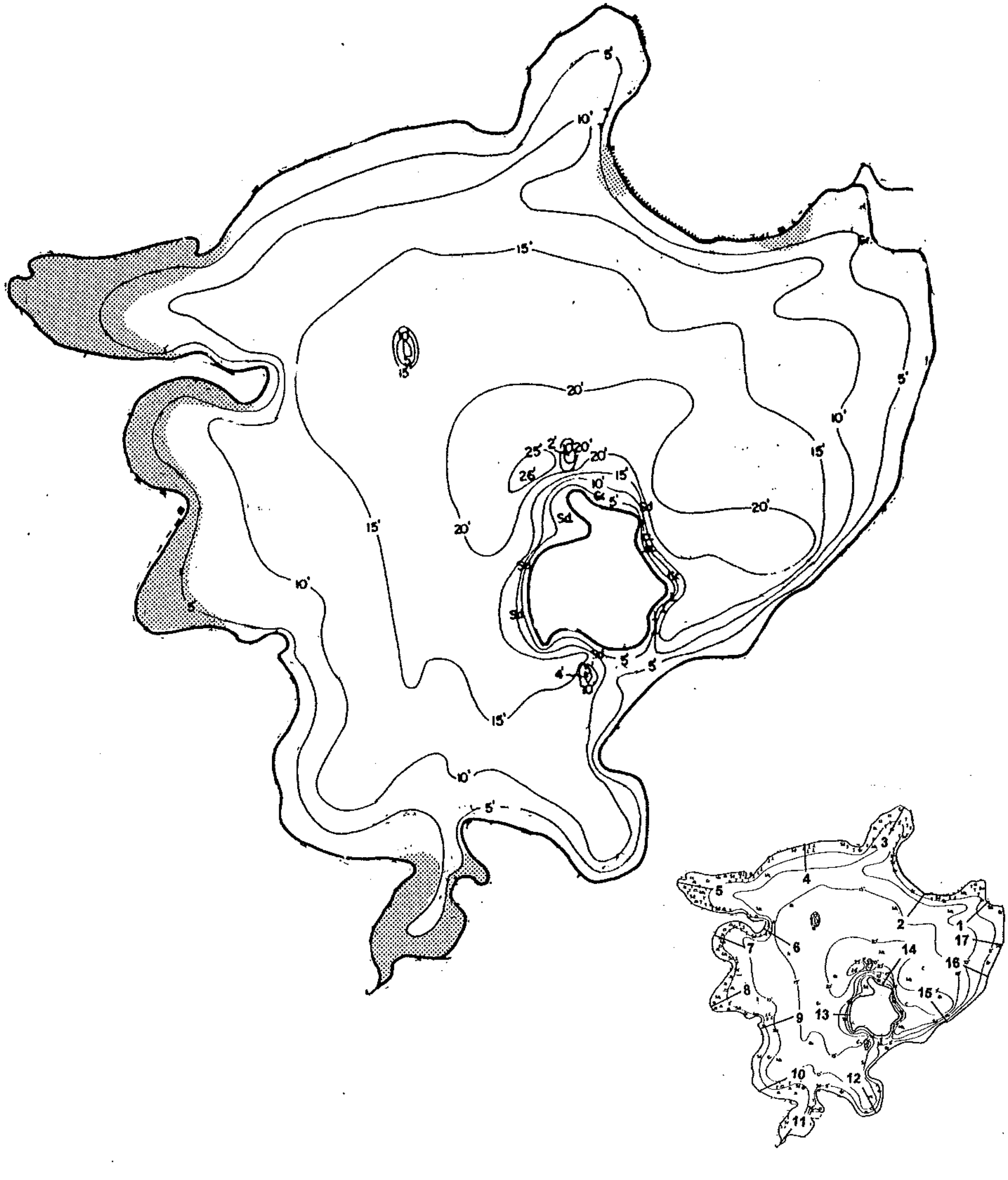


Figure 13. Plant coverage is 8% includes both emergent and submergent (4%). Aquatic plant map showing the general location of plants within Big Bearskin Lake. The small map in the lower right-hand corner shows the transects used to determine the plant species within Big Bearskin Lake.

Figure 14. Emergent plants found in bays in soft sediments on the west side of Big Bearskin Lake.

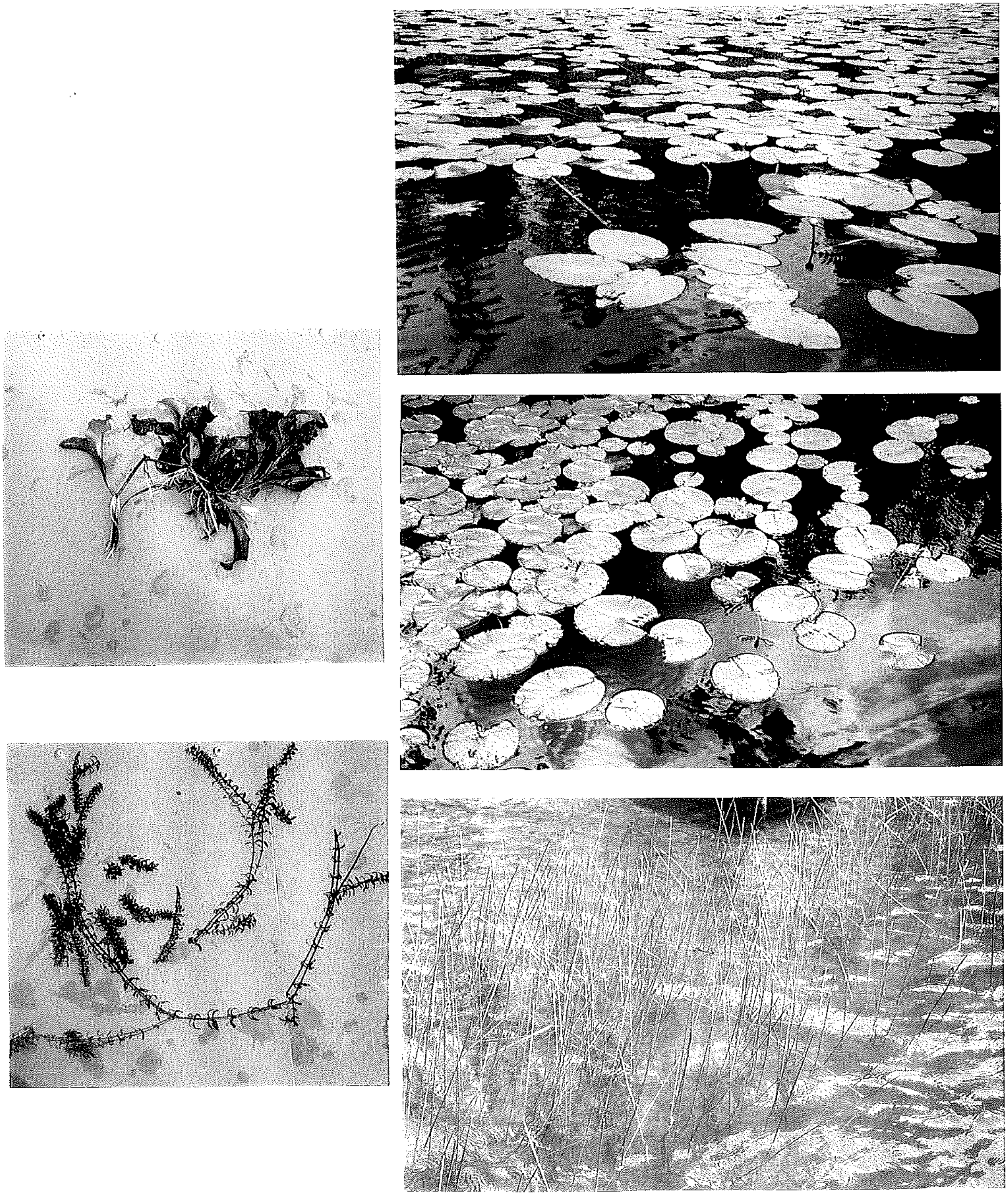


Figure 15. Submerged aquatic plants (left side) are rare in Big Bearskin. Water lilies and bulrush beds (right side) are found in the lake.

Zooplankton

Zooplankton are small crustaceans that eat algae and in turn are eaten by small fish. Big Bearskin Lake has big zooplankton throughout the summer.

Large *Daphnia*, either *D. pulex* or *D. pulicaria*, and, smaller ones, which look like *D. galeata mendotae* are shown in Figure 16.

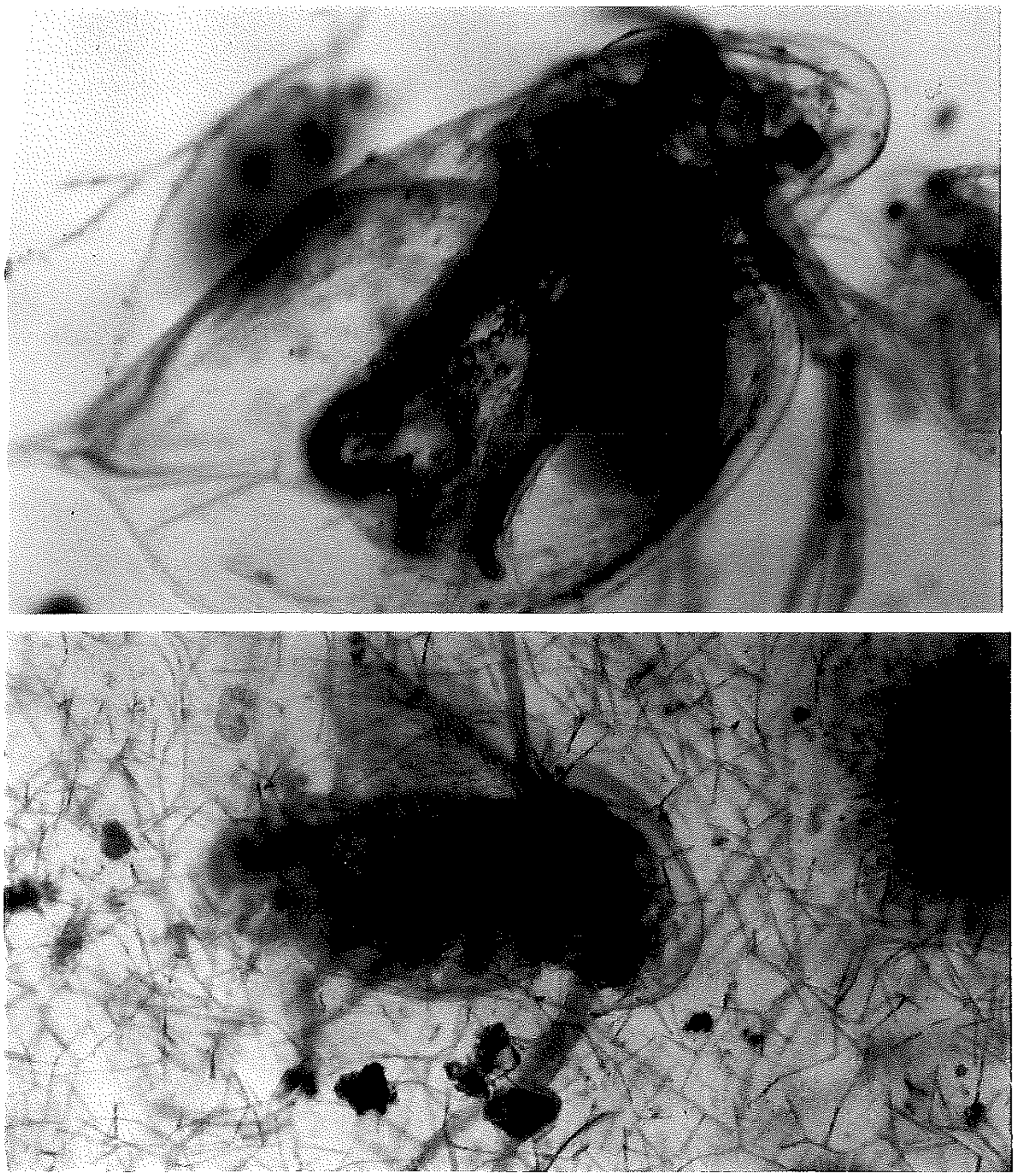


Figure 16. Big Bearskin zooplankton. (top) Daphnia collected on 6.5.96 and (bottom) daphnia collected on 7.25.96. Notice an increase in algae found in the background in July compared to June.

Crayfish

The rusty crayfish has definitely worn out its welcome in Big Bearskin Lake (Figure 17). This voracious non-native crayfish is rapidly becoming as notorious as other exotic invaders such as Eurasian watermilfoil and zebra mussels.

The largest negative impact of the rusty crayfish on a lake ecosystem is that it can decimate aquatic plant beds. Initially this might sound like a good deal for lake users (i.e. fewer weeds easier boating, better swimming). However, the importance of a healthy aquatic plant community far outweighs any inconveniences the plants may cause.

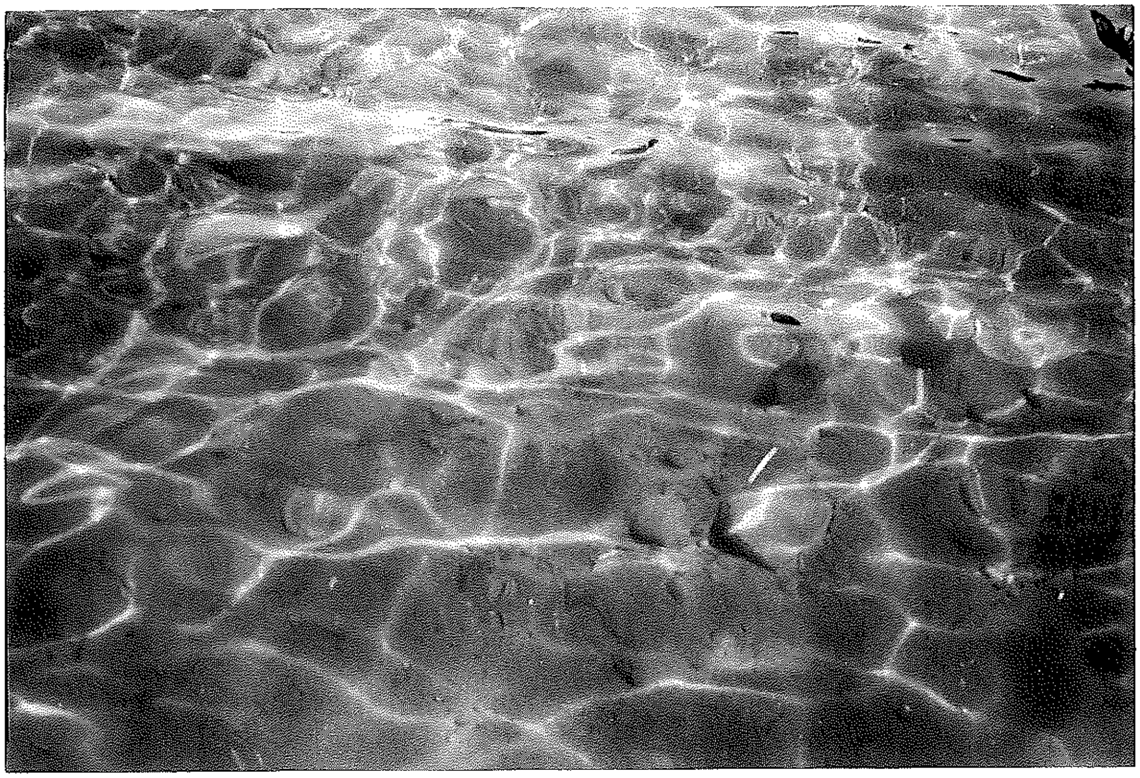
For example, aquatic plant beds stabilize bottom sediments, retard wave action that can cause shoreline erosion, and take up nutrients that may otherwise fuel algae blooms. Additionally, they provide habitat for invertebrates, shelter for young gamefish and panfish, and spawning grounds for gamefish such as northern pike.

Harvesting the rusty crayfish may be having a small impact on the population but the best course of action is to wait to see if the fish community can adapt to feeding on them.

So, while the feeding habits of the rusty crayfish may appear to reduce the aquatic plant coverage in the lake, there are additional ramifications for other parts of the Big Bearskin Lake ecosystem.

Presently there are no sure-fire methods for controlling rusty crayfish populations, but some possibilities have been proposed. There are chemicals that selectively kill crayfish, but none are known that selectively kill *rusty* crayfish and not other native species. Therefore, chemical control is not a prudent option. Intensive harvesting (see photo) is not likely to eradicate the rusty crayfish population, but may reduce the population's size and the ecological impacts that they have.

The best solution may just be to let Mother Nature take its course. This species is relatively new to Big Bearskin, and the resident fish species may simply need time to adapt to this obnoxious visitor. Perhaps if some of the fish that inhabit near shore areas (e.g. bass and sunfish) develop the ability to eat them, natural control may be realized.



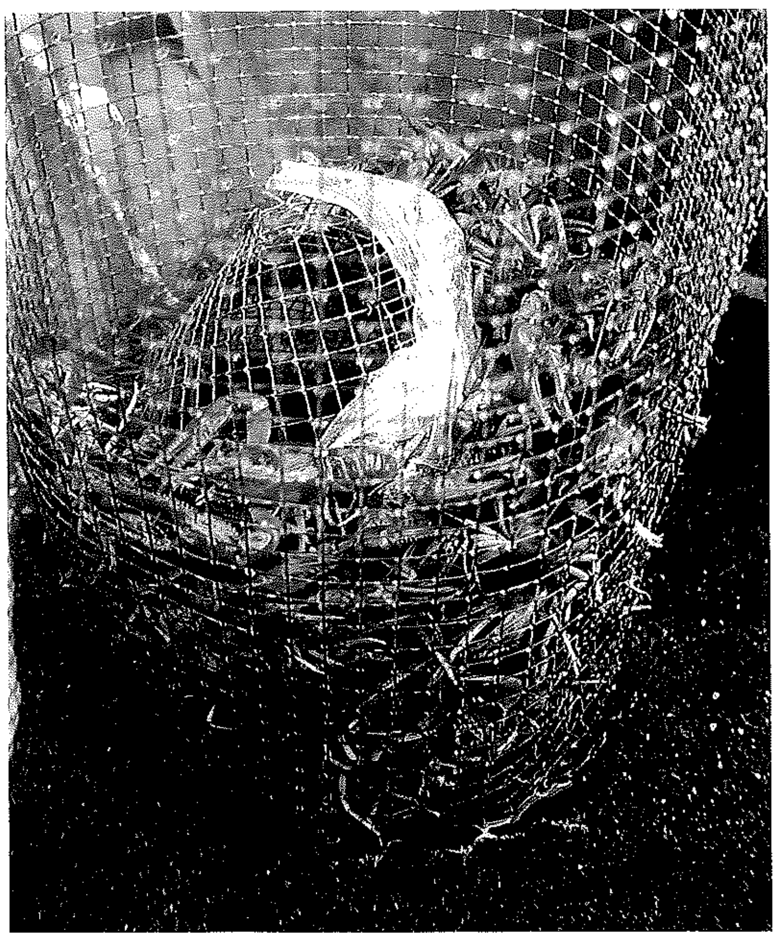


Figure 17. Rusty crayfish prefer a solid, sand and gravel bottom and Big Bearskin has plenty of that (top). Crayfish harvesting has been going on for at least ten years. Homeowners can still harvest over 150 pounds per weekend using baited traps (bottom).

Fish

Big Bearskin has a unique fish community for the area. Walleyes reproduce naturally and are so successful it turns out they may be stunted. Panfish numbers are low at the present time, but in the past they were abundant. Smallmouth bass do fairly well, but largemouth bass don't. Muskies are a factor and have a good population.

List below is a summary and some graphs from WDNR spring surveys. The WDNR also did a young-of-the-year survey and a creel survey.

The Department of Natural Resources surveyed Bearskin Lake in the spring of 1996 to determine the health of its fishery and results are shown in Figure 18.

Results showed that the lake has a good walleye population (Figure 18) and that good natural reproduction is occurring. There was also a fair number of walleyes between eight and sixteen inches present. The largest walleye that the DNR crews handled was 27.8 inches long and weighed a little over seven pounds.

The lake has a good musky population for a lake of its size. The WDNR captured 149 fish in the spring. The largest musky captured was 47.0 inches long.

There are also good numbers of smallmouth bass present. Over 80 fish were sampled in the spring. Several good sized smallmouth bass were captured and the largest was 19.0 inches long and weighed 3 lbs. 13 oz.

Other gamefish present in lesser numbers include northern pike and largemouth bass. The largest northern pike captured was 26.8 inches long. Only three largemouth bass have showed up in the sampling and the largest was 16.0 inches long and weighed 2 lbs. Sampling results from late June should give a better picture of the entire bass population.

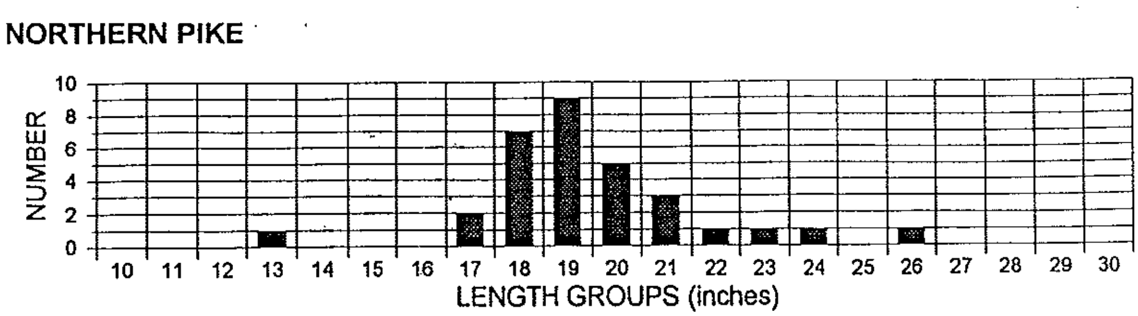
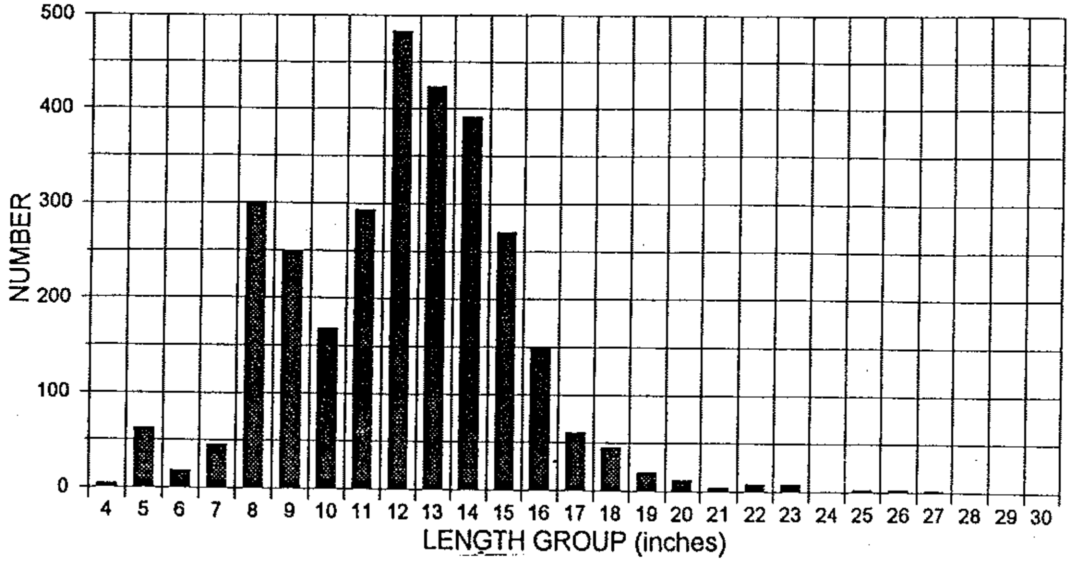
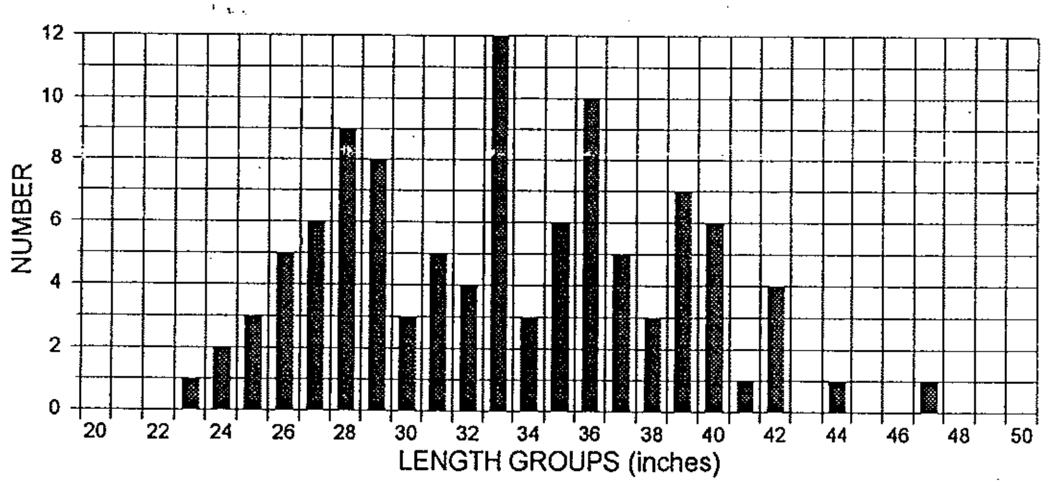


Figure 18. Fish size distribution based on fyke netting and two electrofishing runs this year.

WALLEYE



MUSKY



SMALLMOUTH BASS

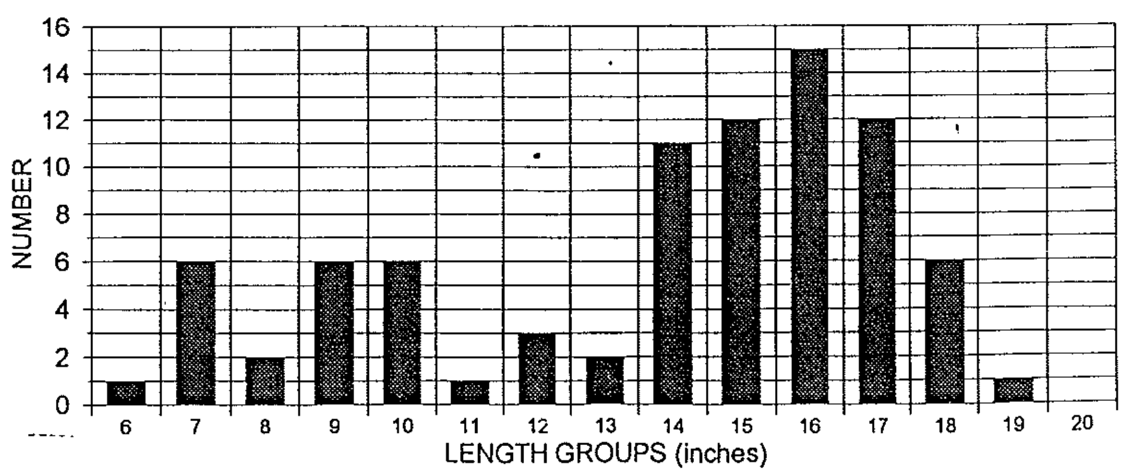


Figure 18. Concluded.

Big Bearskin Panfish Stocking

Big Bearskin used to have abundant sunfish based on WDNR fish surveys from 1961. However they have been scarce for a number of years. Bluegills and pumpkinseed sunfish have been transferred from Bear Lake to Big Bearskin on three occasions.

The most recent was in 1996. Bluegill and pumpkinseed sunfish were transferred from Bear Lake to Big Bearskin Lake from June 3 through 7, 1996 (Table 9). Transfer of fish was conducted by volunteers from the Big Bearskin Lake Association. Permission and permit granted from the Wisconsin DNR.

Table 9. Summary of panfish stocked in Big Bearskin Lake in 1996.

	Bluegills	Sunfish	Total
Number of fish transferred from Bear Lake to Big Bearskin Lake	1,169	2,677	3,846
Pounds of fish transferred from Bear Lake to Big Bearskin Lake	144	455	599
Average weight of fish transferred to Big Bearskin (in ounces)	2.0	2.7	--

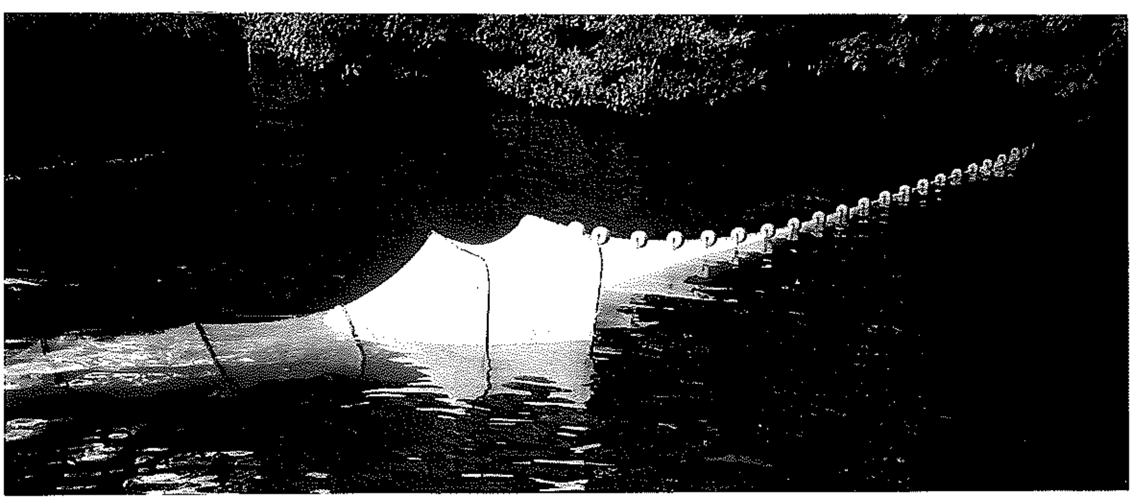


Figure 19. A small-mesh fyke net used to sample young of the year fish.

5. Lake Report Card

The status of Big Bearskin Lake could be graded as average. Although clarity is not great, phosphorus levels are about where they should be for lakes in this part of Wisconsin. Values for phosphorus, chlorophyll and secchi depth are within ecoregion values (Table 10) and that is good. However, there is room for improvement. We have constructed an arbitrary grading scale based on the range of values that are found in the Northern Lakes and Forest Ecoregion (Table 11).

Table 10. Summer average water quality characteristics for lakes in the Northern Lakes and Forest ecoregion, as noted in Descriptive Characteristics of the Seven Ecoregions in Minnesota, by G. Fandrei, S. Heiskary, and S. McCollar. 1988. Minnesota Pollution Control Agency.

Parameter	Northern Lakes & Forests Lake	1996 Big Bearskin	GRADE
Total Phosphorus (ug/l)			
epilimnion	14-27	22	C
hypolimnion	--	26	--
Chlorophyll mean (ug/l)	<10	8.7	C
Chlorophyll maximum (ug/l)	<15	14	C
Secchi disc (feet)	8-15	11.1	B
Total Kjeldahl Nitrogen (mg/l)	<0.750	0.367	--
Nitrite + Nitrate N (mg/l)	<0.01	<0.01	--
Conductivity (umhos/cm)	50-250	86	--
TN:TP Ratio	25:1-35:1	17:1	C
Plant Coverage	--	8%	--

A map showing the ecoregion area and the Big Bearskin Lake location is displayed in Figure 20.

The report card grades indicate that Big Bearskin Lake is in a protection status in terms of water chemistry, meaning no drastic lake or watershed restoration projects are needed. At this point in time the challenge is to keep the lake from getting more fertile.

An important component to watch and to control is nutrient inputs -- both phosphorus and nitrogen. If phosphorus concentrations increase to around 40 ppb or above, nuisance algae blooms could develop, and this could cause a cascade of problems.

Big Bearskin Lake gets a passing grade of a C.

Likewise, construction and lake resident activities can have significant impacts on phosphorus inputs. Studies in Maine show that clearing the trees off your property, even a partial clearing can increase phosphorus inputs to the lake from the runoff. Shoreland projects to reduce nutrient inputs are important.

Table 11. Report card grading guidelines (set up for Lakes in Northern Lakes and Forests).

	A	B	C	D	F
Total Phosphorus	<14	14-20	20-27	28-40	>40
Chlorophyll (mean)	<6	6-7	8-10	11-20	>20
Chlorophyll (max)	<10	10-13	14-15	30	>30
Secchi disc (feet)	>15	10-15	8-9	4.5-7.0	>4.5

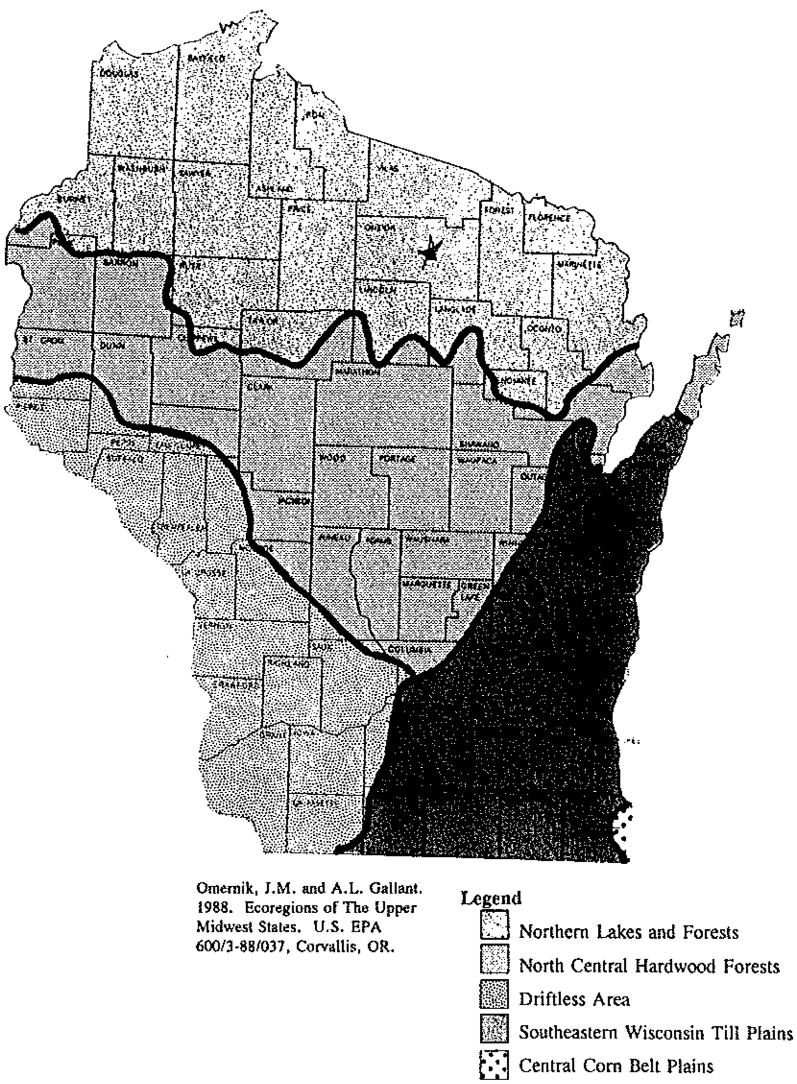


Figure 20. Big Bearskin Lake is in the "Northern Lakes and Forests" ecoregion. Many of these lakes have moderate fertility and good transparency.

6. What Will Big Bearskin Lake Look Like in the Future?

Lake modeling is a tool that aids in predicting what phosphorus concentrations should be in a lake based on the amount of fertilizers that come into a lake on an annual basis. A lake model can also be used to predict what future conditions could be if changes occur in the watershed that bring in more phosphorus or reduce the amount of phosphorus coming in.

Before the models could be run, nutrient and water budget for Big Bearskin Lake was needed. To estimate the nutrient budget, phosphorus concentrations were assigned for various land use delineations and then assuming a certain amount of runoff per year we estimated phosphorus inputs from various land uses. The nutrient input table (Table 12) shows that forested land is the major nutrient contributor to Big Bearskin Lake followed by rainfall which brings in phosphorus naturally. The variables with high uncertainty are groundwater inputs as well as septic tank inputs. Our estimates are that septic tank inputs are relatively low.

Table 12. Phosphorus inputs to Big Bearskin from a variety of sources, based on 1996 data.

Contributing Source	Acre	Hectares	Loading per Hectare	Yearly Loading (kg/yr)	Loading Percent (%)
Forests	1,799	728	0.09	66	41
Residential	146	59	0.50	30	18
Lakes and wetlands	308	125	0.10	13	8
Rainfall	400	162	0.30	49	30
On-site Systems	--	--	--	5	3
Total	~~2,653*~~ 2253	1,074*	--	163	100

* includes lake surface

Lake model predictions indicate that an additional 150 kilograms (330 pounds) of phosphorus coming into Big Bearskin Lake would cause lake phosphorus concentrations to soar to an average of 40 ppb. This would bring on algae blooms earlier than they come on now and would produce greater nuisance conditions then are currently experienced.

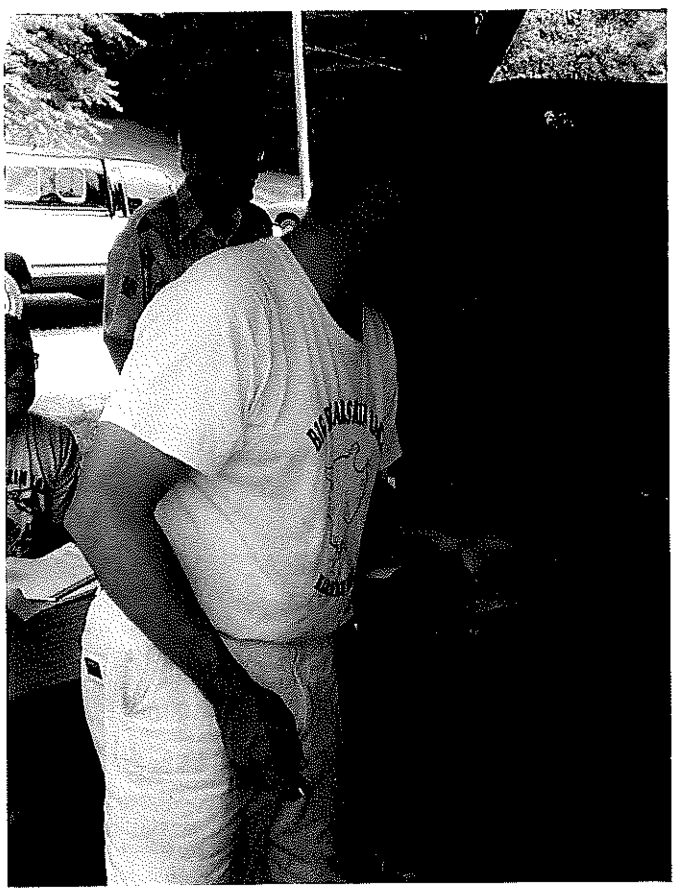
It is important to keep excess phosphorus from coming in Big Bearskin Lake.

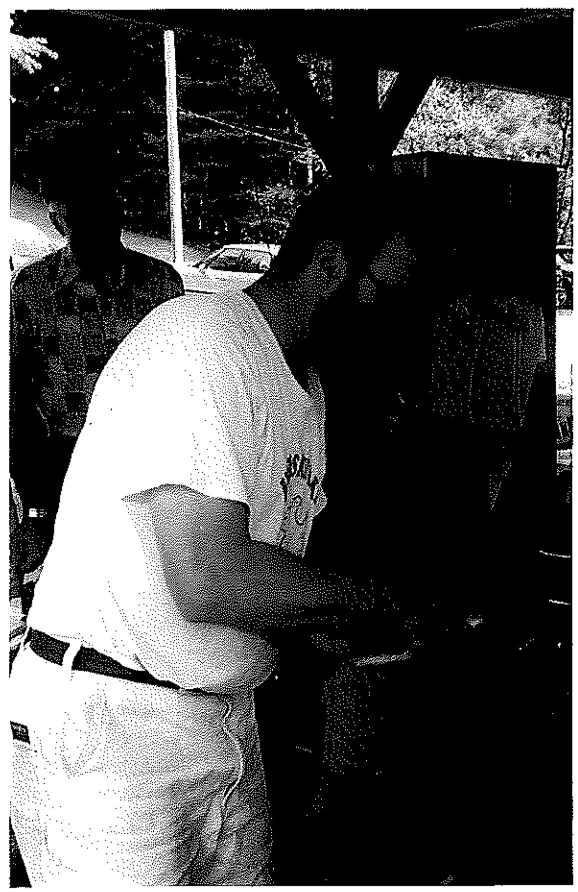
7. Management Plan for Big Bearskin Lake

Projects Already Completed or In Progress

The Big Bearskin Lake Association was formed in the late 1980s. Since the formation of the Lake Association a number of projects have been implemented to improve conditions in Big Bearskin Lake.

1. Built and placed 60 fish cribs.
2. Built and placed 37 half logs for fish structure.
3. Stocking of smallmouth bass over a four year period. The total number stocked exceeds 1800 in number, with the fish size ranging from 3 to 14 inches.
4. Transferred approximately 15,000 panfish from Bear Lake.
5. Built and supplied crayfish traps to members of the association to help reduce the population of the exotic Rusty crayfish.
6. Provided nesting areas for waterfowl.
7. Adopted a catch and release program for Bass.
8. Worked with WDNR to set-up special walleye fishing regulations.





Recommended Projects

A list of projects has been prepared that are intended to protect the water quality of the Big Bearskin Lake. Projects are listed below:

Watershed Projects

1. On-site system maintenance program
2. Lake shoreland projects.

Lake Projects

3. Summer Algae Bloom Reduction
4. Rusty Crayfish Control
5. Panfish Improvement Projects
6. Walleye Management
7. No Wake Zone in Bays for Plant Improvement
8. Continue a lake monitoring program.

Details of these projects are given in the following pages.

The Annual Meeting is a good time to pass around critical information.

Watershed Projects

1. On-site System Maintenance Program.

The septic tank/soil absorption field has been one of the most popular forms of on-site wastewater treatment for years. When soil conditions are proper and the system is well maintained, this is a very good system for wastewater treatment. The on-site is the dominant type of wastewater treatment found around Big Bearskin Lake today.

However, problems can develop if the on-site system has not been designed properly or well-maintained. Around Big Bearskin Lake there are on-site systems that need maintenance and upgrades. At the same time, it is good practice to ensure that systems that are functioning adequately now will continue to do so in the future.

This project calls for an organized program to be developed that makes homeowners aware of all they can do to maintain their on-site systems.

A description of activities associated with the on-site maintenance program are described below:

- WORKSHOP
  A workshop should be scheduled for Big Bearskin Lake residents to demonstrate the installation of a conforming septic system and the proper care and maintenance of a septic tank and septic system.

- SEPTIC TANK PUMPING CAMPAIGN
  Oneida County could work with the Big Bearskin Lake Association in a coordinated campaign effort to get every septic tank associated with a permanent residence pumped 2-3 years and seasonal systems pumped 4-6 years in the Shoreland area to help reduce phosphorous loading to the septic system drainfield.

- ORDINANCE IMPLEMENTATION
  Work to implement a County Ordinance, where septic systems must be "evaluated" at the time a property is transferred. The seller would obtain a septic system evaluation from Oneida County at the time of property transfer. The evaluation would determine if the septic system was "failing", "non-conforming", or "conforming". A "failing" septic system includes septic systems that discharge onto the ground surface, discharges into tiles and surface waters, and systems found to be contaminating a well. The County would require a "failing" system to be brought into compliance with the Oneida County Ordinance within 90 days of property transfer. A dry well, leaching pit, cesspool, or a septic system drainfield with less than 3-foot vertical separation instance from the bottom of the drainfield to the seasonal high water table or saturated soil conditions would be "non-conforming", but not required to be

upgraded at property transfer under the Oneida County Ordinance.

Through these County property transfer requirements a percentage of the septic systems that are not failing but are "non-conforming" would be upgraded to "conforming" if a prospective buyer was applying for a mortgage because the potential buyer's lending institution in some cases will not approve the buyer's loan request because the property to be purchased does not have a conforming septic system. The County's evaluation report would state whether or not the evaluated septic system is "conforming" or "non-conforming".

2. Lake Shoreland Projects.

Activities associated with lakeshore development can impact a lake in many ways. As cabin or home construction increases around a lake, lawns are installed and fertilized. Rooftops, driveways, sidewalks, and roads increase impervious surfaces. Impervious surfaces are surfaces that prevent runoff from infiltrating into the soil. When runoff doesn't infiltrate the amount of runoff increases, and this water picks up extra nutrients and sediments and delivers them to the lake. Another factor is when the runoff doesn't infiltrate into the soil, it is not very well filtered in the surface runoff.

So development around a lake can increase nutrient and sediment inputs to a lake compared to undeveloped conditions. However, cabin owners can implement some projects to minimize adverse impacts on their lake. That is what this alternative is about; the little things that can be done; and although they may seem trivial, everything is cumulative. For example, if each cabin owner could reduce phosphorous inputs to the lake by 1 pound/year, that may not sound like much. But look at it from the perspective of 70 or 80 cabin owners over 10 years. That represents 800 pounds of phosphorous that has not reached the lake.

Aquascaping/Native Plant Reestablishment

For long term success of a lake improvement project, its essential that Big Bearskin Lake maintains a diverse aquatic plant community. Often, a seed bank is already present in a lake, and disturbed areas will be recolonized naturally. When this does not occur, transplanting desirable submerged aquatic plants as may be the solution. This process is called aquascaping. The species being considered are chara, northern watermilfoil and various Potamogeton pondweeds that are native to the area.

At this time because of the rusty crayfish being in the lake, I recommend that lake residents wait until crayfish populations decline and see if aquatic plants come back on their own. The seedbank is still present.

Landscaping for Wildlife

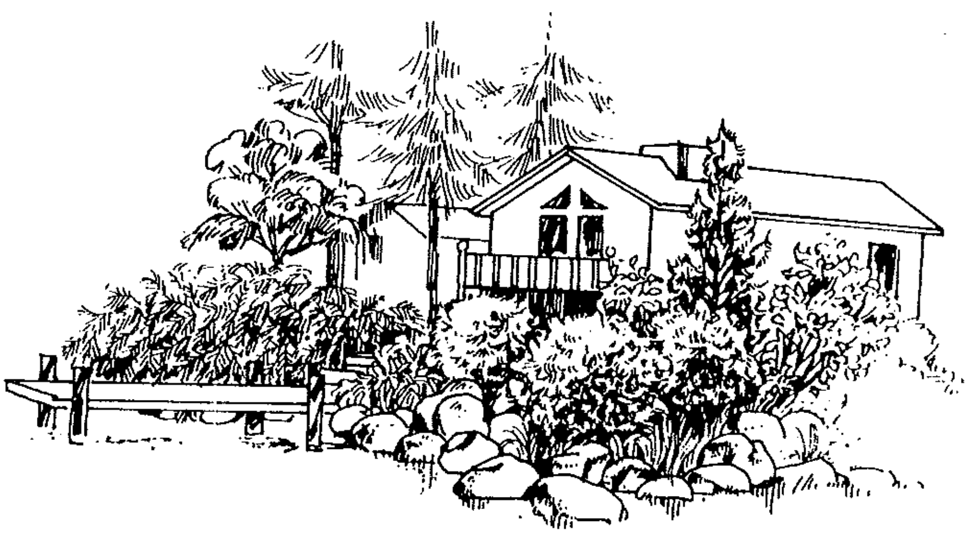
The careful planting of selected land plants and aquatic plants can improve water quality by reducing nutrients that run into the lake (land plants) and by taking up nutrients and by stabilizing bottom sediments (aquatic plants). Examples of typical plants are shown in the fact sheets that will be available to lake association members. Another benefit is planned landscaping can enhance wildlife by creating refuges and food sources for water fowl and aquatic animals. The combination of landscaping and aquascaping is appropriate for wetlands, streams, and lakes. For this project we are encouraging the use of vegetative buffers to help reduce erosion and nutrient inputs to the lakes.

Some benefits of this approach are:

- o Erosion can be a problem nearly anywhere in the watershed. It is especially critical adjacent to a water body because sediment delivery rates are so high. Landscaping upland areas may not only reduce soil erosion, but may reduce the use of fertilizer as well.

- o Transplanting native terrestrial and aquatic plants also aids in reestablishing native plants that have disappeared from the area. One of the objectives of this project is to see if homeowners can reestablish native vegetation in their nearshore areas.

Does Your Lot Look Like This?



A lot with natural vegetation can actually protect the lake by controlling erosion and reducing the need for fertilizers (it will attract wildlife also).

Lake Projects

3. Summer Algae Bloom Reduction

Summer algae blooms in Big Bearskin Lake decrease transparency to less than six feet, and on some days to less than four feet (based on secchi disc readings). *Gleotrichia,* a blue-green algae, is an important species in the summer, but other blue-green are present also. I think that the migration of *Gleotrichia* off the lake bottom and into the water column brings phosphorus up into the water column also.

Gleotrichia may artificially elevate phosphorus levels in Big Bearskin. The phosphorus concentration nearly doubles from June to July. The phosphorus source does not appear to be from the watershed. Muskie Creek runs clean nearly the whole year. It may be that the phosphorus increase is from migrating *Gleotrichia.*

Lake modeling results (Appendix A) show a couple of possible explanations. Based on watershed phosphorus input estimates, the Canfield/Bachman model predicts a spring phosphorus concentration of 24 ppb. In early June it is 15. The Reckhow Natural Lake model predicts a growing season phosphorus concentration of 7, when the actual value is about 22 ppb. One model indicates phosphorus could be an internal source (Reckhow) and the other model indicates the watershed could account for the observed phosphorus concentration.

The phosphorus/algae relationship is in sync in July and August based on trophic state index values (Table 13). However, algae is much lower in June compared to what would be expected based on phosphorus concentrations. It may be that the big daphnia (zooplankton) are eating algae and clearing up the water. Then as the summer progress, *Gleotrichia* and other blue-greens become more important and are not edible.

Table 13. Trophic state index values for the summer of 1996. The index is derived from equations that convert lake data to an index number. The lower the index number, the lower the phosphorus or the greater the secchi disc clarity. Therefore, the lower index number the better the water quality. There is a close relationship between phosphorus, algae, and water clarity. If phosphorus goes up, algae go up, and clarity goes down. When everything is in sync, the index values are nearly the same. If index values are not all the same, then some factors may be causing higher or lower values than expected. In July and August, index values are in sync, but not in June.

	June 5		July 25		August 19	
	TSI	Data	TSI	Data	TSI	Data
Phosphorus	49	15 ppb	53	26 ppb	53	24 ppb
Secchi	34	20 ft	49	7.3 ft	52	5.9 ft
Algae (chl a)	35	1 ppb	55	14 ppb	53	11 ppb

Results of bottom water phosphorus testing does not show elevated phosphorus concentrations. If phosphorus is coming from an internal source I would guess it is from *Gleotrichia*. Therefore if we could control *Gleotrichia*, we could increase summer transparency.

An alum application or possibly an iron application may be a way to tie up bottom phosphorus and reduce the intensity of the *Gleotrichia* bloom, thus improving water clarity. At this point, I don't see any other solution. Watershed phosphorus reduction does not appear to be the answer, also, aeration would not have the desired effect, and herbicides are only a short term solution.

Alum has been used in lakes with *Gleotrichia* with results being only partially successful. Peak bloom episodes were reduced, but algae were still abundant *(Jacoby et al., 1994. Response of a shallow, polymictic lake to buffered alum treatment. Lake and Reservoir Management 10: 103-112 and Jacoby, pers. comm.)*

A factor for Big Bearskin is that it has a low alkalinity of less than 5 ppm (WDNR fishery file, Woodruff). Therefore an alum buffering compound such as sodium aluminate would be needed otherwise an alum treatment could lower the pH, resulting in free aluminum and cause a major fish kill.

An alum project would be expensive. A typical cost is about $400 per acre and 75% of the lake bottom (300 acres) would be treated. This project would cost at least $120,000. Even with a Lake Protection grant , Big Bearskin would need to come up with a 25% match--either with volunteer labor worth $30,000 or with cash or a combination.

Because there are questions about the overall effectiveness of alum for controlling *Gleotrichia*, the low alkalinity of Bearskin with ramifications for a potential fish kill, and the high cost of a whole lake project, I recommend that the Big Bearskin Lake Association pursue a grant to conduct a pilot test on a small scale to see if an alum /sodium aluminate dose would be effective. At the same time a test could be set-up to evaluate the effectiveness of an iron treatment.

Possibly the WDNR Bureau of Research could conduct this. Also a consultant could. I have recently completed a test of this type for Knife Lake in central Minnesota. We found iron may work if reducing conditions in the bottom sediments are not too severe.

4. Rusty Crayfish Control

I have looked at the rusty crayfish situation from every angle. A variety of control measures have been tried over the last 15 years. None have produced satisfactory control. What seems to happen over time are two naturally occurring controls become important. First, the crayfish actually eat themselves out of business. With a decline of weed beds, their food source is diminished, and this will limit their population. Secondly, fish learn how to attack and eat the feisty crayfish. Once the fish community learns how to overcome the threatening posture and slightly oversized pinchers, they will be dining on crayfish. Therefore, one approach is to "let nature take its course".

You can tell when fish are starting to have an impact, because small crayfish will be eaten first, leaving only larger crayfish in the population. Big Bearskin Lake is not at this stage yet. If feasible, maybe lake association members could start measuring a subsample of the crayfish they harvest. Tally sheets have been prepared for the Lake Association. The idea is to see if the crayfish population is getting longer with time. This would give some insight into the impact of fish predation on the crayfish.

Another project to consider is a potentially new way to control crayfish.

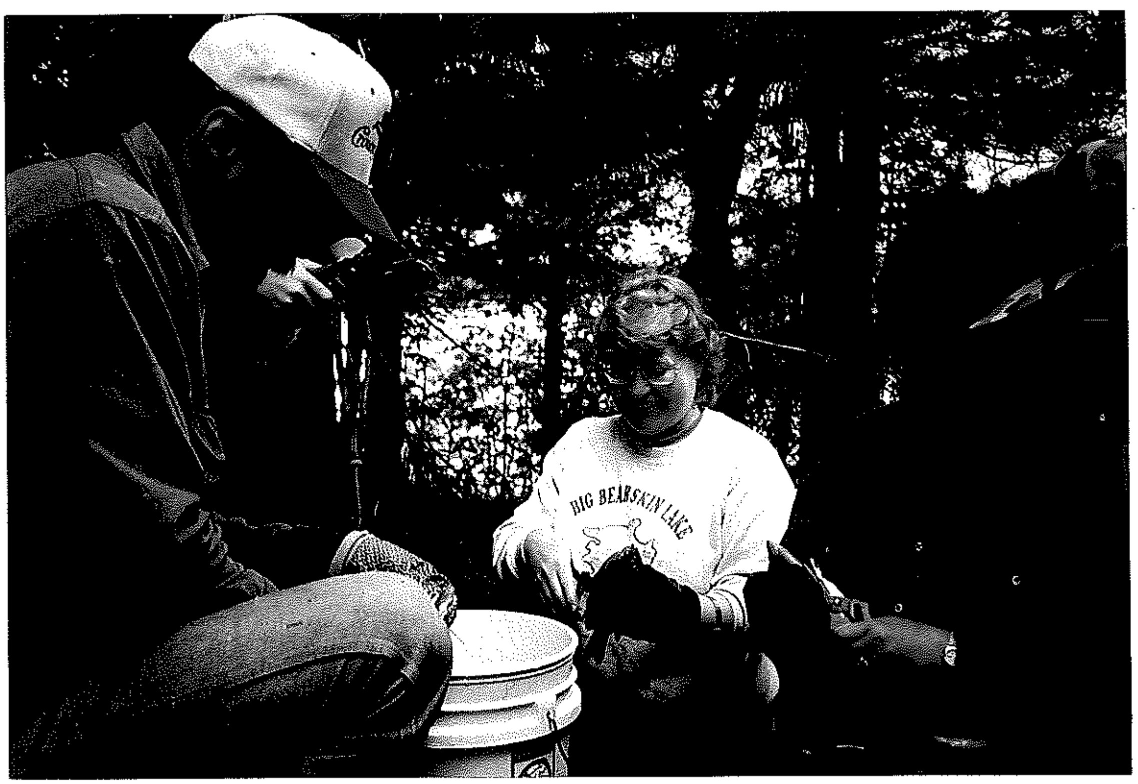
A Big Bearskin Lake resident has made an interesting observation. When WDNR shocking crews passed by his shoreline, he found what appeared to be dead crayfish the following morning. Could electro-fishing stun or kill crayfish or did he observe the empty carapaces from crayfish molting? I recommend the Lake Association follow-up on these observations and pursue the potential rusty crayfish control technique using electro-fishing gear.

5. Panfish Improvement Projects

The Big Bearskin Lake Association has been active in improving panfish population in Big Bearskin. Panfish transfers from Bear Lake have occurred on several occassions. However, panfish still are not abundant.

Aquatic plant reestablishment is probably a key component for panfish to make a comeback. Aquatic plants are currently limited by the grazing of crayfish, and also by poor water clarity. When the crayfish population starts to decline, plants will come back. Actually, stocking and enhancing the smallmouth bass population will help the panfish. I figure that smallmouth can help speed-up the rusty crayfish decline, which will then allow aquatic plants to come back, which will offer improved habitat and spawning success for panfish.

More smallmouth bass may mean more panfish.



Big Bearskin residents are fin clipping Bear Lake panfish before they are transferred and released in Big Bearskin.

6. Walleye Management

When this project first started, I agreed with lake residents that removing smaller walleyes would help the overall walleye population. The WDNR agreed as well. In the last year, a new walleye rule has been established for Big Bearskin. A bag limit of 3 walleyes where one out of the three can be over 14 inches. This rule will help thin out smaller walleyes and protect the larger, breeding population.

7. No Wake Zone in Bays for Plant Improvement

Because aquatic plants are valuable for water clarity and for fish habitat, protecting and enhancing aquatic plants is recommended. Establishing a 'no wake zone' in shallow bays could reduce wave action and the cutting action from props, and improve aquatic plant beds. The Lake Association should work with the WDNR and the county to establish 'no wake zones' in the appropriate bays.

Examples of shallow bay areas (shaded) where a 'no wake zone' could benefit aquatic plants.

8. Continue a lake monitoring program.

To evaluate Big Bearskin Lake, a monitoring program should be ongoing. Monitoring helps detect changes in lake quality as measured by total phosphorus, secchi disc, algae and macrophyte distribution.

Lake Monitoring Details
Secchi Disc transparencies should be taken through the summer monthly.

The surface water samples should be analyzed for the total phosphorus, total nitrogen, and chlorophyll a.

University of Wisconsin-Stevens Point has a very good lake testing program. Lakes are sampled in the spring and the fall and costs are about $120 per lake per year. Citizen volunteers can take the water samples. The UW-Stevens Point contact is Byron Shaw.

Appendix A

Lake Modeling Printouts

WISCONSIN LAKE MODEL SPREADSHEET

VERSION 2.00 - AUGUST 1996

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Although this model has been tested by WDNR, no warranty is
expressed or implied. See users manual prior model use.

LAKE ID Big Bearskin Lake

To auto load wtrshd data, enter county ID, hold ALT and type L.

WATERSHED COUNTY IDENT. NUMBER = 44 CO. NAME Oneida

HYDROLOGIC AND MORPHOMETRIC MODULE

		ENGLISH		METRIC	
TRIB. DRAINAGE AREA	=	2253.0	Ac.	9.12E+06	m^2
TOTAL UNIT RUNOFF	=	12.2	In.	0.310	m
ANNUAL RUNOFF VOLUME	=	2290.6	Ac-Ft.	2.83E+06	m^3
LAKE SURFACE AREA <As>	=	400.0	Ac.	1.62E+06	m^2
LAKE VOLUME <V>	=	4636.0	Ac-ft.	5.72E+06	m^3
LAKE MEAN DEPTH <z>	=	11.59	Ft.	3.53	m
PRECIP. - EVAP.	=	5.8	In.	0.15	m
HYDRAULIC LOADING	=	2483.9	Ac-Ft/Yr	3.06E+06	m^3/Yr
AREAL WATER LOAD <qs>	=	6.21E+00	Ft/Yr.	1.89E+00	m/Yr
LAKE FLUSHING RATE <p>	=	0.54	/Yr Tw =	1.87	Yr

PHOSPHORUS LOADING MODULE

LAND USE	AREA (AC)	LOW	MOST LIKELY	HIGH	LOADING PERCENT
		--LOADING (Kg/Ha-Yr)--			
ROW CROP AG	0.0	0.50	1.50	3.00	0.0
MIXED AG	0.0	0.80	1.00	1.40	0.0
PASTURE/GRASS	0.0	0.10	0.30	0.50	0.0
HD URBAN	0.0	1.00	1.30	2.00	0.0
MD URBAN	146.0	0.40	0.50	0.80	18.3
RURAL RES.	0.0	0.05	0.10	0.25	0.0
WETLANDS	308.0	0.10	0.10	0.10	7.7
FOREST	1799.0	0.05	0.09	0.18	40.7
OTHER LAND USE 1	0.0	0.00	0.00	0.00	0.0
OTHER LAND USE 2	0.0	0.00	0.00	0.00	0.0
LAKE SURFACE	400.0	0.10	0.30	1.00	30.1

POINT SOURCE WATER LOADING (m^3/Yr) =				0.00E+00	---
POINT SOURCE PHOS.(Kg/Yr)		0.00	0.00	0.00	0.0
SEP.TANK OUTPUT(kg/cp-yr)		0.30	0.50	0.80	---
# capita-years =	100.00	----	----	----	---
% P. RETAINED BY SOIL =		98	90	80	---
SEP. TANK LOADING (Kg/Yr)		0.60	5.00	16.00	3.1

TOTAL LOADINGS (Lb) =	1.97E+02	3.55E+02	8.13E+02	100.0
TOTAL LOADINGS (Kg) =	8.93E+01	1.61E+02	3.69E+02	100.0

AREAL LOADING(Lb/Ac-Yr)=	4.92E-01	8.88E-01	2.03E+00
AREAL LOADING(mg/m^2-yr)=	5.52E+01	9.95E+01	2.28E+02
% TOTAL PHOSPHORUS REDUCTION =		0	

To view a graph of phosphorus inputs expressed as percentages of the total phosphorus load, hold ALT and type G. When done viewing the graph, press any key to continue.

*********** *********** *********** *********** *********** *********** *********** * **

PHOSPHORUS PREDICTION MODULE

==

THE OBSERVED SPRING TOTAL PHOSPHORUS = 22 mg/m^3
THE OBSERVED GROWING SEASON PHOSPHORUS = 22 mg/m^3

Enter the spring and/or the growing season P concentration.
The lake models predict either an SPO or a GSM P concentration.
A predicted phosphorus concentration will appear only for those models where the observed value has been entered. An "NA" is returned if a model is not calculated.
Spring Overturn P conc = SPO; Growing Season Mean P conc = GSM

LAKE PHOSPHORUS MODELS	PREDICTED TOTAL PHOSPHORUS (mg/m^3)
1. WALKER, 1987 RESERVOIR MODEL (GSM)	26
14 26 59	
2. CANFIELD-BACHMANN, 1981, NATURAL LAKE MODEL (SPO)	24
3. CANFIELD-BACHMANN,1981,ARTIFICAL LAKE MODEL (SPO)	22
4. RECKHOW, 1979, NATURAL LAKE MODEL (GSM)	7
4 7 16	
5. RECKHOW, 1977, ANOXIC LAKE MODEL (GSM)	36
20 36 83	
6. RECKHOW, 1977 OXIC LAKES qs < 50 m/yr (GSM)	15
8 15 34	
7. RECKHOW, 1977 OXIC LAKES qs > 50 m/yr (GSM)	NA
NA NA NA	
8. WALKER 1977, GENERAL LAKE MODEL (SPO)	25
14 25 57	
9. VOLLENWEIDER, 1975 LAKE MODEL (SPO and GSM)	8
10. DILLON-RIGLER-KIRCHNER, 1975 LAKE MODEL (SPO)	13

P. RETENTION COEFF. <R> qs < 10 m/yr 0.75
P. RETENTION COEFF. <R> qs >= 10 m/yr NA

*********** *********** *********** *********** *********** *********** *********** * **

UNCERTAINTY ANALYSIS MODULE

==

LAKE RESPONSE MODEL	PREDICTED MINUS OBSERVE (mg/m^3)	PERCENT DIFF.	90 PERCENT CONFIDENC INTERVAL		
1.WALKER, 1987 RESERVOIR	4	18	8	65	
2.CANFIELD-BACHMANN, 1981	2	9	8	70	<
3.CANFIELD-BACHMANN, 1981	0	0	7	64	<
4.RECKHOW, 1979 GENERAL	-15	-68	2	18	
5.RECKHOW, 1977 ANOXIC	14	64	13	90	
6.RECKHOW, 1977 qs<50m/yr	-7	-32	4	37	
7.RECKHOW, 1977 qs>50m/yr	NA	NA	NA	NA	
8.WALKER, 1977 GENERAL	3	14	4	68	
9.VOLLENWEIDER, 1975	-14	-64	--	--	
10.DILLON-RIGLER-KIRCHNER	-9	-41	--	--	

<= Range within which 95% of the observations should fall.
See users manual discussion on the use of these models.

*********** *********** *********** *********** *********** *********** *********** * **

PARAMETER RANGE MODULE

Model input values MUST be within the ranges listed below.
WILMS displays FIT if inputs satisfy conditions;NO FIT if not.

PARAMETERS

AREAL WATER LOADING <qs=z/Tw> =	1.89E+00	m/yr
INFLOW PHOSPHORUS CONC.<LTw/z> =	0.053	mg/l
MEAN DEPTH <z> =	3.53	m
FLUSHING RATE <p> =	0.54	/yr
HYDRAULIC RETENTION TIME <Tw> =	1.87	yr
AREAL PHOSPHORUS LOADING <L> =	99.52	mg/m^2-yr

P = PREDICTED IN LAKE PHOS. CONCENTRATION mg/m^3

		Model data base size
1. WALKER, 1985 RESERVOIR MODEL		(41)
1.5 < z < 58 m 0.13 < Tw < 1.91 yr	<FIT>	
0.014 < LTw/z < 1.047 mg/l	P=	26
2. CANFIELD-BACHMANN, 1981 NATURAL LAKE MODEL		(290)
4< P < 2600 mg/m^3 30< L < 7600 mg/m^2-yr	<FIT>	
0.2< z <307 m 0.001< p <183/yr	P=	24
3. CANFIELD-BACHMANN, 1981 ARTIFICIAL LAKE MODEL		(433)
6< P <1500 mg/m^3 40< L <820,000 mg/m^2/yr	<FIT>	
0.6< z <59 m 0.019< p <1800/Yr	P=	22
4. RECKHOW, 1979 NATURAL LAKE MODEL		(47)
4< P <135 mg/m^3 70< L <31,400 mg/m^2-yr	<FIT>	
0.75< qs <187 m/yr	P=	7
5. RECKHOW,1977 ANOXIC LAKE MODEL	<FIT>	(21)
17< P < 610 mg/m^3 0.024< LTw/z< 0.621mg/l	P=	36
6. RECKHOW, 1977 OXIC LAKES qs < 50 m/yr	<FIT>	(33)
P < 60 mg/m^3 LTw/z < .298 mg/l	P=	15
7. RECKHOW, 1977 LAKES WITH qs > 50 m/yr		(28)
P < 135 mg/m^3 LTw/z < 0.178 mg/l	NA	
Tw < 0.25 yr z < 13 m	P=	NA
8. WALKER, 1977 GENERAL LAKE MODEL	<FIT>	(105)
P < 900 mg/m^3 LTw/z < 1.0 mg/l	P=	25
9. VOLLENWEIDER, 1975 GENERAL LAKE MODEL	<FIT>	
NOT AVAILABLE	P=	8
10. DILLON, RIGLER, KIRCHNER, 1975 LAKE MODEL		(15)
P < 15 mg/m^3 107 < L < 2210 mg/m^2-yr	<NO FIT>	
1.5< qs <223 m/yr 0.21< p < 63/yr	P=	13

LAKE CONDITION MODULE

ENTER THE AVE. SPRING MIXED T. PHOSPHORUS = 22 mg/m^3

THE GROWING SEASON CHLOROPHYLL a 10 mg/m^3

ENTER THE AVE. GROWING SEASON CHLOROPHYLL 9 mg/m^3

THE MIXED NATURAL LAKE SECCHI DEPTH =	1.63	m
THE STRATIFIED NATURAL LAKE SECCHI DEPTH =	2.09	m

THE MIXED IMPOUNDMENT SECCHI DEPTH =	1.29	m
THE STRATIFIED IMPOUNDMENT SECCHI DEPTH =	1.82	m

Regressions from: (Lillie, Graham and Rasmussen, 1993)

TROPHIC STATE INDICIES

ENTER TOTAL PHOSPHORUS	22	mg/m^3	T.S.I =	52
ENTER CHLOROPHYLL a =	9	mg/m^3	T.S.I =	51
ENTER SECCHI DISC DEPTH =	3.4	meters	T.S.I =	42

STEADY STATE RESPONSE TIME

Response time is estimated as the amount of time it takes for 95% of the steady-state phosphorus concentration to occur. This time is equal to three times the phos. residence time. The in-lake total P conc.s are taken from the observed SPO and GSM P conc.s entered at the top of the Phosphorus Prediction Module.
PRIOR TO USING THIS MODULE, PERFORM THE MODEL FITTING PROCEDURE AS OUTLINED IN THE USER'S MANUAL.

LAKE FLUSHING RATE <p> =	0.54	/Yr
PHOS RETENTION COEFF. <Rp> =	0.58	
PHOS RESIDENCE TIME <Tp> =	0.78	Yr

where:
Rp = (INF. P CONC. - AVG. INLAKE P CONC.) / INF. P CONC.
Tp = (1 - Rp) / p

RESPONSE TIME <Tr> = 2.3 Yr APPROXIMATELY

WATER AND NUTRIENT OUTFLOW MODULE

THE AVE. ANNUAL SURFACE TOTAL PHOSPHORUS = 22 mg/m^3

ANNUAL DISCHARGE = 2.48E+03 AF => 3.06E+06 m^3

ANNUAL OUTFLOW LOADING = 142.1 LB => 64.4 Kg

WATERSHED LOAD BACK CALCULATION MODULE

This section will calculate predicted phosphorus loads for each model given an in-lake phosphorus concentration.

Enter the spring and/or the growing season P concentration. WILMS will calculate a watershed load using the appropriate models. An "NA" is returned if the model requires either a spring overturn or growing season mean phosphorus concentration and one is not provided.
NOTE: To calculate the Canfield-Bachmann models, the user MUST enter the spring phos. concentration, hold ALT and PRESS "C".

OBSERVED SPRING OVERTURN TOT. PHOS. (SPO) =	40	mg/m^3
OBSERVED GROWING SEASON MEAN PHOS. (GSM)	40	mg/m^3

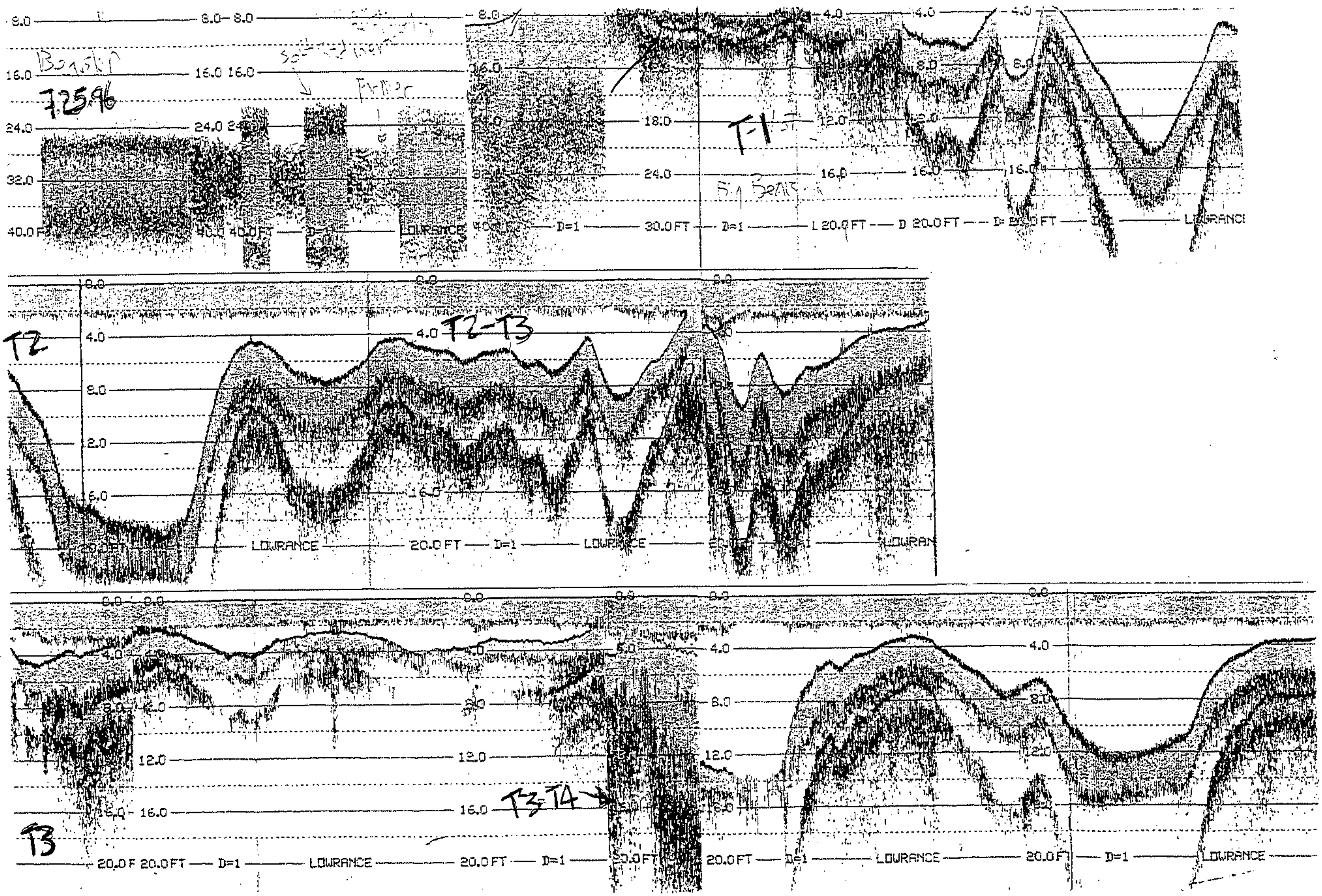
LAKE PHOSPHORUS MODELS	PREDICTED PHOSPHORUS LOAD (Kg/Yr)
1. WALKER, 1987, RESERVOIR MODEL (GSM)	248
2. CANFIELD-BACHMANN, 1981, NATURAL LAKE MODEL (SPO)	300
3. CANFIELD-BACHMANN,1981,ARTIFICAL LAKE MODEL (SPO)	400
4. RECKHOW, 1979, NATURAL LAKE MODEL (GSM)	898
5. RECKHOW, 1977, ANOXIC LAKE MODEL (GSM)	177
6. RECKHOW, 1977 OXIC LAKES qs < 50 m/yr (GSM)	436
7. RECKHOW, 1977 OXIC LAKES qs > 50 m/yr (GSM)	NA
8. WALKER 1977, GENERAL LAKE MODEL (SPO)	257
9. VOLLENWEIDER, 1975 LAKE MODEL (SPO and GSM)	770
10. DILLON-RIGLER-KIRCHNER, 1975 LAKE MODEL (SPO)	489

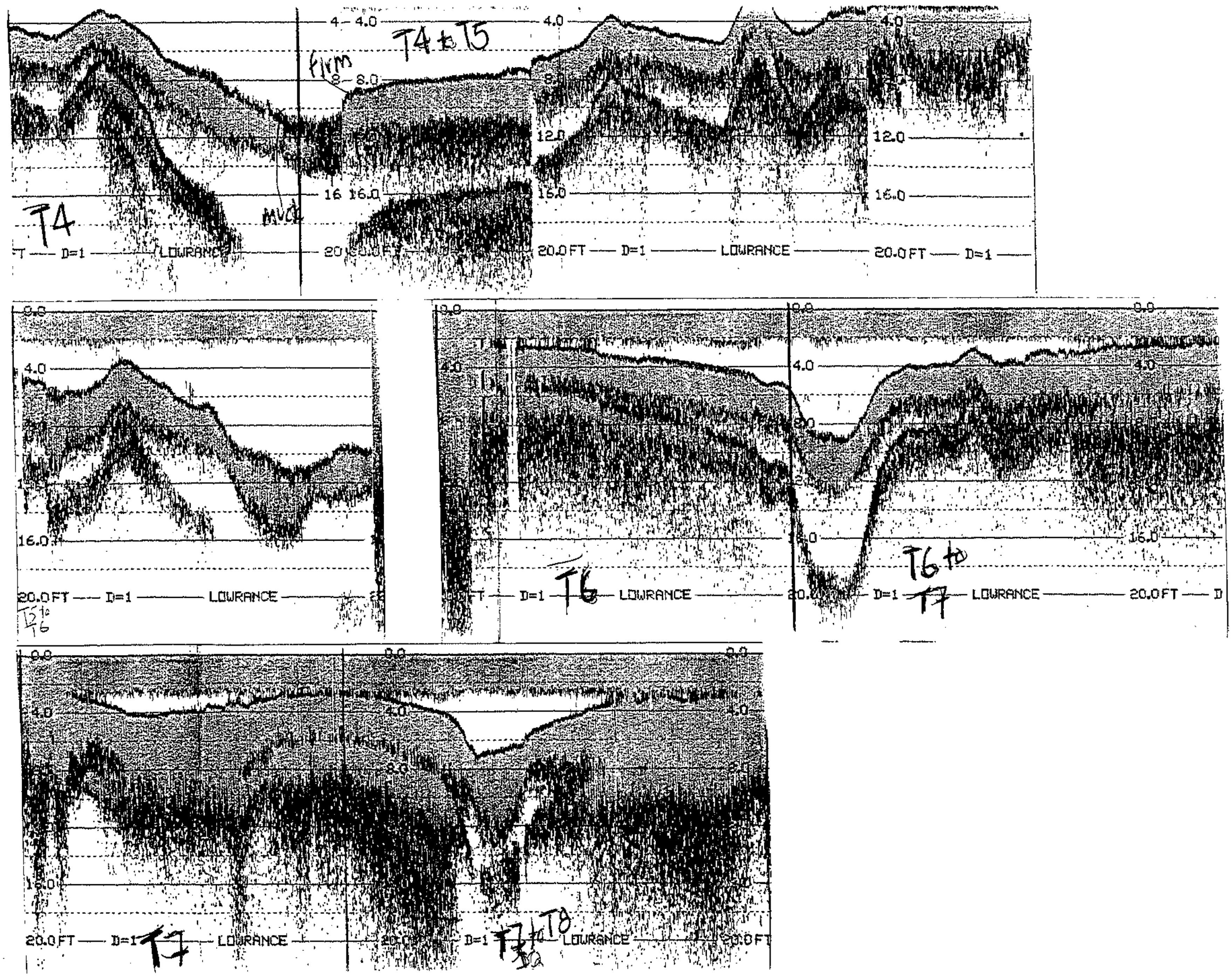
P. RETENTION COEFF. <R> qs < 10 m/yr 0.75
P. RETENTION COEFF. <R> qs >= 10 m/yr NA

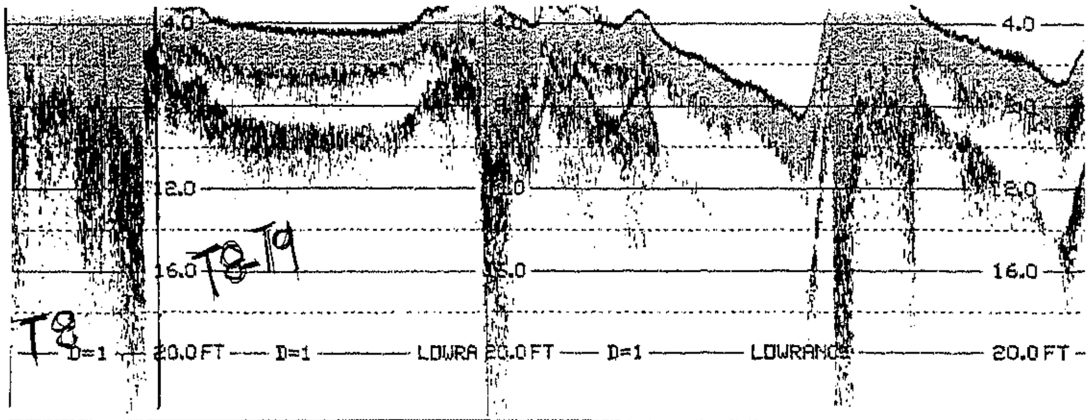
Appendix B

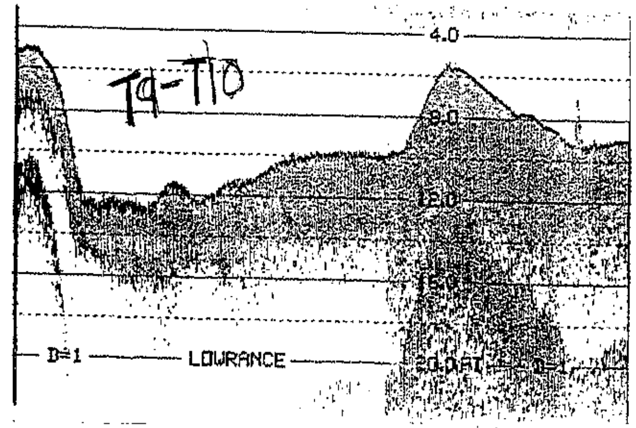
Aquatic Plant Survey Sonar Graphs

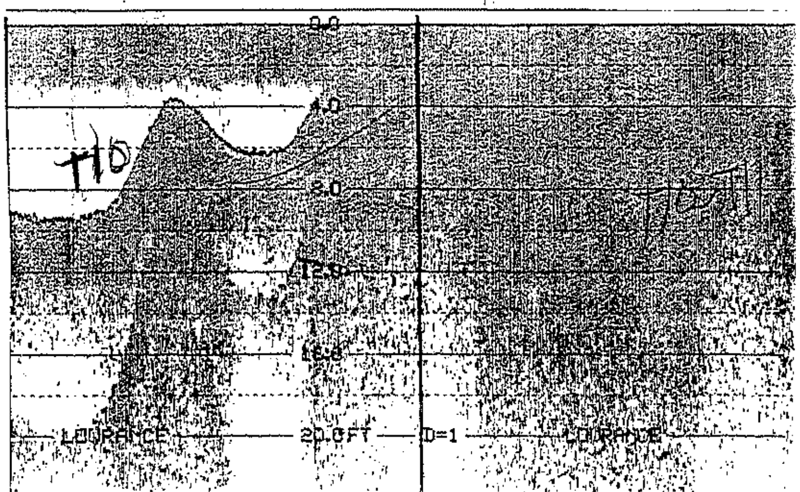
BIG BEARSKIN
7.25.96

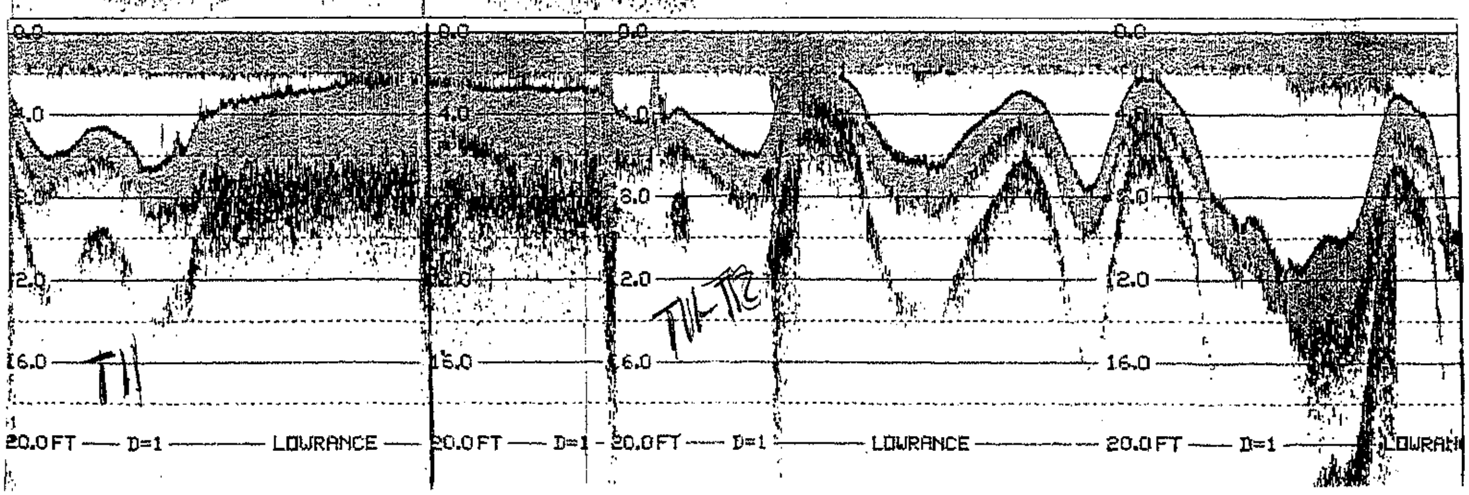


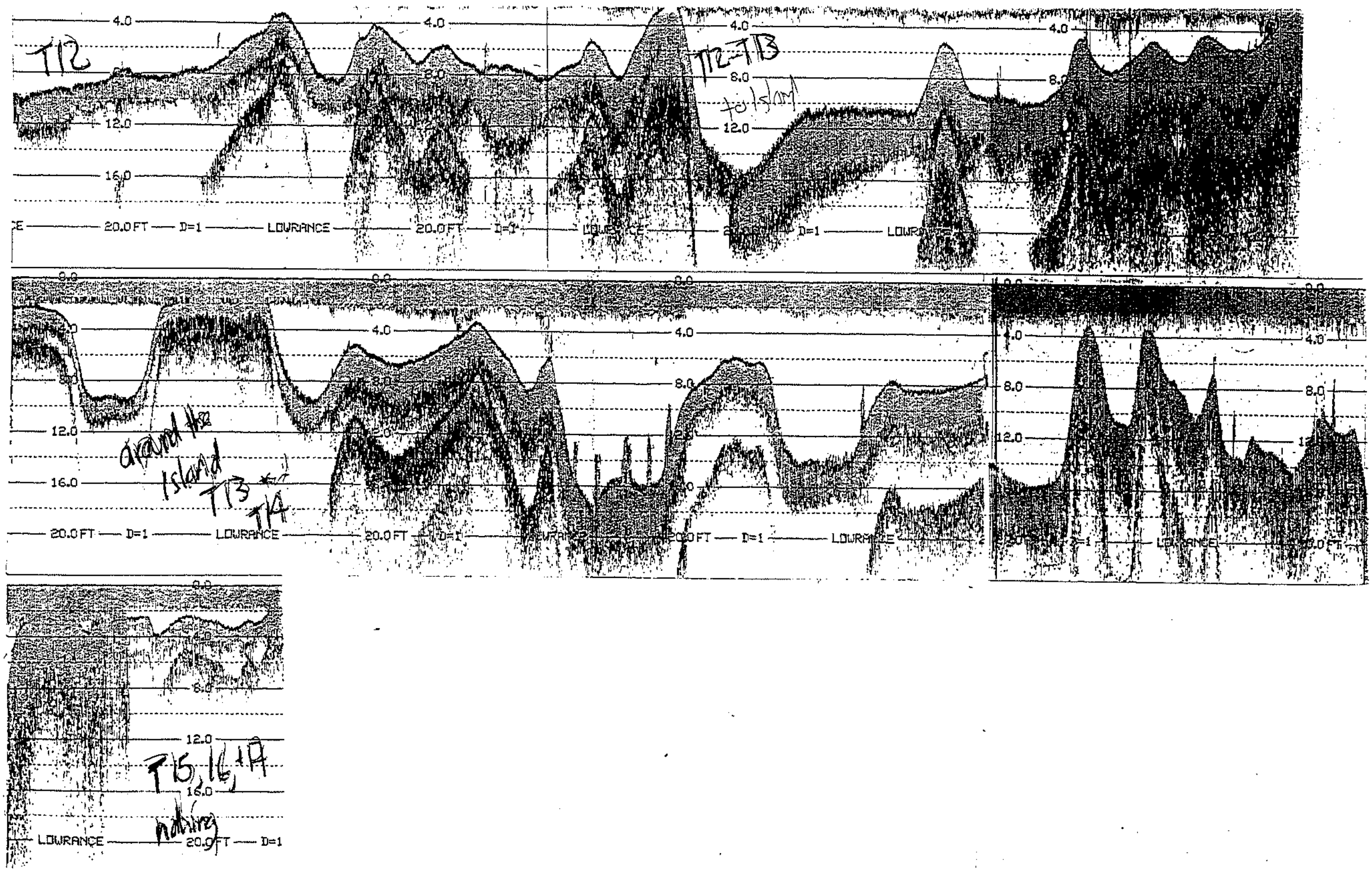

T4
T4 to T5
firm
MVCK
LOWRANCE
D=1
20.0 FT
T5 to T6
T6
T6 to T7
T7
T7 to T8


T8
T8-T9
4.0
12.0
16.0
D=1
20.0FT
LOWRA
LOWRANCE


T9-T10
4.0
8.0
12.0
D=1
LOWRANCE


T10
0.0
4.0
8.0
12.0
LOWRANCE
20.0FT
D=1


T11
T11-T12
0.0
4.0
8.0
12.0
16.0
20.0FT
D=1
LOWRANCE


T12
T12-T13
to island
around the island
T13
T14
T15, 16, + 17
nothing
4.0
8.0
12.0
16.0
20.0FT
D=1
LOWRANCE

Appendix C

WDNR Fish Survey Summaries

COMPILED BY: Robert Schlipf
1996

Big Bearskin Lake

Introduction:

Big Bearskin lake is located in Oneida County in north central Wisconsin. The lake is about 490 acres and has a maximum depth of 26 feet. Big Bearskin's littoral area consists primarily of gravel and rubble(40%), muck(35%), sand(20%) and a limited area of boulders. The purpose of this report is to present some past limnological data on Big Bearskin lake. The two main issues which will be dealt are fisheries and water quality.

Fisheries in Big Bearskin Lake:

A few studies have been done indicating the population levels of different fish species in Big Bearskin lake. It is important to note that each separate study may have used a different method in determining these population levels. Some of the data obtained is just the educated opinion of the person(s) conducting the survey. The information obtained is as follows:

Date: July 11, 1961
Method: Electrical Shocker

-Bluegills had a high population in the 4 to 8 inch range.
-Crappies had an excellent population level.
-Bullheads were abundant in the mud bays and a few were noted elsewhere.
-Large and smallmouth bass were found.
-Suckers had a large population in the weeded areas.
-Walleyes were present throughout the lake and had a large population in the 11 to 14 inch range.

Comments:

The individual conducting the survey believed that the walleyes were having a difficult time reproducing due to the excessive bluegill population. As a result, musky stocking was recommended to help balance the bluegill population. Crayfish were noted throughout the lake, but with the exception of one or two small areas did not seem abundant.

*Source: DNR North Central District; Woodruff, WI

Date: July 5-7,21,25
Method: Netting

- Walleyes had a good population level.
- Muskellunges had a fair population level.
- Bluegills had an extremely high population level.
- Pumpkin Seeds had an extremely high population level.

Comments:

Bluegills and Pumpkin Seeds were in excessive numbers, which was indicative of a stunted panfish condition at this time.

*Source: DNR North Central District; Woodruff, WI

Date: August 22, 1989
Method: Electrofishing 5.9 shoreline miles

- Walleyes 471
- Musky 9
- smallmouth bass 45
- largemouth bass 3

Comments:

Walleyes appear to be maintaining natural reproduction, while muskellunges are not maintaining natural reproduction levels.

*Source: DNR North Central District; Woodruff, WI

Date: October 15, 1991
Method: Electrofishing 5.9 shoreline miles

- Walleyes 335
- Musky 13
- smallmouth bass 7
- largemouth bass 5
- Yellow Perch 69
- Bluegill 25
- Rock Bass 8

*Source: DNR North Central District; Woodruff, WI

Water Quality of Big Bearskin Lake:

Big Bearskin lake is a drainage lake which receives its inflow from Birch lake via Musky creek. A few studies have been done indicating the amount of vegetation present and the water clarity of Big Bearskin lake. The most extensive study available was done in July of 1967 which indicated a few more factors. The information obtained is as follows:

Date: May 5, 1956
-Vegetation was noted as being abundant

Date: July 6, 1961
-Musky weed was noted as being heavy
-Water clarity: clear
-Secchi Disk Depth 8.5 ft

Date July 5-7, 1967
-Acquatic vegetation especially the submergent variety was abundant in the bay areas. Complaints were noted about the abundance of plants and also the algal bloom.
-Water clarity: clear, with a slight algal bloom present
-Secchi Disk Depth 7.0 ft
-Conductance 88 UMOHS/cm

Dissolved Oxygen Profile:

Depth (ft.)	Temp. °F	D.O.(mg/1)
0	69.5	9.0
9	66.0	8.0
25	63	7.0

Inlet: Musky Creek
width 20.0 ft
depth 0.75 ft
Q(in)=20.3 cfs

Outlet: Bearskin Creek
width 7.0 ft
depth 1.0 feet
Q(out)= 9.0 cfs

Date: October 3, 1967
-Algal Species noted: Volvox(60%), Anabaena(15%), Tabellaria(10%), Oscillatoria(5%), Fragilaria(5%), Melosira(3%) and Anaeystis(2%).

Date: 1983 Limnological Database
-Total Alkalinity 4.3 ppm
-pH 7.7
-Turbidity 2.8 JTU
-Mean Secchi Disk Depth 3.2 ft

*Source: DNR North Central District; Woodruff, WI

Remarks:

In the 1950s and 1960s it is apparent that vegetation was abundant in Big Bearskin lake. In the back of this report there is a list of the different types of aquatic plants which were identified on a survey in July of 1967. Unfortunately, most of these plants are probably now absent due to an aggressive crayfish population. Another problem with Big Bearskin lake is that it appears to have excessive algal growth. Studies were done at the beginning of July in 1961 and 1967. These studies show fairly good secchi disk readings, but in July of 1967 a slight algal bloom was noted. Unfortunately, secchi disk readings were not obtained in August when the bloom seems to be in full force. A limnological database for 1983 noted a mean secchi disk reading of only 3.2 feet. This is a cause for concern. Although the bloom is probably not severe enough to cause fish kills, it would be desirable to prevent it if possible. Consequently, Birch lake which outflows into Big Bearskin was investigated as well as logging practices in the 1880s.

Birch Lake: the water source for Big Bearskin

Birch lake is a drainage lake located to the east of Big Bearskin lake. It receives its inlet water from Seed lake and outlets into Big Bearskin lake via Musky creek. The purpose of looking into Birch lake is to determine if it has similar water quality characteristics as Big Bearskin lake. The Department of Natural Resources had very limited information on Birch lake. The following data was obtained on a study done on July 23, 1962.

-Secchi Disk Depth 9.0 ft
-Conductivity 96 UMOHS/cm
-pH 7.0
-water fairly clear

The only other information obtained from the DNR was that in June of 1975 the Northern Lake Service was approved o use chemicals to treat water weeds and algae. From this limited data it is difficult to determine whether Birch lake has algal growth comparable to that of Big Bearskin lake.

*Source: DNR North Central District Office; Woodruff, WI

Logging Practices near Big Bearskin Lake:

Eagle River Lumber Company, Olson and Meiklejohn of Rhinelander, and the Garth Lumber Company Gilkey and Anson were logging in the latter 1880s in the Big Bearskin lake area.[1] Logging can cause erosion which can lead to an excessive amount of nutrients being eroded into surrounding waters. Big Bearskin lake would seem to be much more susceptible to erosion than other lakes in the area as it has fairly dramatic elevation changes in a few areas surrounding the lake. This is evident in the enclosed map. Soil in this area is high in phosphorus content. Therefore excessive erosion could lead to an increased amount of phosphorus in the soil sediment in Big Bearskin lake. In the summer months phosphorus will be released from the sediment when dissolved oxygen levels approach 0 mg/1. This release of phosphorus can cause an algal bloom which can become extremely excessive in some situations. Internal phosphorus recycling may be more evident in Big Bearskin lake due to excessive erosion from logging. Therefore it is conceivable that Big Bearskin lake could have a much more excessive algal bloom than other lakes in the area.

Concluding Remarks:

Big Bearskin lake has a lack of weeds and aquatic plants due to a very aggressive crayfish population. This has been very detrimental to the panfish population, as they have nowhere to hide from larger game fish. The algal bloom on Big Bearskin lake appears to be worse in some years than others, but the overall situation does not seem to be getting any worse. It appears that internal recycling of phosphorus may be the cause of this bloom. John Panuska at the central district office in Madison has a new program (Wilms 2.0) which is supposed to be excellent at determining the amount of internal recycling occurring. He can be reached at (608)-267-7513. If you should have any further questions feel free to contact me, or you may want to contact Ron Theis at the North Central District office at (715)-358-9202.

[1] George Jones, "History of Lincoln, Oneida, and Vilas Counties, Wisconsin."

WISCONSIN
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George E. Meyer
Secretary

D.N.R. SURVEY SUMMARY

LAKE: Bearskin COUNTY: Oneida YEAR: 1996

The Department of Natural Resources is currently surveying Bearskin lake in Oneida county to determine the health of this fishery.

Our efforts so far have shown that the lake has a good walleye population and that good natural reproduction is occurring. There are also a fair number of walleyes between eight and sixteen inches present. The largest walleye that our crews handled on this lake this spring was 27.8 inches long and weighed a little over 7 pounds.

The lake has a good musky population for a lake of its size. We have captured 149 fish so far this spring. The largest musky that we captured was 47.0 inches long.

There are also good numbers of smallmouth bass present. We have captured over 80 fish so far this spring. Several good sized smallmouth bass were captured and the largest was 19.0 inches long and weighed 3 lbs. 13 oz.

Other gamefish present in lesser numbers include northern pike and largemouth bass. The largest northern pike captured so far was 26.8 inches long. Only three largemouth bass have showed up in our sampling and the largest was 16.0 inches long and weighed 2 lbs. Our sampling in late June should give us a better picture of the entire bass population.

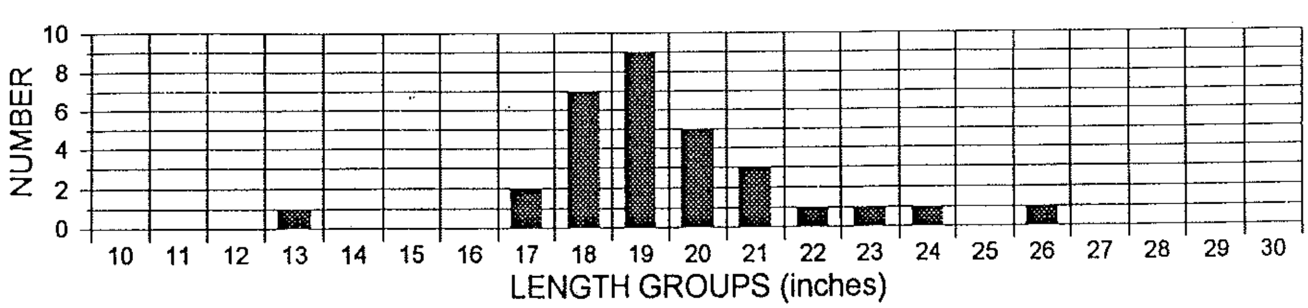
We will also be taking a closer look at the panfish species present in our June sampling. Yellow perch, bluegills, and black crappies have been captured in our earlier survey work.

These results are only preliminary and we will be sampling this lake at various times throughout the coming year as part of our comprehensive survey. Complete results of our fish population and creel (angler) surveys should be available by June of 1997. If you are interested in a copies of these surveys or have any questions about this lake contact DNR fisheries manager Ron Theis at the address given above.

Gamefish Length Frequency Information:

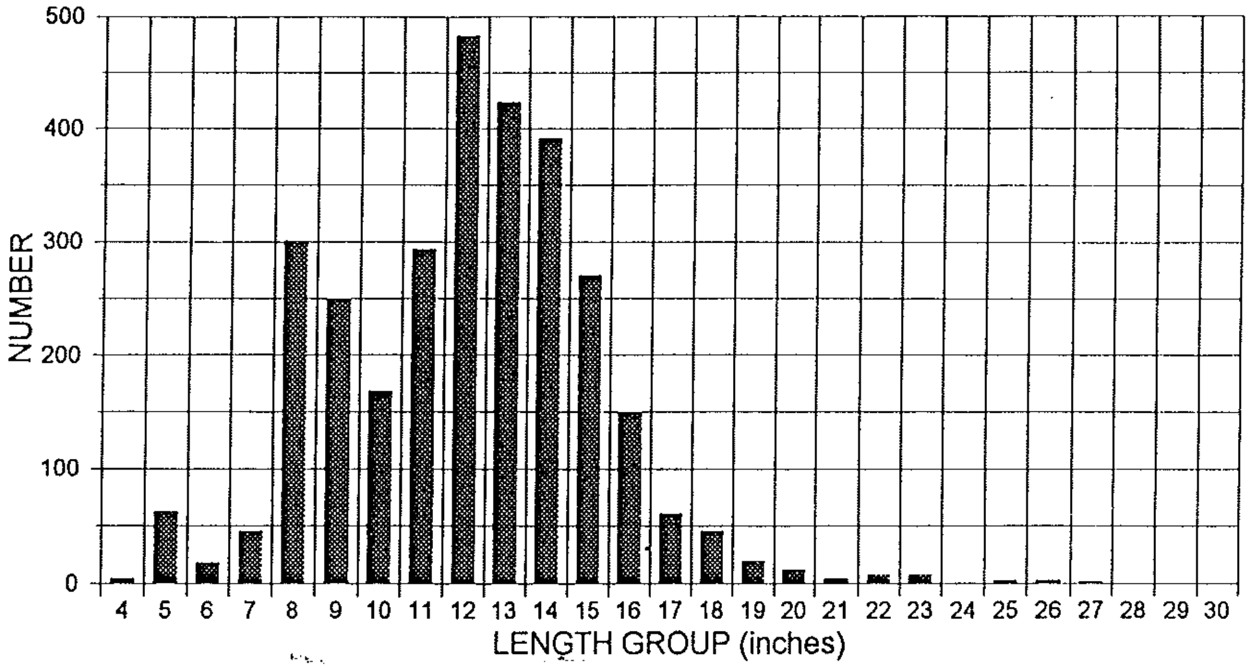
Only information from fyke netting and our first two electrofishing runs this year are included in the following graphs.

NORTHERN PIKE

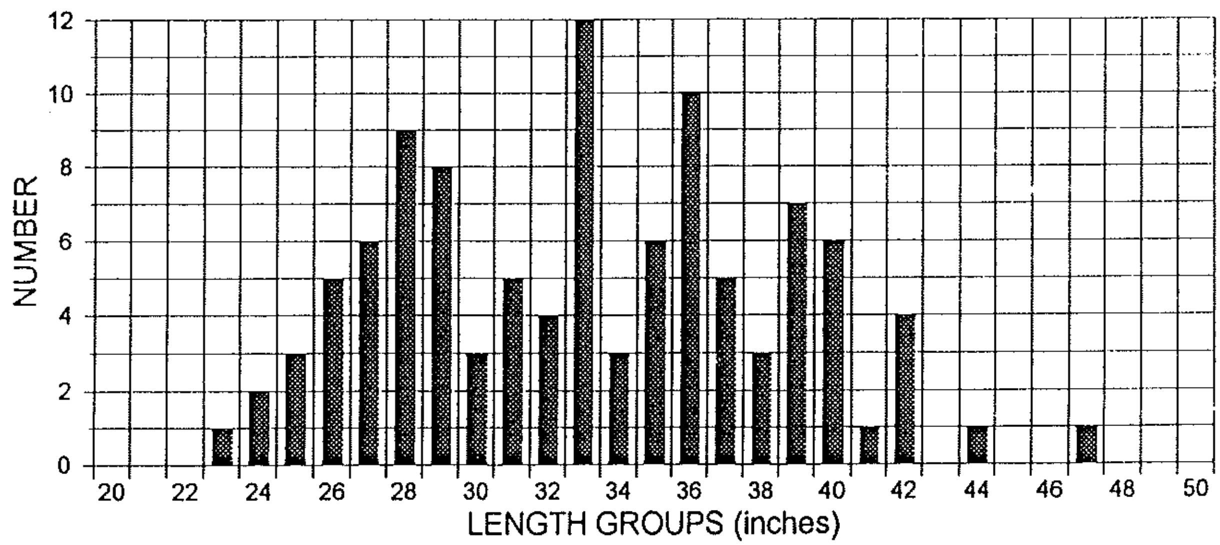


(OVER)

WALLEYE



MUSKY



SMALLMOUTH BASS