Perry Austin: *Maine Morning*, 1999

Comprehensive Lake Management Plan for Big Bearskin Lake, Oneida County, Wisconsin

April 2000

Prepared for
Big Bearskin Lake Association
Harshaw, WI

Prepared by
Steve McComas
Blue Water Science
550 South Snelling Ave
St. Paul, MN 55116
651.690.9602

Funded by Wisconsin DNR and Big Bearskin Lake Association

Comprehensive Lake Management Plan for Big Bearskin Lake, Oneida County, Wisconsin
2000

--Contents--

SUMMARY

Big Bearskin Lake is located in Oneida County, Wisconsin. A lake planning study was conducted in 1996 and additional lake work water conducted in 1999. The lake was sampled in May, June, July, August, and September. A plant survey and a shoreline inventory were also performed. A list of lake imporvement projects were then developed. 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 status of aquatic plants.
- to develop a lake management plan that addresses crayfish, algae, and aquatic plants 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. They are located on the upper west side and the north side of the lake.

Shoreland Inventory: A photographic inventory of all lots around Big Bearskin was conducted in 1999. Approximately 80% of the lots have more than 50% of the shoreline covered with native vegetation. Approximately 67% of the lots have more than 75% of the shoreline in a native buffer. Approximately 73% of the lots have more than 50% of the shoreland covered with native vegetation. Approximately 63% of the lots have more than 75% of the shoreland in a native buffer.

Lake Characteristics

Dissolved Oxygen and Temperature: Big Bearskin Lake is 400 acres in size and is not strongly thermally stratified during the summer. However, oxygen concentrations fall below 1 mg/l in water below about 21 ft by July.

Clarity: The secchi disc transparency are highest in May and June and lowest 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, *Gleotrichia,* 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 was about 8% of the lake bottom in 1996 and about 5% in 1999.

Crayfish: Big Bearskin Lake has a large population of rusty crayfish. The best management approach for the control of them is to let nature take is course. It appears a surge in yellow perch may be starting to reduce the number of small crayfish.

Fish: Big Bearskin Lake has a naturally reproducing walleye population. This reproduction and recruitment was so successful in the past that walleyes were stunted. Muskies also do well in Big Bearskin. Panfish are not common. The minimum size for keeping walleyes was reduced in 1997 and since then, walleye numbers appear to be down. Yellow perch numbers appear to be increasing.

Lake Report Card

-Water Quality in Big Bearskin Lake does not appear to be getting better.
-Water chemistry results were within Ecoregion values in 1996 but not in 1999.
-Summer algae blooms continue to produce poor water quality in mid to late summer.
-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.

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	1996 Big Bearskin	1999 Big Bearskin
Total Phosphorus (ug/l)			
epilimnion	14-27	22	50
hypolimnion	--	26	44
Chlorophyll mean (ug/l)	<10	8.7	13
Chlorophyll maximum (ug/l)	<15	14	36
Secchi disc (feet)	8-15	11.1	8.4
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	--
Plant Coverage	--	8%	5%

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 or unless aquatic plant distribution can increase.

If phosphorus increases, algae blooms will last longer in the summer, if phosphorus decreases, summer clarity should increase. Clear water conditions can be sustained with aquatic plant coverage of 40% of the bottom. Currently, coverage is less than 10%.

Lake Management Projects

Recommended Projects

Watershed Projects

1. On-site System Maintenance Program
2. Lake Shoreland Projects.

Lake Projects

3. Summer Algae Bloom Reduction by Use of Barley Straw
4. Aquatic Plant Improvement Projects
5. No Wake Zone in Bays for Plant Improvement
6. Rusty Crayfish Control
7. 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 concentrations of 22 μg/l in 1996 and 50 μg/l in 1999. The average summer secchi disc transparency was 11 feet in 1996 and 8.4 feet in 1999.

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.

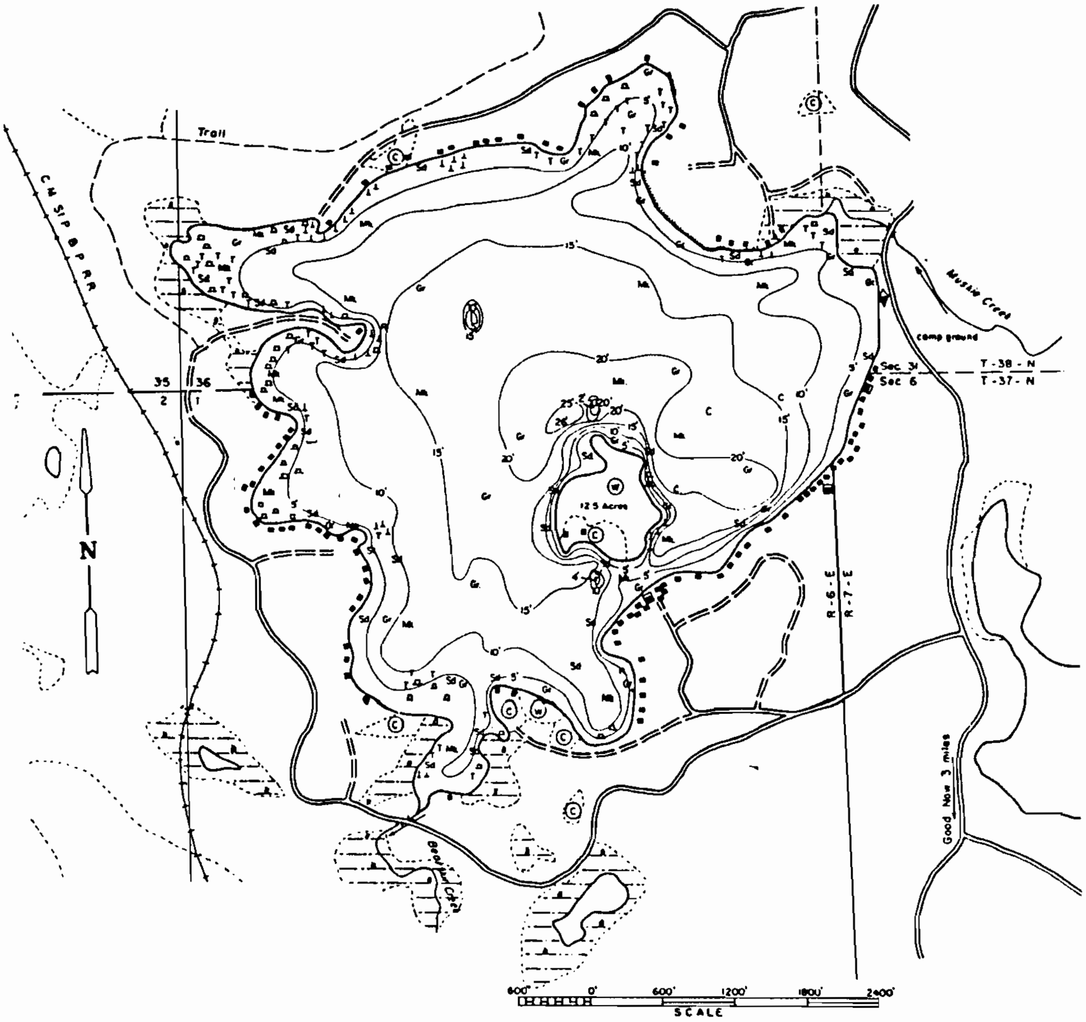


Figure 1. Lake map of Big Bearskin Lake.

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).

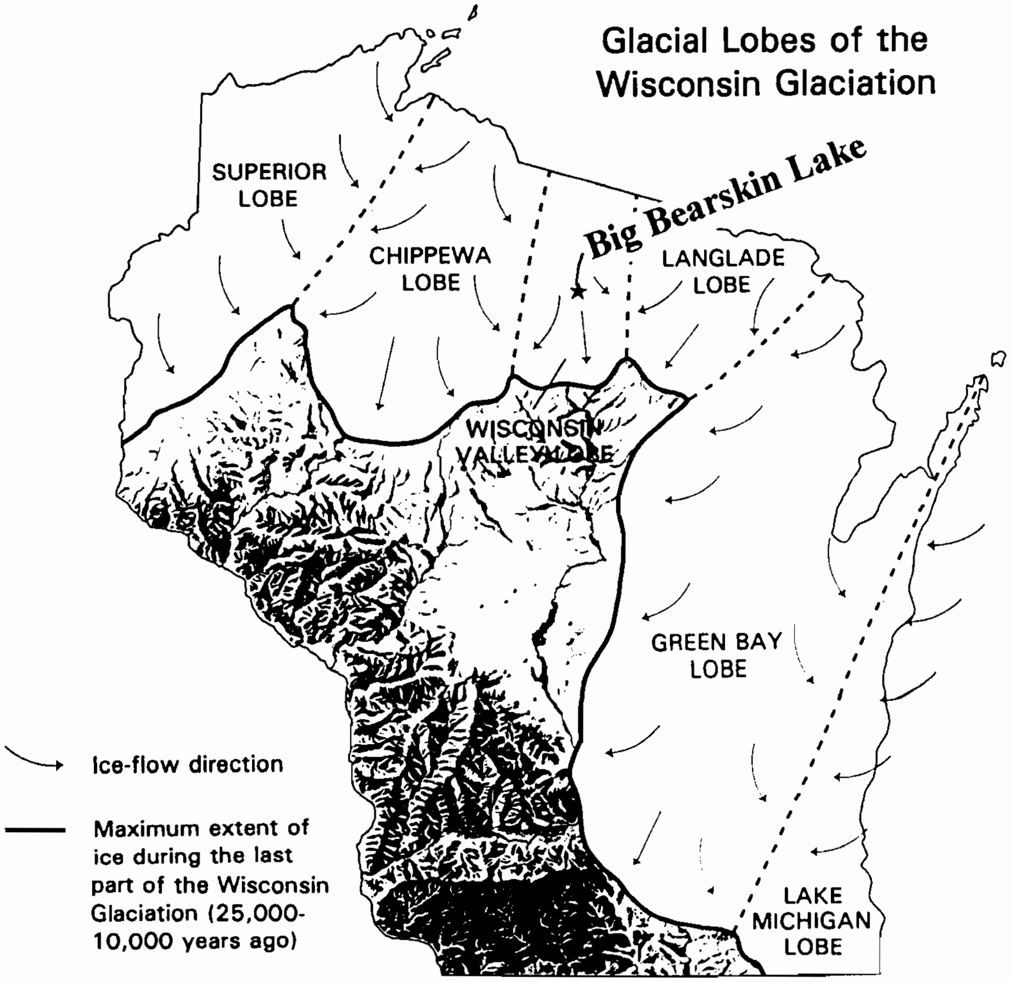


Figure 2. Big Bearskin Lake is in the Wisconsin Valley Lobe. Shown by the black star.

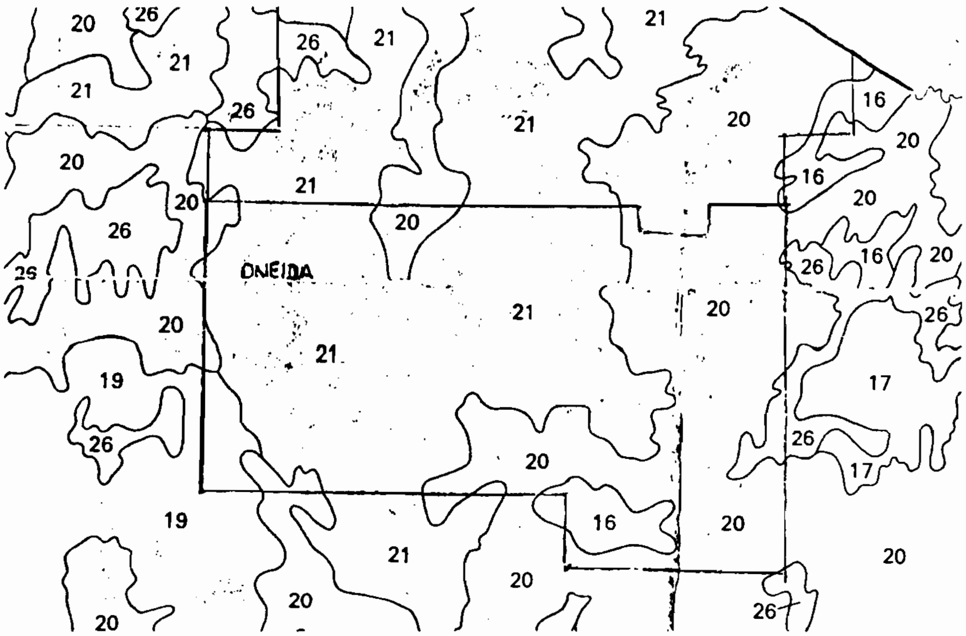


Figure 3. Big Bearskin Lake is located in soil group 21 (shown above) in Oneida County. Average available phosphorus is 138 pounds/acre (from Hole, F.A. 1970)

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	Med 2.5	High >5		Low 0-50	Med 51-100	High 101-200+		Low 0-200	Med 201-400	High 400+		Low 4.5-6.5	Med 6.5-7.5	High 7.5+			Representative corresponding soil names and symbols from Soils of Wisconsin color map, 1:710,000 (Hole, 1976)[2]
	% of soil tests			Av.	% of soil tests			Av.	% of soil tests			Av.	% of soil tests			Av.	Av.	
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 (F3)
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

Watershed and Land Use

The Big Bearskin Lake watershed encompasses approximately 2,253 acres (Figure 4). 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 ratio of watershed area to lake surface area is 5:1.

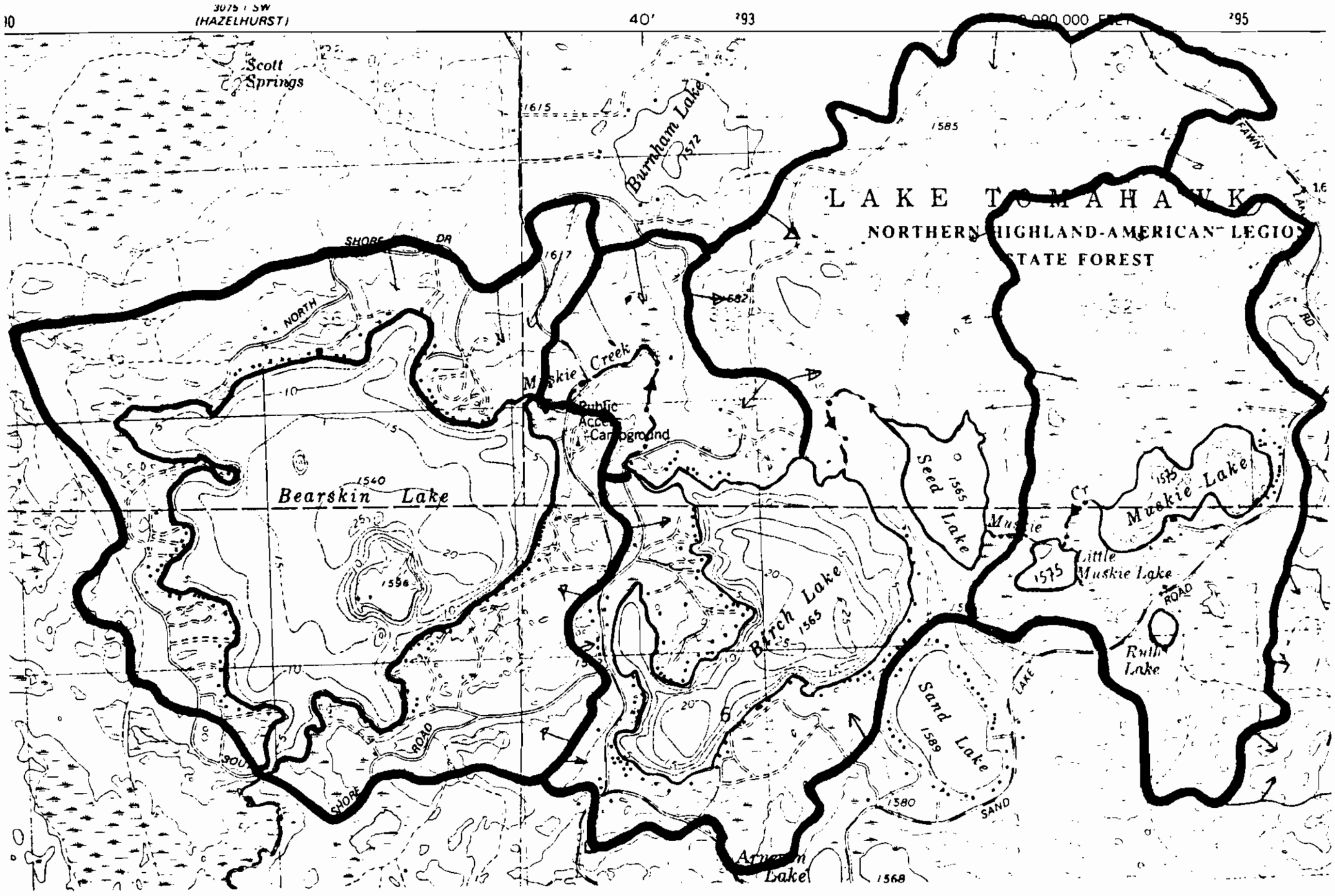


Figure 4. Watershed of Big Bearskin Lake.

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 at Baseflow
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

Shoreland Inventory

The shoreland area encompasses three components: the upland fringe, the shoreline, and shallow water area by the shore. A photographic inventory of the Big Bearskin Lake shoreline was conducted. The objectives of the survey were to characterize existing shoreland conditions to serve as a benchmark for future comparisons.

For each photograph we looked at the shoreline and the upland condition. Our criteria for natural conditions were the presence of 50% native vegetation in the understory and along the shoreline. We also evaluated shorelines for 75% natural conditions.

Results of the inventory are shown in Table 4. Based on our subjective criteria over 70% of the parcels in the Big Bearskin Lake shoreland area meet the natural rankings for shorelines and upland areas. For a lake in the northern counties of Wisconsin this is about normal. However in the next 10 years proactive volunteer native landscaping should maintain existing conditions and improve other parcels.

Table 4. Summary of buffer and upland conditions in the shoreland area of Big Bearskin Lake. Approximately 130 parcels were examined.

	Percent
Shorelines with >50% natural buffer	80%
Shorelines with >75% natural buffer	67%
Upland areas >50% natural conditions	73%
Upland areas >75% natural conditions	63%

Springs and Onsite Systems

A shoreline conductivity survey was conducted in 1996. 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.

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 5. 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.

Big Bearskin Lake
Conductivity Survey
August 19, 1996

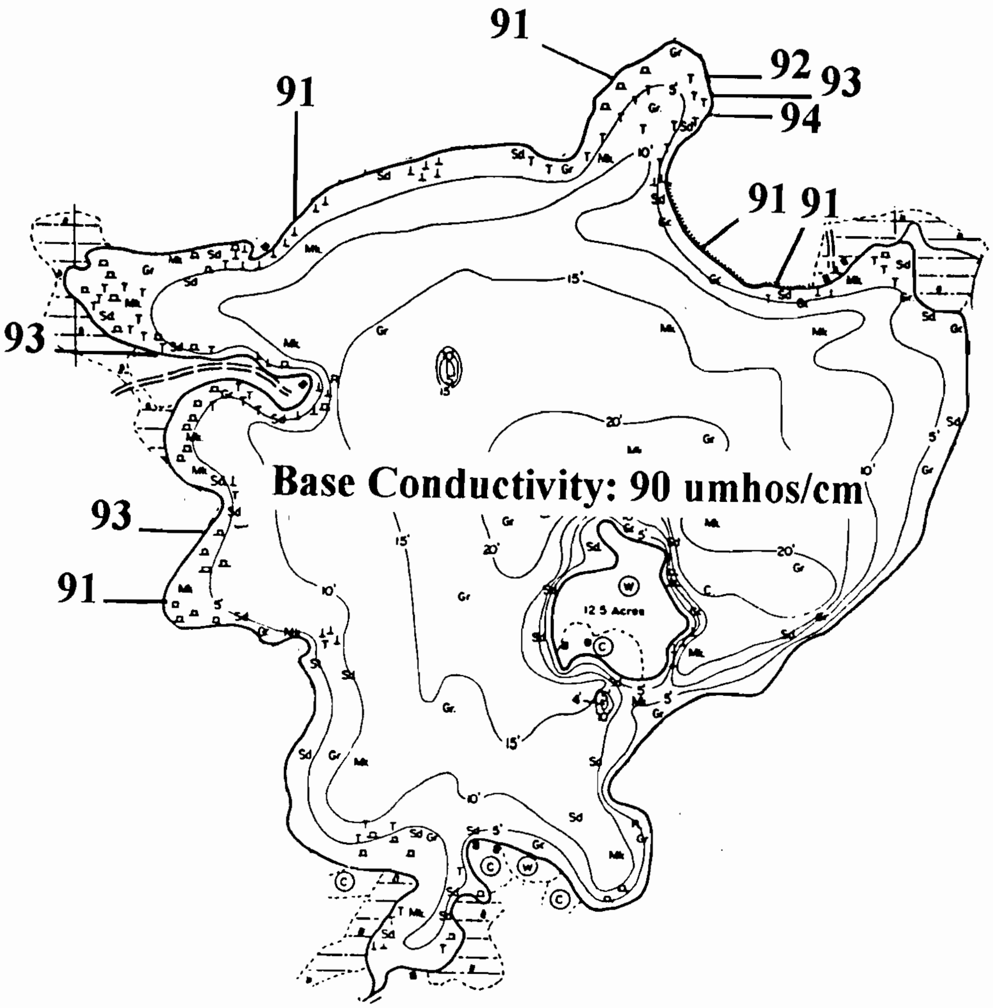


Figure 5. Conductivity survey on Big Bearskin Lake, August 19, 1996. Conductivity readings were stable except for the north and west sides of Big Bearskin. These may be areas of spring inflows.

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 5). A lake contour map is shown in Figure 6. 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).

Table 5. 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 to lake 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

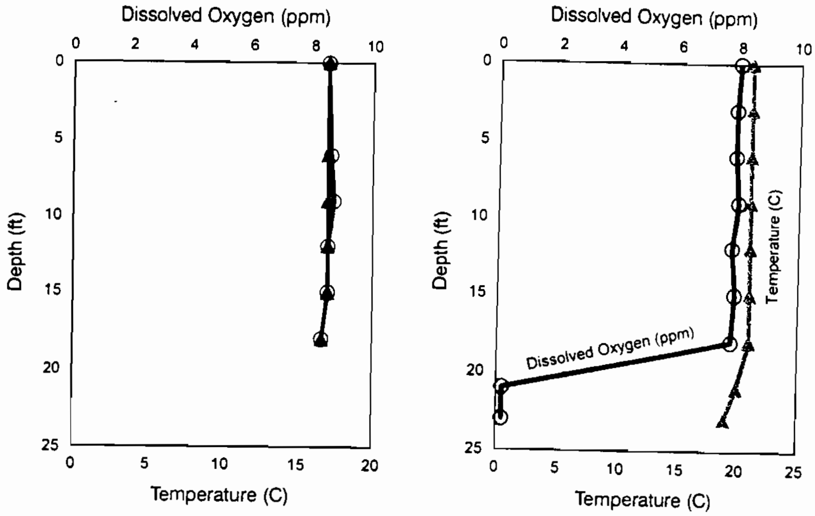
The summer dissolved oxygen (DO) and temperature profiles are shown in Figure 6.

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.

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.

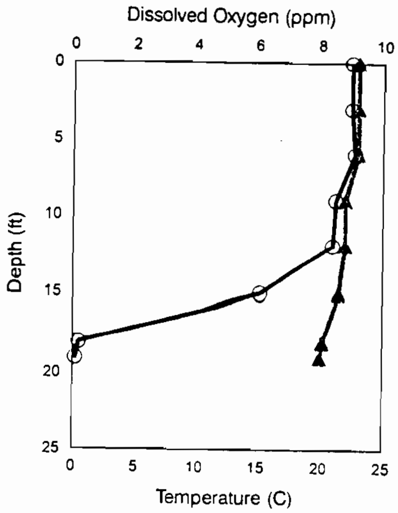
Below the thermocline is the layer of cold, dense water called the *hypolimnion*. This cold layer was not found in Big Bearskin Lake. The lake does not seem to stratify. However, oxygen concentrations in the hypolimnion progressively decline due to the decomposition of plant and animal matter and respiration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



June 5, 1996

July 25, 1996



August 19,1996

Figure 6. 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 (Table 6). In 1996, it went from a high of 20 feet in June to under 6 feet in August. In 1999, it went from 16.5 feet to 4.5 feet. The cause of the decline in clarity is the increase in algae.

Table 6. Secchi disc data. Results are shown in feet.

	1967	1983	1996	1999
May				16.5
June			20.0	10.5
July	7.0		7.3	6.0
August		3.2*	5.9	4.5
September				4.5
Average	7.0	3.2		8.4

*no date

Figure 7. Big Bearskin Lake residents collected water quality data in 1999.

Nutrients in Big Bearskin Lake

Summer water chemistry data was collected during 1996 and 1999. Data collected in 1999 included secchi disc, total phosphorus (TP), chlorophyll a (Chl a), and ammonia (NH_3) (Table 7). Data collected in 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 8). 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 7. Summer monitoring results for Big Bearskin Lake and the Muskie Creek Inlet stream in 1999.

	Secchi Disc (feet)	Total Phosphorus (ppb)		Chl a (ppb)	Ammonia (mg/l)
		top	bottom		bottom
5.18.99	16.5	19	25	3	
5.28.99		26		2	
6.13.99	12.5	27	33	6	
6.24.99	10.0				
6.30.99	9.0	32	44	5	
7.21.99	6.0	36	66	9	
8.11.99	4.5				0.027
9.3.99	4.5	109	45	36	
Seasonal Averages	8.4	50	44	13	

Table 8. Summer monitoring results for Big Bearskin Lake and the Muskie Creek Inlet stream in 1996.

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 found in Big Bearskin Lake are found in Figures 8 and 9. *Gloeotricha* was dominant in both 1996 and in 1999 summer samples.

Aquatic Plants

An aquatic plant survey was conducted on Big Bearskin Lake on July 25, 1996 and more recently on August 10, 1999. Results are shown in Table 9.

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 1996 was roughly 8% of the bottom area. Plant coverage in 1999 was about 5%. This is a significant decrease from 1967 when plant coverage was estimated at 30% by the WDNR.

Table 9. Species list of the aquatic plants found in Big Bearskin Lake in July 6, 7, 1967, July 25, 1996, and August 10, 1999.

Common Name	Scientific Name	1967	1996	1999
		30% coverage	8% coverage	5% coverage
Arrowhead	*Sagittaria sp.*	X		
Bulrush	*Scirpus sp*	X	X	X
Burreed	*Sparganium sp.*	X		
Cattails	*Typha sp*	X	X	X
Pickerel plant	*Pontederia cordata*	X	X	X
Spikeruch	*Eleocharis palustris*	X		
Little yellow waterlily	*Nuphar microphyllum*	X		
Spatterdock	*Nuphar variegation*	X	X	X
White waterlily	*Nymphaea sp*	X	X	X
Cabbage	*Potamogeton amplifolius*	X	X	
Claspingleaf pondweed	*P. richardsonii*	X	X	
Coontail	*Ceratophyllum demersum*		X	X
Elodea	*Elodea canadensis*	X	X	X
Fern pondweed	*P. robbinsii*	X	X	
Stringy pondweed	*P. sp*	X	X	
Water buttercup	*Raniculus sp.*	X		
Water celery	*Vallisneria americana*		X	
Water milfoil	*Myriophyllum sp.*	X		
Water smartweed	*Polygonum amphibium*	X		

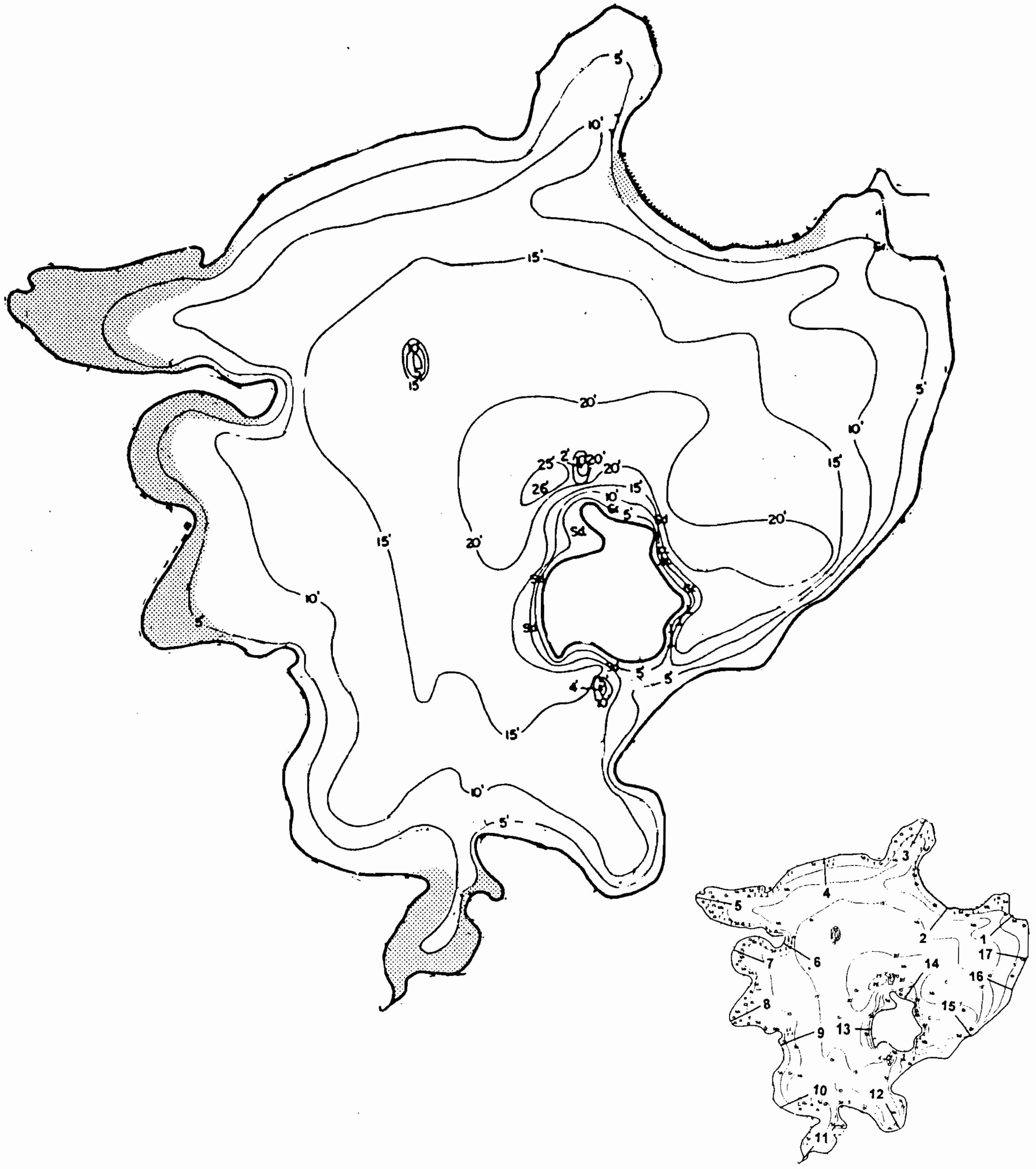


Figure 10. Plant coverage in 1996 was 8% includes both emergent and submergent (4%). Aquatic plant map showing the general location of plants within Big Bearskin Lake. The small map in the lower right-hand corner shows the transects used to determine the plant species within Big Bearskin Lake.

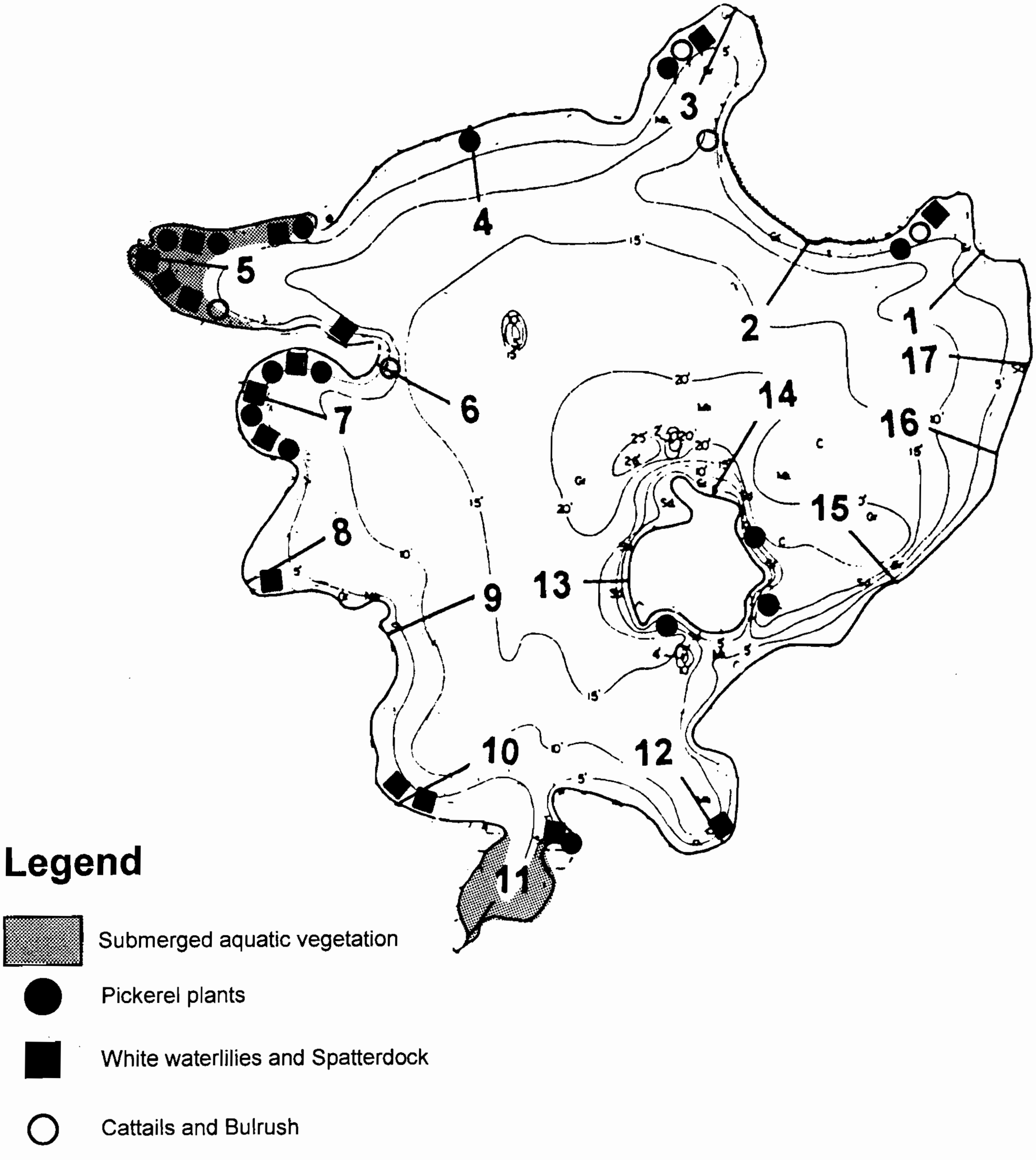


Figure 11. Plant coverage in 1999 was 5% including both emergent and submergent.

Table 10. Individual transect data for Big Bearskin Lake for August 10, 1999.

	T1		T2		T3		T4		T5		T6	
	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6
Coontail												
Elodea									2			
Pickerel plant					1							
Spatterdock					2				1			
Waterlily					1				1			

	T7		T8		T9		T10		T11		T12	
	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6
Coontail										1.5		
Elodea										1.5		
Pickerel plant	1									1		
Spatterdock								2		1		
Waterlily	1		1									

	T13		T14		T15		T16		T17	
	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6	0-3	4-6
Coontail										
Elodea										
Pickerel plant										
Spatterdock										
Waterlily										

Table 11. Big Bearskin Lake aquatic plant occurrences and densities for the August 10, 1999 survey based on 12 transects and 2 depths, for a total of 24 stations. Density ratings are 1-5 with 1 being low and 5 being most dense.

	Depth 0-3 feet (n= 12)			Depth 4-6 feet (n=12)			All Stations (n= 24)		
	Occur	% Occur	Density	Occur	% Occur	Density	Occur	% Occur	Density
Coontail (*Ceratophyllum demersum*)	--	--	--	1	8	1.5	1	4	1.5
Elodea (*Elodea canadensis*)	1	8	2.0	1	8	1.5	2	8	1.8
Pickerel plants (*Pontederia cordata*)	2	17	1.5	1	8	2.0	3	13	1.7
Spatterdock (*Nuphar variegatum*)	2	17	1.5	1	8	2.0	3	13	1.7
White waterlily (*Nymphaea sp*)	4	33	1.0	1	8	1.0	5	21	1.0

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. Results of the zooplankton counts for 1999 are shown in Table 12.

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

Table 12. Big Bearskin Lake zooplankton 1999 data. Results are shown in number/liter.

Date	5.18	5.27	6.13	6.24	7.1	7.21	8.11	9.3	9.22	10.17
Daphnids	**12**	**45**	**6**	**9**	**8**	**12**	**10**	**35**	**112**	**12**
Big (>1 mm)	10	39	5	0	2	8	7	30	103	11
Little (< 1 mm)	2	6	1	6	4	4	3	5	9	1
Ceriodaphnia	0	0	0	0	0	0	0	0	0	0
Bosmina	0	0	0	1	1	0	0	0	0	0
Chydorus	0	0	0	2	1	0	0	0	0	0
Copepods	**14**	**17**	**33**	**67**	**27**	**31**	**4**	**3**	**11**	**20**
Calonoids	8	14	17	29	17	9	3	2	8	15
Cyclopoids	1	2	4	18	9	7	1	0	2	4
Nauplii	5	1	12	20	1	15	0	1	1	1
Rotifers	**0**	**0**	**0**	**6**	**0**	**12**	**0**	**1**	**1**	**1**
Total Zooplankton	**26**	**62**	**39**	**82**	**35**	**55**	**14**	**39**	**124**	**33**

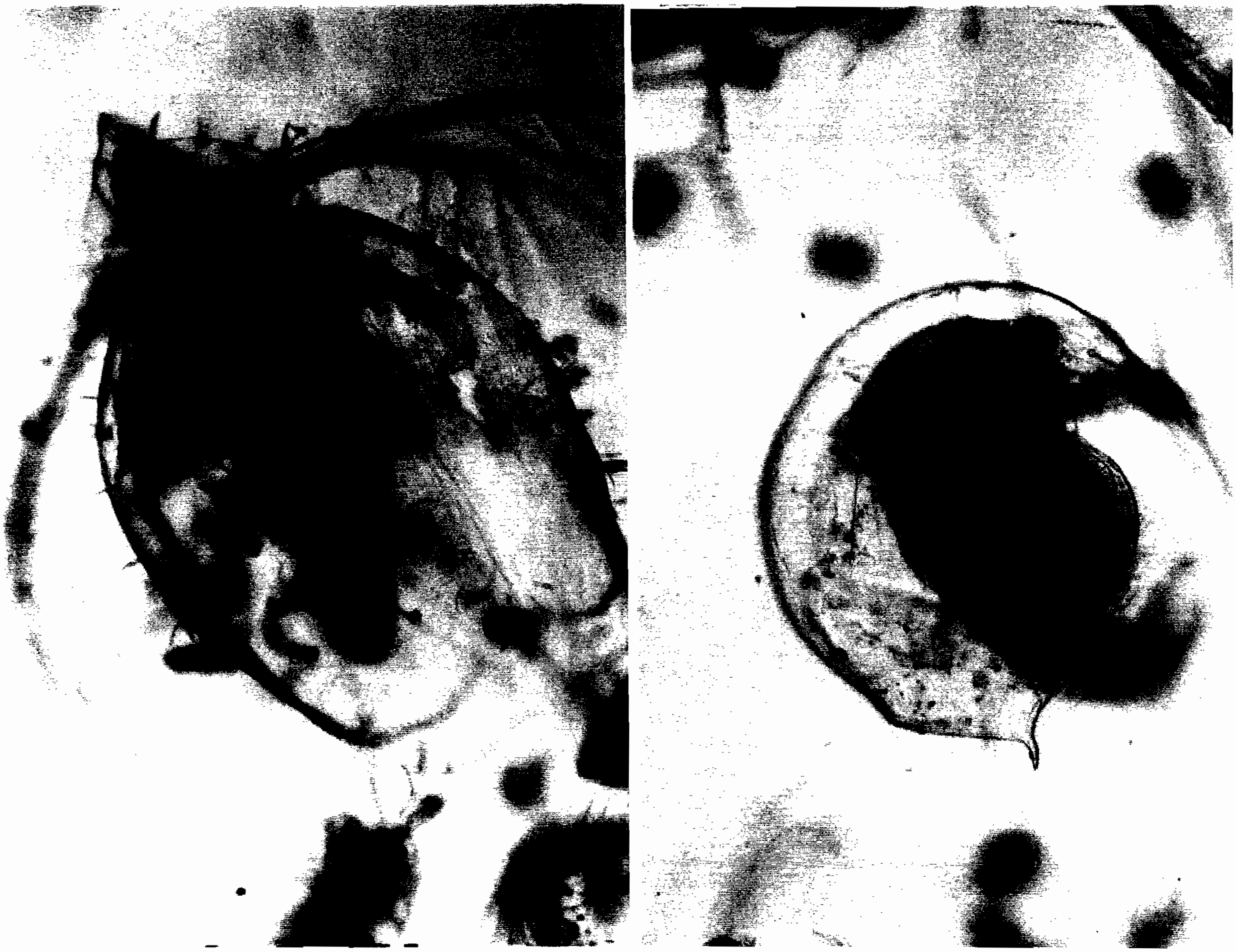


Figure 16. Big Bearskin zooplankton. (Left) Daphnia collected on 5.25.99 and (right) daphnia collected on 6.24.99.

Crayfish

The rusty crayfish has definitely worn out its welcome in Big Bearskin Lake. 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 they 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.

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 nearshore areas (e.g. bass and yellow perch) develop the ability to eat them, natural control may be realized.

Crayfish length distribution in 1999 is shown in Table 13 and Figure 17. Crayfish traps used in Big Bearskin Lake are shown in Figures 18 and 19.

Table 13. Rusty crayfish lengths, August 10, 1999. Three inch lengths are the most common.

Lengths	3 foot depth	8 foot depth	8 foot depth	8 foot depth	Average
1.0					
1.5	1				1
2.0	25	5	6	1	37
2.5	1			6	7
3.0	51	50	20	25	146
3.5				25	25
4.0	4	24	5	14	47
4.5				1	1
5.0					
totals	82	79	31	72	264

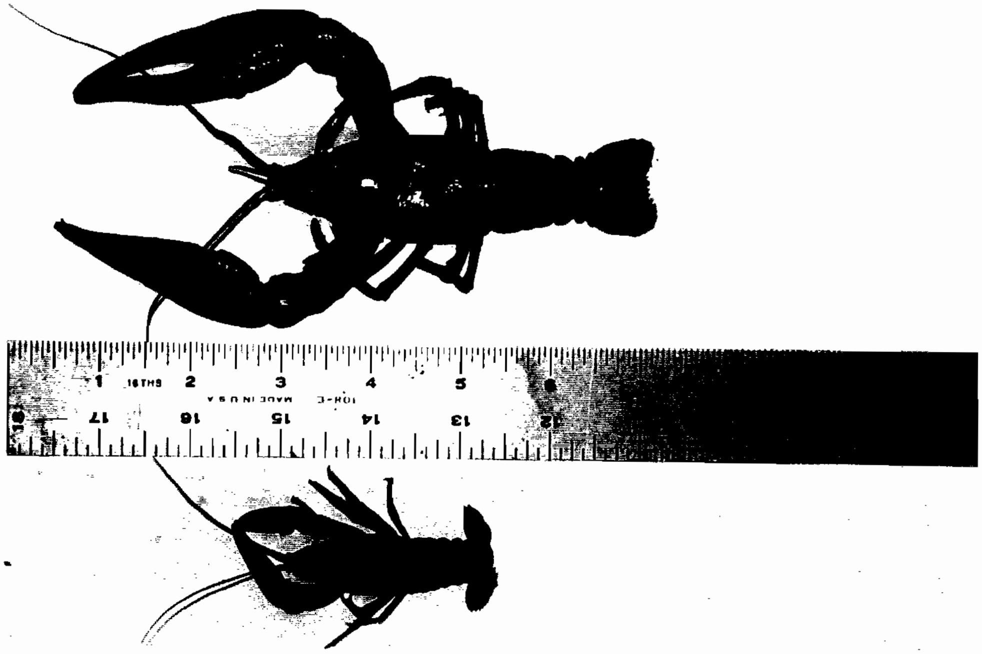


Figure 17. Rusty crayfish prefer a solid, sand and gravel bottom and Big Bearskin has plenty of that. Crayfish harvesting has been going on for at least ten years. Homeowners can still harvest over 150 pounds per weekend using baited traps. Crayfish have different size classes in Big Bearskin Lake. The crayfish at the top is 4 inches long (measured from head to tail) and the crayfish on the bottom in 2 inches long.

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 20. Another survey was conducted in 1999 but results were unavailable at this time.

Results showed that the lake has a good walleye population 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.

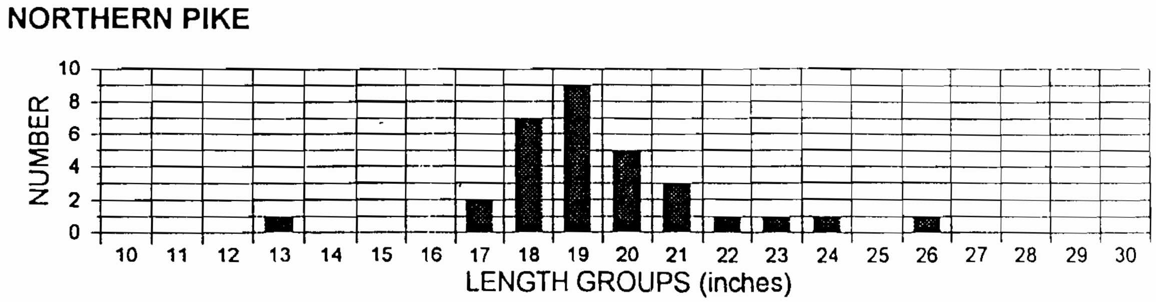
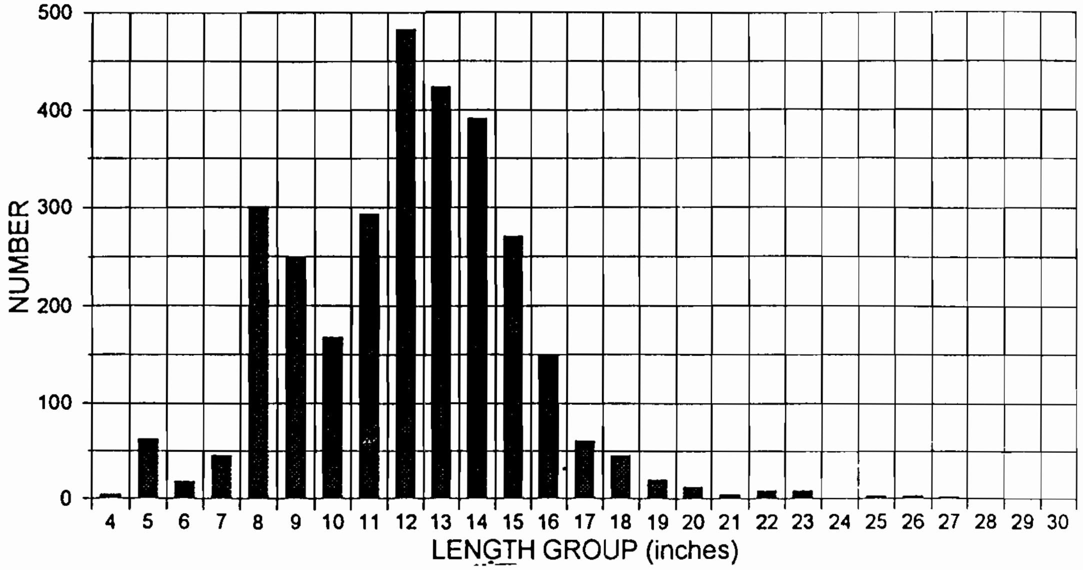
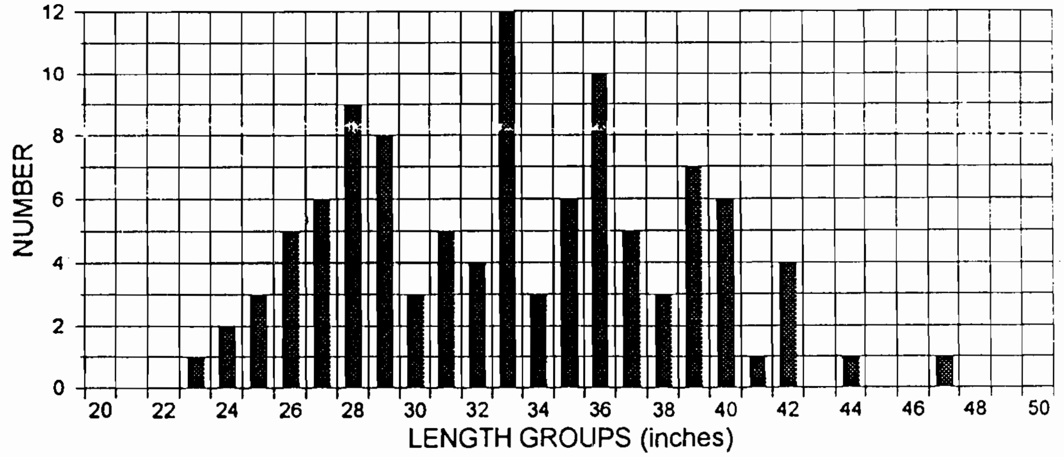


Figure 20. Fish size distribution based on fyke netting and two electrofishing runs in 1996.

WALLEYE



MUSKY



SMALLMOUTH BASS

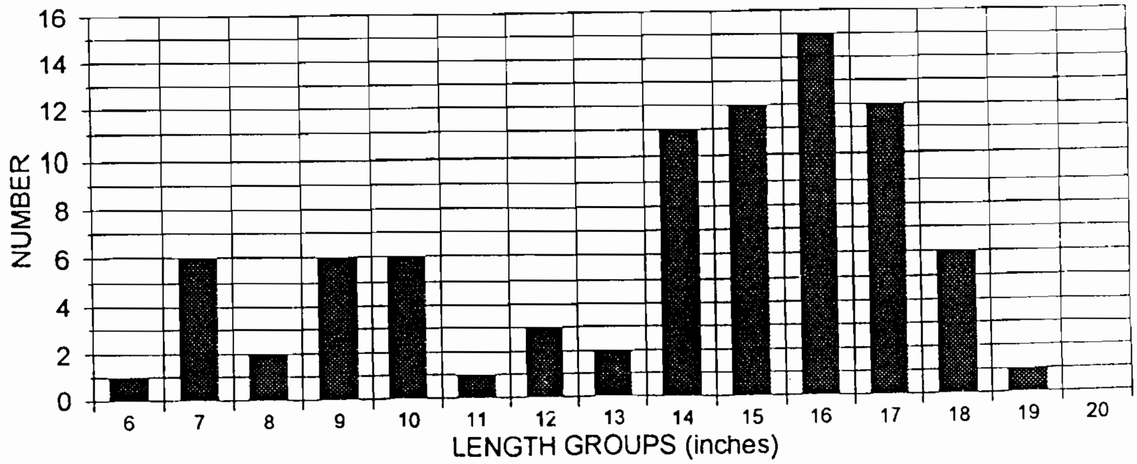


Figure 20. Concluded.

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 14). Transfer of fish was conducted by volunteers from the Big Bearskin Lake Association. Permission and permit granted from the Wisconsin DNR.

Table 14. 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	--

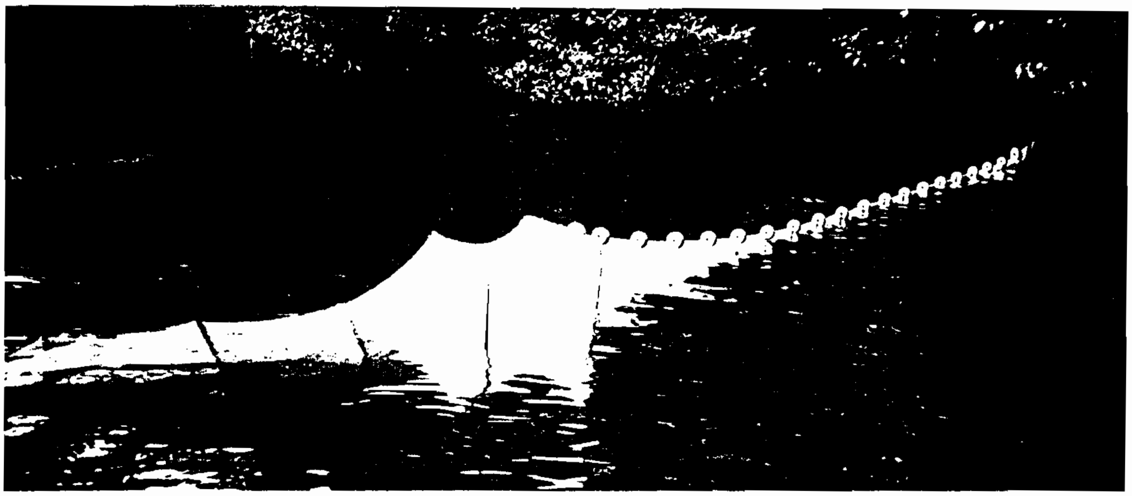


Figure 21. A small-mesh fyke net used to sample young of the year fish.

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 in 1996 but not in 1999 (Table 15).

Table 15. 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	1996 Big Bearskin	1999 Big Bearskin
Total Phosphorus (ug/l)			
epilimnion	14-27	22	50
hypolimnion	--	26	44
Chlorophyll mean (ug/l)	<10	8.7	13
Chlorophyll maximum (ug/l)	<15	14	36
Secchi disc (feet)	8-15	11.1	8.4
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	--
Plant Coverage	--	8%	5%

A map showing the ecoregion area and the Big Bearskin Lake location is displayed in Figure 22.

An important component to watch and to control is nutrient inputs -- both phosphorus and nitrogen. When phosphorus concentrations increase to around 40 ppb or above, nuisance algae blooms can develop. This causes a cascade of problems.

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.

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 16) 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 16. 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*	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.
9. Experimented with placing barley straw around Big Bearskin Lake.
10. Stocked 600 yellow perch in 1998.

Example of a phototype barley straw bale set-up on the shore of Big Bearskin.

Recommended Projects

A list of projects has been prepared that are intended to protect and improve 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 by Use of Barley Straw.
4. Aquatic Plant Improvement Projects.
5. No Wake Zone in Bays for Plant Improvement
6. Rusty Crayfish Control
7. Continue a lake monitoring program.

Details of these projects are given in the following pages.

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.

Lake Projects

3. Summer Algae Bloom Reduction by Use of Barley Straw

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. It appears 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.*

Results of bottom water phosphorus testing does not show elevated phosphorus concentrations. If phosphorus was coming from lake sediments, phosphorus levels would be elevated in the bottom water. Therefore if we can control *Gleotrichia*, we can increase summer transparency.

In 1996, it was proposed to evaluate alum or iron as a way to control *Gleotrichia.* An alum application or possibly an iron application would be a way to tie up bottom phosphorus and reduce the intensity of the *Gleotrichia* bloom, thus improving water clarity. Watershed phosphorus reduction did not appear to be the answer, also, aeration would not have the desired effect, and herbicides would only be a short term solution.

However, in 1997, Roger Soletski and others raised the question of using barley straw for algae control. A literature review of how barley works and barley experience in other lakes is located in the Appendix B.

A barley straw project to control algae blooms in Big Bearskin Lake is theoretically possible. One to two bales per acre has been shown to be adequate. However there has not been a barley straw project for a lake the size of Big Bearskin reported in the literature.

None the less, the Big Bearskin Lake Association is organized to the degree that it appears from a logistics angle, it is feasible.

Barley straw works best at inhibiting blue-green algae growth over other algal groups (literature review is in Appendix B) and *Gleotricha* is a blue-green algae.

If blue-green algae were inhibited, water transparency would improve and aquatic plant distribution could increase.

The cost of a project like this is about $30,000, which covers the cost of straw, straw holding bags, and equipment. There is another $30,000 worth of in-kind labor that would be donated.

4. Aquatic Plant Improvement Projects

Aquatic plants help keep lake water clear. Typically plant coverage of 40% or more is adequate to sustain clear water conditions. Currently, aquatic plant coverage is less than 10% in Big Bearskin. If aquatic plants could colonize out to 10 feet of water depth, the 40% goal could be reached.

Factors limiting aquatic plants are either the algae blooms or the rusty crayfish or both.

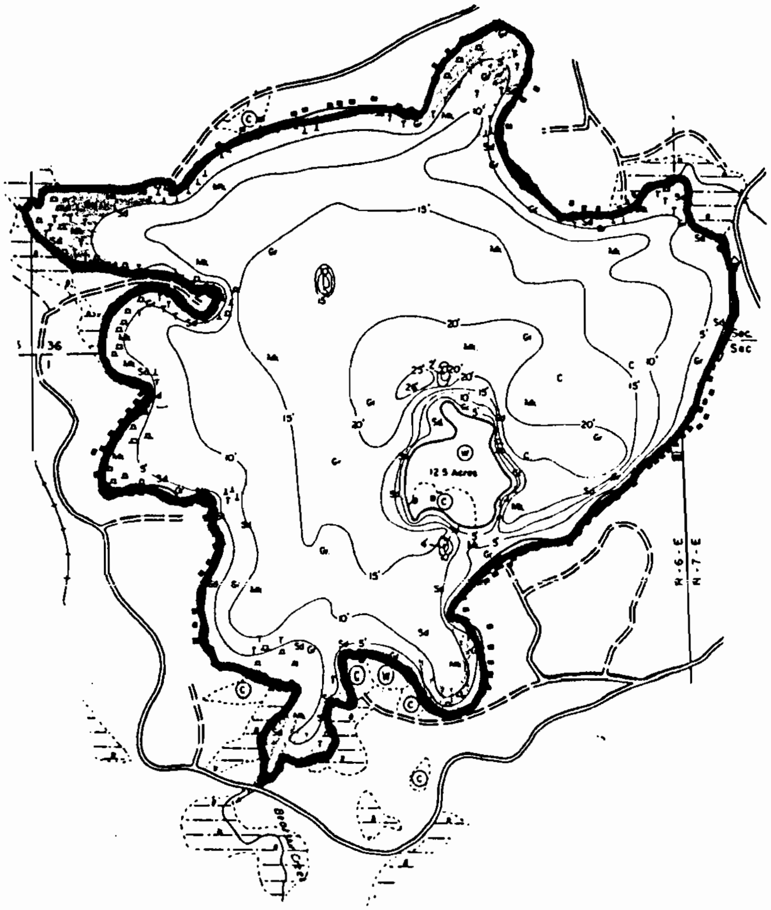
To evaluate the potential of crayfish limiting plant establishment, it is recommended to experiment with several exclosures placed in the lake. An exclosure looks like a cage that is set on the lake bottom. It will keep crayfish out. If crayfish are keeping plants from growing back, then plants should grow within the protected cages.

Eight to sixteen cages measuring about 4 feet by 4 feet by 2 feet high should be placed in the lake over the summer growing season. Plant growth would be checked inside and outside of the cage. If plants respond, then crayfish control using perch should be accelerated.

The cost for constructing, installing, and monitoring the cages could be $5,000.

5. 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.

6. 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.

7. 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.

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

Alternatively, 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 $220 per lake per year. Citizen volunteers can take the water samples. The UW-Stevens Point contact is Byron Shaw.