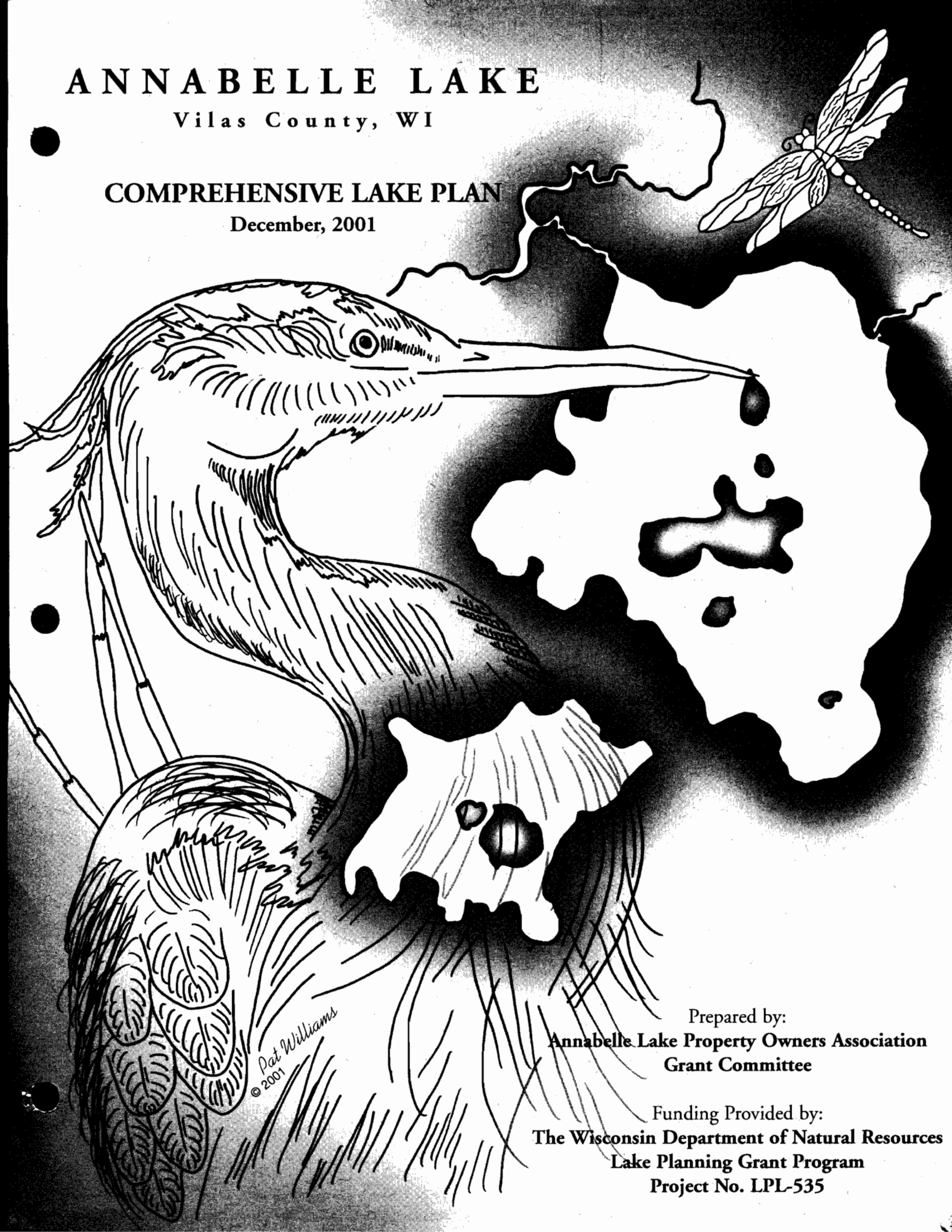
ANNABELLE LAKE

Vilas County, WI

COMPREHENSIVE LAKE PLAN

December, 2001



Prepared by:
Annabelle Lake Property Owners Association
Grant Committee

Funding Provided by:
The Wisconsin Department of Natural Resources
Lake Planning Grant Program
Project No. LPL-535

FORWARD

Dear Annabelle Lake Property Owners Association Member and Friends,

Here is your copy of the comprehensive lake management plan for Annabelle Lake. We hope you will enjoy it and keep it as a reference. It is a comprehensive inventory of Annabelle Lake and the immediate surrounding area. It also contains management recommendations to help us move forward into the future with actions that will protect and enhance the quality of the lake to insure that we and those who come after us will be able to continue to enjoy its natural beauty, recreational potential and its "Northwoods" character.

In January 1998 the Association applied for a Wisconsin Lake Management Planning Project Grant to be funded 75% by the State and 25% by the Association, the latter being primarily through volunteer time. The total grant amount requested was $12,133. The Grant was approved in June 1998. The end result of the Grant is this report. It intended to help our Association and involved government agencies make wise decisions about the future of Annabelle Lake.

This report is an inventory of the physical, chemical, biological, and human components of Annabelle Lake and the surrounding community. This information serves as a baseline from which to make future assessments, as well as the basis for the recommendations contained at the end of this report. Many volunteers from the Association, professional consultants from Northern Ecological Services, and employees of the Wisconsin Department of Natural Resources and Vilas County took part in collecting information, reviewing it, integrating it with other sources of information, writing sections of the report, and developing the recommendations contained in this report. **As new information is gathered, and new ideas and approaches for addressing issues are developed, these should be integrated into revisions and updates to this plan.**

While many individuals have been involved in the activities culminating in this report, special thanks are due to those in the public sector who helped us apply for the grant, develop the information and complete this report. They often gave up weekend and evening time outside of normal working hours to cheerfully help us in this endeavor. These individuals include:

Mike Coshun, Treaty Fisheries Biologist, WDNR, Woodruff, WI
Steve Gilbert, Fisheries Biologist, WDNR, Woodruff, WI
Laura Herman, Self Help & APMP NOR Coord., WDNR, Rhinelander, WI
Tiffany Lyden, Vilas County Lake Conservation Specialist, Eagle River, WI
Jennifer Wudi, Lake Management Coord., WDNR, Rhinelander, WI
Bob Young, Fisheries Biologist, former Lake Mngt. Coord., WDNR, Woodruff, WI

It is the hope of all of us that this report and the effort that went into it will guide our Association in protecting and improving Annabelle Lake.

Sincerely,

Final Grant Report Committee:
Dave Engeseth
Bob Rogacki
Dave Vogt
Pat Williams
Louis & Ruth Williams

"A lake is the landscape's most beautiful and expressive feature
It is earth's eye: looking into which the beholder
measures the depth of his own nature."

Henry David Thoreau (1811-62)

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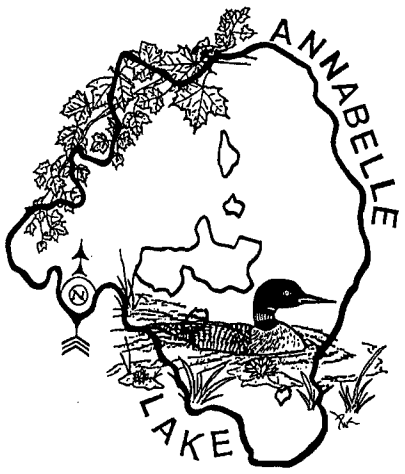


HISTORY

Annabelle Lake Geology

Annabelle Lake is located in the northwestern portion of Vilas County in northern Wisconsin. It is 213 acres in size and has a maximum depth of 30 feet. The elevation of the lake is about 1,671 feet above sea level. The inflow and outflow streams, groundwater levels, precipitation, and surface water runoff influence the water level of the lake. The highest elevation around the shore of the lake is on the south side where the land rises to about 1,710 feet above sea level. The rest of the surrounding land does not have a large elevation rise from the lake.

There is one inlet and one outlet for the lake. The inlet flows into the northeast part of the lake from Lynx, Rudolph, and Canteen Lakes. The outlet flows out of the northwest part of the lake and then in a southwesterly direction towards Crab Lake. The water eventually flows from Crab Lake north into the Presque Isle River.

Annabelle Lake is in the Northern Highland Lake District, which is part of the Superior Upland Province of the Canadian Shield. It is underlain by Precambrian bedrock, more than 600 million years old. The bedrock is composed primarily of granite, quartzose, amphibolite, and metasedimentary rock. The surface of the bedrock is about 270 feet below the land surface. Between the end of the Precambrian Era (600 million years ago) and the beginning of the Ice Age or Pleistocene time period (2 million years ago), the Annabelle Lake area was part of a high landmass where erosion was occurring. During the past two million years, the Annabelle Lake area was probably glaciated many times. Most of the current landforms and sediment are the result of the last glaciation, which took place between 25,000 and 10,000 years ago. As the last of the glacial ice melted in the Annabelle Lake area, it left behind an unsorted mixture of sediments, called glacial till. The glacial till in the northwestern part of Vilas County contains more silt and clay than in other portions of Vilas County, and tends to have more of a reddish coloration. The thickness of the glacial sediments in the Annabelle Lake area is about 120 feet deep. A few miles west of Annabelle Lake, near Presque Isle Lake, the glacial sediments also contain sand and gravel deposits left by glacial melt water. The melting action of the ice caused streams to flow in tunnels under the ice, and out away from the ice, leaving behind the sand and gravel deposits.

History of Presque Isle

"Almost an Island"

Three centuries have passed since early French missionaries traversed this area of Northern Wisconsin. Two French Priests in charge of a missionary expedition traveled up the St. Lawrence River and into the Great Lakes. They were shipwrecked and survived a winter on the shores of Lake Superior, making camp at the mouth of the Presque Isle River. When the spring thaw came and high water appeared, they found their camp surrounded by water on "almost an island."

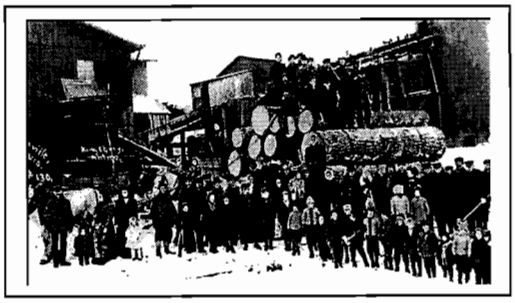
In later years, people traveled upstream to the lake at the headwaters of that river. They named it "Presque Isle" Lake. It turned out to be the largest lake in the area, with beautiful clear water and a well-wooded shoreline consisting of many bays, inlets and islands. Soon the region itself was known as Presque Isle.

Presque Isle Township covers an area of seventy-seven square miles of woods and water. There are more than eighty lakes, and numerous streams and waterways. The sub-continental divide runs through Presque Isle with an elevation of around 1,800 feet. Thus many of the streams and waterways in the northern portion of the township flow north into Lake Superior, through the other Great Lakes, down the St. Lawrence River and into the Atlantic Ocean. At the same time, many of the streams and waterways in the southern part of the Township flow south into the Wisconsin/Mississippi River complex and on into the Gulf of Mexico.

In the late 1880's and early 1900's activity in the area was typical of Vilas County and Northern Wisconsin. Extensive logging and sawmill operations were the rule. Those were days when this area was part of the "pinery"; where oxen and horses lumbered with heavy burdens to the mill, and the cry "TIMBER" echoed from hill and hollow. During this period, farmers from southern Wisconsin and Lower Michigan traveled north behind slow moving oxen hoping to pay for their farms by working winters in the pinery.

Folks from Kentucky emigrated to the north, stayed on, and became natives. Immigrants from Europe, many unable to speak English, forged their way to the north to work the giant pines. It was difficult work and very dangerous; many lost their lives. "Shanty boys" roamed from the East Coast to West Coast cutting giant pines. Many of them were orphan boys, who worked the giant logs or rode the log flows down the river. The boys who lost their lives were buried in unmarked graves on a hill at the north end of town. The site of these potter's graves became known as "Shanty Boy Hill", and today is one of the Historical sites of Presque Isle.

The Vilas County History, written in 1924, states the area was originally named Fosterville, after J. J. Foster. Mr. Foster moved from Greenville, Michigan in 1905 to the Northwoods of Vilas County. There he proceeded to build a large sawmill and logging town. In 1910 William S. Winegar purchased the mill, and renamed the town Winegar. He made it one of the most active industrial sites in Vilas County. In the 1940s the town underwent a major transformation. The days of a rip-roaring lumber camp town, producing up to 120,000 feet of lumber in a single day, made way for a different type of activity. The former" hot pond", where logs were held prior to processing in the mill, became a successful fish rearing pond for the WDNR. At the time it was the largest set of walleye rearing ponds in the state. The project has been one of the most successful in the state, with walleye fry planted in the spring and fingerlings harvested in early fall for stocking in northern Wisconsin lakes. In 1955 the mill was gone and the town was renamed Presque Isle, which is French for "Almost an Island".



Photos of Fosterville

Presque Isle is a quiet, picturesque community where the term, "Almost an Island" is held in high esteem by the locals. This is a place in Wisconsin that has pristine wilderness like no other; it is truly "Wisconsin's Last Wilderness." Many factors contribute to the uniqueness of the area. The waterfall in the heart of town is one of a kind, with its nine triangular shaped blocks giving the water of the Presque Isle River motion of over and around as it cascades over the dam. While the height of it is not great, it is quaint and beautiful. Water is everywhere, and the term, "Almost an Island", depicts most of the land here. Streams, creeks or rivers join many lakes to one

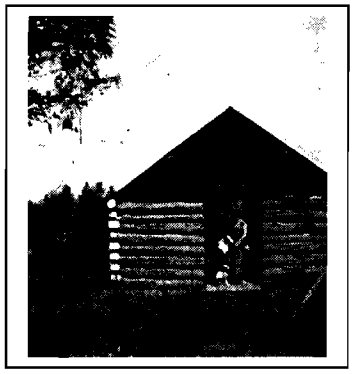
another. The Presque Isle River meanders through the forest, taking the water overflow from many lakes, onto and over the waterfall and continues onward. Because of the continental sub-divide the Presque Isle River flows north, contrary to most rivers in Wisconsin, and continues to repeat it's poetic journey up to Lake Superior. Water provides recreation during the four seasons, and also gives quiet rest to our lifestyles. There is an abundance of wildlife and a great love for the Loon of the Northwoods, by young and old alike. Viewing loons on our lakes enriches and strengthens those involved, whether viewing from boat or shore. Many species of trees and shrubs and a large variety of wild flowers are apparent to the careful observer. The "palette" of color enriches the landscape surrounding the lakes, and is enhanced by blue sky and sunshine. Presque Isle is part of a microclimate that experiences lake effect snows from Lake Superior, to create a winter wonderland.

HISTORY of LAKE ANNA

(Later known as ANNABELLE LAKE)

A Vilas County map from 1926 shows the lake was originally known as "ANNA", located in the Town of Winegar. Lake Anna got its name when one of the original landowners decided to name two of his lakes after his two daughters, Anna and Belle. The lakes were often referred to as Lake Anna and Lake LaBelle. Guides and fisherman would refer to the portage between the two lakes "Anna-Belle". According to Steve Gilbert, Vilas County Fisheries Biologist with the DNR, there were originally two lakes named Anna in Vilas County. This tended to cause confusion, so in the 1950's our Lake Anna became Annabelle Lake.

According to Bob Musgrove III, a long-time Lake Anna resident, in 1920 William "Cap" Clark owned most of the land around Lake Anna. Cap Clark also owned most of the land around La Belle, Armour and Crab Lakes, and in addition ran Clarks Crab Lake Resort. Clark fished Lake Anna often, paddling up the creek from Crab Lake to "La Belle Lake" (today's Belle Lake) and then taking the short portage across to Lake Anna. Cap Clark was also the first owner of the large, 14-acre island on Anna Lake. Local lore has it that he used the island during prohibition for making whiskey for his resort at Crab Lake. Both Cap Clark and "Bear" Hochting, the camp cook at Crab Lake Resort, were the operators of the still. There was also a cabin on the island that had a huge icebox that would hold about 400 pounds of ice when it was loaded from the top, and topped off with 6 inches of cork to insulate it.

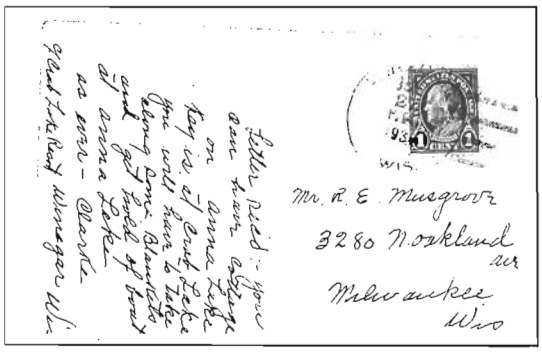


Polak John's Cabin

An immigrant from Poland nicknamed, "Polack John", came to Winegar to work in the woods before World War II. Cap Clark allowed "Polack John to live in the old house on the big island for a long time, until John accidentally burned it down one winter. He left to fight in the war by walking the railroad tracks all the way to Chicago to enlist; only to find out he needed to enlist in Milwaukee! After the war Polack John came back to Winegar to live in his trapper's cabin and run his sawmill during the 1940s, (Today the cabin is gone and Steve Weber owns and operates the mill.) Polack John was a squatter. He didn't own a gun; he trapped and snared rabbits or anything else he could eat. He had no boat, so he built a small raft. When he went fishing he tied a heavy line to his leg with a bait attached to the other end, and rowed the raft around the lake until a musky hit the bait. Once he had a musky hooked, he continued to row the raft, dragging the fish on the line tied to his leg until the fish was drowned. Then he sang all the way back to the island chanting "Moosky Combin'...". People in the area say he was a very nice man who spoke little English, but who helped lots of other folks. John was the caretaker for all the places "back in the woods" on Anna, Crab and Belle Lakes.

Robert W. Musgrove Sr.

Robert W. Musgrove Sr. rented the cottage on Lake Anna for several years, as shown by the postcard from 1934. The Musgroves purchased the big island from Cap Clark in 1949.



1934 Postcard

Elinor & Grace

According to Grace Musgrove, Elinor Ring was quite a gal! Early in life she had been a burlesque dancer, and later became the caretaker of the chorus girls. After she retired she lived on the smaller island next to Musgrove's big island. Some of the lumber that survived the fire started on the big island by Polack John was later used to build Elinor Ring's house. Grace and Elinor were good friends. Elinor was evidently a pretty salty woman, but absolutely straight as an arrow, who loved to fish for pike and tell stories. (Elinor Ring's island later became Tom Herzog's).

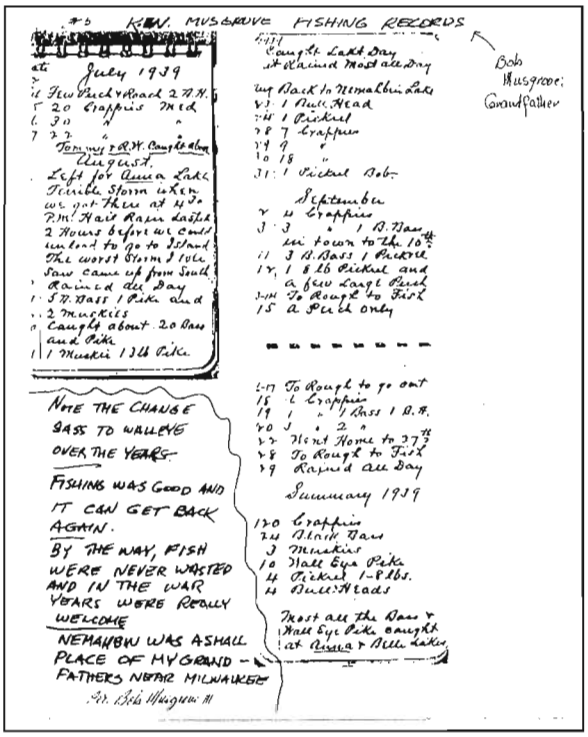
"Gramp" Musgrove Sr. told his grandson, Bob Musgrove III, about the history of the fish in the lake. Lake Anna was originally a smallmouth and muskellunge lake. Walleyes were introduced to Lake Anna by accident. A Conservation Department stocking truck full of walleye fry broke down on Highway B. (At the time Highway B ran right by the shoreline of Anna Lake. Later, when B was moved north to its present location, the old roadbed became the landing that exists today.) "Their only solution to save the fry", he said, "was to dump them into Lake Anna." Gramp Musgrove also said that northern pike were not in the lake until the old dam on the Turtle-Horsehead Creek went out in the late 1940's. The northern pike came up the river, spreading to Lake Anna, Oxbow Lake and into the Presque Isle River.

"We abuse land because we see it as a commodity belonging to us.
When we begin to see land as a commodity to which we belong,
we may begin to use it with love and respect."

Aldo Leopold

During the research for this history of Annabelle Lake, Bob Musgrove III provided old fishing records, dating from 1939 through 1950, which were handwritten by Gramp Musgrove. He was a meticulous record keeper.

Gramp Musgrove's Fishing Notes



K.W. MUSGROVE FISHING RECORDS

Bob Musgrove; Grandfather

July 1939

August

September

Summary 1939

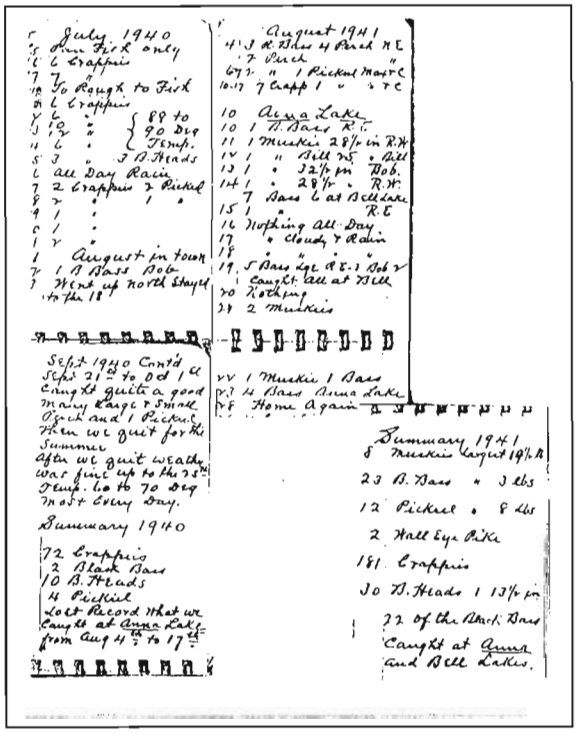
NOTE THE CHANGE BASS TO WALLEYE OVER THE YEARS

FISHING WAS GOOD AND IT CAN GET BACK AGAIN.

BY THE WAY, FISH WERE NEVER WASTED AND IN THE WAR YEARS WERE REALLY WELCOME

NEMAHBIN WAS A SMALL PLACE OF MY GRAND-FATHERS NEAR MILWAUKEE

Sr. Bob Musgrove III



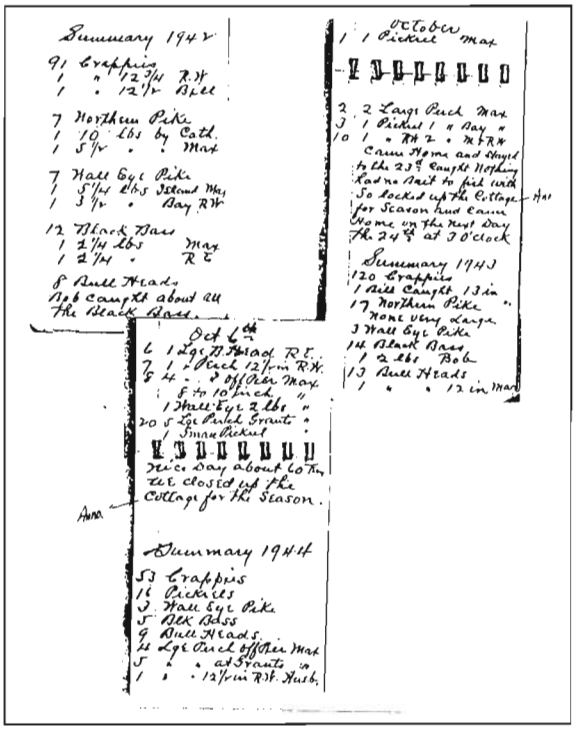
July 1940

August 1941

Summary 1941

Sept 1940 Cont'd

Summary 1940



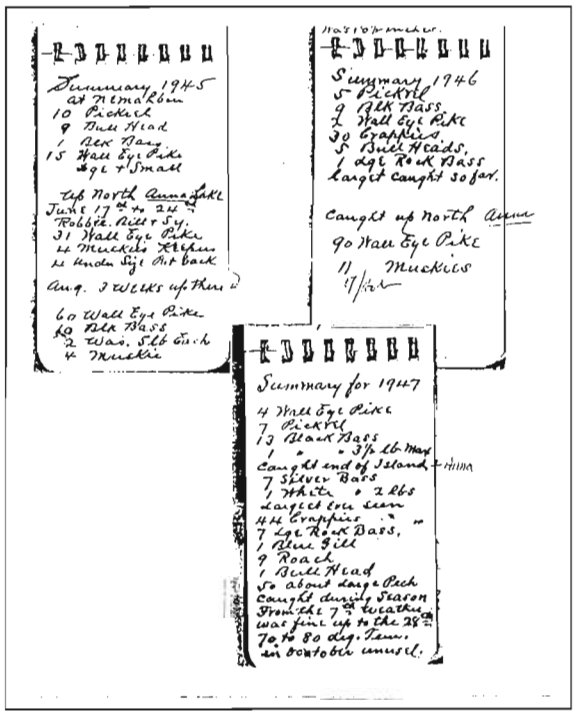
Summary 1942

October

Summary 1943

Oct 6th

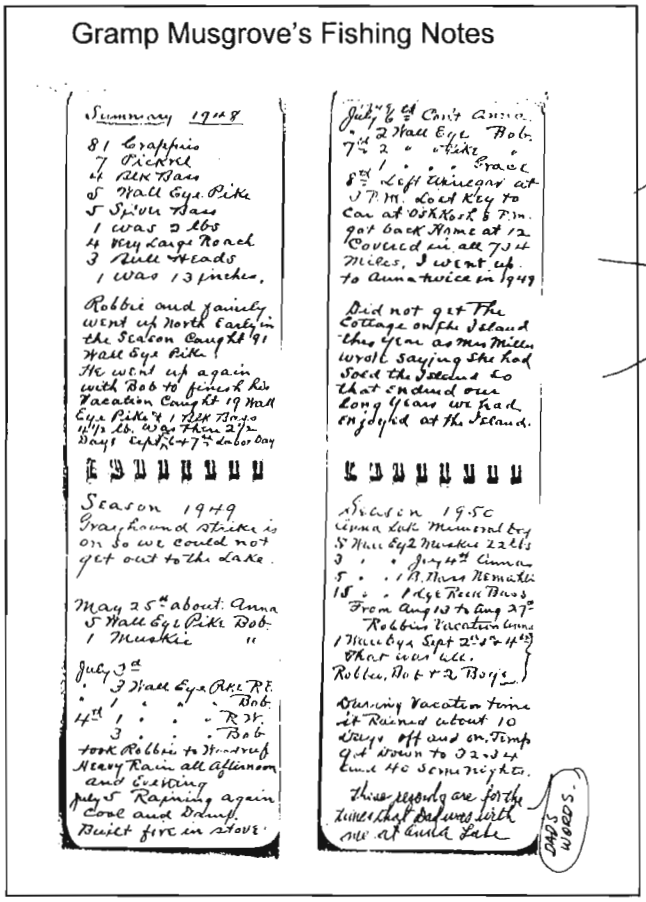
Summary 1944



Summary 1945

Summary 1946

Summary for 1947


Gramp Musgrove's Fishing Notes

Summary 1948
81 Crappie
7 Pickerel
4 Rock Bass
5 Wall Eye Pike
5 Spl'ed Bass
1 was 3 lbs
4 Very Large Roach
3 Bull Heads
1 was 13 inches.

Robbie and family went up North Easter in the Season Caught 91 Wall Eye Pike
He went up again with Bob to finish his Vacation Caught 19 Wall Eye Pike & 1 Rock Bass 11½ lb. Was then 2½ Days left for 7th Labor Day

Season 1949
Greyhound Strike is on so we could not get out to the Lake.

May 25th about: Anna 5 Wall Eye Pike Bob
1 Muskie "

July 3rd
3 Wall Eye Pike R.F.
1 " " Bob
4th 1 " " R.F.
3 " " Bob
took Robbie to Woodruff
Heavy Rain all afternoon and Evening
July 5 Raining again
Cool and Damp
Built fire in stove.

July 6th Can't Anna.
" 2 Wall Eye Bob
7th 2 " White "
1 " " Grace
8th Left Eleanor at J.P.M. Boat Key to Can at Oskkosh 8 P.M. got back Home at 12 Covered in all 7314 Miles. I went up to Anna twice in 1949

Did not get The Cottage on the Island this year as Mrs Miller wrote saying She had Sold the Island so that ended our Long Years we had enjoyed at the Island.

Season 1950
Anna Lake Memorial Day
5 Wall Eye 2 Muskie 22 lbs
3 " July 4th Anna
5 " 1 P. Bass 1 Muskie
18 " 1 Rock Bass
From Aug 10 to Aug 27th
Robbie Vacation Anna
1 Wall Eye Sept 2nd 3rd 4th
What ever I'll.
Robbie, Bob & 2 Boys

During Vacation time it Rained about 10 Days off and on. Temp Got down to 32 & 34 Twice 40 some nights.

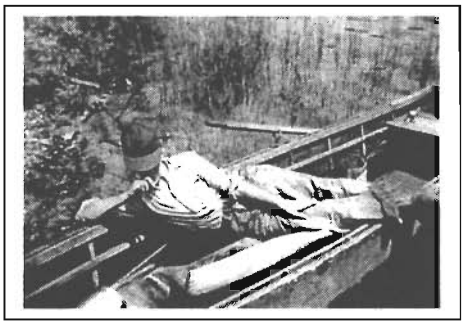
These records are for the Times that I Fished with me at Anna Lake

Many Lake Anna old timers indicated that between 1939 and 1942 all the large, old white pines--called "cork" pines--around the lake and on the islands were logged off for airplane materials for the war effort. The land around Lake La Belle and the south end of Crab Lake was also logged at about the same time. After the logging the fires came. They started near Boulder Junction and covered most of the Lake Anna shore and islands. Strangely, it burned the little island in the South end of the lake, the larger island near the South shore, but then jumped the big island and Elinor Ring's island, only to burn the island on the north end of the lake near the landing. The fire also struck south and east of Lake Anna, burning over most of the land around La Belle and Crab Lakes.

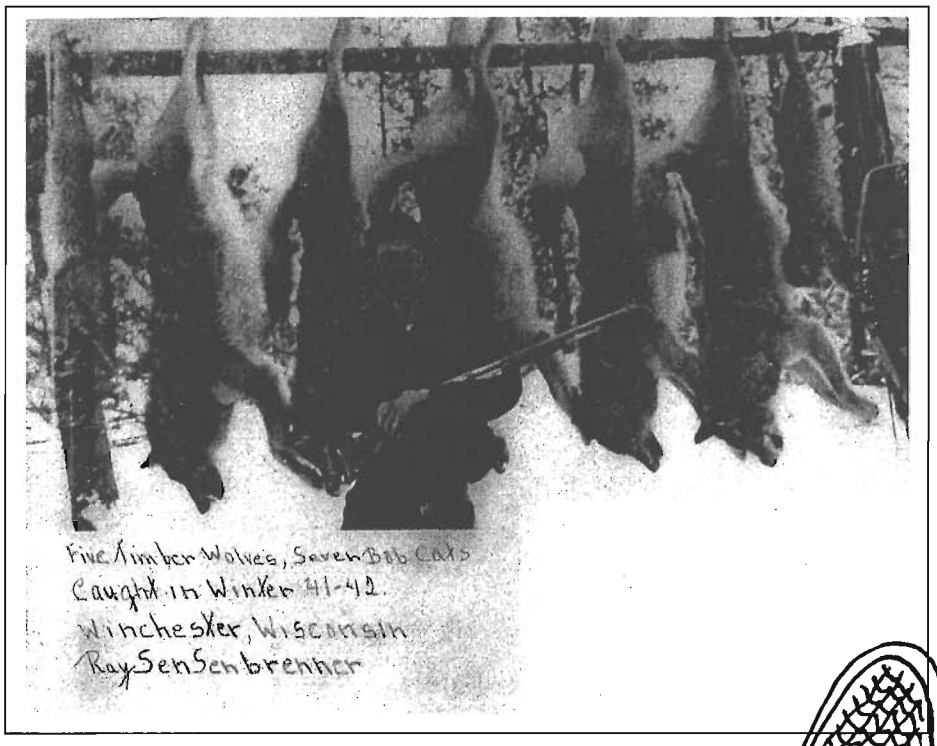
Kelly Morris bought the Lake La Belle property and started the "Kelly Morris Resort". An old fieldstone chimney from the lodge is still standing near the North Shore of Bell Lake. The Resort also had a beachfront where the guests could swim on Lake Anna, as well as a cabin and an old wooden boat. Morris and his guests used to go back and forth between Anna and LaBelle Lakes, using what was then called the "narrows" or the Anna-Belle portage. Morris later sold the land on Bell Lake to "Red" Leekley, a wealthy industrialist from Wisconsin. His guests in the 1950's included President Dwight D. Eisenhower and his brothers, who greatly enjoyed fishing in Northern Wisconsin. Today the property around Bell Lake belongs to J. James Davis III.

According to Gramp Musgrove Sr., and his grandson, Bob III, in the past Lake Anna had extensive weed beds along the north and east shores and around the islands. During this time Mr. Ray Sensenbrenner had a rock dam across the outlet creek, creating a beaver pond of 10 to 15 acres. Ray trapped beavers, muskrats, minks and wolves, which was the way of life for many during that era. According to his daughter Ruth Williams, her Dad's records show that the wolves were trapped in the Winchester area. He also trapped minnows in southern

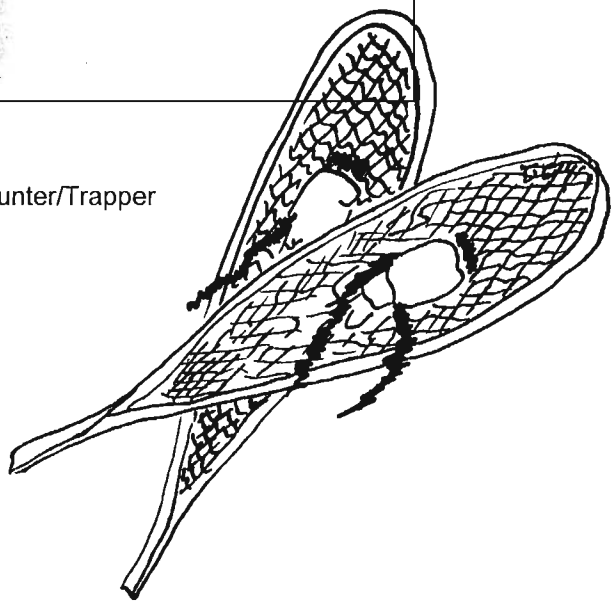
Wisconsin in the 1930's and sold them to local resorts. Ray was also known for his water witching abilities, and helped many locals find the right spot to sink their wells.



Dick Sensenbrenner and weed beds along the shoreline



Ray Sensenbrenner-Hunter/Trapper



Ray with his divining rod

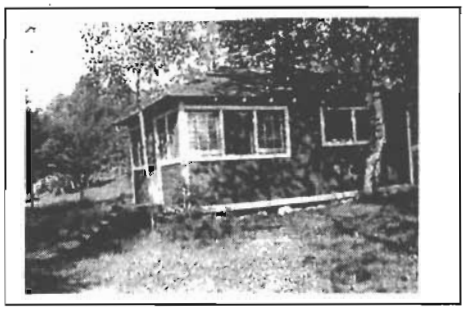
One of the current lake property owners, Shirley Klein, related the following story about her experience with water witching: "When we were ready to put in the well on our property, the plumber refused to drill until the site had been 'witched' by Mr. Sensenbrenner. Ray came over with his well-used, well-polished divining rod and proceeded to 'witch'. He walked straight and tall -- as if in a trance -- looking only straight ahead. When he reached a certain spot, the rod pointed down and seemed to almost drag him down to earth, where he proclaimed, 'This is it! There is water here.' Ironically it was the area we wanted the well to be in anyway, but it sure was worth the $25.00 for the show! I now have a wonderful 137-foot well and the best water in the world." Ray was famous for his water witching talents. He was even called to Texas to find water on an oil field.

The Gotto Farm House

Sig Olsen

One resort was established on Lake Anna. According to Florence Konkolewski and Bob Musgrove III, the resort was originally a farm. It was then purchased by two brothers, Sig and Harold Olsen, who ran a resort there until the 1940's. The Gotto family, including their four children, ran "Anna Lake Resort" from 1940 through the mid-50's. An early brochure states that there were six cabins on 3,000 feet of shoreline with a safe, sandy beach area. All the cabins had wood burning stoves. There was an electric light plant for the camp, and pure cold water was available at the pump. The cabins rented for $25.00 for 3-5 persons, or $30.00 for 4-8 persons. Tom Konkolewski and his brother Ed purchased the resort in the late 1950's and ran it until 1971. (Florence was the Gotto's daughter and Tom was her husband.) During the 1960's the Resort was modernized to include indoor plumbing, running water, gas heat and electricity. It was a hub of activity with Tom and Florence's three children and Ed and Sylviann's four children, when all were full-time summer residents.

The Gotto's

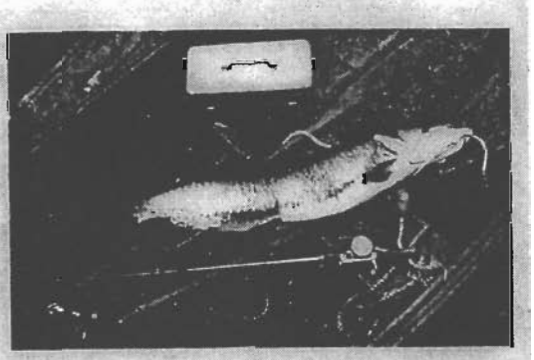


Florence's Cabin

With the death of Tom Konkolewski the resort closed from 1972 thru 1980. The resort property was divided between Florence and Ed. In 1981 Ed and Sylviann Konkolewski reopened as the "North Shore Resort", with two cabins for rent during the summer. Florence Konkolewski still spends a portion of each summer at her cabin on Annabelle Lake, which is in the same area as the original farm home.

According to Florence, "Mr. Gotto sold two cabins from the Anna Lake Resort to Mr. Musgrove in the late 1940's. These cabins were transported over the ice in the winter to the big island where they were combined into the present cottage on Southeastern point of the island."

Anna Lake Resort Brochure 1940-1950



ANNA LAKE RESORT is located on ANNABELLE LAKE about two miles east of Presque Isle, Wis. and two miles from Michigan border line.

Safe Beach for Swimming

A map can be found at back of folder. This is a beautiful clear water lake surrounded by pine and birch trees. There are five islands and many bays. We have on our property over 3000 feet of shoreline and a safe gradual sloping sand beach for swimming.

Many places of interest are only a short distance. Waterfalls in Michigan. Iron and copper mines, saw mills. State forest farms and fish hatcheries. Enjoy this rustic scenery.

Musky, wallyed pike, bass and pan fish are caught in ANNABELLE LAKE. Fishing licenses and food may be purchased in Presque Isle a distance of 2 miles on excellent roads. There are many lakes within a few miles where we will make arrangements for fishing.

All cabins are housekeeping and are on lake front. There are 4 cabins furnished with heaters, comfortable beds, innerspring mattress, pillows and blankets. Please bring your own linens. Bottle gas is furnished for cooking and electric refrigerators in each cabin. Pots, pans, dishes and cutlery are included. Pure cold water at pump. Access to our DEEP-FREEZE for freezing your fish. One boat included in cabin rental. Additional boats available at weekly or daily rates.

CHECKING IN TIME 12:00 noon

CHECKING OUT TIME 9:00 A.M.

Cabins rented from Saturday to Saturday.

3 cabins 3 - 5 persons $35.00 wk.

1 cabin 4 - 8 persons $45.00 wk.

Reservations should be made as early as possible. Deposit of $10.00 required for each week reserved.

All new, safe seaworthy boats. Dry and well cared for. Baits and guides available nearby.

Parties arriving by rail or bus must make arrangements so we can meet them. Small extra taxi charge.

Trails lead from many points on our lake to other lakes. Interesting walks will bring you close to many wild animals, deer, black bear and porcupine.

Bring along your fishing, hiking and swimming clothes and enjoy all this region has to offer.

Anna Lake Resort Brochure 1940-1950

Bob and Peggy Butler's place on the north shore, used to be a farm, as well. The pictures below show the hay field, the road leading in after the trees started to reappear, and the farmhouse with a "woody" station wagon.

The Farm at Bultler's

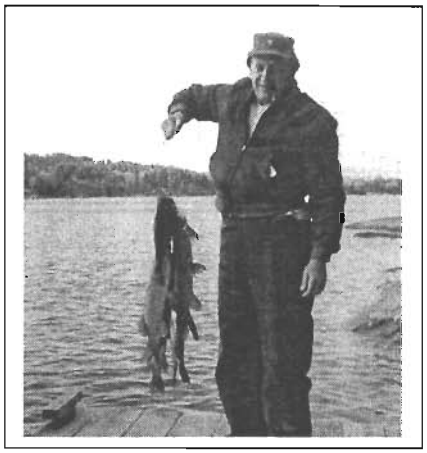
Bob Musgrove III tells of a "daily signal" used when folks were at the lake before or after the tourist season. If everything was OK, the family would hang a large white towel over the porch rail of their cottage. McCaffery's, Sala's, Seeman's and Bob's dad would also look for lights at night. He wrote, "They took pretty good care of each other. Mail delivery in town was the daily social event, and gave everyone a chance to visit with one another."

Nancy & Bob Musgrove

In the letters from Bob and Nancy Musgrove, Bob notes that his Dad started going up to Winegar, WI in the late 1920's. His Dad told him that much of the travel was by portage between lakes. Also many of the old time loggers still lived in Presque Isle, even after the mills shut down. A few were pretty mean characters, including "Alex the Russian", who was killed in a fight with Matt Anderson in his own kitchen on State Line Lake. Bob's Dad also told him that most of today's roads are adaptations of the original logging roads and railroads. One of these old logging roads can still be seen near the boathouse on the Dick Williams property. Another logging road runs through the Williams/Davis property.

Irene Sala

Marge Sala's letter explains how their property came to be known as "Sala's Sandbox". Her Mom and Dad, Ed and Irene, bought the property in 1962. They built their cottage in 1964, and during that year Irene was always sweeping sand off the floor. The Sala's have been coming to the Sandbox for over 36 years, and it has provided continuity for the family in ways that are clearly touching to the generations "over the sands of time".

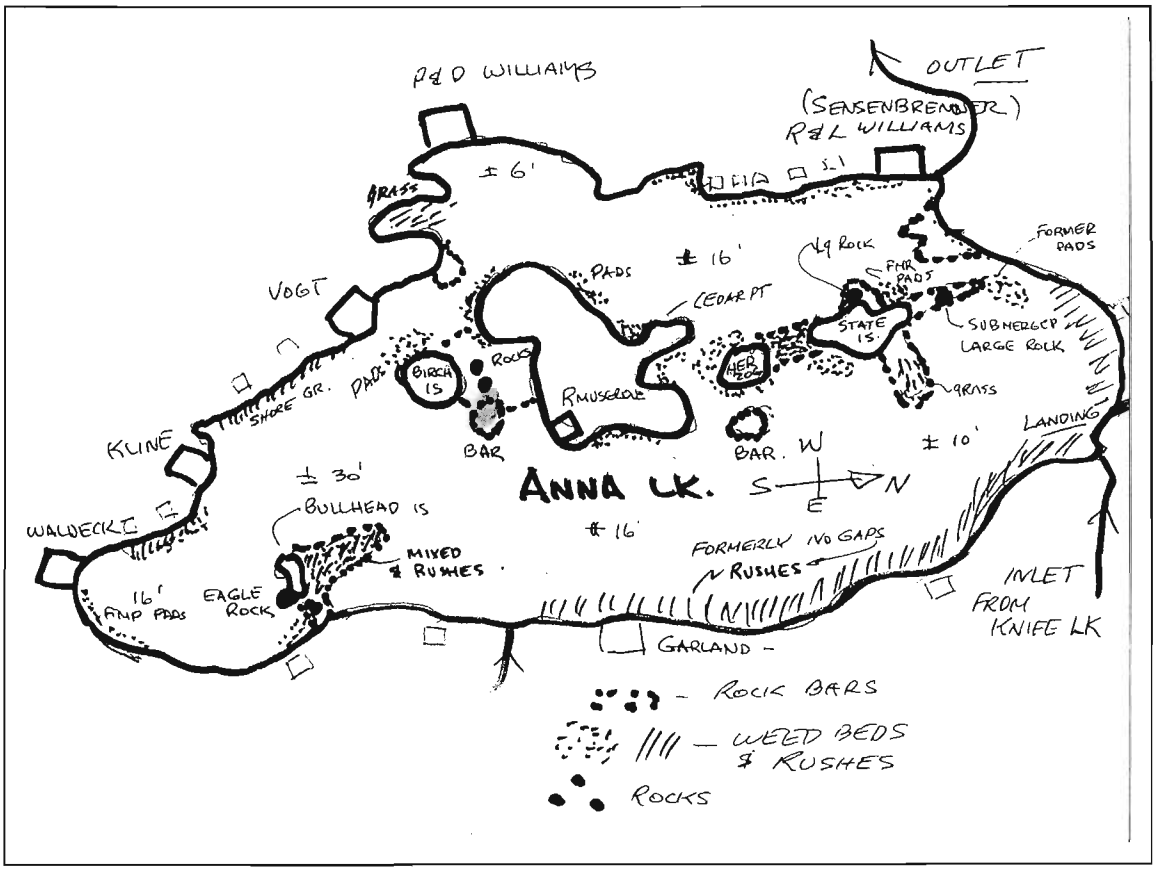


Ed Sala

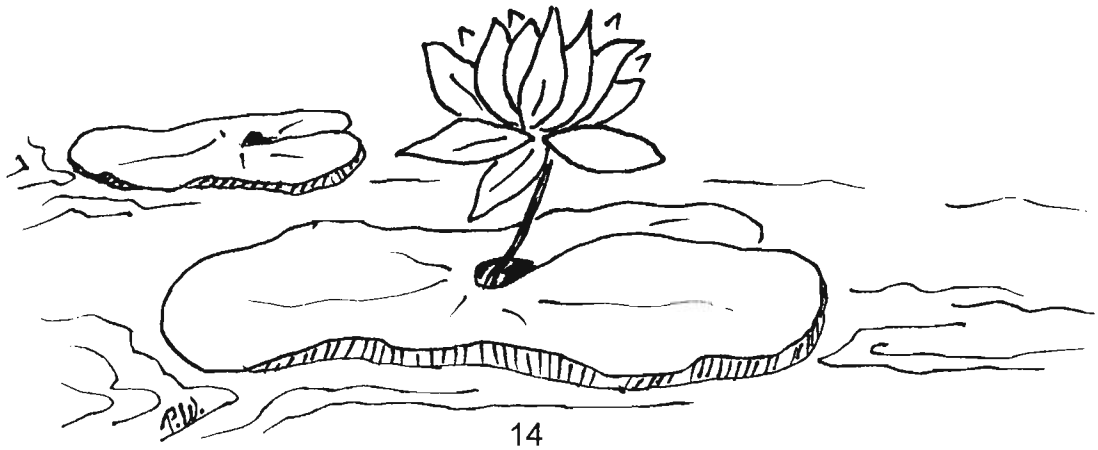
Music. If I were blessed with musical talent I would create a composition made up of the sounds of our cottage years. The laughter and shouts and splashings of little kids in water (Motherrrr, Joe is chasing me with a turtle), birdsongs, partridges drumming, the frog chorus, thunder, rain on the roof, wind, wave sounds, the pure notes of Gail's flute across the water, the silly songs we sang as we rode along to help the boredom of getting to the lake, the occasional sing-a-longs we had at the lake and woven through it all, the wild haunting cries and maniacal laughter of the loons. And, oh yes, the sombre notes of tears. This place has known heartache, too, in a quarter of a century.

Marie Elliot (1973)

Many of those who have been on the lake for generations, tell of the fluctuating water levels. They told of the location of huge boulders that to this day carry the prop marks of motors and scrapes of boat paint. When we look at the hand drawn map done by Bob Musgrove III, some lake areas have nick names like, "Eagle Rock", "Cedar Point", "Bullhead Isle", "Muskie Bay", "Birch Island", and "Ann's Island", to name a few.



Hand Drawn Map by Bob Musgrove III

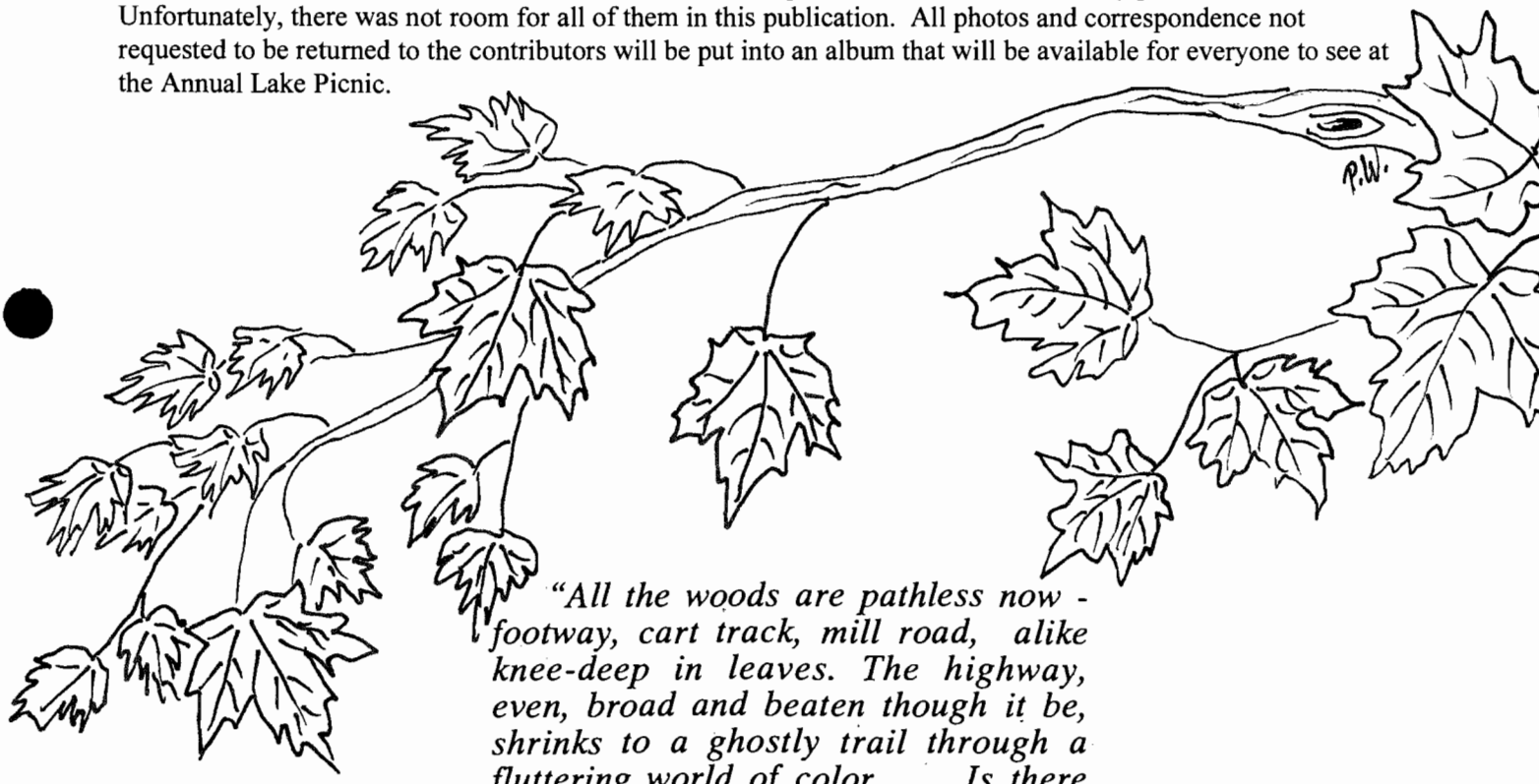


References:

Crab Lake Memories, Liza Tuttle, 1990
"Yarns of Yesteryear", FYI Northwoods, 1997-2001, Gladys Hill
Old Photos and Stories from Lake residents:
Bob & Peggy Butler, Shirley Klein, Florence Konkolewski, Richard Novak,
Bob and Nancy Musgrove, Bob Rogacki, Irene and Marge Sala, Norm Waldeck,
Dick and Pat Williams, and Ruth and Louis Williams,
1926 Winegar area map from Bob Musgrove
Hand-drawn Annabelle Lake Map by Bob Musgrove III.
Old fishing records from "Gramp" Musgrove Sr.

Thanks to everyone who shared their stories. Your help made it possible to assemble this history so that it can shared with everyone. The knowledge of "old times" makes us all appreciate the many hardships that people went through to preserve the natural beauty of Annabelle Lake and its watershed.

Thanks to everyone who sent material and current photos, too. There were many photos submitted. Unfortunately, there was not room for all of them in this publication. All photos and correspondence not requested to be returned to the contributors will be put into an album that will be available for everyone to see at the Annual Lake Picnic.



"All the woods are pathless now - footway, cart track, mill road, alike knee-deep in leaves. The highway, even, broad and beaten though it be, shrinks to a ghostly trail through a fluttering world of color . . . Is there magic abroad? Have genii or gnomes caught you suddenly into a golden world? There is gold all about you - overhead, underfoot. It must be these lithe, gray-stemmed woodland giants stored all the sunshine in their hearts, and now exhale it through their leaves."

M. McCulloch Williams, 1892.

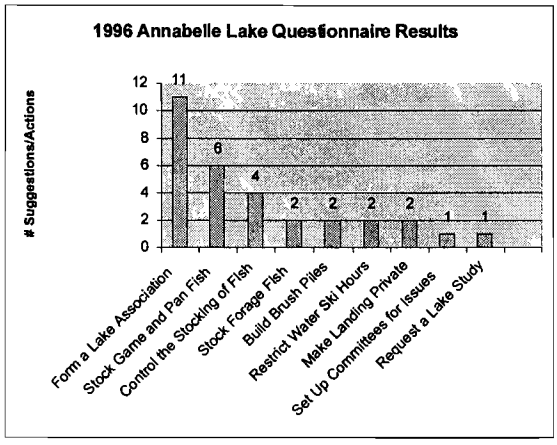
Annabelle Lake Property Owners Association
Formation History

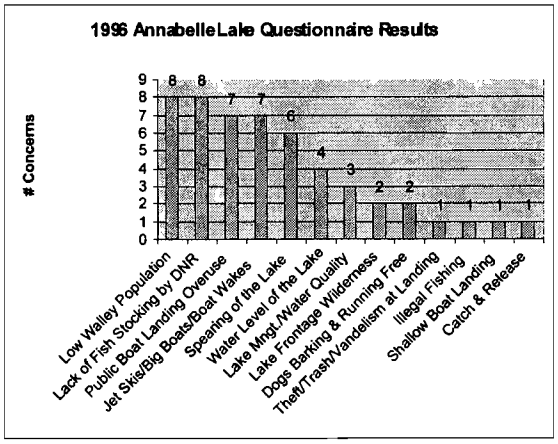
On February 19, 1995, Mr. & Mrs. Richard Williams and Mr. & Mrs. Robert Schaefer, two year-round property owners on Annabelle Lake in Vilas County, shared their views and concerns about the future protection of Annabelle Lake. They reached the conclusion that working together as an organized group, who shared a common interest in the lake, would be beneficial to all.

On August 14, 1995, they wrote to Cathy Techtmann, the community resource agent for Iron County, after hearing her speak on PBS radio. On January 4, 1996, Pat Williams wrote to her to obtain further information regarding the process for forming a Lake Association, and to notify her that an informational meeting had been set for the property owners around Annabelle Lake to be held at the Community Building in Presque Isle on July 6, 1996 at 1:00pm. Cathy was asked to speak at this meeting, but she informed us that the person to handle these matters in Vilas County was Mr. Brian Pierce, Resource Agent at the Vilas County Extension Office.

On February 19, 1996, an informational letter was sent to 34 property owners on or near Annabelle Lake inviting them to attend the July 6th meeting. The letter stated that the purpose of the meeting was to discuss the formation of a Lake Association, and that a slide program and handouts on lake associations would be provided to everyone. A questionnaire requesting opinions about the formation of an association was also sent to each property owner.

The meeting took place as planned. Dick Williams served as Chairperson, Pat Williams as Secretary, and Bob & Carol Schaefer handled the welcome/registration duties. Twenty-six people, representing fourteen of the property owners, attended this first meeting. Results of returned questionnaires disclosed the following suggestions and concerns:





Results of questionnaires distributed to Annabelle Lake property owners 2/19/1996

Mr. Bryan Pierce gave an informational presentation, passed out handouts and conducted a question and answer discussion about formation of a Lake Association. A vote was then taken which confirmed an interest in the formation of a Lake Association. Interim Officers were elected, and dues were temporarily set at $10.00. A volunteer Steering Committee was established and set a date of August 12, 1996 for their first meeting. The first annual meeting of the Annabelle Lake Property Owners Association was set for Saturday, August 31, 1996, at 3:00pm, at the Presque Isle Community Building. Everyone present agreed to notify those who were not in attendance of the August meeting. The purpose of the meeting would be to vote on the official formation of a

FISHERIES INFORMATION

History

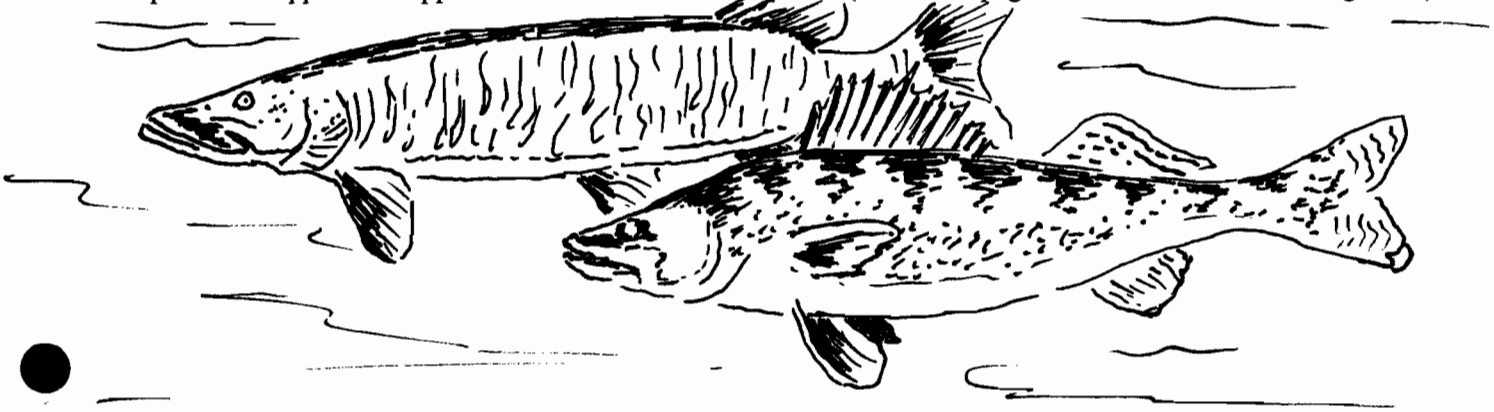
The earliest fisheries survey conducted by the Wisconsin Department of Natural Resources (WDNR) occurred in 1963. An electrofishing survey conducted on July 2, turned up walleye, smallmouth bass, yellow perch, bluegill, rock bass and muskellunge. This survey was conducted at a time of year that does not give a complete picture of the fishery. However, this survey did provide information on of the presence or absence of the major fish species.

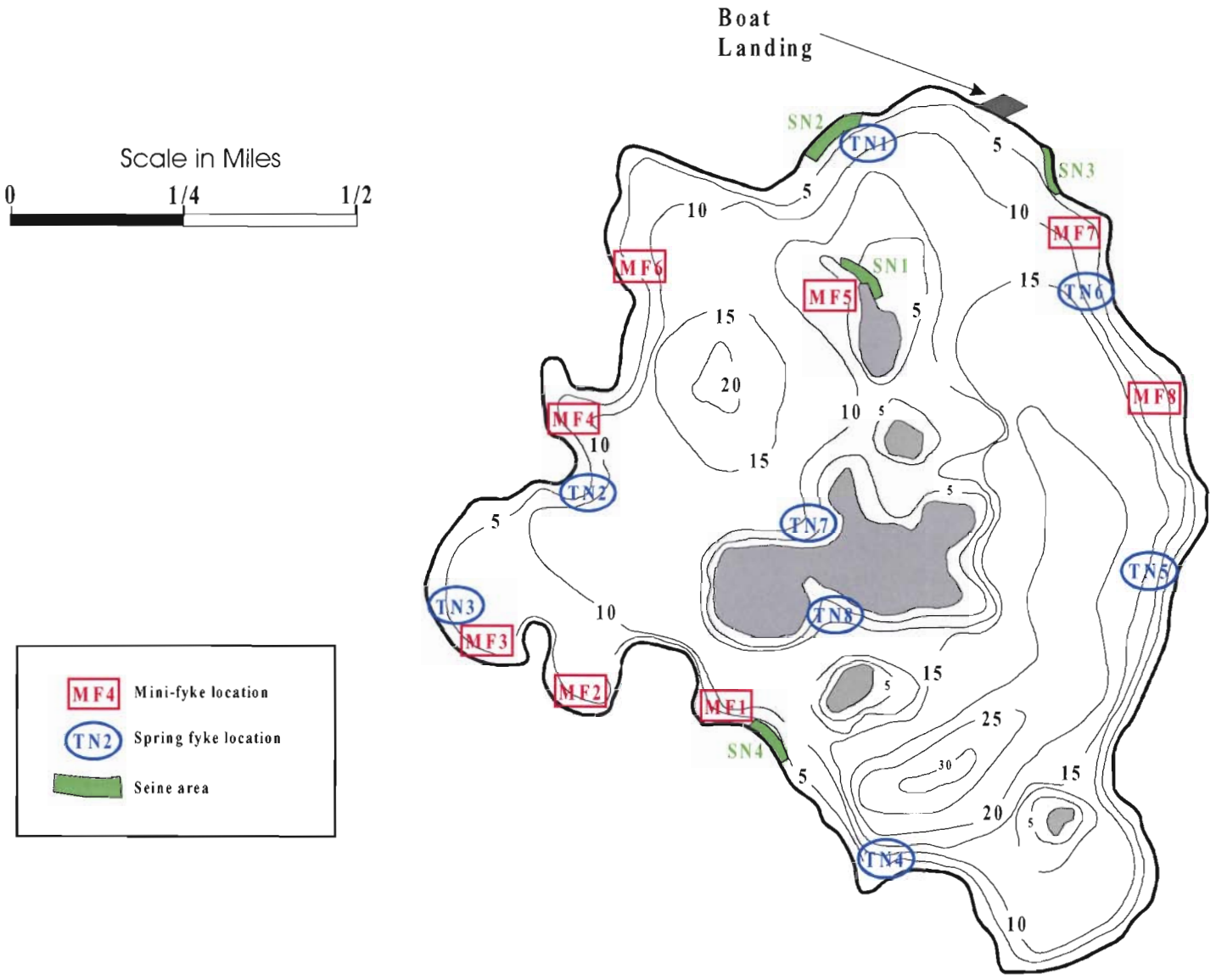
A more comprehensive survey conducted in 1967 gave a more complete picture of this fishery. During the survey fyke nets, gill nets and minnow seines were used to sample the fish community in late August and early September of that year. Walleye were again the most common gamefish species captured. The most common panfish species found in 1967 were bluegill, followed by black crappie. Species noted in this survey but not the captured in 1963 were: northern pike (6), black crappie (13), pumpkinseed (5), darters (64), slimy sculpin? (1), and white sucker (2).

Intensive fisheries surveys of Annabelle Lake were not conducted again until the late 1980's. Most of that survey work was directed at walleye due to the treaty fisheries issue. Details of those surveys are included in the walleye section, which follows.

In 1996 WDNR conducted a creel (angler) survey of Annabelle Lake. From May 4, 1996 to March 1, 1997, a department employee counted and interviewed anglers on the lake. Information on all species targeted and caught was collected as part of this survey. A total of 2,566 angler hours or 12.0 hours per acre were spent on Annabelle Lake. This is a low level of fishing activity compared to the Vilas County average of 35.7 hours/acre and the state average of 33.6 hours/acre. Almost all of the fishing activity took place in the summer months. Peak fishing activity occurred during the month of July (688 angler hours). Almost no fishing occurred during the winter months. A total of only 10 angler hours were estimated for all the winter months combined. This was expected due to the lack of good winter access and few year round residents on the lake. Details of the creel report are included in the appropriate summary sections for each species in this document. The full Creel Census report is included in Appendix A.

During calendar 2000, Northern Ecological Services (NES), a private contractor, was hired by the Lake Association to conduct a survey of the lake. Part of their work included sampling the fishery. NES conducted spring and summer netting surveys of the lake following standard WDNR monitoring protocol. Figure 3-1 from the NES study appears on the following page and shows the sampling locations for their study. Their survey showed that game fish and panfish species present were about the same as found in previous surveys. The major difference was that largemouth bass (30) were captured for the first time and that no black crappies were found during their survey. The NES survey also took an in-depth look at non-game fish species. A full copy of the NES report either appears in Appendix C or is available from NES. (Please see page 22 for details on contacting NES.)





Client: Annabelle Lake Property Owners Association	
Job number: 13798001	Drawn: M. Melchior
File: C:\lakes\Annabelle\bathmap	10/15/00

Project:

Figure 3-1. Annabelle Lake fisheries sampling locations

NES
Ecological Services
2825 South Webster Avenue
Green Bay, WI 54301
(920) 499-5789
www.nelsoninc.com/nes

Sheet No. 1

Walleye

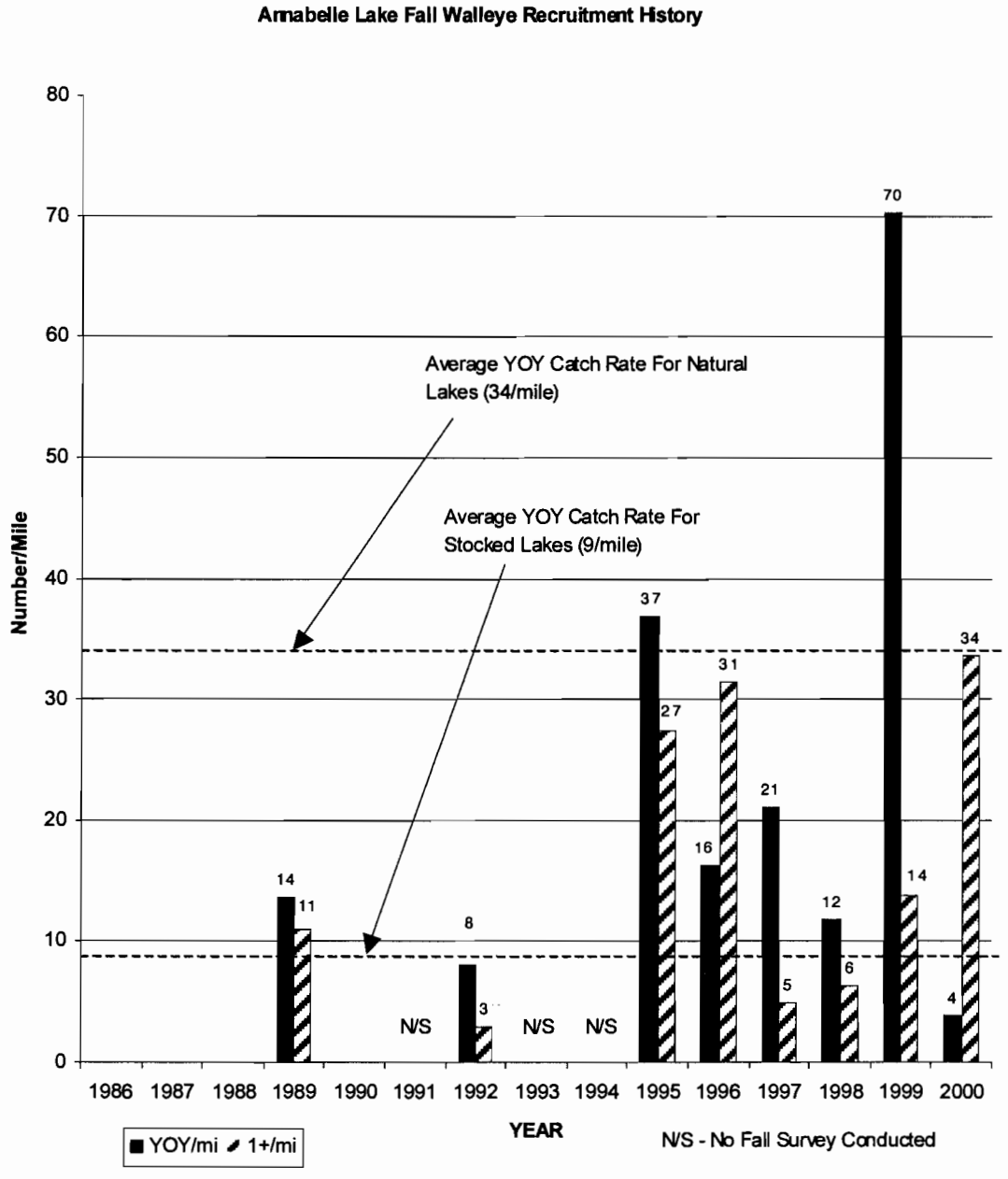
Walleye are the most abundant gamefish species in this Annabelle Lake. They are probably not native to this lake and were likely introduced in the early 1900's. WDNR had a history of sporadic stocking of walleye from 1933 until 1978. WDNR stocking of walleye was discontinued after 1978, due to indications that natural reproduction was occurring.

Annabelle Lake Stocking History, 1930 to 2001

Species	Number planted	Size	Date
Walleye	76,000	Fry	1933
Perch	85	Yearlings	1936
Muskellunge	114,375	Fry	1937
Walleye	757,850	Fry	1937
Walleye	1,750,000	Fry	1938
Muskellunge	50,000	Fry	1939
Perch	25,000	Fingerlings	1939
Walleye	341,080	Fry	1939
Muskellunge	50,000	Fry	1940
Walleye	600,000	Fry	1941
Muskellunge	30,000	Fry	1941
Muskellunge	100	Fingerlings	1941
Muskellunge	8,000	Fry	1942
Muskellunge	625	Fingerlings	1946
Largemouth Bass	4,200	Fry	1946
Walleye	11,440	Fingerlings	1958
Muskellunge	500	Fingerlings	1964
Muskellunge	600	Fingerlings	1969
Muskellunge	200	Fingerlings	1970
Muskellunge	400	Fingerlings	1973
Walleye	5,000	Fingerlings	1974
Muskellunge	437	Fingerlings	1977
Walleye	1,785	Fingerlings	1977
Walleye	9,000	Fingerlings	1978
Muskellunge	300	Fingerlings	1980
Black Crappie	500	Fingerlings	1995 private
Walleye	100	Fingerlings	1996 private
Black Crappie	400	Fingerlings	1996 private
Walleye	200	Fall Fingerlings	1997 private
Black Crappie	400	Fall Fingerlings	1997 private
Smallmouth Bass	200	Fall Fingerlings	1997 private
Black Crappie	300	Fall Fingerlings	1998 private
Smallmouth Bass	150	Fall Fingerlings	1998 private
Walleye	200	Fall Fingerlings	1999 private
Black Crappie	400	Fall Fingerlings	1999 private

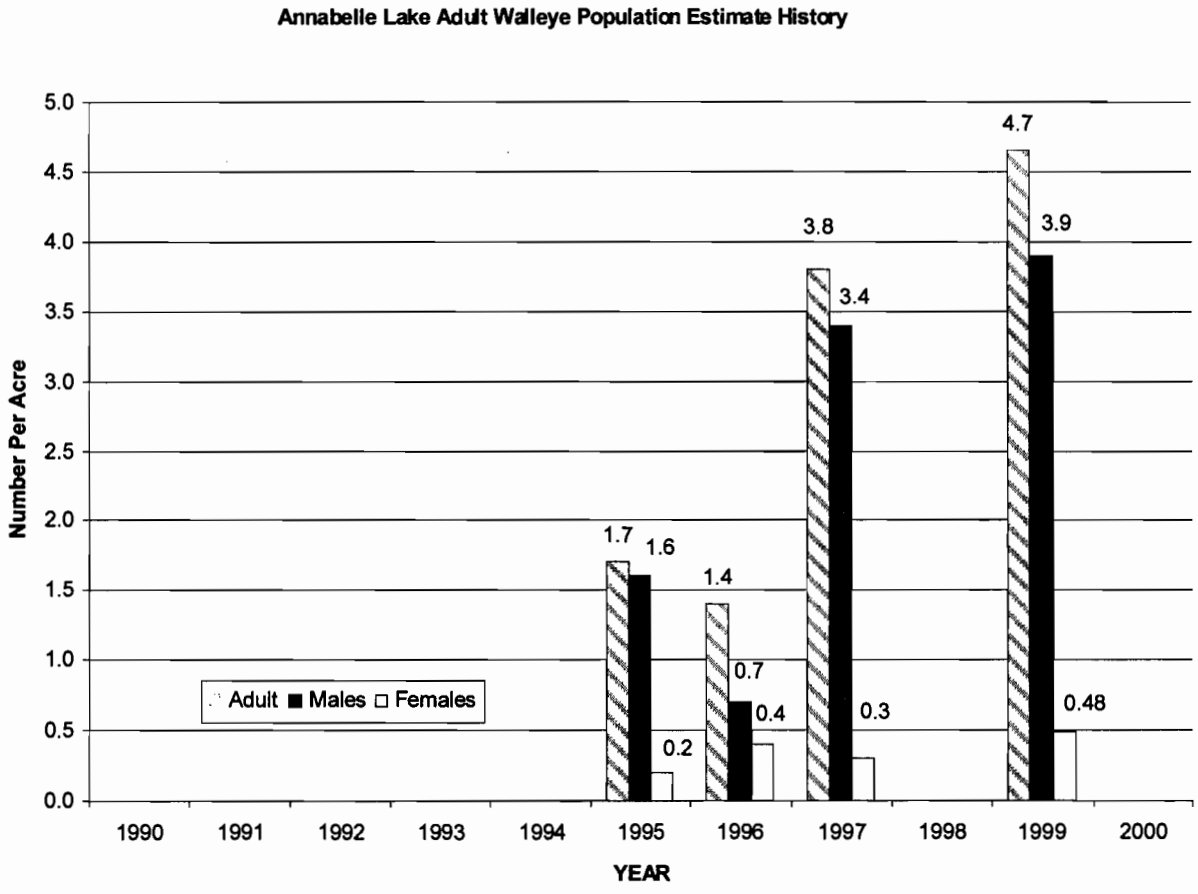
Annabelle Lake Stocking History 1930 - 2001

Fall recruitment surveys conducted by WDNR and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) since 1982, show that significant natural reproduction of walleye is occurring in Annabelle Lake. Above average year classes formed in 1994, 1995, and 1999 are responsible for the current adult walleye population levels, as shown in the graph below.



Walleye catch per unit of effort of young-of-year (YoY) and yearling or older (1+) fish captured in fall electrofishing surveys of Annabelle Lake (1986-2000)

Annabelle Lake was selected by GLIFWC as a long-term walleye trend lake. That means they will survey the walleye population in the lake every two to three years. Surveys of adult walleye were conducted by GLIFWC in 1995, 1996, 1997, and 1999. Results of the GLIFWC survey indicate that adult walleye abundance in Annabelle Lake increased from 1995 to 1999. The estimate for 1995 showed 1.7 adult walleye per acre and the number in 1999 was 4.7 per acre (990 adults). The 1999 level is slightly above average for our best naturally reproducing walleye waters in the state.



Estimated number of adult walleye in Annabelle Lake 1995 -1999
Estimates made by GLIFWC from surveys they conducted

In 1999 the adult walleye population of Annabelle Lake was dominated by small walleye. The dominance of small walleye is due to the good natural reproduction in the late 90's and the slow growth of walleye in Annabelle Lake. Most (91%) of the current adult population is less than 15 inches in length. The lack of walleye greater than 15 inches is due to the lack of good natural reproduction that occurred throughout northern Wisconsin in the late 1980's and early 1990's. The population estimate from 1999 projected that there were only 80 fish 15 inches or larger present. The largest walleye captured in this survey was 27 inches in length.

A creel (angler) survey conducted by WDNR in 1996 showed that walleye were the second most sought after fish in Annabelle Lake. Slightly over 35% of all the anglers fishing the lake targeted walleye. Fishing pressure for walleye was greatest in the month of May (431 angler hours). It was estimated that anglers caught 347 and harvested 2 walleye during the survey. Anglers spent an estimated 500 hours to harvest one legal walleye in 1996. The walleye harvest rate on Annabelle Lake was well below the Vilas County average of 7.3 hours per walleye. The low harvest rate could be expected due to the few adult fish greater than the 15-inch size limit in the population at that time. A full copy of the Creel Census Report from the DNR appears in Appendix A.

Conclusions and Management Recommendations for Walleye

The walleye population of Annabelle Lake is headed in the right direction and the numbers should increase as the 1999 year-class matures. The numbers of legal size fish should increase in the next year or two as the 1994 and 1995 year-classes attain 15 inches in length.

Stocking of walleye is not currently needed to keep this fishery going as long as we see good natural reproduction on a regular basis. The walleye population will continue to be monitored and the outlook for this lake is good. One management option would be to change the walleye regulation from the standard 15 inch minimum to a no minimum length, but allow harvest of only 1 walleye over 14 inches. This would increase angler harvest, but would not likely increase the numbers of larger fish in the population due to the slow growth rates and low productivity of Annabelle Lake. Walleye greater than 12 inches from Annabelle Lake are listed in the statewide mercury advisory. A regulation change allowing for the harvest of smaller fish, which tend to have lower mercury levels, may allow for the better utilization of this species in Annabelle Lake.

Muskellunge

Muskellunge are an important and popular gamefish in Annabelle Lake. Current surveys though not directed specifically at muskellunge show that this species is doing well and naturally reproducing in Annabelle Lake. Muskellunge were stocked periodically in Annabelle Lake from 1937 to 1980. Stocking was discontinued in 1980 when the WDNR determined that adequate natural reproduction was occurring.

Tribal harvest (Bad River Band) of muskellunge has occurred infrequently in Annabelle Lake. Tribal spears have harvested a total of 3 muskellunge since 1985.

Muskellunge was the most sought after fish species in the creel survey of Annabelle Lake. Almost half of all anglers in the 1996 survey stated they were targeting muskellunge.

It was estimated that anglers caught 27 and harvested 3 muskellunge in 1996. The largest muskellunge harvested that was measured by the WDNR clerk was 40 inches in length.

Smallmouth Bass

Limited information is available on the smallmouth bass population of Annabelle Lake. They are probably native to the lake and no stocking of this species is noted in the stocking record. The current population is maintained through natural reproduction. Every general survey of the lake has turned up smallmouth bass. Largemouth bass are currently not present in Annabelle Lake despite stocking of fry that occurred in 1946.

Creel survey results from 1996 show that less than 7% of the anglers targeted smallmouth bass. Anglers caught 131 bass during this survey and did not harvest a single fish. The current angling regulation for bass on Annabelle Lake is a bag limit of 5 fish and a minimum size limit of 14 inches.

Northern Pike

Northern pike are present in Annabelle Lake but not in significant numbers. Surveys have regularly turned up a few small pike. Less than one percent of anglers fishing the lake said they were targeting pike in the 1996 creel survey. Anglers reported catching only 13 pike and none were harvested during this same survey.

Panfish

Yellow perch, bluegill, and black crappie are the major panfish species present in Annabelle Lake. All three are probably native to the lake. Stocking of yellow perch and black crappie has occurred in the past. This has resulted in no noticeable increase in the populations of either species.

Less than 8% of the anglers fishing this lake in 1996 were after panfish. Anglers harvested an estimated 162 bluegills and 92 yellow perch in the year of this survey. None of the anglers interviewed were targeting black crappies and none reported catching any. Black crappie populations are cyclical and it appears that they are currently at a low point in the cycle.

Management Recommendations

Muskellunge: The current 34-inch minimum length limit and the promotion of catch and release appear to be providing adequate protection to this fishery. A 40-inch minimum size limit would provide additional protection, but should be considered only if it is applied across numerous lakes in the area. Future surveys of this lake should attempt to collect additional information on the muskellunge fishery.

Smallmouth Bass: Future management potential for this species remains low due to competition from the walleye population that is currently present and the low fertility of this body of water.

Northern Pike: Promoting or increasing the pike population would not be in the best interest of Annabelle Lake given the current fish community.

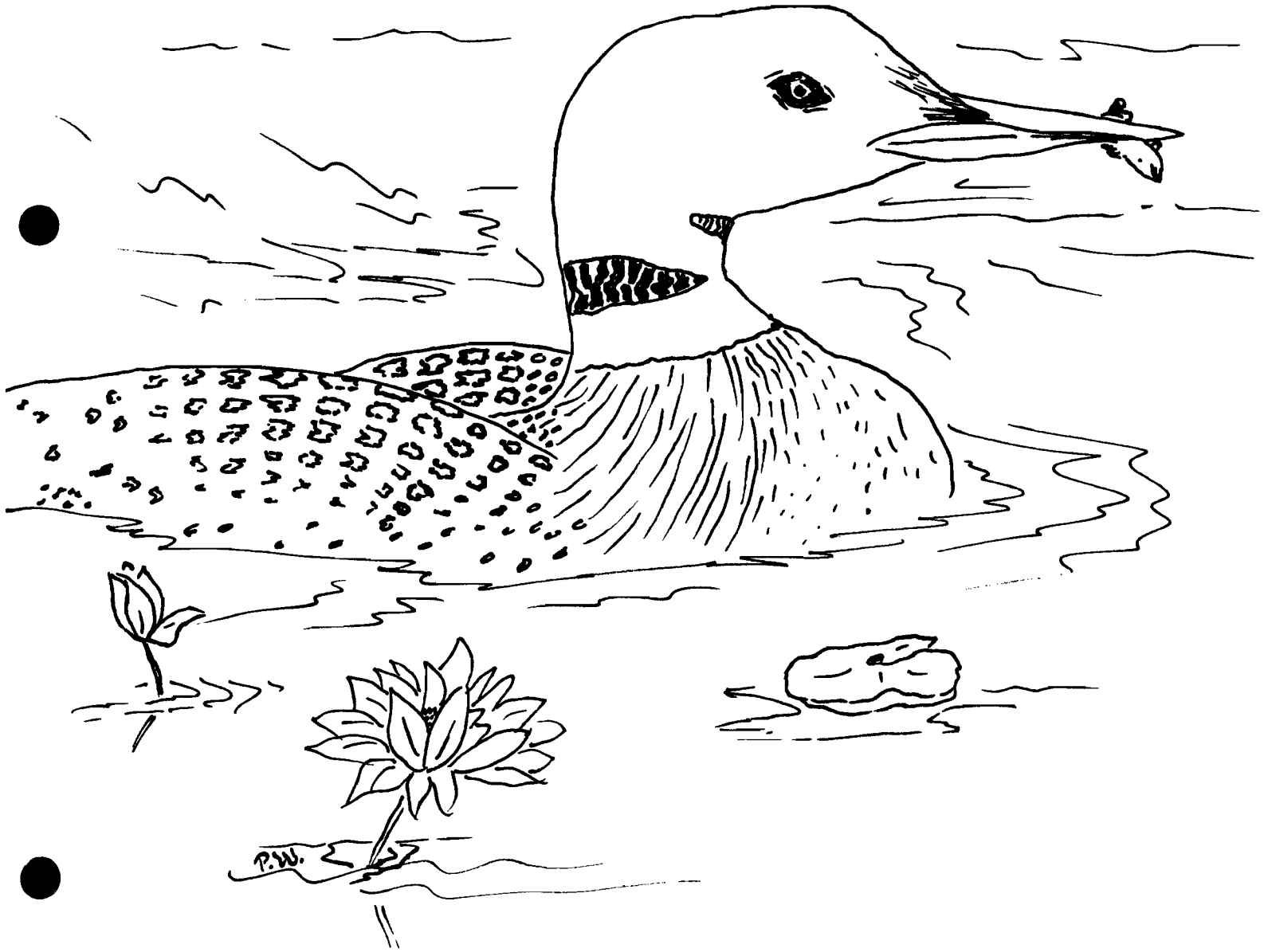
Panfish: Annabelle Lake does not have the habitat or fertility to provide quality fishing for panfish. The low numbers of black crappies currently present could be part of the reason we have observed better natural walleye recruitment in the last five years. High black crappie numbers tend to suppress walleye recruitment.

Future Management of the Annabelle Lake Fishery

Annabelle Lake is currently providing an average fishery given the current fisheries community and limited fertility. Naturally reproducing walleye and muskellunge populations are providing adequate angler opportunities. Stocking of these or any other species currently present would not significantly add to the fishery. Stocking of Annabelle Lake is not recommended at this time.

The fishing regulations currently in place seem to provide adequate protection to the fish populations that are present, while still allowing modest angler harvest. One potential change would be to modify the current walleye regulation to no minimum length, but allow the harvest of only 1 fish over 14 inches per angler per day.

The Department of Natural Resources will continue to monitor the Annabelle Lake fishery and make the necessary changes in the management plan as warranted by changes in the fish community.



AQUATIC VEGETATION

Survey

During the month of August 1998, the Northern Ecological Services, Inc. (NES) conducted an Aquatic Vegetation Survey on Annabelle Lake. This study was funded by DNR as part of the Annabelle Lake Association's Lake Planning Grant. Their report is either included in Appendix D or available from NES. (Please see page 22 for details on contacting NES.)

The survey was conducted to determine the total aquatic plant species present in Annabelle Lake, the distribution of these plants in the lake and to determine if any exotic or invasive plant species were present in the lake.

The Northern Ecological Service, Inc. methodology included the plant survey, Floristic Quality Assessment and aquatic vegetation community type mapping. NES also provided management recommendations for both aquatic habitat and shoreline development.

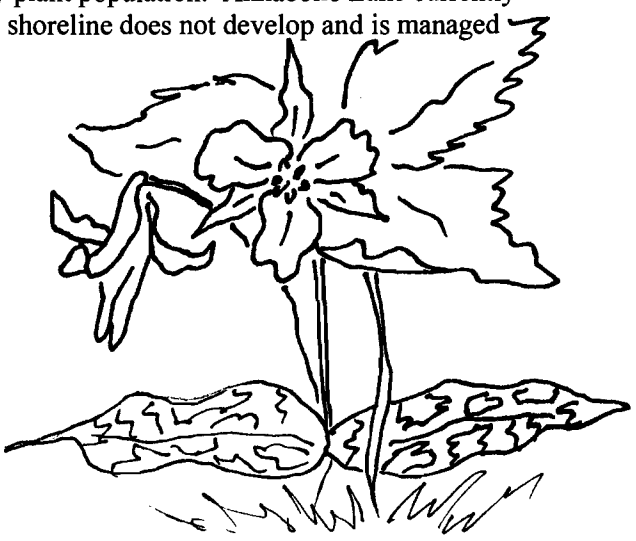
Summary

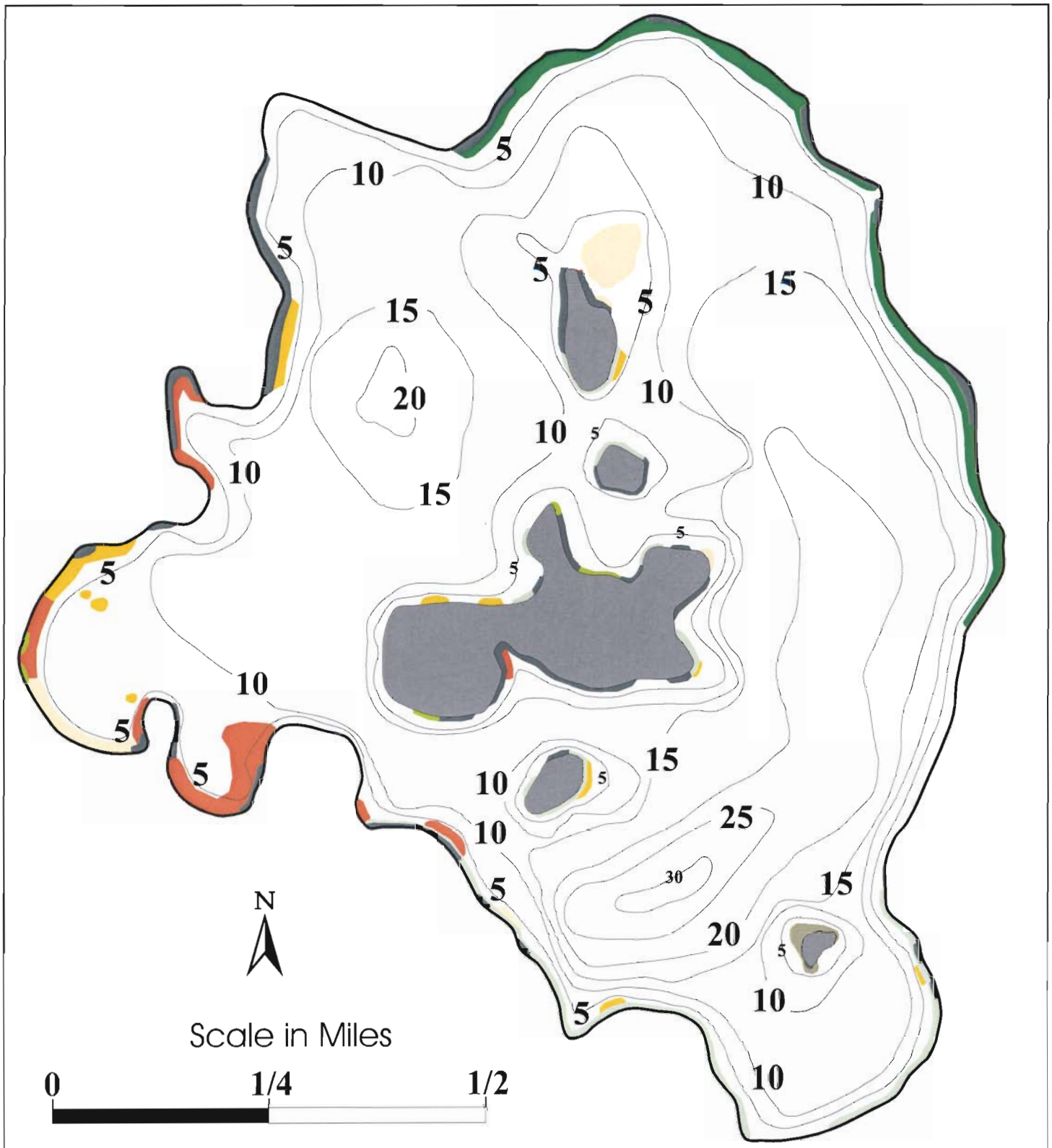
The report indicates that Annabelle Lake has a total of 19 aquatic plant species. The location of plant species collected during the survey is shown Figure 3-1 entitled Emergent and Floating-leaved Vegetation Map and in Figure 3-2 entitled Submergent Vegetation Map. In addition, Table 3-1 lists the common name and scientific name of each plant. Table 3-1 is titled Aquatic vegetation observed in Annabelle Lake and Relative Abundance at the Lake and State Level. (Note: Several corrections to Table 3-1 appear on the page following this table.)

Several interesting things were found during the aquatic survey. Annabelle is home to the spiny-spored quilwort (Isoetes echinospora), which are rare in Wisconsin. It is found in abundance in Annabelle Lake. Several other species of plants including the water horsetail (Equisetum fluviatile), and floating-leaf bur reed (Sparganium fluctuans), water milfoil (Myriophyllum tenellum), and water lobelia (Lobelia dortmanna) are common in Annabelle Lake but infrequently observed in Wisconsin lakes. The report suggests that Annabelle Lake water quality is good for supporting these species of plants. NES found no exotic or invasive species of plants in Annabelle Lake.

NES management recommendations for Annabelle Lake aquatic habitat include the following. (Information extracted NES report included in this document)

- No direct vegetation management activities (harvesting or planting) are required for Annabelle Lake.
- Vegetation in the lake is of high quality, under natural conditions.
- Because the submerged species found in northern sand-bottom lakes are often small, rosette-forming species this causes limited cover for the fisheries. NES suggests that fish cribs, creation of brush cover should be considered to provide habitat for the fisheries.
- To maintain good plant coverage and to protect the plants that are rooting in a depth of 1.3 feet, maintaining water levels to support these plants would be beneficial to the lake.
- Shoreline management is also important in maintaining a healthy plant population. Annabelle Lake currently has a maintained low shoreline development. If Annabelle Lake shoreline does not develop and is managed properly, the aquatic vegetation should remain healthy.





NES
NORTHERN ECOLOGICAL SERVICES, INC.

Northern Ecological Services, Inc.
Reed City, MI Green Bay, WI

Figure 3-1. Emergent and Floating-leaved Vegetation Map

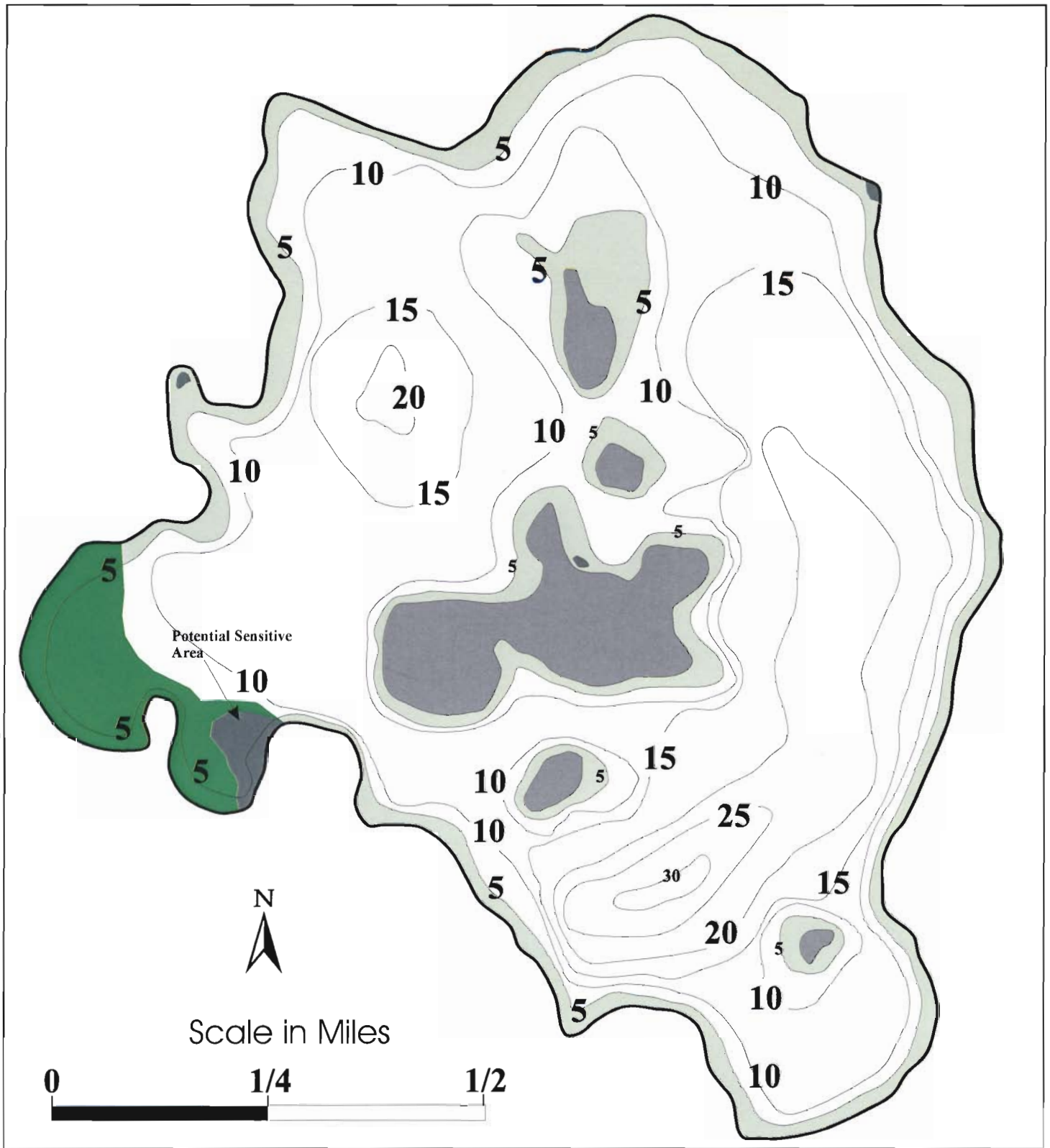
Emergent Vegetation	Dominant Species
	Pontedaria cordata
	Scirpus acutus
	Sparganium chlorocarpum
	Eleocharis smallii
	Equisetum fluviatile

Floating-leaved Vegetation	Dominant Species
	N. variegata and S. fluctuans
	Nuphar variegata
	Sparganium fluctuans

Annabelle Lake, Vilas County, Wisconsin

Date: 8/14/98	
Sheet: 1 of 1	By: PJR

Source: Bathymetry Map from Fishing Hotspots, Inc.



NES NORTHERN ECOLOGICAL SERVICES, INC. Northern Ecological Services, Inc. Reed City, MI Green Bay, WI	**Figure 3-2. Submergent Vegetation Map** Dominant Species *Potamogeton epihydrus* *Utricularia vulgaris* *Isoetes echinospora, Eriocaulon septangulare, and Myriophyllum tenellum* **Annabelle Lake, Vilas County, Wisconsin**	**Date: 8/14/98**	
		Sheet: 1 of 1	**By: PJR**

Source: Bathymetry Map from Fishing Hotspots, Inc.

Aquatic Vegetation Update

We received a letter from the Department of Natural Resources that states:
When Northern Ecological Services, Inc. prepared the Aquatic Vegetation Report for Annabelle Lake in August 1998, the specimens of the plants were identified and sent to the Department of Natural Resources. This is typically done with plant surveys to insure the correct identification of the plants in the survey. The specimen identifications that were questionable by the DNR were sent to Dr. Robert Freckmann with the University of Wisconsin – Stevens Point. Dr. Freckmann is a professor of botany at the University. The results of Northern Ecological Services, Inc. survey of plants are in:

- **Annabelle Lake has large purple bladderwort** (utricularia purpurea), **not common bladderwort** (utricularia vulgaris). Common bladderwort has yellow flowers. **Large purple bladderwort (what Annabelle Lake has) has purple flowers.**

The DNR stated to us in a letter – "we should be proud to know that Large purple bladderwort is listed as a 'Species of Special Concern' by the Wisconsin Natural Heritage Program", and we are one of the few lakes who have this special plant.

- Efluviatile is correctly named, however, the common name is water horsetail, not hard-stemmed bulrush.

- **There was a plant that could not be identified by NES. It is, Northern Manna Grass** (glyceria borealis). **This is an important source of food for a variety of ducks including gadwall, mallard, and wood ducks.**

- **Common water starwort** (callitriche verna) **is really Waterwort** (elatine minima). **Another special plant in Annabelle Lake, according to the DNR. This plant is an indicator of good water quality, as it does not tolerate turbidity and requires clear water.**

The WDNR trained volunteers from the Annabelle Lake Association in 1999 and 2001 in the collection and pressing of aquatic vegetation. During the last week of August 1999, Sandy Wickman and Cathy Cleland came to Annabelle Lake, to train several of us on aquatic plants and collection procedures in the lake. The day was overcast, cold and drizzling. Nevertheless, we went out onto the lake and both Sandy and Cathy got into the water to demonstrate plant collection techniques.

Don and Doris Mussay, Kathy Vogt, and Kathy, Laura, Mark, & David Johnson were trained. They collected many plant species at different depths, at four locations on the lake. Two sets of each specimen were labeled and pressed by Dave & Sue Engeseth, Dave, Kathy & Erik Vogt, Dick & Pat Williams and Louis & Ruth Williams in December 1999. One set was given to the WDNR and the Association retained one. In August 2001, Laura Herman spent an afternoon training Bob, Colleen & Brad Bodee; Trish, Joe & Ellen Gallagher; and Dave Vogt in collection and pressing techniques. These volunteers were joined by Dave and Sue Engeseth; Bob Rogacki; and Dave & Erik Vogt in the collection and pressing of plant specimens from the 15 transects of the original study. These plants will be identified and mounted before the end of 2001, with one set going to the WDNR and one set remaining with the Association.

Volunteers continue to monitor the boat landing for any signs of exotic species on an on-going basis.

SHORELAND VEGETATION

Survey

On October 2, 2000, Pat Williams, Dave Vogt, Erik Vogt, and Tiffany Lyden from the Vilas County Land & Water Conservation Department conducted a visual survey of the vegetation along the shoreline of Annabelle Lake by boat. Notes describing major shoreline characteristics and predominant species of the plants, shrubs, and tree growing along the shoreline appear below. This information will serve as a baseline for comparison with future conditions. Photographs of houses and cottages around the Lake were also taken during the survey and appear at the end of this section.

A majority of the shoreline of Annabelle Lake remains in a natural state. There are a few areas where some or all of the natural vegetation along the shoreline has been removed. In most cases these areas have been planted in grass, but there are some areas where bare soil is exposed.

The existence of trees, shrubbery, and underbrush along the shoreline to a depth of about 35 feet inland is important in preserving the water quality of Annabelle Lake. The presence of trees, shrubs, and undergrowth reduces sediment and nutrient runoff into the lake, and provides critical habitat for both land and aquatic wildlife. Selective cutting of vegetation can provide access and lake views, while maintaining a buffer of vegetation along most of the shoreline. Selective cutting of vegetation in an area 30' wide by 35' deep is permitted under county zoning rules to provide for access and lake views. However, the remainder of the shoreline is to be maintained in natural vegetation for 35 feet from the shore.

Bare soil areas have the greatest potential for contributing sediment and nutrients to Annabelle Lake during rainstorms and spring runoff. Planting and seeding areas of bare soil significantly reduces sediment and nutrients washing into the lake. Curved pathways or accesses down to the water also help slow down runoff, since they allow for water to infiltrate into the ground before it reaches the lake. Downed trees on land or in the water provide valuable habitat for wildlife and fish.

Plant, Shrub, and Tree Species Found on the Shoreline

For the purpose of survey the shoreline around the Lake was divided into segments roughly corresponding to the boundaries of property owners around the Lake. Each segment was assigned an alphabetic designation. These designations appear on the short descriptions shown below, and on the map following the descriptions. The designations also appear on the photos of homes and cottages around the lake, which appear at the end of this section.

A) Natural shoreline, sweet gale growing in bay.

B) Very dense natural shoreline. Sweet gale, cedar, maple, balsam, tag alder, ferns, and black spruce. A patch of pickerelweed growing in water, patches of burreed growing in water, downed trees, shallow bay. On western side of bay, shore is wet, marshy. Leatherleaf, cedar, maple, sweet gale, iris, ferns, sphagnum moss, leatherwood, downed trees, tree stumps.

C) Maple, cedar, hemlock. A lot of downed trees can be seen along the shore

D) *Tip of peninsula.* The ground is higher than area B. White pines, maple, cedar, white birch, black spruce, sweet gale, leatherwood, a patch of pickerelweed growing in water

E) Sugar maples, balsams, white pine, blueberry, ferns, sedges, white and yellow birch, tag alders. There is a little rock along shore. Vegetation opens up a bit at house area.

F) Wetland. Sweet gale, black ash, sphagnum moss, blueberries, tamarack, a few trees, mostly low growing. A patch of pickerelweed is growing in water with black spruce, birch, and cedar on the shore.

G) *Resort.* Mostly cut lawn, narrows to only about 60 ft. at water's edge. Sand beach where grass meets water, rest of shoreline has about 20' vegetation buffer between grass and lake. Tag alder, sweet gale, sedges, and other emergent plants. On grass - no shrubs or groundcover, but some maples, and 1 spruce tree.

H) Completely natural shoreline, small cabin, sedges, maple, balsam, alder, one willow

I) Open grass area, small beach, little bit of sedges, sweet gale, emergent vegetation, two buildings close to water, a few spruce, mountain holly bushes, sumac and white pine at tip of point, very natural shoreline after the buildings.

J) Low area along part of shoreline, natural shoreline, stones along shoreline edge, tag alder, leatherwood, leatherleaf, sedges, downed trees, sweet gale, ferns, black spruce, maples, a few hemlocks, tamarack, white pine, white birch, cedar. There is a lot of pickerelweed growing back in the bay, along with lily pads, and 3-way sedge near house. The house is close to water with a large grass area, but about a 10' wide strip of natural vegetation extends along shoreline, except by the dock and small boat landing area.

K) Red pine, alder, sweet gale, some grass by house, about 15' of natural vegetation buffer of sweet gale, small trees - white pines and balsams, maybe a few cherry trees. The vegetation buffer gets narrower as you go north around point, with just sweet gale and sedges in water. Grass all the way down to the water at boathouse. There is an old rock wall.

L) All grass right down to water, house close to water, rock wall along shore, and bare soil by dock area. There is a little bit of sweet gale on lot line, and a few trees in grassy area.

M) There is grass all the way to shore, with very few trees, a rock wall, and an old boathouse.

N) Shrubs and ground cover on hill leading up to house, some trees - balsam, maple, red pine, birch. A lot of brush in water, pickerelweed patch, alders, yellow birch, sweet gale, little bit of grass, curved path down to pier.

O) There is a lot of grass, with a slight slope to lake, and just a few plants along shore - three-way sedge, sweet gale, sedges, bulrush, and some pickerelweed. In grass area, a few small trees, no ground cover or shrubs, maple, balsam, ferns, cedar, white birch.

P) Natural shoreline - maple, spruce, sweet gale, three-way sedge, yellow birch, a couple of logs laying along shore, cherry, white pine, white birch. At house - 50' wide grass, a small buffer (2' wide) of birch, maple, and sweet gale. North of house - very natural shoreline of sweet gale, small section of rock on shore, maple, tag alder, white birch, sedges, white pine, balsam, black spruce, maple, cedar, red pine. Popple and tamarack trees are set back a little ways from shore. Ground cover, shrubs, and trees are all present. In some areas, sweet gale is growing 5-6' out from shore. At point, water is shallow, some pickerelweed growing. About 200' wide patch of bulrush growing in water, out 50' from shore in some areas.
Q) Grass all the way to shore, a small clump of trees, bulrush growing in water.

R) There is a small cottage close to water, with grass going all the way to shore to a small beach.

S) *Island owners.* Sweet gale, white birch, popple, balsam, tamarack, bulrushes growing in water, small path to pier

T) *Boat landing.* Bulrushes growing in water, sweet gale, alder, maple

U) Red pine, some rocks and bare soil, in front of house about 40' wide area of grass and bare soil right down to shore

V) Ash, cedar, bulrush, maple, alder, white birch, sweet gale, pickerelweed, two patches of bulrush growing in water. A lot of cedar growing near house, with a small narrow path to lake. White pine, balsam, hemlock. South of house - another patch of bulrush about 20-30' wide growing in water, lots of cedars, downed trees at shore.

W) Cedars and hemlocks, gentle slope to lake, pretty narrow area of grass leading down to lake, some irises, white and yellow birch, bulrush growing in water.

X) Lots of white birch, some hemlock, white pine, spruce, slightly exposed/unvegetated hill, vegetated buffer along most of shoreline, some rock, sweet gale, a few bulrush growing in water.

Y) Low land with bulrush growing in water, white cedar, maple

Z) Cedar, maple, lots of downed trees, bulrush growing in water. About a 25' opening of grass to lake, natural shoreline on either side of opening, lots of cedar and hemlock, white birch, popple. Where bulrushes are not growing, sweet gale is growing along shore. Going south, vegetated shoreline, except for 20' opening of stairs and grass, rest of shoreline is very natural, sweet gale, white pine, popple, spruce, balsam, some rocks along edge, a downed white pine tree still growing perpendicular to shore, cedar, intermittent stream.

AA) Grass for about a 110' opening all the way down to shore. About a dozen trees, no ground cover or shrub layer, some rocks on shore.

BB) Cedars, lots of white birch, alder, some downed trees, popple, sweet gale, some maple, small black spruce. House up on small hill, grass opening about 20' wide at lake, then widens back a bit away from shore. At shore, quite a bit of sedge. South of house - cedars, downed trees, pickerel weed, hemlock

CC) Downed wood, maple, cedar, some emergent vegetation, popple, alder, white birch, hemlock. House close to water, about a 35' grass opening down to water, a few trees in grass area. Pretty natural shoreline, boathouse, downed trees, hemlocks, maples, sweet gale.

DD) Alder, sweet gale along parts of shoreline, rocks.

EE) Hemlock, downed trees. About a 35' opening at lake, some exposed soil by shore. White birch, popple, alders, sweet gale, cedars

FF) About a 30' wide opening at shore that narrows back towards house. Some sedges on shore, lots of small hemlocks near opening. Maples, white birch, popples, larger hemlocks away from shore

GG) Very natural shore, house set back away from lake, about a 20' wide opening to house, trees, some grass. Rest of shore area is mostly hemlock, some cedar, yellow birch, and sweet gale on shore.
HH) a lot of downed wood, new house, and a lot of trees cut for construction. Exposed soil.

II) About a 200' opening of grass, no vegetation buffer except a few trees - hemlock, maple, red pine, no ground cover or shrubs. Rocks along shore.

JJ) About a 150' opening of grass, bare soil in spots, fairly steep slope down to lake. Sparse large hemlocks, a few young trees planted. Yellow birch, cedar, some downed trees, some emergent vegetation growing in water, a little sweet gale.

KK) About 15' opening, rest of shoreline is open forest floor under tall hemlocks, clump of balsams coming up about 20' back from shore, emergent vegetation, sedges at shore, downed trees

LL) There are lots of cedars, lots of downed trees, hemlocks. Burreed, pickerelweed, and other emergent vegetation are growing in water. Natural forest shoreline.

MM) Natural shoreline. Balsams, hemlock, yellow birch, maple, three-way sedge, alder, sweet gale, cedar, downed wood, pickerel weed and other emergent vegetation growing in water.

NN) Sweet gale, balsam, hemlock, maple, one white birch. About a 40' wide opening to the lake, with a few larger trees and vegetation down at lake. About 20' back from shore, grass area widens. At shore, some rocks and pickerel weed growing.

OO) *Big Island with cottage.* Cedar and hemlock, about a 30' wide grassy opening to lake

PP) *Smaller Island with cottage.* White pines, about a 30' grassy opening to lake.

QQ) Island

RR) Island

SS) Island

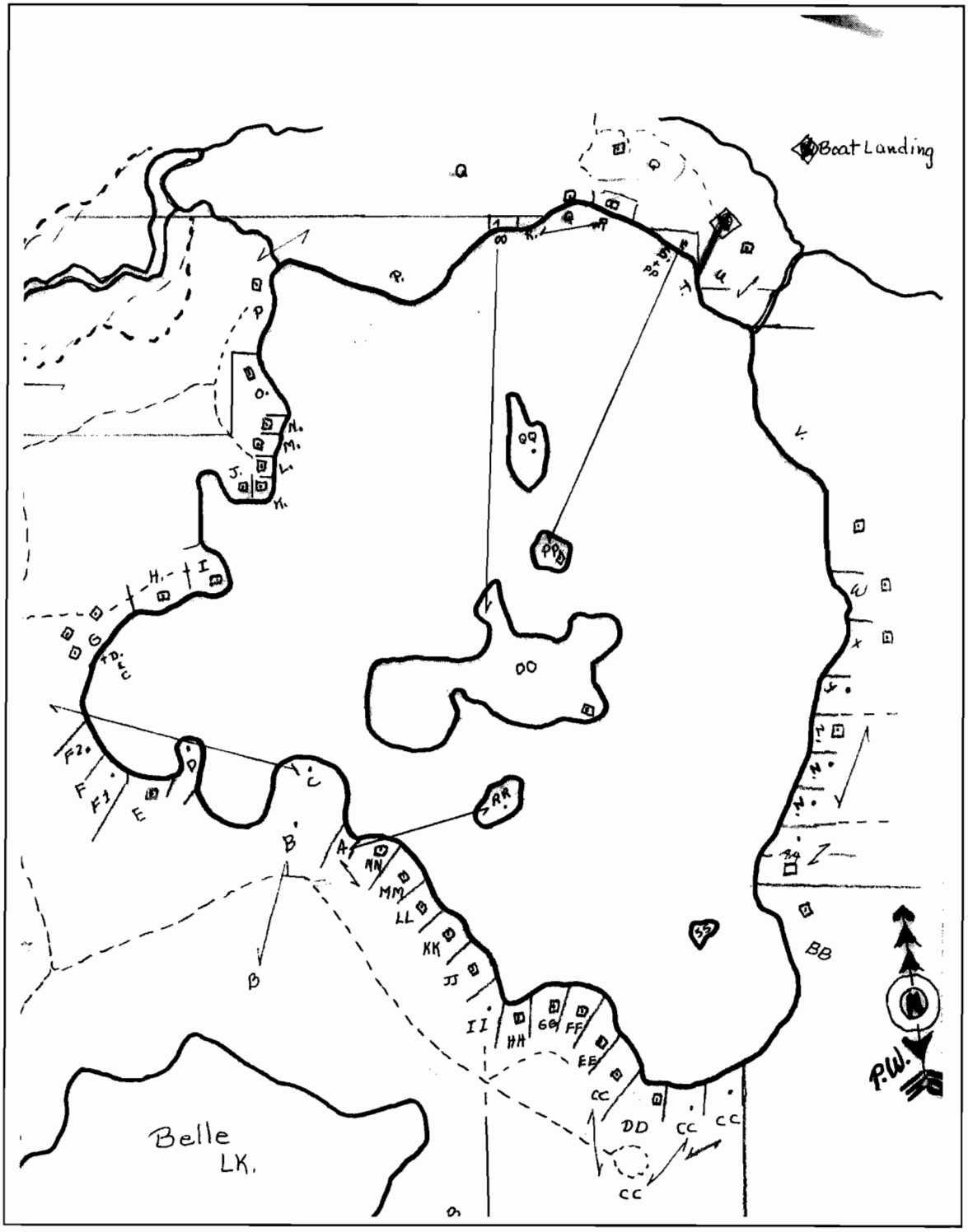
Pictures of each of the homes and cottages around Lake Annabelle appear below, along with a copy of a map showing the current fire numbers.

THE PEACE OF WILD THINGS

When despair of the world grows in me
And I wake in the night at least the sound in fear
of what my life and my children's lives may be.
I go and lie down where the wood drake
rests in his beauty on the water, and the great heron feeds.
I come into the presence of still water.
And I feel above me the day-blind stars
Waiting with their light.
For a time I rest in the grace of the world, and I am free.

Wendell Berry

ANNABELLE LAKE SHORELAND VEGETATION SURVEY MAP



Map of segment designations for the Shoreland Vegetation Survey 2000

WATER QUALITY

Lake Characteristics

LOCATION: South of and adjacent to County Highway B, approximately 3 miles east of the intersection of County Highways W and B in the town of Presque Isle.

PUBLIC ACCESS: On the north end of the lake. Drive 3 miles east of the intersection of County Highways W and B, in the town of Presque Isle. From "B" turn right on Butler Road and immediately bear to the left for approximately 50 yards to the steep black top landing. The lake shoreline at this location can be very shallow. Parking for 2 rigs is possible.

SPECIAL FEATURES: There are five islands. Three privately owned, one Town owned and the smallest one is Timber Company owned.

PHYSICAL CHARACTERISTICS:

Size - 213 acres including the islands with 189 acres of navigable water.

Depth - 30' hole.

Water Source - Drainage lake with an inlet and an outlet, both of which are too small to be navigable.

Shoreline - 4.24 miles.
Moderately developed with homes/cottages. Despite this development, the natural shoreline is aesthetically pleasing due to property setbacks and zoning.

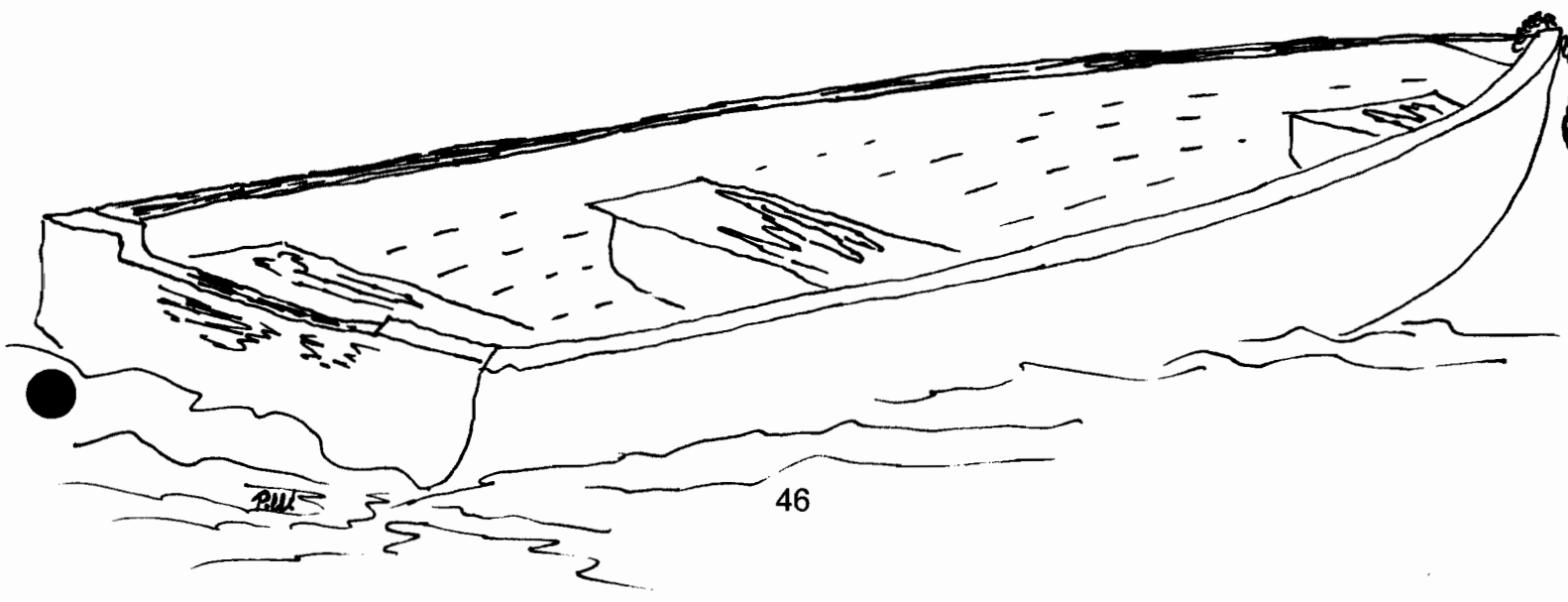
Bottom - 68% gravel, 12% sand, 11% rubble, 7% muck and 2% boulders.

Water - Low fertility and light brown in color with low transparency.

Vegetation - Submergent and emergent species.

FISHING TIPS: Annabelle is a decent lake for those interested in walleye or muskellunge. Both the sharp reed lines and downed timber offer habitat and casting targets. Annabelle Lake has the potential to produce limited numbers of decent walleye and muskellunge, with a trophy always a possibility.

Reference: Fishing Hot Spots, Book #9, North Central Series, Bob Knops and Russ Warye, 1987



Watershed

The watershed for Annabelle Lake is outlined in blue in the map on the following page. The size of the watershed is 3.46 square miles with a perimeter of eleven miles and 1,128 feet. It contains three other lakes. Annabelle Lake, along with its neighboring lakes, lies north of the sub-continental divide, and its outlet eventually feeds the Presque Isle River, which runs northward. The Presque Isle River runs along the western edge of Porcupine Mountains State Park in Michigan's Upper Peninsula before emptying into Lake Superior.

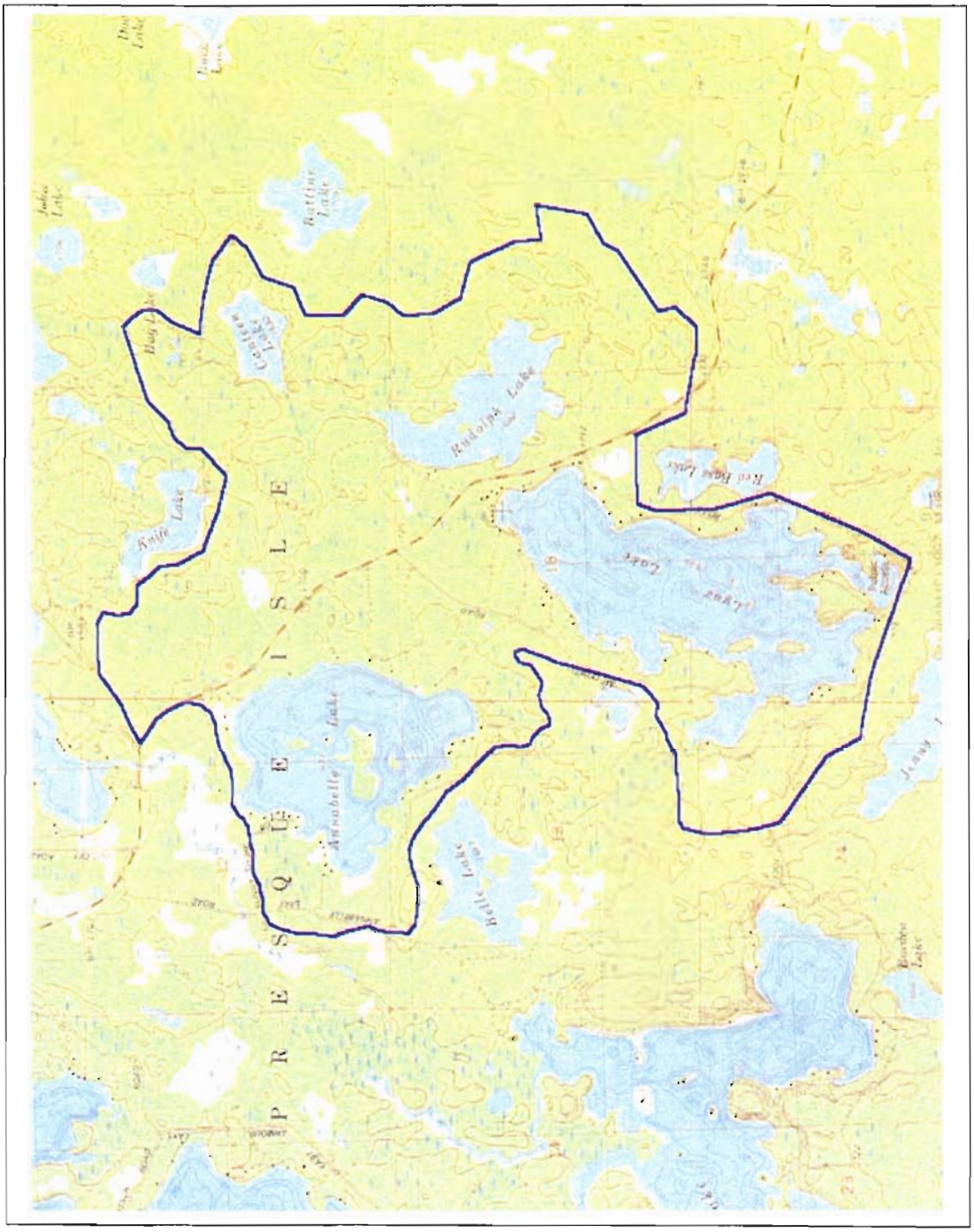
The watershed's path to the Presque Isle River consists of a number of crossings of County Highway B. Lynx Lake has an elevation of 1,699 feet, and its outlet flows north across Highway B into Rudolph Lake. The outlet of Rudolph Lake flows north to join the outlet of Canteen Lake, both of which have elevations of 1,692 feet. The combined stream flows westerly re-crossing Highway B just before entering Annabelle Lake on the northeast corner of the lake. This is the main inflow of water for the Lake. There are several other intermittent streams on the lake, fed from nearby wetlands.

The outlet of Annabelle Lake lies on the northwest corner of the lake. Given the close proximity of the inlet and outlet, and the location of the islands in the middle of the lake, it appears that the flushing rate for the southern portion of the lake may be slow. This is especially true since the deepest part of the lake lies south of four of the islands, including the Musgrove's 14-acre island. Also, the Drainage Basin/Lake Area ratio (DB:LA) is 10.4. This relatively low number indicates a relatively long retention time and a flushing rate that is likely to exceed one year.

While not a part of the Lake Annabelle watershed, it is still of interest to trace the outlet of the Lake to the Presque Isle River, as a number of neighboring lakes are involved. Within a quarter of a mile the outlet joins the outlet of Oxbow Lake coming from the north. A beaver dam backs up the combined stream shortly before it flows through the culvert on Annabelle Lake Road. This and other beaver dams on the outlet help to maintain the level of the lake during dry periods. From there the water turns southward and flows into Crab Lake. Crab Lake and North Crab Lake, both with elevations of 1,647 feet, have an outlet from North Crab Lake that flows north into Armour Lake with an elevation of 1,644 feet. The outlet of Armour Lake in turn flows north into Horsehead Lake with an elevation of 1,642 feet. The outlet of Horsehead Lake flows north across Highway B into Little Horsehead Lake. The outlet of Little Horsehead, with an elevation of 1,636 feet, flows southward and crosses Highway B in the town of Presque Isle just after flowing over the dam at the park. This stream flows between Highway W and the walleye rearing ponds and until it empties into the northward flowing South Branch of the Presque Isle River, which has its beginnings as the outlet from Presque Isle Lake with its elevation of 1,632 feet.

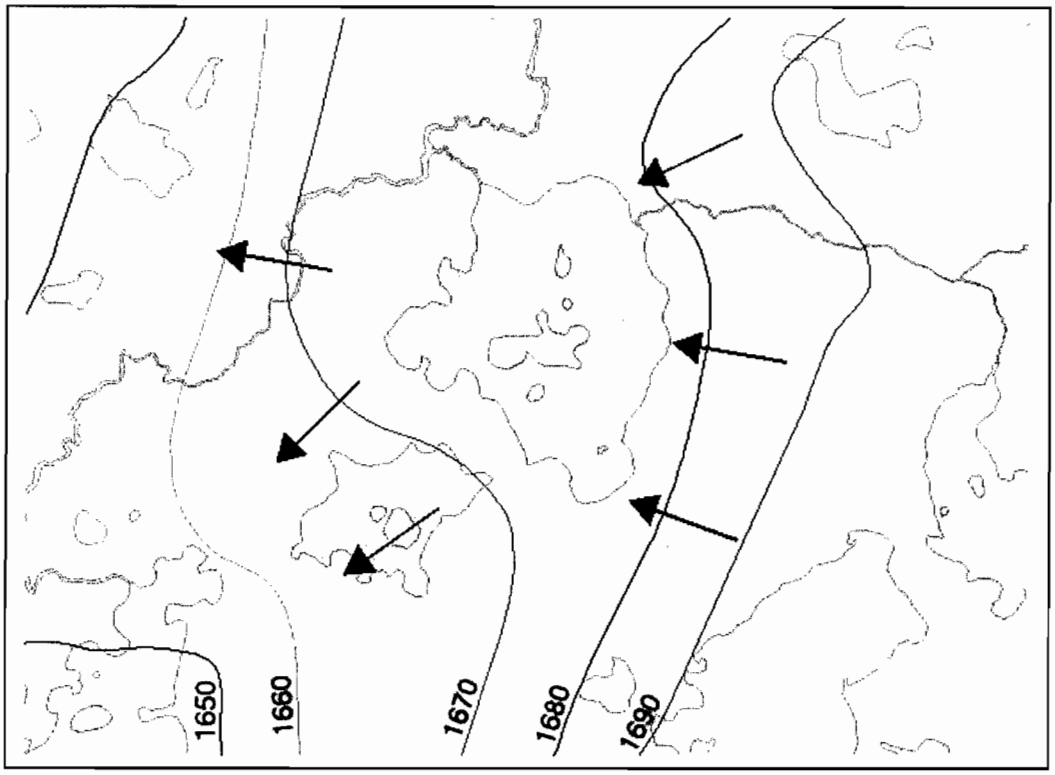
While the old adage of "stand anywhere, throw a rock and hit a lake", is particularly true for this area of Presque Isle Township, it is important for everyone to remember how interconnected these waters are. What happens in one lake can have an impact on many others. While individual lake associations tend to concentrate on "their" waters, the need for cooperation among the associations, the Town, Vilas County and the WDNR becomes apparent when one traces the interconnected watersheds.

Within the Annabelle Lake Watershed, most of the development is along the shores of Lynx and Annabelle Lakes, with a few off-water homes along the County and Town roads. There are only one or two dwellings north of Highway B in the watershed, and Rudolph and Canteen Lakes are virtually undeveloped. The remainder of the land is almost all Woodlands/Wetlands.



Annabelle Lake Watershed Map

Groundwater Flow Direction



Map of General Groundwater Flow Direction

Arrows show the approximate direction of groundwater flow.
Numbers show approximate altitude of water table in feet above mean sea level.

Because the direction of groundwater flow around Annabelle Lake is generally east to west, the lake is particularly susceptible to groundwater pollution that occurs on the east side of the lake. Nutrients and chemicals in septic systems along the east shoreline can be carried to the lake via groundwater flow. Other contaminants that may enter the groundwater east of the lake, including fertilizers or chemicals, all have the potential to eventually flow into Annabelle Lake.

Source: Water Resources of Vilas County, WI G.L. Patterson, US Geological Survey, 1989; and Vilas County Mapping Dept.

Self-Help Lake Monitoring Program

Lake residents have been collecting data on water clarity and water chemistry since late 1996, as a part of the Wisconsin Self Help Program. Supplies and equipment are provided by the WDNR, and data collected by volunteers is reported back to them. These data help identify the overall health or state of the water in the lake. It is important to monitor this data longitudinally (over time) to check for any changes. There are three "trophic states" related to relative age of the lake. These states describe a lake's condition, but are not an exact measure. The Trophic State Index (TSI) ranges from 0 to 100, and gives an indication of the Trophic State of a given lake. The three Trophic States for lakes can be defined as follows:

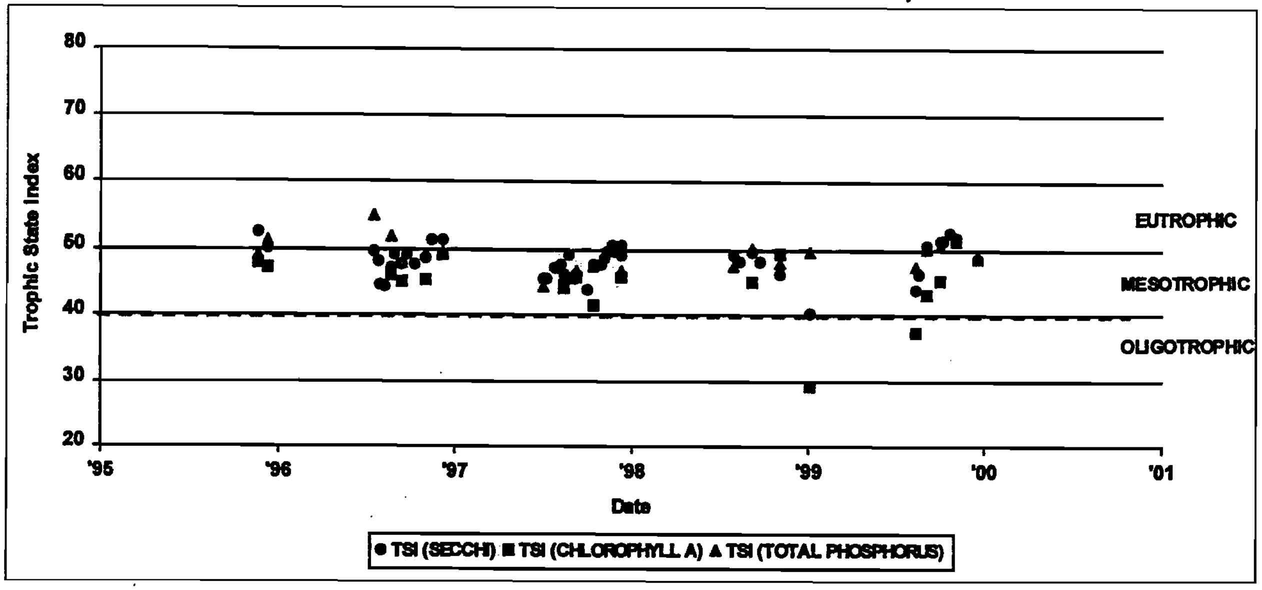
Eutrophic — *These lakes are high in nutrient level, and support a large biomass, with lots of plants and animals living in the lake. They support large fish populations and have good fish growth due to the number of minnows and rough fish (suckers, etc.), but may experience extensive algae blooms. They are also vulnerable to winterkill due to oxygen depletion. The TSI in these lakes ranges from 50 to 100.*

Oligotrophic — *Lakes in this category are clear, and have few plants and algae. They are low in nutrients and do not support large fish populations. However, oligotrophic lakes often develop a food chain capable of sustaining a desirable fishery of large game fish, but the population will be small. Fishing pressure can decidedly decrease the catchable size fish numbers. Their TSI index ranges from 0 to 40.*

Mesotrophic — *These lakes lie between the Oligotrophic and Eutrophic stages. A natural aging process occurs in all lakes moving them from Oligotrophic, through Mesotrophic and eventually to Eutrophic. Mesotrophic lakes have increased nutrients, and more plants than Oligotrophic ones. There is some accumulation of organic matter on the bottom. These lakes support a good fishery. In the Summer Mesotrophic lakes tend to stratify, with a bottom layer or Hypolimnion that has temperatures in the 40-50's (degrees Fahrenheit), and very little dissolved oxygen. This limits cold-water fish and causes phosphorus cycling from the sediments. The TSI for these lakes ranges between 40 and 50.*

Using the data collected on Secchi depth, chlorophyll-A, and total phosphorous, the WDNR prepared a graph of the Trophic State Index (TSI) for Annabelle Lake based on each of these three measures. This graph appears on the following page. The primary purpose of these data and the TSI is to track the state of the lake over time, and to watch for changes. Examination of the graph shows a relatively stable TSI from 1996 through 2000. (Note: The 2001 data has been collected, but not yet integrated into the graph at this time.) The one set of outliers for Secchi and Chlorophyll-a indices at the end of 1999 is the result of the late date of collection—early November, as compared to mid-October for other years. Thus, from this graph, it appears that the TSI index for Annabelle Lake has been between the low 40's and the mid 50's, with no apparent trend upward or downward over the past five years. This means that Annabelle Lake is primarily in a Mesotrophic State. The fact that it is a stained lake – clear brown water due to the tannins absorbed in the seepage wetlands surrounding the lake – tends to move the TSI readings upward, especially those related to Secchi depth

TROPHIC STATE INDEX GRAPH FOR ANNABELLE LAKE, DEEP HOLE



Understanding Trophic State Index

The Trophic State Index is a scale that gives us an indication of how nutrient-enriched a lake is. The index can be calculated from Secchi depth because water clarity indicates how much algal growth is occurring in a lake. Better estimates of trophic state can be calculated from chlorophyll (the green pigment in algae) or phosphorus, the nutrient which fuels algal growth.

The data you collect (secchi depth, chlorophyll and total phosphorus) are translated onto a common TSI scale via mathematical equations. Resulting values are indicated respectively as TSI (Secchi depth), TSI (chlorophyll) and TSI (total phosphorus), and are plotted on a graph independently. The Trophic State Index ranges from 0-100 with lower values indicating nutrient-poor (oligotrophic) waters and higher values indicating more nutrient-rich (eutrophic) waters. The scale is continuous and Wisconsin's lakes range over much of the scale.

General points of transition occur in the TSI scale at 40 and 50. If most of your lake's TSI numbers fall below 40, your lake is generally oligotrophic. If most of them are above 50, your lake is generally eutrophic. In between 40 and 50 is the mesotrophic range, indicating moderate enrichment. There is nothing magical about these numbers - they happen to generally correlate with lake productivity conditions as described in the box on the attached page.

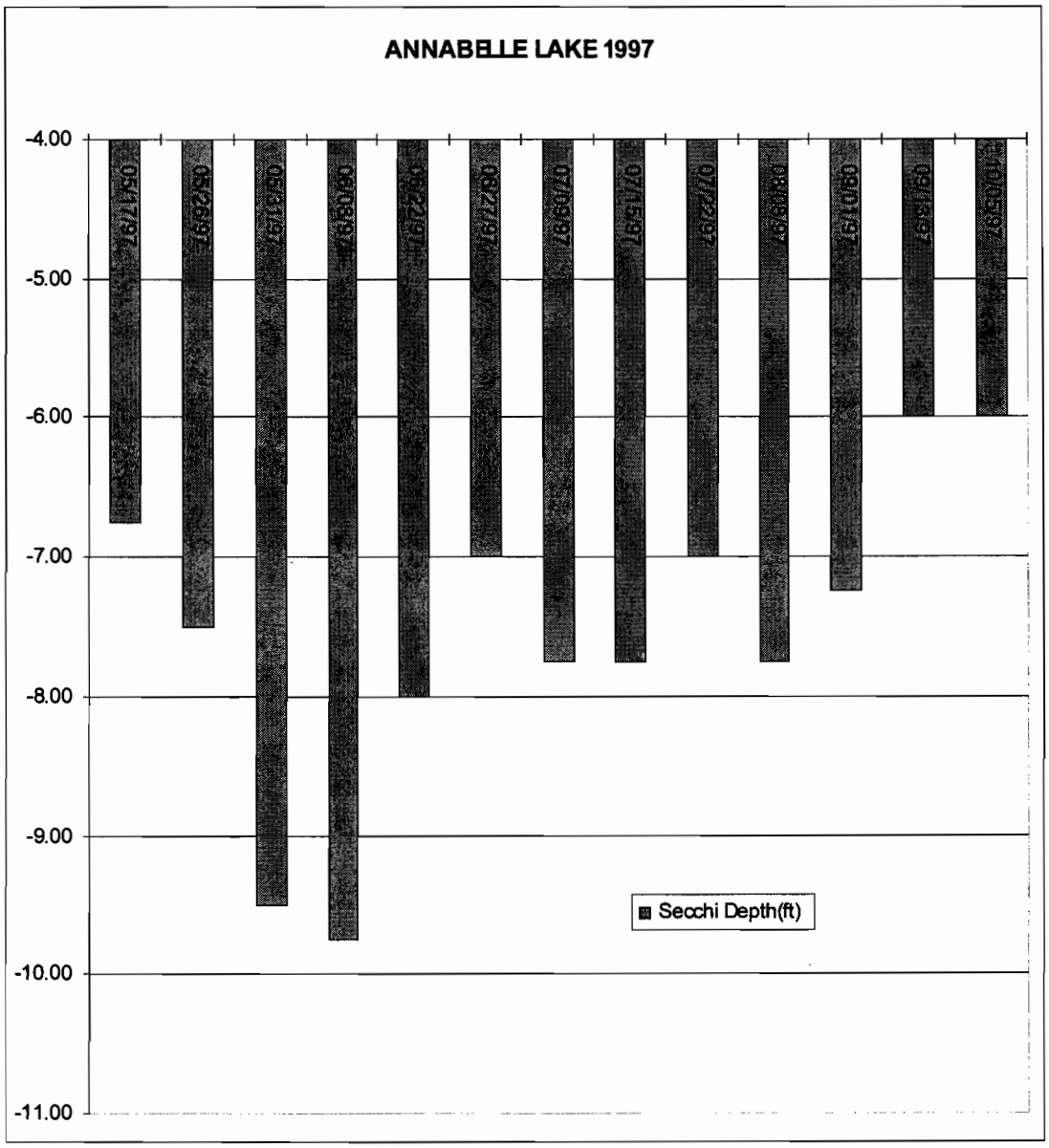
One more thing to know about TSI values: if your lake clearly has any of the following conditions on the day you sample, a.) a lot of suspended solids (murky brown water), b.) naturally stained (clear brown water), or c.) a lot of plants, take the corresponding trophic state index values with a grain of salt, as these factors can skew the resulting TSI values.

Remember that lakes naturally vary -- some lakes have always been nutrient-rich and full of plants and algae; others are naturally nutrient-poor. Lakes can change slightly over the year and from year to year because of weather and other natural cycles (algal abundance, etc.). Lakes naturally become more enriched over thousands of years as they age and eventually fill in with sediment and plants. What we don't want to see is a lake that is becoming noticably more eutrophic over several years -- if we can see a lake "age", it's most likely because of cultural (human-caused) eutrophication. Immediate action is needed to protect these lakes. Explanation taken from Self-Help Lake Monitoring Summary Report, 1993-1995.

Trophic State Index Graph for Annabelle Lake 1996 – 2000
Based on Secchi Depth, Chlorophyll-A, and Total Phosphorus data
collected as a part of the Self Help Lake Monitoring Program
Prepared by the WDNR

Secchi depth readings are taken by lowering a disk with alternating black and white quarters into the water. The rope attached to the disk is marked off in one-foot intervals. The disk is lowered until it disappears, and the depth is recorded to the nearest _ foot. The reading is then checked by raising the disk until it reappears. The readings taken in 1997 appear below.

It should be noted that the shallowest readings occur in the early spring and late fall. At these times the nutrients from the bottom of the lake are mixed throughout the lake waters as the lake "turns over". This results in an increase in the levels of plankton and algae suspended in the water and this decreases the clarity.



Annabelle Lake Secchi Depth Readings 1997
Collected as a part of the Self Help Lake Monitoring Program

The WDNR provided the following graph of average Secchi depths based on the data supplied by the self-help volunteers.

ANNABELLE LAKE - Vilas County

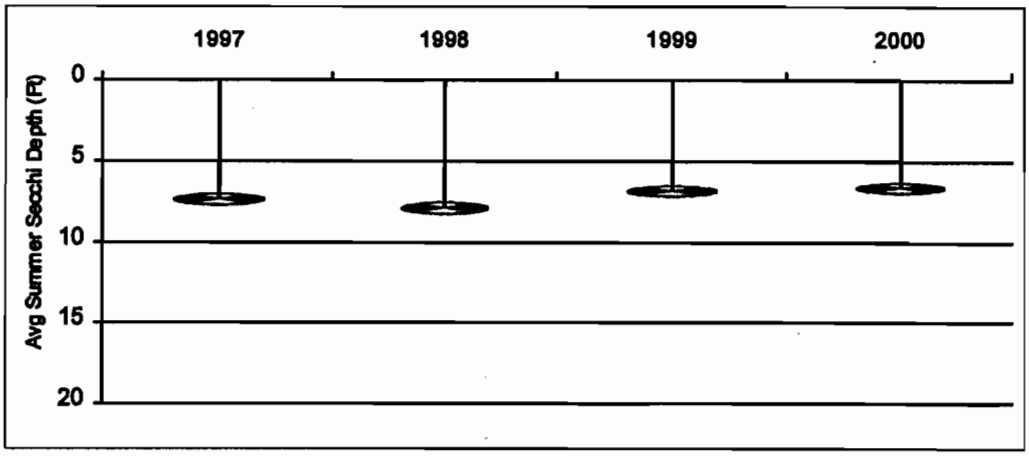
WATERBODY ID: 2953800

SITE: DEEP HOLE

STORET: 643444

Table 1: Summary of water clarity readings *(Summer average includes June, July and August data only)*

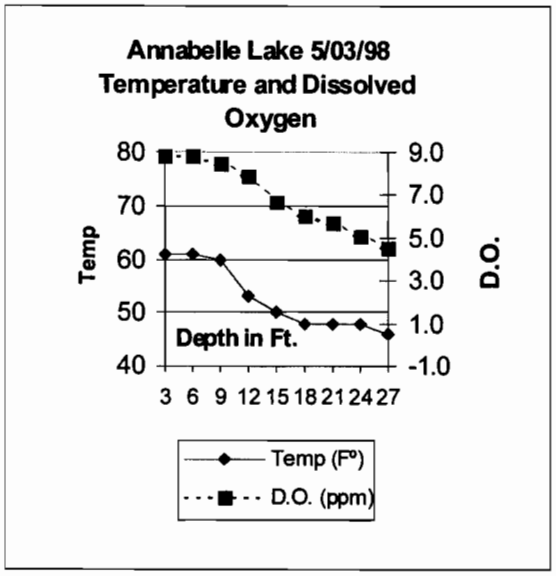
Year	Summer Water Clarity Average (Ft)	Minimum Reading	Maximum Reading (Ft)	Number of Readings	Sampling Period
1997	7.9	7.0	9.8	7	6/97 - 8/97
1998	8.4	7.0	10.0	9	6/98 - 8/98
1999	7.3	6.8	7.5	3	6/99 - 7/99
2000	7.0	5.5	10.0	6	6/00 - 8/00

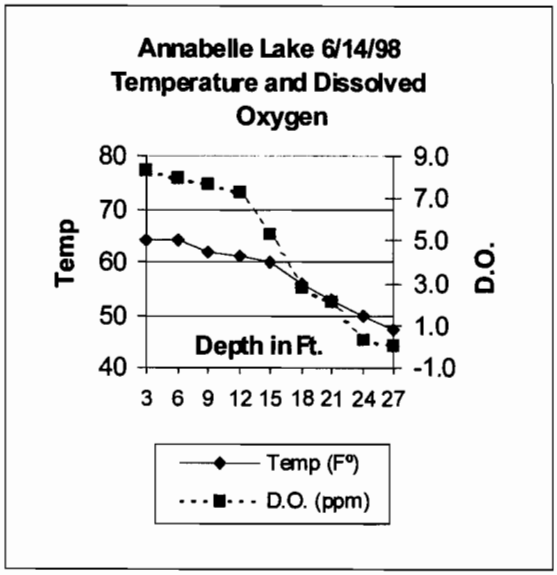


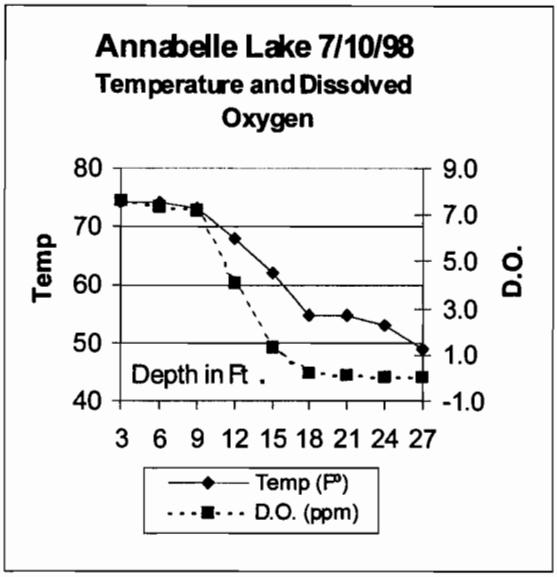
Average Secchi depth for Annabelle Lake 1997 – 2000
Based on Secchi depth readings
Collected as a part of the Self Help Lake Monitoring Program
Prepared by the WDNR

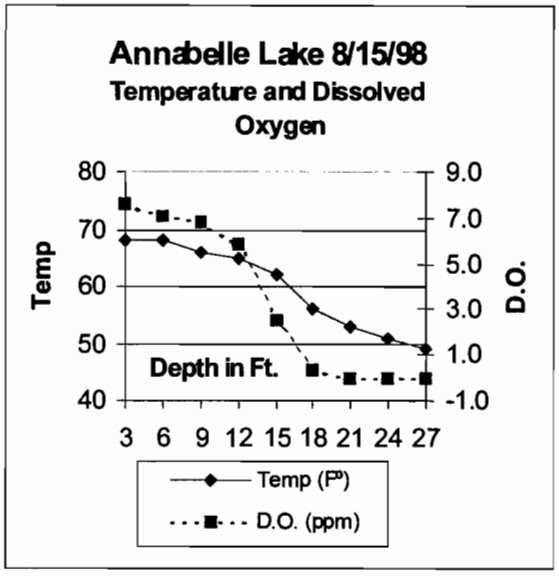
These averages are relatively stable over time, indicating that the lake is not changing rapidly. Furthermore, they compare very well with the reading of 5.5 feet taken during the surface water inventory of September 9, 1960, since it is equal to the minimum reading taken over the four-year period shown above. That reading was taken on 8/21/00. This indicates that there has been no long-term deterioration of water clarity. This is encouraging since water clarity is one on the most sensitive indicators for the increase in nutrients in the lake. A great deal can be learned from Secchi depths alone. Interestingly, the WDNR has been testing the capability of measuring water clarity from satellite flyovers coordinated with on the water Secchi depth readings across the state. Minnesota has been working on a similar program.

In addition to Secchi depth readings, which are generally taken every two weeks, measurements of temperature and dissolved oxygen are taken at three-foot intervals five times per year. Water samples are taken at three-foot intervals, and brought to the surface. The sampling device contains a thermometer for taking temperature readings. Samples of the water are treated with chemicals and a simple titration process is used to determine the dissolved oxygen in parts per million Graphs of temperature in degrees Fahrenheit and dissolved oxygen in parts per million at each of the depths from 3 to 27 feet are shown below for 1998.

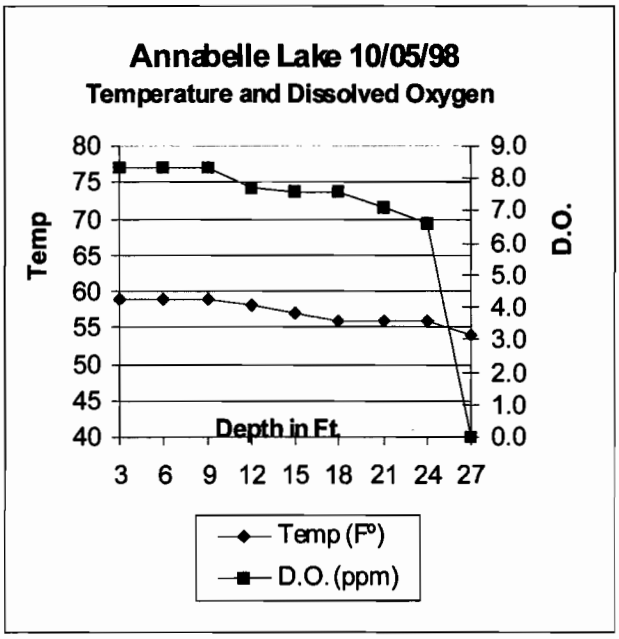








Annabelle Lake water temperature & dissolved oxygen at 3' intervals 1998
Collected as a part of the Self Help Lake Monitoring Program



Annabelle Lake water temperature & dissolved oxygen at 3' intervals 1998
Collected as a part of the Self Help Lake Monitoring Program

These graphs illustrate that in the spring after ice out, the temperature nearer the surface (left hand side of the graph) is beginning to rise and a thermocline or area of rapid temperature change is beginning to form between 9 and 15 feet. At the same time the dissolved oxygen is relatively evenly distributed at all depths, with some drop off as the depth increases. By July and August the lake is stratified and the cooler water at the bottom of the lake below the thermocline no longer mixes with the warmer surface water. As a result of the decomposition of plant and algae that has sunk to the bottom of the lake, the dissolved oxygen below 15 feet drops to practically zero. These anaerobic conditions are further exhibited by a slight sulfurous odor when samples from below 15 feet are brought to the surface. Finally, in the fall the lake turns over once again as the lake heads for ice up. This results in a more uniform temperature and the reintroduction of oxygen into the lower levels of the lake.

Two additional types of information are collected, along with temperature and dissolved oxygen. Samples are taken at the 3-foot depth. One is fixed with the addition of sulfuric acid and sent to the State Hygiene Lab in Madison for testing of total phosphorous. The other sample involves filtering water to collect plankton and algae samples. The amount of water filtered depends on the Sechhi depth, and generally runs between 500 or 800 mls for Annabelle Lake. The filter paper is wrapped in foil and shipped to Madison on ice, along with the phosphorous sample. There it is examined to determine the density of the microscopic plant and animal life suspended in the water at the time the sample was taken. The TSI indicators for phosphorous and chlorophyll shown in the DNR graph at the beginning of this section, are based upon these samples. Fortunately, the data show the levels of phosphorous and chlorophyll have remained relatively constant over the four-year period. A complete set of the raw data for 1996 through 2000 Self Help Program can be found in Appendix B.

The above data and information indicate that Annabelle Lake is in a Mesotrophic state, tending towards more Eutrophic conditions. While all lakes become more Eutrophic over time, there should be concern to not accelerate this process with the input of nutrients or sediments to the lakes.

Comprehensive Water Chemistry

As a part of the Lake Planning Management Grant the State also funded comprehensive water chemistry testing during two spring and two fall turnover periods. Sampling was conducted in Fall 1998, Spring and Fall 1999, and Spring 2000. Using the same equipment used for the self-help temperature and dissolved oxygen testing, additional samples were taken at the three foot level, with nitric acid added to the sample for metals testing and sulfuric acid added to the sample for phosphorous testing. These four samples were taken at or near the spring and fall turnover periods. Turnover testing is done when the water in the lake is mixed top to bottom. Turnover results are different than summer sampling results because nutrients and sediments from the bottom layers of the lake are brought up during this mixing.

pH:

A lake's acid level is indicated by pH. A pH of 7.0 is neutral. Lower values are acidic. A change of 1 pH unit is a tenfold change in acid level because pH values are on a logarithmic scale. The pH levels in Wisconsin lakes range from 4.5 to 8.4. Most aquatic life requires a pH between 6 and 9 to live. Lakes with low pH might see increased concentration of mercury, if metals are present in the lake bottom or surrounding soils. This is because metals become more soluble at lower pH levels.

Effects of Acidity on Fish (Olszyk,1980)

pH	Effect
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth disappear
5.2	Walleye, lake trout disappear
5.0	Spawning inhibited in many fish
4.7	Northern, suckers, sunfish disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3.0	Toxic to all fish

pH for Annabelle Lake

Fall 1998	Spring1999	Fall 1999	Spring 2000	Average
No Data- Lab Spill	6.83	6.73	6.90	6.820

Based on these data Annabelle Lake appears to be closer to neutral than to the 6.5 reading where walleye spawning is inhibited. It is of interest to note that these readings are less acidic than the 6.3 reading taken during the surface water inventory on September 9, 1960. This would appear to indicate that acid rain has not had a great impact on Annabelle Lake.

Alkalinity:

Alkalinity is a measure of certain dissolved compounds, mostly carbonates, which neutralize acid. The lower the alkalinity level, the greater the effect acid rain may have on the lake. High alkalinity levels buffer the lake because bicarbonate (HCO3-) and carbonate (CO3=) neutralize hydrogen ions from any acid added to the lake. Alkalinity levels are determined by the soils and bedrock of the area. In Northern WI, the alkalinity of seepage lakes average around 25 mg/l, and drainage lakes average around 50 mg/l.

Sensitivity of Lakes to Acid Rain

Sensitivity	Alkalinity (mg/l CaCO3)
High	0 - 2 mg/l
Moderate	2 -10 mg/l
Low	10-25 mg/l
Nonsensitive	> 25 mg/l

Alkalinity for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
No Data-Lab Spill	8 mg/l	10 mg/l	16 mg/l	11.3 mg/l

Based on the above data it appears that Annabelle Lake's sensitivity to acid rain is low, and this is in agreement with the long-term pH measures, above. The alkalinity reading of 9 mg/l taken during the surface water inventory of 9/9/1960 indicates that this measure has also remained stable over time.

Hardness:

The type of minerals in the soil and watershed affects a lake's hardness. If the soils are sandy, or if direct rainfall is a major source of lake water, hardness will be low. Lakes with low levels of hardness are considered soft water lakes and are more susceptible to acidification by acid rain. Soft water lakes are generally less productive than hard water lakes.

Hardness Level	Total Hardness as mg/l CaCO3
Soft	0 - 60 mg/l
Moderately Hard	61 – 120 mg/l
Hard	121 – 180 mg/l
Very Hard	> 180 mg/l

Hardness for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
9.6 mg/l	9.1 mg/l	11.0 mg/l	10.0 mg/l	9.925 mg/l

Annabelle Lake appears to be a very Soft lake. Hardness is not as good an indicator of sensitivity to acid rain as Alkalinity, so this is not a matter of great concern.

Conductivity:

Conductivity is related to the amount of dissolved substances in water, but it does not indicate which minerals are present. Normal values are roughly about two times the water hardness. If conductivity is much greater than two times the hardness, the water may be receiving high concentrations of contaminants introduced by humans. Changes in conductivity over time may indicate changing water quality.

Conductivity for Annabelle Lake in umhos/cm

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
No data-Lab Spill	29	98 – Approx. Ice Melted	27	28

Given that these two samples show a conductivity level that is 2.8 times the hardness further study of this characteristic would be prudent. Perhaps field tests could be run in the future. However, the data are very similar to the reading of 27 umhos/cm taken during the surface water inventory of 9/9/1960.

Calcium:

The amount of calcium in a lake is related to the presence of calcium-bearing minerals in the area. Calcium is one of the two major factors that determine water hardness, the other being magnesium. Northern WI lakes typically average around 10-mg/l of calcium.

Calcium for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
2.5 mg/l	2.3 mg/l	2.8 mg/l	2.6 mg/l	2.55 mg/l

These data show low levels of calcium, as would be expected from the low levels of hardness.

Magnesium:

Magnesium is closely related to the bedrock geology of the area. Magnesium concentrations are usually lower than calcium concentrations and typically average about 5 mg/l in northern WI.

Magnesium for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
0.82 mg/l	0.78 mg/l	0.98 mg/l	0.86 mg/l	0.86 mg/l

These are extremely low levels of magnesium and further explain the softness of the lake water.

Total Nitrogen:

Total nitrogen is the sum of total Kjeldahl nitrogen and Nitrate+ Nitrite. It is used to calculate the N:P ratio (see below).

Total Nitrogen for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
0.56 mg/l	0.51 mg/l	0.51 mg/l	0.52 mg/l	0.525 mg/l

These are low levels of total nitrogen, and are more characteristic of an oligotrophic state.

Total Phosphorus:

Phosphorus can promote excessive aquatic plant growth in lakes. It occurs naturally in soils, but human activities can greatly increase the quantities of phosphorus available to lake systems. Major sources include soil erosion, septic systems, detergents, runoff from lawns and farms, fertilizers, and human and animal wastes. Concentrations below 20 ug/l for natural lakes and 30 ug/l for impoundments will normally prevent nuisance algal blooms.

Total Phosphorus for Annabelle Lake

Fall 1998	Spring 1999	Fall !999	Spring 2000	Average
12 ug/l	14 ug/l	12 ug/l	No data	12.7 ug/l

These readings would indicate a nearly oligotrophic state for Annabelle Lake. The water quality index based on Total Phosphorus is as follows:

Water Quality Index	Total Phosphorus
Excellent	0 - 1 ug/l
Very Good	1 - 10 ug/l
Good	10 - 30 ug/l
Fair	30 - 50 ug/l
Poor	50 - 150 ug/l
Very Poor	> 150 ug/l

Since phosphorus is a major concern in many of the lakes in southern Wisconsin, where it promotes weeds that require harvesting and cause unpleasant algae blooms, care should be taken by all lake owners and users to keep the phosphorus levels in Annabelle Lake as low as possible.

Nitrogen to Phosphorus (N:P) Ratio:

The N:P ratio compares total nitrogen levels to total phosphorus levels. If the total nitrogen levels are more than 15 times the total phosphorus levels, then the lake is considered phosphorus limited, meaning phosphorus levels directly affect plant and algae growth. If the ratio is less than 15, then nitrogen levels control plant and algae growth.

N:P Ratio for Annabelle Lake

Fall 1998	Spring 1999	Fall 1999	Spring 2000	Average
46.7	36.4	42.5	?	41.9

Given the low degree of development in the Annabelle Lake watershed, it is not surprising that phosphorus levels in the lake control plant and algae growth. That is, in order to maintain current conditions it is imperative for everyone to limit phosphorus input into the lake.

References: Wisconsin Surface Water Survey, DNR, 1960.
Understanding Lake Data, Shaw, et al, 1994.
Limnological Characteristics of WI Lakes, Richard C. Lathrop & Richard A. Lillie, Trans. Wis. Acad. Sci., Arts, and Letters, 68:90-96.

Weather & Wildlife Records

Pat Williams has been tracking dates for ice-out, freeze-up, and various wildlife events since she and Dick moved to their year-round residence on Annabelle Lake in 1995. Her records are shown below.

Pats weather related charting

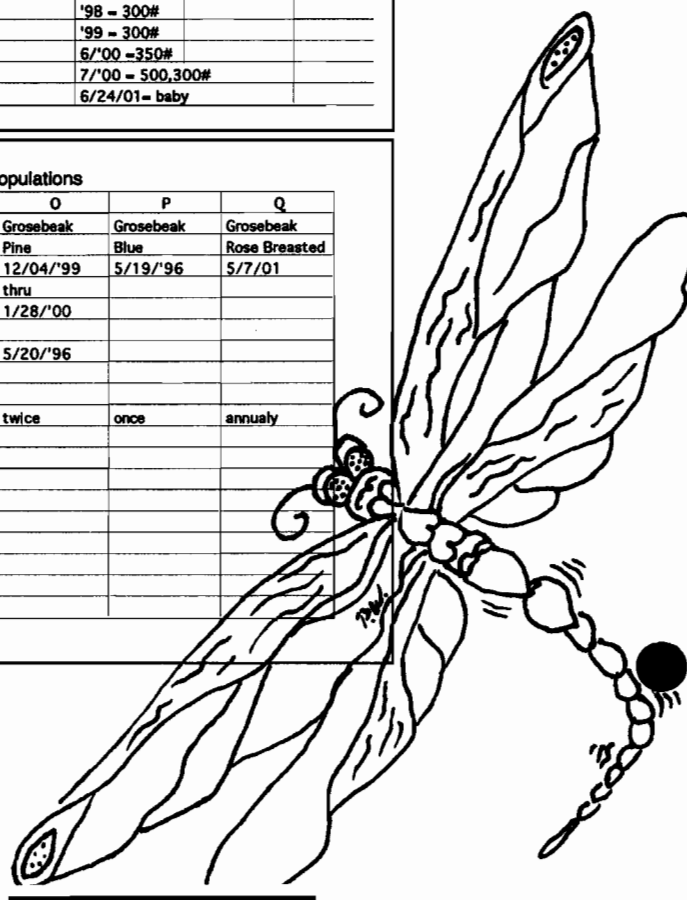
	A	B	C	D	E	F	G
1	Ice out	Freeze up	1st snow	Maple sap run	Winter S/Index	Drought	Rain
2	4/23/'95	11/12/'95	9/22/'95	------	'96	'98	'00
3	5/13/'96	11/08/'96	9/21/'96	------	Severity Index	drought	5/30-9/27=
4	4/26/'97	11/10/'97	10/14/'97	3/10/'97	168/177	lake down 13.5	21.01 inches
5	4/07/'98	12/19/'98	10/13/'98 *	2/19/'98	worst since	dryest in 109yrs.	
6	4/13/'99	11/30/'99	10/13/'99 *	3/17/'99	1948		
7	3/27/'00	11/18/00	10/07/'00**	2/23/'00	over 200"		7/10/'00
8	4/21/01			3/18/01	of snow!		3.50" above
9							recorded norm
10			* same				3." on dock
11			***12 3/4"!!!		'00-'01		
12					over 200" snow		4/26/01
13							lake 11"
14							above normal

Annabelle & Belle Lks, Aquatic Invertebrates, Waterfowl and Wildlife Populations

	A	B	C	D	E	F	G	H	I
1	dragonfly hatch	lakefly hatch	blackfly hatch	hummers	loons	ducks	black bear	frogs	goldfinch
2	6/10/96 - 72	7/2 96 - 76	5/14-5/28'95	5/14-9/19-95	4/27-11/17'9	6/11-9/26'96	7/4/'95 1	green	3/30- '98
3	6/10/97 - 80	5/29/97 - 68	6/1-6/15 '96	5/13- '96	4/18- '98	6/5-11/9 '97	5/21/'96 1	heavy hatch	4/5- '99
4	6/12/98 - 71	6/24/01-84	5/28-6/11'97	5/14- '97	4/16- '99	4/7-10/5 '98	6/11/'97 1	each yr	3/15 - '00
5	5/22/99 - 68		5/10-5/20'98	5/14- '98	3/31-10/'00	5/28-10/2'99	5/28/'98 1	'95-'01	
6	5/3/00 - 70		4/25-5/6'99	5/10- '99	* 7/24-6 loons	3/3-10 '00	7/9/'99 1	lg adult pop	
7	4/29/01-82		5/12-6/1 '00	5/6-9/18 '00		4/18/01	6/27/'00 1		
8				5/6/01	'96-1 chick		7/3/'00 2		
9					'97- 1 pr	'97 ducklings	6/24/01		
10					'98-1 pr	'98 ducklings			
11					'99- 1 pr	'99 ducklings	est. wt.		
12					'00- 1 pr	'00 ducklings	'95 - 250#		
13						6/17/01 -	'96 - 300#		
14					4/20/01-3loon	** ducklings	'97 - 350#		
15							'98 - 300#		
16							'99 - 300#		
17							6/'00 -350#		
18							7/'00 - 500,300#		
19							6/24/01- baby		

Annabelle & Belle Lks, Aquatic Invertebrates, Waterfowl and Wildlife Populations

	J	K	L	M	N	O	P	Q
1	osprey	canada geese	blue heron	eagles	Grosebeak	Grosebeak	Grosebeak	Grosebeak
2	'96- 1pr+1ck	4/14/'99 pr	4/6/'99 rooky	'95 - 1	Evening	Pine	Blue	Rose Breasted
3	'97-1pr+2ck	5/3/'00 pr	3/30/'00 *	'96 - 1	3/29/ '98	12/04/'99	5/19/'96	5/7/01
4	'98-1pr+2ck	5/6/01 pr	4/8/01 *	'97 - 2	4/2/'99	thru		
5	'99-1pr+1ck			'98 - 2	3/07/'00	1/28/'00		
6	'00-1pr+1ck		rookery is on	'99 - 3	5/13/96			
7	4/13/01-2ck		Belle Lk	'00 - 3 to 4	3/20/01	5/20/'96		
8	* 6/11-2ck							
9	nest -Belle Lk							
10		'00 3 goslings	*'01-19 nests	no nest yet	annualy	twice	once	annualy
11		in Anna creek		on annabelle				
12								
13	Black Flies -		Swans - 4*		Cardinal - male			
14	mostly in May		*4 on 11/4/00		ist 10/24/00			
15	5/9-19/01		on video					
16								
17								
18								
19								



RECOMMENDATIONS

Fisheries

- Cooperate and assist the WDNR in exploring the modification of the walleye regulation for Annabelle Lake from the standard 15 inch minimum to a no minimum length, but harvest of only 1 walleye over 14 inches.
- Promote natural shorelines for fish spawning/habitat by encouraging owners to leave the shoreline in a natural state, and to leave/create shoreland buffer strips.
- Protect weed beds and shallow areas used by spawning fish.
- Provide education on exotic fish species to prevent their introduction into the lake or its watershed.
- Disseminate future results of WDNR/GLFWIC surveys to Association members.
- Continue to work with the WDNR in tracking the results of shocking, fyke netting and other types of fisheries studies by WDNR/GLIFWC to ascertain changes in conditions that warrant changes in fisheries management. These might include:
  - Stocking by the WDNR or continued stocking by the Association
  - Construction of fish cribs or brush piles

Aquatic Vegetation

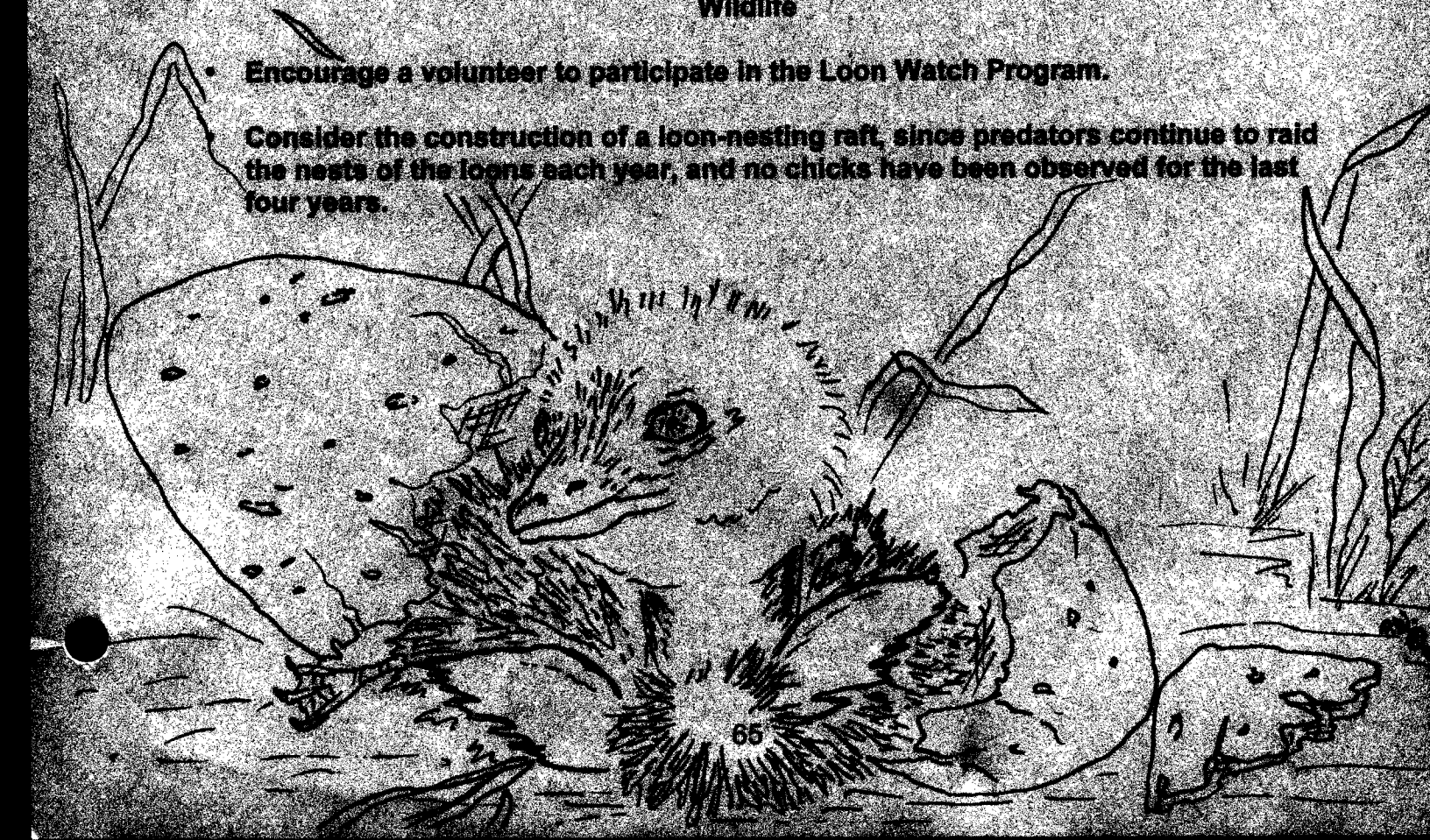
- Promote boating practices to maintain the health of Pipewort, Spiny-spored Quillwort, and Water Lobelia, to prevent them from being overcome by sedimentation.
- Identify those areas supporting Large Purple Bladderwort, and determine ways to protect this "Species of Special Concern".
- Consider methods to maintain lake water level to support plants rooting in 1.3 feet of water or less.
- Exotic Species:
  - Continue to monitor the boat landing on a periodic basis for indication of Eurasian Water Milfoil. Continue to report this activity to the WDNR, and alert them at the first hint any infestation.
  - Keep the Eurasian Water Milfoil sign at the boat landing in good repair.
  - Promote education among Association members and those living within the watershed in the identification and possible eradication of Eurasian Water Milfoil, Purple Loosestrife, Zebra Mussels, and any other exotic species of concern.

Water Quality

- Continue participation in the Self-Help Lake Monitoring program to provide a longitudinal reference for the health and well being of the lake water.
- Consider field-testing water chemistry at turnover every five years to provide a comparison with the 1990 data and the four tests done as a part of this grant.
- Educate Association members and those living within the watershed on the importance of limiting the introduction of non-natural phosphorus through fertilizers, detergents, septic systems, and other human sources.
- Promote natural shoreline buffers through education and demonstration.
- Monitor new state septic system regulations and alternative systems for better nutrient removal.
- Encourage enrollment in the Vilas County Septic Maintenance program.
- Encourage regular periodic home drinking water testing through newsletters and programs.

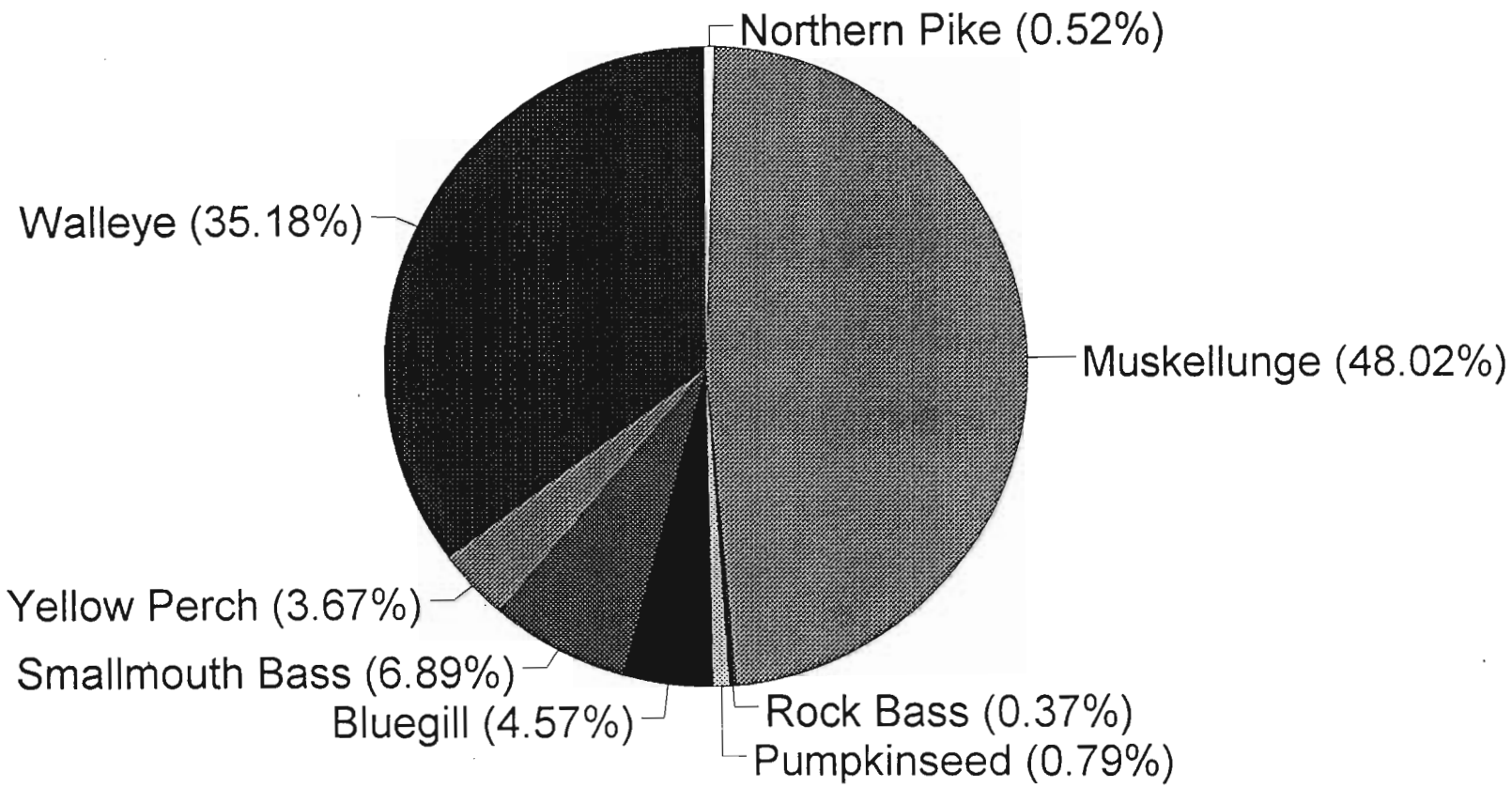
Wildlife

- Encourage a volunteer to participate in the Loon Watch Program.
- Consider the construction of a loon-nesting raft, since predators continue to raid the nests of the loons each year, and no chicks have been observed for the last four years.



TOTAL ANNUAL ANGLER DIRECTED EFFORT BY SPECIES

This graph illustrates the percentage of time that anglers spent fishing for each species during the entire creel survey. The percentages are based on the species of fish anglers told the clerk they were fishing for, not what they actually caught.



* If a particular species is not present in the graph it is because no one reported they were fishing for that species.

Annabelle Lake Fisheries Final Report

Prepared by NES Ecological Services

for

Annabelle Lake Property Owners Association

December 21, 2000

1.0 INTRODUCTION

This data report outlines the information collected as part of a comprehensive fisheries study being completed by the Annabelle Lake Property Owners Association. The main focus of this portion of the fisheries investigation documents panfish and non-game species composition and relative abundance, and this report details the study methods, results, discussion of results, and management recommendations. This project is a continuation of studies funded by the Annabelle Lake Property Owners Association and the Wisconsin Department of Natural Resources (DNR). Fish sampling guidelines follow those established by the Wisconsin DNR (Woodruff, Wisconsin) in accordance with the Wisconsin DNR Comprehensive Fisheries Survey Guidelines.

2.0 LOCATION DESCRIPTION

Annabelle Lake is a 212-acre seepage lake in northern Vilas County, Wisconsin and is located 10 miles north (T43N, R43N) of Boulder Junction, WI. Maximum depth in Annabelle Lake is 30 feet, with the 82% of the lake being in the 3-20 foot depth range. Including islands, the lake has a shoreline of 4.24 miles. The geographic area is typified by glacial drift sand and gravel deposits over granitic and metamorphic bedrock (Kammerer 1981), and the dominant vegetative cover is primarily young forest with cedar, pine and birch dominated riparian areas. Annabelle Lake is partially developed, and although the area has been logged, approximately 70% of the shoreline is currently undisturbed.

Vegetation assemblages in Annabelle Lake are typical of a northern, soft water, sand-bottomed lake. A total of 19 species were observed in a recent survey, including some infrequently encountered species (NES 1998). Shoreline habitat is of good quality, with native vegetation and some large woody debris cover.

3.0 METHODS

The following sections detail the methods used in surveying. Some differences in sampling techniques are described here. The Wisconsin DNR requires that fish be measured and counted to the nearest 0.1 inch, while NES requires fish measured to the nearest 1.0 millimeter. Graphs and data have been converted to accommodate DNR requirements. In addition, DNR guidelines suggest measuring the first 25 fish from each net until a total of 250 are measured for the sampling period and then counting the remaining fish. NES requires that all captured fish are to be measured unless this is deemed unfeasible by the fisheries biologist, in which case a maximum of 100 per net should be measured for each species. Numbers for this survey did not exceed 25 per net except in two cases.

3.1 Spring Fyke Net Survey

To assess the population of panfish and non-game fish species in Annabelle Lake, a Spring trap (fyke) net survey was completed. The fyke nets used consisted of a series of 3 foot diameter metal hoops containing three or four cone-shaped throats that prevent escape. The square mesh size of the traps was 0.5 inches, and each trap opening was connected to a 75-foot lead and two 25-foot wings. A total of eight (8) trap nets were set for four (4) consecutive nights and were lifted every morning and reset (See Figure 3-1 for location). Upon lifting, total lengths of all fish were measured to the nearest millimeter, and weight and scale samples were taken from representative fish before release. Sampling stations were selected based on habitat type, with a variety of habitats being represented (Table 3-1). The table below lists only emergent and floating-leaved vegetation, but the entire littoral zone, or near shore zone, of the lake was also populated by northern water milfoil (*Myriophyllum tenellum*), spiny-spored quillwort (*Isoetes echinospora*), and pipewort (*Eriocaulon septangulare*). These submergent species are present but not listed in the table below, as their coverages were sparse but consistent throughout the lake. It should be noted that fyke net site TN3 was also dominated by great bladderwort (*Utricularia vulgaris*), also a submergent species not listed in the table below.

Table 3-1. Spring fyke net locations according to habitat type

Fyke net (trap net)	Habitat conditions
TN1	Gravel/sand substrate, shallow and gradual littoral zone, plant coverage (10% pickerel weed (*Pontedaria cordata*), 2% bulrush (*Scirpus acutus*)
TN2	Cobble/gravel bottom, 6'-7' max. depth with sharp drop, no plant coverage
TN3	Silt/organic substrate, woody debris, shallow, 25% burreed (Sparganium spp.) coverage
TN4	Cobble and organic substrate, woody debris, shallow with sparse coverage of water horsetail (*Equisetum fluviatile*) and bulhead lily (*Nuphar variegata*)
TN5	Cobble/boulder substrate, submerged logs, 5-8' deep with sharp drop, no vegetation coverage
TN6	Sand substrate, shallow, 75% bulrush coverage
TN7	Gravel/sand substrate, 5-6' deep, moderate drop and no significant vegetation coverage
TN8	Gravel/sand substrate, 3-4' deep, near shore coverage of pickerel weed, bulhead lily and floating-leaf burreed

3.2 Mini-fyke net survey

Summer recruitment surveying was completed using mini-fyke net sampling. Mini-fyke nets are similar in design to standard fyke or trap nets, with smaller dimensions. Mini-fyke nets consisted of a 3.0ft x 3.0ft frame, 1/8 inch bar mesh and a 50 foot lead. Eight (8) nets were fished for two full 24-hr periods and were lifted each morning (See Figure 3-1 for net locations). Upon lifting, total lengths of all fish were measured to the nearest millimeter, and weight and scale samples were taken from representative fish before release.

Represented habitats are shown in the table below. The table lists only emergent and floating-leaved vegetation, but the entire littoral zone of the lake was populated by northern water milfoil, spiny-spored quillwort, and pipewort. These submergent species are present but not listed in the table below, as their coverages were sparse but consistent throughout the lake. It should be noted that mini-fyke net site MF3 was also dominated by great bladderwort, also a submergent species not listed in the table below. The site MF2 contains a population of ribbon-leafed pondweed (*Potamogeton epihydrus*), also a submergent species.

Table 3-2. Mini-fyke net locations according to habitat type

Mini-fyke net	Habitat conditions
MF1	Gravel/sand substrate, shallow and gradual littoral zone, plant coverage (20% bulrush, water lily and burreed)
MF2	Cobble/gravel/sand bottom, shallow, 70% burreed coverage
MF3	Silt/organic substrate, woody debris, shallow, 25% burreed coverage
MF4	Cobble and organic substrate, woody debris, shallow, 40-75% pickerel weed, water lily and burreed coverage
MF5	Sand/gravel substrate, very shallow (1-2ft), 80% pickerel weed
MF6	Sand substrate, shallow, 40% burreed and 20% bulrush coverage
MF7	Gravel/sand substrate, shallow, 70-90% bulrush/burreed coverage
MF8	Gravel/sand substrate, shallow, 50% bulrush coverage

3.3 Seining

The purpose of this seining sampling effort was to assess the forage and young-of-the-year populations. Extensive woody debris, as well as dense bulrush, burreed and lily populations in near shore areas made seining difficult, and thus only four areas were sampled. Seining of beach areas was performed using a 30 ft x 4 ft x ¼ inch bar mesh seine net. Seine passes 1,2, and 4 were made parallel to shore, over a length of approximately 150 feet. Seine pass 3 was made using a circular pattern around a fixed pivot point at three

locations along the same shoreline area. All fish captured were measured to the nearest 1.0 millimeter and released.

4.0 RESULTS AND DISCUSSION

The data shown in the following sections are presented in several forms typical of fisheries surveys. Pie charts show the number of fish captured and give an indication of the fish population assemblage, or *community composition* according to species. *Length-frequency histograms* are graphs that show the number of fish caught within a certain size or length group and can provide valuable information regarding the age class strength for fish species. *Total length* of fish, the length measured from the tip of the snout to the end of the tail, or caudal fin, is commonly used in fisheries management, and is used here. Fish scales, spines and other hard, calcified structures in fish form by accumulating minerals at different rates, depending on the environmental conditions, particularly water temperature. The result of seasonal environmental fluctuation is the formation of growth rings, or *annuli*, much like in trees. These annuli allow fish biologists to determine age classes, which can be combined with length-frequency and other data to obtain an accurate picture of the fish community. Graphs of total length versus age give an indication of the rate of growth for fish species. These graphs typically show the total lengths of fish regressed against the age of each fish at the last annulus formation, however, since the June 1 survey should be fairly close to the hatch date for each species, total length at time of capture was graphed against the nearest age class. Length versus age graphs show comparisons to regional data (Wisconsin DNR 1990), but these are based on general regional data and any conclusions should be made with caution. In lakes and other biological systems, management recommendations should be made on a case-by-case basis when possible.

A variety of fish species were captured in this survey, and each is listed in the table below. Gamefish species are highlighted in gray. A discussion of results is included in each subsection.

Table 4-1. Fish species captured in Annabelle Lake fyke/seine sampling, 2000

Common Name	Scientific Name
Black bullhead	*Ameiurus melas*
Bluegill	*Lepomis macrochirus*
Bluntnose minnow	*Pimephales notatus*
Burbot	*Lota lota*
Common shiner	*Luxilus cornutus*
Fathead minnow	*Pimephales promelas*
Golden shiner	*Notemigonus crysoleucus*
Johnny darter	*Etheostoma nigrum*
Largemouth bass	*Micropterus salmoides*
Logperch	*Percina caprodes*
Mudminnow	*Umbra limi*
Northern pike	*Esox lucius*
Rock bass	*Ambloplites rupestris*
Smallmouth bass	*Micropterus dolomieu*
Tiger muskellunge	*Esox lucius x E. masquinongy*
Walleye	*Stizostedion vitreum*
Yellow perch	*Perca flavescens*

4.1 Survey Results and Discussion

A total of 12 fish species and only 144 individual fish were captured in Annabelle Lake during the Spring 2000 fyke net sampling period. Mini-fyke sampling yielded 11 species and 807 fish, while seining yielded 6 species and 311 fish. The pooled data from all sampling gear (spring fyke, minifyke and seining) shows a total of 17 fish species and 1262 individual fish captured (Table 4-2, Fig 4-1 to 4-3). Catch per effort data can be seen in Table 4-2.

The contagious distribution of some juvenile fish can be misleading and should be highlighted. In this case, juvenile black bullheads make up 17% of the total catch numbers, but juvenile black bullheads congregate in tight schools. All of the black bullhead juveniles captured were in the same net haul, and were of the same length, apparently cohorts.

Panfish are represented in Annabelle Lake by bluegill and rockbass, which together make up nearly 40% of the total number of fish captured in this study (Table 4-2). Bluegills, 90% of which were captured in the August mini-fyke sampling, make up approximately 22% of the captured fish in Annabelle Lake. Three year classes of bluegill are represented in the mini-fyke catch (Figure 4-4). Growth rates for bluegill appear to be slightly greater than the statewide average, but within the normal range (Figure 4-10). Rockbass, corresponding to 16% of the total catch, are represented by at least four (4) year classes.

Table 4-2. Total catch of all gears for 2000 Annabelle Lake fisheries study

	Spring Fyke			Mini-fyke			Seine			Total (all gears)			
	Total captured	No. Lifts	Fish / lift	Total captured	No. Lifts	Fish / lift	Total captured	No. Lifts	Fish / lift	Total captured	No. Lifts	Fish / lift	Percent of total catch
Black bullhead	**3**	32	0.09	**206**	32	6.44				**209**	64	3.27	16.6%
Bluegill	**15**	32	0.47	**263**	32	8.22	**2**	4	0.50	**280**	68	4.12	22.2%
Bluntnose minnow				**3**	32	0.09	**8**	4	2.00	**11**	36	0.31	0.9%
Burbot	**2**	32	0.06							**2**	32	0.06	0.2%
Common shiner				**20**	32	0.63	**143**	4	35.75	**163**	36	4.53	12.9%
Fathead minnow	**1**	32	0.03	**6**	32	0.19	**1**	4	0.25	**8**	68	0.12	0.6%
Golden shiner	**1**	32	0.03							**1**	32	0.03	0.1%
Johnny darter				**1**	32	0.03				**1**	32	0.03	0.1%
Largemouth bass				**30**	32	0.94				**30**	32	0.94	2.4%
Logperch	**1**	32	0.03				**2**	4	0.50	**3**	36	0.08	0.2%
Mudminnow				**3**	32	0.09				**3**	32	0.09	0.2%
Northern pike	**3**	32	0.09							**3**	32	0.09	0.2%
Rock bass	**39**	32	1.22	**168**	32	5.25				**207**	64	3.23	16.4%
Smallmouth bass	**25**	32	0.78	**30**	32	0.94				**55**	64	0.86	4.4%
Tiger muskellunge	**1**	32	0.03							**1**	32	0.03	0.1%
Walleye	**25**	32	0.78							**25**	32	0.78	2.0%
Yellow perch	**28**	32	0.88	77	32	2.41	**155**	4	38.75	**260**	68	3.82	20.6%
Number of species	12			11			6			17			
Total captured per gear	144			807			311			1262			

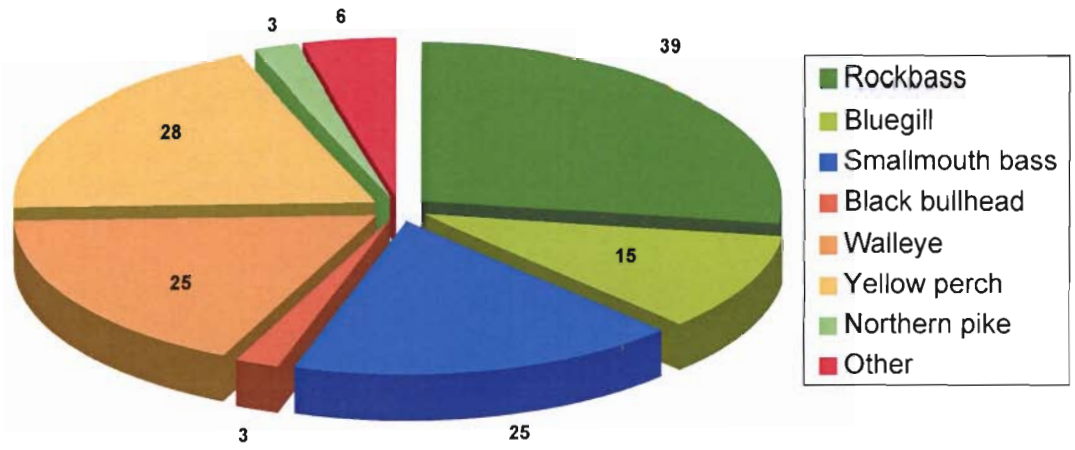


Figure 4-1. Total numbers of fish captured in June 2000 fyke catch Annabelle Lake (Vilas Co., WI)

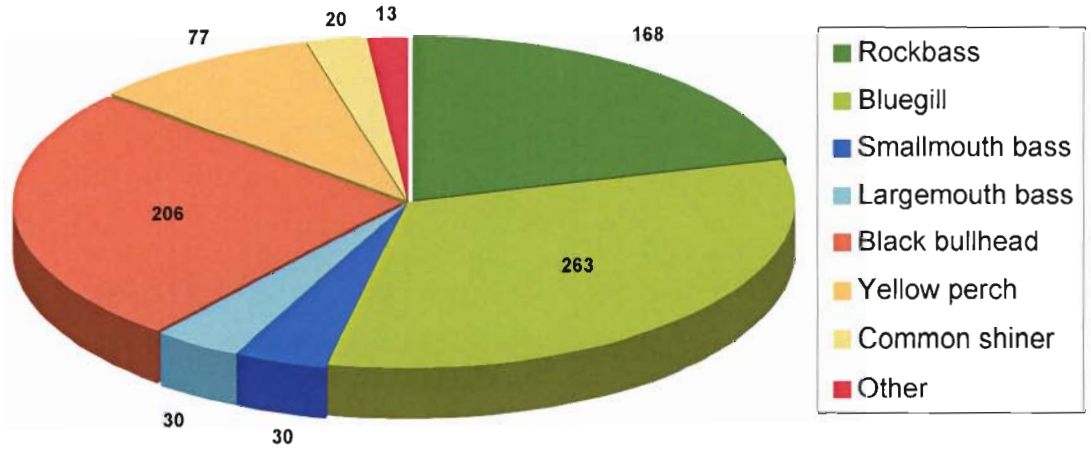


Figure 4-2. Total numbers of fish captured in August 2000 mini-fyke catch Annabelle Lake (Vilas Co., WI)

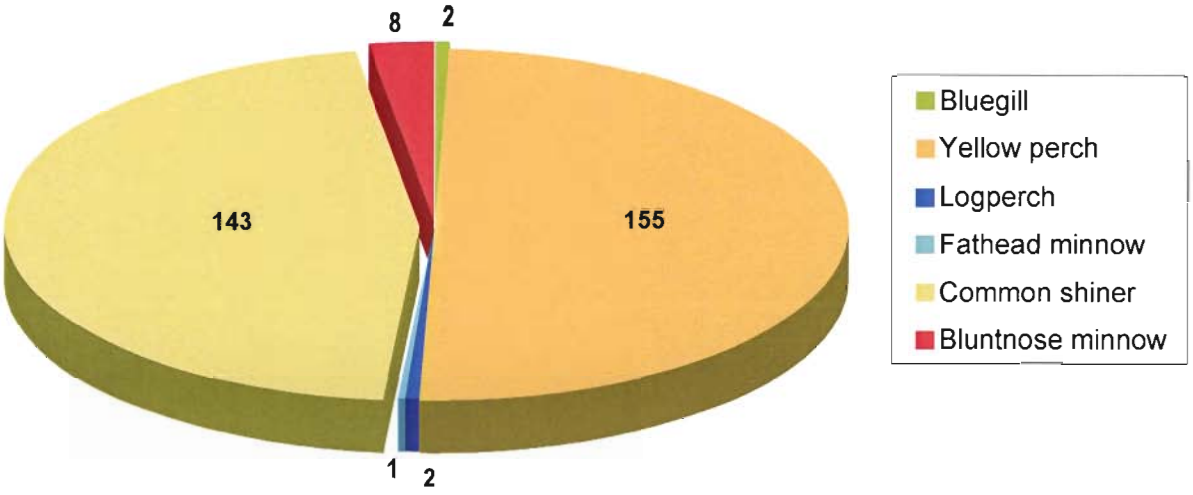


Figure 4-3. Total numbers of fish captured in August 2000 seine catch Annabelle Lake (Vilas Co., WI)

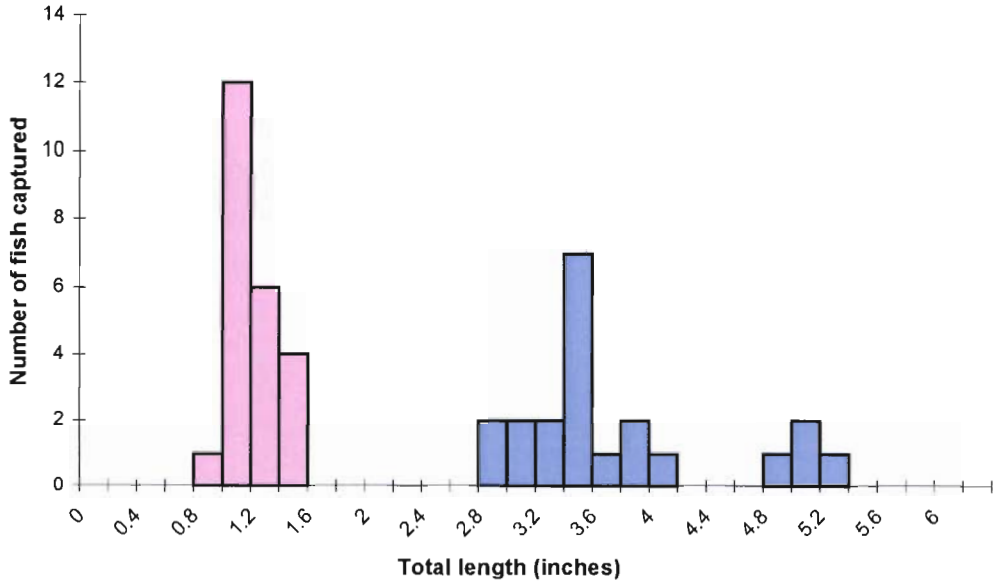


Figure 4-4. Bluegill (*L. macrochirus*) Frequency Distribution Annabelle Lake (Vilas Cty., WI) August 2000 Mini-fyke Net Survey

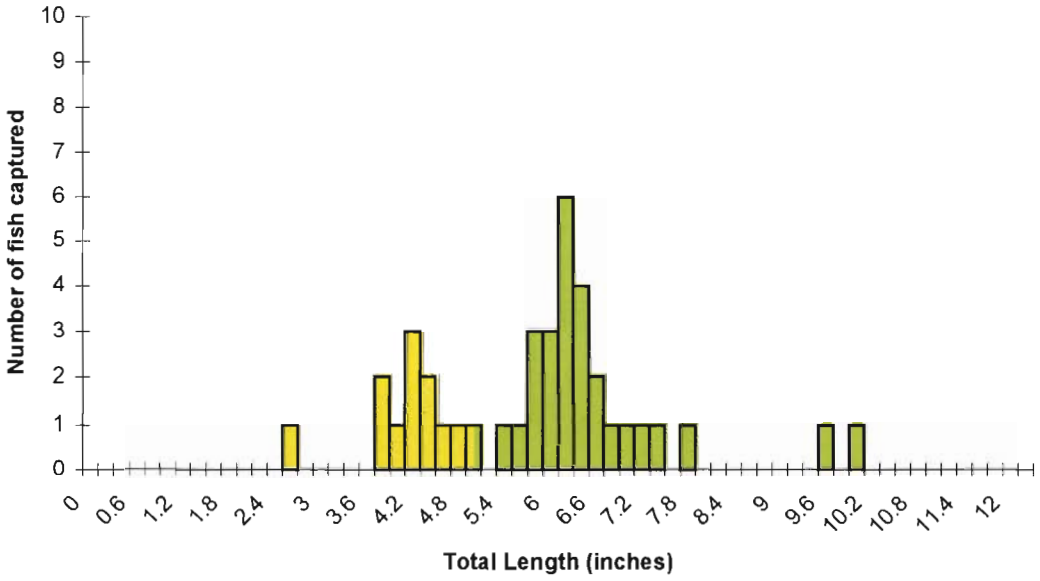


Figure 4-5. Rock Bass (*A. rupestris*) frequency distribution Annabelle Lake (Vilas Cty., WI) June 2000 fyke net survey

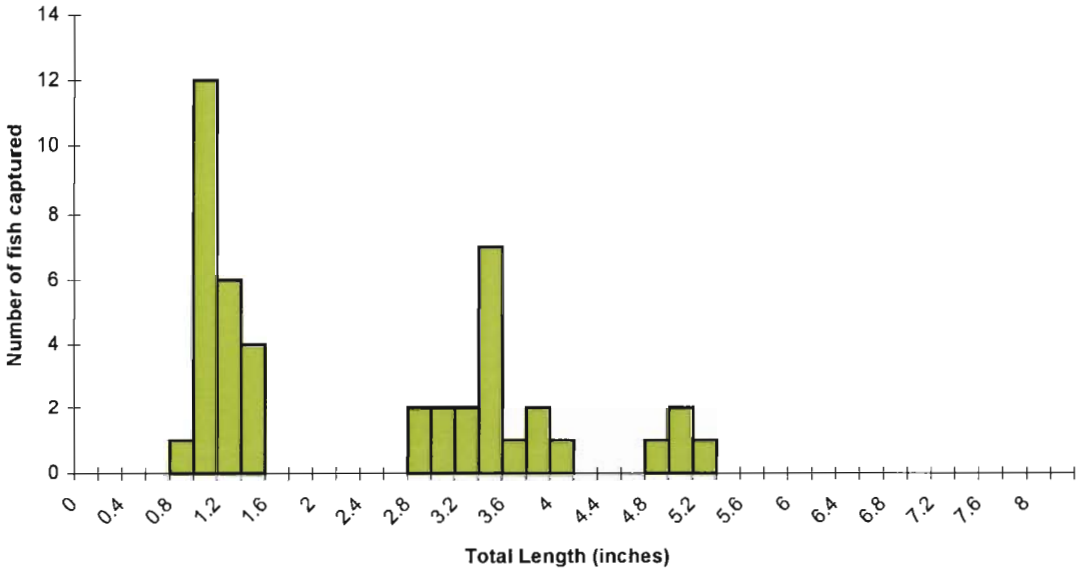


Figure 4-6. Rock Bass (*A. rupestris*) frequency distribution Annabelle Lake (Vilas Cty., WI) August 2000 mini-fyke net survey

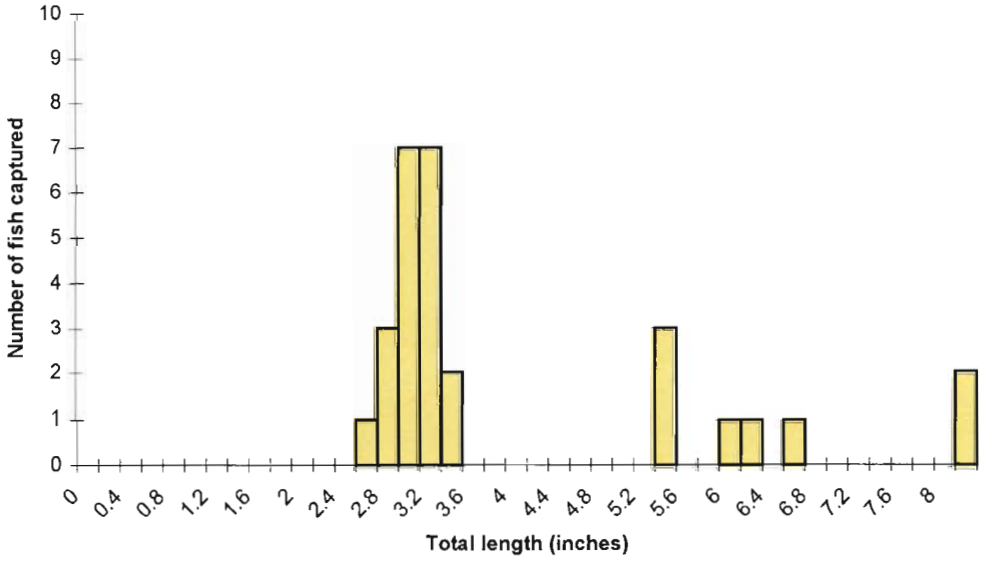


Figure 4-7. Yellow Perch (*P. flavescens*) frequency distribution Annabelle Lake (Vilas Cty., WI) June 2000 fyke net survey

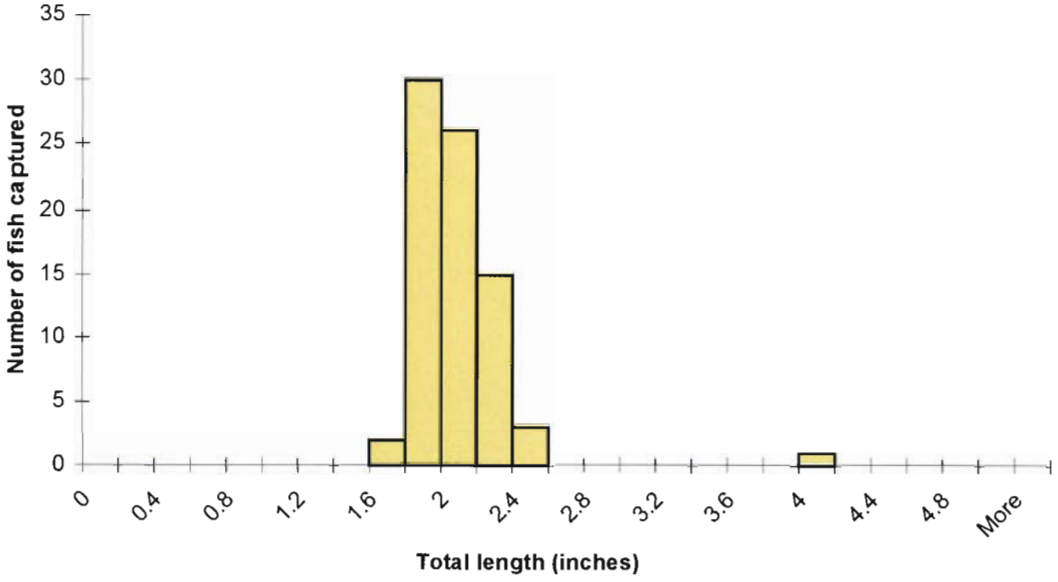


Figure 4-8. Yellow Perch (P. flavescens) frequency distribution Annabelle Lake (Vilas Cty., WI) August 2000 mini-fyke net survey

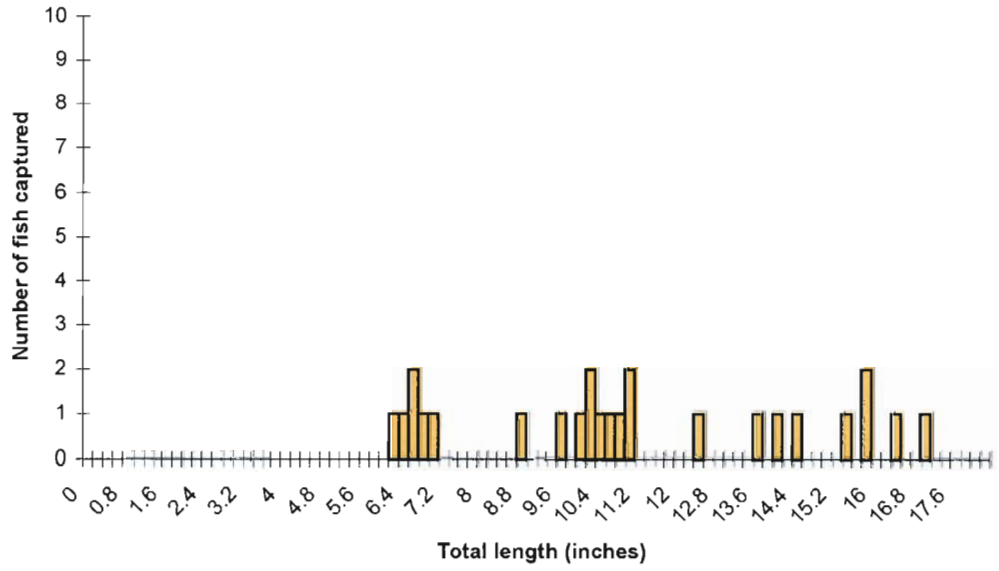


Figure 4-9. Walleye (S. vitreum) frequency distribution Annabelle Lake (Vilas Cty., WI) June 2000 fyke net survey

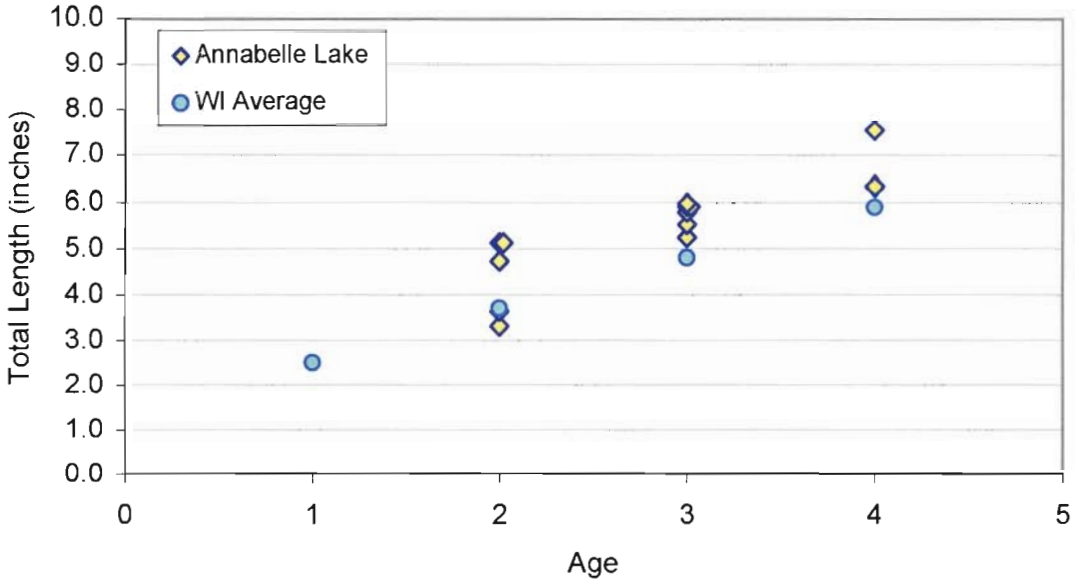


Figure 4-10. Bluegill length-at-age for Annabelle Lake spring fyke net survey June 1, 2000 (all data pooled)

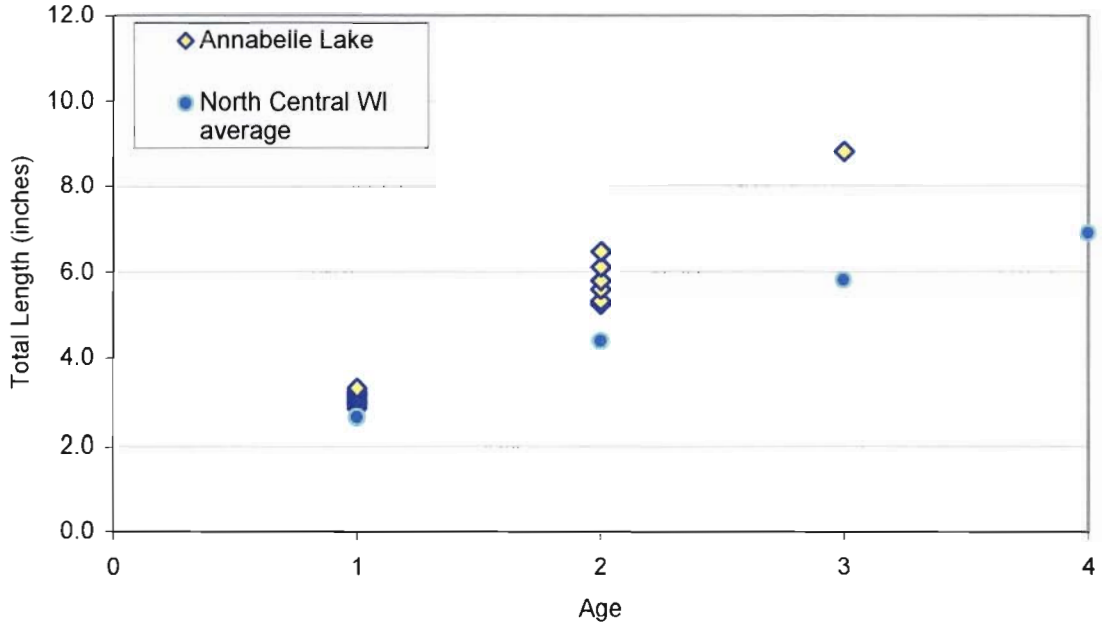


Figure 4-11. Yellow perch length-at-age for Annabelle Lake spring fyke net survey June 1, 2000 (all data pooled)

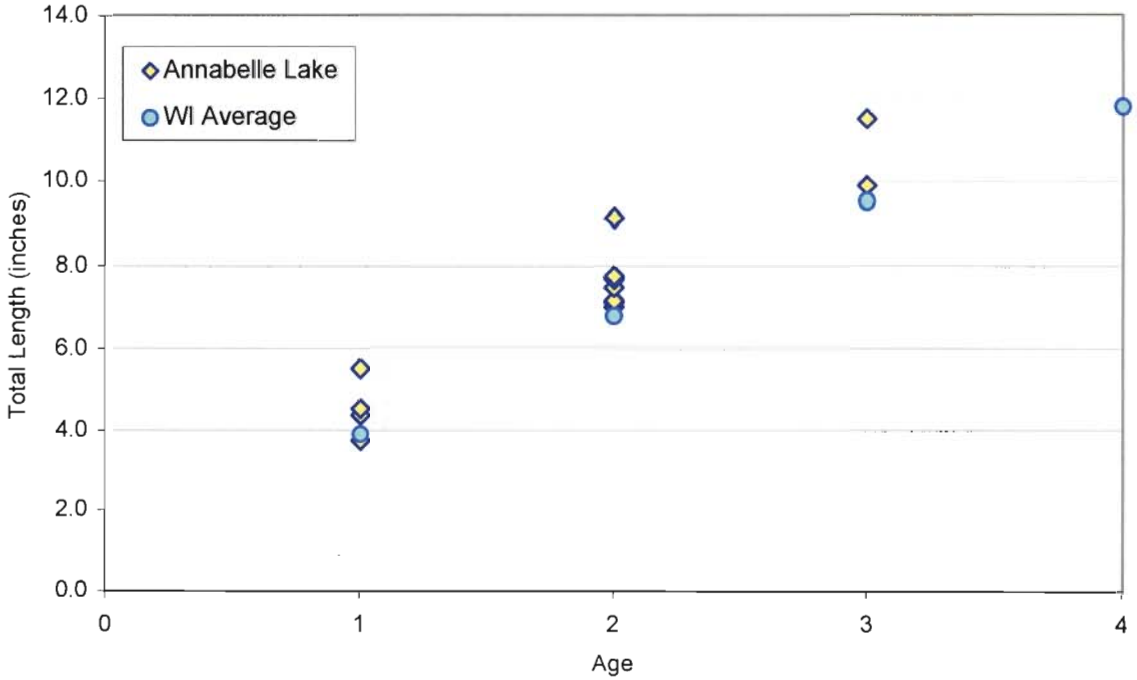


Figure 4-12. Smallmouth bass length-at-age for Annabelle Lake spring fyke net survey June 1, 2000 (all data pooled)

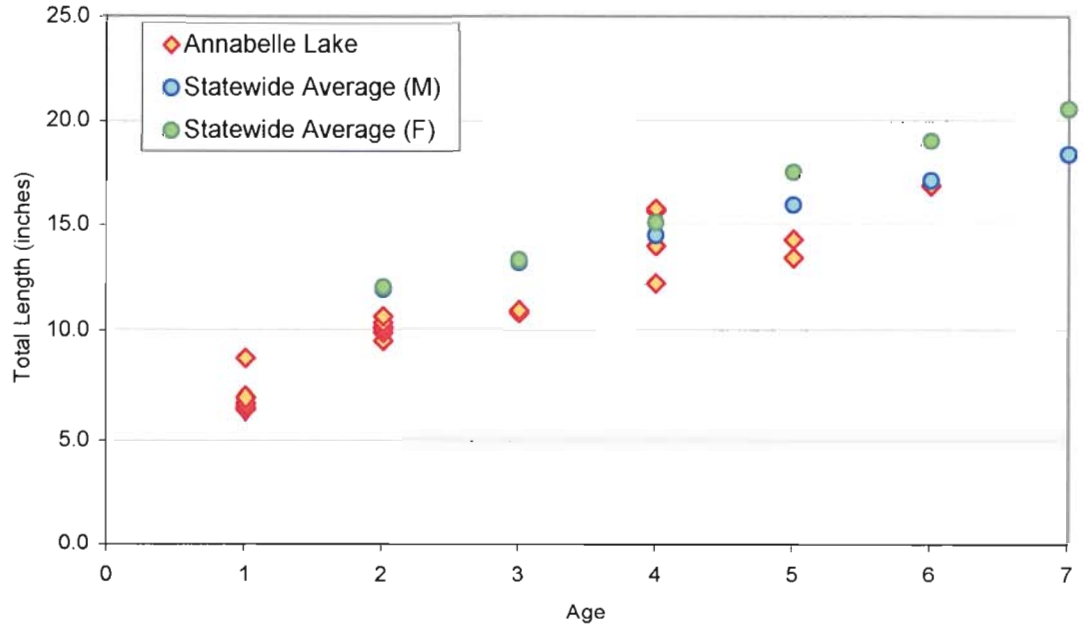


Figure 4-13. Walleye length-at-age for Annabelle Lake spring fyke net survey June 1, 2000 (all data pooled)

Gamefish captured in this survey include northern pike, tiger muskellunge, largemouth bass, smallmouth bass, walleye and yellow perch. Yellow perch constitute 21% of the total fish captured, with most of the yellow perch being juveniles captured from seine net hauls. Recruitment of yellow perch is demonstrated by the capture of age 0+, or young-of-the-year fish shown in Figure 4-8. In all, a total of four year classes were captured in this survey, three in spring, and an additional year class in the fall survey (Figure 4-7). Age determination shows growth rates for Annabelle Lake yellow perch are within the normal range for North Central Wisconsin (Figure 4-11).

Walleye were only represented in the spring trap net survey, and no juveniles were captured in beach seining (Figures 4-1 through 4-3). From the length-frequency distribution (Figure 4-9), it is possible to discern at least three year classes, each represented by only a few individuals. Growth data suggests that growth rates for Annabelle Lake walleye are slightly below the mean value, but within the normal range for the state of Wisconsin (Figure 4-13). Seining produced no young-of-the-year, but Wisconsin DNR electrofishing results have shown both age 0+ and 1+ fish in both 1998 and 1999 surveys (Wisconsin DNR 1998, Wisconsin DNR 1999).

All other fish are represented by only a few individuals, but do give evidence of a diverse fish assemblage.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Results show that Annabelle Lake has a balanced, diverse fish assemblage with several year classes represented for most species. Mini-fyke catches show recruitment of bluegill, yellow perch and rock bass. An analysis of length vs. age shows that the growth rate of smallmouth bass, bluegill, and yellow perch may be very slightly greater than the Wisconsin statewide average. A larger sample size and an analysis of back-calculated length at annulus formation would give a more accurate determination of these trends. The data is encouraging, and suggests that although these fish species can often develop stunted populations, the Annabelle Lake populations appear to have normal growth rates.

Lakes are typically classified according to their trophic state, which is a direct characterization of lake productivity and nutrient concentration. Lakes generally fall into one of three categories; *eutrophic* lakes have high nutrient concentrations and abundant plant and algae growth, while *oligotrophic* lakes have low nutrient concentrations and low productivity. Finally, *mesotrophic* lakes fall somewhere in between the latter two states. *Dystrophic* lakes, like neighboring Belle Lake, which do not fit in the normal trophic

state classification, contain high levels of humic and tannic acids that stain the lakes brown or yellow, and such lakes are usually have low levels of algae and plant growth.

Yearly average data for Secchi depth (Fig. 5-1), total phosphorus (Fig. 5-2) and chlorophyll a (Fig. 5-3) indicate that Annabelle Lake is mesotrophic according to Carlson's Trophic State Index (TSI) (Carlson, 1977). However, it must be noted that the TSI is most reliable for lakes with a plant community dominated by algae and with low amounts of non-algal turbidity or color. Annabelle Lake's plant community is likely dominated by macrophytes, rather than algae, and there is a distinct staining caused by organic acids. Therefore, the TSI calculations for Annabelle Lake may not accurately indicate the trophic status of the lake. Nevertheless, water quality data and the relatively high quality of the aquatic macrophyte community point to Annabelle as being a mesotrophic lake with some dystrophic characteristics. Lakes can show characteristics of dystrophy and can sometimes fluctuate between states (Carpenter and Pace 1997). An additional indicator of the lake's good health is the fact that its average Secchi depth is only slightly below the Northeast Wisconsin average, while both the average total phosphorus and chlorophyll a levels are typically below the regional average (Lillie and Mason, 1983).

In lakes like Annabelle Lake, the epilimnion, or the layer of oxygenated warm water, is largest just after spring mixing. The epilimnion can shrink, or become narrower in midsummer due to consumption of oxygen by decomposition in the sediments of the hypolimnion. Algal growth, and consequently zooplankton growth is limited to those regions of the epilimnion that are also considered the photic zone, or light penetration zone. Zooplankton, the primary food source for many small fish, will migrate below the photic zone periodically, but feed primarily on algae in the photic zone.

Various studies have demonstrated an inability of algae and submersed macrophytes to persist beyond some minimum light level (i.e., photic zone) that ranges all the way from 2% to 21% of surface light. Generally, photic zone depth is assumed to be 1.7-3 times the Secchi depth (Horne and Goldman 1994). Therefore, the photic zone in Annabelle Lake would be anywhere from 11.05 feet to 15.3 feet. The observed photic zone (i.e., maximum depth of observed vegetation) for Annabelle Lake is suggested to be less than that at 5.0 feet, however, it is possible that very sparse vegetation persisted to greater depths and/or that, for this lake, Secchi depth was closer to being indicative of actual photic zone depth. Given that panfish populations appear healthy and diverse, and that water quality data and photic zones appear normal, it is reasonable to assume that Annabelle Lake has normal zooplankton populations. More detailed algae and zooplankton studies would be needed to confirm this assumption.

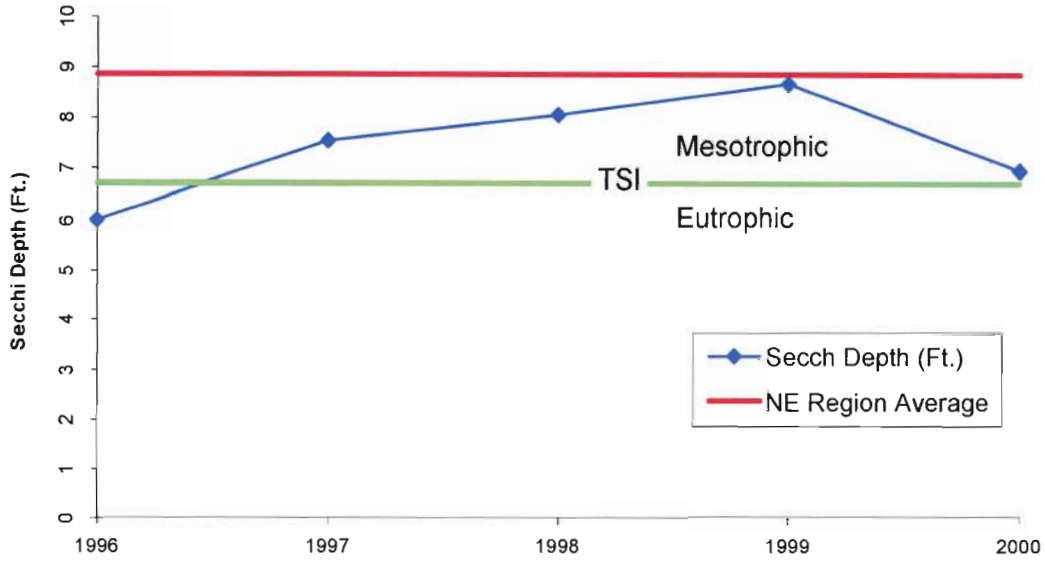


Figure 5-1. Secchi Depth readings for Annabelle Lake 1996-2000 (from Vogt 2000)

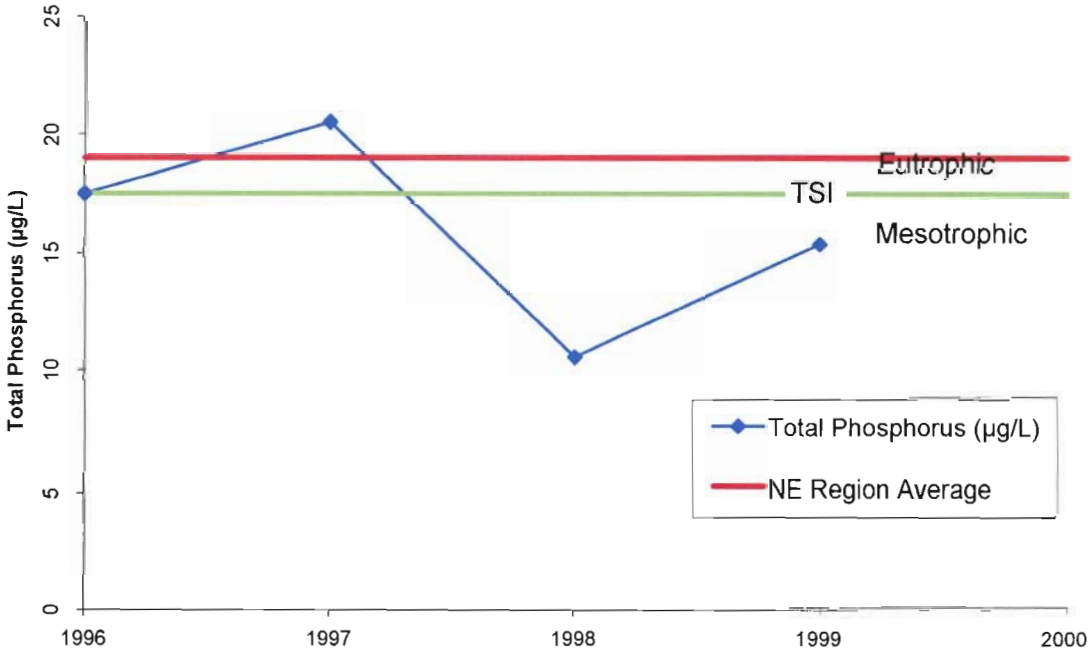


Figure 5-2. Yearly average total phosphorous readings for Annabelle Lake 1996-2000 (from Vogt 2000)

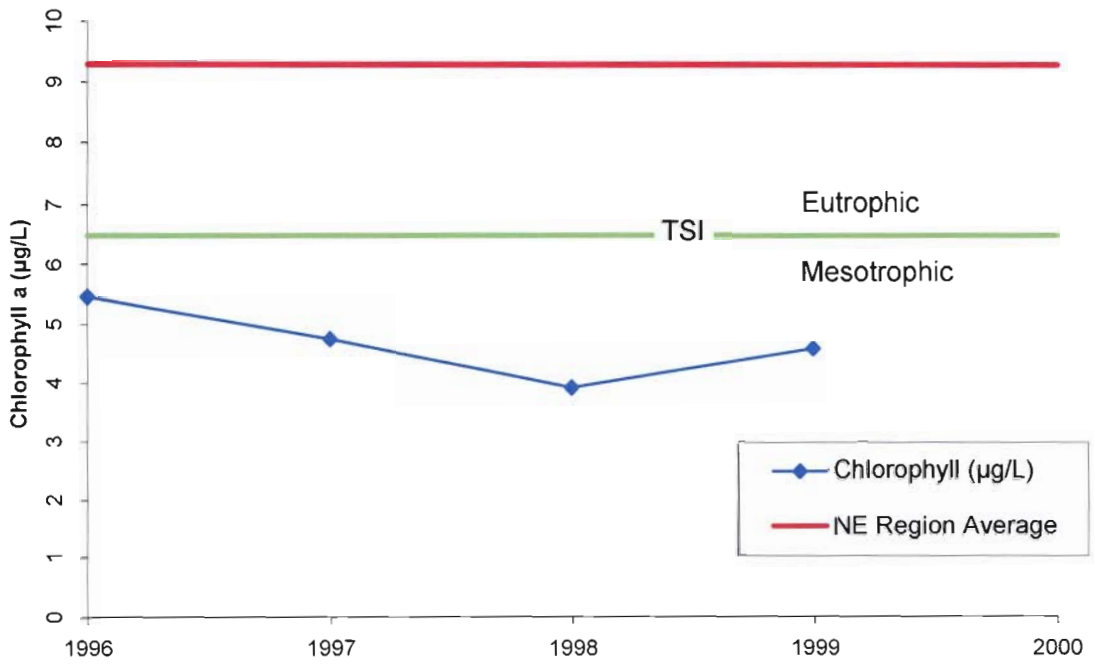


Figure 5-3. Yearly average chlorophyll *a* readings for Annabelle Lake 1996-2000 (from Vogt 2000)

Trophic state can have effects on fish populations in various ways including the indirect effect of decreased macrophyte density. Aquatic vegetation density has been shown to be extremely important juvenile habitat for panfish and other species, and juvenile fish tend to prefer dense macrophyte beds for protection from predators (Crowder and Cooper 1982, Gotceitas 1990, Hayse and Wissing 1996). Low algae abundance is correlated with low zooplankton abundance, and can result in poor growth rates in fish (Carpenter and Kitchell 1993, Jones 1992). It is often difficult to relate cause and effect in trophic systems, however. For example, zooplankton biomass may be low as a response to increased fish abundance, and the opposite may also be true (Vanni and Layne 1997). In order to elucidate exactly how the interactions between vegetation, algae abundance, and zooplankton populations are effecting fish growth, algal and zooplankton populations would need to be examined in detail. In any case, growth rates in Annabelle Lake appear normal, and fluctuations in secchi depth likely echo the presence of adequate zooplankton populations.

This study concentrates on assessing the composition and health of the fish community, and does not focus on abundance estimates. Based on the data shown, NES recommends continued water quality monitoring by volunteers and also recommends maintaining the natural quality of the shoreline. Annabelle Lake has a high quality natural shoreline, with well managed lots that emphasize setbacks and only partial clearing of woody plants. To maintain the balance in the fish community, the landowners on Annabelle Lake should strive to minimize development on the lake. No direct fisheries management action is recommended regarding the panfish or non-game fish communities, apart from maintaining healthy shorelines. Preservation of natural shorelines should be a goal for the Annabelle Lake Property Owners Association. Landowners should be encouraged not to remove aquatic vegetation or fallen trees, thereby ensuring adequate habitat for fish. The habitat complexity afforded fish by fallen timber is difficult to recreate artificially, and the importance of maintaining fallen trees cannot be overstated (Newbrey 2000).

Gamefish data has been collected by the local Wisconsin DNR Fisheries office. NES will consult with the local Wisconsin DNR office to help make gamefish recommendations for Annabelle Lake.

6.0 ACKNOWLEDGEMENTS

NES would like to thank Mike Coshun and Steve Gilbert of the Wisconsin DNR Fisheries office in Woodruff, WI for information, equipment usage and guidance. We would also like to thank Pat Williams and David and Kathy Vogt for lodging and assistance. Special thanks to Eric Vogt for excellent sampling assistance on all fisheries survey work.

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