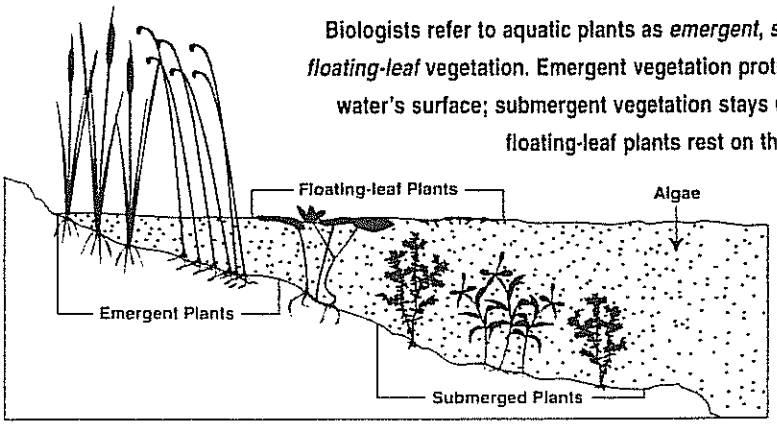
AQUATIC PLANTS AND THEIR CRITICAL ROLE IN KANGAROO LAKE

Aquatic Vegetation – Definition

Although many lake users consider aquatic plants (leafy plants, bulrushes) to be "weeds" and a nuisance to the recreational use of the lake, they are actually an essential element in a healthy, functioning lake ecosystem. It is very important that lake stakeholders understand the importance of lake plants and the many functions they serve in maintaining and protecting a lake ecosystem. With increased understanding and awareness, most lake users will recognize the importance of the aquatic plant community and their potential negative effects on it.

Diverse aquatic vegetation provides habitat and food for many kinds of aquatic life, including fish, insects, amphibians, waterfowl, and even terrestrial wildlife. For instance, wild celery and wild rice both serve as excellent food sources for ducks and geese. In addition, many of the insects that are eaten by young fish rely heavily on aquatic plants and the algae attached to them as their primary food source. Plants also provide cover for feeder fish and *zooplankton* (microscopic animals), stabilizing the predator-prey relationships within the system. Furthermore, rooted aquatic plants prevent shoreline erosion and the re-suspension of sediments and nutrients by absorbing wave energy and locking sediments within their root masses. In areas where plants do not exist, waves can re-suspend bottom sediments decreasing water clarity and increasing plant nutrient levels that may lead to algae blooms. Lake plants also produce oxygen through photosynthesis and use nutrients that may otherwise be used by *phytoplankton* (free-floating algae), which helps to minimize nuisance algal blooms.



Biologists refer to aquatic plants as *emergent*, *submergent*, and *floating-leaf* vegetation. Emergent vegetation protrudes above the water's surface; submergent vegetation stays underwater; and floating-leaf plants rest on the water surface.

Study Results

Analysis of Current Aquatic Plant Data

The Floristic Quality Assessment indicates that Kangaroo Lake has a relatively high quality plant community made up of many species that are normally found in somewhat disturbed systems - lakes with development and other forms of human influences. However, the great variety of species found during the 2003 survey indicates that although the lake is moderately disturbed, it still supports an aquatic plant community of higher quality. It should be noted that fully 40% of the plants found in the north basin are not present in the south basin (Figure 1).

Y = Yes and N = No

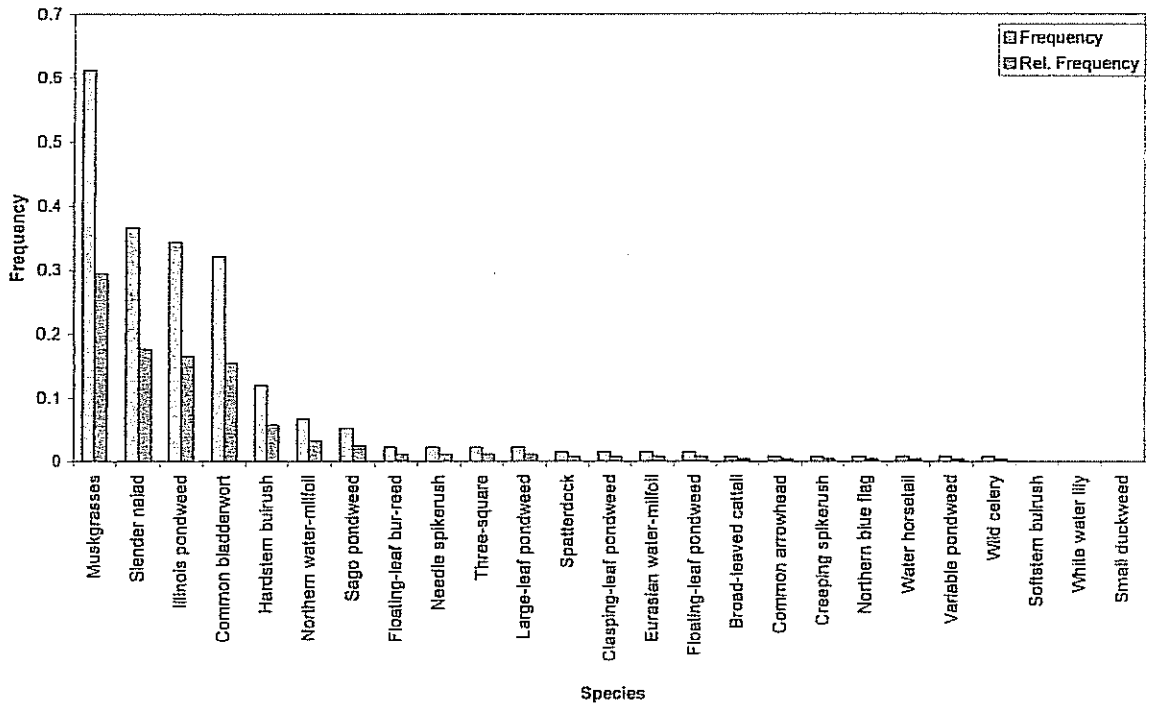
. Aquatic plant species occurring in Kangaroo Lake north basin. .

Scientific Name	Common Name	Found in South Basin - 2003
Iris versicolor	Northern blue flag	Y
Sagittaria latifolia	Common arrowhead	Y
Schoenoplectus acutus[1]	Hardstem bulrush	Y
Schoenoplectus tabernaemontani[2]	Softstem bulrush	Y
Sparganium fluctuans	Floating-leaf bur-reed	Y
Typha latifolia	Broad-leaved cattail	Y
Lemna minor	Small duckweed	Y
Nuphar variegata	Spatterdock	Y
Nymphaea odorata	White water lily	Y
Chara sp.	Muskgrasses	Y
Myriophyllum sibiricum	Northern water-milfoil	Y
Myriophyllum spicatum	Eurasian water-milfoil	Y
Najas flexilis	Slender naiad	Y
Potamogeton amplifolius	Large-leaf pondweed	Y
Potamogeton pectinatus	Sago pondweed	Y
Utricularia vulgaris	Common bladderwort	Y
Vallisneria americana	Wild celery	Y
Menyanthes trifoliate	Buckbean	N
Sparganium americanum	Common bur-reed	N
Hippuris vulgaris	Mare's tail	N
Chelone glabra	White turtlehead	N
Typha angustifolia	Narrow-leaved cattail	N
Zizania aquatica	Wild rice	N
Carex lasiocarpa	Wire sedge	N
Potentilla fruticosa	Shrubby cinquefoil	N
Thelypteris palustris	Marsh fern	N
Sarracenia purpurea	Pitcher plant	N
Cladium mariscoides	Twig rush	N

[1]Formally know as *Scirpus acutus* [2]Formally know as *Scirpus validus*

FIGURE 1

Unfortunately, although there is a great variety of aquatic plants associated with Kangaroo Lake, the occurrences of most plants within the lake are quite low (Figure 2).



Frequency results for 2003 vegetation survey at Kangaroo Lake.
Species with zero values were incidentals.

FIGURE 2

Considering that the substrate types and water depths of the aquatic plants are very similar for the entire lake, it would be expected that these species would occur in greater frequencies throughout the lake instead of just a few locations and in limited numbers (Figure 3).

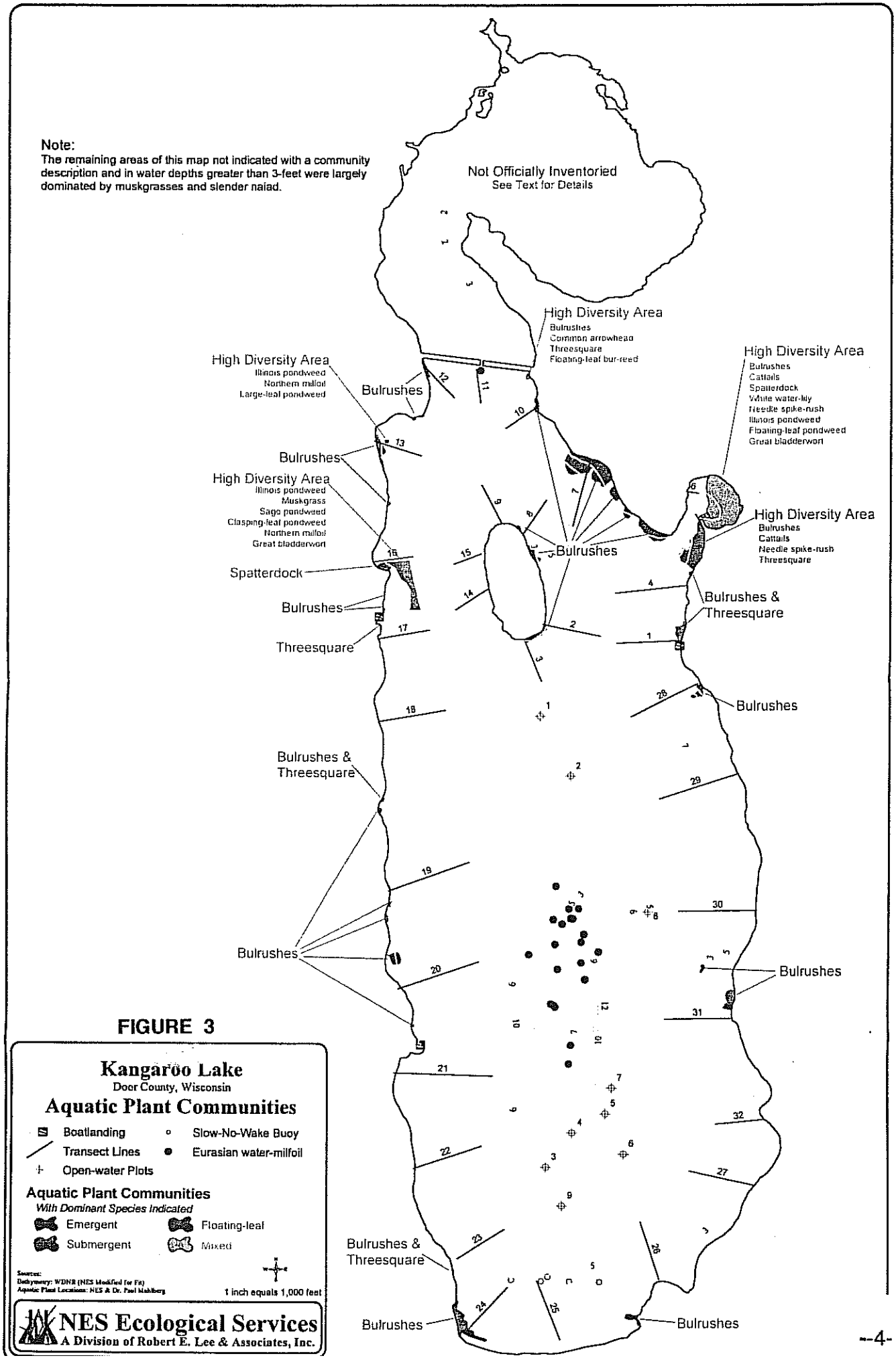

Note:
The remaining areas of this map not indicated with a community description and in water depths greater than 3-feet were largely dominated by muskgrasses and slender naiad.
Not Officially Inventoried
See Text for Details
High Diversity Area
Bulrushes
Common arrowhead
Threesquare
Floating-leaf bur-reed
High Diversity Area
Illinois pondweed
Northern milfoil
Large-leaf pondweed
Bulrushes
High Diversity Area
Bulrushes
Cattails
Spatterdock
White water-lily
Needle spike-rush
Illinois pondweed
Floating-leaf pondweed
Great bladderwort
Bulrushes
High Diversity Area
Illinois pondweed
Muskgrass
Sago pondweed
Clasping-leaf pondweed
Northern milfoil
Great bladderwort
Bulrushes
High Diversity Area
Bulrushes
Cattails
Needle spike-rush
Threesquare
Spatterdock
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FIGURE 3
Kangaroo Lake
Door County, Wisconsin
Aquatic Plant Communities
Boatlanding
Slow-No-Wake Buoy
Transect Lines
Eurasian water-milfoil
Open-water Plots
Aquatic Plant Communities
With Dominant Species Indicated
Emergent
Floating-leaf
Submergent
Mixed
Sources:
Bathymetry: WDNR (NES Modified for Fit)
Aquatic Plant Locations: NES & Dr. Paul Mahlberg
1 inch equals 1,000 feet
NES Ecological Services
A Division of Robert E. Lee & Associates, Inc.

Anecdotal information from long-term lake residents indicate that there were greater occurrences of emergent and floating-leaf species in the lake at one time. This is also confirmed by an aerial photo of Kangaroo Lake taken in 1962, by the Door County Soil and Water Conservation department showing three (3) large areas of broad leaf aquatic plants which have disappeared over the years (Figure 4).

See circled areas in the Lake.

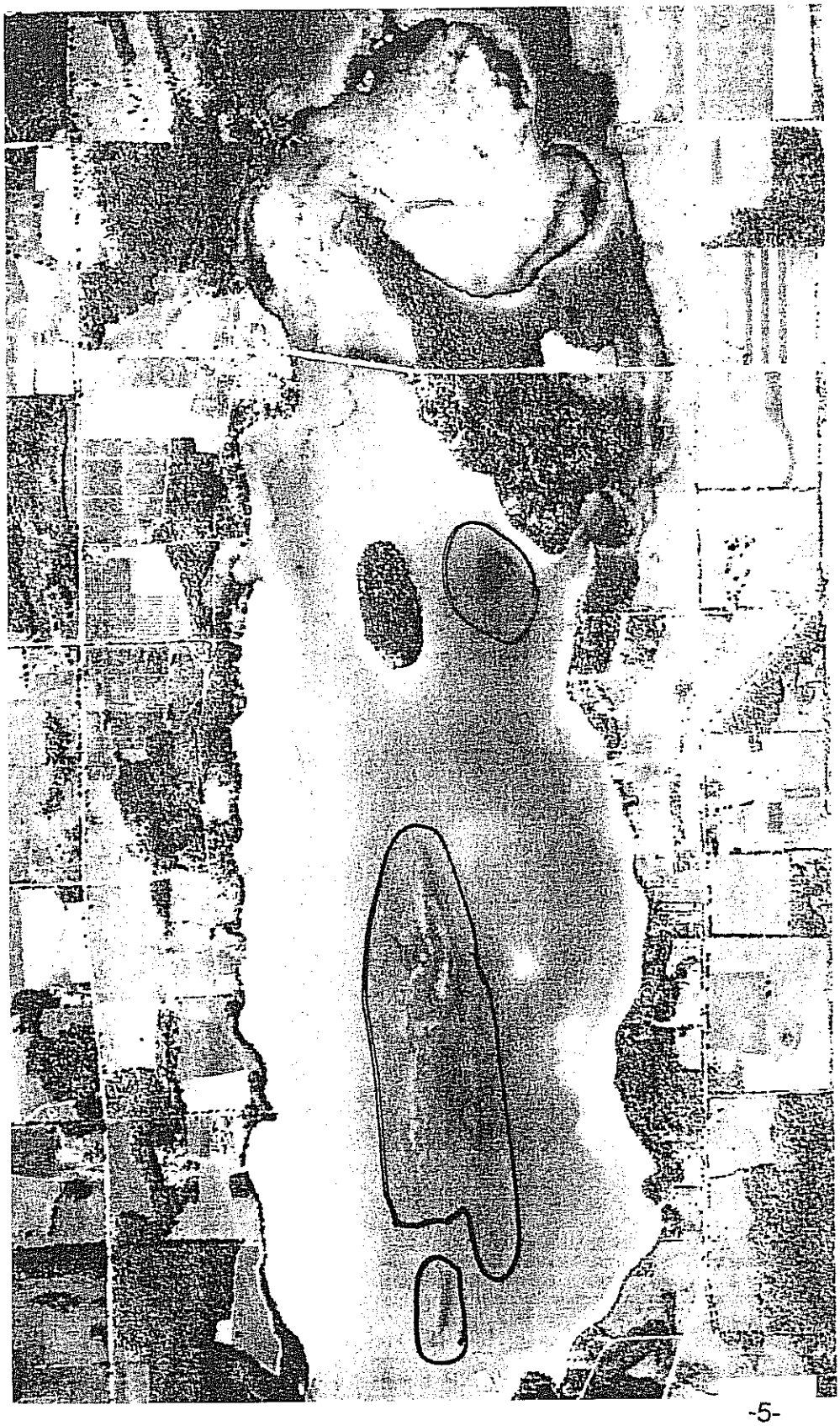


FIGURE 4

Loss of aquatic plants in the south basin of the lake is especially true for bulrushes, an emergent plant that was once very common in Kangaroo Lake. Examination of Figure 5 presents two important observations;
1) there has been a drastic decline in bulrush occurrence in Kangaroo Lake, and 2) those populations that do currently occur, are likely remnants of the historic stands. The decline in bulrush occurrence within the lake is likely attributable to two primary factors 1) continued development of the lake's natural shorelands, and 2) impacts due to recreational motor boating. Radomski and Goeman (2001) found a 66% reduction in vegetation coverage on developed shorelines when compared to undeveloped shorelines in Minnesota Lakes. They also found a significant reduction in abundance and size of northern pike, bluegill and pumpkinseed associated with these developed shorelines. Many studies have documented the adverse affects of motorboat traffic on aquatic plants (e.g. Murphy and Eaton 1983, Vermaat and de Gruyne 1993, Mumma et al. 1996, Asplund and Cook 1997). In all of these studies, lower plant biomasses and/or declines and higher turbidity were associated with motorboat traffic.

The negative effects of motorboats are amplified in shallow lakes such as Kangaroo Lake because so much of their bottom is exposed to hull and propeller turbulence. Sediment disturbance has been documented at depths up to 10 feet; however, most impacts are observed in waters 6 feet deep or less (Asplund 2000, Hill and Beachler 2001 (as referenced in Dudiak and Korth 2002). Using the 7 foot contour line on the map of Kangaroo Lake as a guide, this means that of 44% of the south basin's acreage is susceptible to the effects of motorboat disturbance. This is a significant area of exposure and has likely contributed to not only the decreased plant abundances and diversity in the southern portion of the lake, but also the perceived increases in turbidity that many lake users have reported (Szymanski 1996). The increased turbidity cannot only be attributed to the effects of motorboat traffic because research has shown that those increases are relatively short-lived, lasting only a day or two and are most prevalent on weekends and holidays with higher boat traffic (Asplund 1996). Therefore, a portion of the increased turbidity is likely the result of wind re-suspension. However, this scenario leads us right back to motorboat activity because motorboats are likely the factor that has reduced the occurrence of bulrush and other aquatic plants within the lake. Aquatic plants do not only function as habitat for fish and wildlife; they also hold bottom sediments in place with their extensive root structures – a function that is incredibly important in shallow lakes. In other words, the reduced plant abundances, as brought on by motorboat traffic, have increased the occurrence of wind-induced sediment re-suspension.

Boating is an economically important activity in Wisconsin and continues to grow in popularity annually. In fact, the number of registered boats increased in Wisconsin by over 300% between 1960 and 2000 (Dudiak and Korth 2002). Furthermore, according to the National Marine Manufactures Association, the horsepower of boat motors have increased nationwide from an average of 40.3 in 1975 to 82.4 in 2001. We can assume that the use and adverse effects, as outlined above, have increased on Kangaroo Lake.

CURRENT AND HISTORIC BULRUSH COMMUNITIES

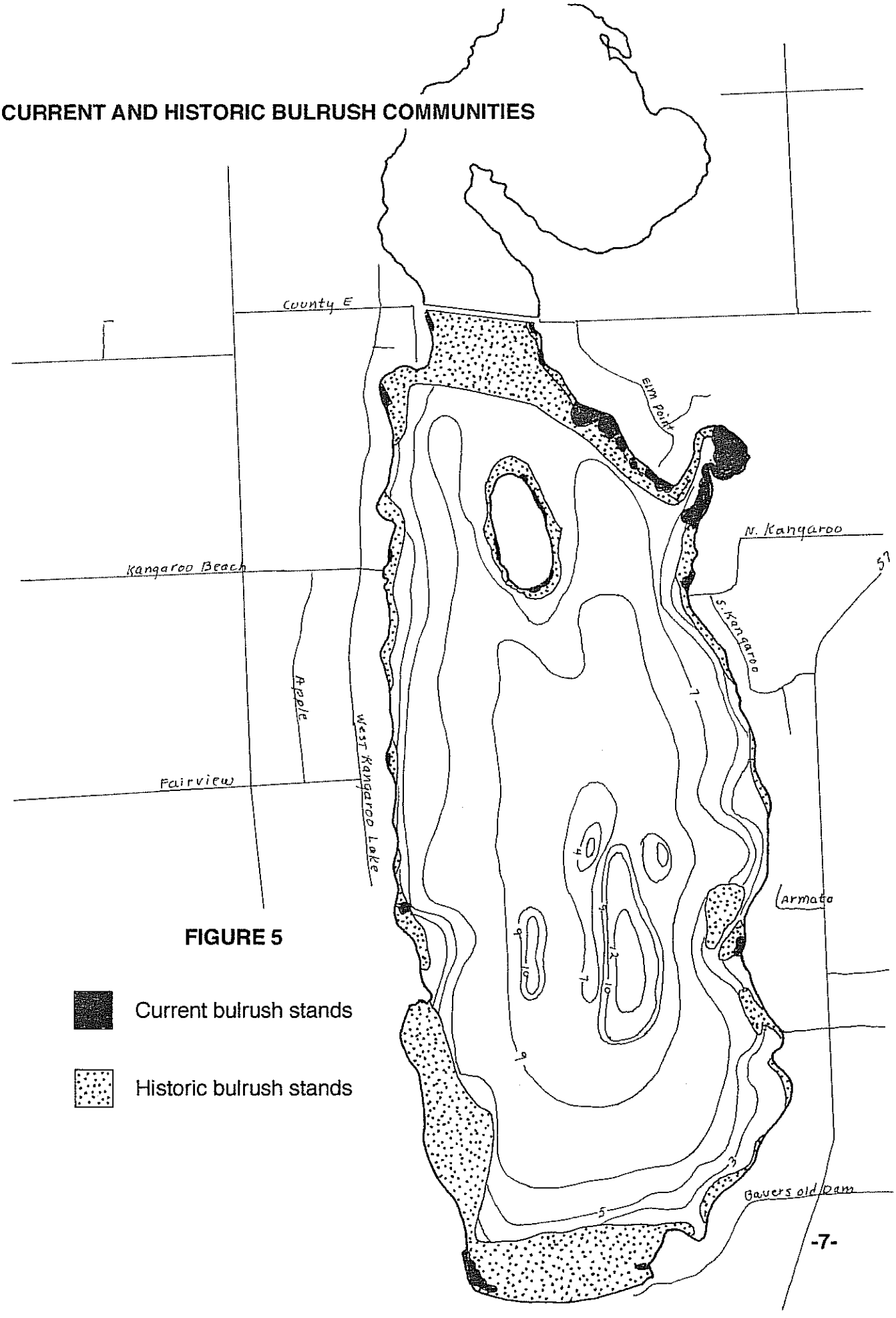


FIGURE 5

Current bulrush stands

Historic bulrush stands

A few areas of high aquatic plant diversity currently exist in Kangaroo Lake with the most apparent areas being located in the basin north of the causeway and the bay that forms the "paw" of the lake's namesake (or the Bayou, as it is called locally). Other areas of less diversity occur in both north corners of the south basin of the lake. Interestingly, all of these areas, especially that of the north basin and the Bayou, are protected from high-speed motorboat traffic and are likely remnants of the plant community that once existed on Kangaroo lake. In addition, the dominance of the plant community by two low growing plants like muskgrass and slender naiad (Figure 3) further indicates the negative effects of motorboat traffic on the lake's important plant population. In the end, the apparent declines in abundance and diversity of aquatic plants in Kangaroo Lake have likely had an adverse effect on the lake's fishery.

MANAGEMENT ALTERNATIVES

Lake management is a difficult and often controversial task to undertake because so many different types of people use our lakes for an equal variety of activities. Some people look to our lakes strictly for natural beauty, while others enjoy fishing, swimming, and recreational boating. All of these uses are important to the economic well being of our state and local communities and can coexist if each user group takes into account the needs of the other groups and that of the lake ecosystem.

Focus of Management Alternatives

AQUATIC PLANTS

The fact is that Kangaroo Lake is a shallow lake and even though its water quality has only fluctuated a bit over the past decades, it is still showing signs of stress. This stress shows itself most intensely in the degradation in the lake's aquatic plant community. Obvious reductions of bulrush stands along with those communities of higher diversity all indicate degradation in the overall health of the lake. These losses affect the lake in a variety of ways, including:

- Reductions in quality habitat that supports the lake's fishery and wildlife.
  Aquatic plants provide vital nursery, rearing, and feeding habitat for game fish and waterfowl.

- Loss of plant root structure that holds bottom sediments in place.
  This leads to increased turbidity because waves produced by wind and motorboat traffic can re-suspend bottom sediments into the water column.

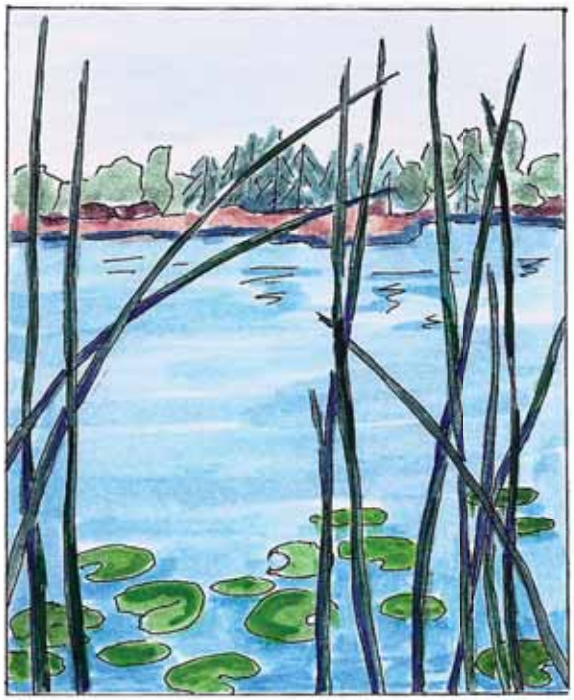
- Decreased competition against the further spread of Eurasian water milfoil and other exotics.

Native plants compete with exotics, slowing and at times, preventing their spread.
Loss of the natives opens areas for easy establishment by exotic plants, much like an exposed area of soil is first colonized by weed species.

- Decreased competition with algae.

Because of competition for light, nutrients, and other needs, shallow lakes are normally dominated by either macrophytes (leafy plants, bulrushes) or algae. Lakes dominated by macrophytes are considered to be in a "clear state" (Kangaroo Lake's current state) and lakes dominated by algae are considered to be in a "turbid state" (Lake Winnebago is an excellent example).
Continued loss of aquatic macrophytes may cause Kangaroo Lake to shift to a "turbid state".

TURBID STATE



CLEAR STATE

Recent research, points to motorboat traffic as the primary factor in the reduction of these important plant communities. Yet, most lake users engage in motorboat recreation; therefore, the management alternatives presented here do not call for a complete ban on recreational watercraft use on the lake. On the contrary, they work to strike a balance between the needs of recreational boaters and the environmental needs of this delicate ecosystem. The alternatives also present methods to help restore the lake's aquatic plant community and battle the spread of Eurasian water milfoil.

FINAL CONCLUSION

The success in the efforts to maintain and enhance the ecology and health of Kangaroo Lake depends on the support of **ALL** lake stakeholders and users. Compromise by the various types of lake users is paramount.

The DNR Madison Research division recommended that Kangaroo lake implement;

- A 600-foot slow no-wake zone
- Expansion of the recommended voluntary slow no-wake zone to include most of the shallow areas from the southern end of the island to the causeway (site of large historic bulrush stands).

Several alternatives to the above recommendations were presented to the membership in 2001 in an effort to meet the needs of all lake users, and still protect as much of the vulnerable aquatic plant life as possible. The introduction of a voluntary 500=foot slow no-wake zone was designed as the compromise and was passed by 89% of those attending the annual meeting in 2001 (71 properties and 135 attendees). See Figure 6.

Our ultimate challenge is to keep Kangaroo Lake in a clear state and prevent the move to a turbid state.

Kangaroo Lake Association, Inc.

500 FOOT
SLOW NO-WAKE ZONE

Studies Presented

2001 - DNR Recommendation and
89% Attendee Approval
2003 - Baileys Harbor Town Board
approved signs

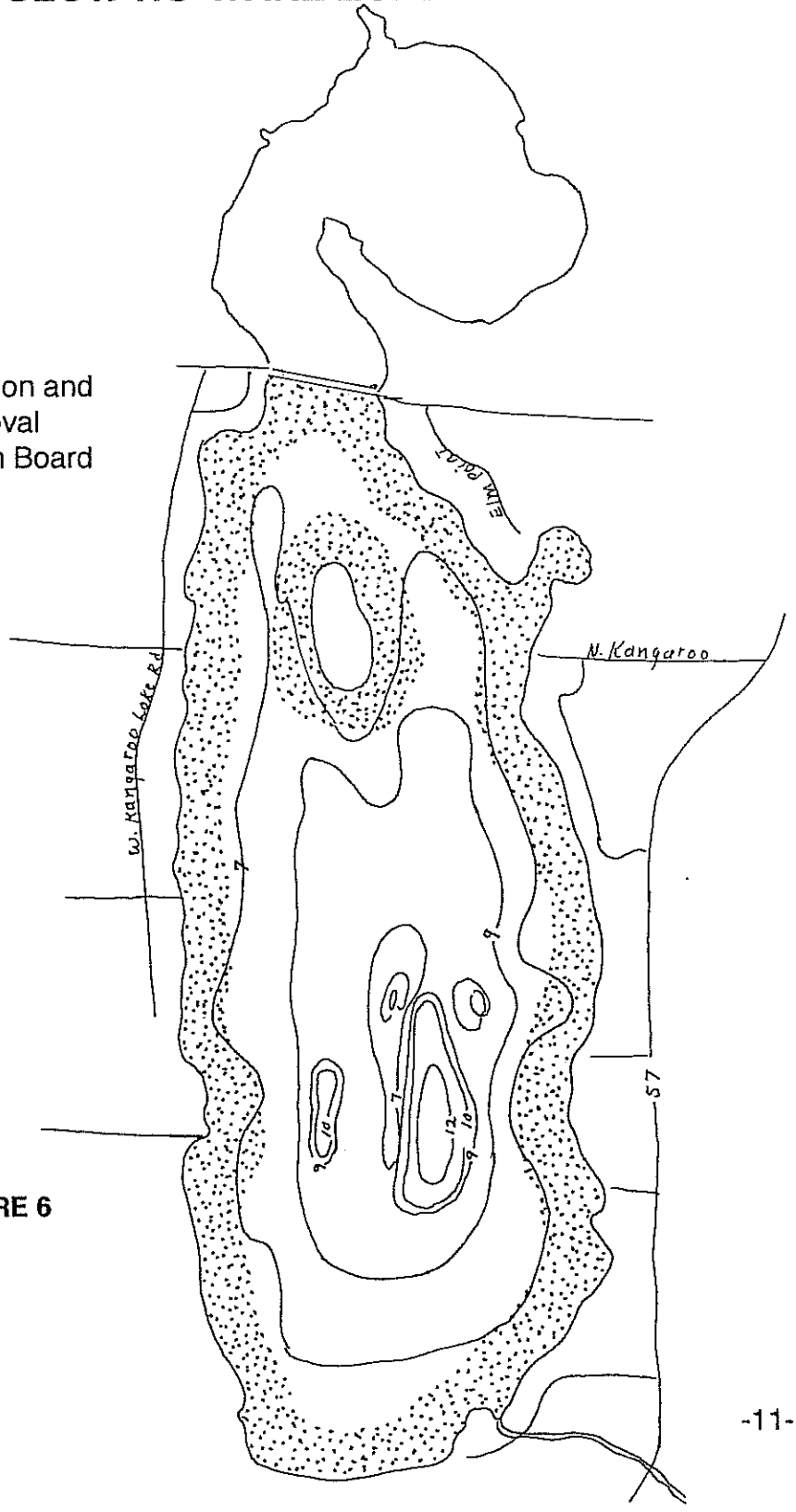


FIGURE 6

INFORMATIONAL SOURCES

- Kangaroo Lake Comprehensive Lake Management Plan, NES Ecological Services and Onterra, LLC – 2004

- Kangaroo Lake "No Wake Zone" Recommendation, DNR Research Division,

  Madison, WI – 2001

EDITORIAL NOTE

A substantial majority of the above "educational release" was extracted almost verbatim from the published "Kangaroo Lake, Comprehensive Lake Management Plan". Technical terms were replaced with more common wording. Illustrations were altered where necessary, to fit this educational release format and aid in the conversion from color to black and white.