Ecological Systems	Native Plant Community Types (NPC)	NPC Codes
Not defined	Aquatic systems are not classified in the native plant communities system.	None

D. Carlson MN DNR

Swan Lake, Cook County, Border Lakes Subsection

Past distribution

Past distribution of deep lakes is not available.

Current distribution

Deep lake - current
Percent of subsection

- 0 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- 3.0 - 5.0
- 5.0 - 9.0
- 9.0 - 15
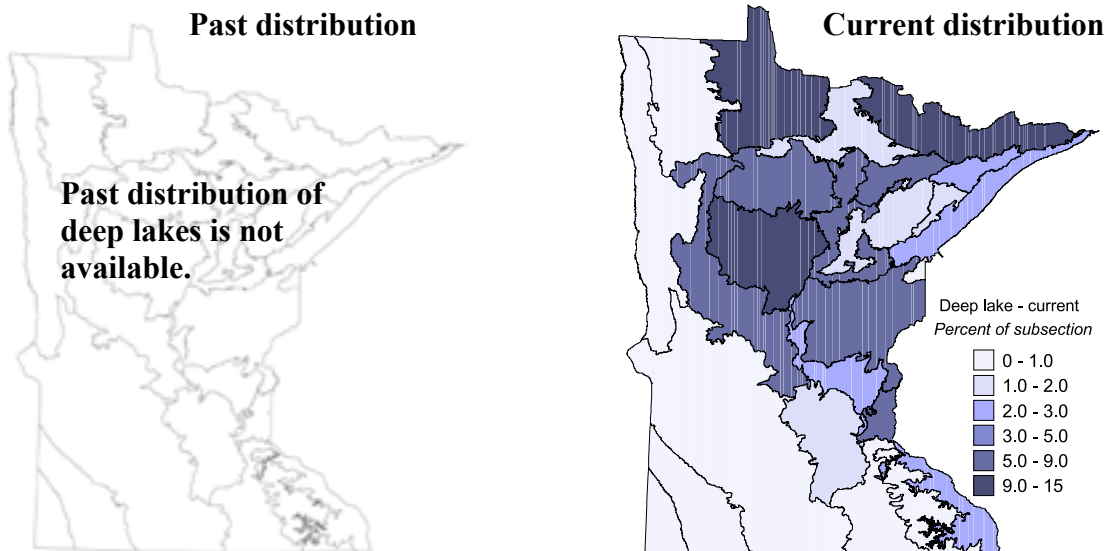
Source: MN DNR 24k Lakes 1990

General Description

Generally, deep lakes are water bodies greater than 15 feet (5 meters) deep, and can be further classified into four types based on surface area and alkalinity (Table 6.2; Valley et al. 2004).

Table 6.2. Lake Classification Parameters

Area	Small: < 500 acres (200 hectares)	Large: > 500 acres (200 hectares)
Alkalinity	Alkaline: > 100 ppm mg/L CaCO$_3$	Not alkaline: < 100 ppm mg/L CaCO$_3$

Deep lakes also vary in productivity, ranging from the classic northeastern Minnesota lakes with clear water, cold temperatures, low productivity, and minimal aquatic vegetation to lakes in southern Minnesota with high productivity, low water clarity, and moderate to high levels of aquatic vegetation. A combination of factors related to climate, geology, land use, and land cover results in the general trend of lakes increasing in water clarity and decreasing in productivity and alkalinity from southwestern to northeastern Minnesota. Fish communities, and presumably other aquatic organisms, also vary along this distribution of lake types in Minnesota (Breining 1989).

Deep lakes are the most sought after recreational lakes in Minnesota, both in terms of water-based activities, such as fishing, and in the development of recreational homes along their shorelines. Shoreline development and the resulting loss of shoreline habitat, increased inputs of nutrients, and clearing of aquatic vegetation continue to negatively affect many of Minnesota's deep lakes. Stocking of game fish species has likely altered the native aquatic faunal communities, but little research is available about the effects of this activity. These lakes also face pressures from several non-native invasive species, such as Eurasian milfoil (Myriophyllum spicatum)and curly-leaf pondweed (*Potamogeton crispus*). These invasives can harm communities of native plants and hence animal habitat, as well as impact water quality and available dissolved oxygen.

Examples of Important Features for Species in Greatest Conservation Need

SGCN that use deep lakes are one of the least represented group of species in the set of species in greatest conservation need, reflecting our distinct lack of knowledge about the status of many of the organisms that inhabit deep lakes. A special group of very deep water species such as the **bloater, kiyi, nipigon cisco, shortjaw cisco, deepwater sculpin,** and **pygmy whitefish** all occur in water depths of at least 75 feet (25 m), with some in depths up to 1,200 feet (400 m). Most of these species are found in Lake Superior, many exclusively, but the nipigon cisco, shortjaw cisco, and deepwater sculpin also occur in some inland deep lakes. The nipigon cisco is found only in Lake Saganaga. Little is known about the habitat needs of these very deep water species, but given the relative rarity of both these species and their specialized habitat needs, further research into appropriate management actions is important.

Species such as the **least darter, longear sunfish,** and **pugnose shiner** are found in deep lakes, but need vegetated shallows as spawning habitat. The **piping plover** and the **Hariy-necked tiger beetle (***Cicindela hirticollis rhodensis)* both require undisturbed sandy shores of large lakes.

Management Options to Support Species in Greatest Conservation Need

- Remove, manage, and reduce the spread of non-native invasive species, particularly in rare very deep-water habitats.
- Encourage shoreline restoration.
- Enforce shoreline development and aquatic vegetation removal restrictions.
- Continue research and survey into the status and trends of deep lake organisms.