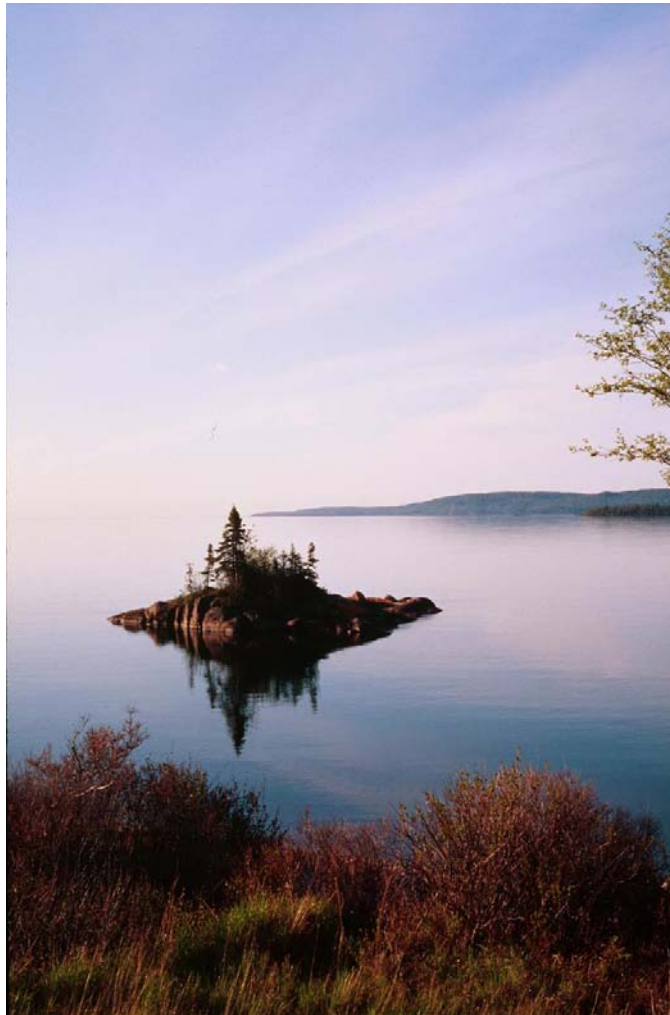


Chapter 6

Status of Habitat in the Lake Superior Basin



Island near Rosspport, ON
Photograph by: Patrick T. Collins, MN DNR

Lake Superior Lakewide Management Plan
2000

Chapter 6 Contents

EXECUTIVE SUMMARY.....	6-1
6.0 ABOUT THIS CHAPTER.....	6-5
6.1 STATUS OF HABITAT IN THE LAKE SUPERIOR BASIN.....	6-5
6.1.1 The Lake Superior Basin.....	6-5
6.1.1.1 Geology and Glacial History.....	6-5
6.1.1.2 Climate.....	6-8
6.1.1.3 Human Population.....	6-10
6.1.1.4 Political Boundaries.....	6-12
6.1.1.5 Land Use and Ownership.....	6-13
6.1.1.6 Parks and Protected Areas.....	6-16
6.1.2 The Aquatic Environment.....	6-17
6.1.2.1 Bathymetry and Basin Morphology.....	6-17
6.1.2.2 Sediments.....	6-19
6.1.2.3 Sedimentation and Turbidity.....	6-21
6.1.2.4 Currents and Circulation.....	6-22
6.1.2.5 Temperature.....	6-24
6.1.2.6 Ice Cover.....	6-26
6.1.2.7 Nutrients.....	6-27
6.1.2.8 Oxygen.....	6-28
6.1.2.9 Primary Production - Chlorophyll <i>a</i>	6-28
6.1.2.10 Water Level Fluctuations.....	6-29
6.1.2.11 Great Lakes Natural Regions and Seascapes.....	6-30
6.1.2.12 Nearshore Habitat and Embayments.....	6-31
6.1.2.13 Offshore Habitat.....	6-34
6.1.3 Aquatic Communities.....	6-35
6.1.3.1 Phytoplankton.....	6-35
6.1.3.2 Zooplankton.....	6-36
6.1.3.3 Benthic Communities.....	6-38
6.1.3.4 Fish Communities.....	6-38
6.1.4 The Terrestrial Environment.....	6-43
6.1.4.1 Ecological Land Classification.....	6-43
6.1.4.2 Vegetation.....	6-48
6.1.4.3 Disturbance.....	6-50
6.1.4.4 Succession.....	6-53
6.1.4.5 Wildlife.....	6-54

6.1.5 Islands.....	6-55
6.1.6 Shorelines.....	6-60
6.1.6.1 Shoreline Classification.....	6-60
6.1.7 Wetlands.....	6-64
6.1.7.1 Coastal Wetlands.....	6-67
6.1.7.2 Threats.....	6-68
6.1.8 Tributary Streams.....	6-70
6.1.8.1 Accessible Stream Length.....	6-74
6.1.8.2 Stream Water Quality.....	6-75
6.1.9 Inland Lakes.....	6-84
6.1.10 Rare and Declining Species.....	6-93
6.1.10.1 Bald Eagle.....	6-94
6.1.10.2 Peregrine Falcon.....	6-97
6.1.10.3 Piping Plover.....	6-99
6.1.10.4 Common Tern and Caspian Tern.....	6-102
6.1.10.5 Gray Wolf.....	6-102
6.1.10.6 Canada Lynx.....	6-105
6.1.10.7 Northern Brook Lamprey.....	6-107
6.1.10.8 Lake Sturgeon.....	6-108
6.1.10.9 Arctic Grayling.....	6-111
6.1.10.10 Deepwater Ciscoes.....	6-112
6.1.10.11 Pitcher's Thistle.....	6-113
6.1.10.12 Lake Huron Tansy.....	6-115
6.1.10.13 Houghton's Goldenrod.....	6-115
6.1.10.14 Ginseng.....	6-115
6.1.10.15 Other Rare Plants and Animals.....	6-116
6.1.10.16 Rare Communities.....	6-121
6.1.11 Other Important Species.....	6-125
6.1.11.1 Wild Rice.....	6-125
6.1.11.2 Walleye.....	6-127
6.1.11.3 Coaster Brook Trout.....	6-129
6.1.11.4 Lake Trout.....	6-131
6.1.11.5 Lake Whitefish.....	6-136
6.1.11.6 Woodland Caribou.....	6-139
6.1.11.7 Trumpeter Swan.....	6-141

6.1.11.8 Neotropical Migrant Birds.....	6-141
6.1.12 Areas of Quality	6-142
6.1.13 Stresses on the Ecosystem.....	6-142
6.1.13.1 Changes in Forest Composition	6-142
6.1.13.2 White Pine	6-144
6.1.13.3 Forest Fragmentation.....	6-145
6.1.13.4 Pollution and Nutrient Loading.....	6-148
6.1.13.5 Sedimentation.....	6-149
6.1.13.6 Exotic Species	6-150
6.1.13.7 Recreational Use	6-154
6.1.13.8 Shoreline Development.....	6-155
6.1.13.9 Dams and Water Diversion	6-159
6.1.13.10 Lake Level Management	6-161
6.1.13.11 Dredging.....	6-162
6.1.14 Information Gaps / Data Needs.....	6-163
6.2 STRATEGIES, ACTIONS AND PROJECTS TO PROTECT AND RESTORE HABITAT	6-163
6.2.1 Habitat Committee Next Steps.....	6-173
6.3 PROJECTS AND RESULTS.....	6-174
ACKNOWLEDGMENTS.....	6-229
REFERENCES.....	6-230

Addendum

ADDENDUM 6-A. RARE PLANT AND ANIMAL SPECIES FROM THE LAKE SUPERIOR BASIN.....	6A-1
ADDENDUM 6-B RARE COMMUNITY ASSOCIATIONS IN THE LAKE SUPERIOR BASIN.....	6B-1
ADDENDUM 6-C . HABITAT DATA FOR 65 LAKE SUPERIOR TRIBUTARIES IN ONTARIO (OMNR DATA).	6C-1
ADDENDUM 6-D. IMPORTANT HABITAT AREAS OF THE LAKE SUPERIOR BASIN.....	6D-1
ADDENDUM 6-E. SELECTED STREAM MONITORING DATA FOR ONTARIO TRIBUTARIES (OME DATA).	6E-1

ADDENDUM 6-F . PRESENCE OF FISH SPECIES OBSERVED DURING 1953-1996
IN TRIBUTARIES WITHIN MANAGEMENT UNITS OF LAKE SUPERIOR.....6F-1

ADDENDUM 6-G. SPECIES NAMES 6G-1

ADDENDUM 6-H LAKE SUPERIOR HABITAT MAP 6H-1

Figures

Figure 6-1 Action Summary..... 6-4

Figure 6-2. Generalized Geology of the Lake Superior Area..... 6-6

Figure 6-3. Mean annual temperatures calculated from monthly values 6-9

Figure 6-4. Growing season precipitation 6-10

Figure 6-5. Population density of the Lake Superior Basin in 1996 (people/km²) 6-11

Figure 6-6. Population change (percent) between 1991 and 1996 6-12

Figure 6-7. Counties and districts of the Lake Superior basin 6-13

Figure 6-8. Private Land (pink) in the Lake Superior Basin 6-14

Figure 6-9. Parks and protected areas..... 6-18

Figure 6-10. Lake Superior bathymetry..... 6-19

Figure 6-11. Surface sediment distribution in Lake Superior 6-20

Figure 6-12. Depositional basins (shaded) (IJC 1977)..... 6-21

Figure 6-13. Major surface currents and upwellings..... 6-23

Figure 6-14. Seasonal changes in water temperature with depth for Lake Superior 6-24

Figure 6-15. Mean August surface water temperature for Lake Superior 6-26

Figure 6-16. Normal winter maximum ice cover for Lake Superior..... 6-27

Figure 6-17. Annual water level fluctuations in Lake Superior, comparing present and
natural values..... 6-30

Figure 6-18. Seascapes of Lake Superior (World Wildlife Fund Canada 1999)..... 6-31

Figure 6-19. Nearshore (dark) and offshore (light) habitats..... 6-32

Figure 6-20. Wave exposure zones (WWF)..... 6-33

Figure 6-21. Phytoplankton zones of Lake Superior based on taxonomic data 6-36

Figure 6-22. Benthic biomass diversity (Shannon’s diversity index) 6-39

Figure 6-23. Spawning habitat for major fish species..... 6-42

Figure 6-24. Ecological land classification of the Lake Superior basin..... 6-44

Figure 6-25. Current land cover classes of the Lake Superior basin..... 6-48

Figure 6-26. Proportion of Lake Superior basin (excluding the lake itself) in various land cover classes (1999) 6-48

Figure 6.27. Old growth red and white pine stands in the Ontario Lake Superior Basin..... 6-51

Figure 6-28. Occurrence of fire in the Canadian portion of the Lake Superior basin 1920-1990..... 6-51

Figure 6-29. Areal extent of fires in the Canadian portion of the Lake Superior basin by fire size class (ha) and decade 6-52

Figure 6-30. Lake Superior islands 6-55

Figure 6-31. Lake Superior islands size distribution in terms of number of islands and total area 6-56

Figure 6-32. Major islands. 6-59

Figure 6-33. Lake Superior Shoreline 6-61

Figure 6-34. Lake Superior shoreline types 6-62

Figure 6-35. Proportions of wetland types for the Minnesota Lake Superior basin - “bog” includes bog and fen..... 6-66

Figure 6-36. Forested (green) and non-forested (orange) wetlands in the U.S. Lake Superior basin..... 6-66

Figure 6-37. Wetlands in the Ontario Lake Superior basin..... 6-67

Figure 6-38. Lake Superior shoreline wetlands: extensive (green) and fringing (blue)..... 6-69

Figure 6-39. Perennial streams in the Lake Superior basin..... 6-71

Figure 6-40. Perennial stream lengths (km) in the Lake Superior basin 6-72

Figure 6-41. Major watersheds and rivers (Lake Superior Decision Support Systems data)..... 6-72

Figure 6-42. Classification of Wisconsin streams in the Lake Superior basin..... 6-73

Figure 6-43. Causes of Habitat Impair 6-78

Figure 6-44. Inland Lakes of the Lake Superior basin 6-85

Figure 6-45. Secchi depth (m) for 1,128 Ontario and 147 Minnesota lakes within the basin 6-86

Figure 6-46. Trophic status of inland lakes in the Lake Superior basin..... 6-89

Figure 6-47. Frequency of occurrence of major sport fish species in 612 Ontario lakes in the Lake Superior basin..... 6-90

Figure 6-48. Potential bald eagle nesting habitat within 1.6 km of Lake Superior 6-95

Figure 6-49. Peregrine Falcon Habitat in the Lake Superior basin 6-98

Figure 6-50. Piping plover habitat in the Lake Superior basin..... 6-101

Figure 6-51. Wolf range in the Lake Superior basin C. 1997 6-103

Figure 6-52. Critical management areas for lake sturgeon..... 6-109

Figure 6-53. Pitcher's Thistle Population 6-114

Figure 6-54. Rare plant habitats 6-121

Figure 6-55 Sand (green) and cobble / gravel (red) beaches 6-123

Figure 6-56. Distribution of wild rice in the Lake Superior basin 6-126

Figure 6-57. Commercial fisheries..... 6-132

Figure 6-58. Historical and present distribution of woodland caribou in the Lake Superior basin. 6-140

Figure 6-59. Historic forest cover in the U.S. portion of the Lake Superior Basin..... 6-143

Figure 6-60. Age class structure of the Ontario commercial forest..... 6-144

Figure 6-61. Number and area of roadless wilderness patches (>1 km from nearest road) in the Canadian portion of the Lake Superior basin 6-147

Figure 6-62. Roadless wilderness (>1 km from nearest road) and recent cuts in the Canadian portion of the Lake Superior basin 6-148

Figure 6-63. Approximate distribution of purple loosestrife in the Lake Superior basin 6-151

Figure 6-64. Man-made shorelines: red is retaining walls, harbour structure, and breakwater; green is rip-rap..... 6-156

Tables

Table 6-1 Post-glacial lake phase names for the Lake Superior Basin, with approximate ages..... 6-8

Table 6-2 Land Ownership in the Lake Superior basin..... 6-15

Table 6-3 Parks and protected areas in the U.S. Lake Superior basin..... 6-17

Table 6-4 Estimated quantity of clay and silt-sized sediment inputs to Lake Superior 6-22

Table 6-4a Mean water levels (m) under current and natural conditions..... 6-29

Table 6-5 Nearshore waters and embayments nominated as Aquatic Biodiversity Investment Areas 6-34

Table 6-6 Dominant zooplanton species in Lake Superior 6-37

Table 6-7 Mean annual fish yield (kg·ha⁻¹·yr⁻¹) and percent of total yield for Lake Superior contributed by different species or species groups 6-40

Table 6-8 Principal fish species in the four main habitat zones of Lake Superior..... 6-41

Table 6-9 Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin 6-45

Table 6-10 Physical features of Lake Superior shoreline..... 6-63

Table 6-11 Wetland area for the U.S. Lake Superior basin (exclusive of open water and deep marsh wetlands)..... 6-65

Table 6-12 Some major Lake Superior tributaries 6-73

Table 6-13 Summary of Lake Superior tributaries known to contain anadromous fishes 6-74

Table 6-14. Ontario streams with habitat impairments 6-76

Table 6-15 Minnesota stream assessments for aquatic life (MPCA 1996) 6-78

Table 6-16 Wisconsin Lake Superior tributaries 6-79

Table 6-17 Michigan non-attainment streams in the Lake Superior basin 6-83

Table 6-18 Major Inland Lakes in the Lake Superior Basin 6-88

Table 6-19 Inland lakes in the Lake Superior basin 6-88

Table 6-20 Wisconsin lakes in the Lake Superior basin with impaired waters 6-91

Table 6-21 Michigan non-attainment lakes in the Lake Superior basin 6-92

Table 6-22 Current and potential peregrine falcon territories in the Lake Superior basin 6-99

Table 6-23 Piping plover survey results, Michigan 6-101

Table 6-24 Tributaries with current or historical lake sturgeon populations 6-110

Table 6-25 Embayments important to lake sturgeon in Lake Superior 6-111

Table 6-26 Rare plant habitats 6-120

Table 6-27 Critical and important habitat in Lake Superior for lake trout 6-133

Table 6-28 Estimated quantity of total, spawning, and nursery habitat, and biological parameters for lake trout in each management unit in Lake Superior 6-135

Table 6-29. Estimated quantity of total, spawning, and nursery habitat, and biological parameters for lake whitefish in each management of Lake Superior 6-138

Table 6-30 Point sources of pollutants in the Lake Superior watershed 6-149