



## Marion Lake

Linn County

Willamette/Sandy Basin

Location	
<b>Area</b>	261 acres (105.6 hect)
<b>Elevation</b>	4,130 ft (1,258.8 m)
<b>Type</b>	natural lake
<b>Use</b>	recreation (w ilderness)
<b>Location</b>	63 miles southeast of Salem in Mt. Jefferson Wilderness
<b>Access</b>	2 miles by trail from Forest Service Road off Ore Hw y 22
<b>USGS Quad</b>	Marion Lake (24K), Madras (100K)
<b>Coordinates</b>	44° 33' 41" N, 121° 52' 20" W
<b>USPLSS</b>	township 12, range 7 1/2, section

Marion Lake is located near the western edge of the spectacular Mt. Jefferson Wilderness, and it is the largest lake in Oregon not accessible by automobile. Indeed, with the exception of massive Waldo Lake it is the largest natural lake in the Willamette National Forest on the west slope of the Central Cascades. Throughout this portion of the Cascades are found hundreds of lakes. Most of those in the Willamette National Forest lie within heavy stands of timber and thus have low visibility. Many are remote and reached only by trail. The geologic history of the Cascades accounts for an abundance of lakes in the high country, in contrast to the relative scarcity in lower elevations near the Willamette Valley. At lower elevations there are steep canyons where the activity of streams has been little altered by lava flows or glacial activity. At higher elevations, the slopes are generally less steep and both glacial and volcanic processes have been significant in recent geologic times. Glacial basins have been scoured out and many streams and rivers have been dammed by glacial moraines and lava flows to form lakes. Much of this activity has been recent enough that there has been insufficient time for water to erode the outlet barriers of the lakes.

Marion Lake lies in a deep, glacially scoured basin. Maximum depth is approximately 185 feet and there is little fluctuation in water level throughout the year. Surface inflow is from a number of small streams, the principal one being Eight Lake Creek which enters at the eastern end. Outflow is into Marion Creek, a tributary of the North Santiam River which is joined about seven miles downstream. Maximum relief in the 14 square mile drainage basin is about 2000 feet and slopes are moderate. There are a variety of land cover types, including a fir-hemlock forest, lava fields, marshland, and more than a dozen lakes and ponds.

Marion Lake has long been one of the most popular back-country lakes in Oregon, even in the days when it could be reached only by a long overland hike from the railroad terminus in Detroit. Since completion of the Santiam Pass Highway, only a short two-mile hike is needed from the end of a Forest Service road. The lake is stocked annually with rainbow trout and there is a natural reproduction of brook trout and cutthroat trout. Although the rate of catch is generally not large, there are many stories of large fish that have come from this lake. Certainly many people are drawn to the lake simply for the wilderness setting and the tranquility it offers. Backpackers can find many unimproved campsites along the shoreline. Unfortunately, the shoreline environment suffers to some degree from overuse in the most popular areas. Marion Lake was named in 1874 by the Marion County road viewing party under the leadership of John Minto. Marion County, in turn, had been named for General Frances Marion of Revolutionary War fame.

The various indicators of trophic state for Marion Lake are not consistent: the relatively transparent water (Secchi disk depth = 19.7 to 22.3 feet; 6.0 to 6.8 meters) indicates oligotrophic to mesotrophic condition; total phosphorus concentrations (0.033 mg/l) are typical of mesotrophic to eutrophic lakes; and the presence of blooms of blue-green algae (*Anabaena*) signifies eutrophic conditions. These apparent inconsistencies between physical, chemical, and biological characteristics are also found in Suttle Lake, Odell Lake, and Diamond Lake. All of these lakes are located in mountainous regions, all have similar morphometric characteristics due to their mode of origin, and all have a source of phosphorus from their respective drainage basins. The phosphorus entering Marion Lake is probably from natural sources; there are extensive marshy areas just upstream from the primary inlet. On 9/1/82 a high phosphorus concentration in the inlet water (0.069 mg/l) was measured. It is doubtful that human activities are sufficient to contribute appreciable amounts of phosphorus. As far back as the 1930s dense algal blooms were observed in the lake (Ziesenhenn 1937). This was prior to the time of much human activity in the drainage basin, thereby supporting the idea of a natural phosphorus source. Major ion concentrations are slightly higher than in other Cascade lakes; their source is probably the same as the phosphorus source (conductivity in the inlet water was 47 umhos/cm, and in the lake was 39 umhos/cm).

The high phosphorus concentration supports a blue-green algal bloom (*Anabaena flos-aquae*) each summer. As noted, these blooms have occurred over the past 45 years and are a natural event in Marion Lake. The density of *Anabaena* is sufficient to give the water a greenish cast, and in certain areas of the lake where the wind concentrates the algae, the lake surface appears to be covered with "green paint". These algae drive the pH up to values as high as 9. It is interesting to note the presence of *Cyclotella stelligera*, which was dominant on 8/5/82. Although numerically dominant, this diatom is very small, and *Anabaena* contributed more biomass than did *Cyclotella*. *Cyclotella stelligera* is associated with oligotrophic lakes (such



Source: Oregon National Guard, 1981-82. View looking northwest.

Drainage Basin Characteristics									
<b>Area</b>	14.1 sq mi (36.5 sq km)		<b>Relief</b>	steep		<b>Precip</b>	85-95 in (216-241 cm)		
<b>Land Use %</b>	<b>Forest</b>	<b>Range</b>	<b>Water</b>	<b>Irrig</b>	<b>Non Irrig</b>	<b>Urban</b>	<b>Other</b>		
	93.0	-	5.0	-	-	-	2.0		
<b>Notes</b>	Other - Rock outcrops and lava fields								
Lake Morphometry			Maximum		Average				
<b>Area</b>	261.0 acres (105.6 hect)		<b>Depth</b>	185 ft (56.4 m)		64ft (19.4 M)			
<b>Ave/Max Depth Ratio</b>	0.340		<b>Volume</b>	16,610 acre ft (20.52 cu hm)					
<b>Shoal area</b>	12%		<b>Volume factor</b>	1.03					
<b>Length of Shoreline</b>	3.6 mi (5.8 km)		<b>Retention time</b>	5 mo					
<b>Notes</b>	-								
Water Quality									
<b>Trophic status</b>	mesotrophic, lake experiences blue-green algal blooms supported by natural source of nutrients								
<b>Sample date</b>	08/05/82		<b>Temp</b>	59.0F (15.0C)		<b>Diss. Oxygen (mg/l)</b>	-		
<b>Transparency</b>	19.7 ft (6.0 m)		<b>Phosp (mg/l)</b>	0.033		<b>Cholorophylla (mg/l)</b>	0.2		
<b>Alkalinity</b>	16		<b>Conductivity (umhos/cm)</b>	37		<b>pH</b>	8.5		
<b>Major Ions</b>	<b>Na</b>	<b>K</b>	<b>Ca</b>	<b>Mg</b>	<b>Cl</b>	<b>SO4</b>			
	2.3	1.0	3.6	1.3	0.8	0.3			
<b>Notes</b>	Sample taken near inlet stream								
<b>Sample date</b>	09/01/82		<b>Temp</b>	-		<b>Diss. Oxygen (mg/l)</b>	-		
<b>Transparency</b>	-		<b>Phosp (mg/l)</b>	0.069		<b>Cholorophylla (mg/l)</b>	0.1		
<b>Alkalinity</b>	22		<b>Conductivity (umhos/cm)</b>	47		<b>pH</b>	-		
<b>Major Ions</b>	<b>Na</b>	<b>K</b>	<b>Ca</b>	<b>Mg</b>	<b>Cl</b>	<b>SO4</b>			
	2.6	1.1	4.4	1.5	0.9	0.7			
<b>Notes</b>	-								
<b>Sample date</b>	09/01/92		<b>Temp</b>	64.4F (18.0C)		<b>Diss. Oxygen (mg/l)</b>	11.1		
<b>Transparency</b>	20 ft (6.0 m)		<b>Phosp (mg/l)</b>	0.033		<b>Cholorophylla (mg/l)</b>	0.2		
<b>Alkalinity</b>	16		<b>Conductivity (umhos/cm)</b>	37		<b>pH</b>	8.50		
<b>Major Ions</b>	<b>Na</b>	<b>K</b>	<b>Ca</b>	<b>Mg</b>	<b>Cl</b>	<b>SO4</b>			
	2.3	1.0	3.6	1.3	0.8	0.3			
<b>Notes</b>	-								

as Bull Run Lake, Woahink Lake, and Clear Lake near Florence in this survey), whereas *Anabaena* occurs in more eutrophic lakes.

Marion Lake develops thermal stratification but the limited data available indicate a rather gradual decrease in temperature with depth, rather than a well mixed surface layer (epilimnion) overlying a thermocline where the temperature drops sharply with depth. There is significant oxygen depletion in the bottom waters (hypolimnion) resulting from the algal bloom (decomposition of algal cells that have settled into the hypolimnion). Overall, Marion Lake is classified as mesotrophic. The high phosphorus concentrations observed would normally create a higher trophic state, but it appears that the biological productivity is limited by physical characteristics (cool water, incomplete stratification) and only a mesotrophic condition can be achieved.

Phytoplankton Surveys:

8/5/82

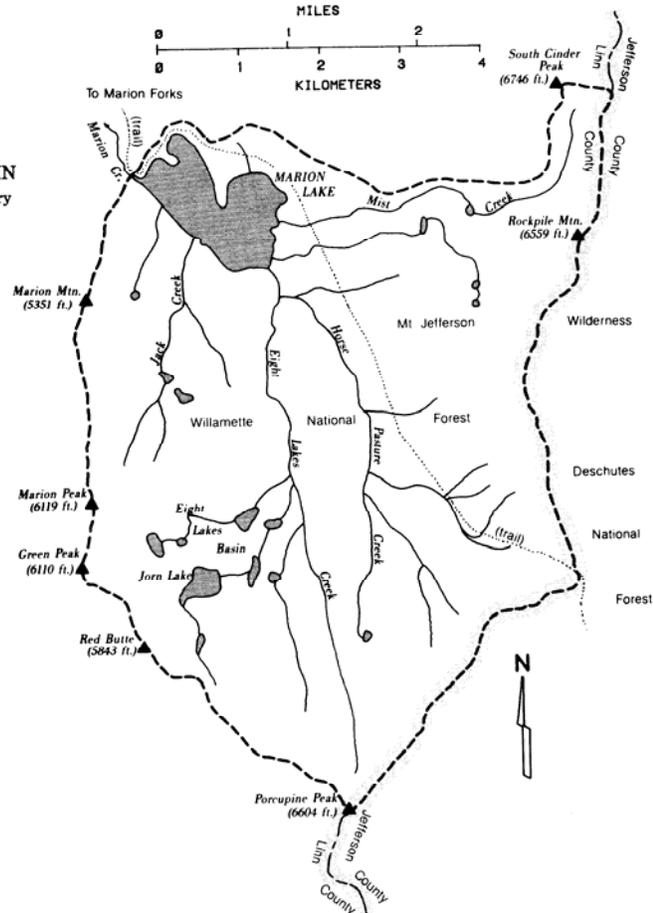
Alga	#/ml	%
<i>Cyclotella stelligera</i>	2,623	92.1
<i>Anabaena flos-aquae</i>	140	4.9
<i>Synedra rumpens</i>	47	1.7
<i>Nitzschia</i> sp.	37	1.3
Total	2,847	100.0

9/1/82

Alga	#/ml	%
<i>Anabaena flos-aquae</i>	343	75.4
<i>Ankistrodesmus falcatus</i>	64	14.1
<i>Chromulina</i> sp.	24	5.3
<i>Oocystis pusilla</i>	12	2.6
<i>Nitzschia</i> sp.	8	1.8
<i>Sphaerocystis schroeteri</i>	4	0.8
Total	455	100.0

DRAINAGE BASIN

--- Basin Boundary

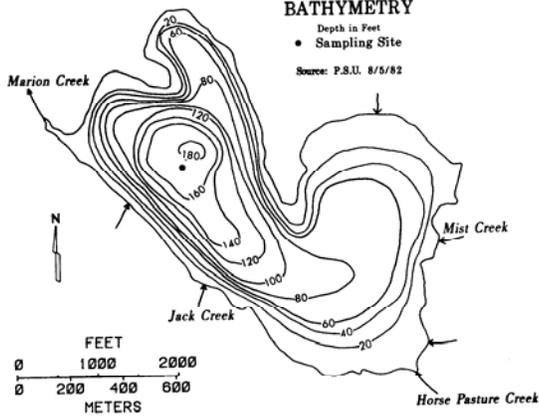


BATHYMETRY

Depth in Feet

● Sampling Site

Source: P.S.U. 8/5/82



TEMPERATURE AND OXYGEN

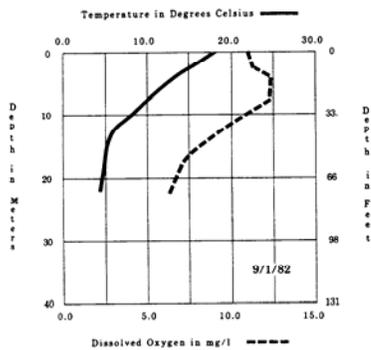


Photo Captions

1. Marion Lake
2. Eight Lakes Basin
3. Porcupine Peak

