

Tyhee Lake

Lake Monitoring Results

2016 Provincial Lake Monitoring Program

Who – MOE E.P Bio Staff (10-12 people)

Why – BC Lakes Status and Trend Monitoring

2016 lake count: 69 Lakes, 95 sites

Field Season – Spring Turnover (mixed)

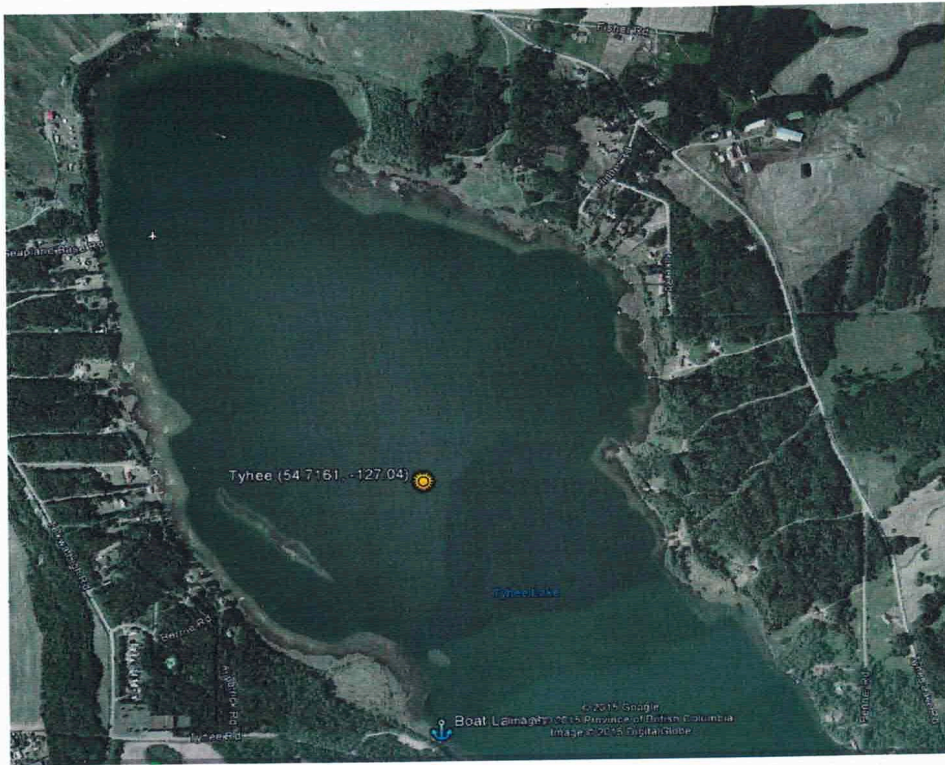
- Summer Stratification

Field Parameters

- Secchi Depth
- Vertical Profiles (Temp, DO, Conductivity, pH)
- Water Chemistry
- Plankton
- QA/QC

Stakeholder Partnerships –within government (Parks, FLNRO, EP...)

- External (Stewardship groups, BVRC, FN...)



Tyhee Lake sampling location

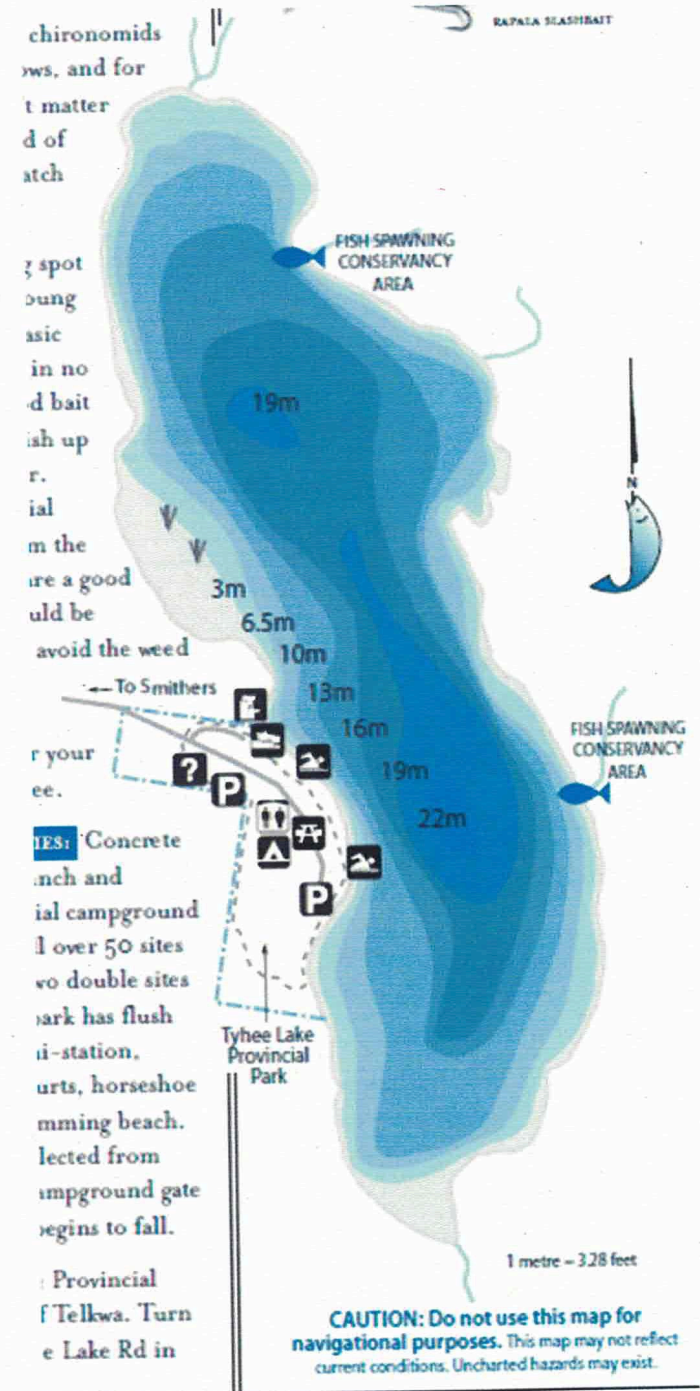
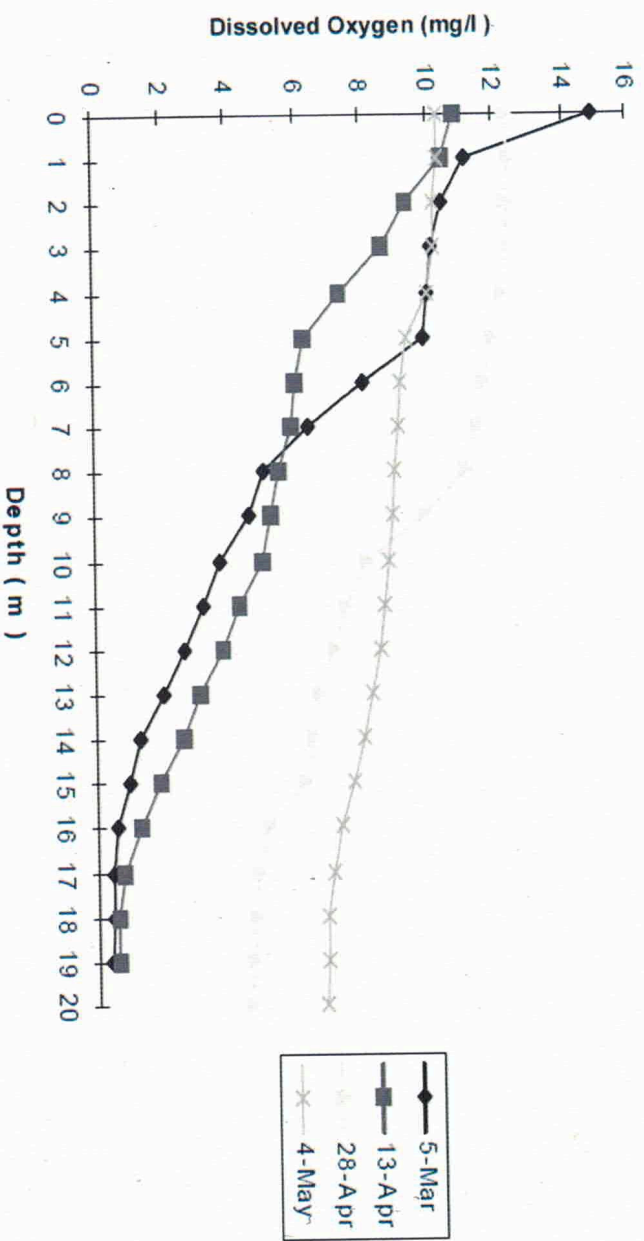
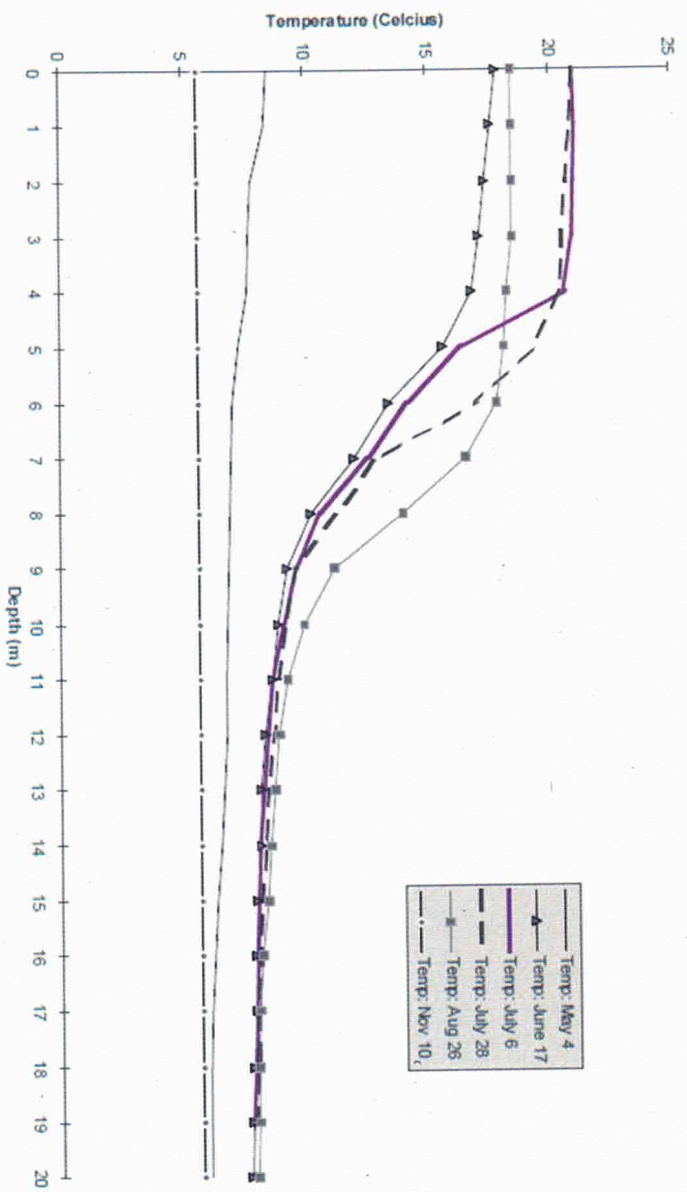


Figure 10 Dissolved Oxygen for Tyhee Lake, 1992 (Portman, 1992)



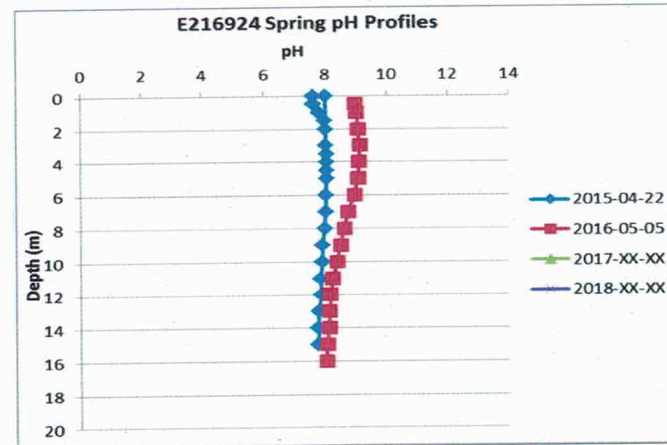
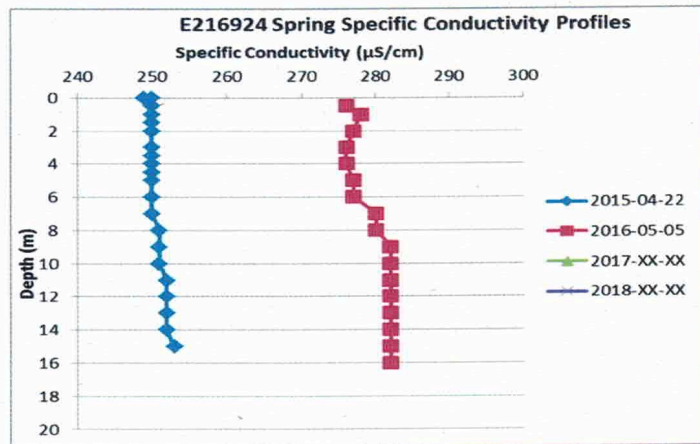
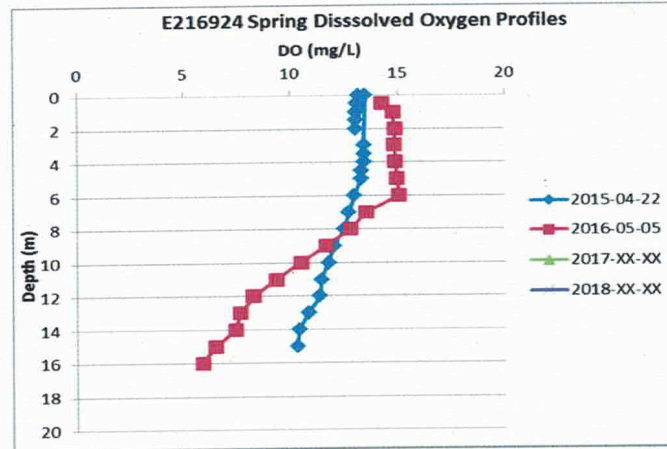
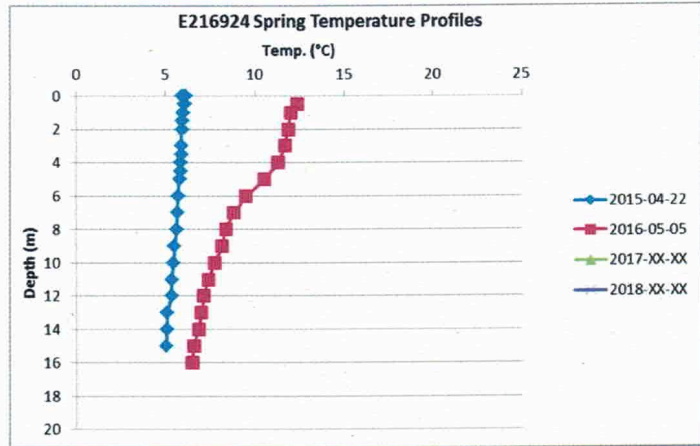
1992 DO – March, April, May

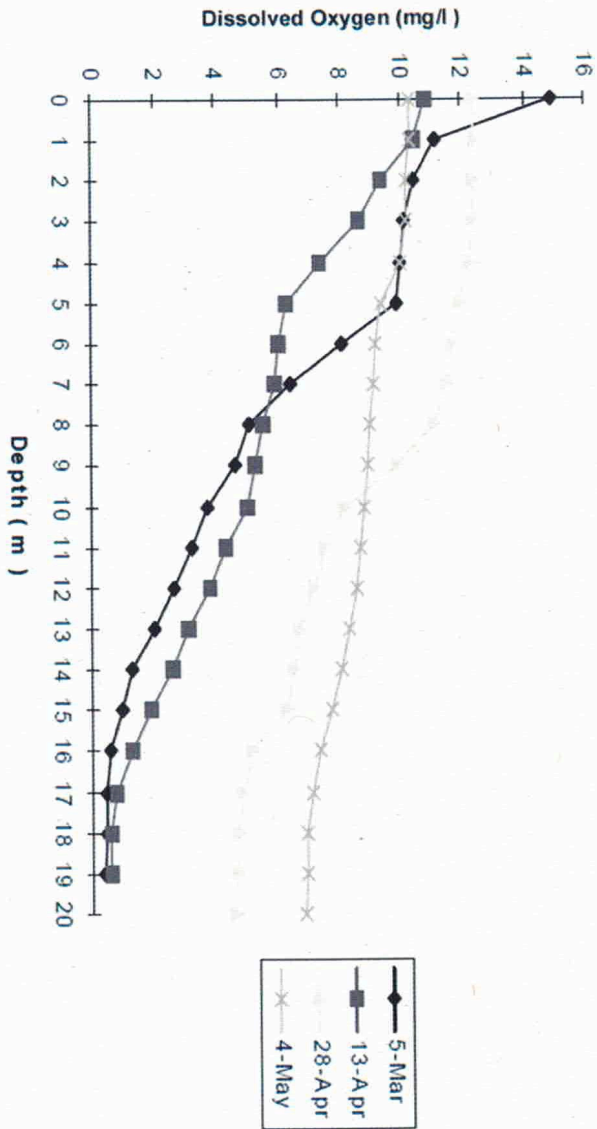
Figure 8. Temperature Profile for Tyhee Lake, May to November 1992 (Portman, 1992)



1992 Temp. – May, June, July Aug, Nov

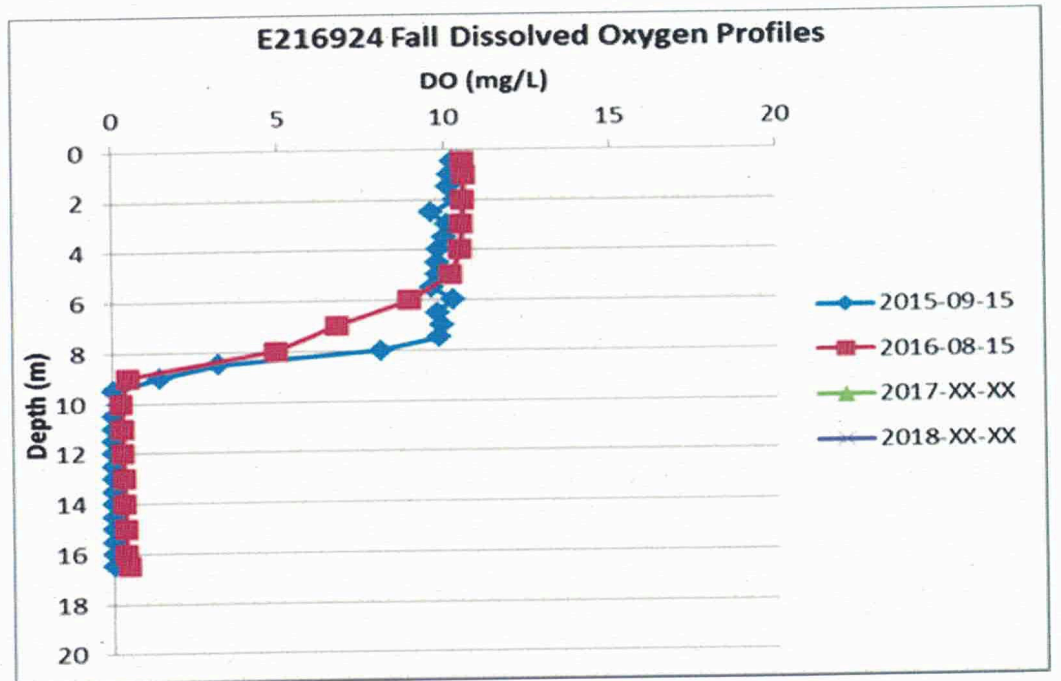
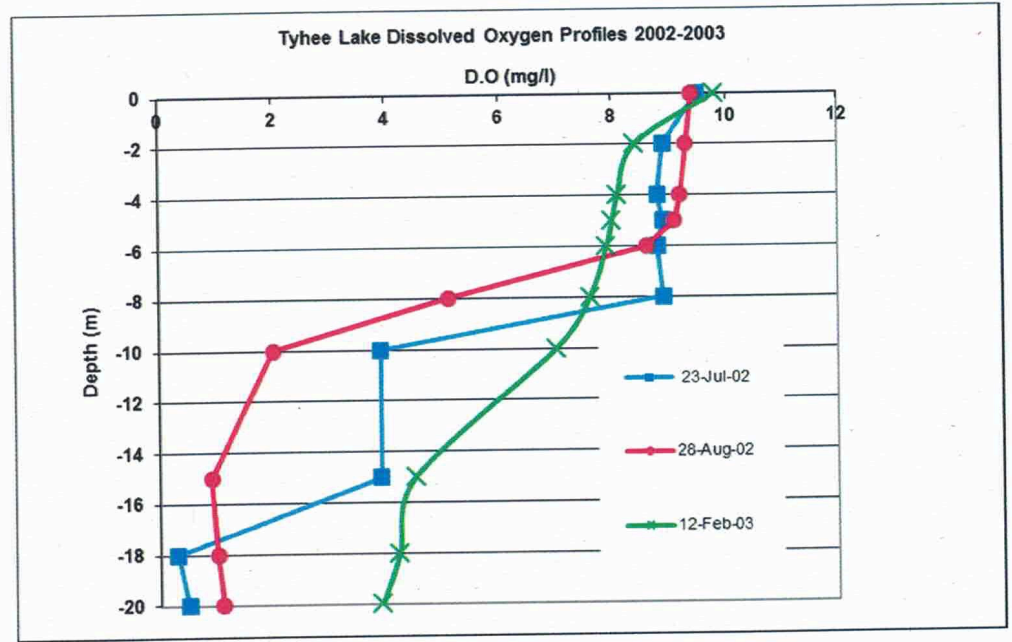
Tyhee Lake Spring "turnover" Profiles (2015-2016)



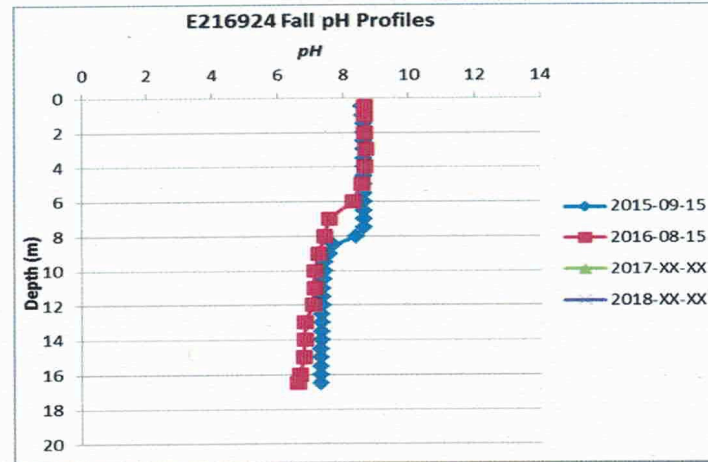
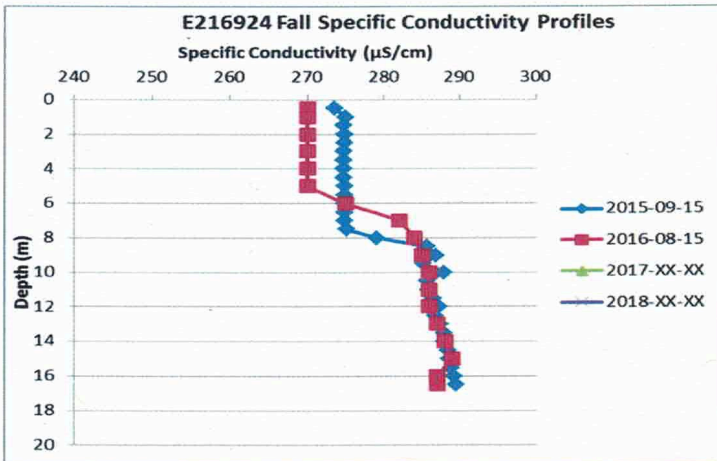
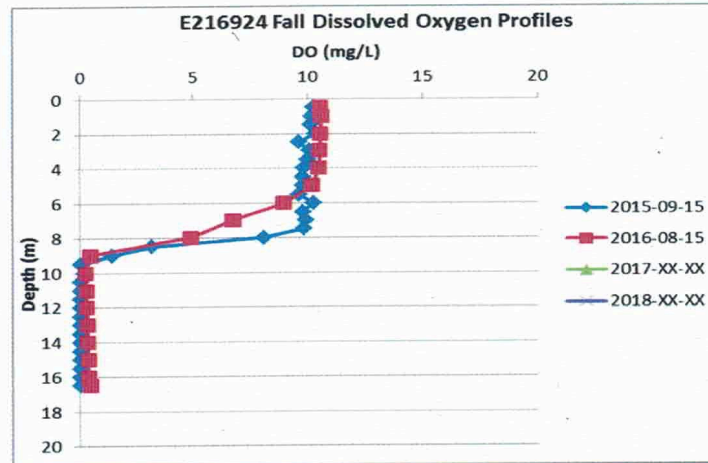
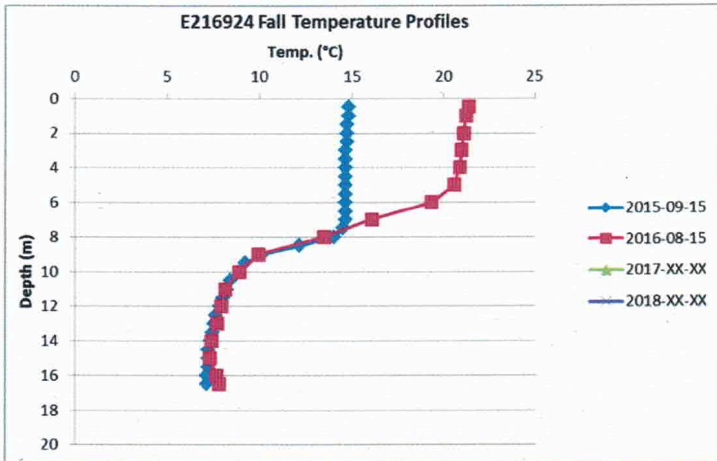


<0.5mg/L DO = anoxic

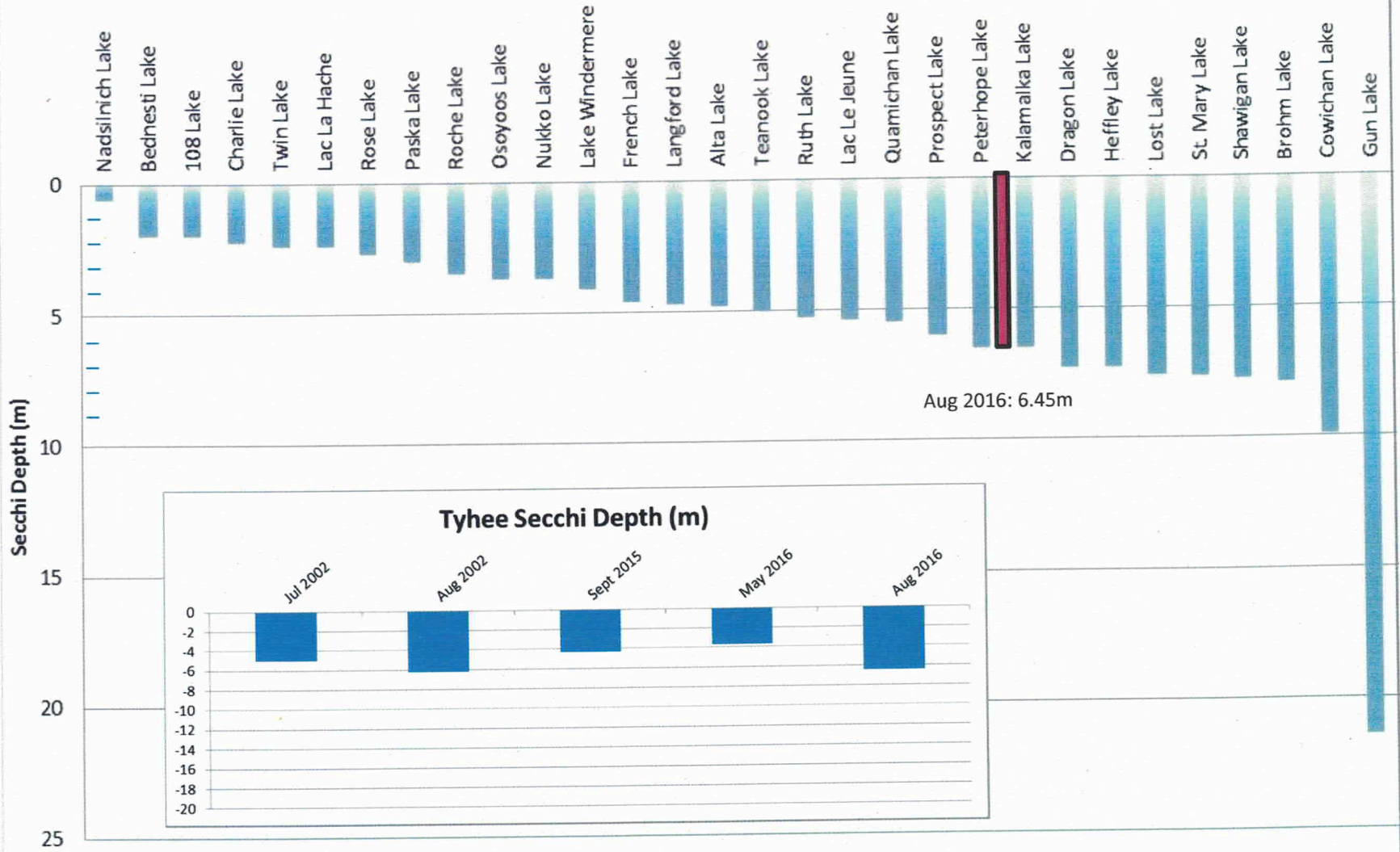
Figure 10 Dissolved Oxygen for Tyhee Lake, 1992 (Portman, 1992)



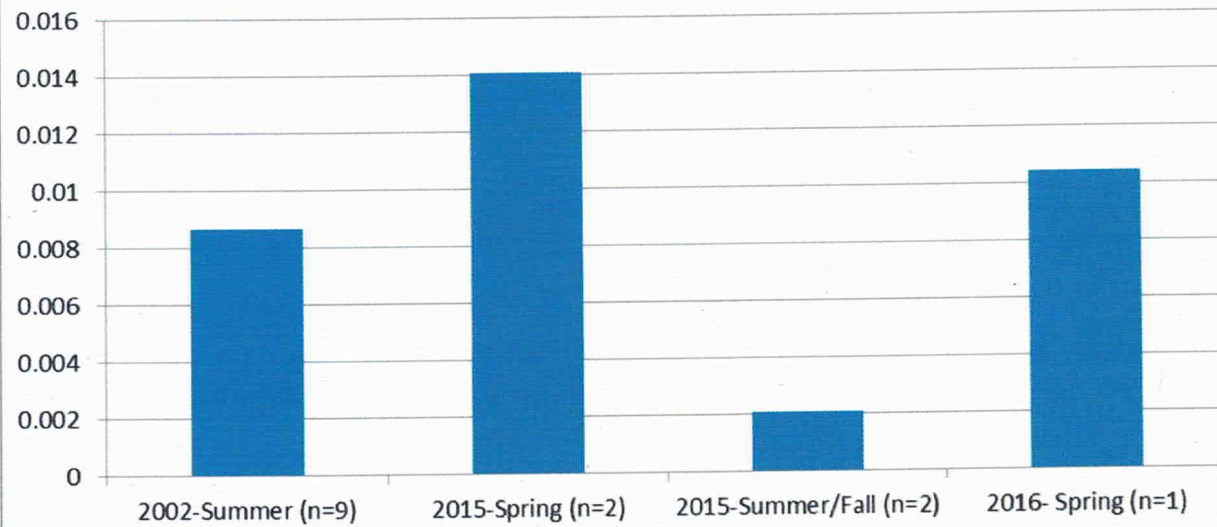
Tyhee Lake Late Summer "stratified" Profiles (2015-2016)



2016 Secchi Dip-In Results



Tyhee Lake Average Chlorophyll A (mg/L)

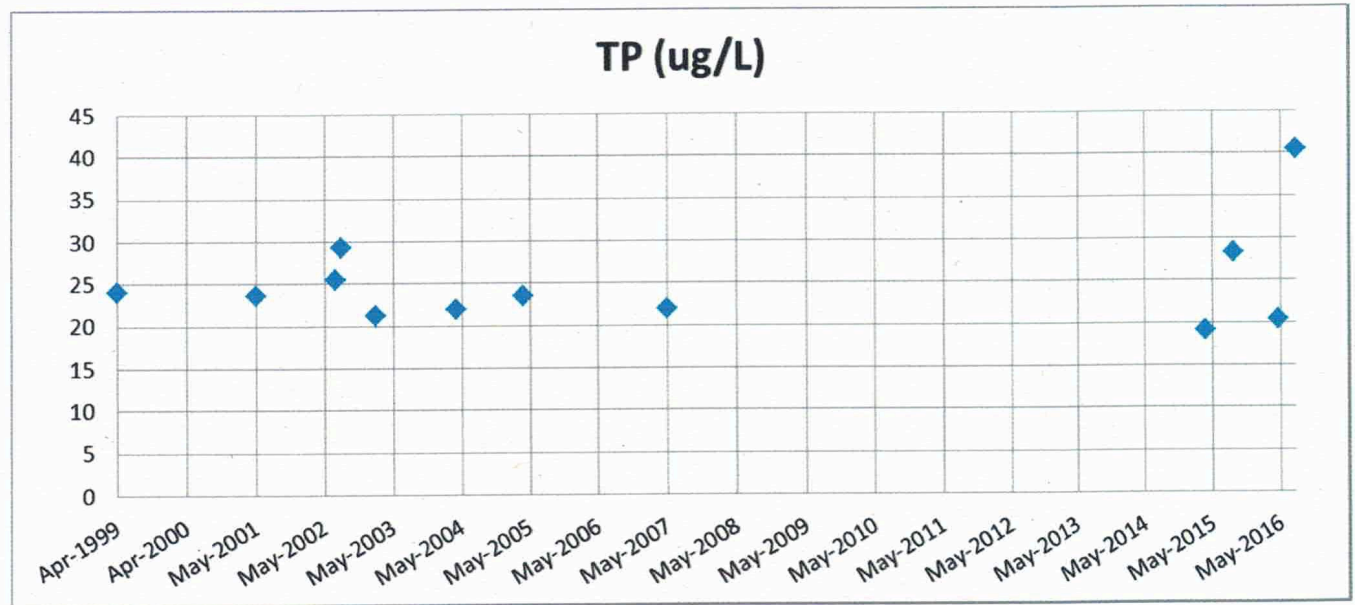


Tyhee Lake Total Phosphorus (ug/L) (1999-2016)

	Date	TP (ug/L)	n
SPRING	May-99	24	5
SPRING	May-01	24	6
SUMMER	Jul-02	26	4
SUMMER	Aug-02	29	4
WINTER	Feb-03	21	4
SPRING	Apr-04	22	8
SPRING	Apr-05	24	4
SPRING	May-07	22	4
SPRING	Apr-15	19	3
SUMMER	Sep-15	28	2
SPRING	May-16	20	2
SUMMER	Aug-16	41	2

Recommended level:
TP AL WQG Lakes: 5-15ug/L

Tyhee Lake: TP 19-41 ug/L
RT 2.9-16.6 yrs, mean 5yrs



*TP in lakes is either the spring overturn concentration, if RT of epilimnetic water exceeds 6 months or
The mean epilimnetic growing season concentration, if RT below 6 months

Date	Composite Depth	[TP]	Date	Composite Depth	[TP]
Apr 2015	0.5	19	Sep 2015	2.5	8
	8	19		10.5	16.5
	16	20			
May 2016	1	7	Aug 2016	1	6
	9	16		12	16

Table 1. Summary of water quality objectives for Round, Tyhee and Seymour lakes.

Variable	Objective Value	Objective met? (yes/no)
Fecal Coliforms	Near Intakes: $\leq 10/100\text{mL}$ (90th percentile) At Beaches: $\leq 200/100\text{mL}$ (geometric mean); $\leq 400/100\text{mL}$ (90th percentile)	Round – yes ³ Tyhee – yes Seymour – no
Turbidity	≤ 1 NTU (average); ≤ 5 NTU (maximum)	Round – no Tyhee – yes Seymour – no
Total phosphorus (at spring overturn)	Short Term Objective: $\leq 15 \mu\text{g/L}$ (average) Long Term Objective: $\leq 10 \mu\text{g/L}$ (average)	Round - no Tyhee – no Seymour – no

Table 8. Summary of Total Phosphorus Concentrations

	Average Spring Phosphorus Concentrations ($\mu\text{g/L}$), 2004, 2005, 2007 (all lakes) & 2011 (Seymour only)		
	# years with data	range	average
Round Lake	3	66 - 103	87.0
Tyhee Lake	3	23 - 26	24.2
Seymour Lake	4	13 - 22.7	18.6

The sediment core report for Tyhee Lake states that the lake appears to be naturally eutrophic, with spring TP ranging from 35 – 43 $\mu\text{g/L}$ during dates prior to European settlement (pre-1850s). The report concludes that *diatom macrofossils in the sedimentary profile indicate that Tyhee Lake is probably naturally productive (mesotrophic), but after AD 1950, significant eutrophication occurred due to anthropogenic influences in the watershed.*

Based on the forgoing, it is therefore suggested that the phosphorus objective for Tyhee Lake be a summer average of 40 $\mu\text{g/L}$.

- Phosphorus concentrations at all lakes continue to be consistently above the water quality objective level, often by a large margin. Considering historical phosphorus concentrations identified through sediments cores from Round and Tyhee lakes, it is recommended the **total phosphorus (TP) objectives be amended as follows:**

Round Lake	20 $\mu\text{g/L}$ TP as a summer average
Tyhee Lake	40 $\mu\text{g/L}$ TP as a summer average
Seymour Lake	No P objective until a sediment core can be taken

Table 6. Summary of Turbidity Results for Smithers Lakes

	Turbidity (NTU) - 2004, 2005, 2007, 2011		
	# years with data	# of samples	# of exceedances
Round Lake - average of 5 samples in 30 days	2	3 sites in 2007 (1 had only 4 samples), 3 sites in 2013 (1 had only 4 samples)	all 6 (or 4 if we don't include the 4 samples sites)
Round Lake - individual samples	2	25	4
Tyhee Lake - average of 5 samples in 30 days	2	3 sites in 2007, 3 sites in 2013	0
Tyhee Lake - individual samples	3	19	0
Seymour Lake - average of 5 samples in 30 days	2	1 site in 2007 (other 2 sites only had 3 samples & 4 samples in 30 d), 3 sites in 2013	4 (or all 6 if we want to include the data that didn't meet min reqs)
Seymour Lake - individual samples	4	15	1

Table 7. Summary of True Colour Results for Smithers Lakes

	True Colour (Col. Unit) 2004, 2005, 2007, 2013 (all lakes) and 2011 (Seymour only)		
	# years with data	# of samples	# exceedances
Round Lake	4	54	17
Tyhee Lake	4	51	2
Seymour Lake	5	46	44