

Water Quality Trends in Okanagan, Skaha and Osoyoos lakes


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- *Nutrient Management History*
- *Water Quality Trends and Status*
- *Future considerations*

The Problem in the 1960's

- Secondary sewage
- Cyanobacteria blooms
- Municipal STP phosphorus control needed to reduce eutrophication

Municipal STP Tertiary Treatment Implementation




Kelowna 1972 & 1990




Penticton 1972-81, 1994


Spray Irrigation Disposal of Effluent



Vernon, 1977



Oliver, 1984
Tertiary treatment by irrigation




Osoyoos 1970

Non Point Source phosphorus control efforts

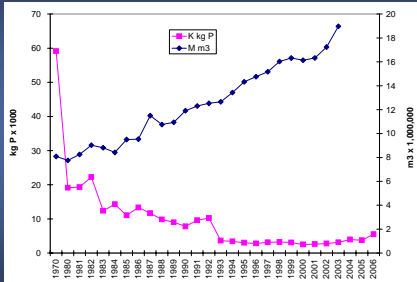
- Agriculture Code
 - aerial surveillance
 - Manure storage
 - Relocation of feedlots/run-off
- Forest Range Practices Act
 - stream protection set backs
- Liquid Waste Management Planning
 - reduce septic tank problem areas
 - storm-water planning



Deep Creek
Manure spreading
Runoff
Winter Spreading of manure



Municipal Effluent Volume (M m³/yr) and Phosphorus Loading (K kg/yr), to Surface Waters of Okanagan Basin 1970 to 2006 (-13M m³ to Okanagan Lake)



•1974 Point source control goal of 90% P reduction (60K kg to 2.5K kg P) was largely achieved in the first 15 years

Morphometry of Lakes

	Okanagan	Skaha	Osoyoos
Volume (M m3)	24,644	588	397
Mean Depth (m)	76	26	14
Flushing Time (yr)	53	1.2	0.7

Water Quality Monitoring



Phosphorus



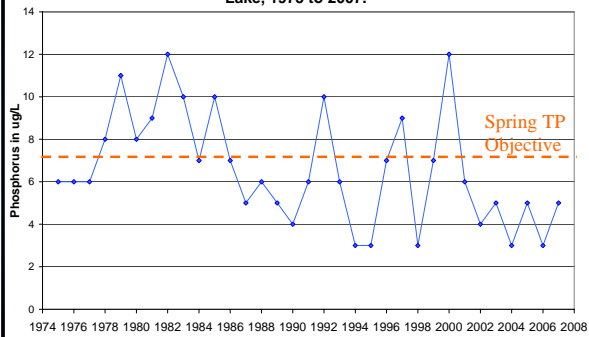
Phytoplankton
Chlorophyll a



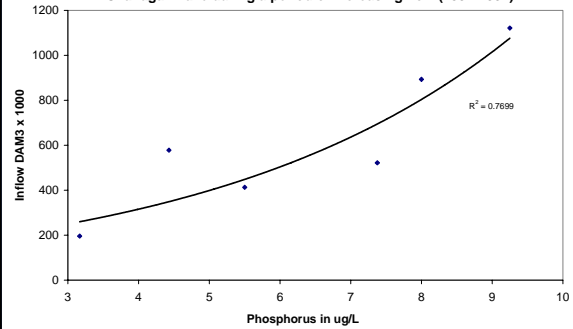
Secchi Disk
Water clarity

- Trends
- Status
 - Water Quality Objectives – spring total phosphorus
 - Trophic Index – chlorophyll a

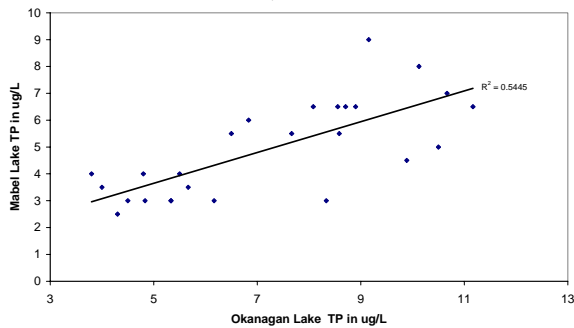
Spring total phosphorus (ug/L) in the south end of Okanagan Lake, 1975 to 2007.



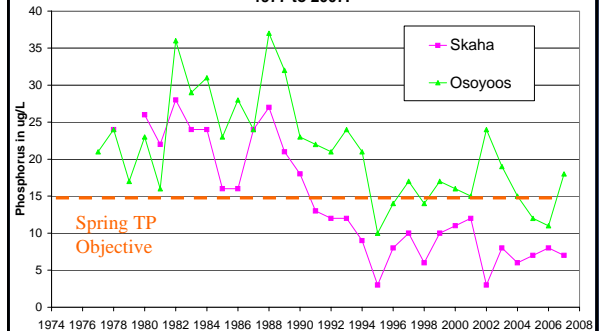
Relationship between inflow and fall phosphorus (1yr lag) in Okanagan Lake during a period of increasing flow (1992-1997)

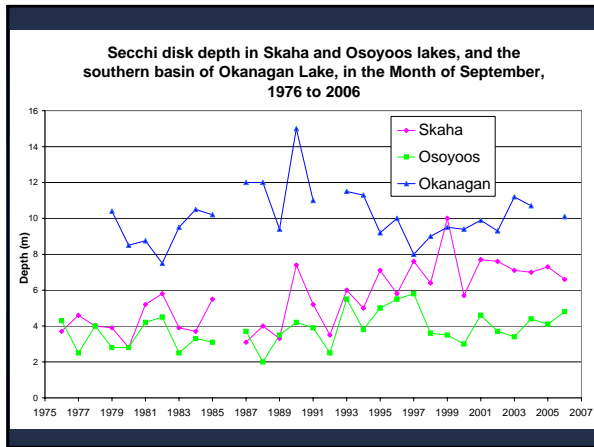
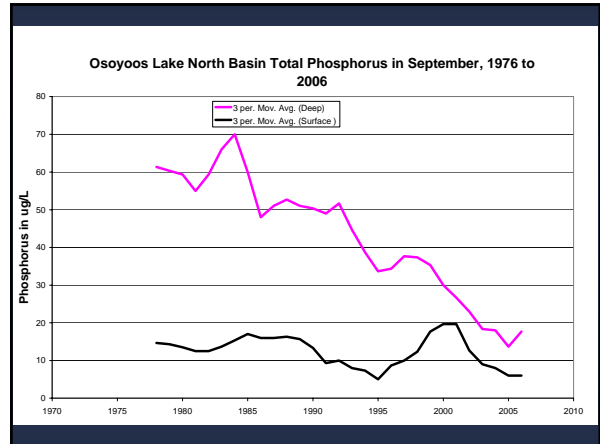
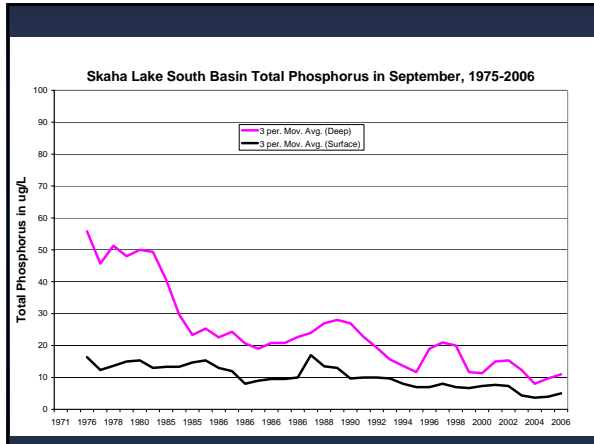


Relationship between Total Phosphorus in Mabel and Okanagan lakes, 1976 to 2003



Spring total phosphorus (ug/L) in Skaha and Osoyoos lakes, 1977 to 2007.





Trophic Status

- the total weight of living biological material (*biomass*) in a waterbody
 - Phosphorus
 - Secchi Disk
 - Chlorophyll *a*

Carlson Trophic Status Index

Trophic Status Index	Chl a (ug/L)	Secchi Depth (m)	TP (ug/L)	Attributes
<30	<0.95	>8	<6	Oligotrophy: Clear water, oxygen throughout the year in the hypolimnion
30-40	0.95-2.6	8-4	6-12	Hypolimnia of shallower lakes may become anoxic
40-50	2.6-7.3	4-2	12-24	Mesotrophy: Water moderately clear; increasing probability of hypolimnetic anoxia during summer
50-60	7.3-20	2-1	24-48	Eutrophy: Anoxic hypolimnia, macrophyte problems possible

Trophic Status Index (TSI) for Osoyoos Lake North Basin

Year	TSI Chl a	TSI TP	TSI Secchi	Trophic Status Attributes
1971	60	51	45	TSI 50-60 Eutrophy: Anoxic hypolimnia
1994	51	44	40	TSI 40-50 Mesotrophy: Water moderately clear; increasing probability of hypolimnetic anoxia during summer
2004*	46	41	41	
2005*	46	34	40	
2006*	46	34	42	

* Includes Okanagan Nation Alliance data

Water Quality Summary

- Okanagan Lake
 - Slight decreasing trend in spring phosphorus
 - Strong influence of climate (higher flows higher nutrients)
- Skaha Lake
 - Significant decrease in phosphorus
 - Significant increase in water clarity
- Osoyoos Lake North Basin
 - Significant decrease in phosphorus
 - Slight increase in water clarity
 - Slight improvement in trophic status

Future Considerations

- Population growth
 - Nutrient loading?
 - Trace contaminants?
- Climate change
 - Wetter and more variable?
 - Warmer waters and more algal blooms?
- Mountain Pine Beetle
 - Changing hydrographs and soil erosion?

