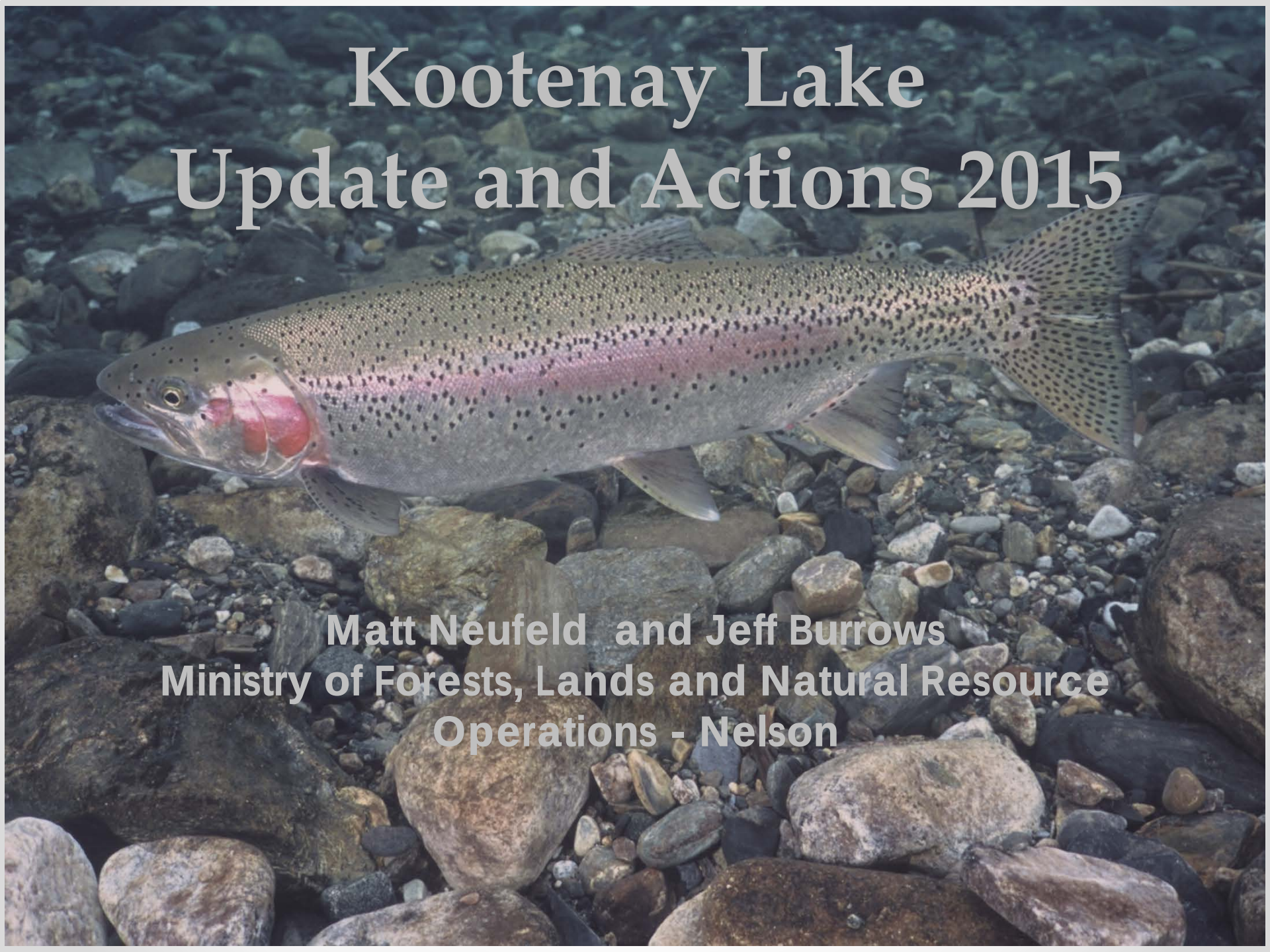
Kootenay Lake Update and Actions 2015



Matt Neufeld and Jeff Burrows
Ministry of Forests, Lands and Natural Resource Operations - Nelson

Outline

History Leading to 2015

- Kokanee
- Gerrard Rainbow
- Kootenay Lake Fishery
- IHN Virus
- Nutrient Program

Recap Current Status

- Kokanee, Gerrards, Nutrients and the Fishery

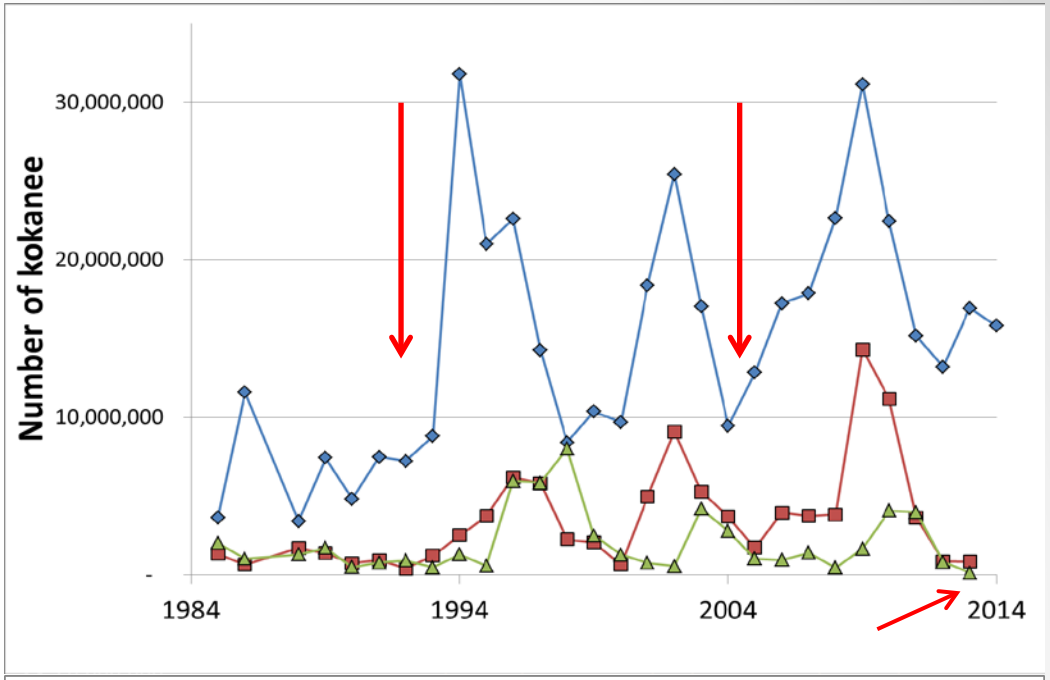
Future - Goals and Actions

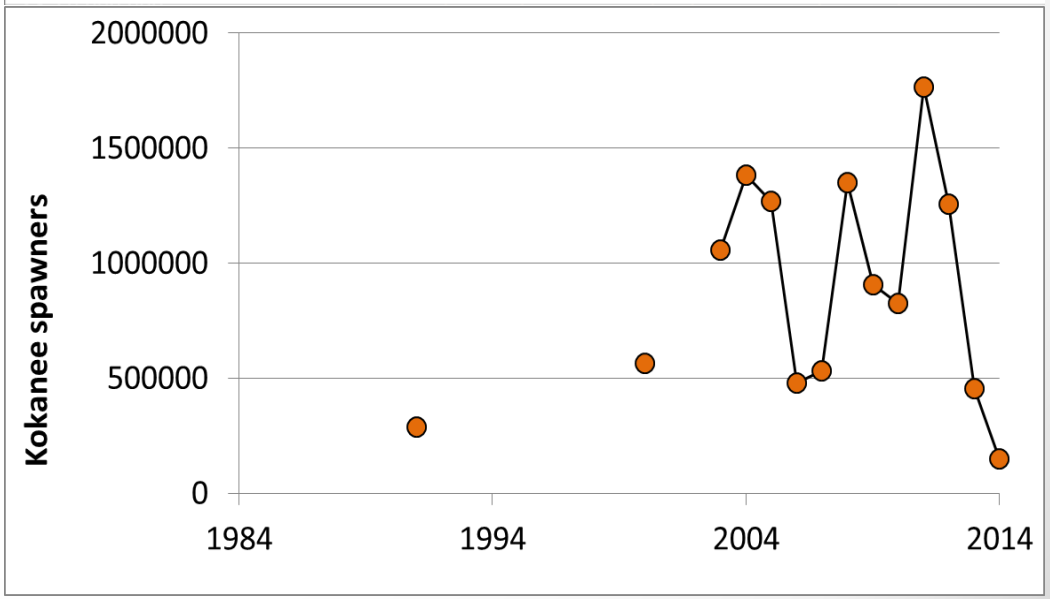
- Kokanee - promote population recovery
- Gerrard Rainbow – population management, trophy fishery
- IHN Virus - mitigation
- Nutrient Program – continued food production for kokanee

Questions, Your Input and Ideas

History - Kokanee

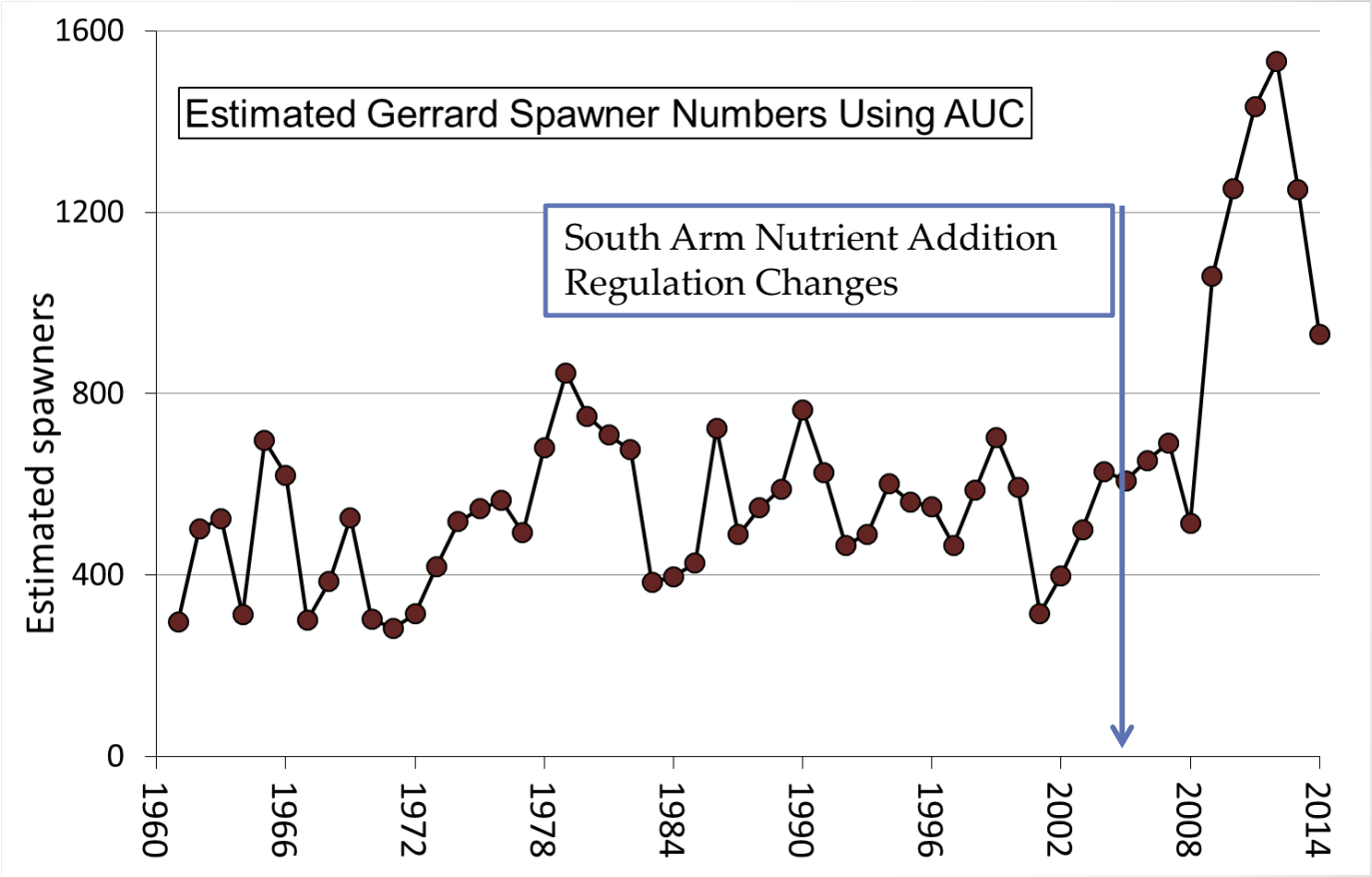
- Kokanee numbers fluctuate
- Improvements since nutrient restoration
- Fry estimates more than doubled with nutrient restoration and have remained high (2014 was post nutrient average)
- Recent very strong reduction in 2 and 3 year old survival
- 2014 ~150,000 spawners and 33 million eggs lowest recorded
- 1991 - low before nutrient restoration 285,000 spawners and 41 million eggs





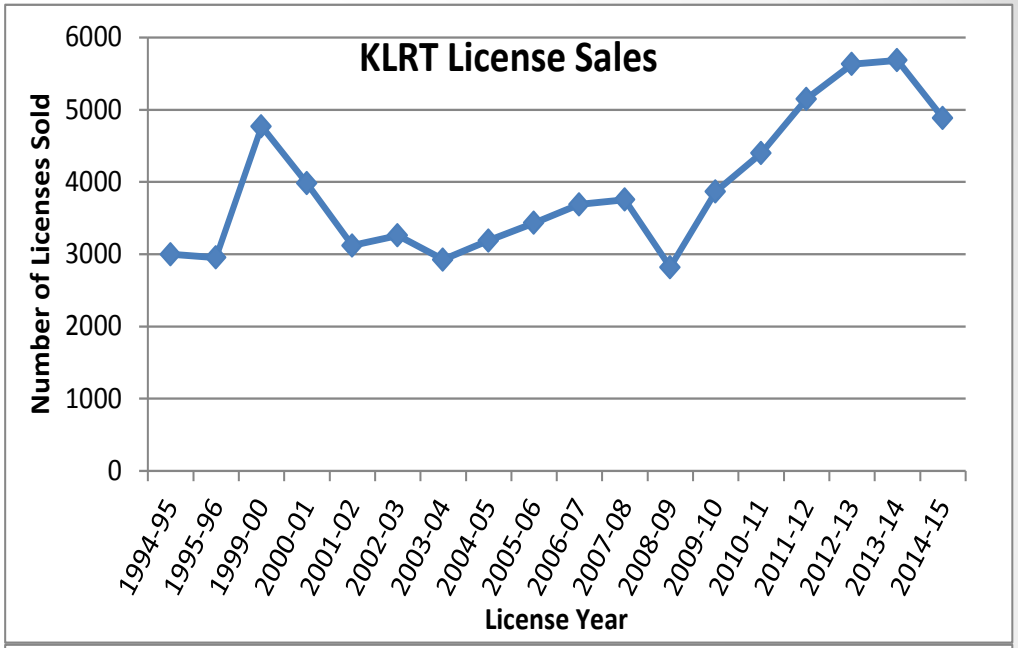
History – Gerrard Rainbow Trout

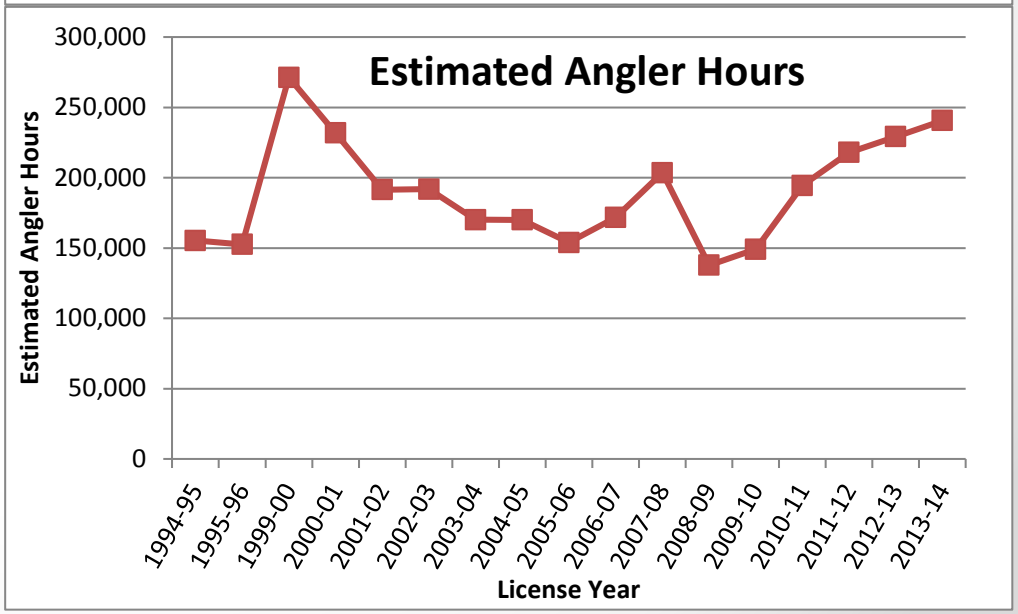
- Daily bank counts since 1961
- Cyclical
- Long term average ~550
- 2012 peak 300% higher than long term average, and nearly 200% higher than prior record.
- Recent decline



History - Kootenay Lake Fishery

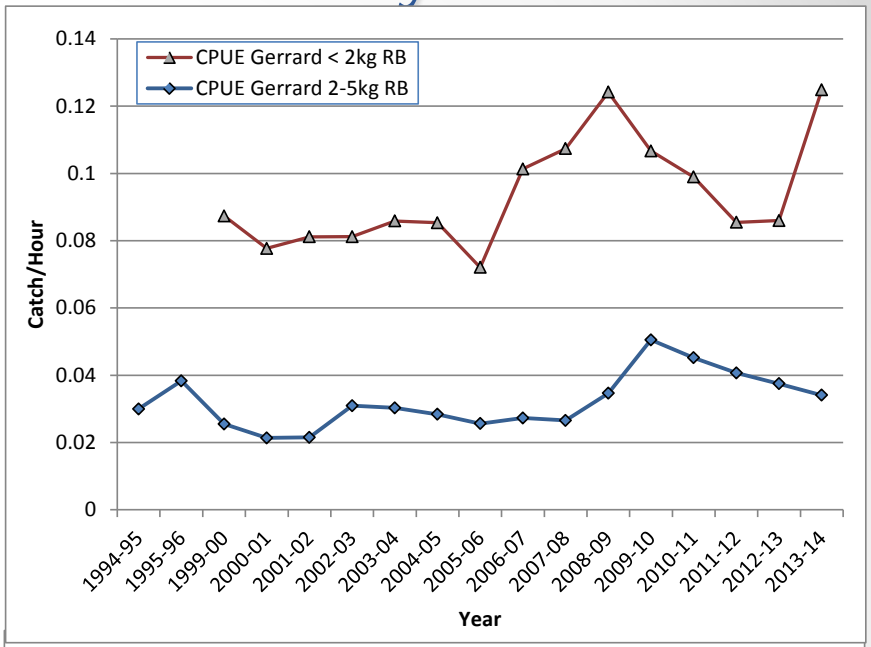
- Estimated direct expenditures between **$3-5 million annually**
- Trout licence sales higher in the last four years than ever (corresponding increases in effort)
- 2014-15 sales high (~5,000), but likely decrease in 2015
- Angler harvest low despite high effort (~13%; harvest likely not driving current change in abundance)

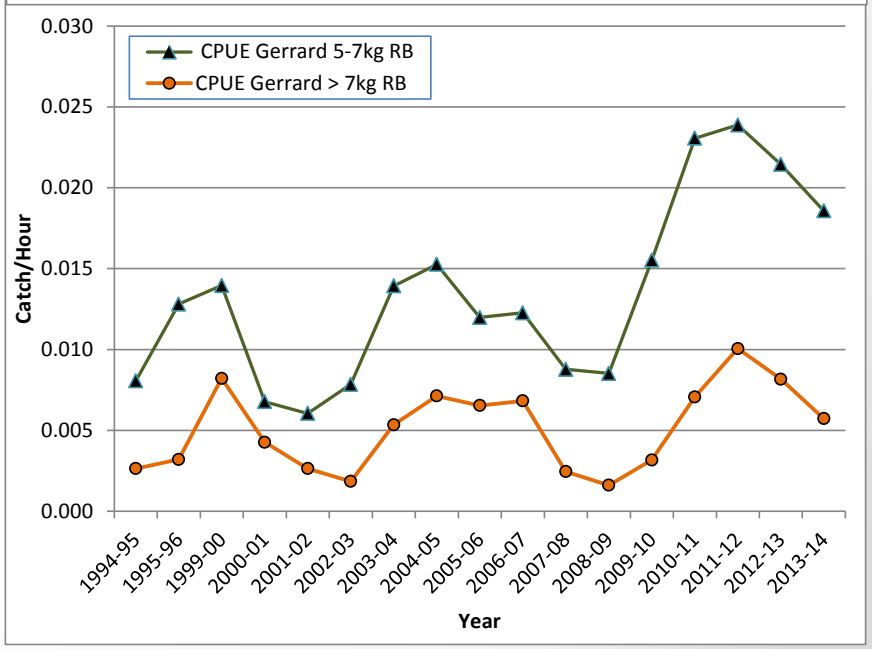




History - Kootenay Lake Fishery

- Catch rate in the past 4 years for almost all size classes were highest ever observed (peak 2011-12)
- Decreasing catch rates in the past two years for all size classes over 2kg
- Likely significant decrease in catch rates currently; not yet reflected in survey results
- Increasing catch rates for the smallest fish (highest ever observed)



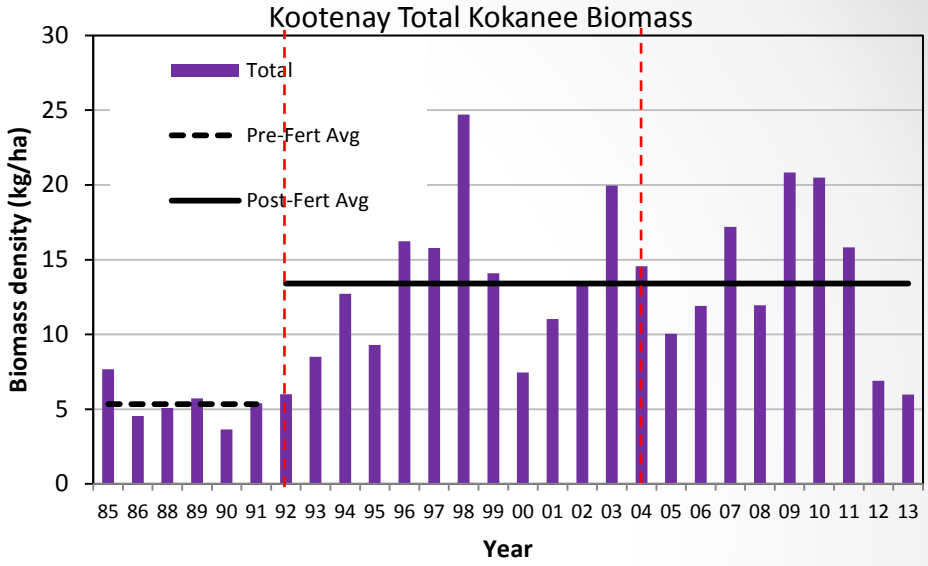


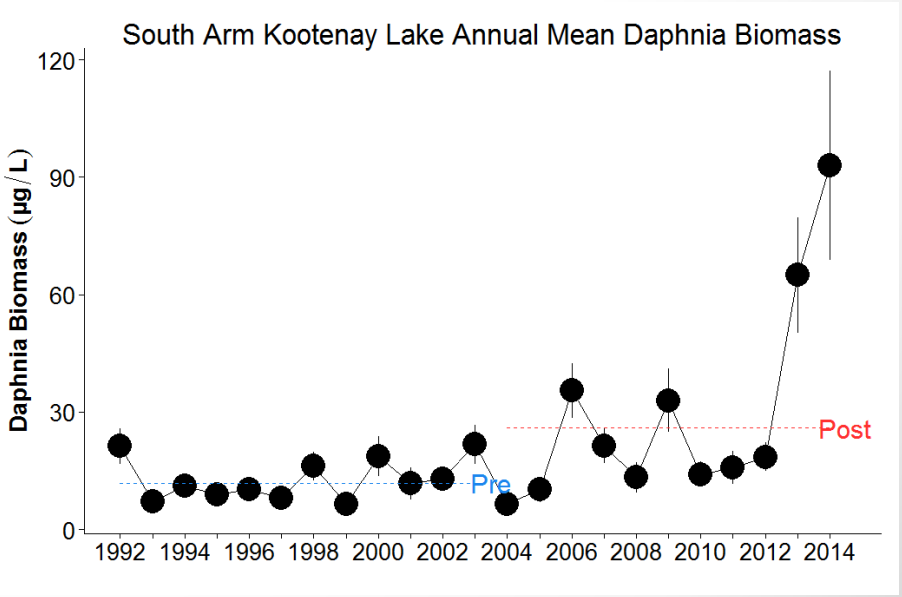
History – What about the Fish Disease in Kokanee?

- Infectious hematopoietic necrosis virus (IHN) found for the first time in adult kokanee spawners at Meadow Creek in 2013 and again in 2014;
- Kokanee fry samples 2014 and Gerrard spawners testing indicated no viral infection
- Potential sources; migrating animal (e.g. birds), present in the past but undetected, introduced by a person/boat, or many other possibilities.
- Disease (e.g. IHN virus) and parasites are rarely a major factor that affect wild population status- likely the case for Kootenay Lake:
  - no significant fish kills identified (2013 event, likely small impact -?)
  - adults have spawned successfully despite infection
  - egg to fry survival has remained high (IHN typically kills fry)
  - levels of infected kokanee declining
  - rainbow trout not currently infected
- **IHN virus is not harmful to people**, and can't transfer to people by either touching or eating infected fish.

History - Nutrients

- Productivity in the lake has increased
  - Gerrard abundance has increased
  - Kokanee biomass has increased 2.5 times since nutrient additions
  - Zooplankton has increased, particularly in the South Arm





Current Status - Recap

- Recent low older Kokanee abundance
- Kokanee fry ~ average abundance
- Recent record high Gerrard trout abundance
- Decreasing Gerrard rainbow trout size and large fish abundance, degrading condition of trout in fishery
- High abundance of young Gerrard rainbow trout – could increase kokanee recovery time
- Nutrient program continues to produce fish food
- IHN virus remains present

Kokanee: stock recovery

- Fall fry abundance in 2014 remained high (over 15 million) suggesting recovery could be significant in just two years; *if predator abundance declines rapidly.
- Fry production in 2015 likely to be 7-12 million. Even with low spawner number, recovery building block present.
- The significant uncertainty around recovery time centers on predator response to current low kokanee abundance

Actions

- **Regulation change**
  - In the short term proposing a decrease in kokanee quota (0/day) effective April 2015.
  - Could provide 2.5 million extra eggs
- **Expert Review:** Provincial stock assessment team and Freshwater Fisheries Society BC engaged to **review all options, such as stocking,** to speed recovery of kokanee stocks, then maintain abundance

Gerrard rainbows:

population management, trophy fishery

- We expect a sharp decline in spawner number and large fish catch rate in 2015
- Small fish catch rates suggest we currently have the raw material to maintain or increase Gerrard numbers as kokanee abundance increases

Actions

- **Regulation Change:** In the short term, daily rainbow quota on the Main Lake proposed to increase to 4/day, 1 over 50cm - decreasing juvenile Gerrard abundance has likely benefits for kokanee recovery (~10,000 caught annually, only 3,000 harvested);
- **Expert Review:** In the short and medium term: Provincial stock assessment team engaged to help better understand predator/prey dynamics in the lake, and inform future management decisions.
- **Future Regulation change:** if and when juvenile cohort abundance has been reduced sufficiently and kokanee abundance increases

Nutrient Restoration: maintain food

- Proven performer
- Quick kokanee recovery depends on continued nutrients (food for fish)
- **Action:** Optimization of timing and inputs
  - Investigate timing with fry outmigration to increase juvenile Kokanee survival
  - Increased monitoring and continued consideration of natural variability and climatic events (flow, temp and natural input) will ensure nutrient additions are optimized to best move up the food chain.

Future –Fish Disease in Kokanee?

- There is no practical way of controlling disease in wild fish populations

- We can't rule out virus as a factor: continue to limit virus at spawning channels where we have some control
  - carcass removal
  - flushing
  - summer drying
  - kokanee testing will continue annually

Questions and your ideas

- **Looking for your input and to answer any questions as we further develop actions**
  - Input and question form provided tonight can be returned to organizers
  - Questions answered and update on actions provided on Ministry web page:
  - www.env.gov.bc.ca/kootenay/fsh/main/mainfish.htm
  - Google "Kootenay Fisheries"
- **Update bulletin will be available soon**
  - email list (sheet at the door)
  - Regional web page www.env.gov.bc.ca/kootenay/fsh/main/mainfish.htm

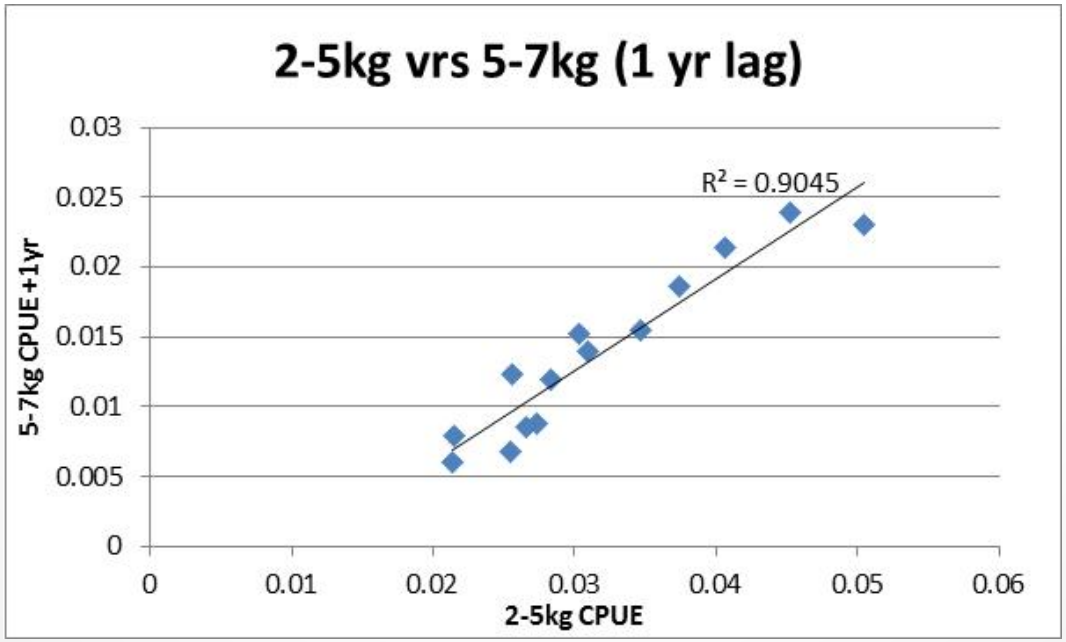
Appendix Q&A

How Long Until Recovery?

- Recovery time hard to predict because of uncertainty in predator response
- Best case – Less than one kokanee generation (~2 years)
  - We currently have the building blocks for quick recovery - fry production and young Gerrard abundance
  - Potential upturn in kokanee spawners by 2017 and concurrent stabilization in Gerrard catch rate and size
  - Requires an increase in kokanee survival rates, and a corresponding strong reduction in predator abundance
- Worst Case – two kokanee generations or more (8+ years)
  - If predator numbers are slow to drop off and young Gerrards exert additional pressure on depressed kokanee stocks

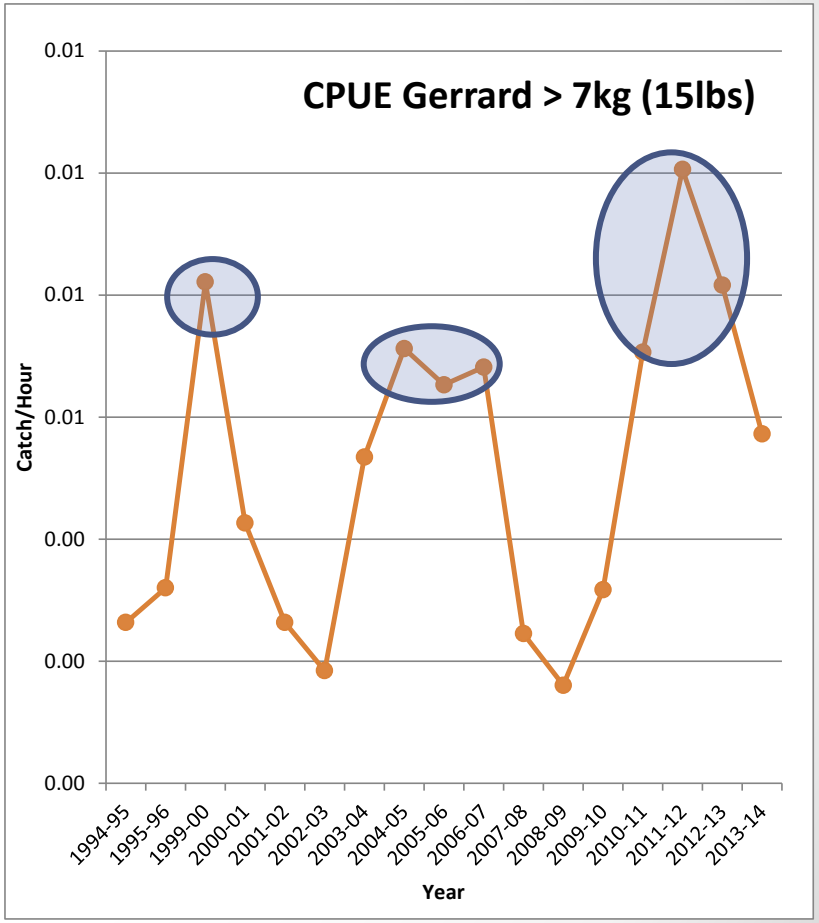
KLRT Creel Survey Comparison

- KLRT vs Creel: effort estimates – **within 0.5% of each other** (Creel 46,053; KLRT 46,311angler days)
- >50cm BT and RB catch and harvest – **1.5 to 2x higher in KLRT** – likely reflects survey bias that is well recognized including anglers that do not report if they did not catch, recollection bias as creel completed on day of catch (with harvest in hand) and survey up to 1.5yrs latter, anglers reporting boat catch not personal catch and other (creel survey a valuable reference point to correct for survey bias)
- Year to year predictive power is internally consistent - KLRT catch rates by size class in one year predict future catch rates of larger fish, so useful index of abundance and fishery performance



Where are the Really Big Fish (>25 lbs)

- Was happening well before current pred:prey mismatch
- Catch data not suitable to differentiate big (>15lbs) vs very big (>25lbs).
- Peaks in the past (small numbers) but not since mid 2000's.
  1. Natural mortality plus angler harvest removal at high enough rate for none to make it to > 25 lbs (need to get >8yrs old).
  2. Large fish corresponded in past with Gerrard peaks, but latest peak 2x past peaks, so competition with each other may have been strong enough to limit size
  3. Adequate prey size not available for the very biggest (energetics poor if kokanee size is small for very largest fish?).
  4. Genetic Selection – anglers preferentially remove the largest fish
  5. Combination of some of the above.



Worms in Fish

- Worms reported by anglers are "**broad fish tapeworm**", native to Kootenay Lake
- Larvae infect both freshwater and marine fishes, and are **always present** in the Kootenay Lake rainbow population at some level.
- There is **no practical way of controlling parasites** in wild fish populations. For anglers, the key consideration is care in the preparation of your catch prior to consumption.
- Tapeworm eggs are excreted in the feces of **animals hosting the adult tapeworm (fish-eating birds or mammals)**, develop in water into larvae that work their way through the food chain and eventually into fish.
- **Heavy infestations of these larval tapeworms could kill some fish**, especially those an already weakened condition, such as older fish, malnourished fish, or post-spawning migrants that are just returning to the lake.
- **Parasite loads fluctuate**. Although more trout appear to be affected by these parasites now than in the recent past, some anglers and retired fish biologists recall relatively high levels of parasites in past decades.
- We don't know for sure why these parasites are more common at some times, but this cycle is common in other populations

Impact of Proposed Regulation Changes

Gerrard Rainbow Trout

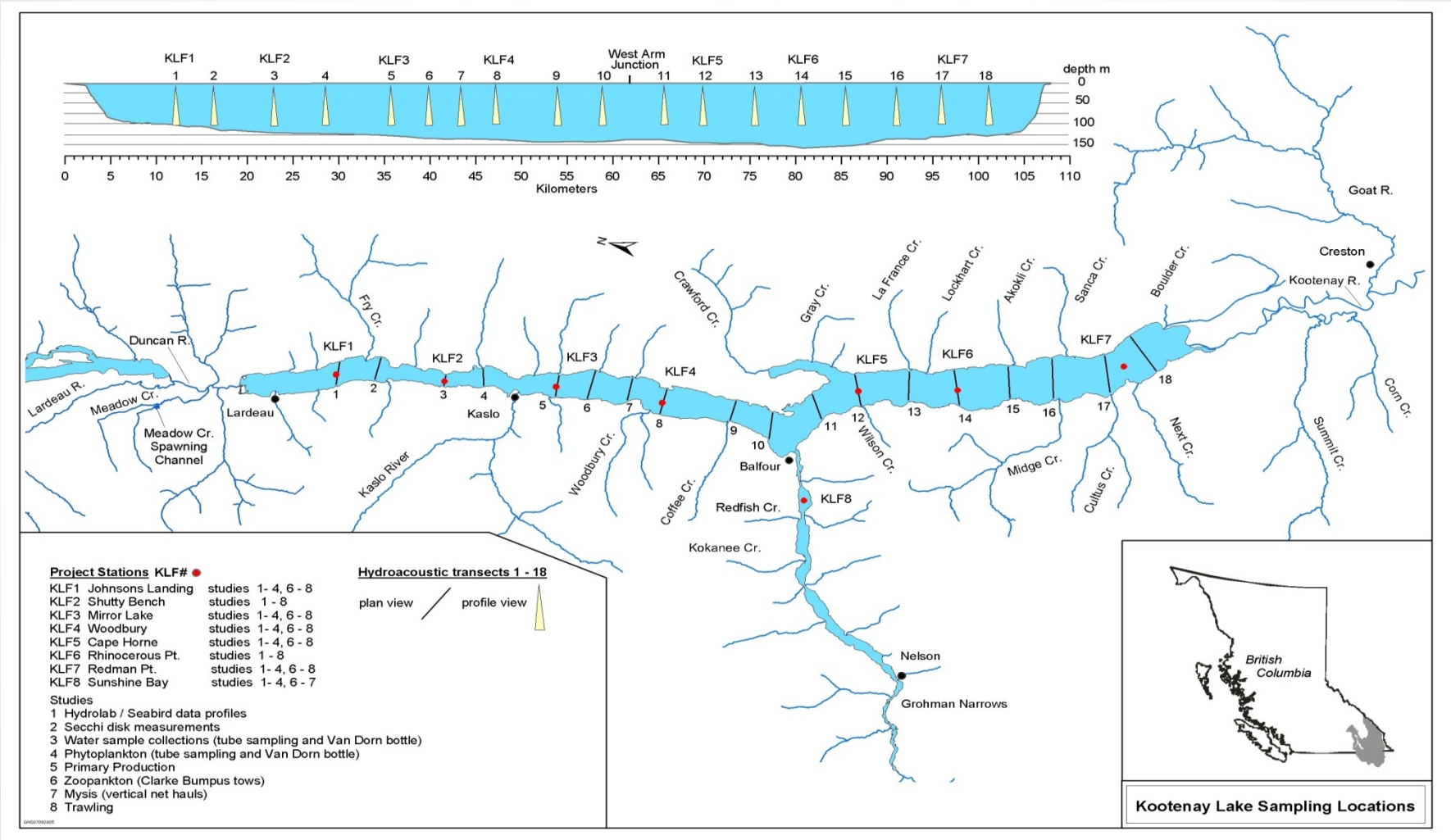
- annual small rainbow catch is 10,000-15,000 fish, and only 25-30% harvested
- **Anglers can help:** there is potential to reduce the young Gerrard population by as much as 10,000 fish in one year if all fish were kept.
- For perspective, total production of 1 year old Gerrards annually is ~20,000, which decreases by the time they enter the fishery.

Kokanee

- measurable increase in egg numbers from 0 harvest. The estimated gain could be ~10% or more in 2015.

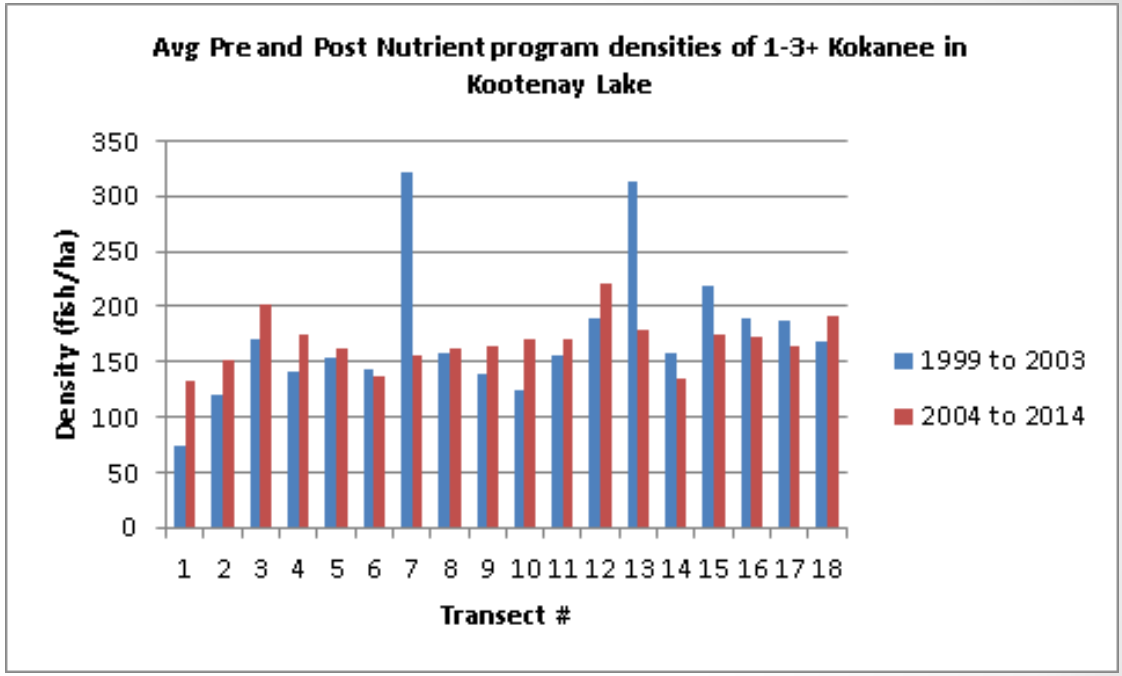
Assumed potential harvest under 15/d limit = 10,000KO		
limit	harvest	number of extra eggs to MC
0	0	2,500,000
2	6125	968,750
5	9125	218,750
15	10000	0

Kokanee Distribution

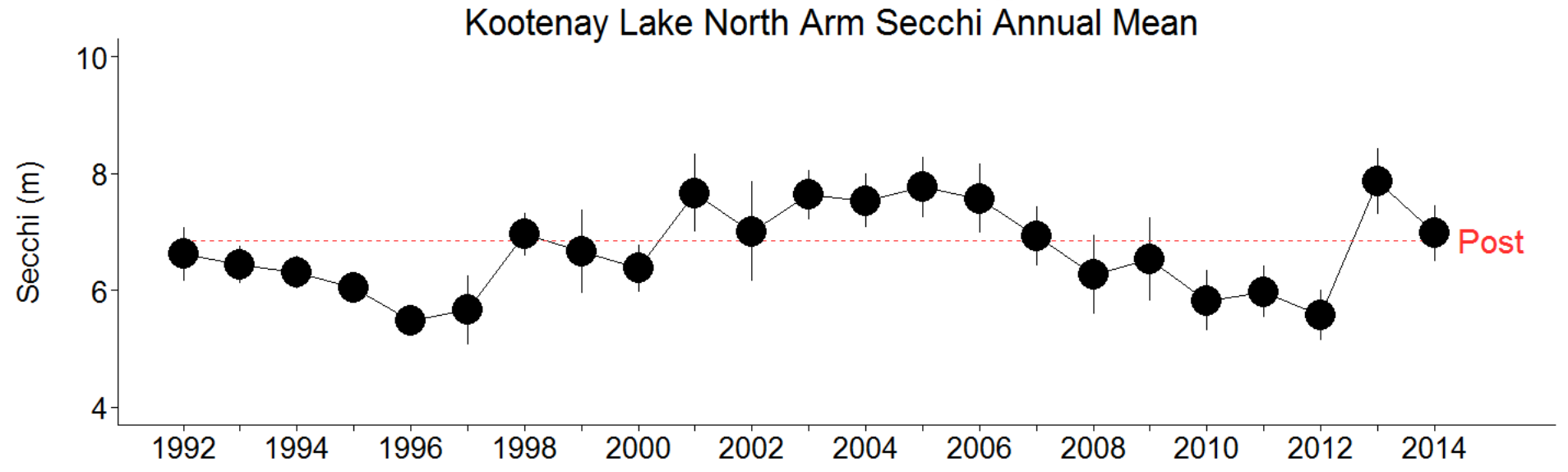


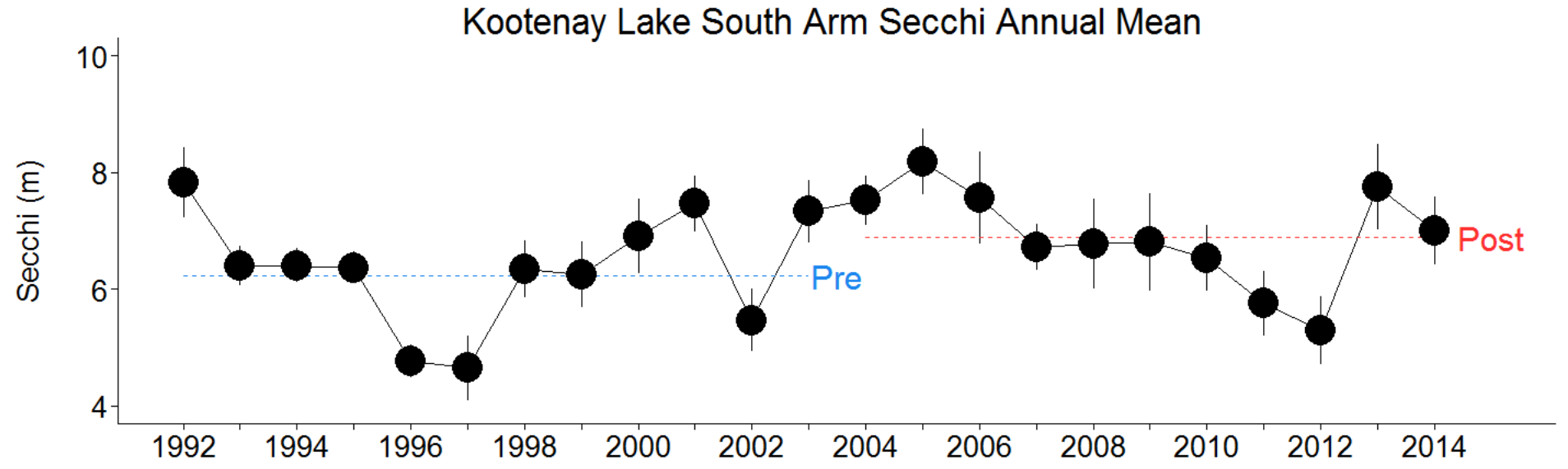
Kokanee Distribution

- Density of kokanee higher after south arm nutrients
- No significant change in distribution, with high densities at all transects in both the north and south arms

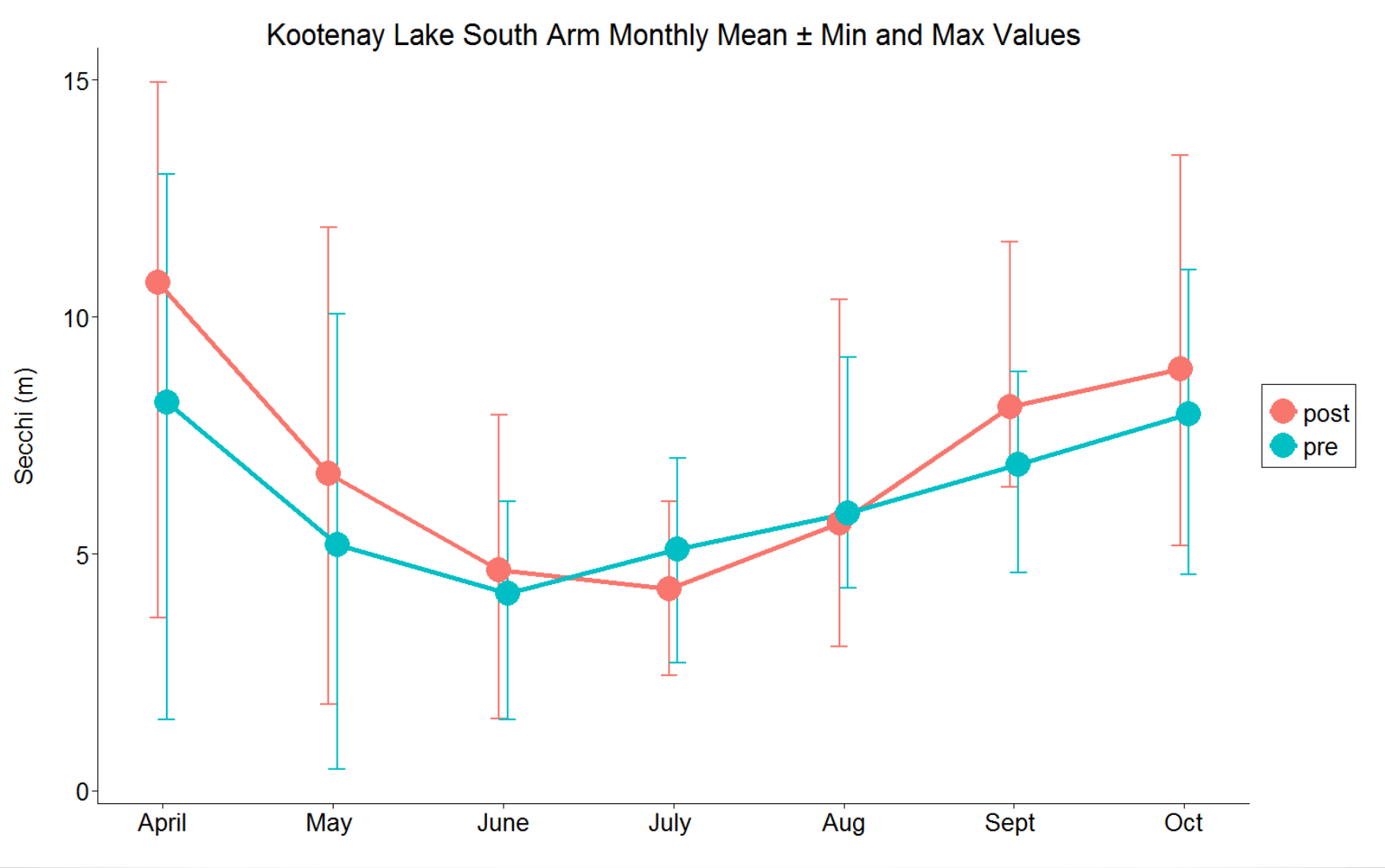


Secchi – measure of transparency

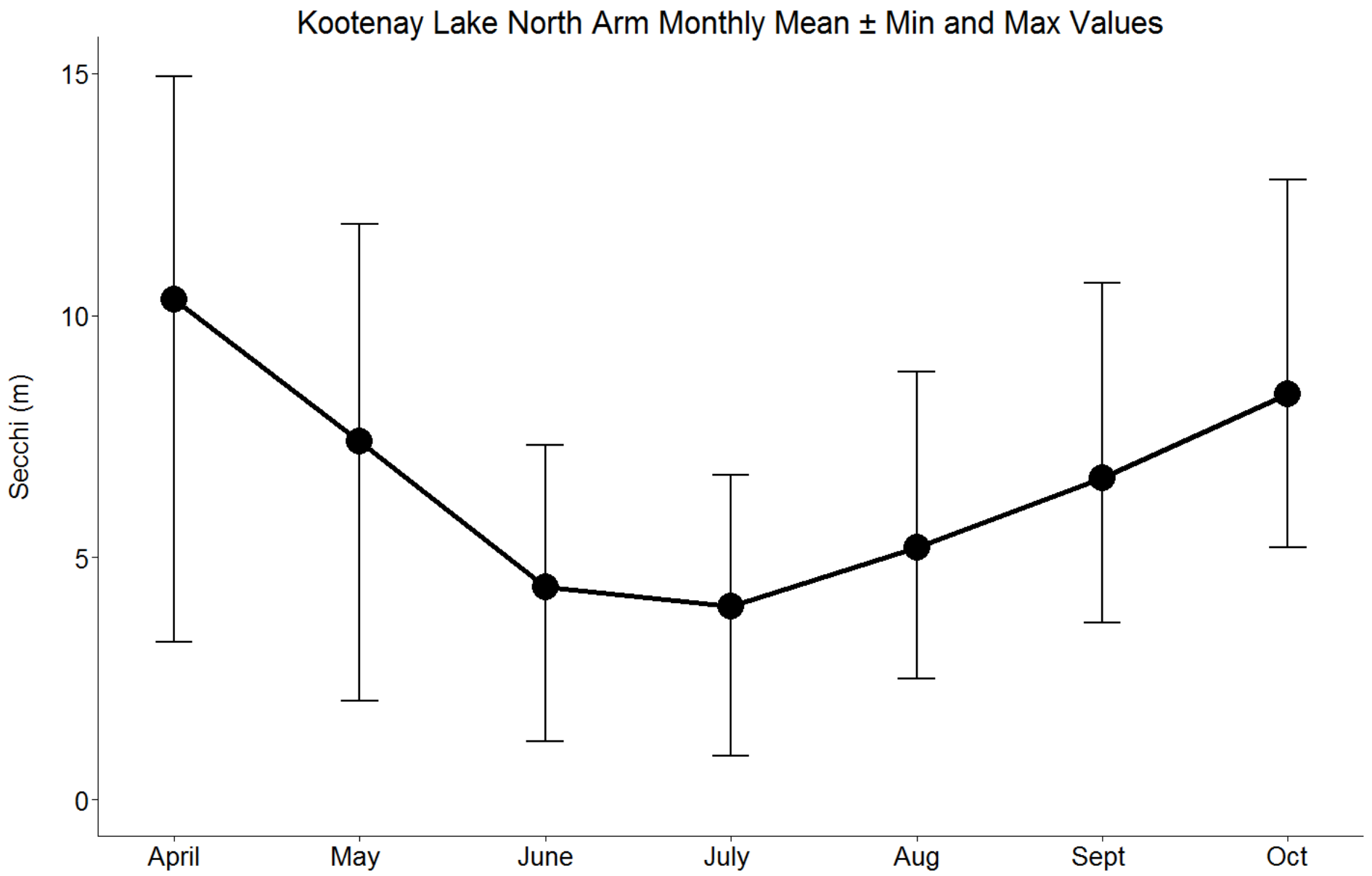




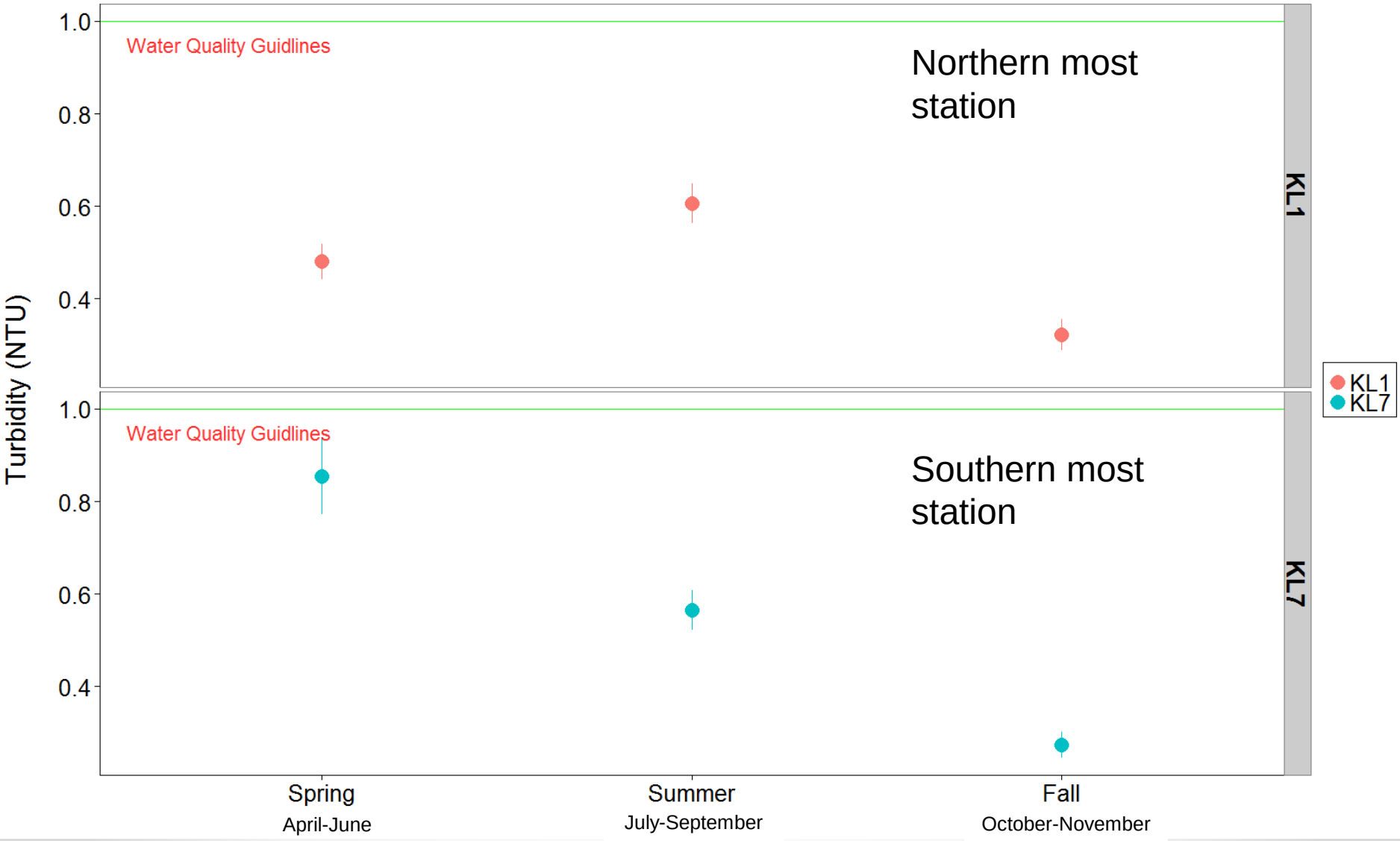
South Arm Secchi



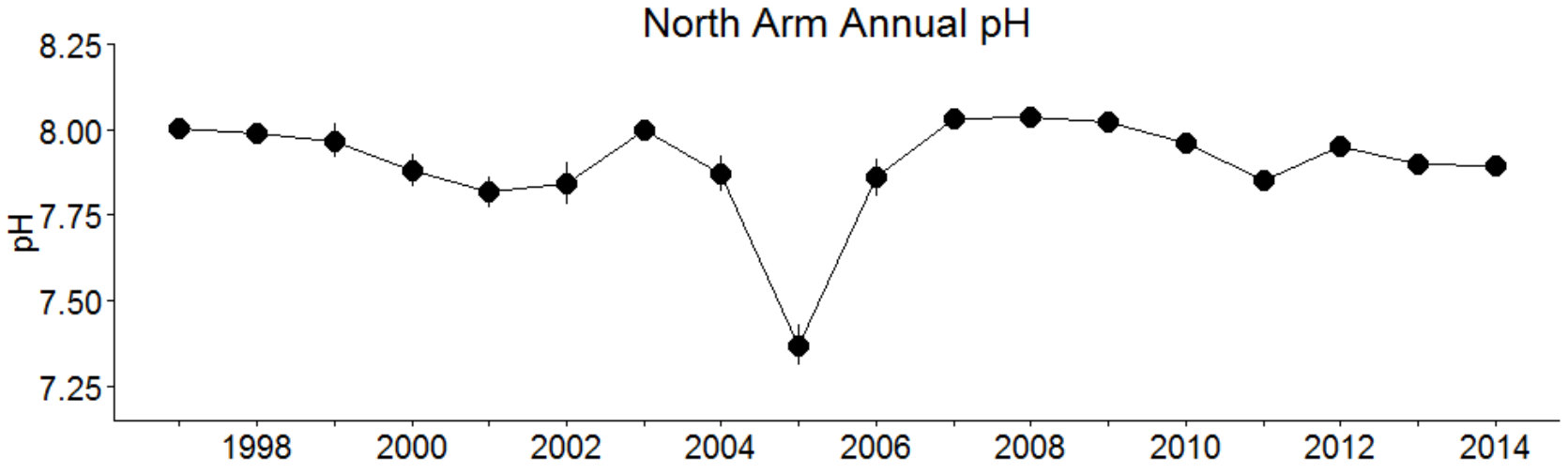
North Arm Secchi

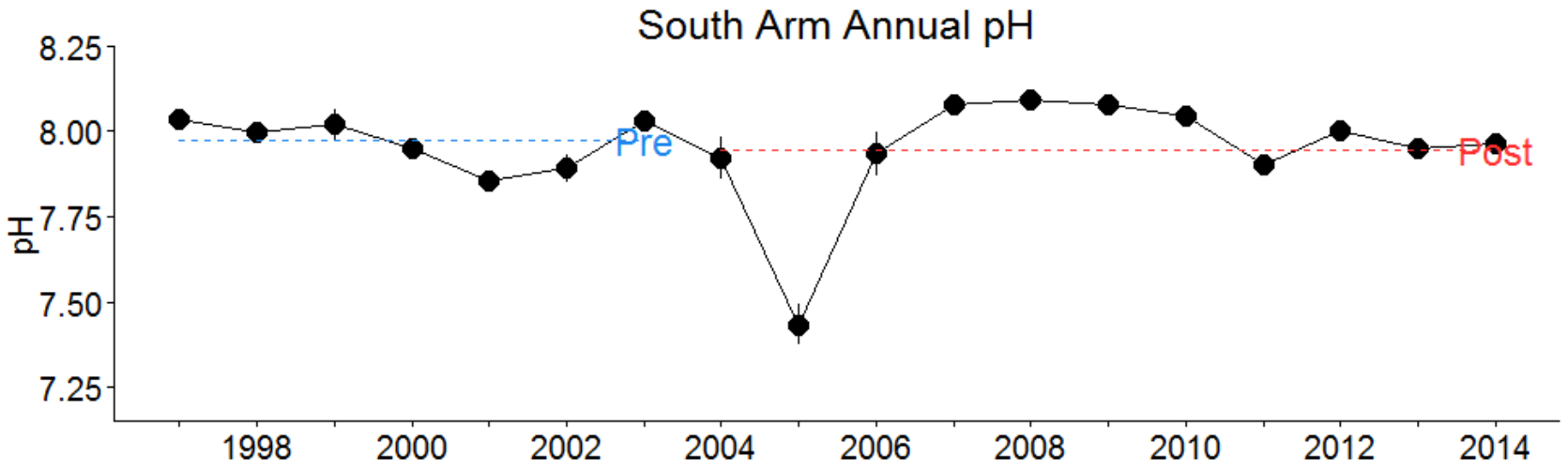


Turbidity

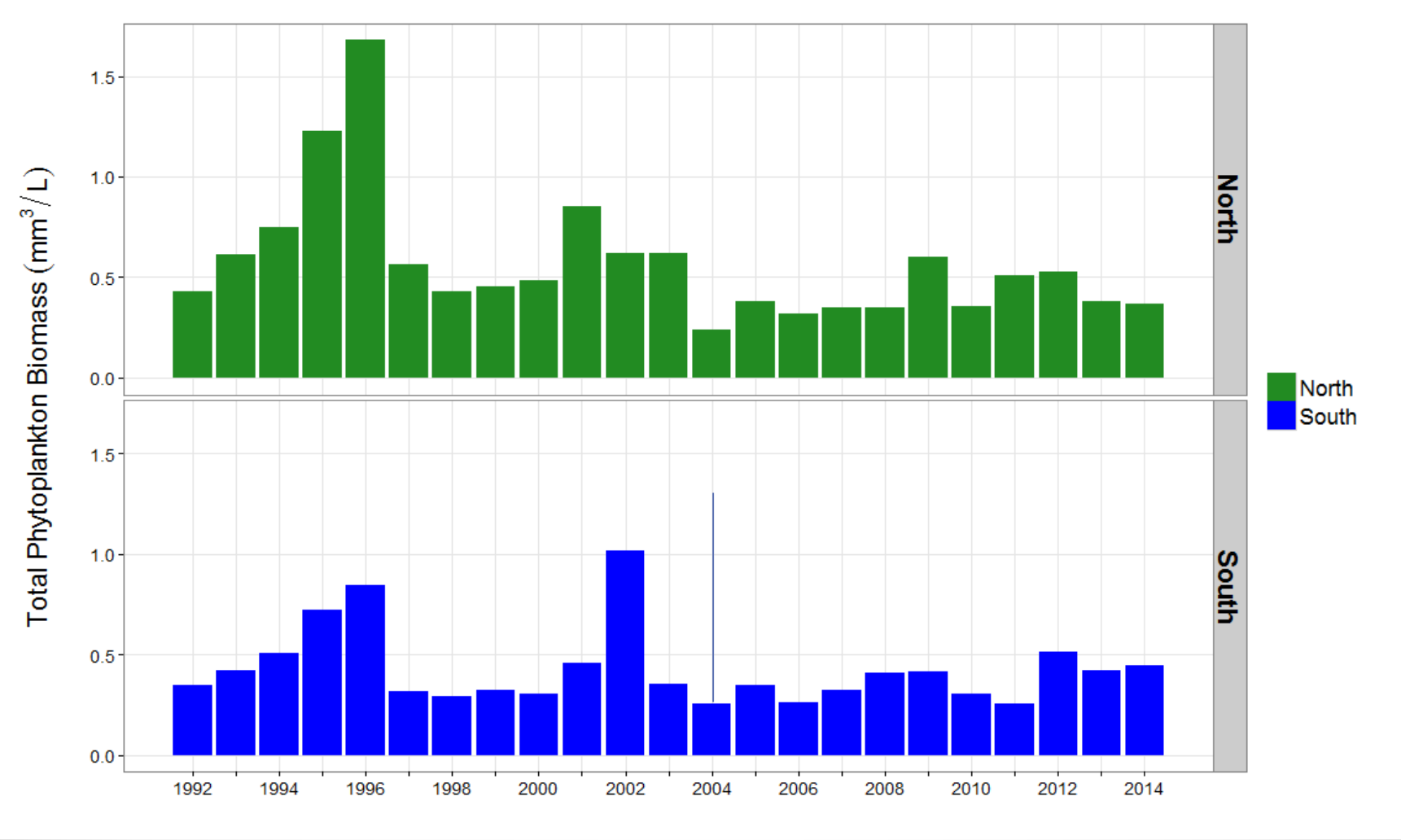

Turbidity (NTU)
1.0
0.8
0.6
0.4
Water Quality Guidlines
Northern most station
KL1
Water Quality Guidlines
Southern most station
KL7
KL1
KL7
Spring
April-June
Summer
July-September
Fall
October-November

pH

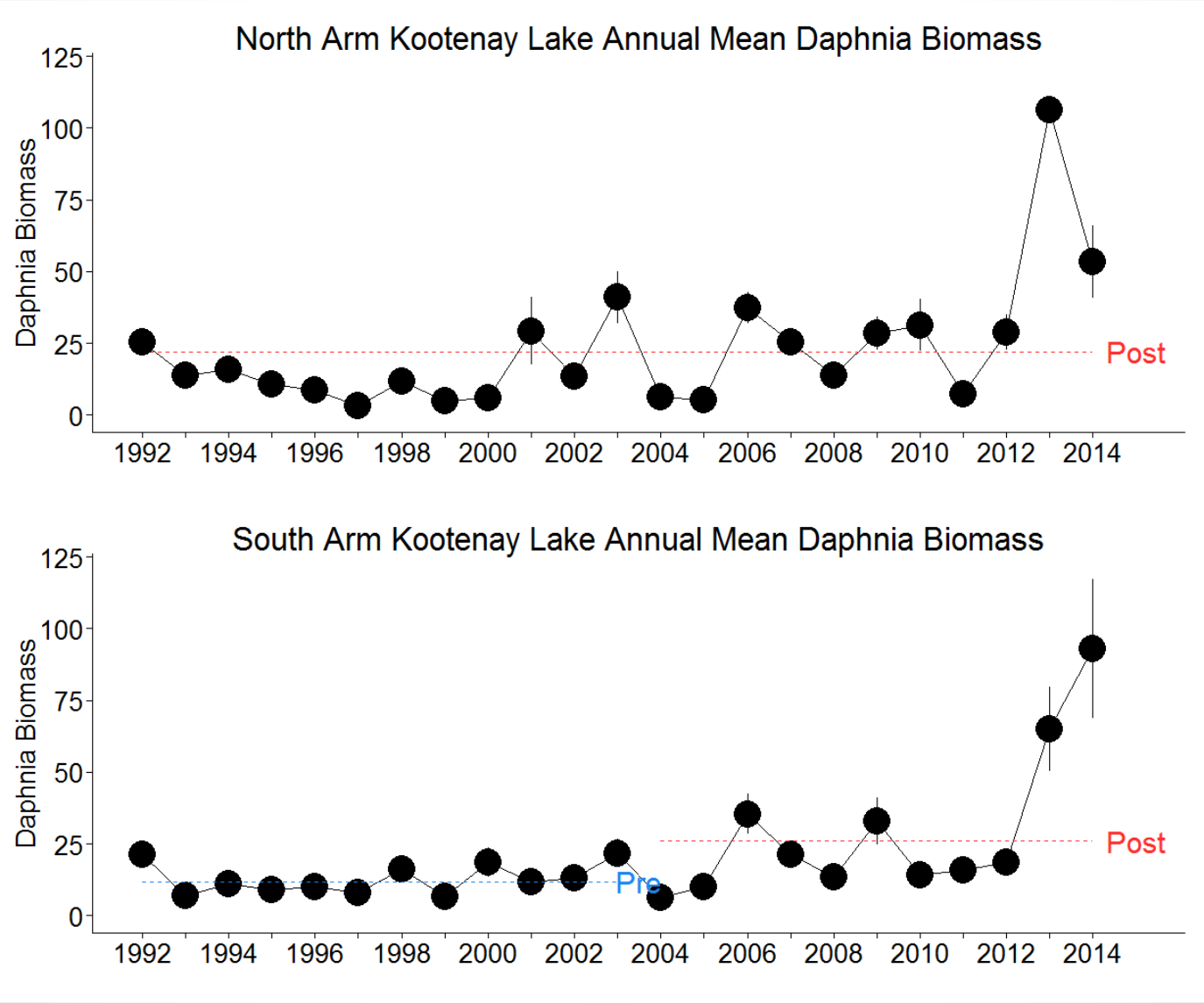

North Arm Annual pH
pH
8.25
8.00
7.75
7.50
7.25
1998
2000
2002
2004
2006
2008
2010
2012
2014


South Arm Annual pH
pH
8.25
8.00
7.75
7.50
7.25
Pre
Post
1998
2000
2002
2004
2006
2008
2010
2012
2014

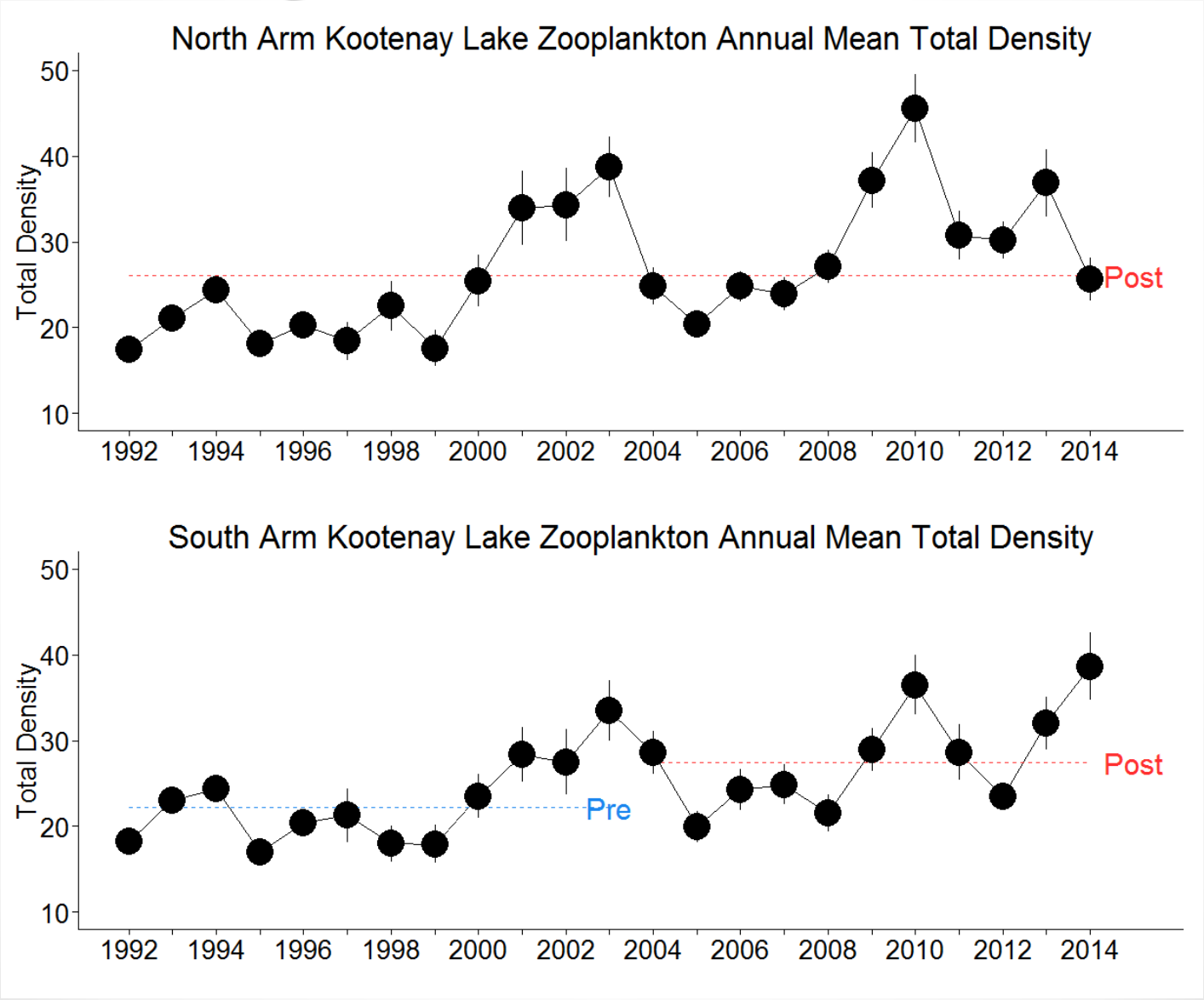
Phytoplankton



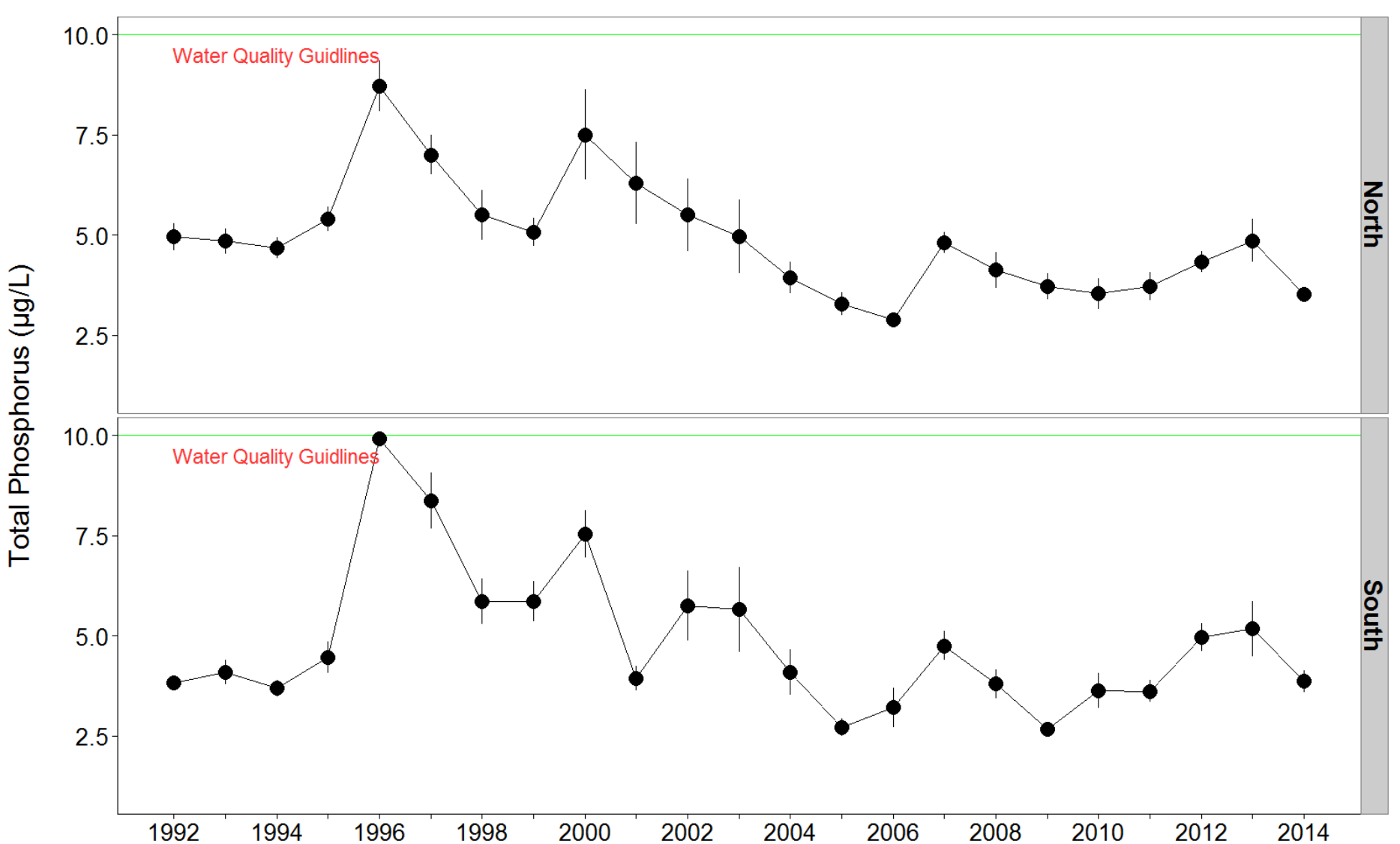
Zooplankton – Adult Kokanee Food *Daphnia*



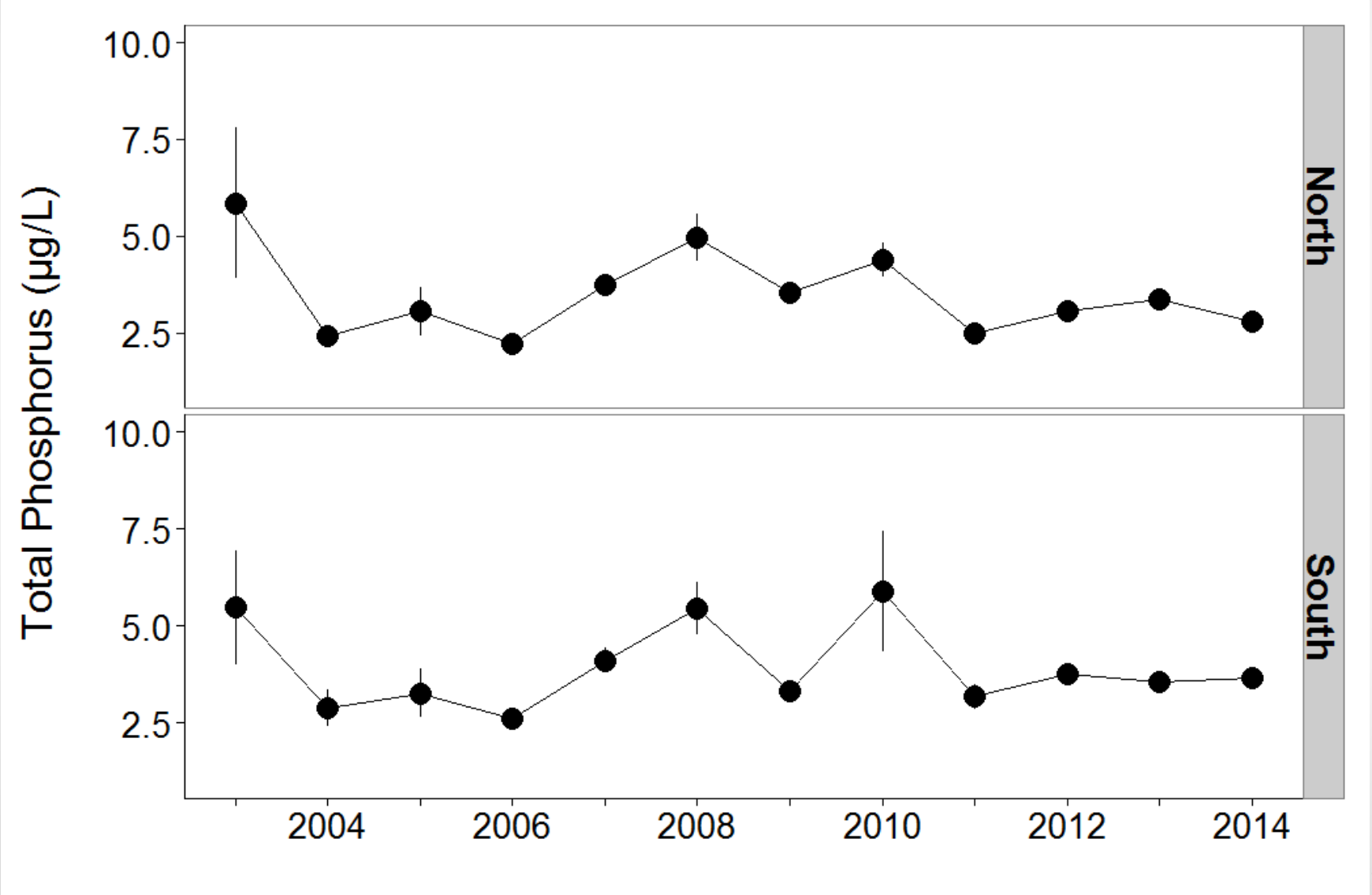
Zooplankton – Kokanee Food Total Density



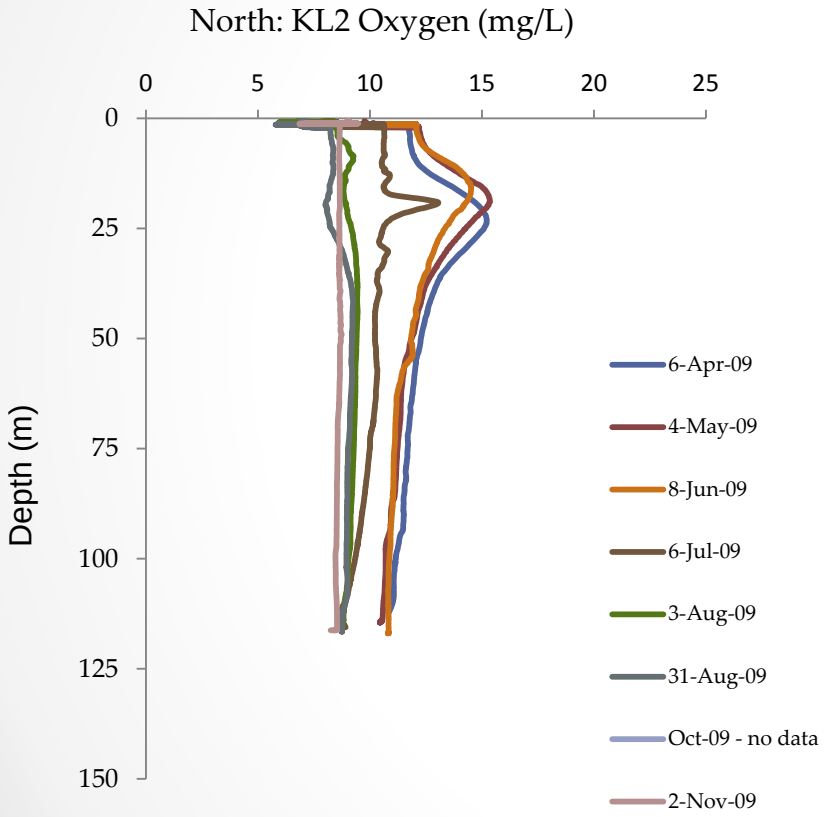
Phosphorus – Top 20 meters

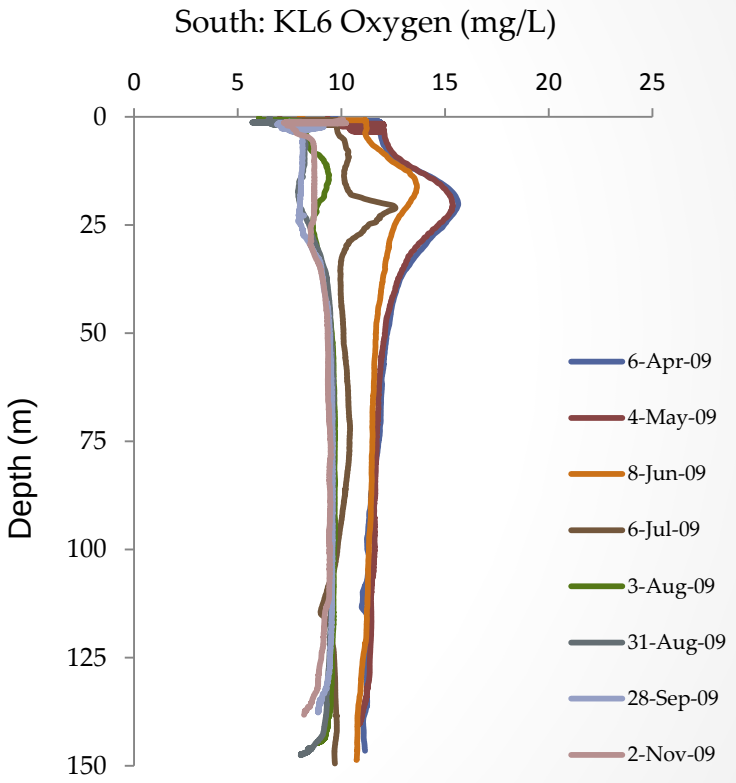


Phosphorus - Bottom

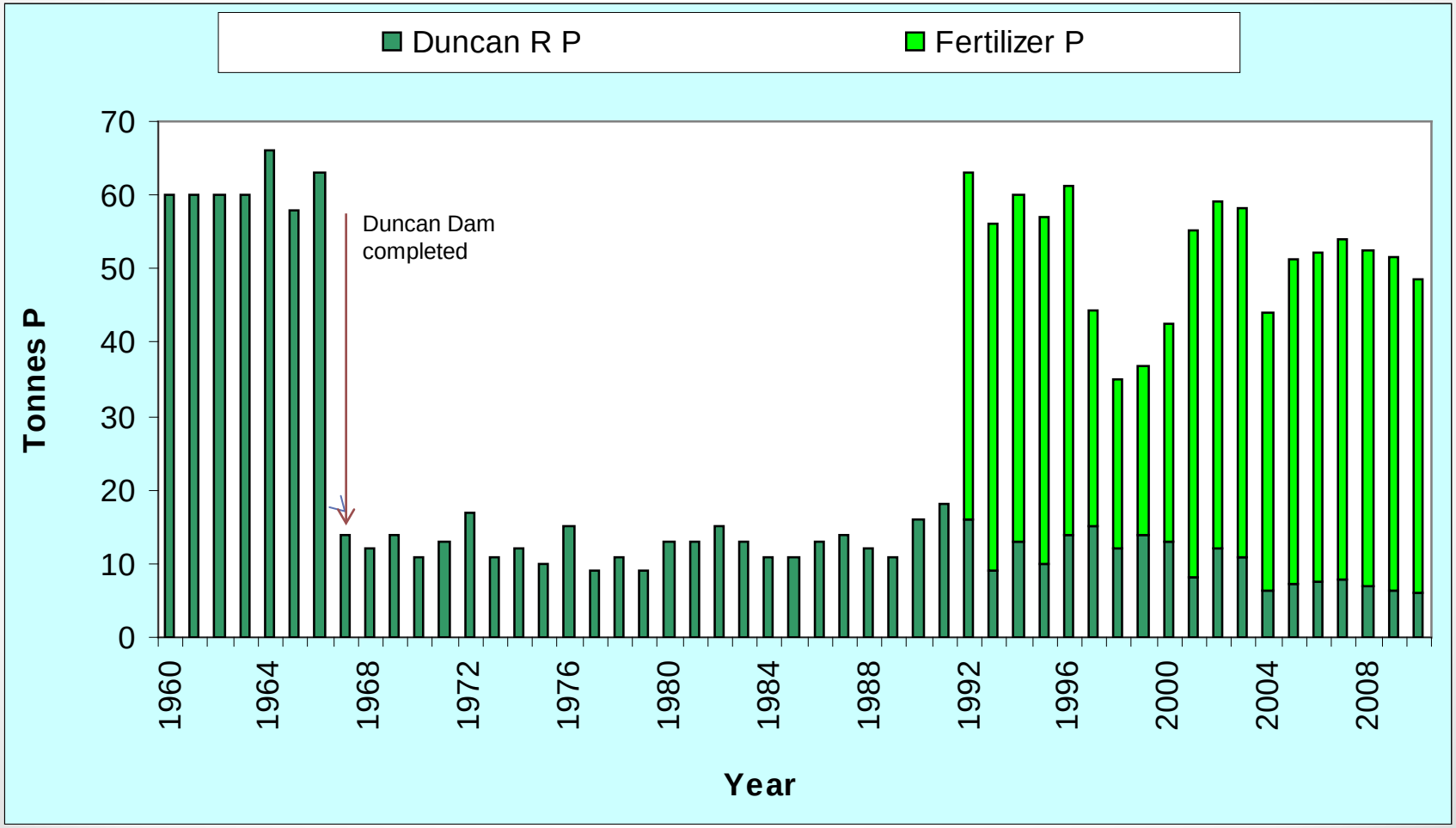


Oxygen Profile in a higher phytoplankton year

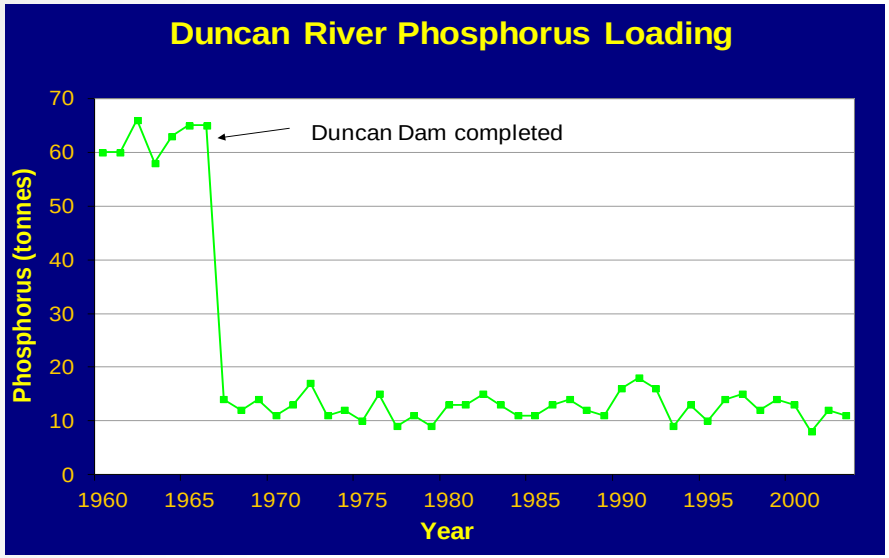


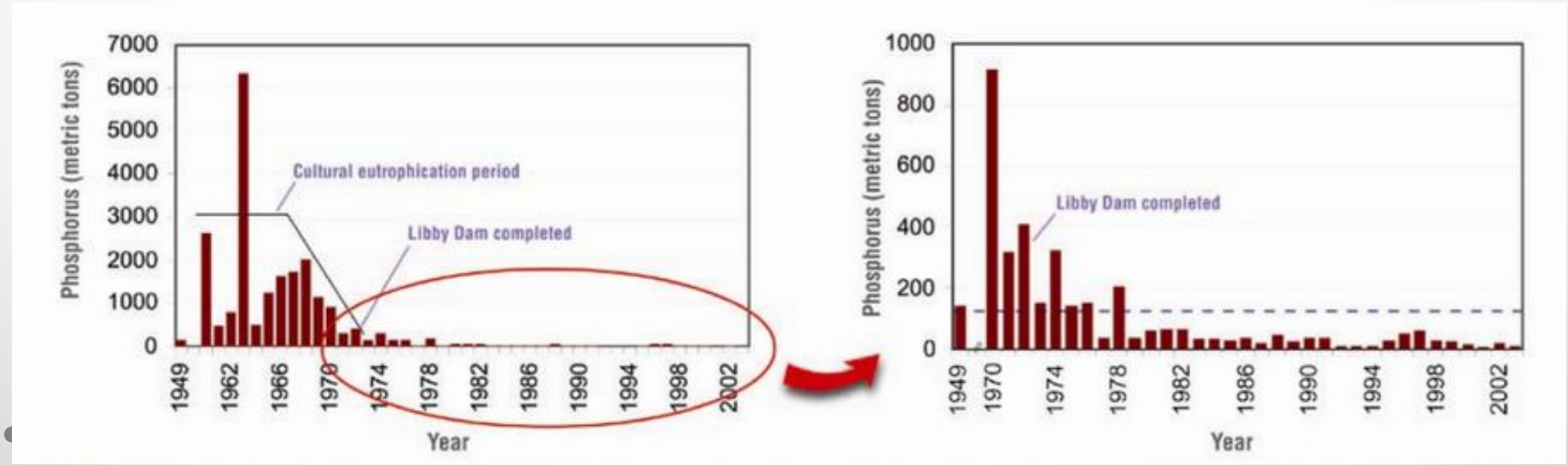


Phosphorus loading

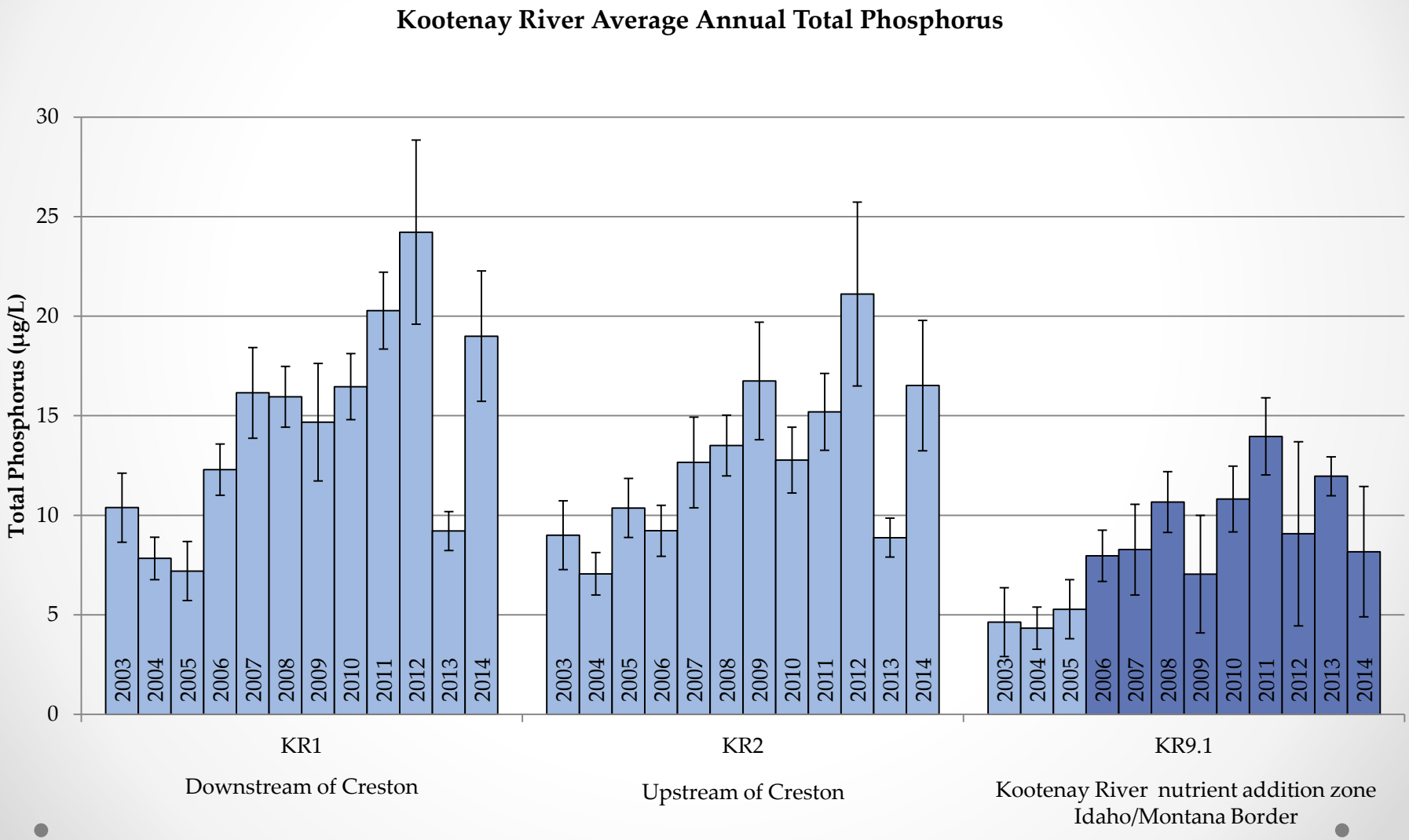


Phosphorus loading

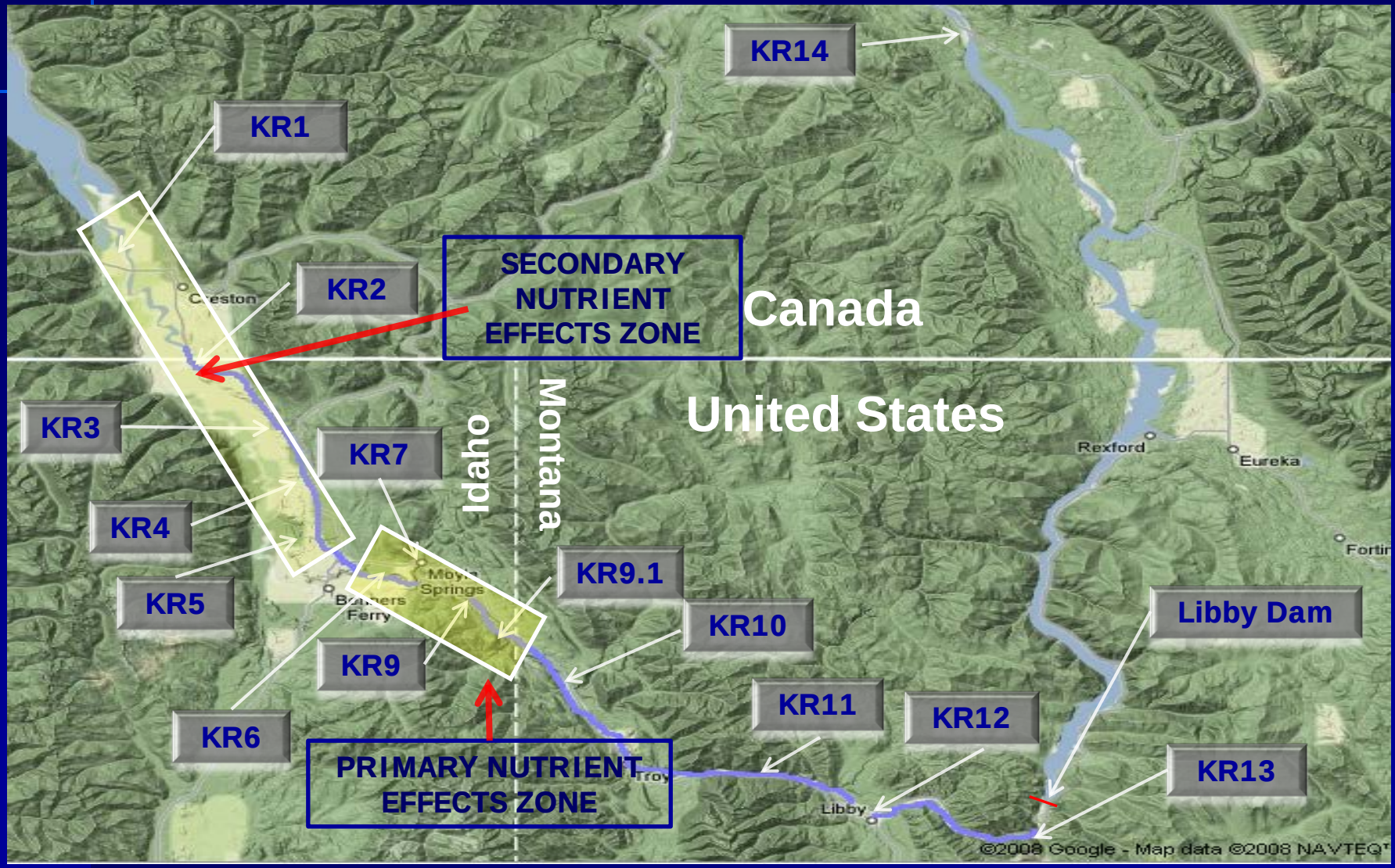




Phosphorus loading in Kootenay River



Kootenai(y) River Nutrient Addition Bio-Monitoring Sites



Nutrient addition Zones