Kootenay Lake Advisory Team

November 12-13, 2020

Virtual Meeting

Thank you to Funders and Contributors

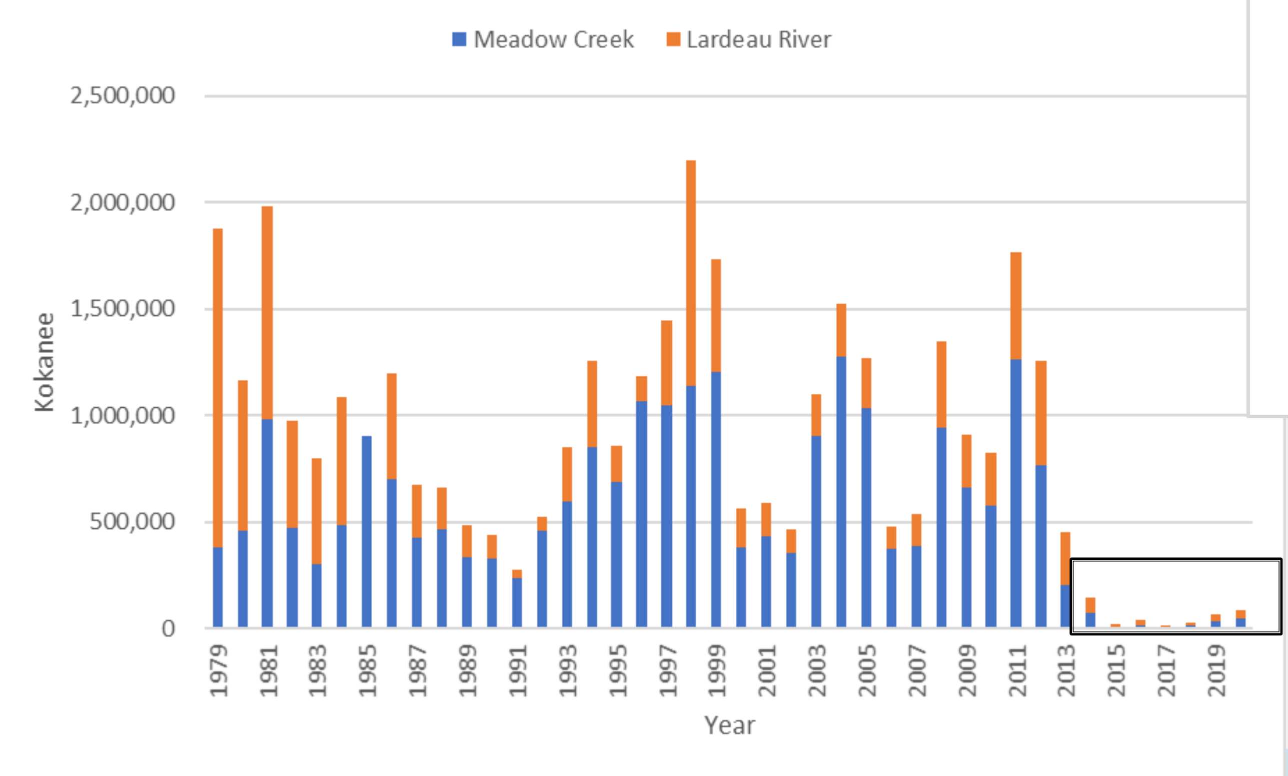
- Acknowledgments for funding – Nutrient program funding (including monitoring; FWCP, KTOI, BC Hydro, ENV, FLNR) Action plan implementation and enhanced monitoring (FFSBC, FLNR, FWCP, and HCTF)

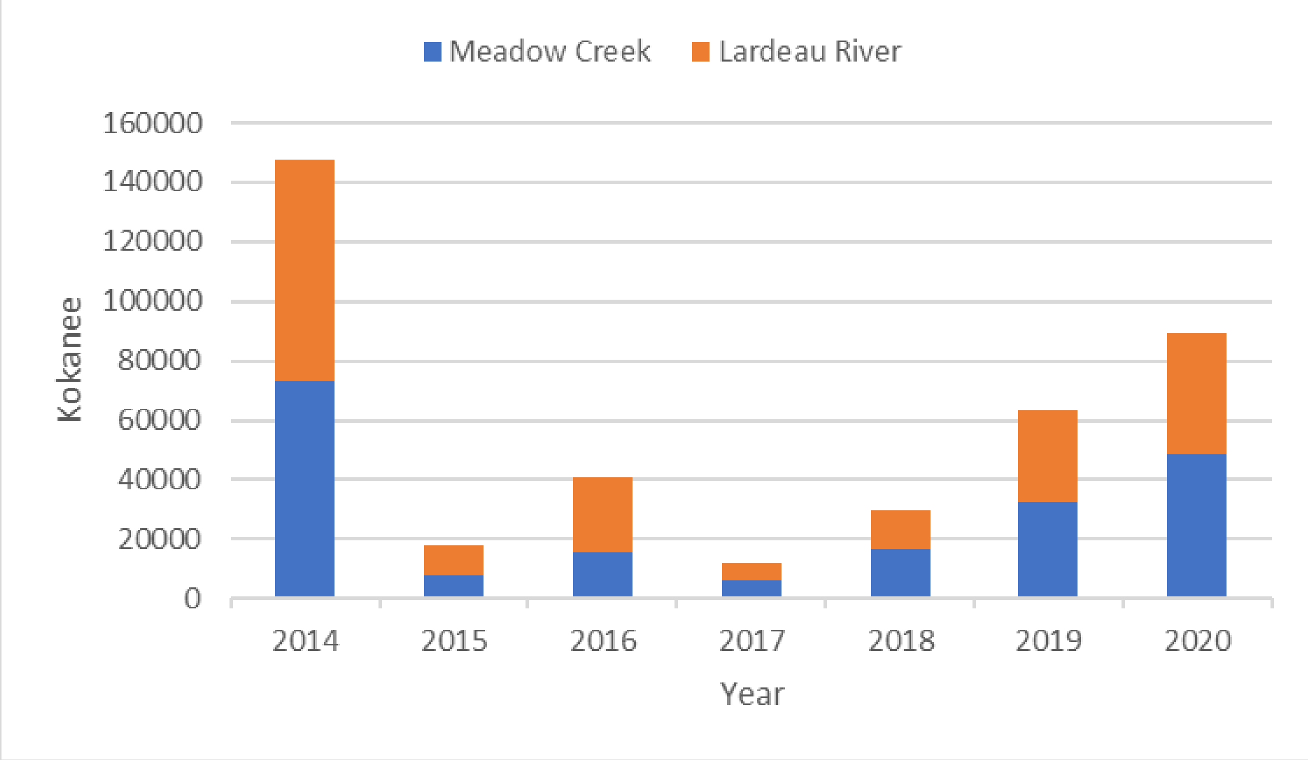
- Acknowledgments for contributors – too many to list…truly a collaborative, multi-faceted effort to recover Kootenay Lake. We thank all Advisory Team members, research technicians, FFSBC staff, nutrient program delivery team, external contractors delivering monitoring components…

Outline

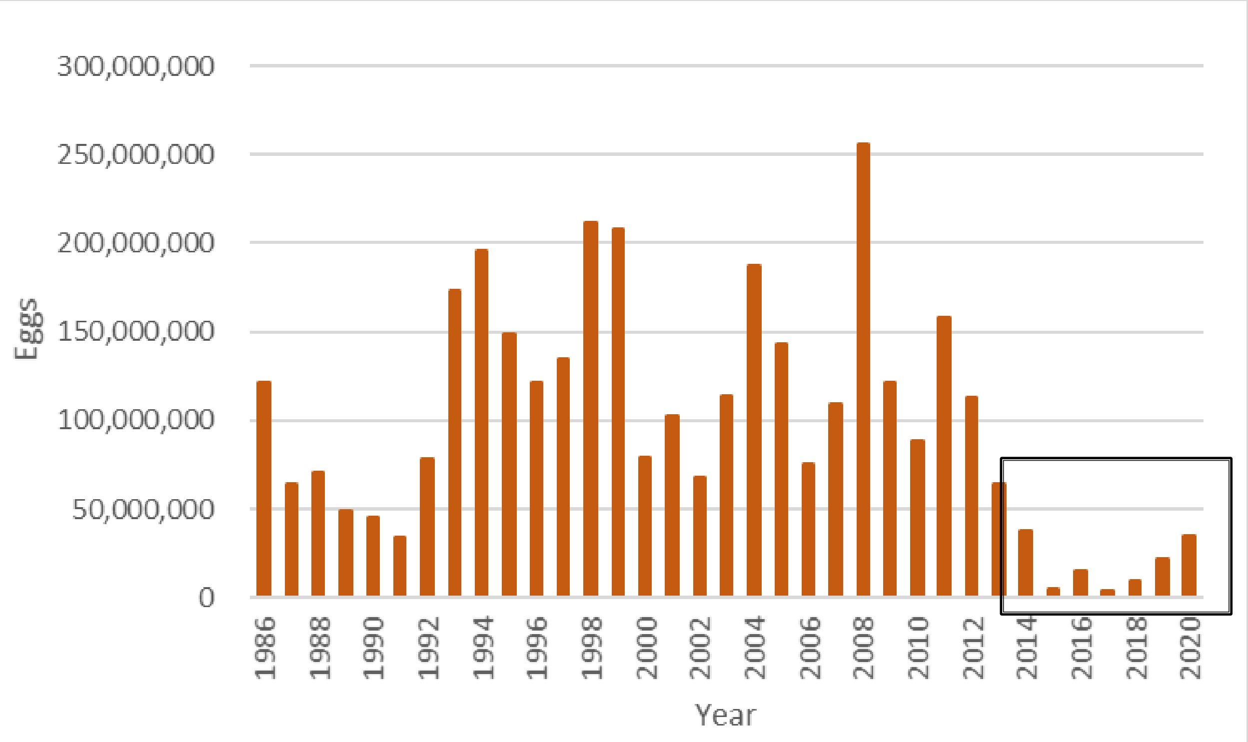
- Biological Response Update
- Review Actions, Triggers, and Implementation update from 2020 (what did we do?)
- Provide some analysis/ideas to help inform discussions around Key Questions.

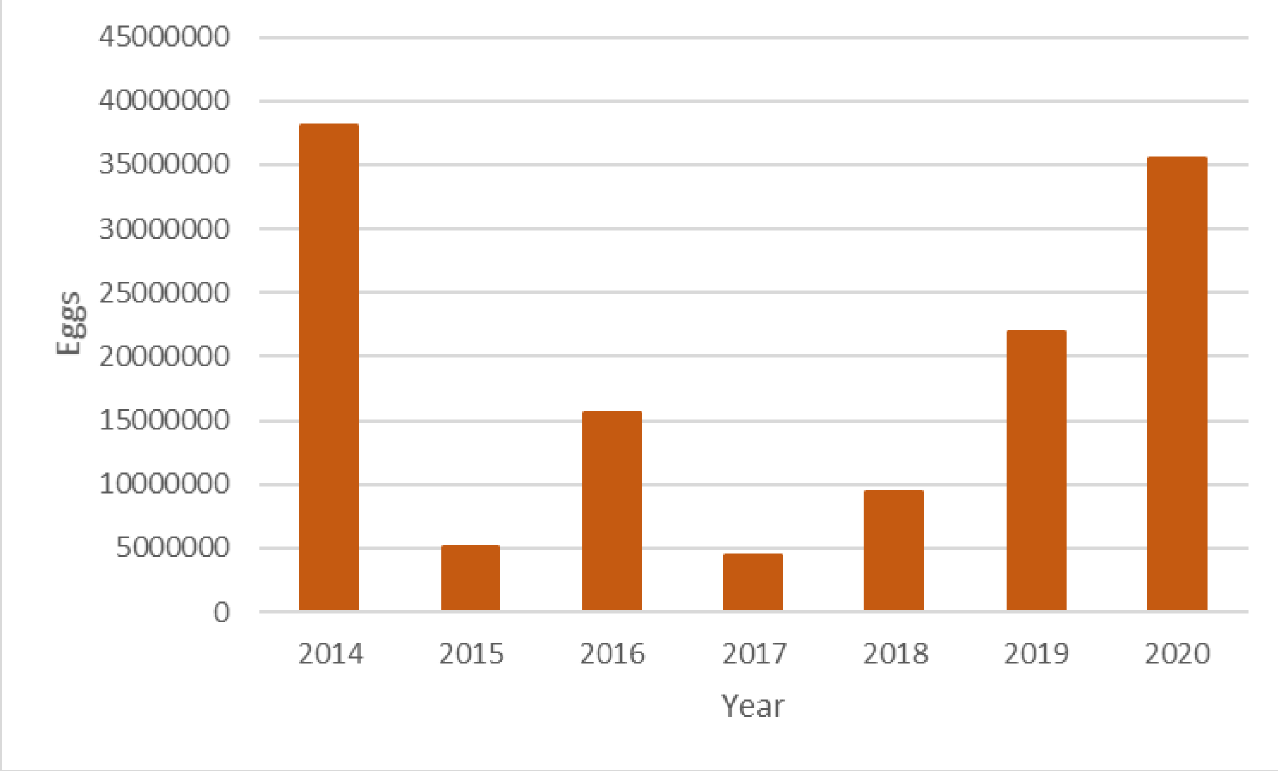
Kootenay Lake North Arm Kokanee Escapement



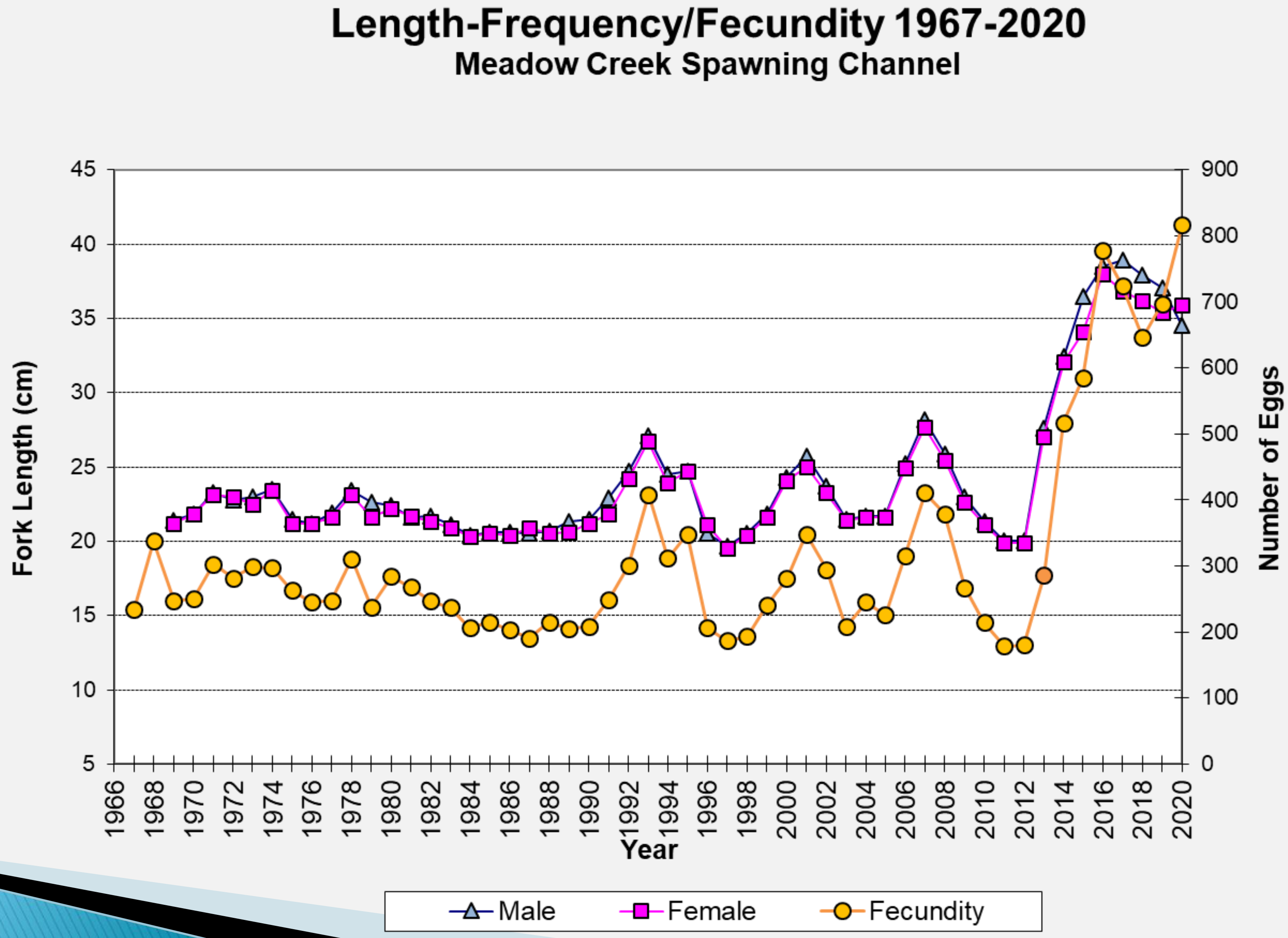


Kootenay Lake North Arm Kokanee Egg Deposition

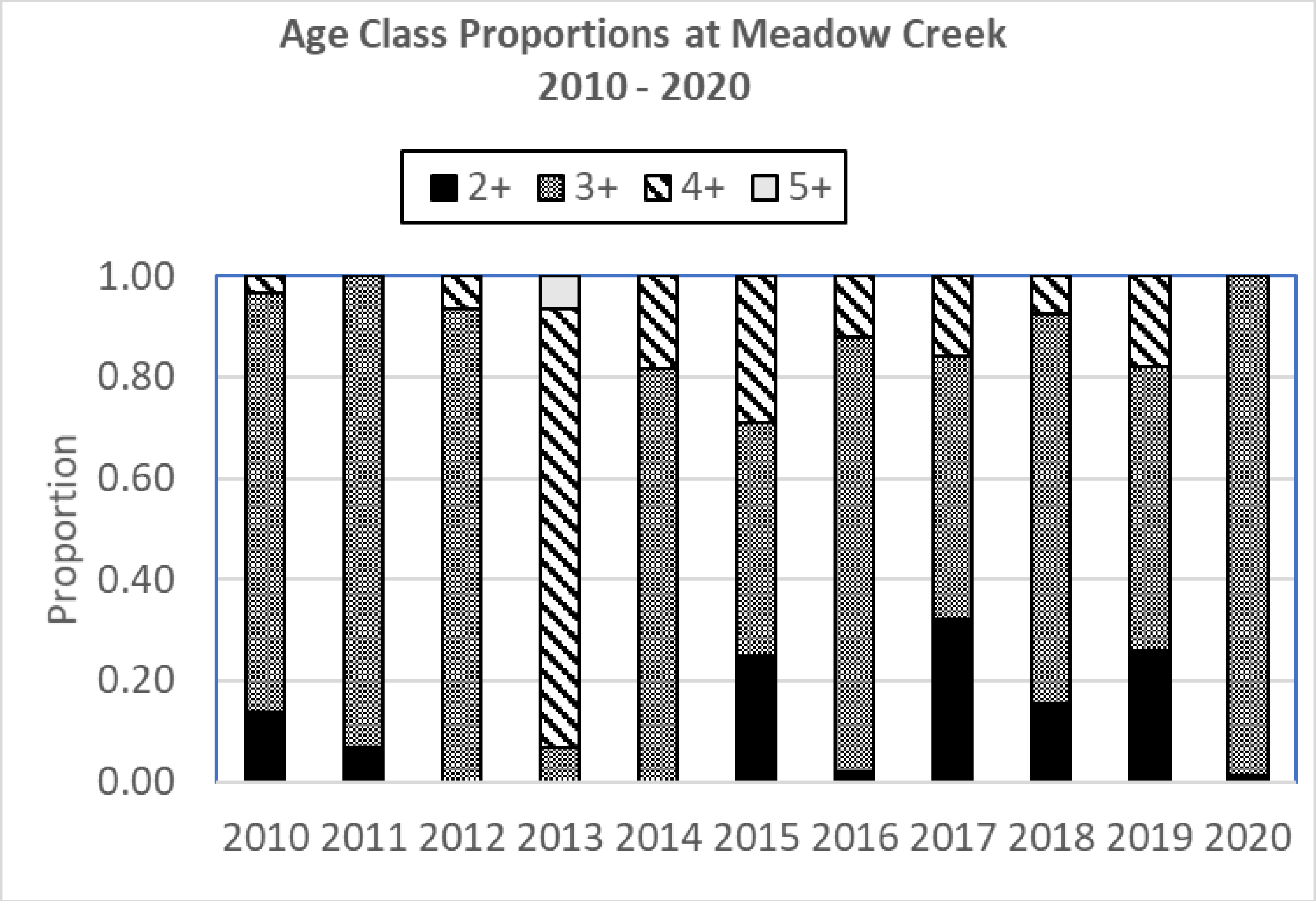




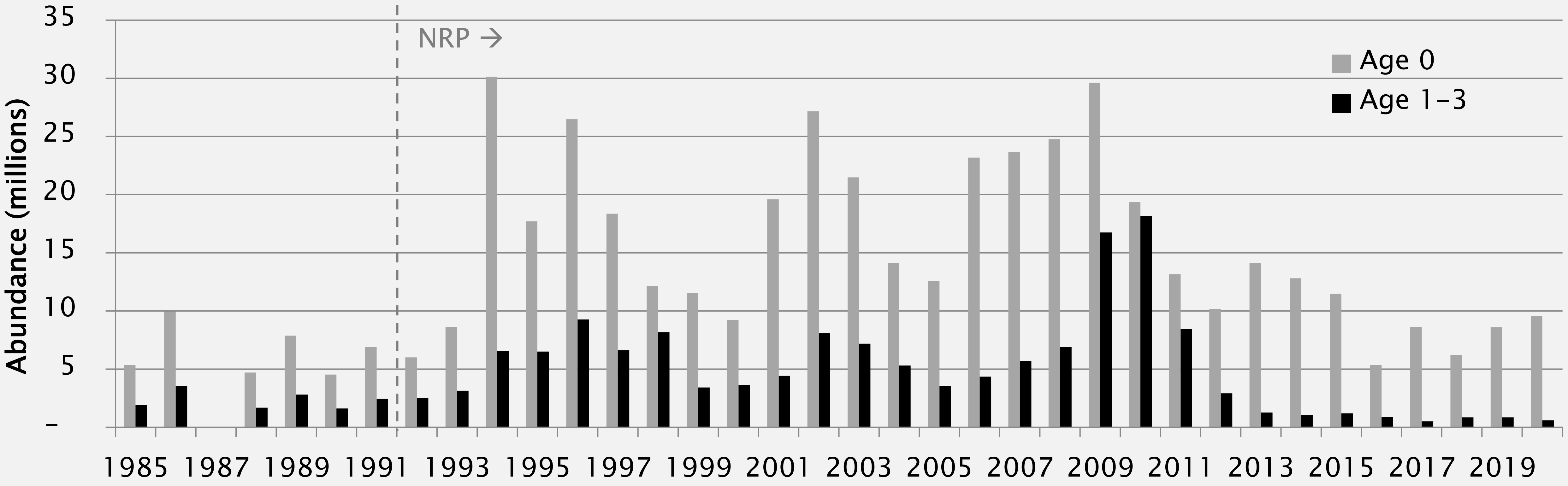
Meadow Creek Kokanee Size and Fecundity



Meadow Creek Kokanee Age Distribution

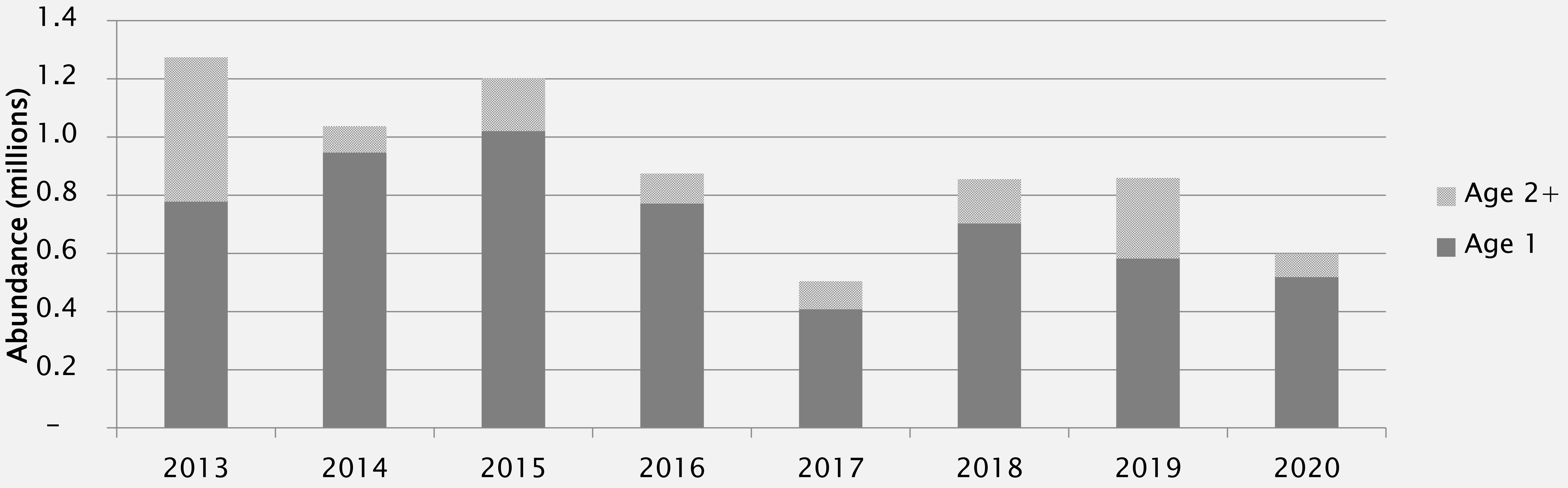


In-lake Kokanee abundance



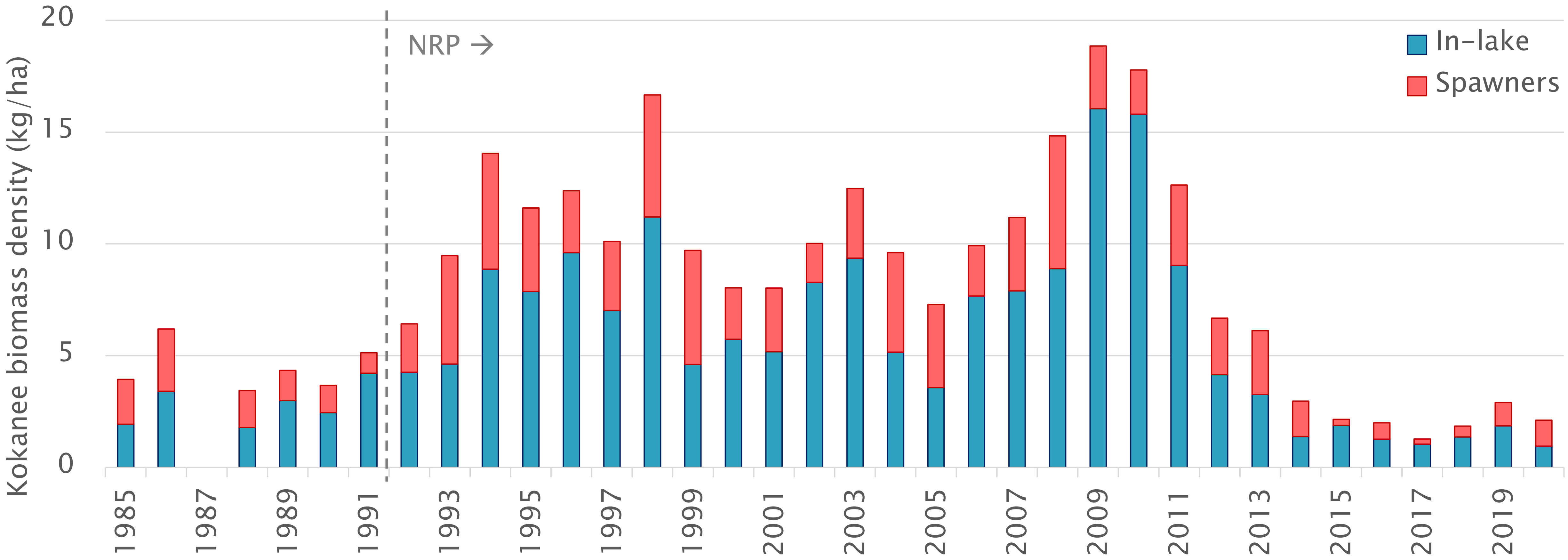
Acoustic abundance trends from fall surveys of Kootenay Lake. 2020 data are preliminary.

Age 1 & 2+ in-lake Kokanee abundance



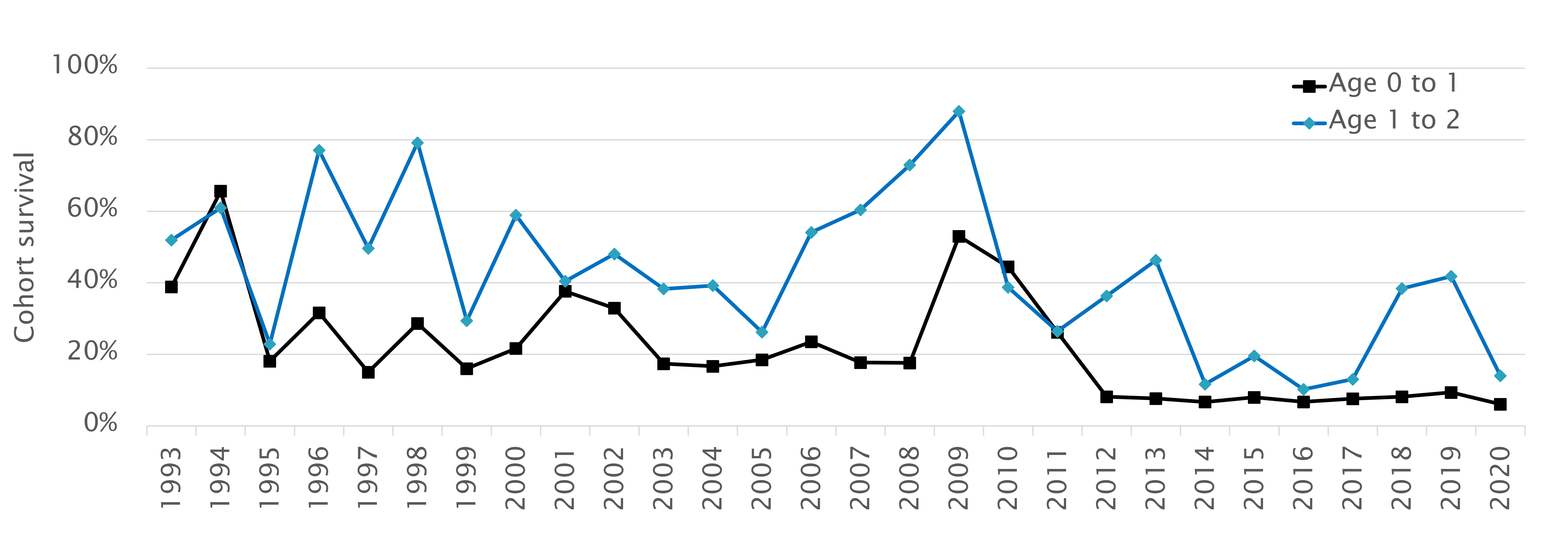
Acoustic abundance by age from fall surveys of Kootenay Lake from 2013-2020. 2020 data are preliminary.

Kokanee fall biomass density



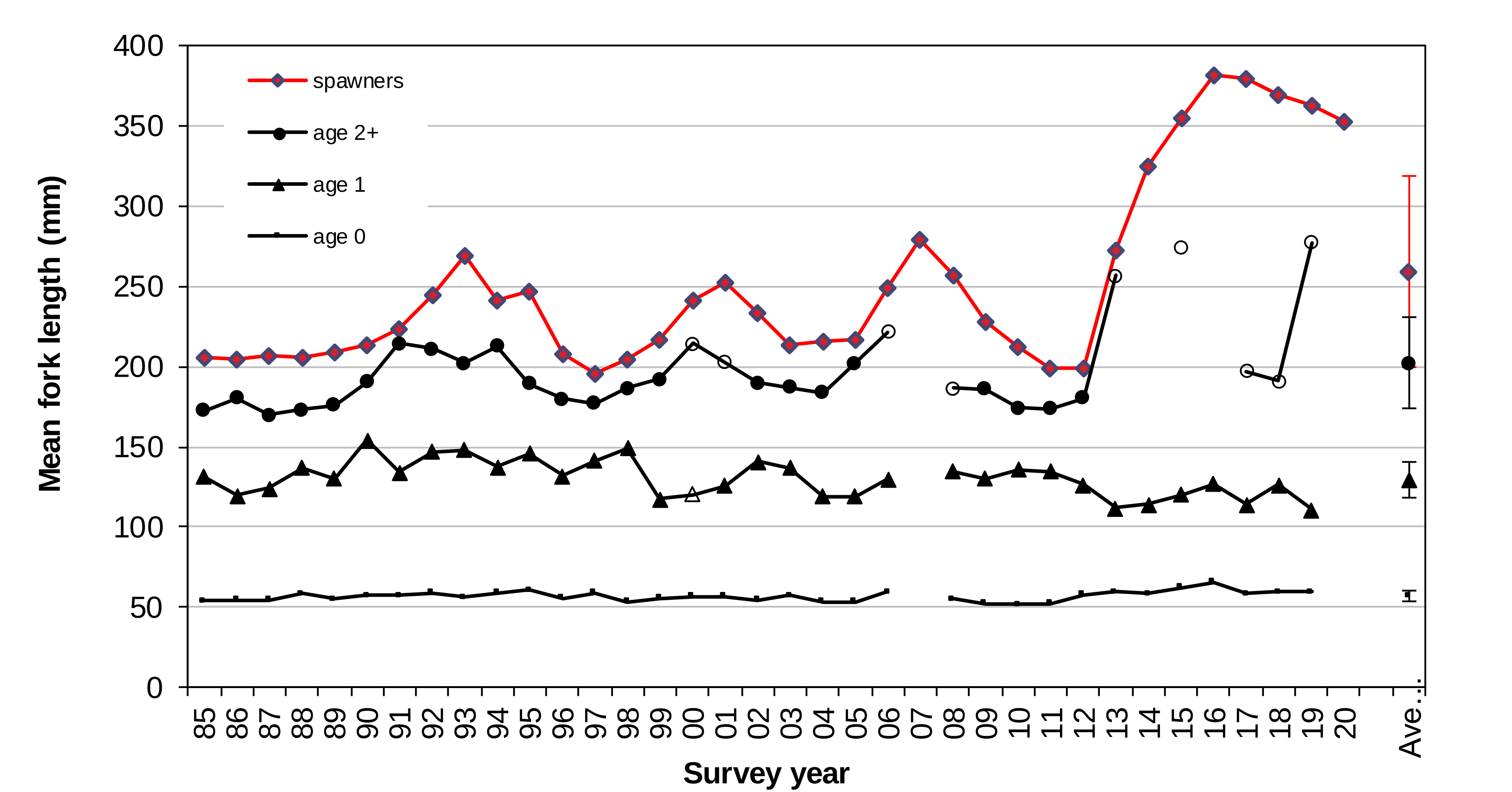
In-lake and spawner biomass trends for Kootenay Lake. 2020 data are preliminary.

Kokanee cohort survival (September acoustic surveys)



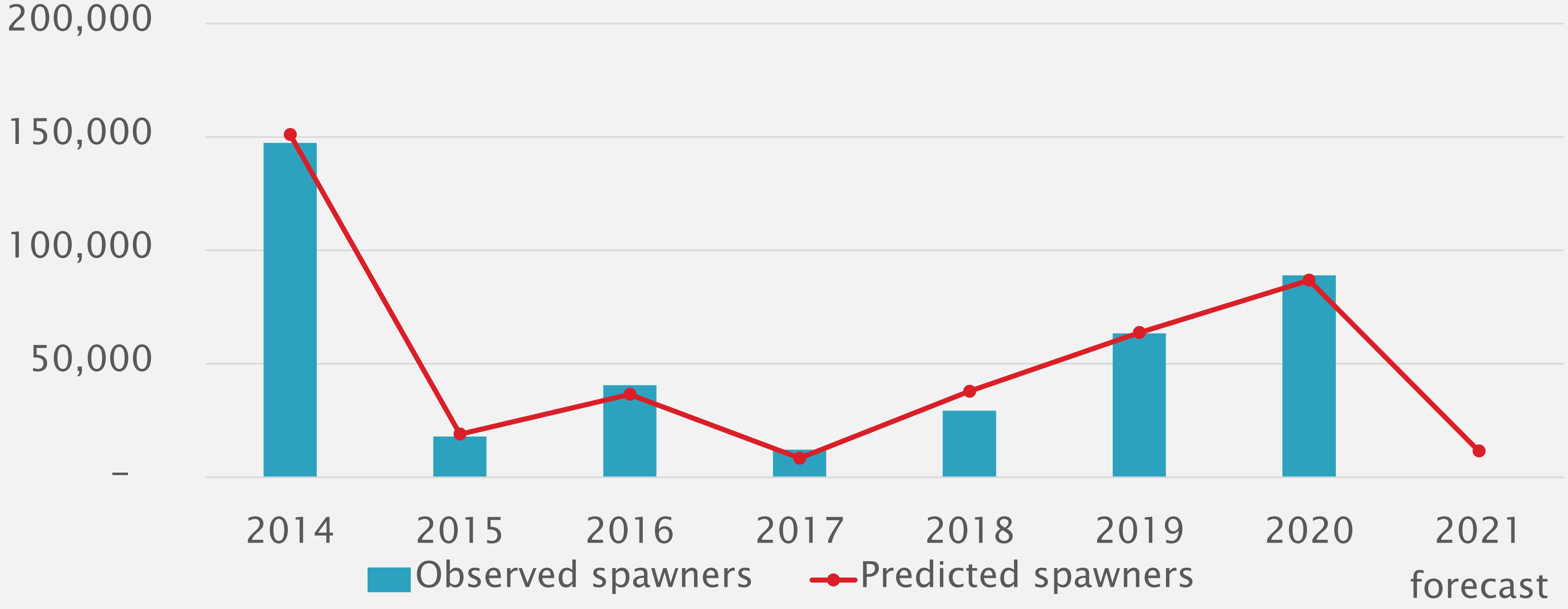
Survival trends between September hydroacoustic sureys for Kootenay Lake Kokanee. 2020 data are preliminary.

Kootenay Kokanee – Mean Fork Length



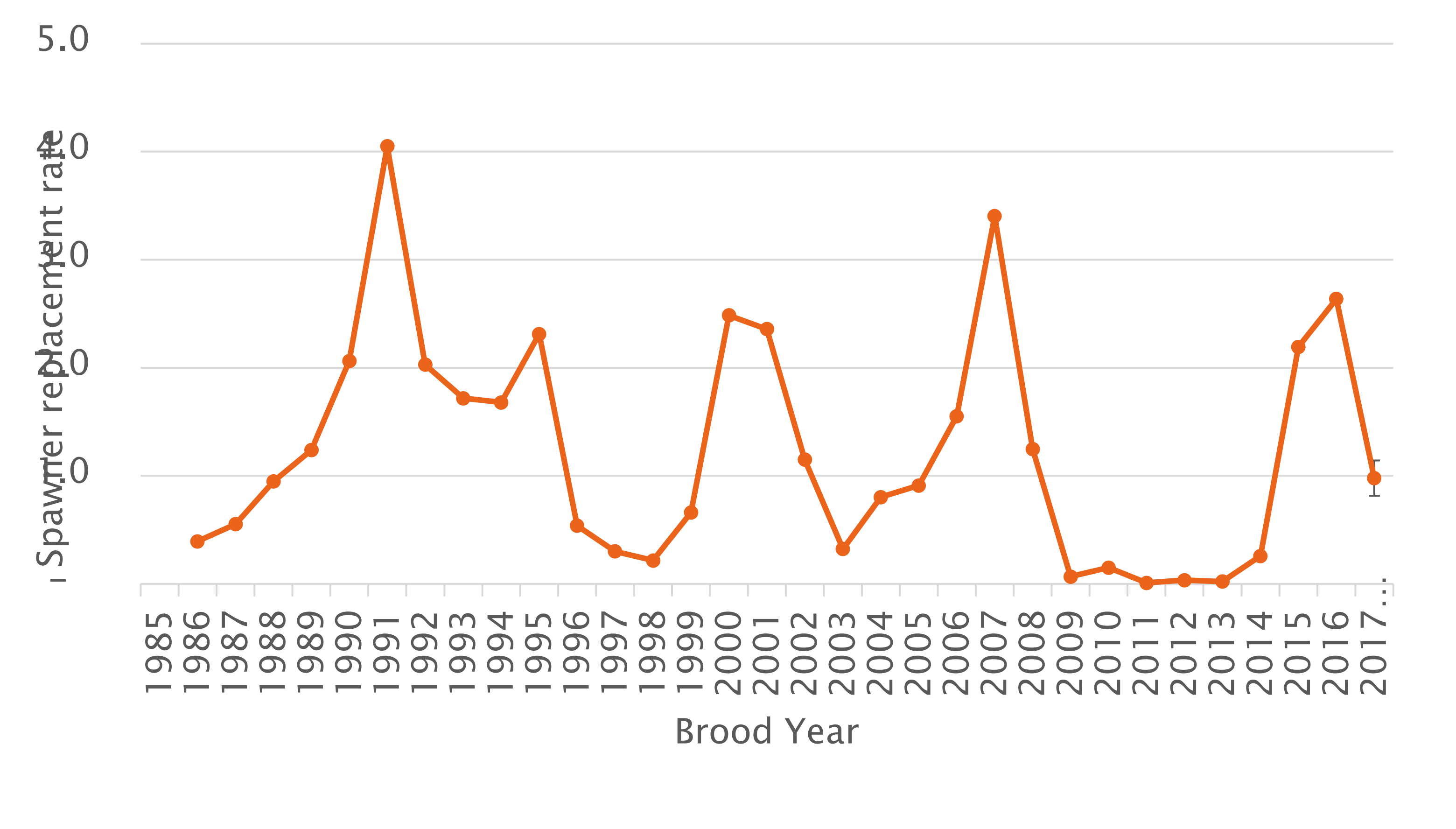
Mean fork length of trawl caught from fall trawl sampling in Kootenay Lake, and mean spawner fork length from Meadow Creek spawning channel. Fork lengths from trawl captured fish are corrected to an October 1st standard. Sample sizes less than 10 are identified by hollow points.

Kokanee spawner forecast



Spawner forecast for North Arm Kootenay Lake Kokanee spawners. 2021 forecast based in preliminary acoustic data from the fall 2020 survey.

Kokanee spawner replacement

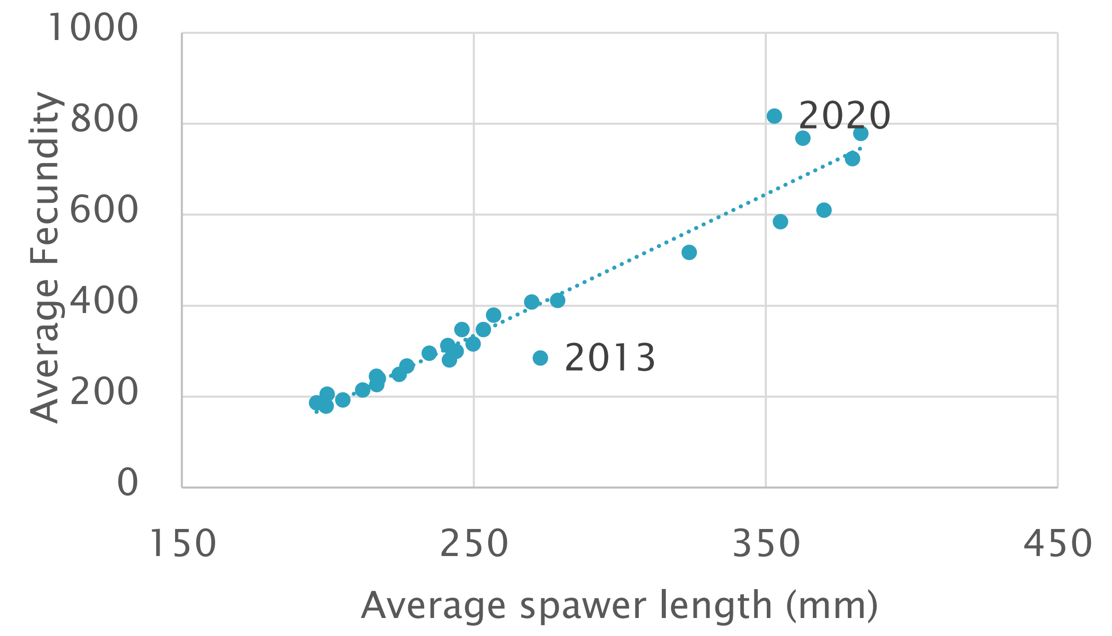


1. Dramatic improvement in replacement rate for 2015 and 2016 BY's (aligns with improved 1-2 survival in 2018, 2019)

2. 2017 BY estimate based on 2021 spawner forecast and average spawner age structure. Bounds show range with 12 vs 18 K spawners. Replacement still likely better than 09-14 BY's.

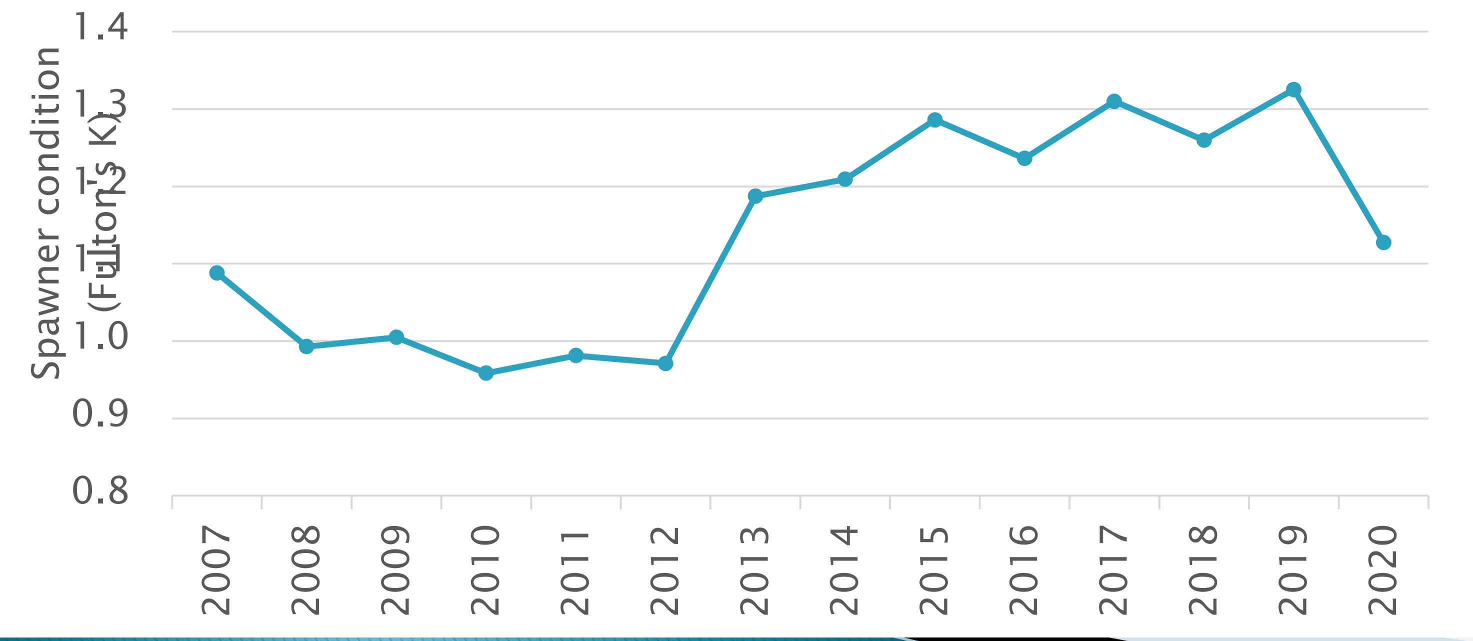
3. Not shown (or conclusive) but Meadow replacement rate improved relative to Lardeau for 2015 & 2016 BY's suggesting egg plants produced more spawners for Meadow.

Insights from Kokanee spawner fecundity and condition



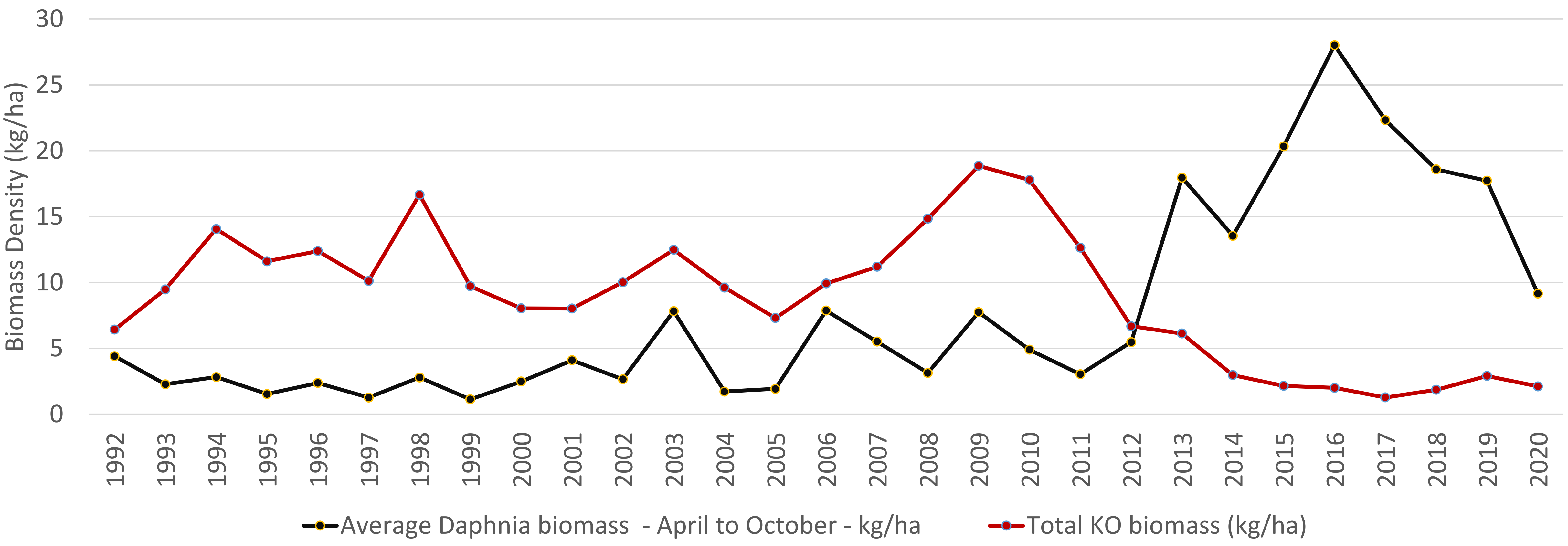
- 2020 fecundity > predicted by length suggests growth better in 2019 than 2020 – fecundity is set prior to spawning year
- 2013 demonstrates the opposite where growth much better than year prior

Key point – lower fecundity likely next year regardless of growing conditions in 2021

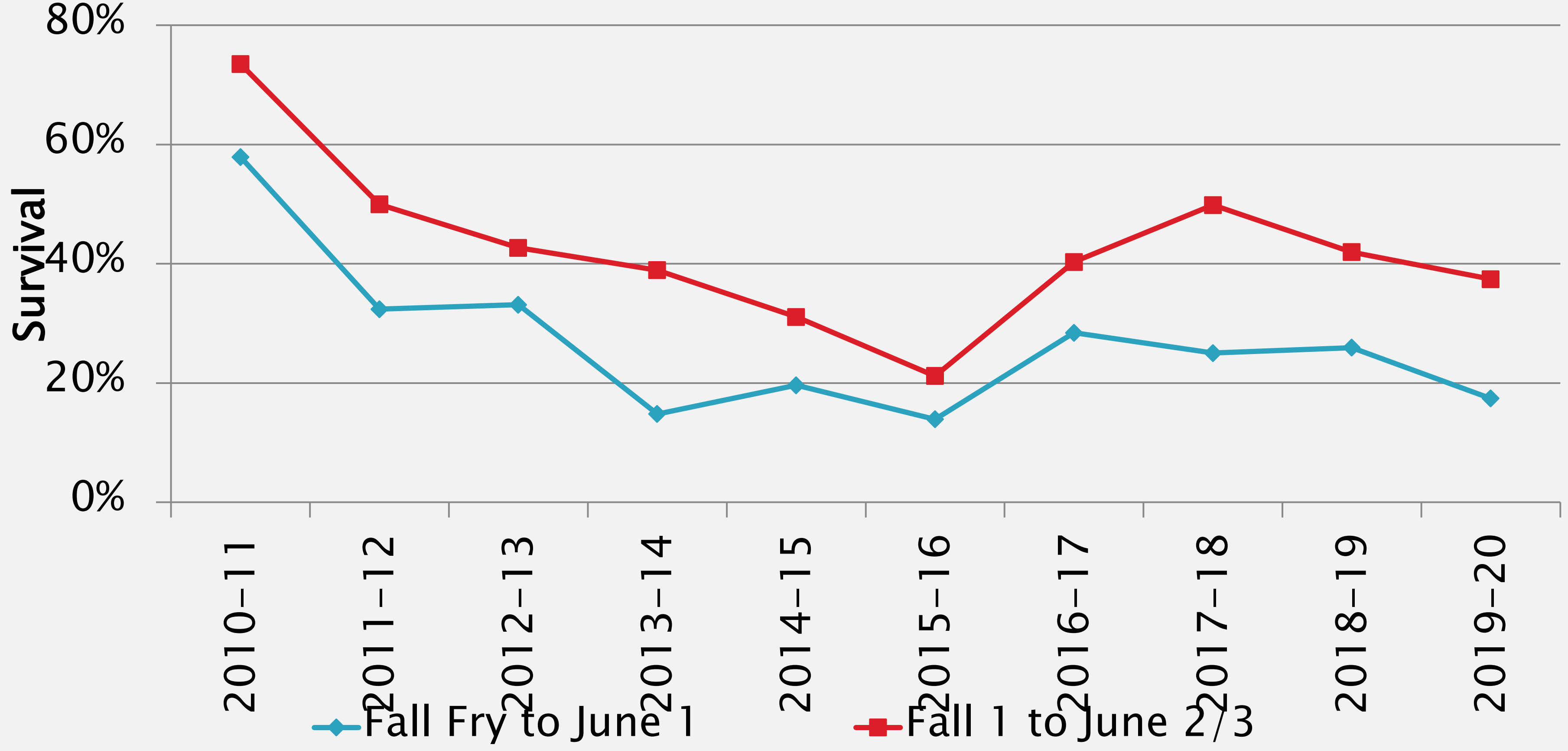


- No trawl data in 2020 but 2020 spawner K suggests reduced growing conditions compared to other post-collapse years
- Reduced K not likely related to increased grazing pressure

Average Daphnia biomass and total Kokanee biomass (kg/ha)



Kokanee Fall to June survival



Survival trends for Kootenay Lake Kokanee from September to following June. 2020 data are preliminary.

Summary of Acoustic/Kokanee data

- Fry abundance moderate in 2020 and likely in 2021 providing basis for recovery with improved survival while age 1 Kokanee numbers low and age 2+ very low.

- Forecast for 2021 spawners very low (12-18K), similar to 2015, 2017. However, spawner replacement rate for 2021 expected to be near 1 (much better than earlier BY's in post-collapse era).

- In-lake survival trends – no improvement in age 0-1, return to earlier post-collapse low for age 1-2. June data suggests most mortality occurs between Sept & June, so impacts of predator removal program on Kokanee likely to be observed in 2021 as opposed to 2020.

- In-lake biomass remains low, larger proportion was spawners in 2020, very low in-lake due to weak age 2+ numbers

- No trawling in 2020 (2 broken down boats & low fish densities) but size/condition/fecundity data from Meadow spawners suggests reduced growth year relative to other post-collapse years, but still plenty of Daphnia resources on a seasonal average basis.

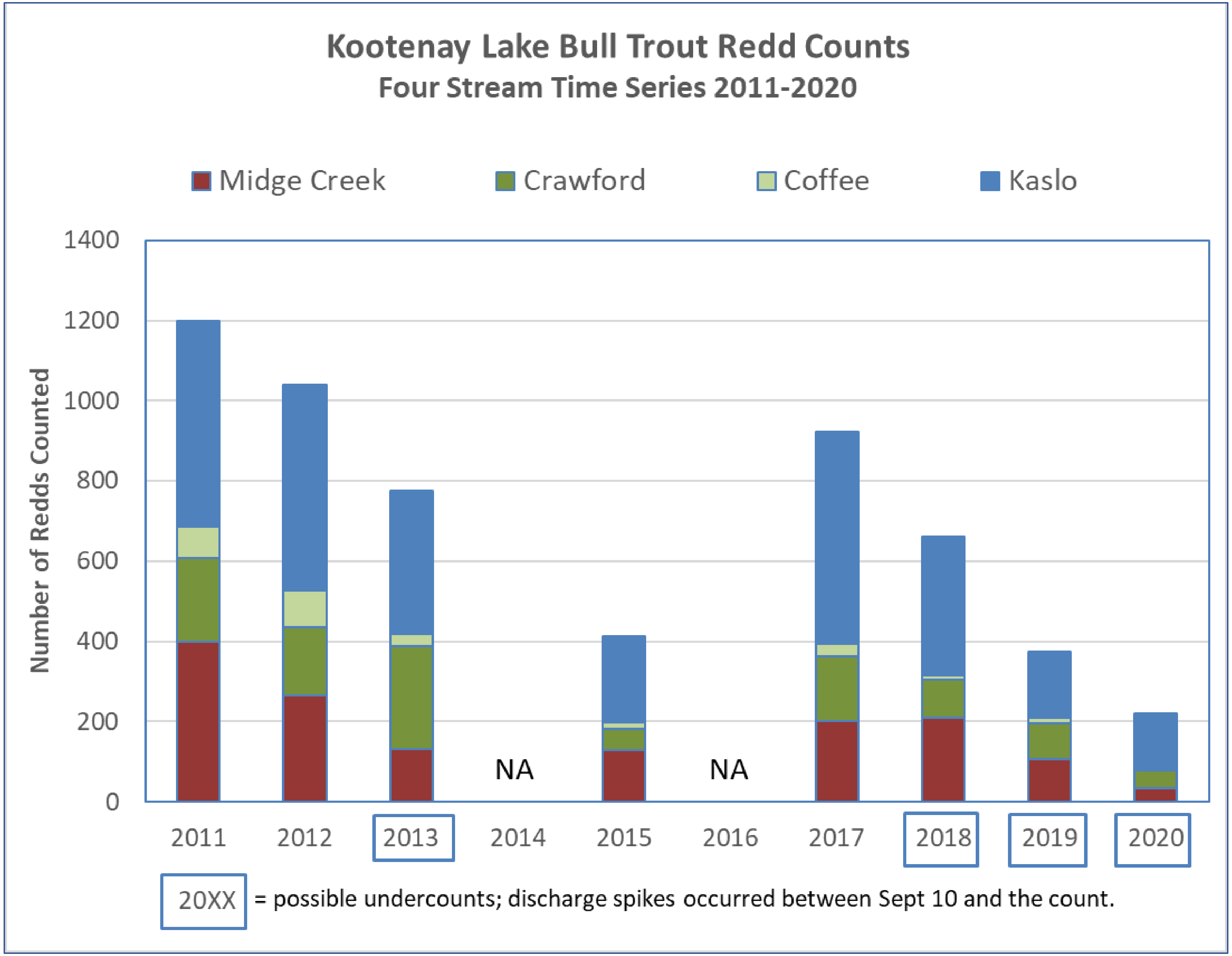
- Likely lower fecundity next year, and with range of spawners forecast 2021 egg deposition could be as low as 3 million and likely not much higher than 7 million

Kootenay Lake Bull Trout Redd Counts 2020

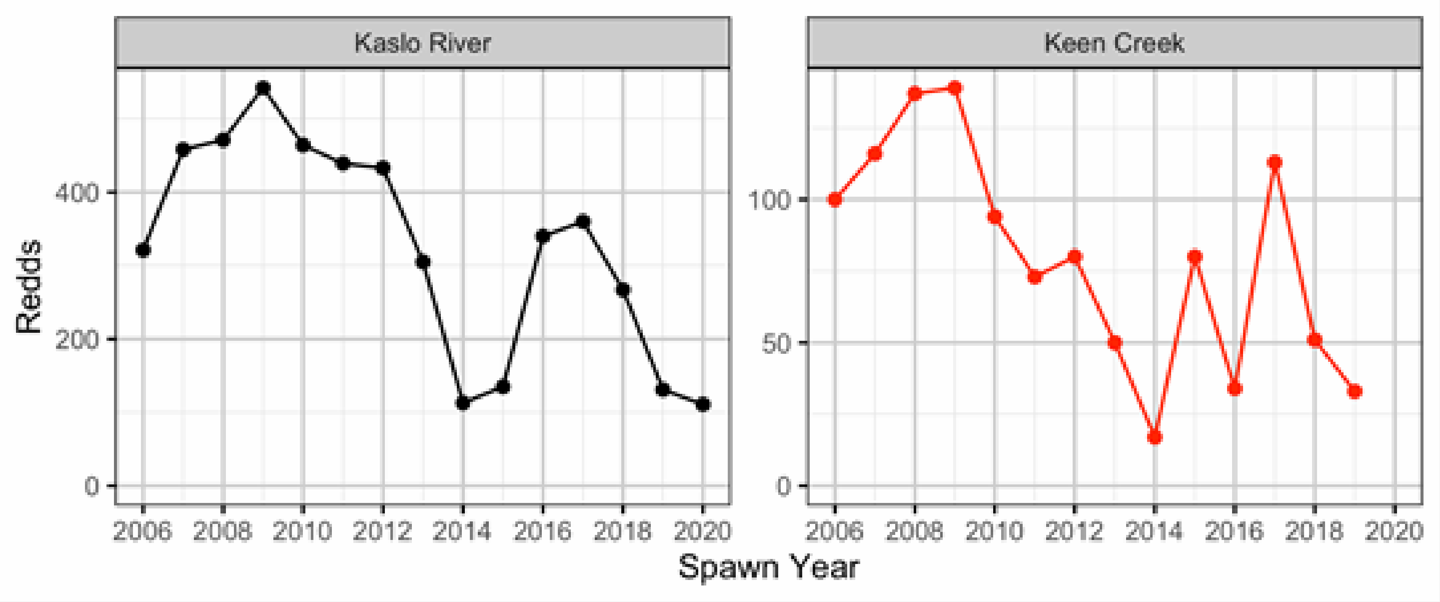
Stream	2019	2020	Decline
Upstream Flip Bucket Fish Count - Duncan Dam	na	na	-
Hamill	na	na	-
Poplar	0	na	-
Meadow	38	36	5%
North Arm tributaries	**inc**	**inc**	-
Crawford	91	43	53%
Kaslo-mainstem	131	111	15%
Kaslo-Keen	33	na	-
Coffee	14	5	64%
Central tributaries	**269**	**inc**	-
Midge	105	34	68%
Cultus	11	na	-
South Arm tributaries	**116**	**inc**	
TOTAL REDDS COUNTED	**423**	**229**	-

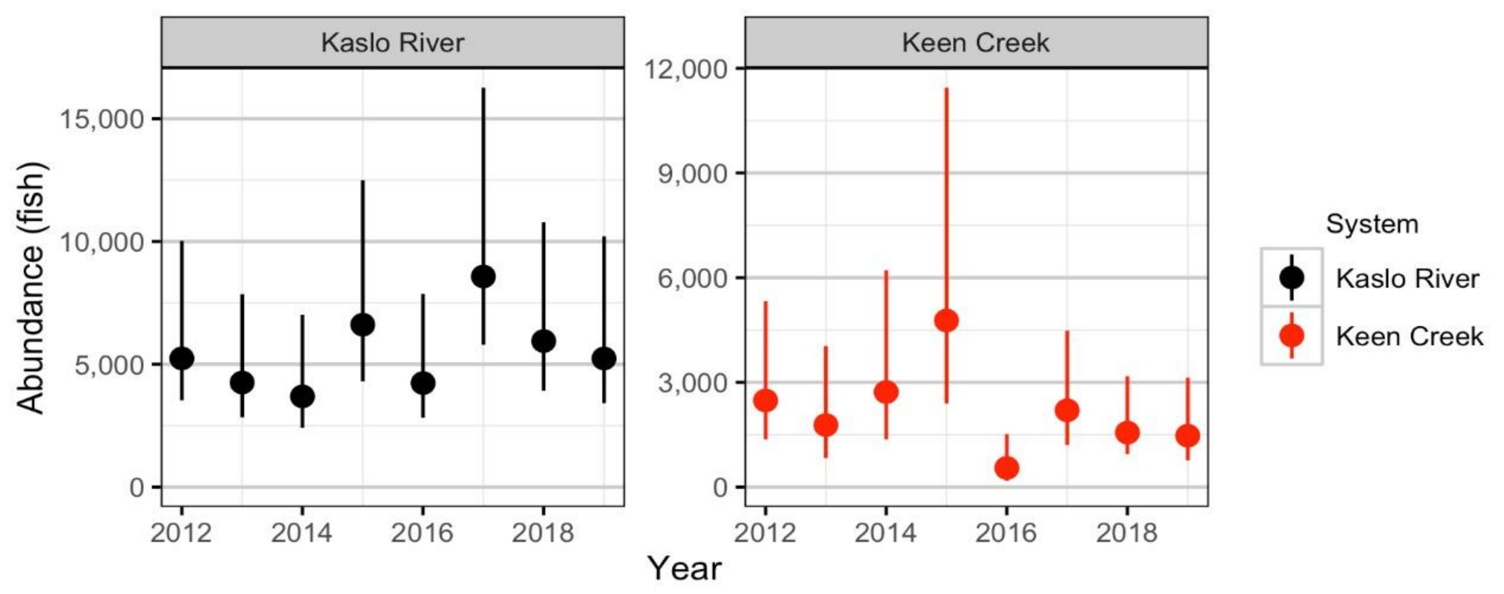
- Orange shading = incomplete counts
- 5 streams counted in 2020

Data credits: FWCP, HCTF, Redfish Consulting Ltd. Masse Environmental Consultants, Mountain Water Research

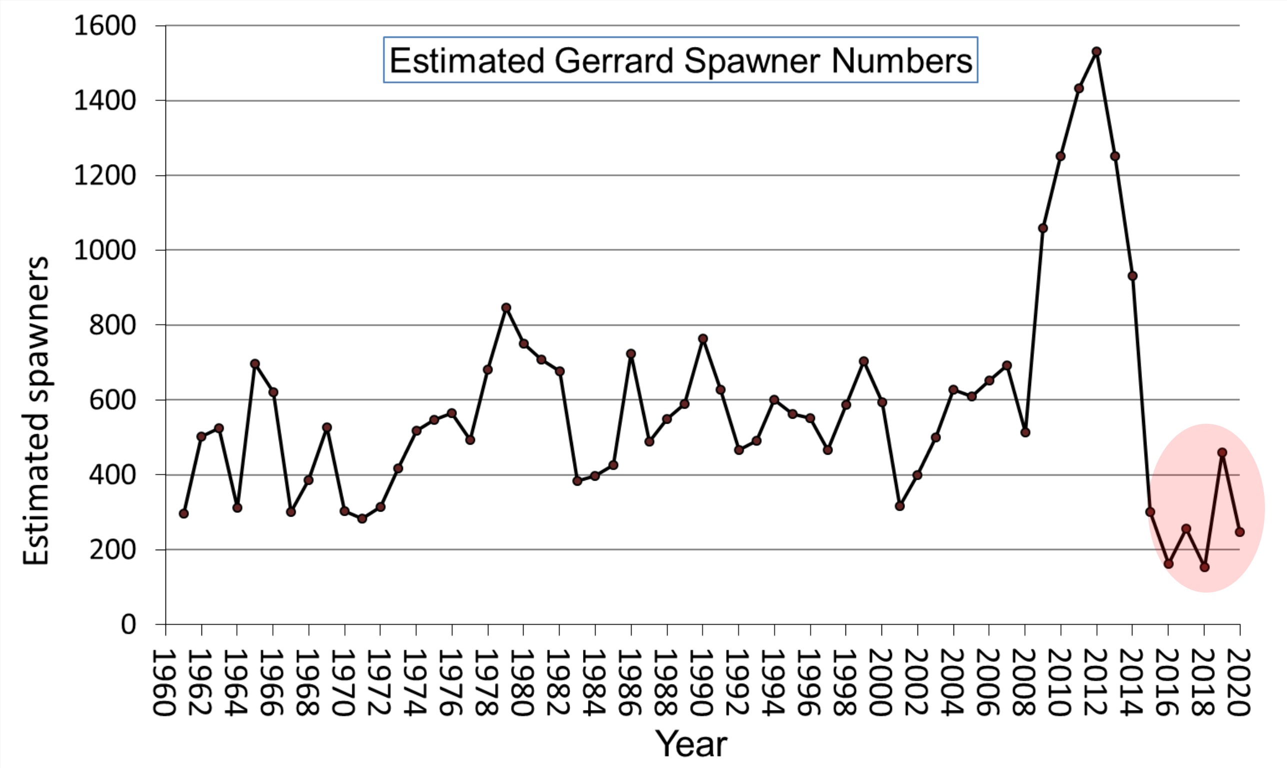

Kootenay Lake Bull Trout Redd Counts
Four Stream Time Series 2011-2020
Midge Creek
Crawford
Coffee
Kaslo
Number of Redds Counted
1400
1200
1000
800
600
400
200
0
NA
NA
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
20XX = possible undercounts; discharge spikes occurred between Sept 10 and the count.

KASLO RIVER–BULL TROUT REDD COUNTS AND AGE 1





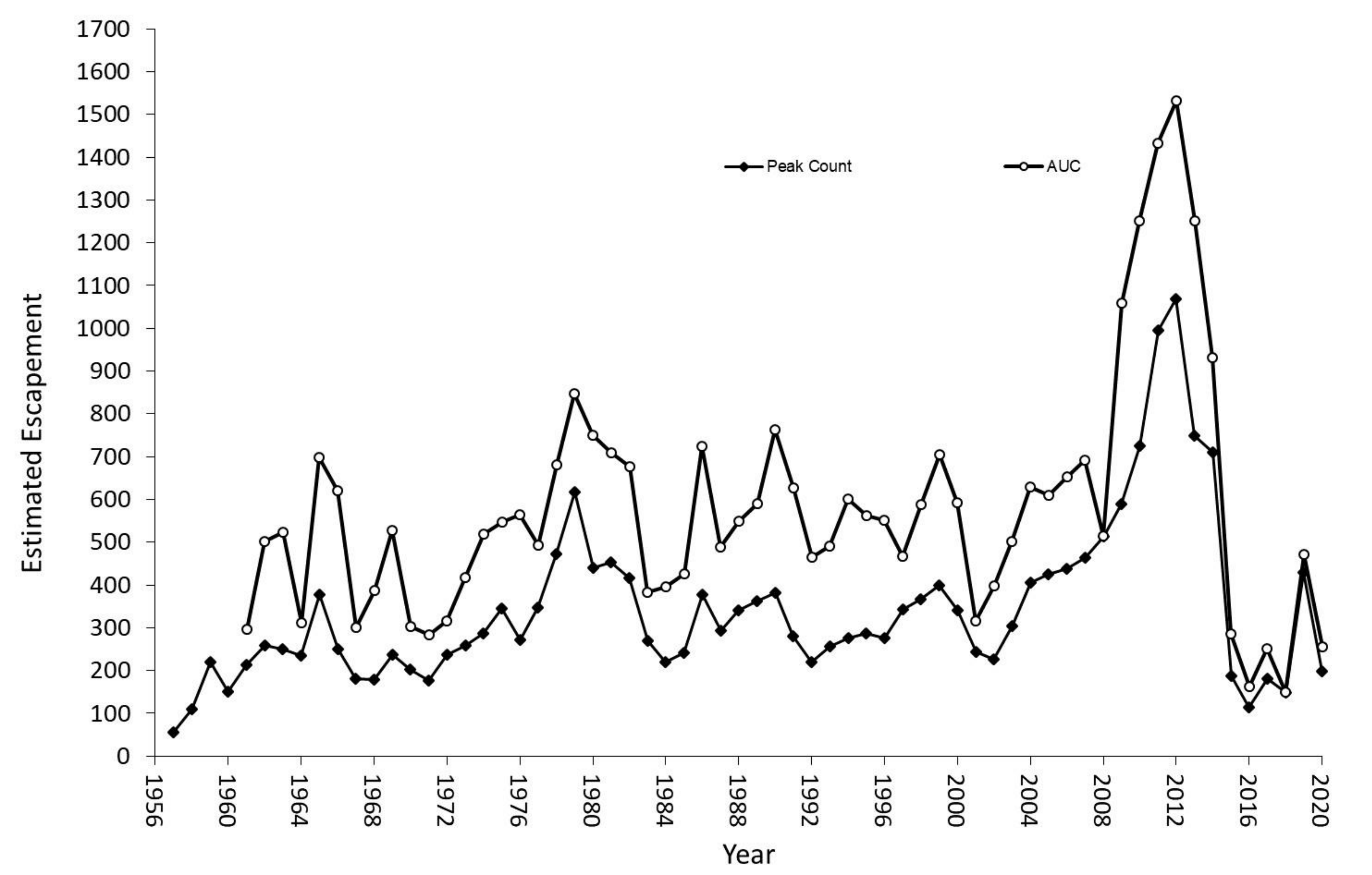
Gerrard Spawner Abundance



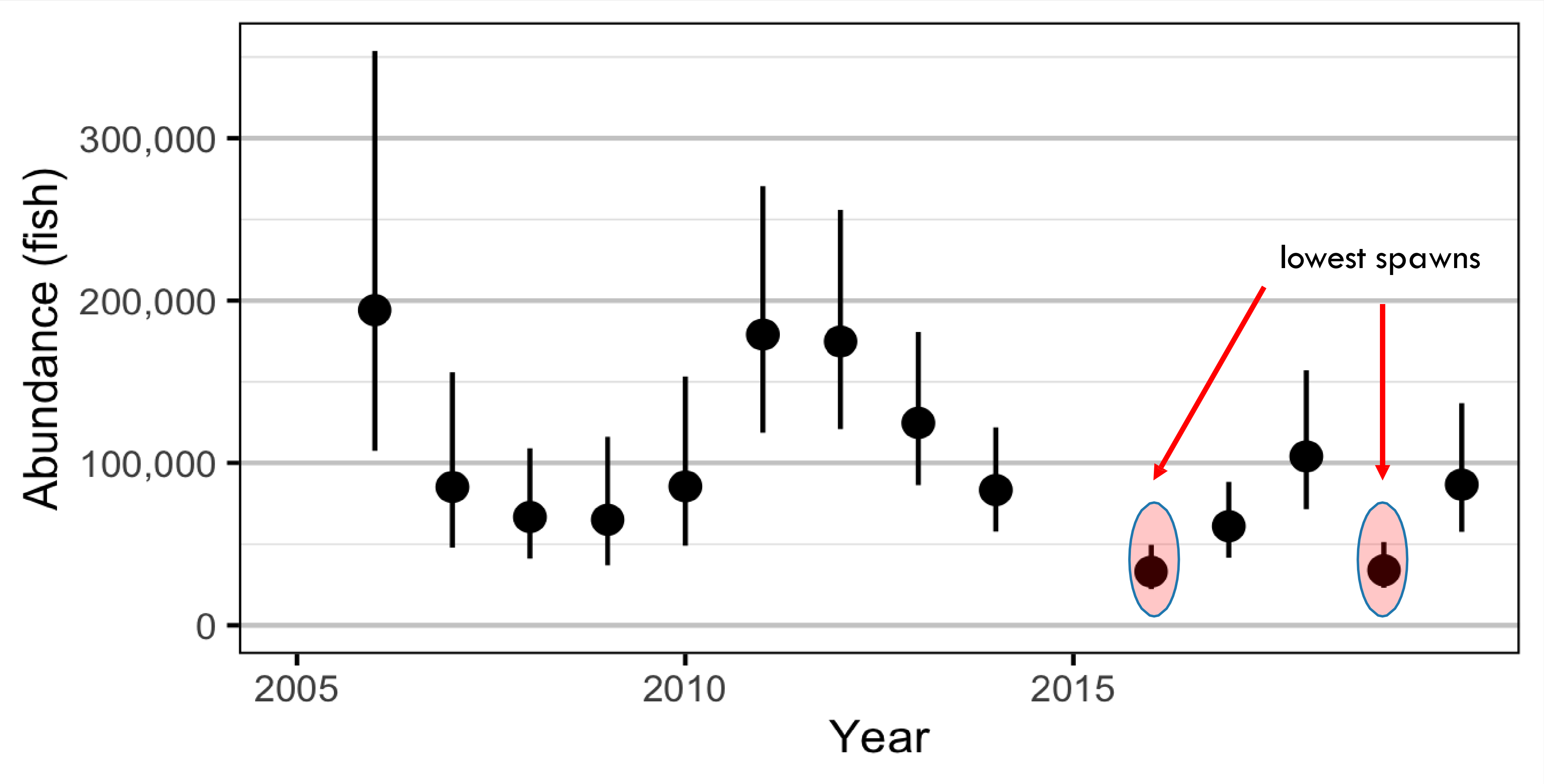
- Sustained low spawner size and abundance
- Spawner age remains stable

Gerrard Spawner Bio Data				
Year	Mean FL (cm)	mean Wt (Kg)	Mean Age	Sample Size
1949-59	67		5.3	54
1979	83			11
1980	83			8
1981	79	5.8		10
1982	83	7.2		21
1991	83	7.4		15
1992	78	7.1		23
1994	75	6.8	6.0	17
1998	81	7.3	6.4	18
2004	72	7.1		25
2005	77	4.4		25
2006	83	6.9		37
2010	73	4.5		59
2014	78			20
2016	58	1.9	5.8	24
2017	53	1.4	5.9	20
2018	54	1.7	4.9	20
2019	63	1.6	5.9	39
2020	54	1.4		25

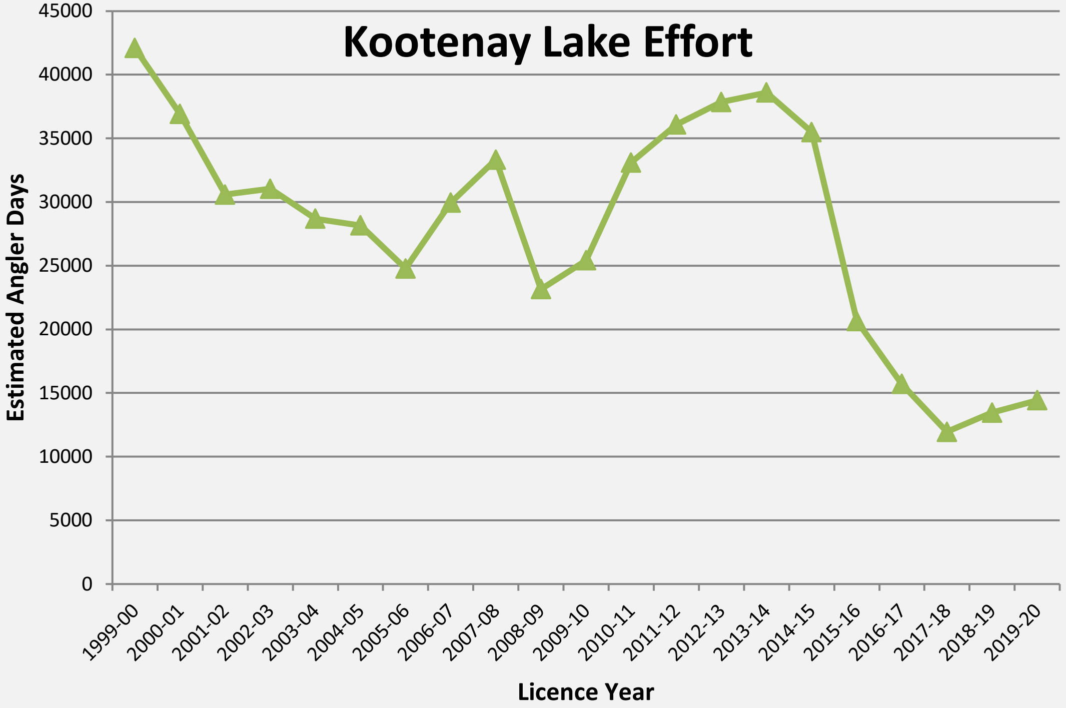
GERRARD SPAWNER ESCAPEMENT



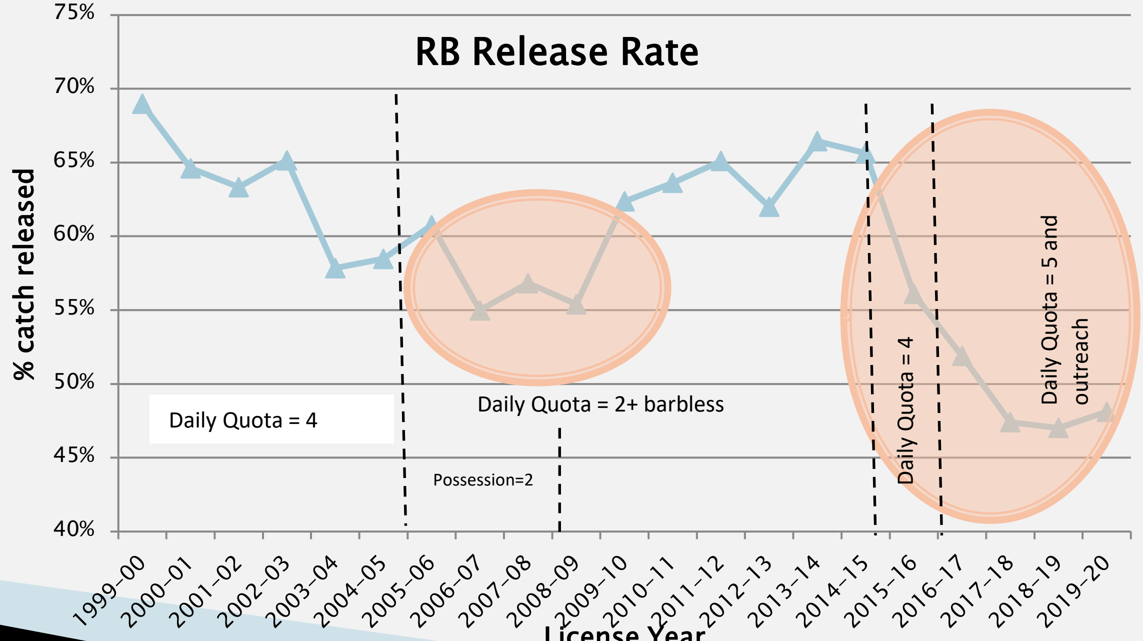
AGE 1 RECRUITS



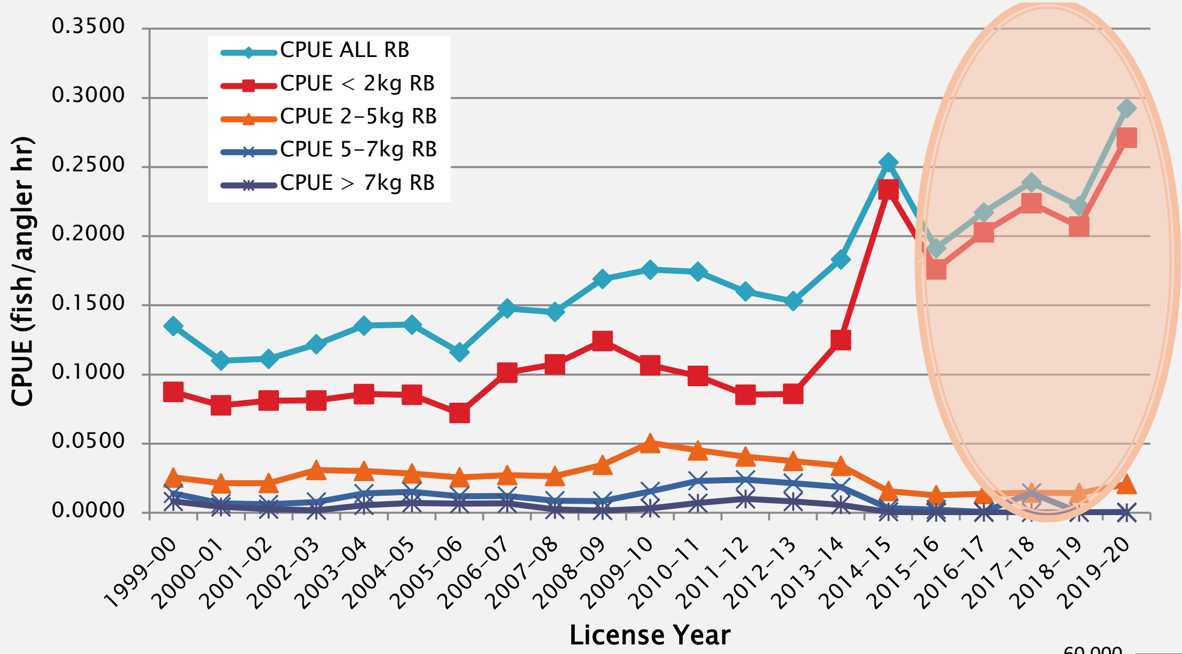
Fishery Trends– KLRT Creel



- Effort declines: 40,000 to 14,500 angler days, modest increases in recent years
- Recent outreach/daily quota increase=more harvest



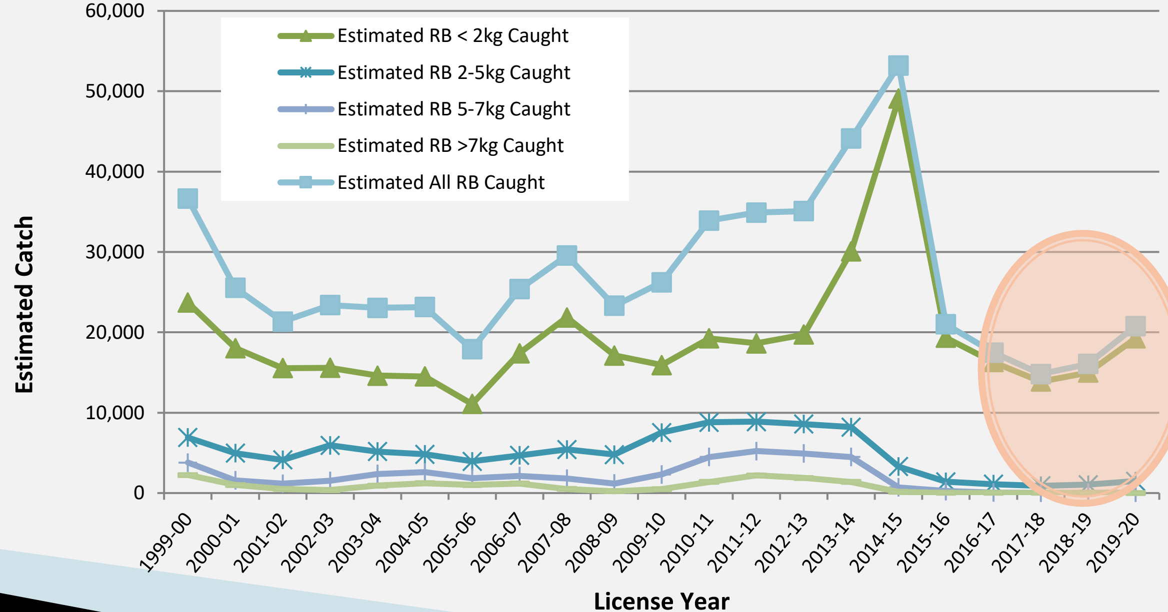
Rainbow Trout Catch Trends (KLRT)



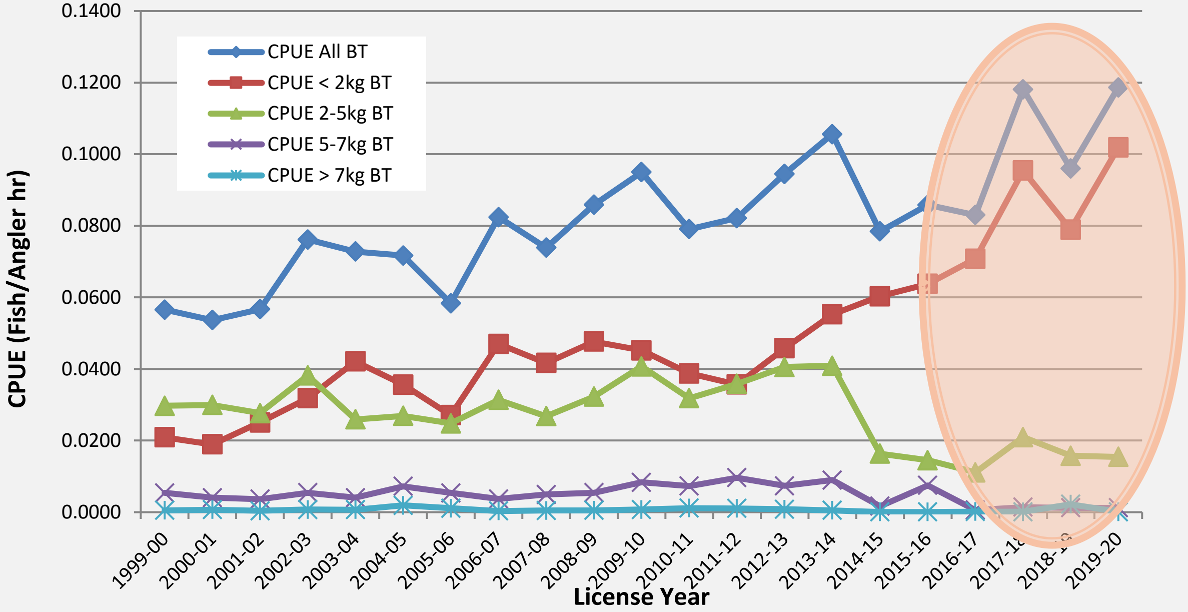
** Catch values could be inflated by ~50%-100%

- General RB CPUE increase over time?
- Large size classes gone, catch now all small

- Departure between CPUE and catch trends



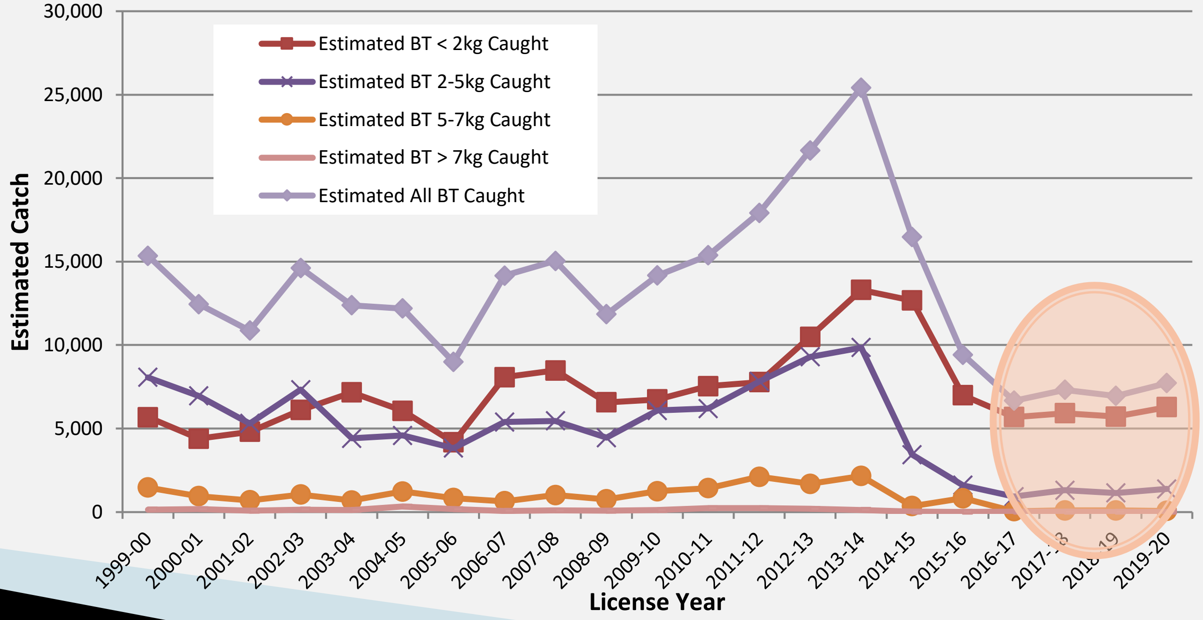
Bull Trout Catch Trends (KLRT)



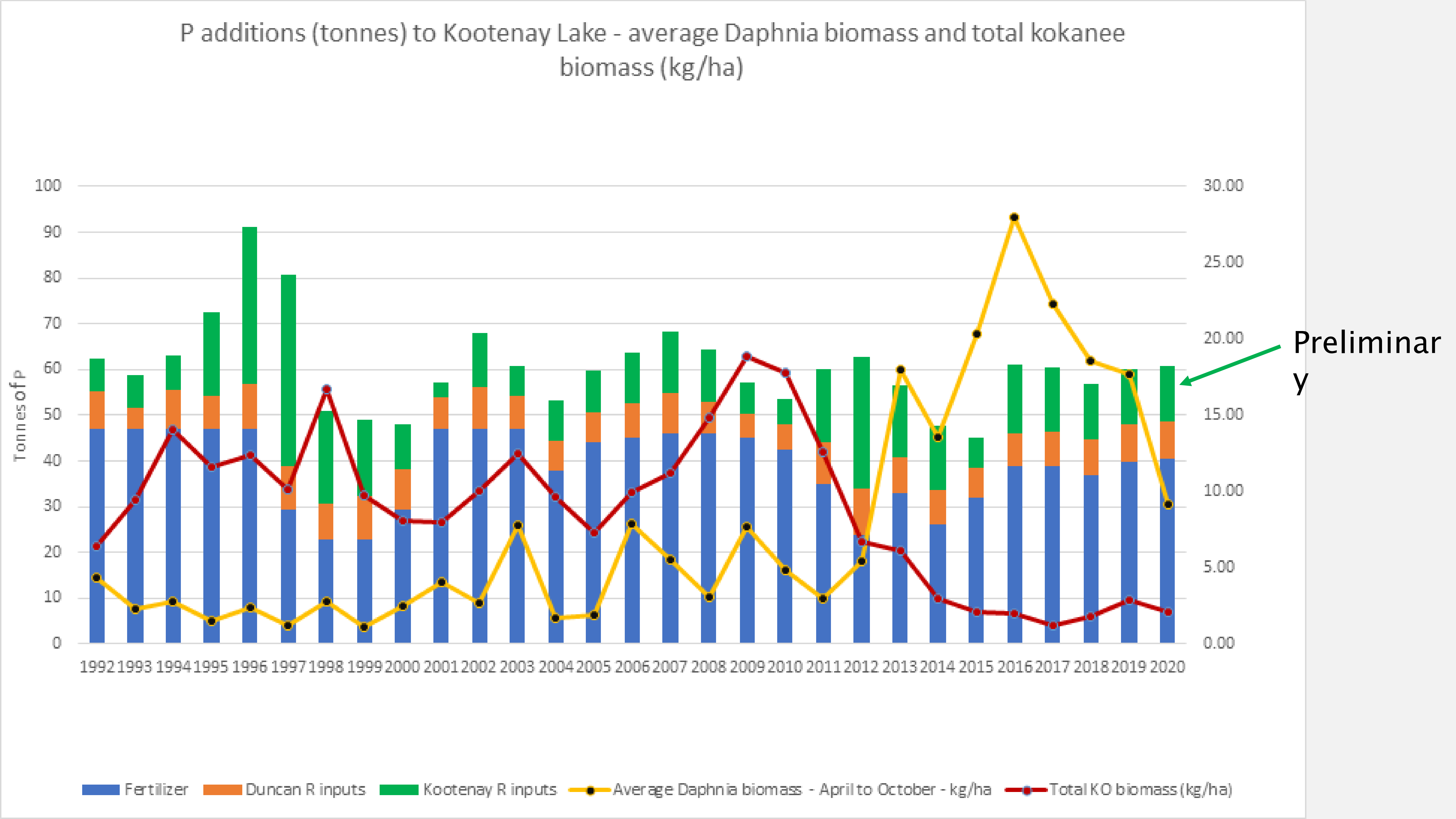
** Catch values could be inflated by ~50%– 100%

- General BT CPUE increase over time?
- Large size classes gone, catch now all small

- Departure between CPUE and catch trends

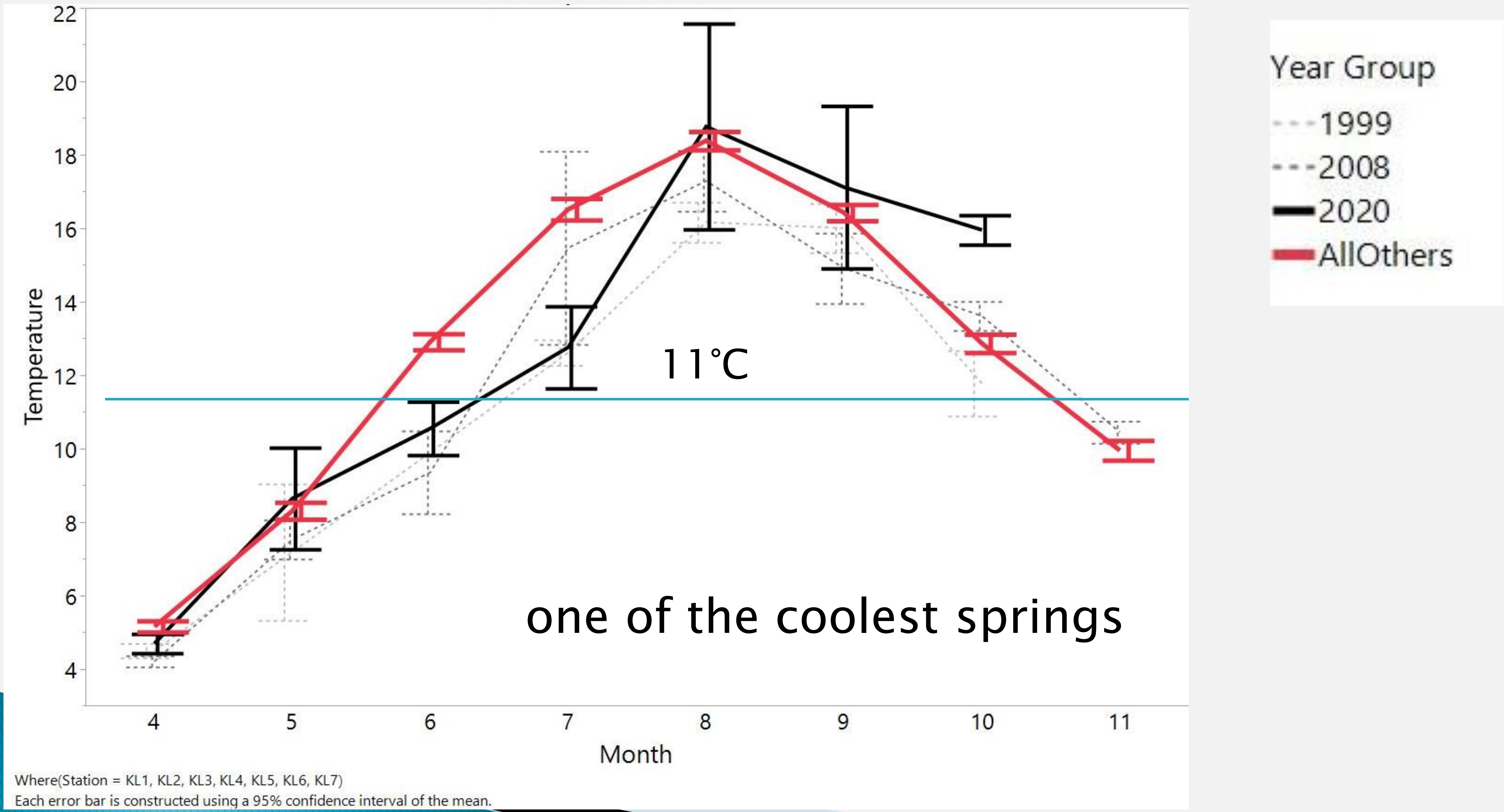


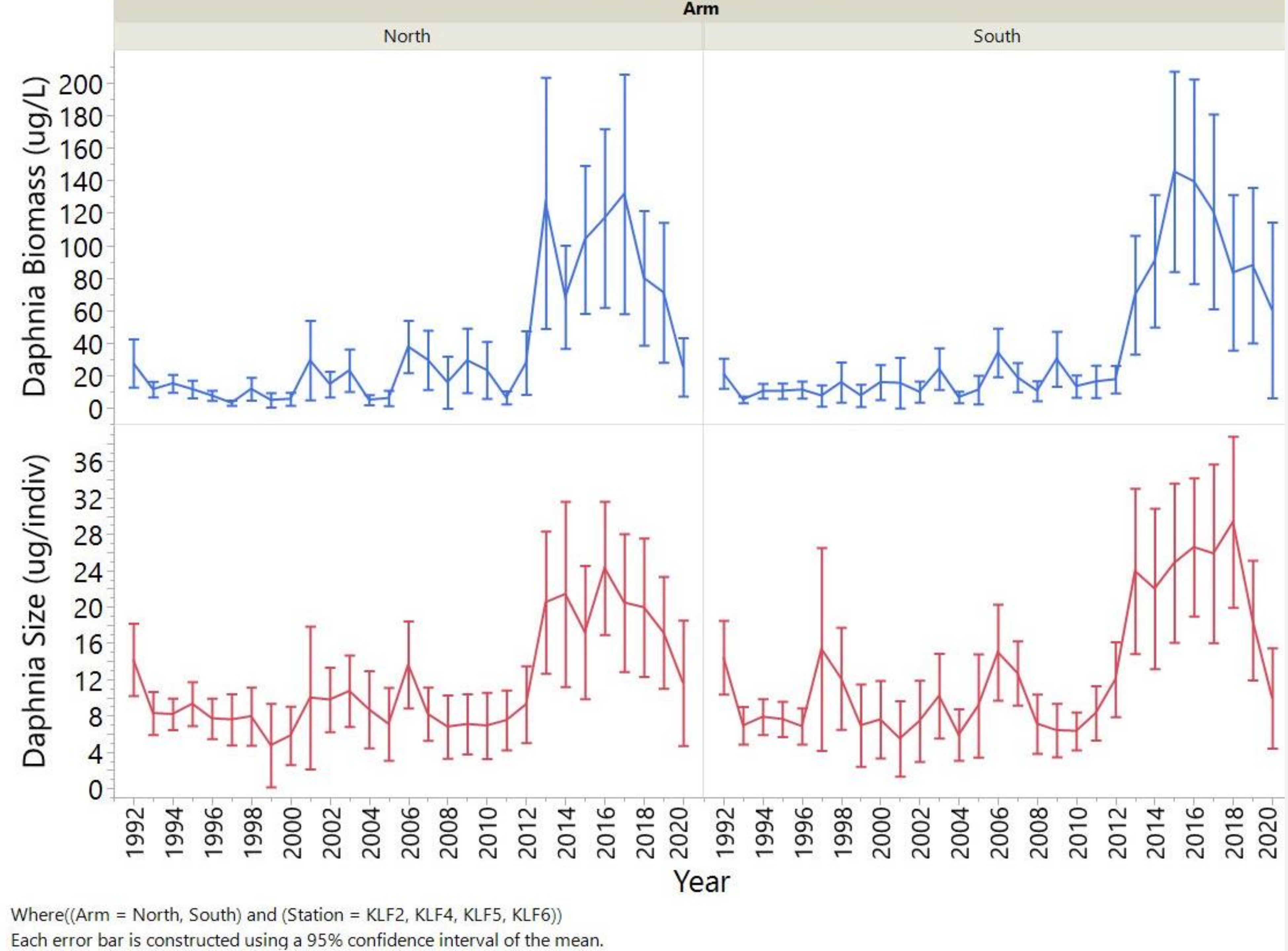
2020 Nutrient Restoration Program Summary



P additions (tonnes) to Kootenay Lake - average Daphnia biomass and total kokanee biomass (kg/ha)
Tonnes of P
100
90
80
70
60
50
40
30
20
10
0
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Preliminary
Fertilizer
Duncan R inputs
Kootenay R inputs
Average Daphnia biomass - April to October - kg/ha
Total KO biomass (kg/ha)

Kootenay Lake Temperature Stratification

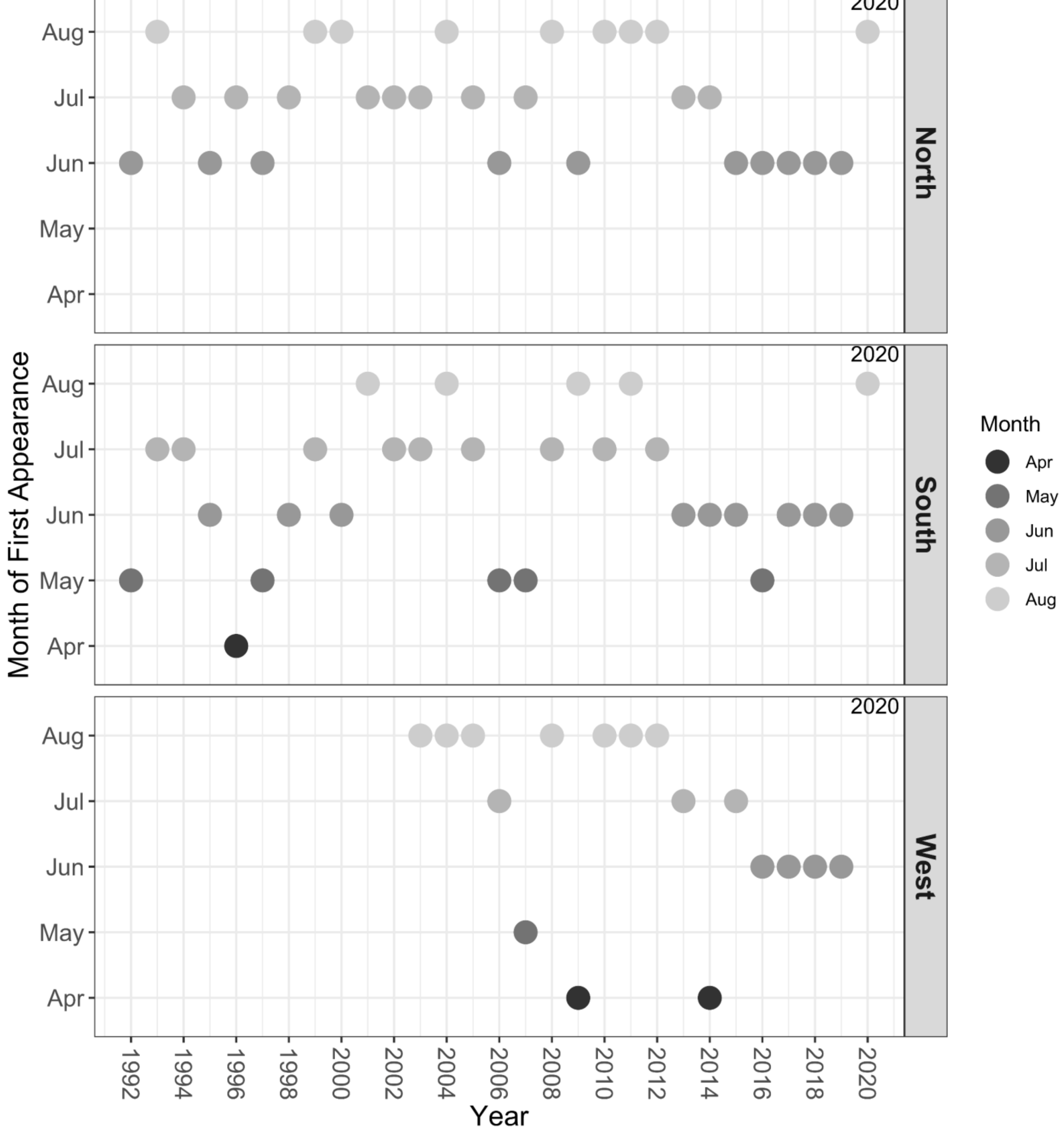




Kootenay Lake Daphnia Biomass and Size by Arm

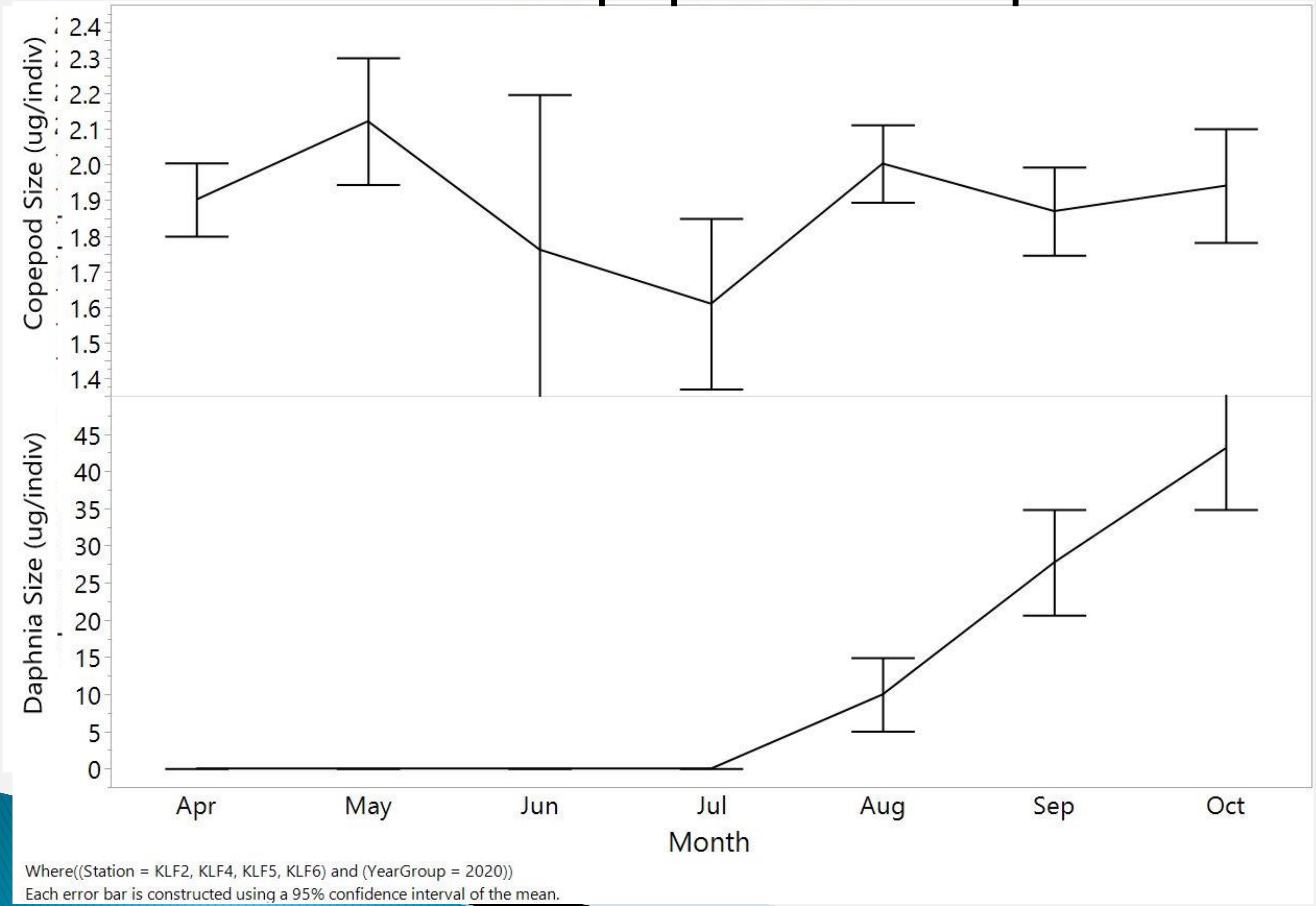
Preliminary analysis

- 2020 data averages include stations 2,4,5,6
- Averages of all replicates
- No west Arm data



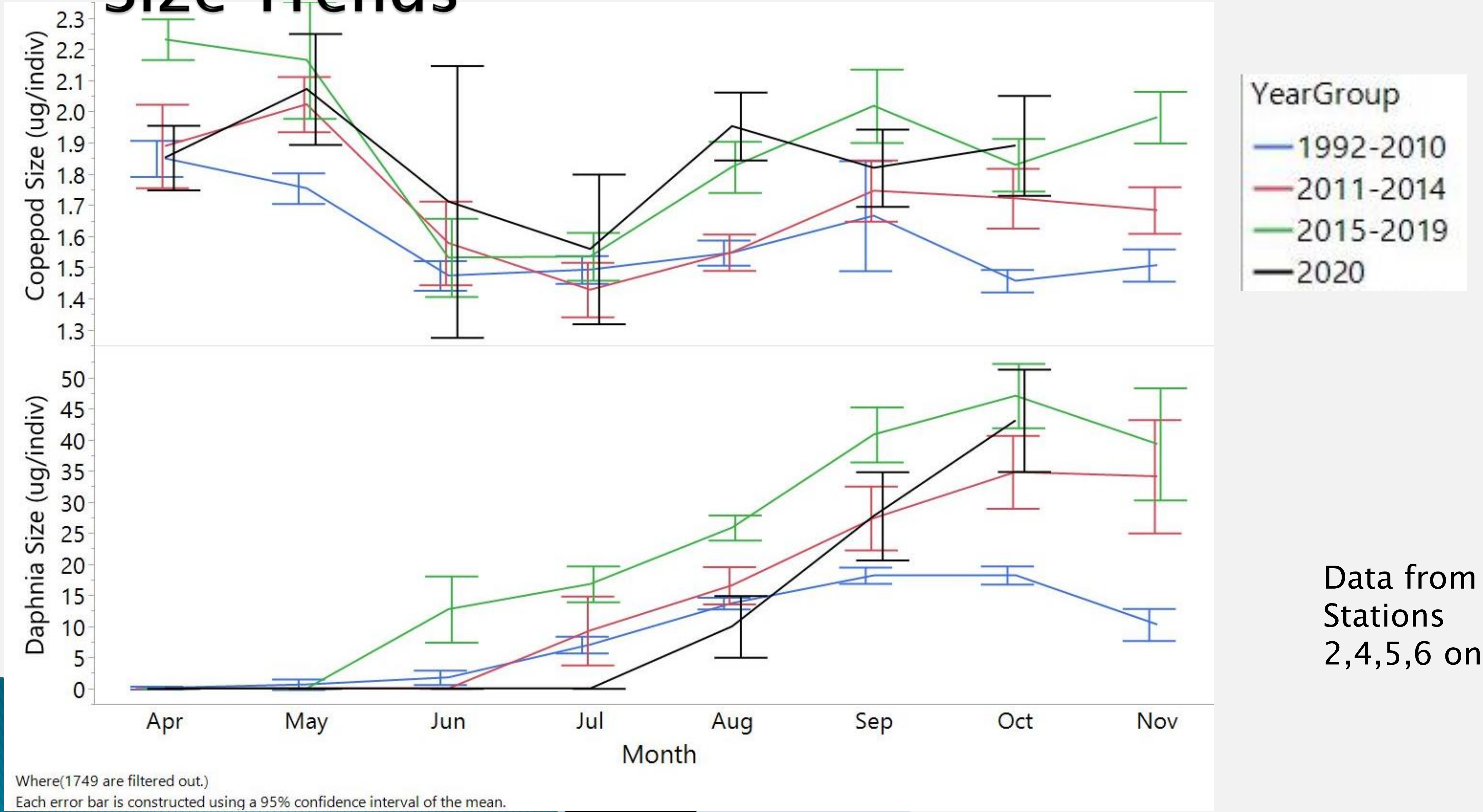
When are Daphnia first detected?

2020 Annual Copepod and Daphnia Size Trends



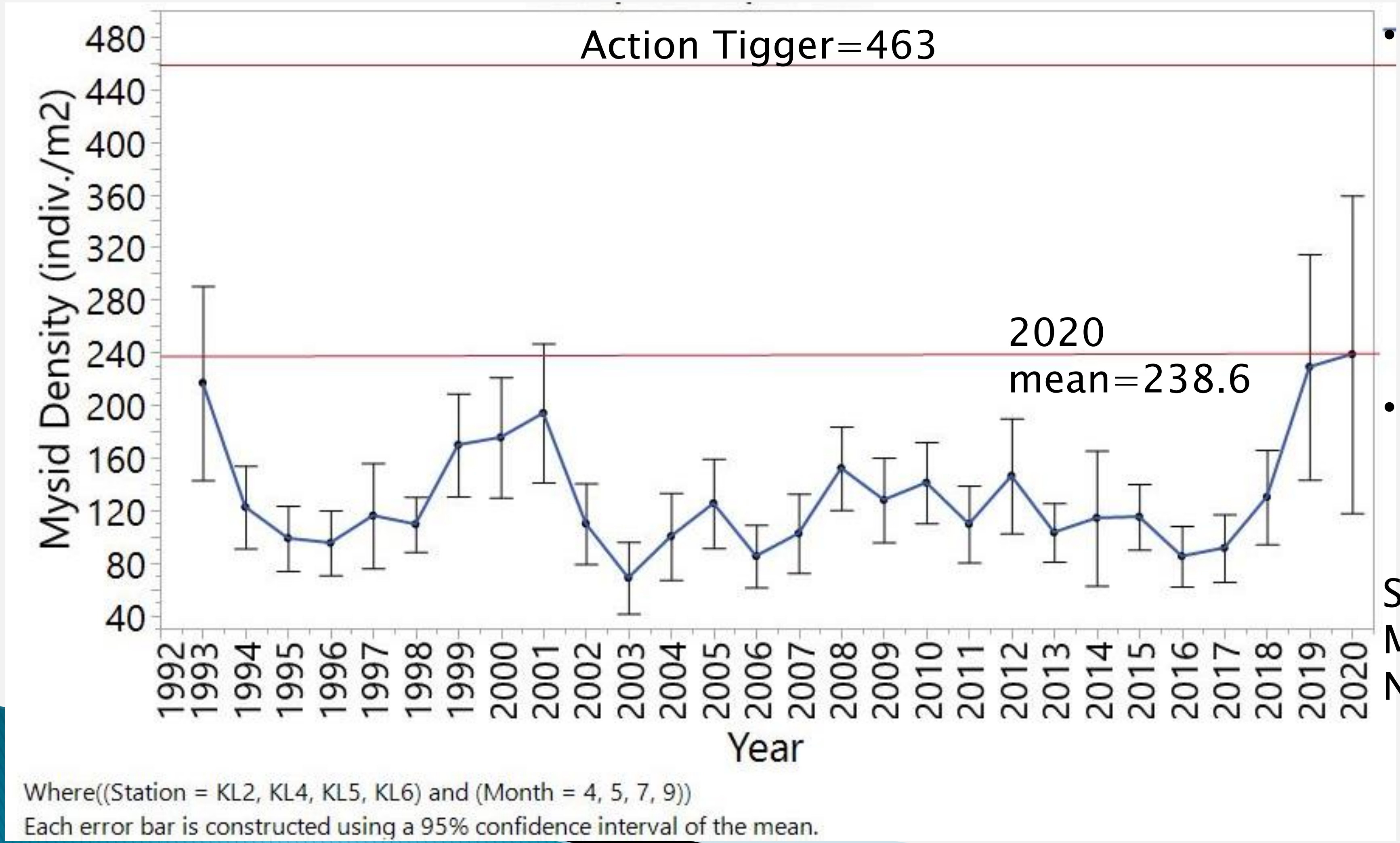
Data from Stations 2,4,5,6 only

1992-2020 Annual Copepod and Daphnia Size Trends



Data from Stations 2,4,5,6 only

Mean Mysid biomass and density by year and depth



- Samples normally taken Apr–Nov
  - 7 stations, 3 replicates at each (1 shallow, 2 deep)
  - Deep = central part of main body, bottom to top
  - Shallow = periphery of main body, bottom to top typically <40m
- 2020 sampling occurred at 4 stations over 4 months

Stations 2,4,5,6 only
Months 4,5,7,9 only
North and South Arms only

2020 Nutrient Restoration Take Homes

- 2 NRP reviews (FWCP and KTOI)
- Covid = reduced sampling
- Nutrient loads similar to 2019
- Temps: one of coldest springs since 1992
  - 2020 makes 4 years of below average air temps Jan-Mar
  - Not great for Daphnia production which need at least >11°C
- Smaller mean 2020 Daphnia size and biomass
- 2020 Mysid biomass higher in N and lower in S as compared with 2019

Summary: Biological Response Update

- 2020 NA kokanee escapement ~90,000,egg deposition ~35 mil, highest escapement and egg supply since 2016
- High kokanee size and fecundity (Meadow)
- Kokanee ages= almost all age 3+ (Meadow)
- Sustained low juvenile 1-2 survival, low 2021 kokanee escapement estimate
- Lake-wide BT redd count estimate of 229, lowest estimate on record
- KLRT: continued low effort, general increase in CPUE through time, large size classes gone
- Age 1+ Gerrard estimates increased from last year
- Daphnia biomass/size down in 2020 compared to 2019 but higher than pre-kokanee decline
- Mysid biomass and density increased in 2020 from 2019

2020 Implementation and Ongoing Actions

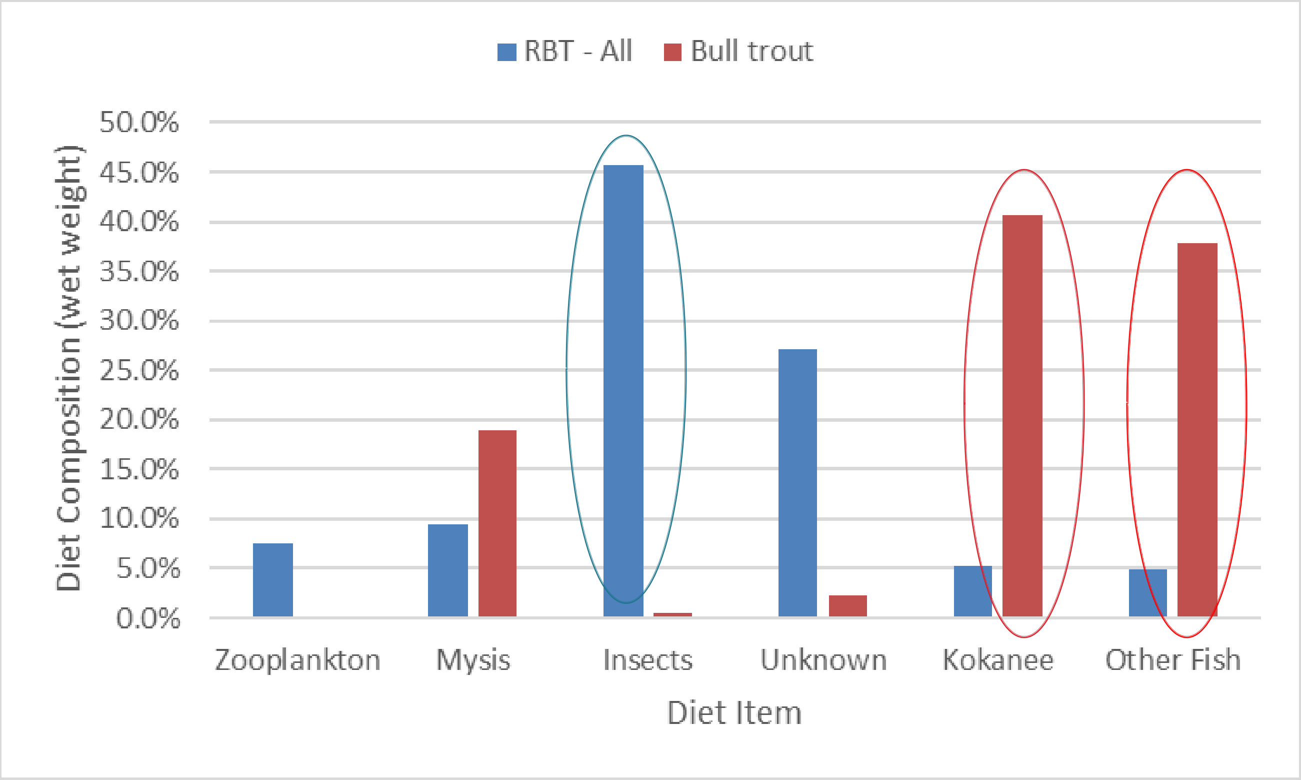
Ongoing Actions : Piscivore Monitoring (2015-2020)

- Objective: To better inform recovery actions, contribute to predator reduction efforts

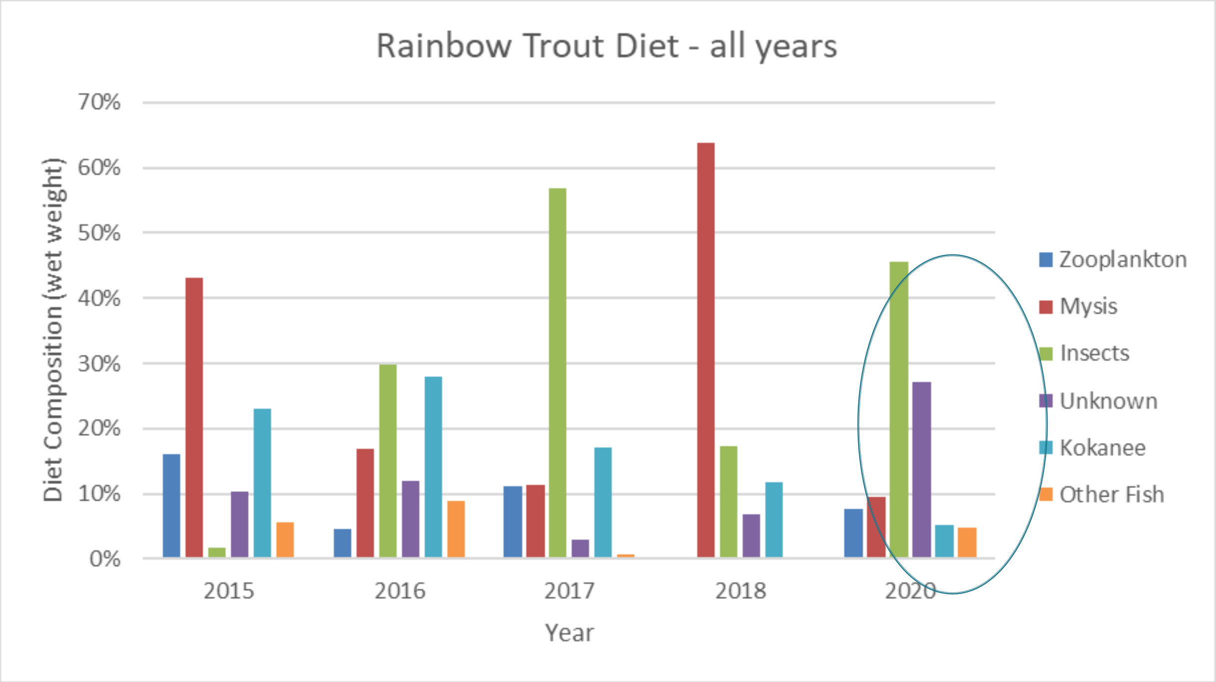
- Fish samples collected by angling guide, using standard large lake fishing methods
  - Total of 4840 angler hours expended (2015-2020)
  - Total of 1081 RB and 404 BT harvested (2015-2020)
- Used data and samples collected by guide to analyse:
  - Age structure + diet composition
  - Catch rate
  - % Gerrards
  - Maturation rate (% ripe) by ecotype
  - Data used for bio-energetics modeling

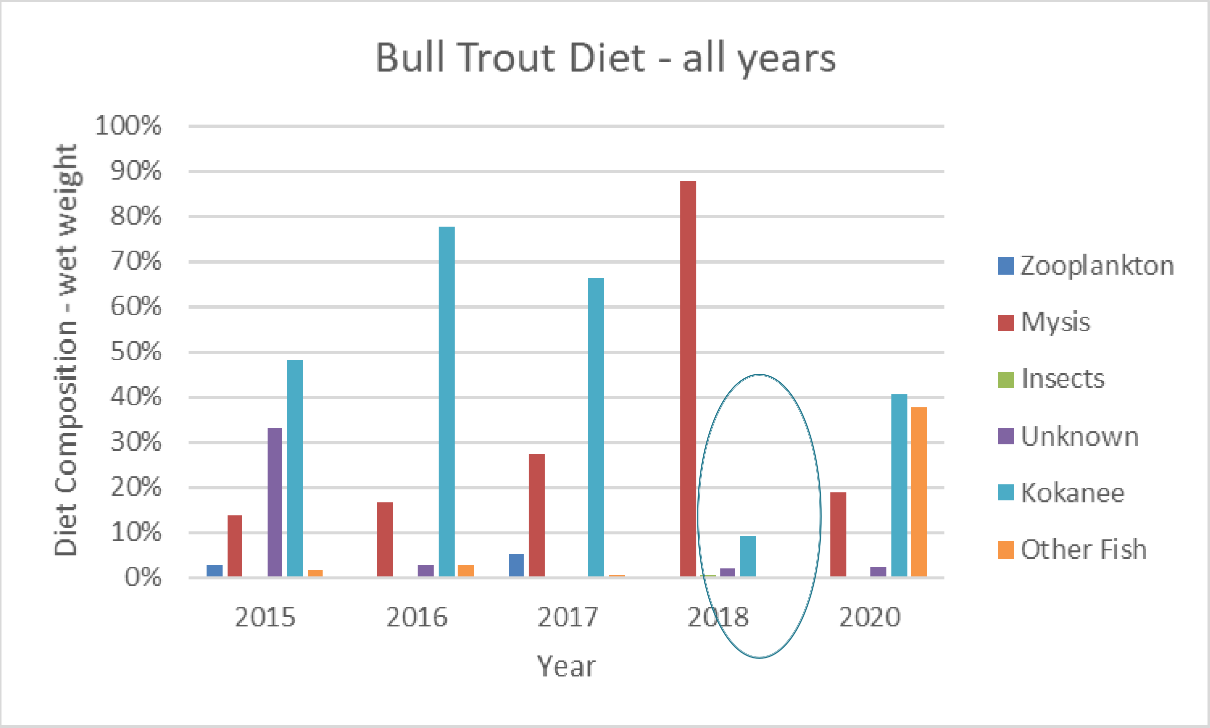
Ongoing actions: Piscivore Monitoring
2020 Results– Diet Composition (preliminary)

- Insects continue to be most significant portion of RB diet
- Kokanee/other fish continue to be most significant portion of BT diet



Ongoing actions: Piscivore Monitoring 2015-2018, 2020 Results– Diet Composition

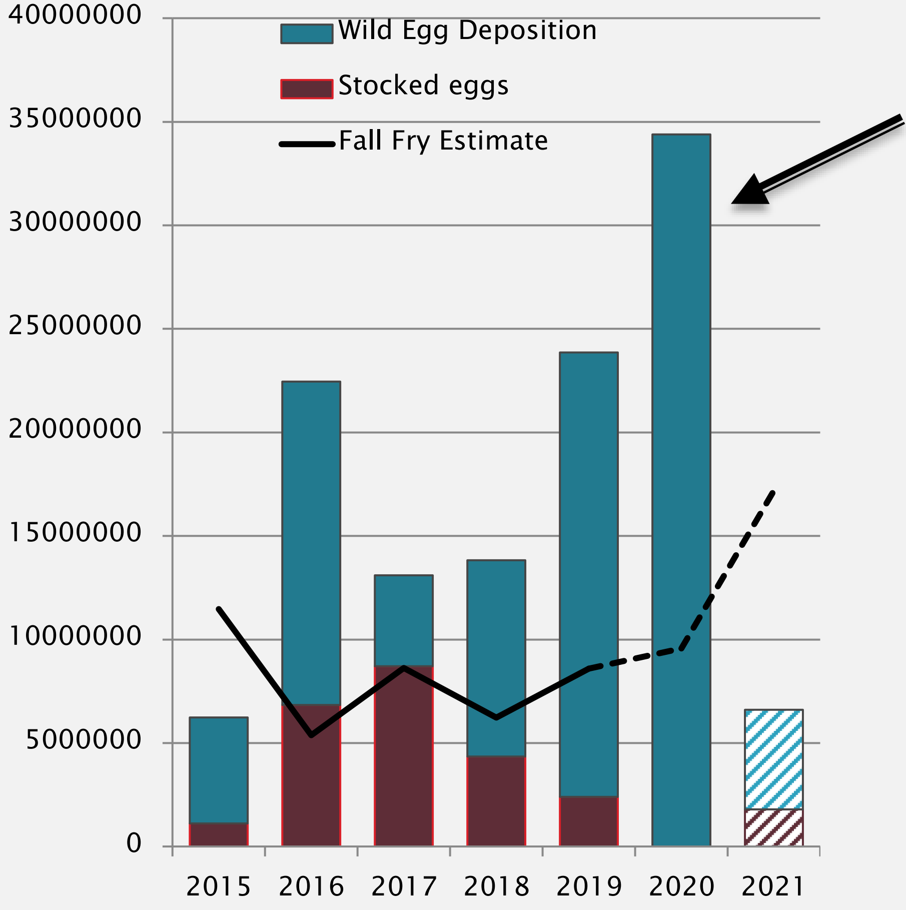




- Shift from kokanee to other fish in diets?

Action Update: Kokanee Supplementation

- No stocking in 2020
- 2019 meeting recap:
  - Forecasted wild egg deposition >25 mil in 2020
  - Estimated stocked egg supply of 1 mil eggs (<5% of wild egg)
- Actual egg supply ~ 35 mil



Action Update: Fishing Regulations

Kokanee Angling Closure

- Action – maintain kokanee daily quota=0
- Trigger – <140,000 spawners; age 0-1 <11%, KLRT >2kg RB CPUE mod-high
  - Implemented in 2015, continued

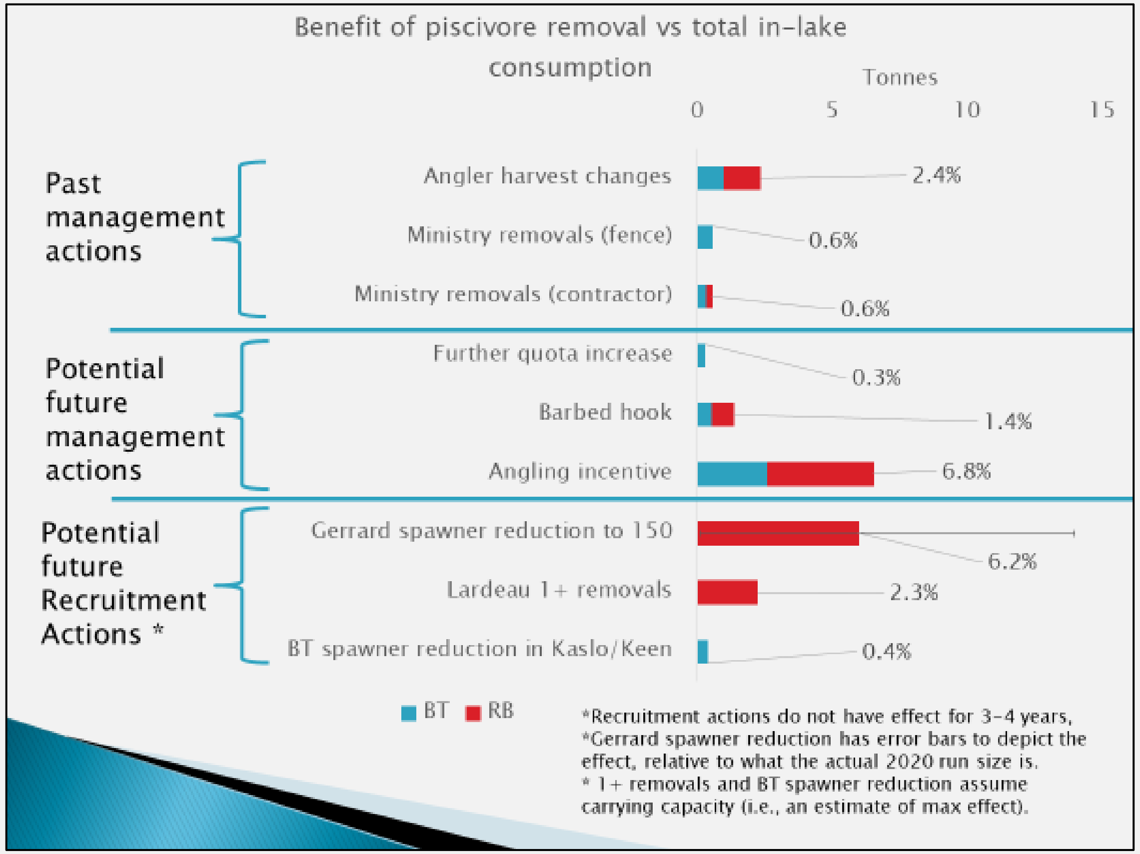
Recreational Fishery Regulations

- Action – liberalize piscivore fishing regulations
- Trigger – <140,000 spawners; age 0-1 <11%
- New 2020 Fishing Regulations:
  - Barbed hooks
  - Increase in piscivore quotas
    - BT = 3/day any size
    - RB = 5/day (2 >50cm), 10/year >50cm
    - Rescind north arm closure

Action Update: Predator Management

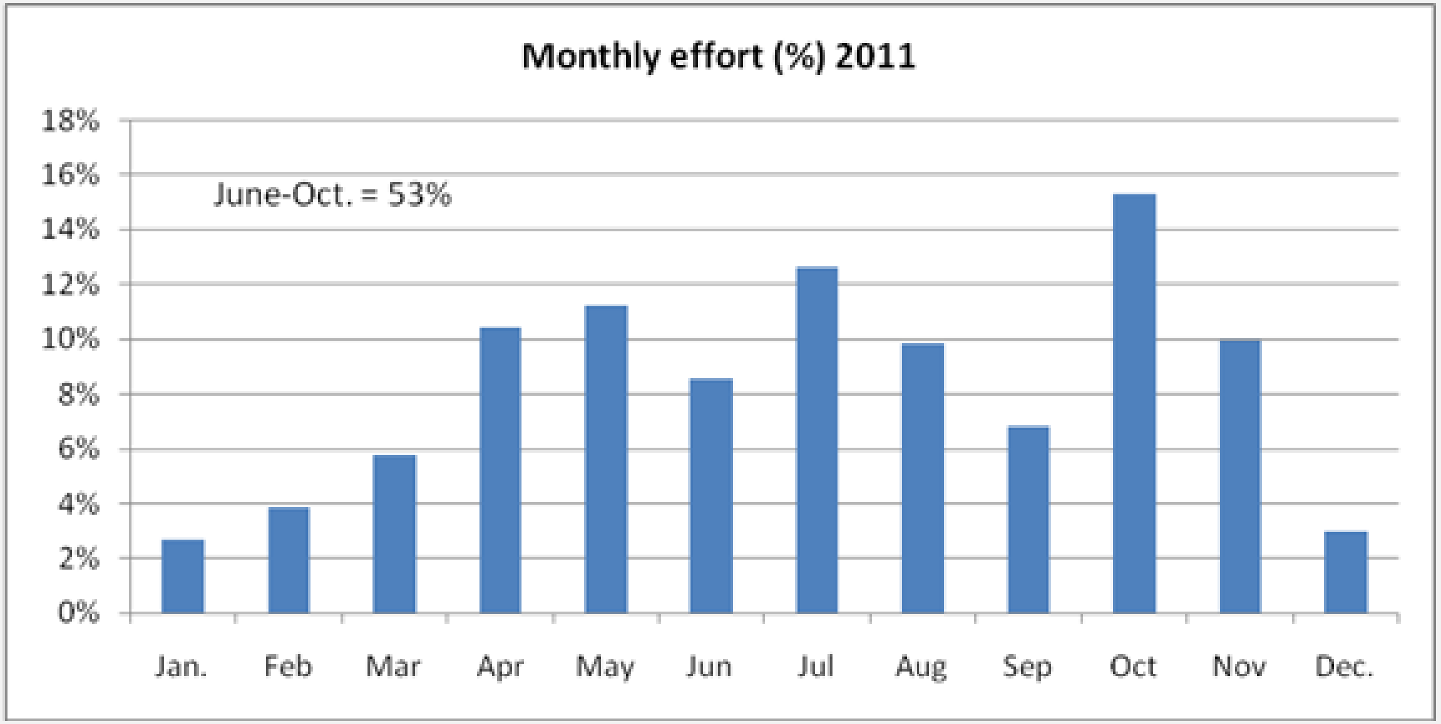
- 2019 meeting recap: focus on predator reductions via the Angler Incentive Program

Pisc. red. actions: Reduce 2020 predators	No	
	Yes- Contracted removals	6
	Yes- Kelt fence	3
	Yes- Angling reward	**13**
	Uncertain	3
Pisc. red. actions: Curtail pisc. recruitment	**No**	**9**
	Yes- Gerrard spawner reductions	1
	Yes- remove juveniles (Lardeau)	
	Yes- BT spawner reductions	4
	Uncertain	3



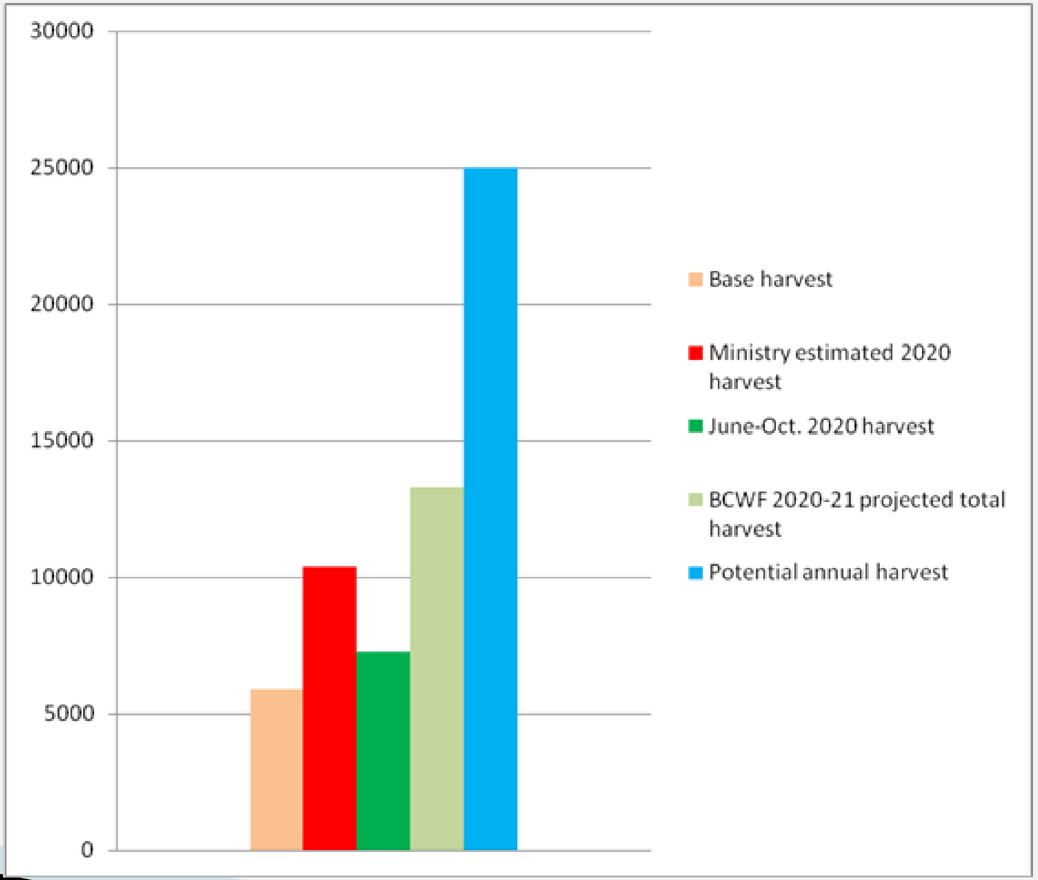
Action Update: Predator Management

- Kootenay Lake Angler Incentive Program



Action Update: Predator Management

- Kootenay Lake Angler Incentive Program



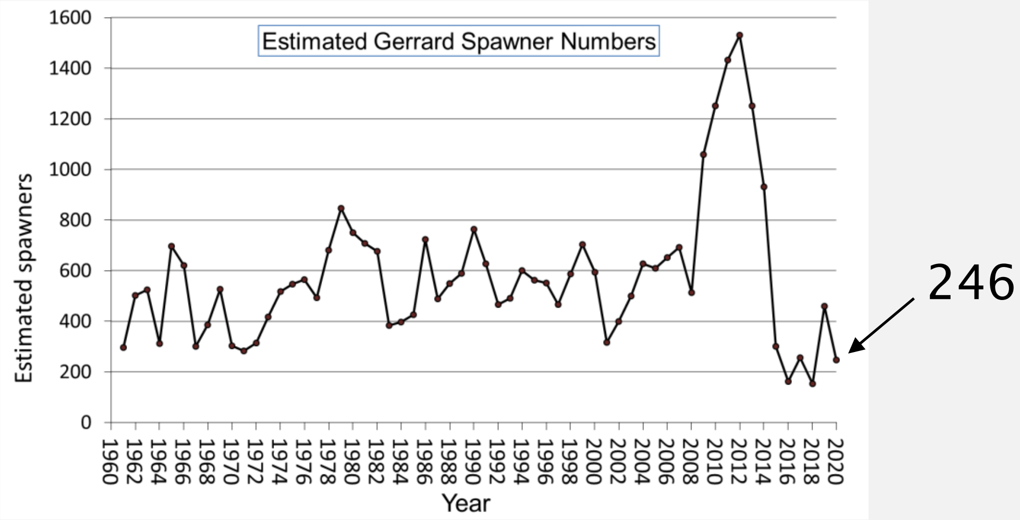
Action Update: Predator Management

- Kootenay Lake Angler Incentive Program– Creel
  - Point-access creel– Balfour and Woodbury, 20 creel days (14 Balfour, 6 Woodbury), apportioned to months with highest effort (June-November; 2011 creel report)
  - 13 creel days to date; 60 groups and 105 interviews

- Used to inform management decisions on the KLAIP
  - 43% of anglers are non-KLAIP
  - 56% of anglers have KLRT licenses (compared to 77.5% pre-collapse)

Action Update: Predator Conservation

- Gerrards
  - Action – reduce exploitation though regulations;
  - Trigger<50-100 spawners; ***action not triggered***
  - Hatchery Supplementation "Gene Banking"
  - Trigger – <50-100 spawners in two consecutive years; ***action not triggered***
- Bull Trout
  - Action – reduce exploitation though regulations;
  - Trigger – escapement < 50/500 spawners in Kaslo River and lake-wide index respectively; ***action not triggered***



Stream	2019	2020	Decline
Upstream Flip Bucket Fish Count - Duncan Dam	na	na	-
Hamill	na	na	-
Poplar	0	na	-
Meadow	38	33	13%
North Arm tributaries	**inc**	**inc**	-
Crawford	91	41	55%
Kaslo-mainstem	131	111	15%
Kaslo-Keen	33	na	-
Coffee	14	5	64%
Central tributaries	**269**	**inc**	-
Midge	105	30	71%
Cultus	11	na	-
South Arm tributaries	**116**	**inc**	
TOTAL REDDS COUNTED	**423**	**220**	-

Action Update: Mysis and NRP

Mysis Removal

- Action – Evaluate feasibility, mysis removal
- Trigger – Explore feasibility, removal if density/biomass > 463 ind/m2 (2 SD > mean)
- *Action not triggered*

- Explore options to further develop feasibility this winter

Nutrient Restoration Program

- Action – Continue current implementation program (max amounts of nutrients in the summer during optimal growing conditions)
- Trigger – none
  - Program delivered – dates range from April–September

First Nations Updates

- Okanagan Nation Alliance
- Ktunaxa Nation

Summary: 2020 Implementation and Ongoing Actions

- Piscivore monitoring continued in 2020; rainbow diets still mainly insects, bull trout diets mainly kokanee/other fish
- No stocking in 2020
- Fishing regulations: kokanee closure cont'd, liberalized piscivore fishing regulations
- Predator management via the Angler Incentive Program; 7269 entries to date
- Predator conservation action for bull trout and rainbow trout not triggered
- Mysis removal action not triggered, options to develop feasibility are being explored
- NRP delivered in 2020
- First Nations Updates

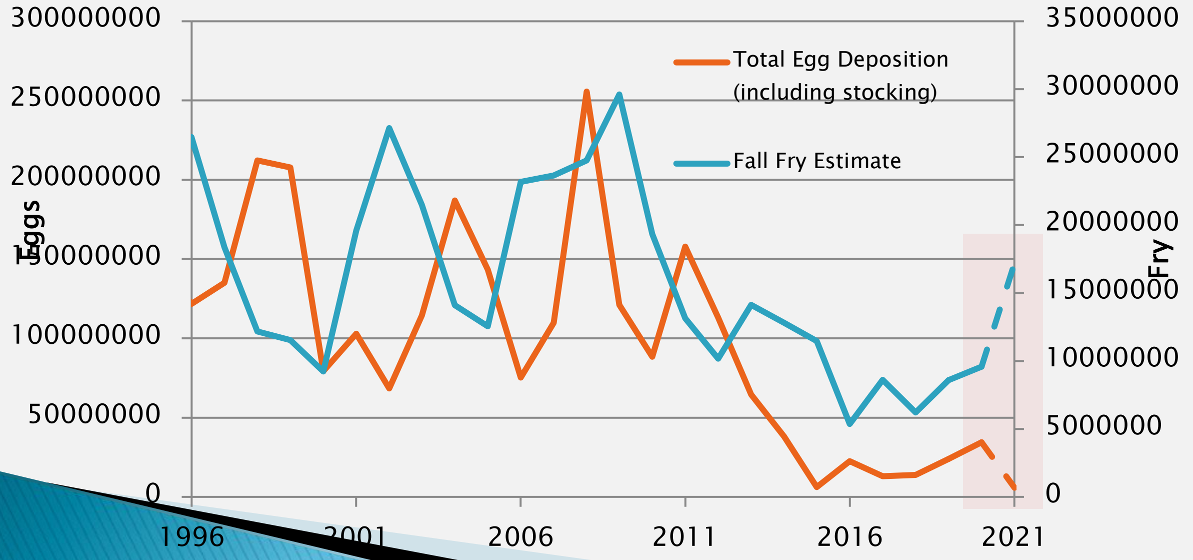
Key Questions

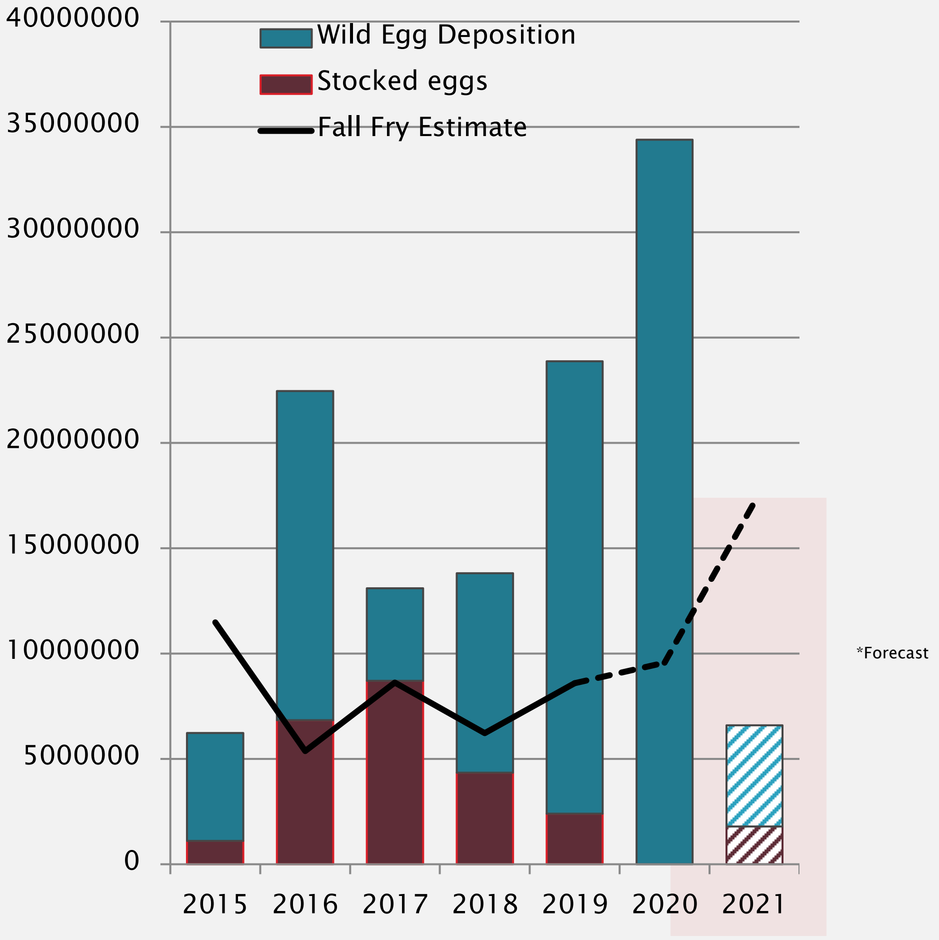
Key Questions

- Should we propose to collect eggs and stocking in 2021?
- Should we continue to reduce predation pressure in 2021?
- Should we continue piscivore monitoring and diet sampling?
- Are there any other actions we should revisit?

Should we propose to collect eggs and stocking in 2021?

- Action: Stock 5 million eyed eggs; trigger: KO escapement <140,000, <11% age 0-1, <17.0 million fry
- Without stocking, fall fry likely to be ~17 million in 2021
- 2021 stocked egg supply likely ~1 million (<20% of estimated wild deposition) sources – Kinbasket(?), Whatshan (~800K to 1 mil), Hill Creek (~800K)
- What about fall fry supply in 2022?
- Evidence that stocking works (spawner replacement)





*Forecast assumptions:

- egg to fall fry similar to previous 5 year mean (~50%)
- 2021 spawners 12K (50% F) and fecundity ~800

Should we continue to reduce predation pressure in 2021?

If no:

- Should current liberal fishing regulations remain the same?

If yes:

- Should we continue reducing predation pressure at the same level as predator reduction actions in 2020?
  - If no, should we continue at a reduced level?

Should we continue to reduce predation pressure in 2021?

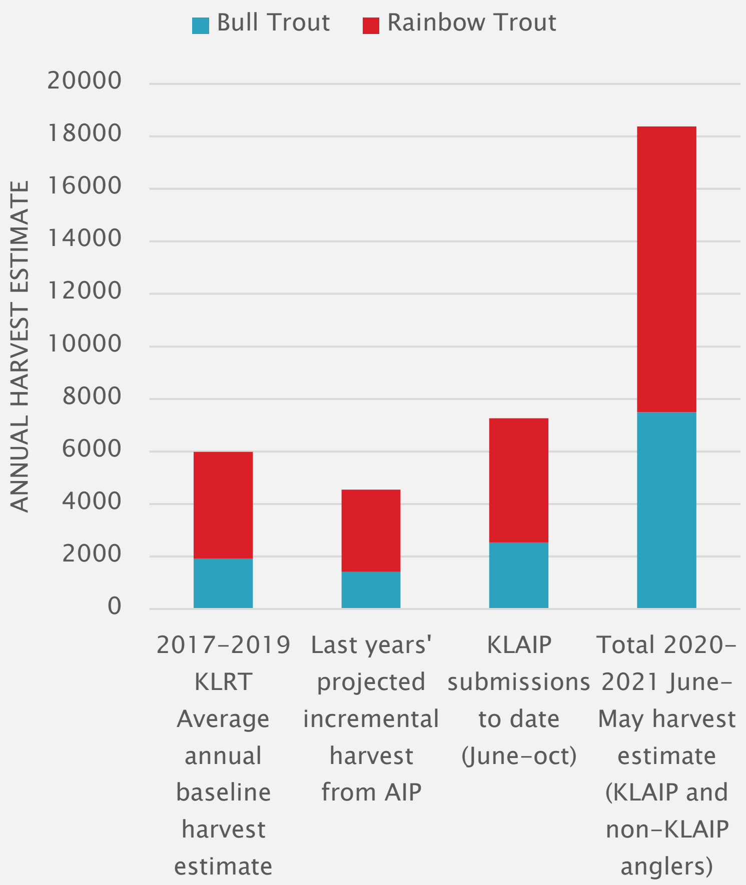
- What is the impact of 2020 predator reduction actions (i.e., KLAIP)?
  - Highly effective program
  - What is the total in-lake harvest for 2020 angling year to date? What is the total predicted by end of March 2021?
  - What is the risk of overshooting with the KLAIP?
  - How close are we to spawner conservation thresholds outlined in the KL Action Plan?
- What are the key informational components we need to reach a decision about predator reduction actions in 2021?

What is the total in-lake harvest for 2020 KLAIP year to date and how does it compare to what we projected? What is the total predicted by end of Mar 2021?

- From June 1-Oct 30, 7269 fish have been removed in total under the KLAIP. We assumed 35% of the catch is bull trout (from the creel).
- We estimated from the KLRT (2017-2019) that the average harvest was was 1917 BT and 4074 RB annually (this was assuming 10% increase in effort and 90% retention)
- From this, we assumed the KLAIP would result in a modest 10% increase in effort (catch) and 90% retention rate to estimate there would be an additional 1413 BT (3330 total) and 3141 (7215 total) RB harvested.
- Using new creel information (43% of anglers are non-KLAIP – prelim creel estimate), expanded to the (harvest-rate adjusted; 49% BT; 52% RB for last years' KLRT) total KLAIP submission thus far (2544 BT; 4725 RB), the total harvest of all fish from June 1-Oct 31, 2020 is 3485 BT and 6578 RB. This is very close to the estimate we made last year of ~10K total harvest
- Using the distribution of catch from the 2011 creel to expand out to the remainder of the KLAIP year (June-May), we estimate a total harvest (KLAIP and non-KLAIP) of 7499 BT and 10884 RB from June 1-2020 to May 31 2021.
- Barbed hooks and regs could have made a bit of difference in increasing catch as well

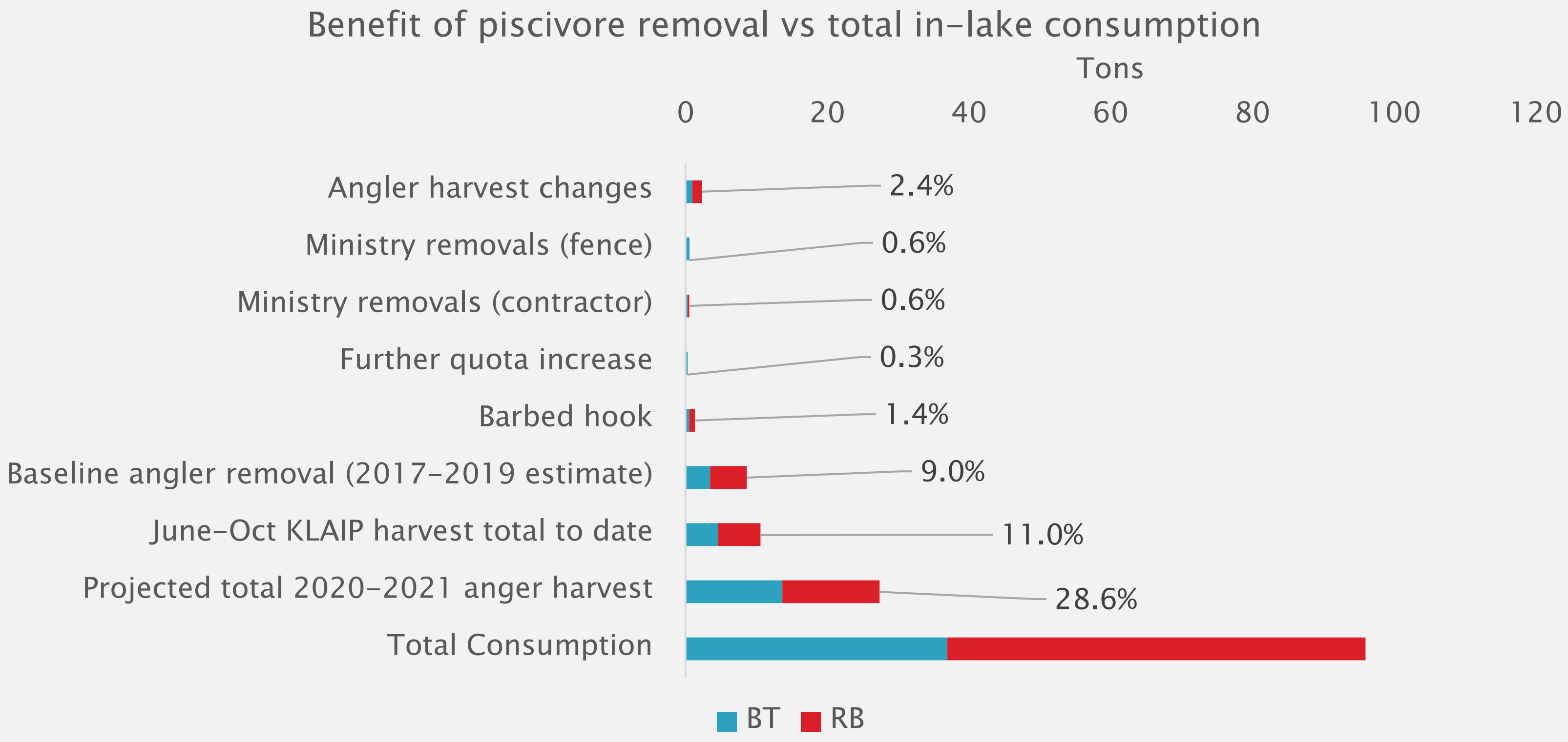
Notes and assumptions:

- prior estimates of KLRT total harvest may be UNDERESTIMATES, as proportion of non-KLRT has changed (2020 creel thus far suggests 56% rather than pre-collapse estimate of 77.5%).
- 2020 creel results are based on few interviews and thus considered somewhat cautionary
- Total harvest estimate for 2020-2021 doesn't include Apr-May (unless some people had been stockpiling for KLAIP), so note that the KLAIP year isn't quite lined up to a normal license year.
- Total harvest estimate for 2020-2021 assumes constant catch rate throughout the year, in proportion to the 2011 angling year. If density declines to affect CPUE for the remainder of the year, or the % KLAIP is lower in the winter then the catch will decline and the extrapolated future catch is an OVERESTIMATE.



How much kokanee biomass/production is projected to be saved in 2020-2021 relative to prior years?

- Most recent bioenergetics results were used to determine the total that fish submitted under the AIP would have consumed
- 2020-2021 angling year is projected to greatly surpass any prior years' actions or status quo angler harvest
- Keep in mind angling can never get you to 100% because younger age classes are not as vulnerable
- Also note that total rainbow consumption is predicted to be declining naturally due to lower recruitment years for 2015-2018 brood.



What is the risk of overshooting with the KLAIP?

- All data suggest that adult piscivore populations are (or should be) declining

  1) Gross harvest estimate is a substantial proportion of 5+ (RT) and 6+ (BT) (rough age for catchable population) population sizes

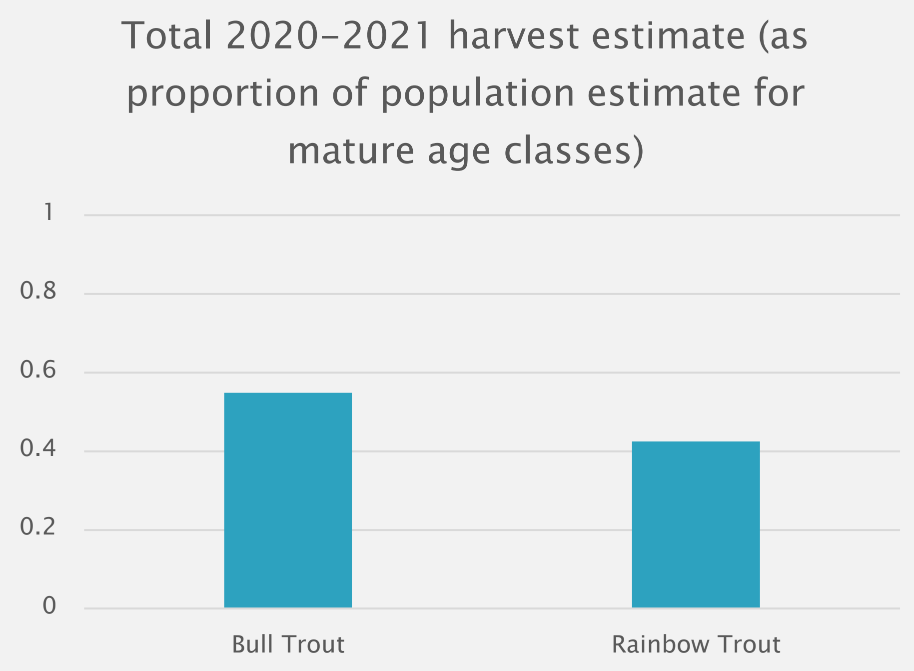
  2) Guide caught CPUE/size structure

  3) For Bull Trout, redd count has been declining and went down substantially in 2020 (reduced from 361 to 242 in one year). The 2020 angling year and KLAIP will continue to intercept mature Bull Trout, which are highly catchable post-spawn.

- Although adult populations are declining, how much is too much?
  - We have thresholds for these in the KLAP

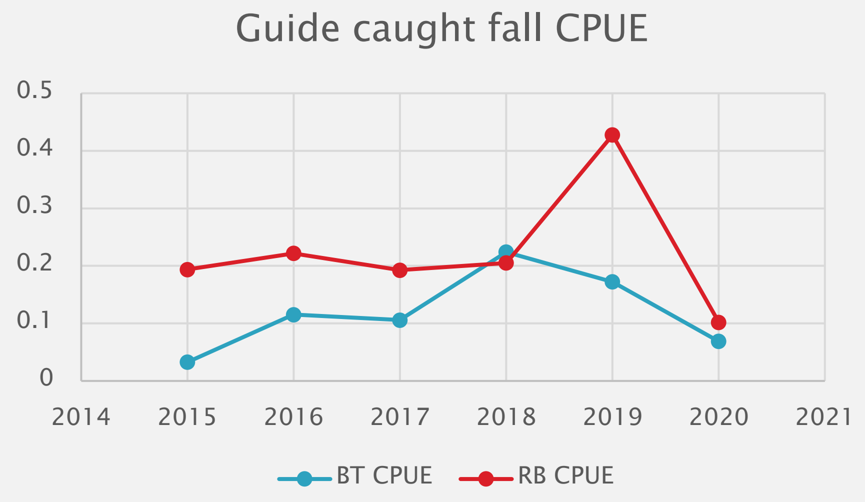
Proportion of mature population harvested in 2020

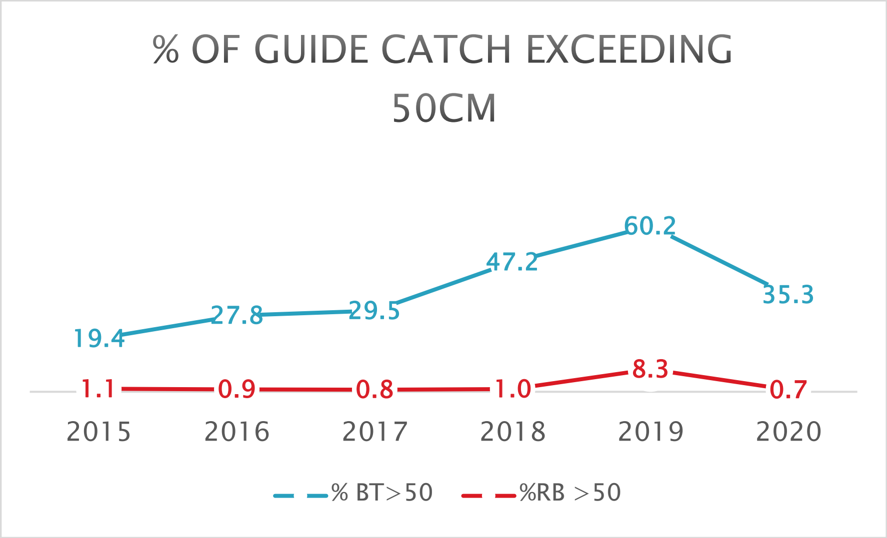
- If on track for ~18K fish removal, substantial proportion of mature population will be removed
- Prior population estimate work suggested the in-lake population should be ~18K age 5-9 rainbow trout (accounting for weak incoming cohorts from 2015-2018 brood years) and ~14K age 6-14 bull trout
- This suggests exploitation on “catchable” age classes could be ~40-60% in 2020-2021. (prior recent years were probably closer to ~10-20% if pop estimates were reasonable)
  - Note* Rainbows were adjusted downwards to account for 72% gerrard in Kerry Reed catch.
- This seems likely to result in recruitment overfishing if maintained, but…..
- Will it be maintained? Exploitation rate may decrease in future years if catch rate declines overall (no hyperstability - lower effort) and age/size structure shifts (smaller fish are less catchable)



Guide caught CPUE and size structure

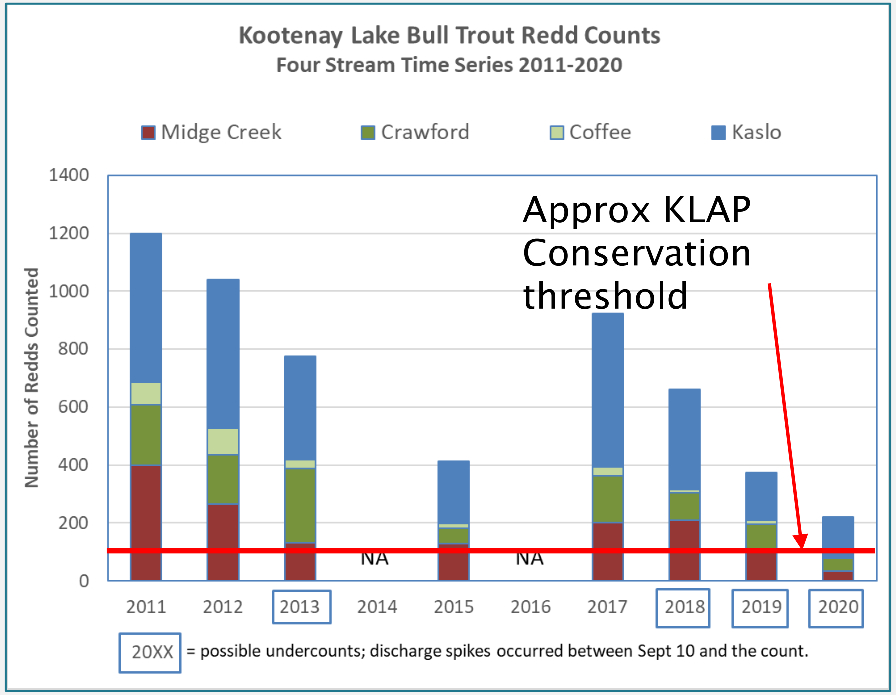
- CPUE is standardized to fall sampling… although 2020 fall sampling has another 2 months to go, CPUE has declined
- Catch is now smaller – likely a fishery effect of removals of larger (more catchable) fish.
- CPUE and size are related (younger, smaller age classes are less catchable)





How close are we to spawner conservation thresholds outlined in the KLAP?

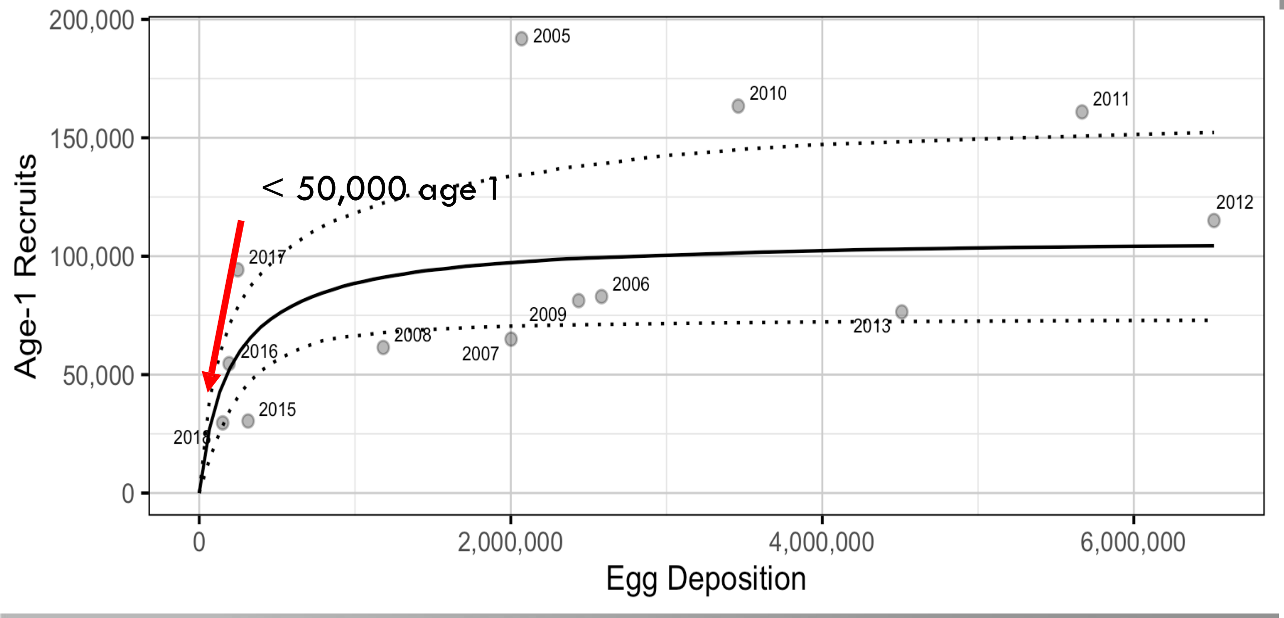
- Keep in mind, conservation thresholds trigger fairly substantive conservation actions be considered as outlined in the KLAP (zero retention, aquaculture etc.). So they are not targets we should be shooting for.
  - 50/500 for bull trout (assume this means spawners?)
    - 2020 Kaslo count: 111 redds → over quadruple the threshold of spawners
    - 2020 limited (Kaslo, Midge, Crawford, Meadow, Coffee… represent ~50-60% of spawning population) lake-wide survey: 229 redds = 503 spawners → still ~double conservation threshold (but uncertainty due to missing Duncan flip bucket count/incomplete redd survey).
  - Rainbow threshold of 50-100 AUC.
    - Most recent count is 246
    - Most recent count is not reflective of 2020-2021 fishing season so we won't know until 2021
    - Very low proportion of >50cm in guide catch and lower catch rates suggest we're heading for lower #s in 2021.
- We won't have a full accounting of 2020 actions until 2021, but the 2020 fishing season has almost certainly taken us closer to conservation thresholds



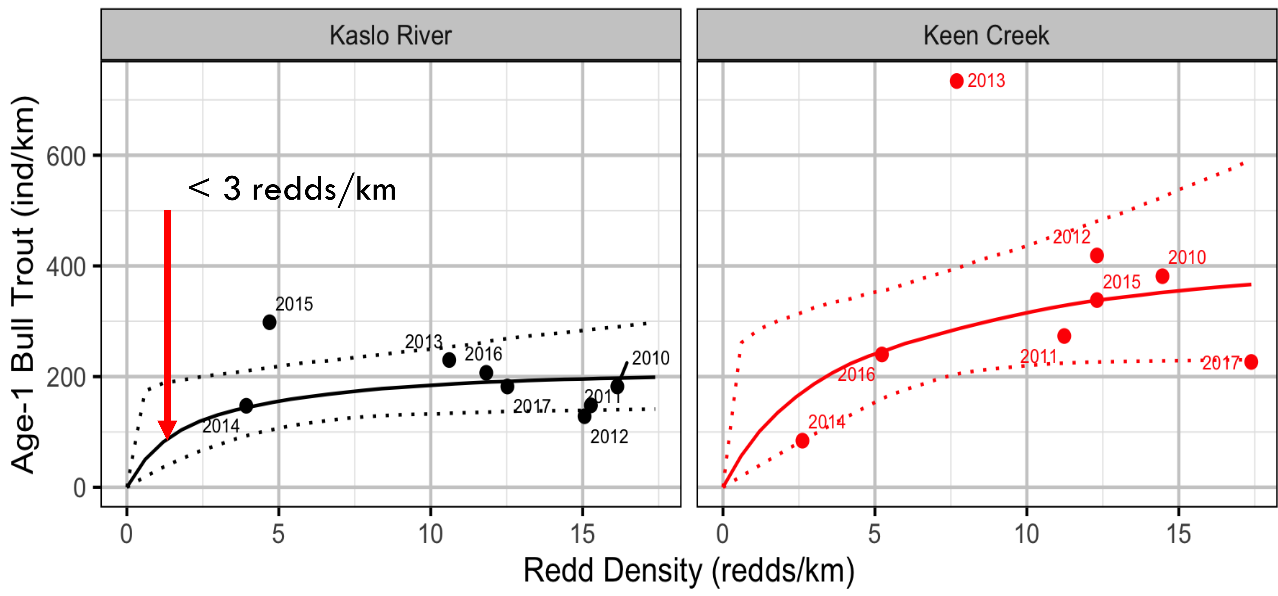
RECOMMENDATIONS – GREG ANDRUSAK

- CONTROLLING RECRUITMENT IS KEY TO ENSURE KOKANEE RECOVERY
- WE NEED TO KNOW THE SIZE OF THE FISH (GERRARD) TO GET THE NUMBER OF EGGS PER SPAWNER
- RECOMMENDATION (GERRARD)- NEED TO REDUCE < 125 SPAWNERS, REDUCE RECRUITMENT TO <50%, RISK IS LOW (MULTIPLE AGES)
- RECOMMENDATION (KASLO RIVER)- BT REDUCE REDD DENSITIES < 3 REDDS/KM TO REDUCE RECRUITMENT TO <50% BY REMOVING SPAWNERS PRIOR (< 100 REDDS REQUIRED), RISK IS LOW (MULTIPLE AGES)
- LAKE PEND O’REILLE PROVIDES THE EVIDENCE FOR SUCCESS

Gerrard-age 1 recruits



Kaslo-redd counts



Should we continue piscivore monitoring and diet sampling?

- Angling guide– sci collection permit
  - Age structure + diet composition (are predators getting closer to being satiated?)
  - % Gerrards in fishery
  - Size structure of catch
  - Catch rate
  - Data used for bio-energetics modeling

- Is enhanced monitoring necessary to continue?
  - Not necessary for recovery, but may be essential for understanding recovery, esp. *during* recovery.
  - Informs management decisions during recovery
  - Controlled dataset, real-time data

Are there other actions we should revisit?

- What further actions may accelerate kokanee recovery?

Summary

- Biological update
- 2020 Implementation and Ongoing Actions
- Key Questions
  - Should we propose to collect eggs and stocking in 2021?
  - Should we continue to reduce predation pressure in 2021?
  - Should we continue piscivore monitoring and diet sampling?
  - Are there any other actions we should revisit?

Thank you!