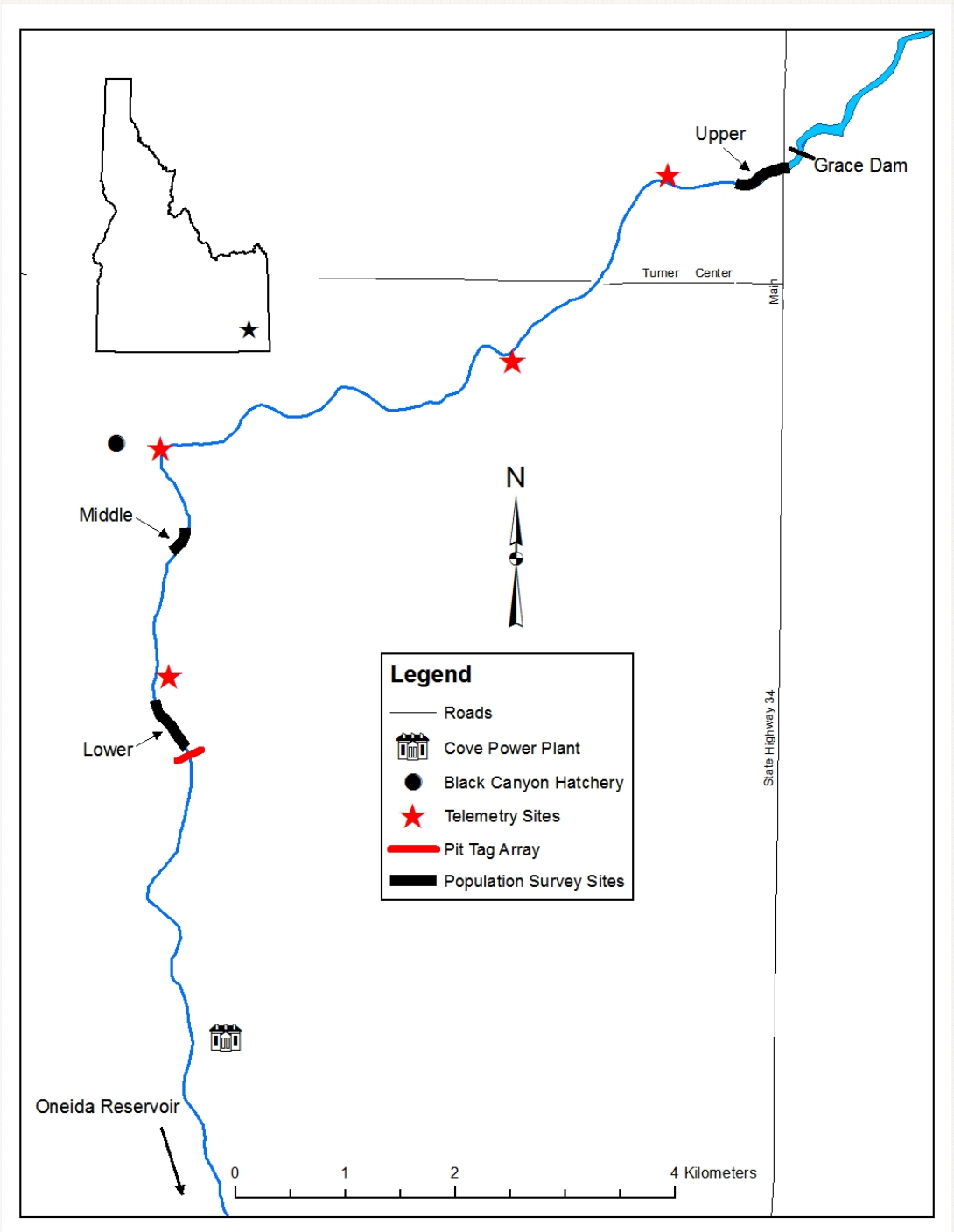
Bonneville Cutthroat Trout Monitoring in the Black Canyon of the Bear River: Responses to Whitewater Boating Flows

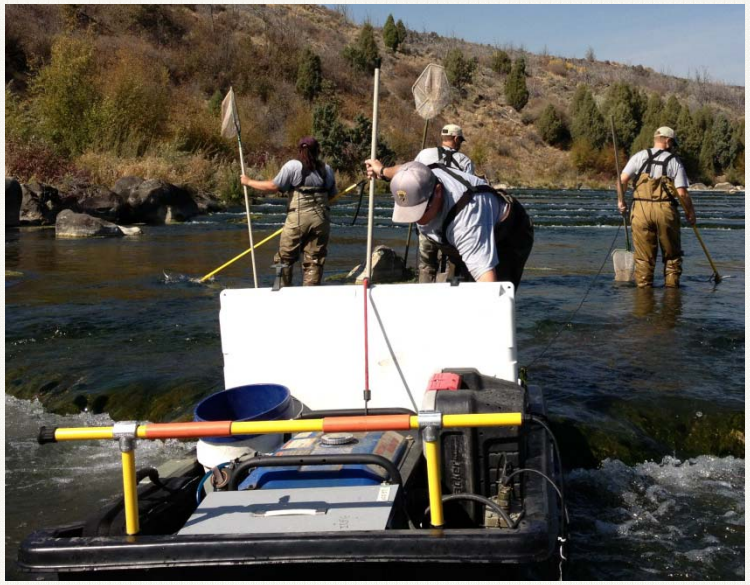
Objectives

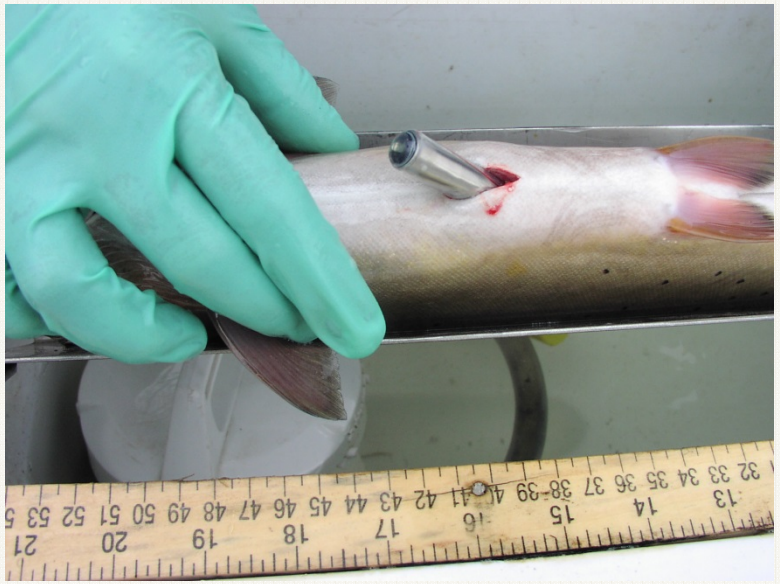
- Identify the response of BCT to WWBF events using radio telemetry and Passive Integrated Transponder (PIT) tags
- Monitor Fish abundance and species composition
- Evaluate fish entrainment into the Gentile Valley Canal

Study Site Overview



Methods and Analysis for Radio Telemetry Study



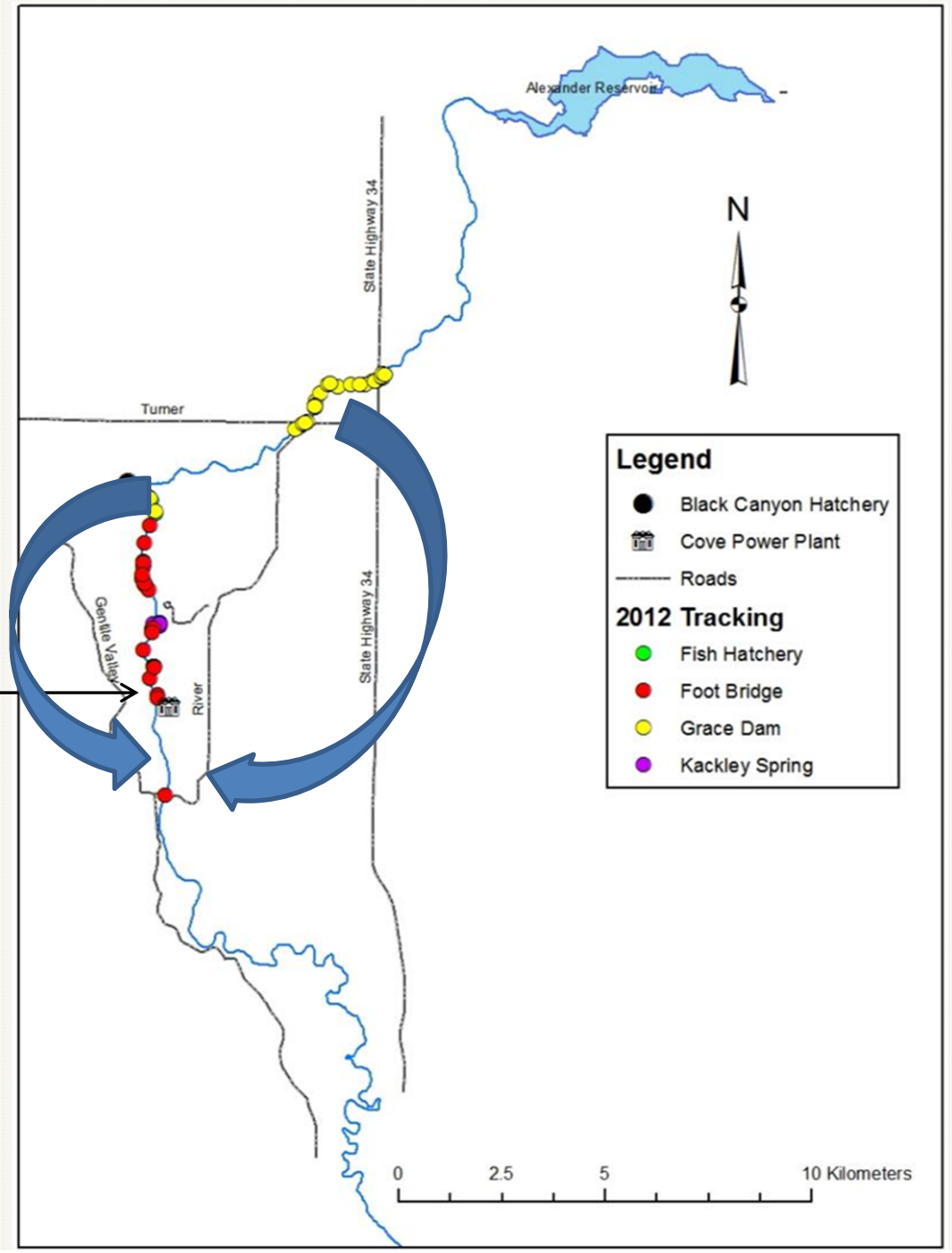


- We used downstream movement of telemetry-tagged fish to determine if BCT were displaced during WWBF events

Defining Displacement

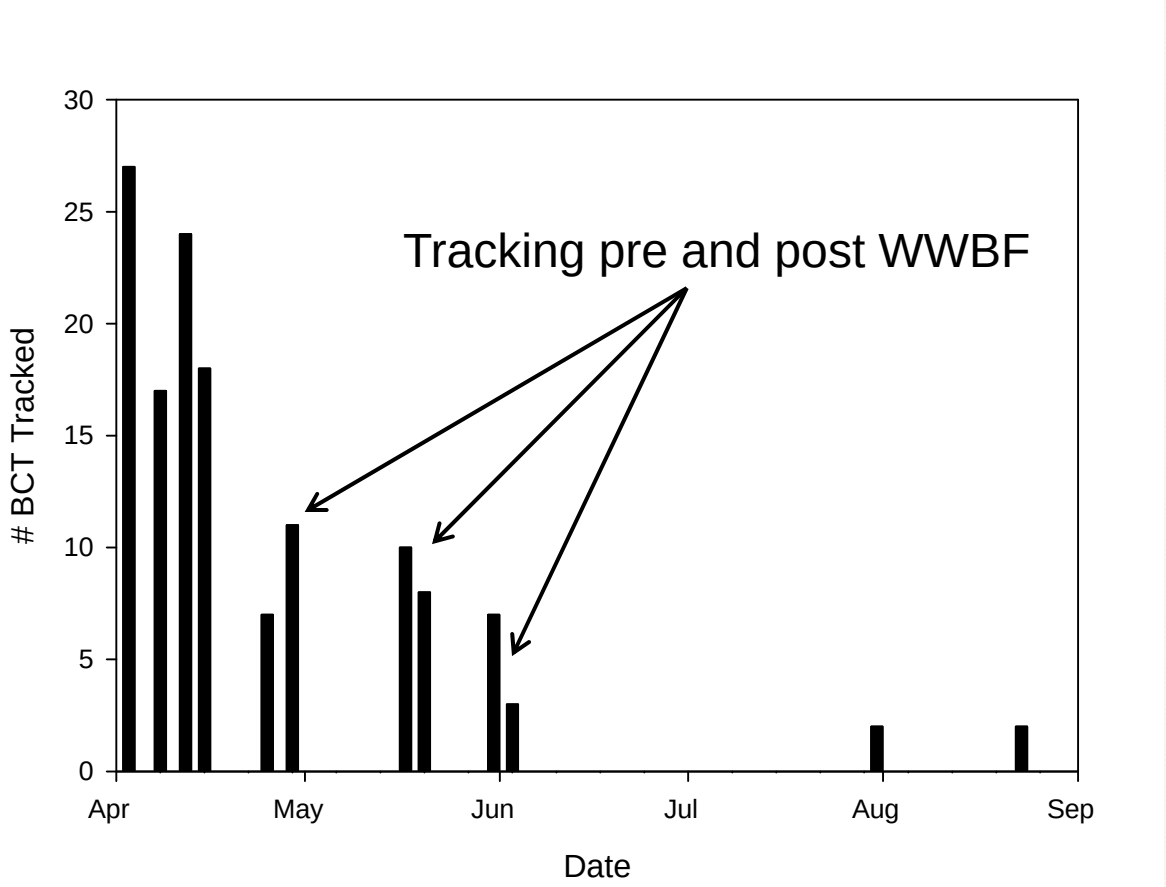
Observations where BCT moved below Cove Dam during WWBF events.

We choose the Cove Power Plant as a cutoff point for defining displacement because all of the BCT tracked below that location were mortalities.



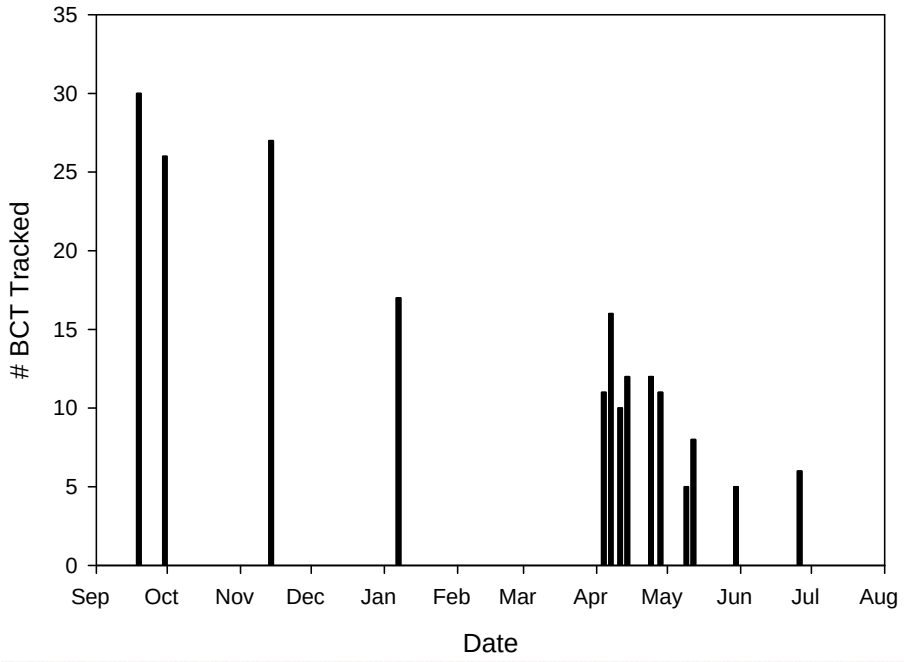
Results

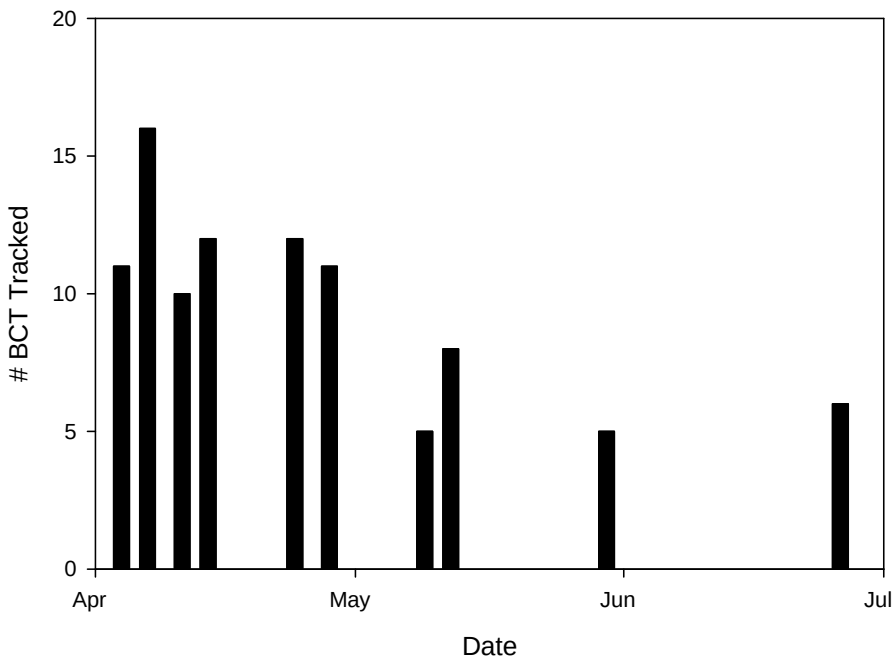
2013 Tracking



*Over half of the telemetry tagged BCT disappeared from the study area during the first month.

2014 Tracking





BCT Displacement Estimates During WWBFs

Year	Date	Tracked	Displaced	
			Number	Percent
2013	4/13 - 4/14	18	1	5.6
	4/26 - 4/28	7	0	0.0
	5/18 - 5/19	8	0	0.0
	6/1 - 6/2	1	0	0.0
2014	4/5 - 4/6	11	0	0.0
	4/12 - 4/13	10	1	10.0
	4/25 - 4/27	11	0	0.0
	5/10 - 5/11	5	0	0.0
	Total	71	2	2.8

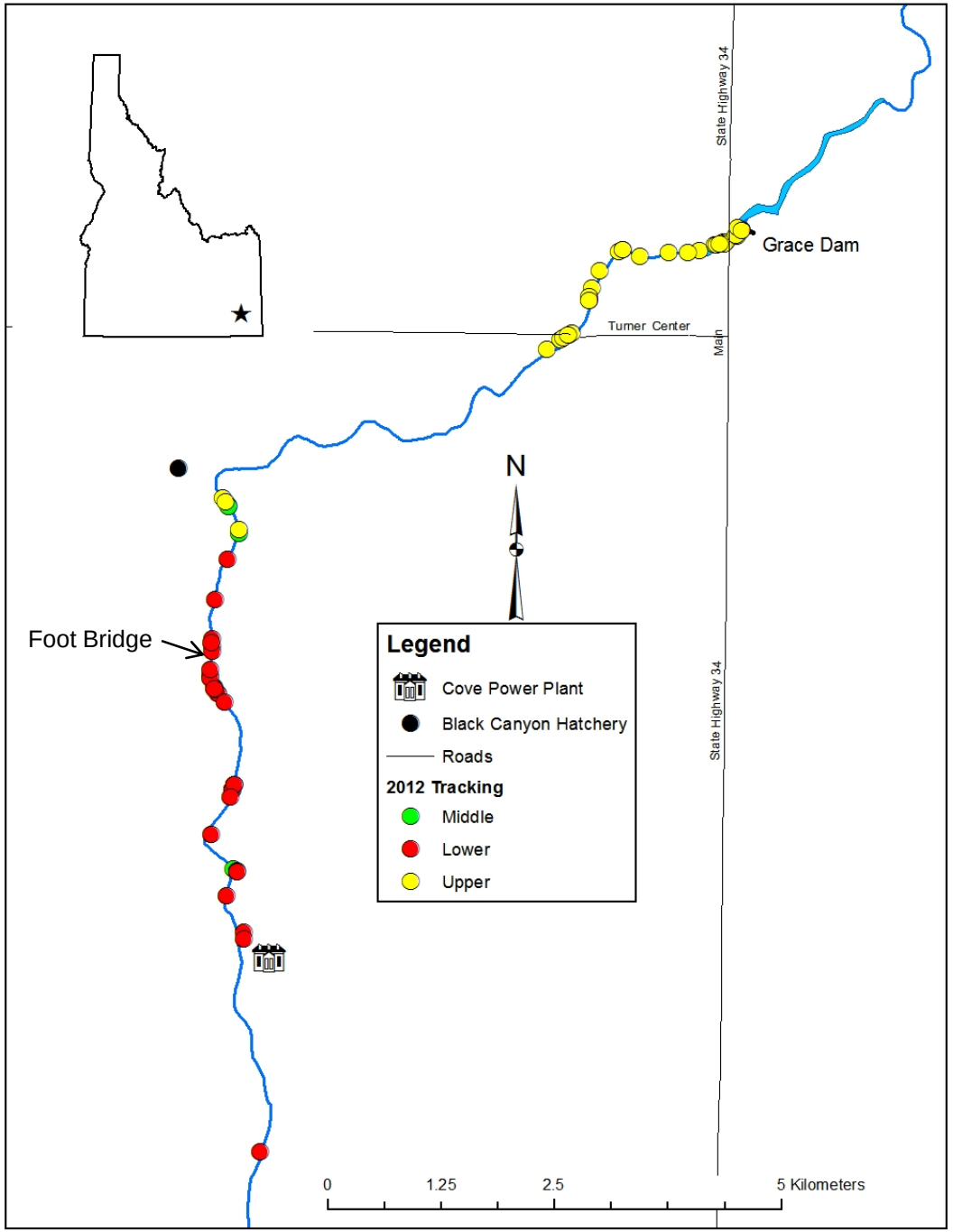
2012 Telemetry Tracking Locations

<u>Spring</u>

- Tagged 39 total BCT
- 22 at Grace Dam, 16 at the Foot Bridge, and 1 at Kackley Springs

<u>Fall</u>

- Tagged 13 from fish population survey sites (see study site)
- 1 Upper, 6 Middle, 6 Lower



2013 Telemetry Tracking Locations

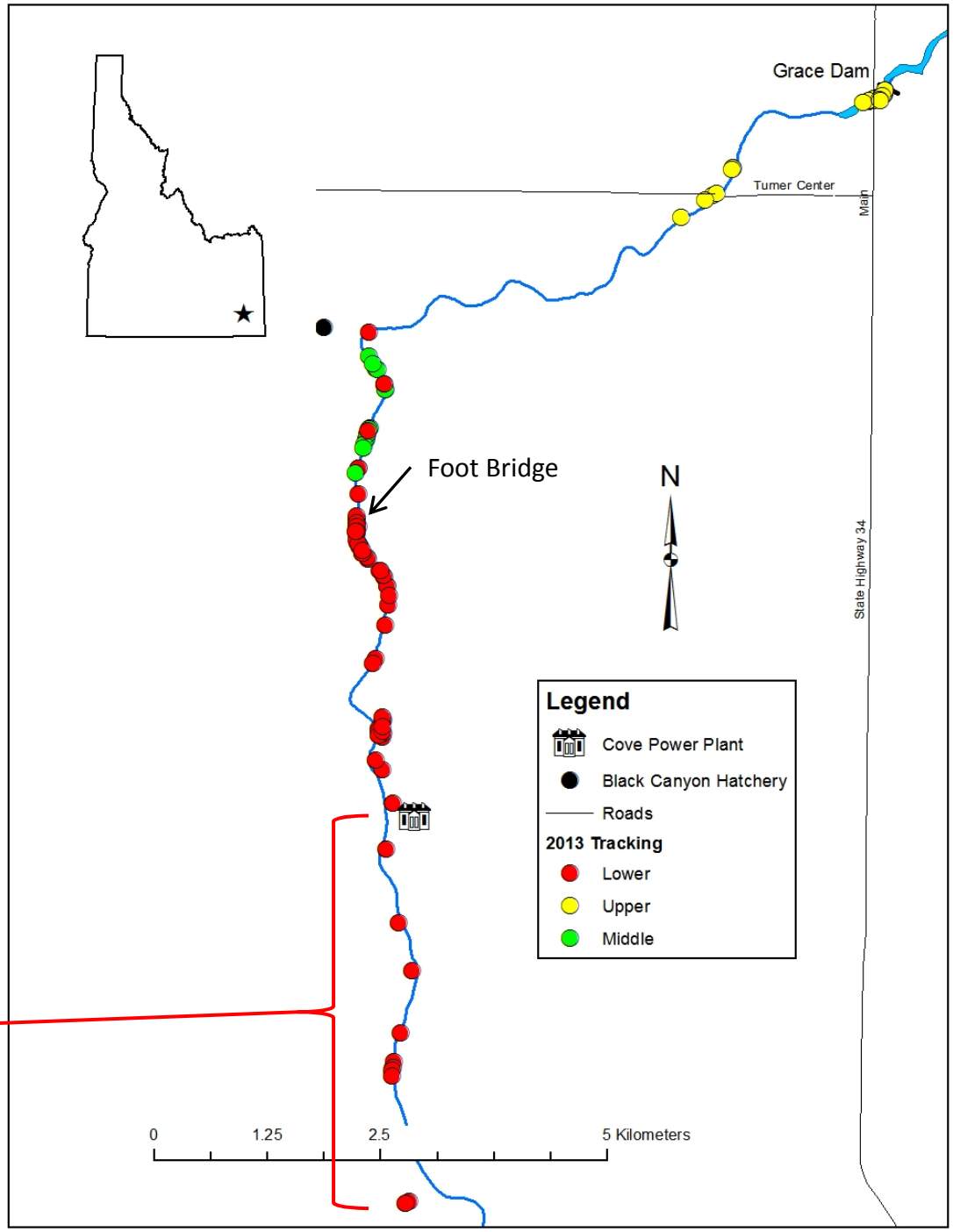
Spring

- Tagged 27
- Released 12 Grace Dam and 15 Foot Bridge
- Tracking 13 from previous Fall

Fall

- Tagged 30
- Released 15 Grace Dam and 15 Foot Bridge

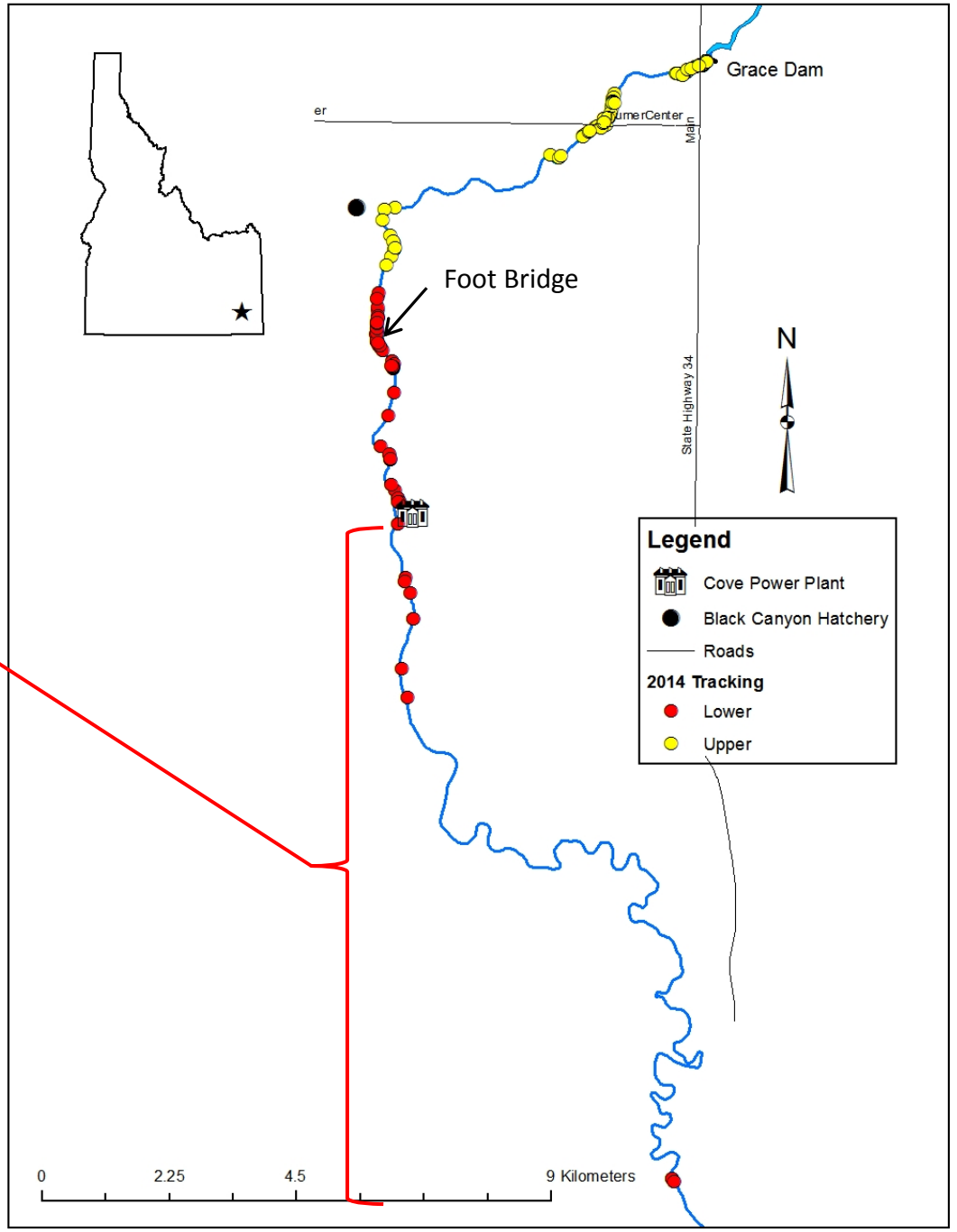
All of the BCT tracked below the Cove Power Plant were mortalities



2014 Telemetry Tracking Locations

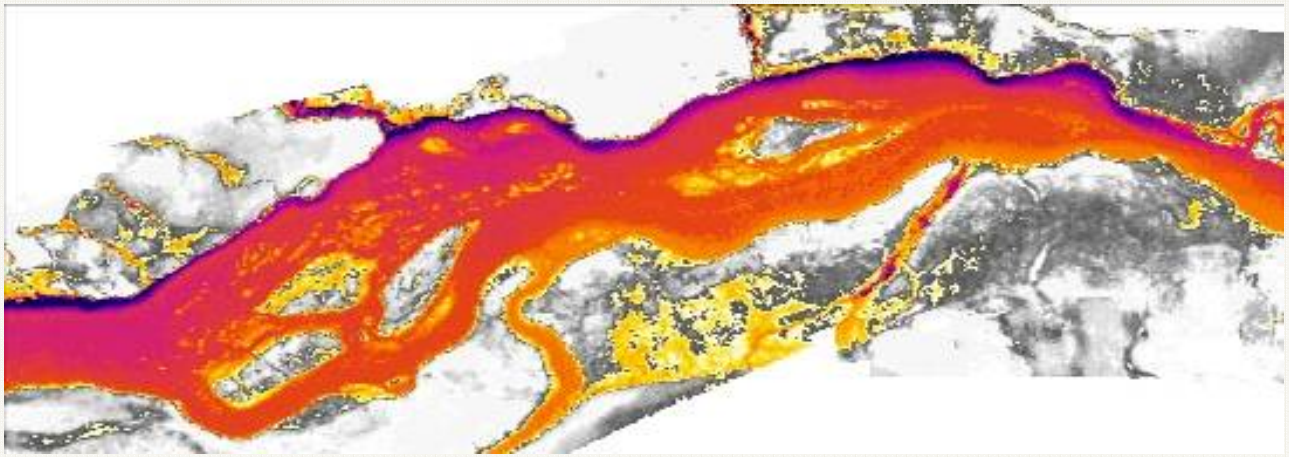
- Tracking 30 from previous Fall

All of the BCT tracked below the Cove Power Plant were mortalities

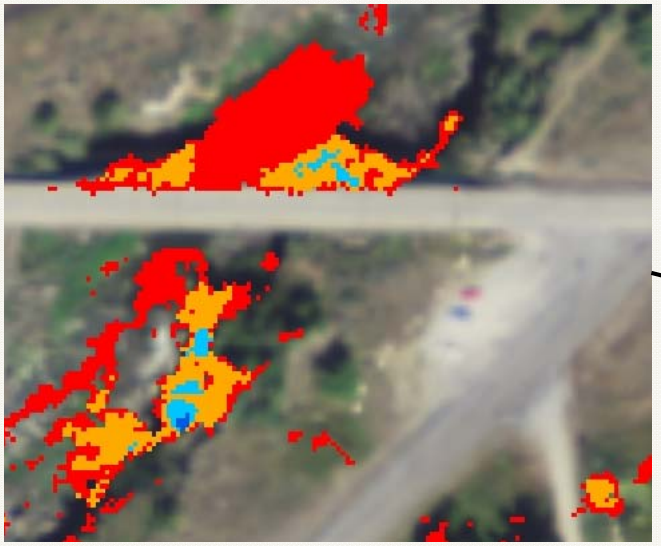


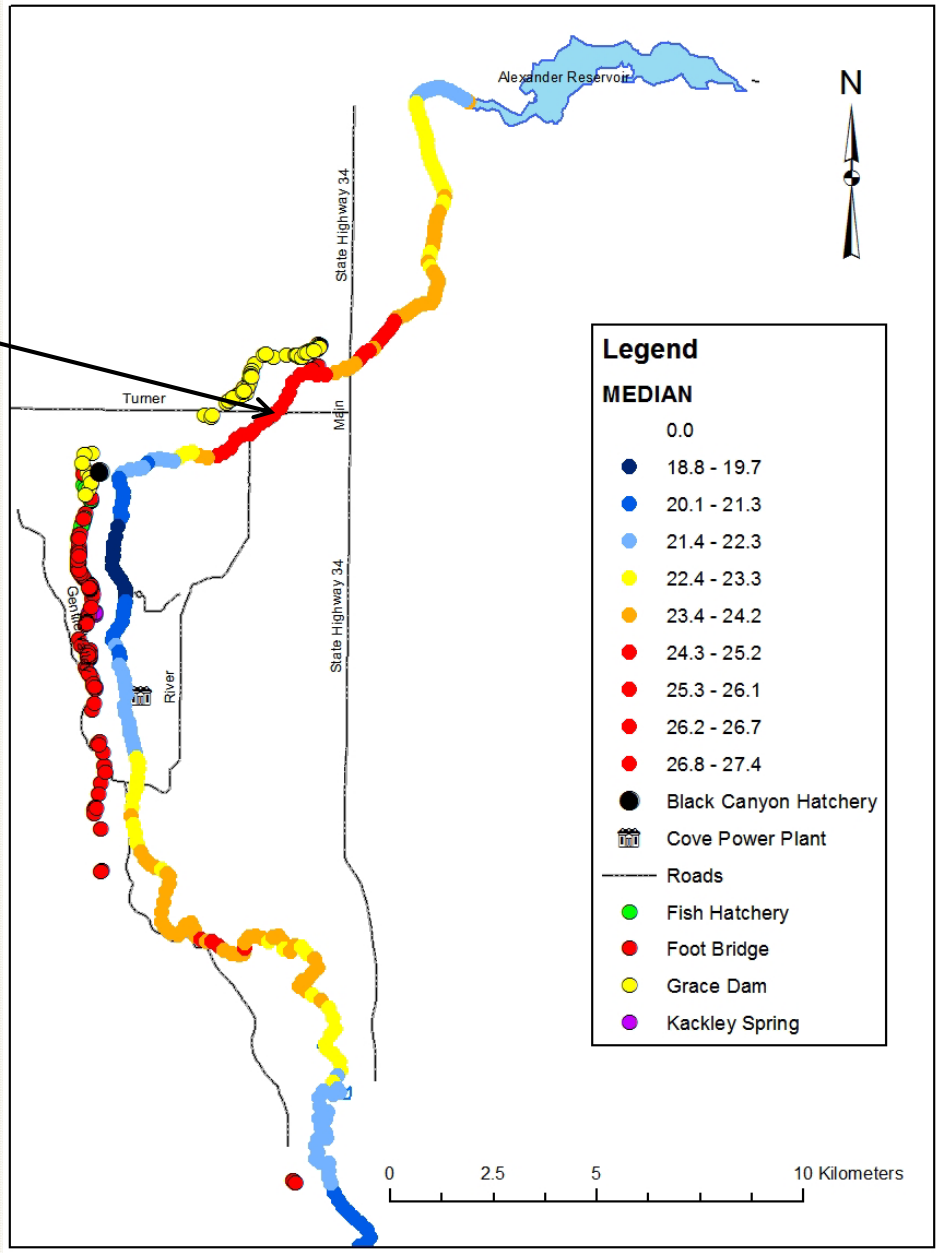
Radio Telemetry Summary

- Most of the telemetry-tagged BCT disappeared from the study area
- Pre and post WWBF tracking results suggests low levels of displacement (<3%)
- Water temperature appears to influence habitat selection by BCT



BCT Tracking and Thermal Imaging





Thermal image at Turner Bridge
BCT find the cold-water inputs

Fish locations are dots on the left
Water temperatures are on the right

It appears that water temperatures limit fish use below the spring inputs downstream of Cove Power Plant

PIT-tagging Study
Methods & Analysis

- PIT tag a sample of the BCT being released from the broodstock program
- Released those fish at Grace Dam and Foot Bridge
- Use fixed array to detect downstream movements during WWBF events

Results

PIT tag results
2012 River Array and WWBF

No Pit tags were detected on the river array

- All pit tagged BCT were released at Grace Dam
- We had difficulty keeping the river array running during WWBF events
- Similar to telemetry tagged fish released at Grace Dam, PIT-tagged fish did not appear to make it downstream to lowest site near the Foot Bridge.
- The following year we began stocking PIT-tagged fish at the Foot Bridge.

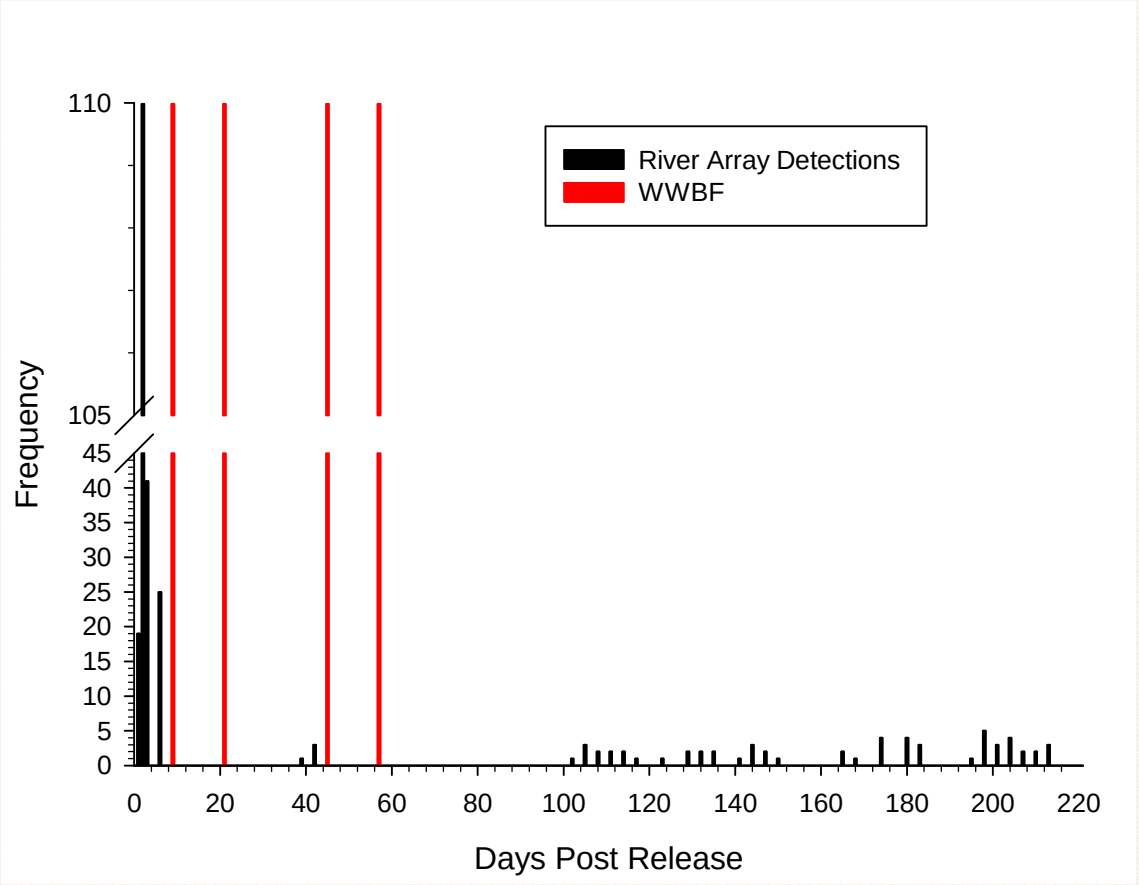
PIT tag Results
2013 River Array and WWBF

<u>BCT released at Grace Dam</u>

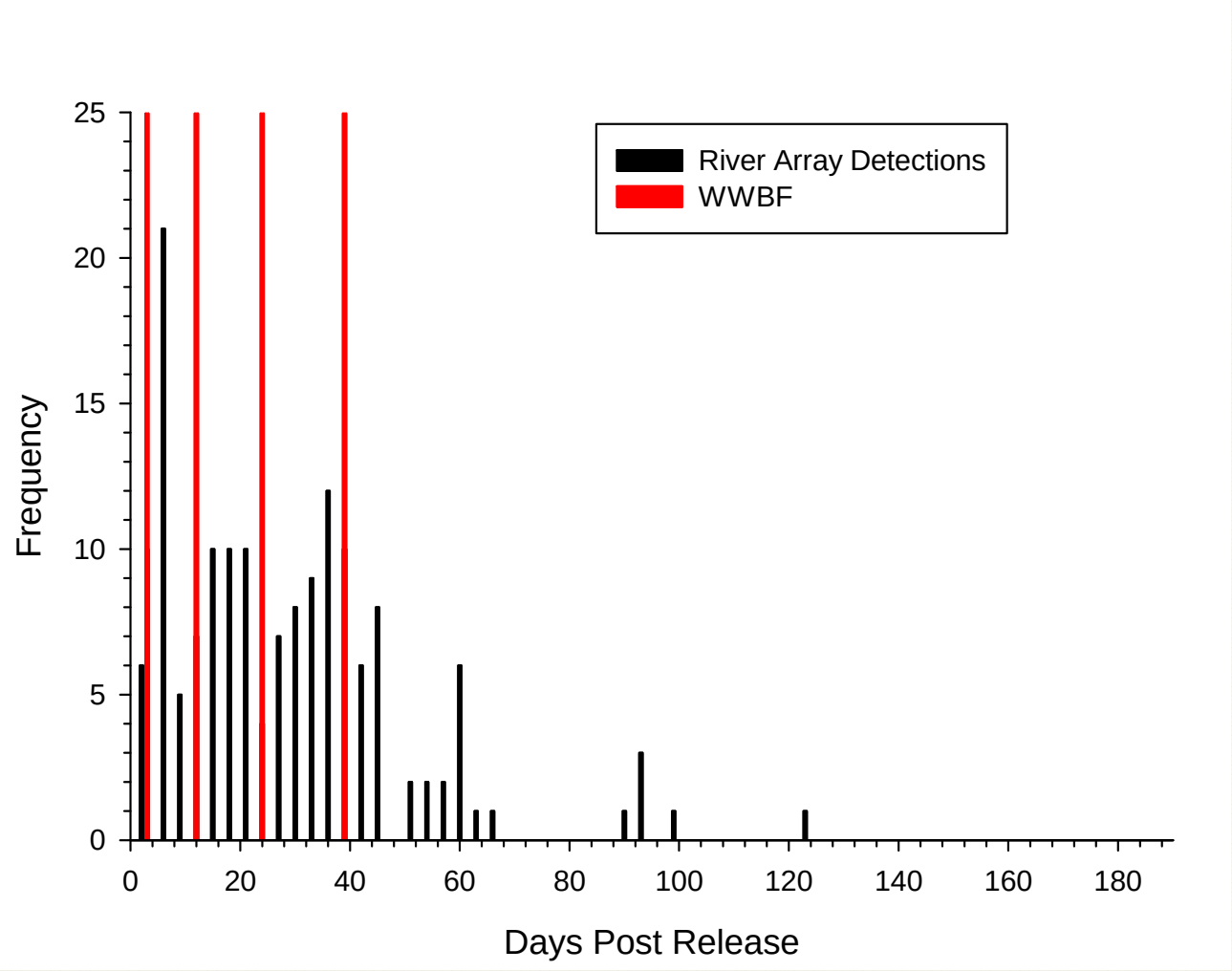
- Similar to 2012, no PIT-tagged BCT stocked at Grace Dam were detected at the PIT tag array.

<u>BCT released at Foot Bridge</u>

- 195 of the 300 (65%) PIT-tagged BCT moved downstream of the array prior to the first WWBF event.



2014 River Array and WWBF



PIT Tag Summary

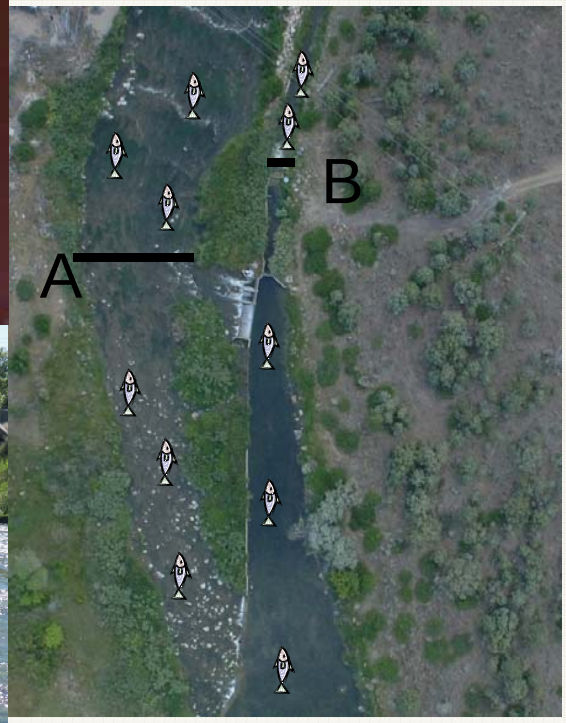
- In 2012, we do not believe the array was working well during the WWBF events. For PIT tag evaluation, this year was a bust

- In 2013, the majority of PIT-tagged BCT left the study area prior to WWBF events

- In 2014, PIT-tagged BCT gradually moved downstream past the array, a spike in detections was observed after the first WWBF event but not after the two subsequent WWBF events.

- Overall: we did not observe consistent downriver movement associated with WWBF events from PIT-tagged BCT.

Methods and Analysis for Irrigation Entrainment Study



Entrainment

		# Entrained				
Tag Year	# Released	2012	2013	2014	Total	% Entrained
2012	390	0	0	1	1	0.3
2013	975		12	6	18	1.8
2014	513			7	7	1.4

Percent entrained was estimated by dividing the total number entrained by the total number released for that year.

How many other canals have we screened that entrain insignificant numbers of BCT? It would have cost hundreds of thousands of dollars to screen this canal and the impact on the population would have been negligible.

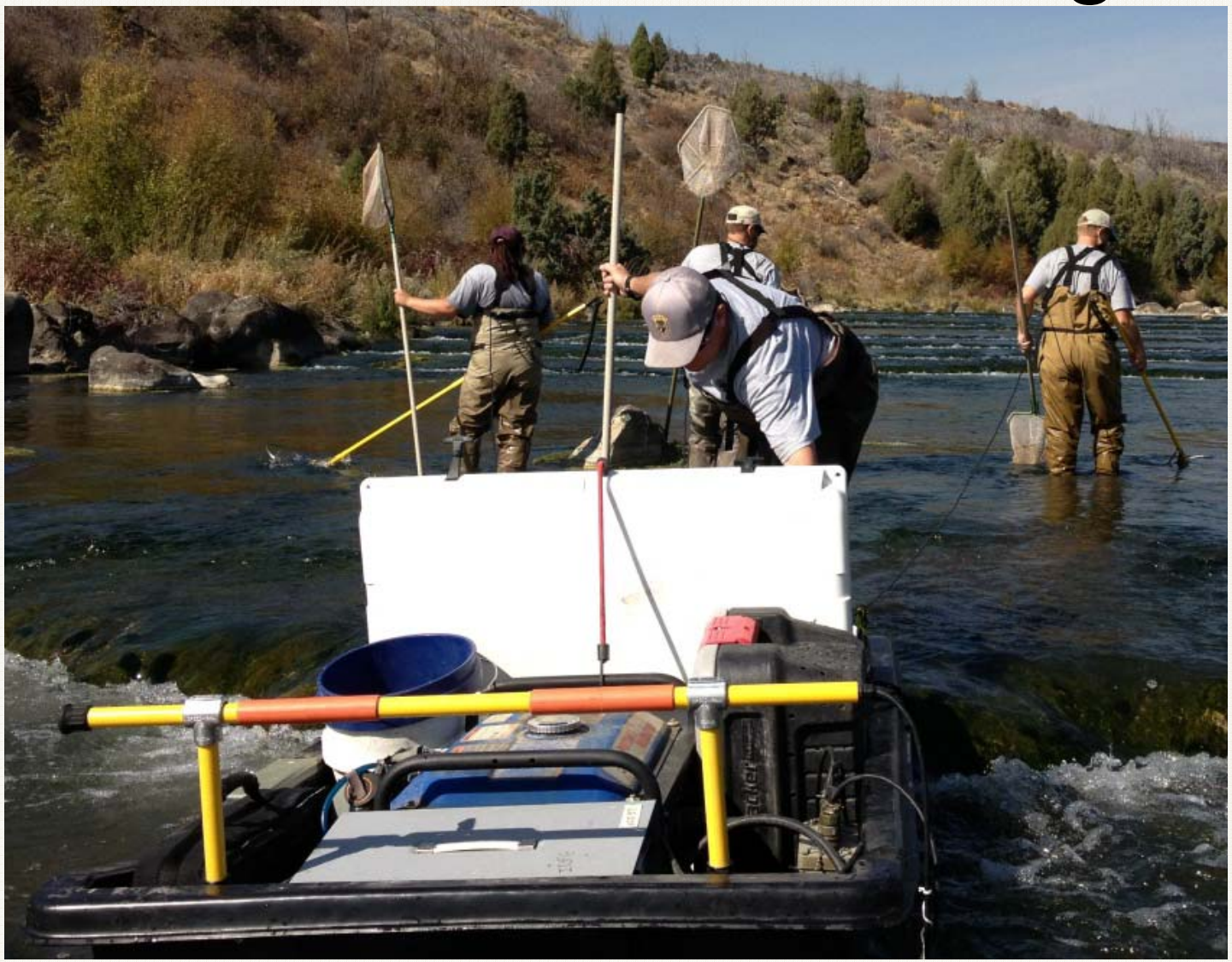
Entrainment (Gale et al. 2008)

	# Detected			
Year	River	Canal	Total	% Entrained
2012	0	0	0	0.0
2013	213	18	231	7.8
2014	72	7	79	8.9

BCT had to encounter array to be included in the sample size.

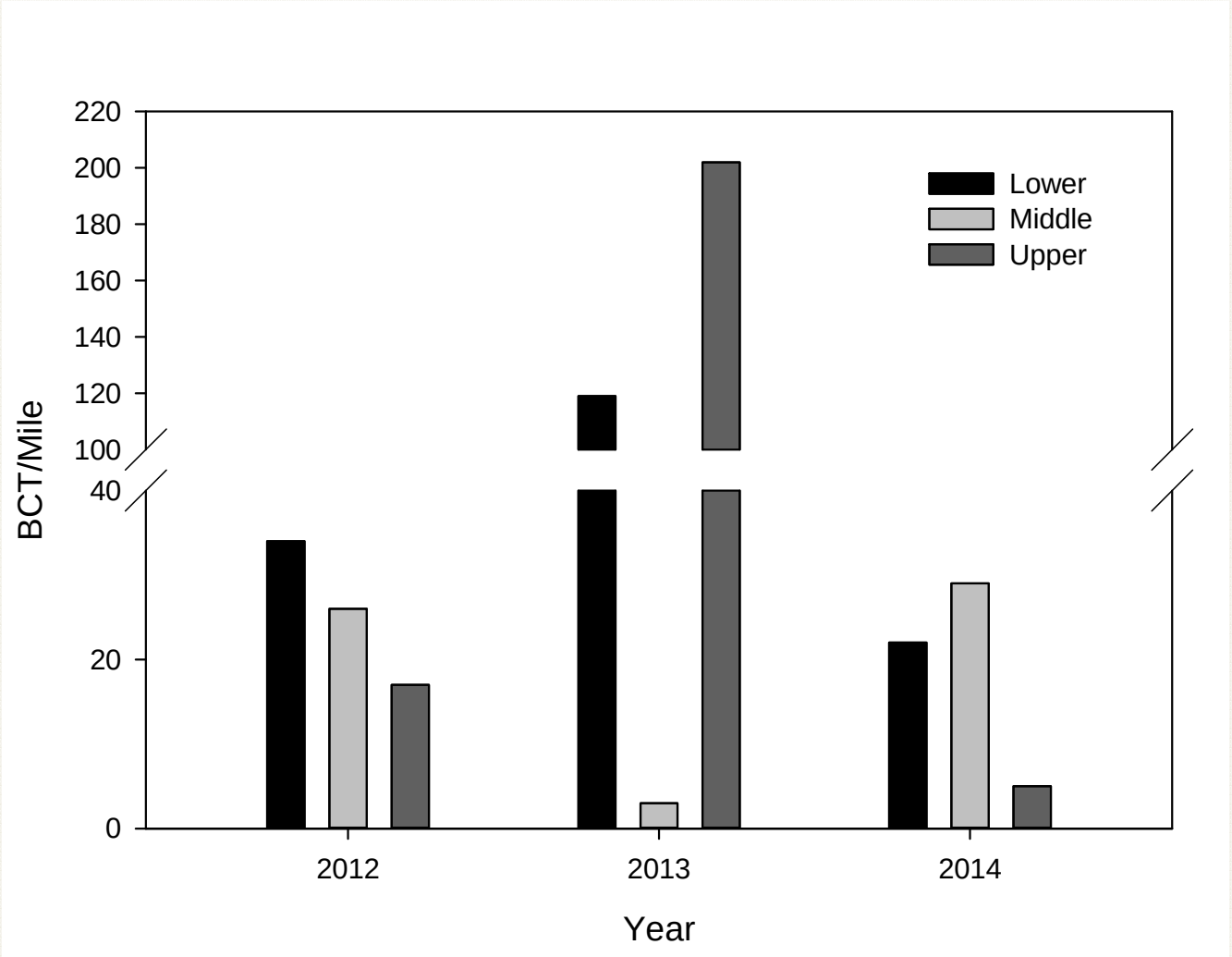
Fish Population Monitoring

Methods and Analysis for BCT Abundance Monitoring

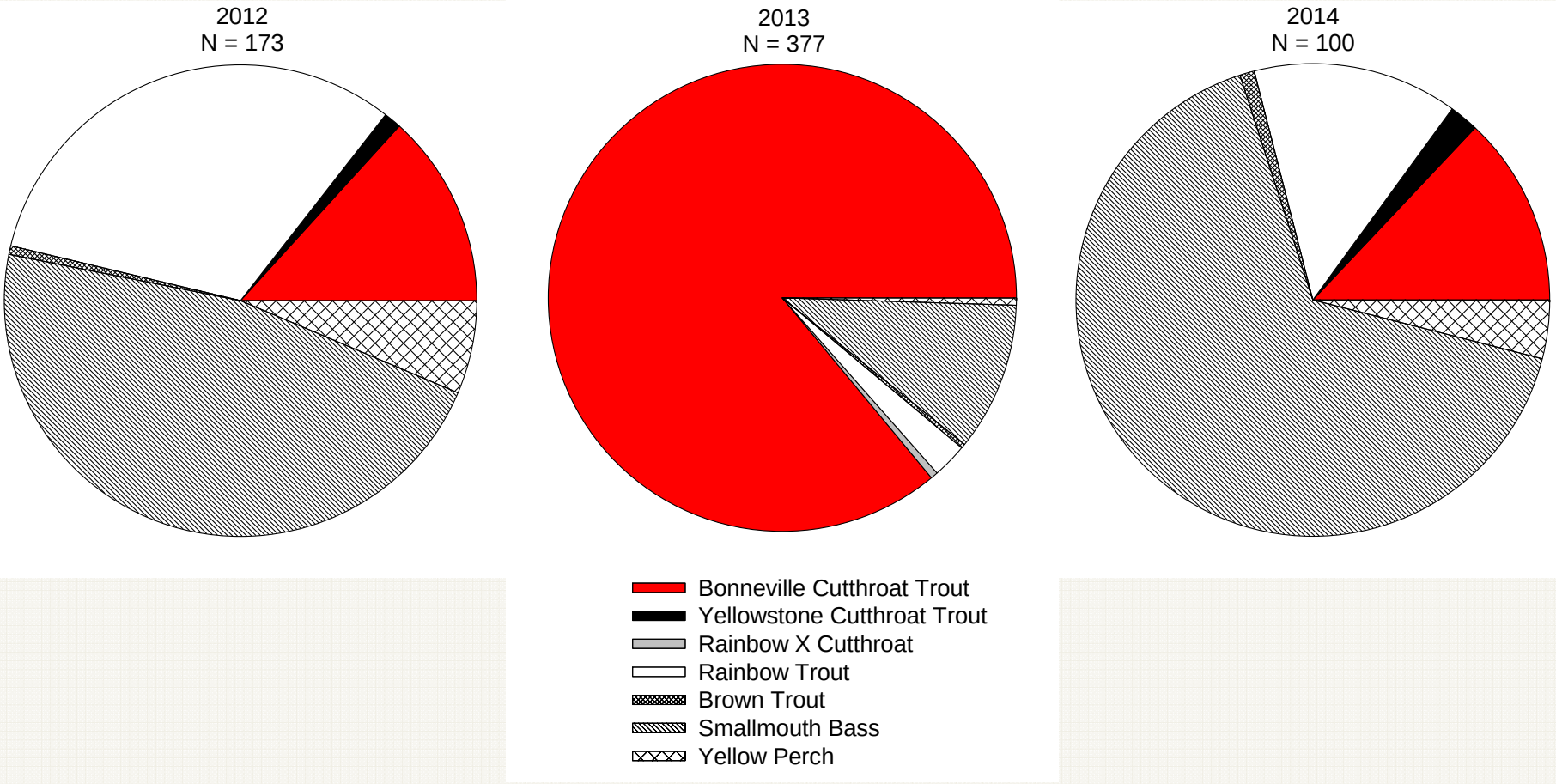


Results

BCT Abundance (BCT / mile)



Species Composition



Condition of BCT Sampled

Population	Sample size	Relative Weight (W_r)
Nounan	48	83
Pegram	76	82
Black Canyon	41	80

The Relative Weight (W_r) index uses 100 (or a range of 95 -105) as a benchmark for a fish in good condition.

Conclusions

- WWBF did not appear to have a significant impact on BCT in Black Canyon.
- Our results are limited to the size of fish that we tagged (150-300mm). Young of year BCT may or may not respond differently to WWBF.
- BCT entrainment in the Gentile Valley Canal was minor. The worst case scenario of entrainment was <9%. Screening this large diversion is not warranted.

Where do all the BCT go?

Predation
Fall vs Spring Release

				Number of tags recovered from cormorant nest			Totals	
Year Tagged	Season	Method	# Tagged	2012	2013	2014	Number	Percent
2012	Spring	Hatchery	300	167	0	0	167	**56**
2013	Spring	Hatchery	608		67	8	75	**12**
2014	Spring	Hatchery	513			53	53	**10**
2012	Fall	Survey	90		3	0	3	**3**
2013	Fall	Hatchery	300			20	20	**7**
2013	Fall	Survey	67			0	0	**0**

BCT released in the Spring are at least twice as likely to be lost to bird predation compared to those released in the Fall.

Predation
Release Location

			Recoveries	
Year	Location	Tagged	Number	Total (%)
2012	Dam	300	167	**56**
2013	Dam	303	52	**17**
2014	Dam	207	28	**14**
2013	FTB	605	38	**6**
2014	FTB	306	25	**8**

BCT released at Grace Dam were twice as likely to be lost to bird predation compared to those released at the Foot Bridge

Limiting Factors for BCT in the Black Canyon Reach of the Bear River

1. Bird Predation
2. Water temperatures
3. Flow management and non-native species interaction