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Hayden Cody

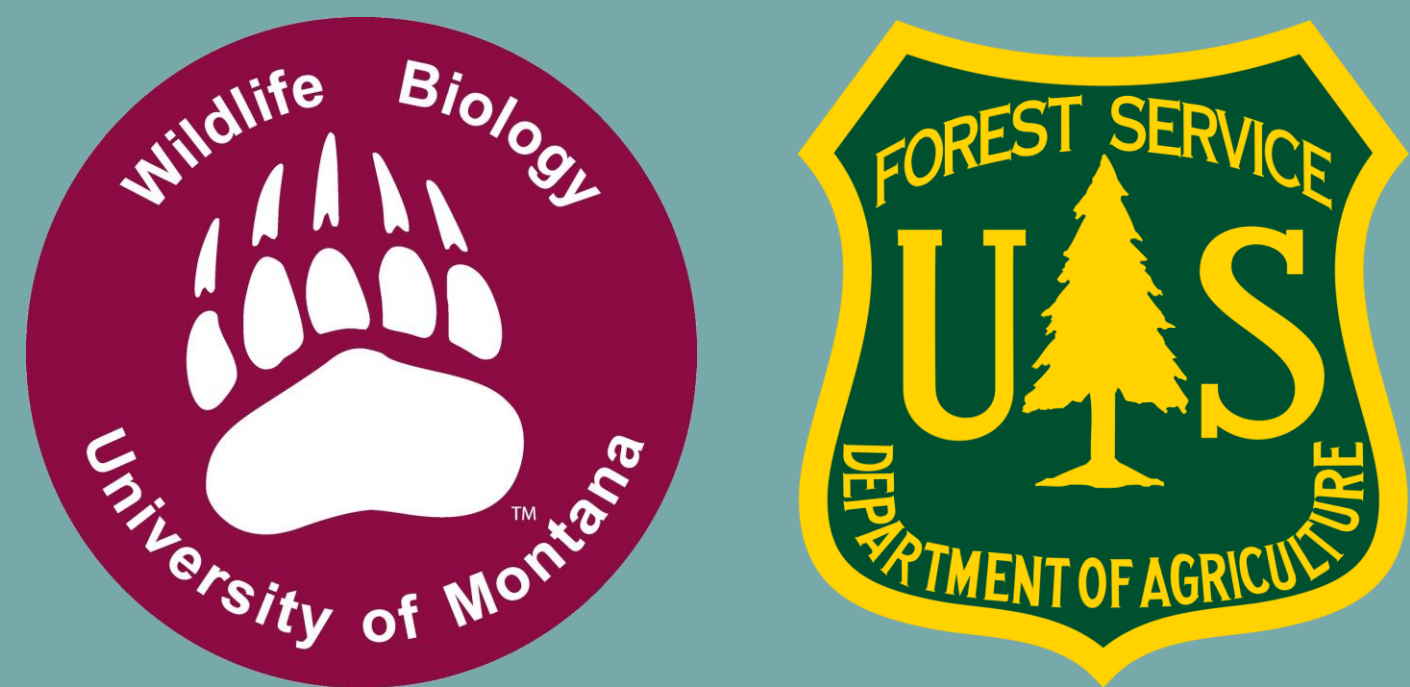
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Westslope Cutthroat Trout summer movement in western MT headwater streams

Hayden Cody, Andrew Lahr and Lisa Eby
Wildlife Biology Program, University of Montana



Introduction

In western Montana, Westslope Cutthroat Trout (WCT) have become increasingly confined to small headwater tributaries. In these systems, habitat degradation and Eastern Brook Trout (EBT) invasion pose major threats to WCT. Even though movement is a well-established process by which fishes access critical habitats throughout their life history⁴ (Fig. 1), little is known about resident WCT movement in these headwater systems. As we work to conserve these populations, describing the scales of movement and understanding how they differ among streams is useful.

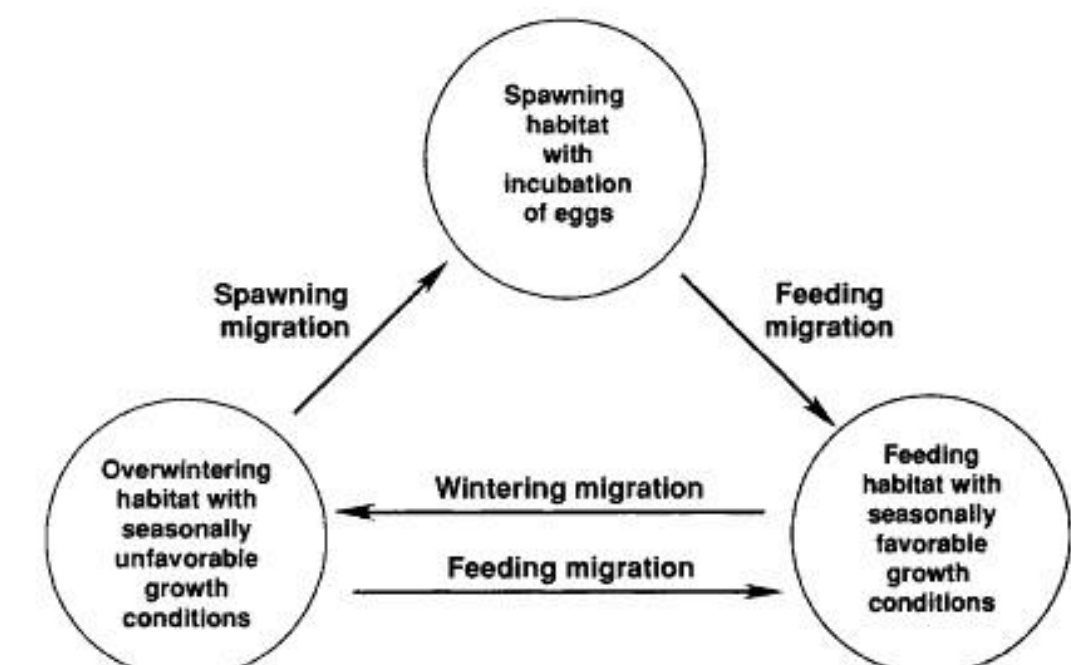


Figure 1. The basic life cycle of stream fish with emphasis on patterns of habitat use and migration⁴

Objective

Describe summer WCT movement in five western MT streams of varying habitat characteristics (and differing Eastern Brook Trout presence.)



Study Area

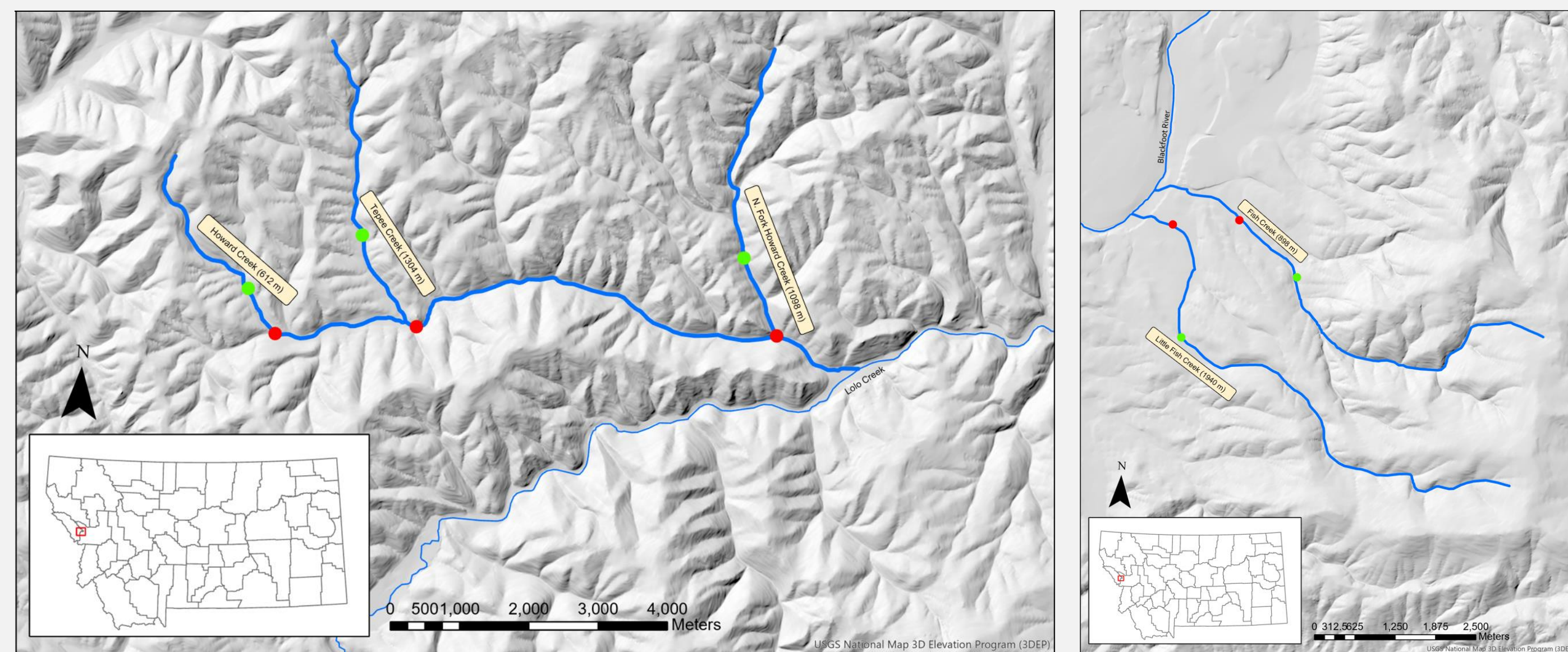


Figure 3. Study streams in Lolo Creek watershed (left) and Blackfoot River watershed (right). The green and red dots indicates the upstream and downstream end of the study reaches.

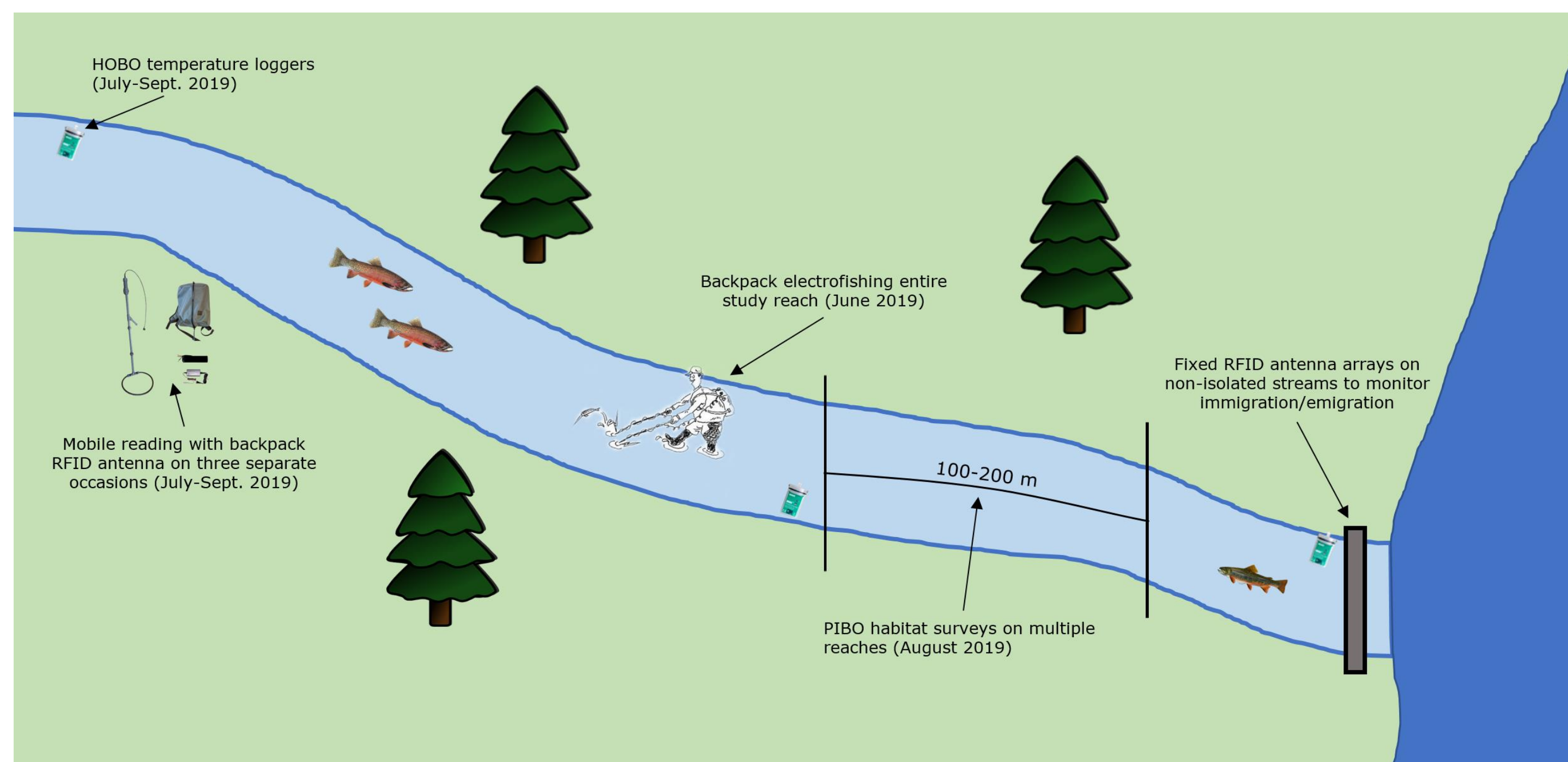


Figure 2. We tagged trout in study reaches and relocated fish along a reach ~1.5-2 times the tagged section.

Methods

- We captured 478 WCT and 250 EBT across all streams in June 2019, individuals > 70mm were tagged with 12 mm PIT tags.
- Stream were resurveyed 3 times with a mobile reader.
- Movement distances were quantified by calculating Euclidean distance between detection locations because sites were relatively linear.
- Habitat data (temperature, wetted depth and width at baseflow, number & size of pools, large woody debris, and bank characteristics) were collected.

Results

Creek	Tepee	N. Fork Howard	Howard	Fish	Little Fish
Complexity					
Pool (%)	7.2%	31.4%	22.3%	6.3%	0.0%
Total Pool Volume (m ³)	4.7	35.4	816.1	9.8	0.0
Total Pool Area (m ²)	12.4	88.3	908.5	27.8	0.0
LWD (#/m)	0.04	0.9	0.7	0.07	0.2
Undercut (%)	15.1%	59.5%	36.8%	26.3%	30.5%
Water Temperature (°C)					
Mean/Range	11.6 (6.7-14.9)	10.7 (6.3-13.3)	11.3 (5.8-19.1)	12.4 (7.5-21.0)	11.8 (7.7-15.0)

Table 1. Habitat characteristics for all streams.

Creek	Length (mm, mean/range)		Tagged (#)		Re-detected (#)		Moved (%)		Median Distance (m)		Emigrated (#)	
	WCT	EBT	WCT	EBT	WCT	EBT	WCT	EBT	WCT	EBT	WCT	EBT
Tepee	86 (36-167)	122 (67-186)	57	136	45	103	78.9%	75.7%	12.7	18.7	0	8
N. Fork Howard	110 (61-178)	103 (38-164)	29	40	24	29	82.8%	72.5%	76.9	75.2	5	2
Howard	100 (19-193)	108 (41-161)	24	63	13	35	54.2%	55.6%	18.4	19.6	0	1
Fish	111 (47-180)	-	108	-	83	-	76.9%	-	33.5	-	-	-
Little Fish	113 (43-220)	-	128	-	105	-	82.0%	-	42.5	-	-	-

Table 2. Summary statistics for WCT and EBT for all detections. Ghost tags were eliminated from the dataset by only including individuals with calculated distance moved > 3m.

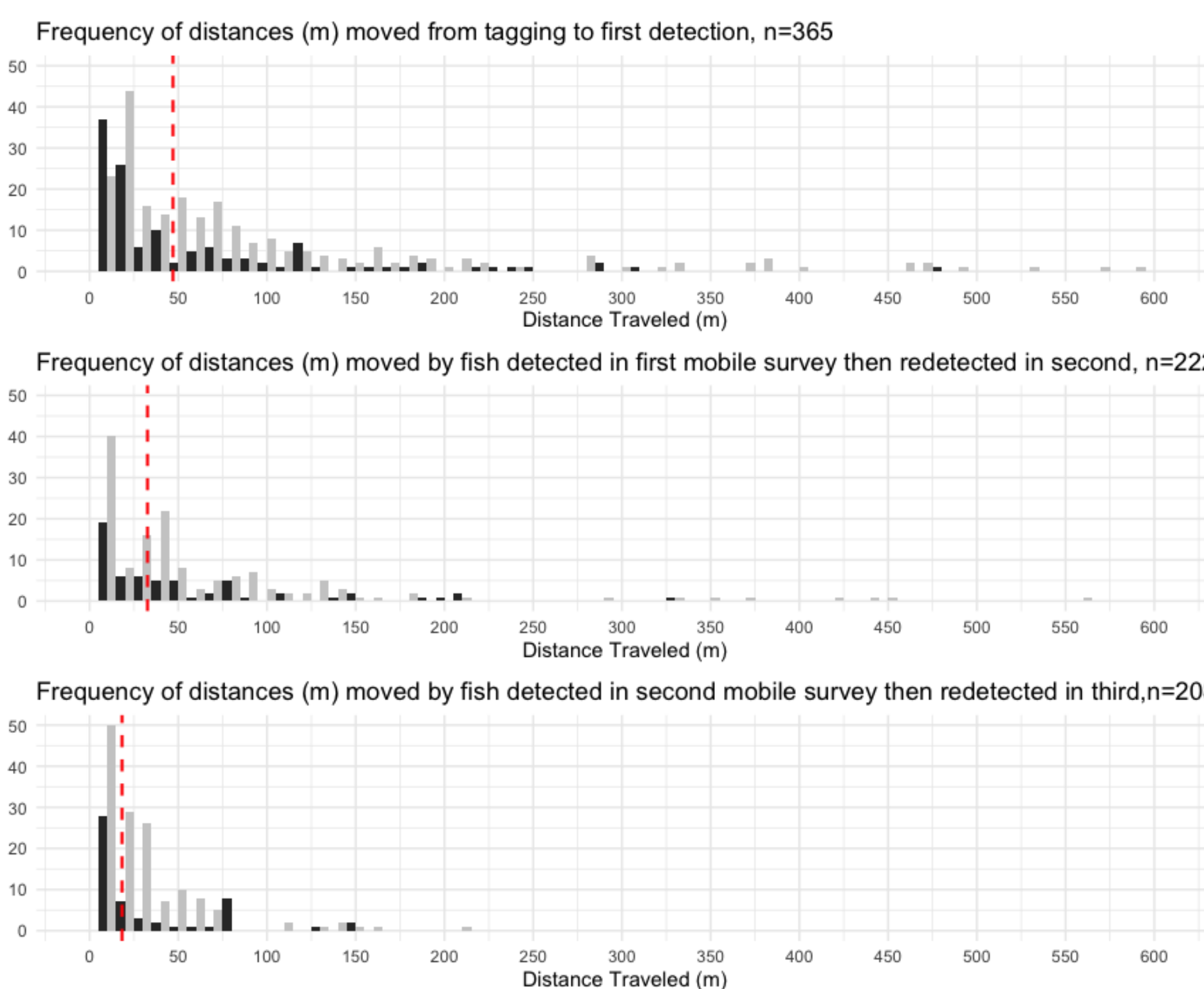


Figure 4. Most movement occurred under 100 m across the summer. Dashed lines indicated median distance moved during each interval.

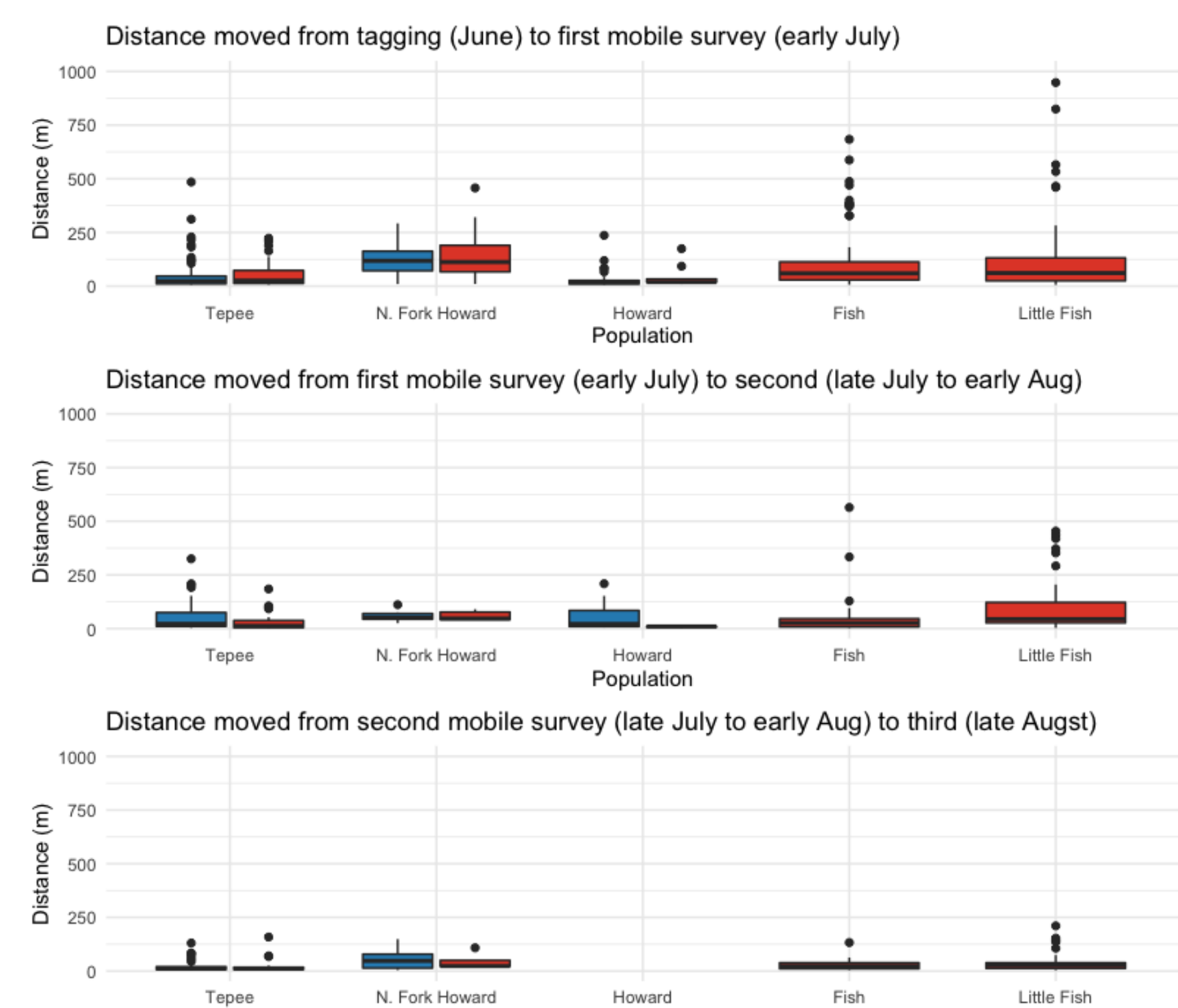


Figure 5: Mean distance moved (m) for WCT and EBT for all detections in the five study streams. Most creeks showed similar patterns. Howard Creek had fewer fish moving and consistently small WCT movements.

Discussion

- Similar to Harrison et al. (2019) median movement in all streams was low (< 50 m). We observed substantial individual variation with a few longer movements.

- Shepard (2009) found that EBT displace WCT in mountain streams which may lead to different movement patterns in WCT in the presence of EBT. In our few sites, we did not observe a difference in distance moved by WCT associated with the presence or absence of EBT.

- Existing literature suggests that trout tend to have limited movement in heavily pooled streams². Howard Creek had a large beaver pond, giving it the highest total pool volume. It also had the lowest movement. Even though N. Fork Howard had the highest pool habitat per length of stream it also had the highest median and variation in movements in the Lolo Watershed.

- Because of the channelized habitat and lack of pools due to stream incision we expected more movement in Tepee Creek, but unexpectedly fish there showed similar movement patterns.

- Despite what we know about the importance of LWD and undercut banks to fish habitat occupancy³, there was no clear trend between these variables and movement in our sites.

Future Considerations

- Examination of changes in fish movement when considering restoration actions such as those involving instream structures (e.g. Beaver Dam Analogs) as well as ensuring habitat needs are met with the isolation of fish populations above barriers is needed.



Figure 6. Beaver pond (red box) in Howard Creek.

Figure 7. Lower channelized portion (red line) of Tepee Creek.

Acknowledgements

We thank our partners at E Bar L Ranch, the Nature Conservancy, USFS Lolo National Forest, Clark Fork Coalition and MT Fish, Wildlife and Parks. In addition, field work wouldn't have been possible without help from our numerous volunteers. Additional funding for this work was provided by the University of Montana through the Irene Evers Competitive Undergraduate Research Scholarship and the Montana Water Center.

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