Fish in the Floodplain: Self-regulating floodgates to improve juvenile salmon access to critical overwintering habitat

DFO-PSF-GSRO
Tide Gate Workshop
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Acknowledgements

KFN team: Cassandra Harper, Jessica Blesch, Kat Delaney, Brennan MacDonald, Craig Orr

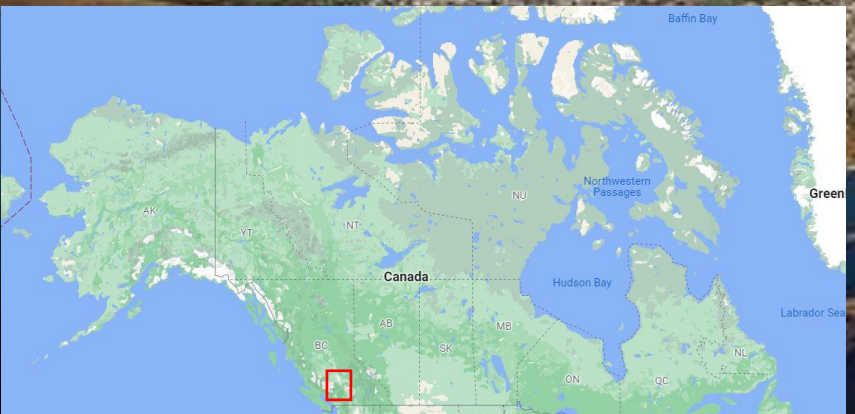
Bailey team: Michelle Bailey, Lauren McCallum, Olivia Kwan, Mackenzie Sheridan, Kamil Szlachta, Serena Moore, Jordan Field

Hinch Lab: Patrick Zubick, Emma Cooke, Natalie Butler, Paige Roper, Arielle Koenig

Floodgates as barriers

Giannico and Souder 2004

Lower Fraser River



Floodgates on the Fraser

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Floodplain vital for juvenile salmon

Jason Ching

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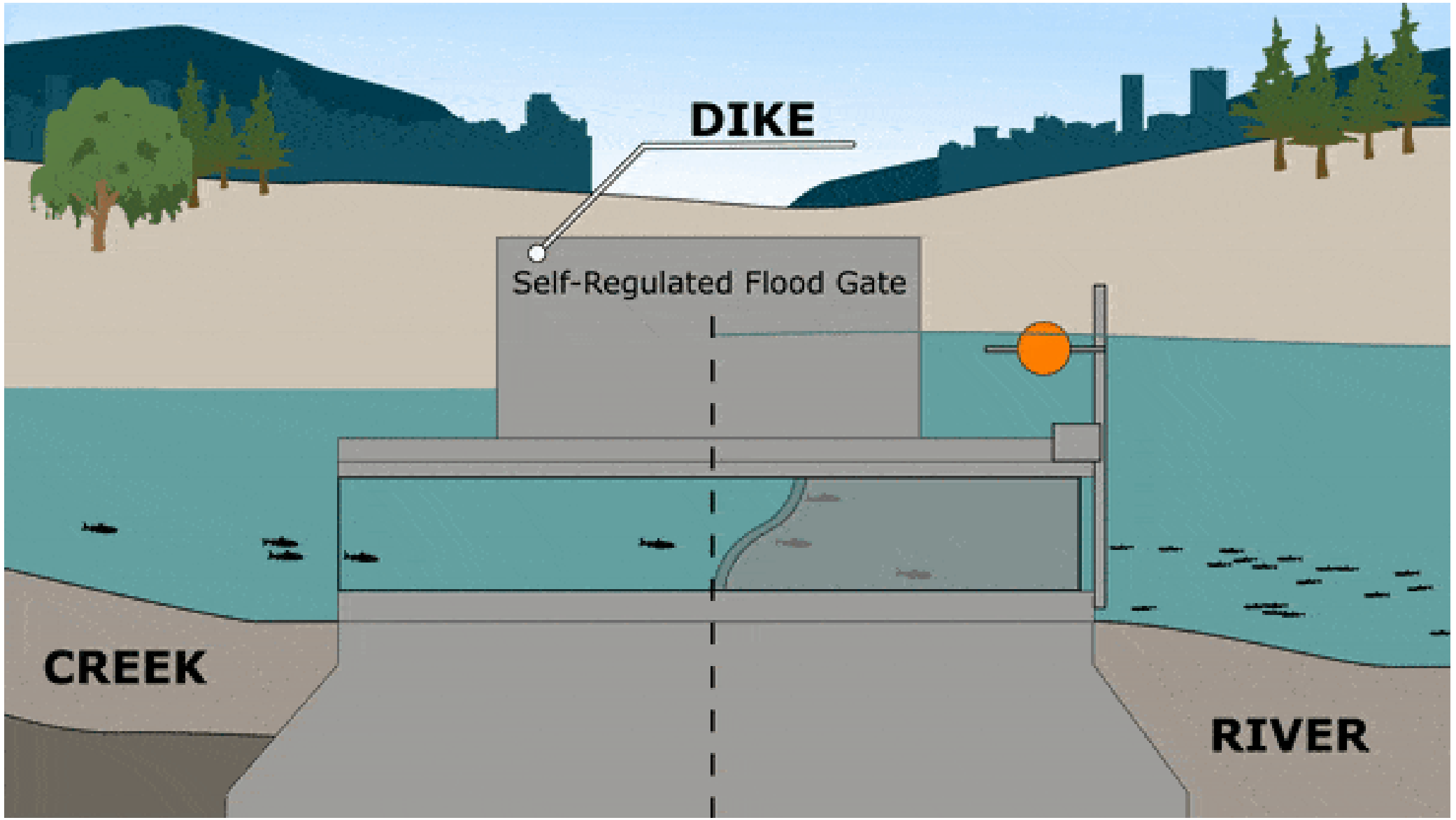
Floodgates are failing

City of Abbotsford

Self-regulating floodgates



Research Goals

- Compare juvenile salmon movements through a top-mounted floodgate, a self-regulating floodgate, and an ungated site

- Document juvenile salmon attraction, upstream passage success and efficiency, survival through overwintering, and duration of floodplain residency at these floodgate structures

- Determine the timing of fish movement relative to floodgate function

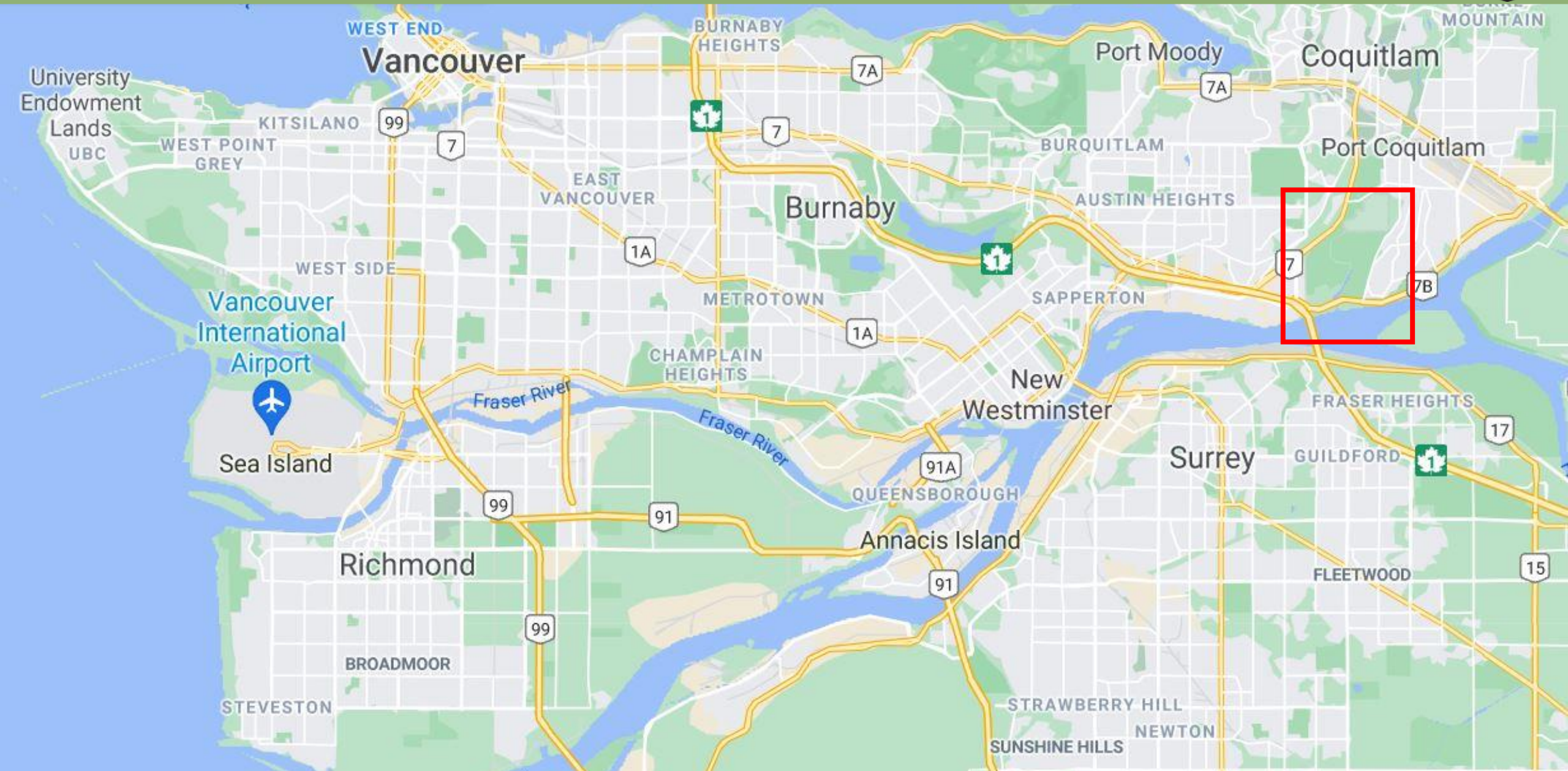
- Provide recommendations on improvements for self-regulating gate operations

Study Design

- Released 1,500 PIT-tagged hatchery-reared coho over the course of overwintering
- 150 fish released per week for 10 weeks (Nov – Feb)
- Monitored coho passage and movement through three floodgate designs
- Collected data on tide and opening/closing of floodgates

KWL consulting

Study Site


WEST END
Vancouver
BURNABY HEIGHTS
Port Moody
Coquitlam
MOUNTAIN
University Endowment Lands
UBC
KITSILANO
WEST POINT GREY
EAST VANCOUVER
Burnaby
BURQUITLAM
Port Coquitlam
AUSTIN HEIGHTS
WEST SIDE
Vancouver International Airport
METROTOWN
SAPPERTON
CHAMPLAIN HEIGHTS
Fraser River
Fraser River
New Westminster
FRASER HEIGHTS
Sea Island
Surrey
GUILDFORD
QUEENSBOROUGH
Annacis Island
Richmond
FLEETWOOD
BROADMOOR
STEVESTON
STRAWBERRY HILL
NEWTON
SUNSHINE HILLS
99
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1
7A
1A
91A
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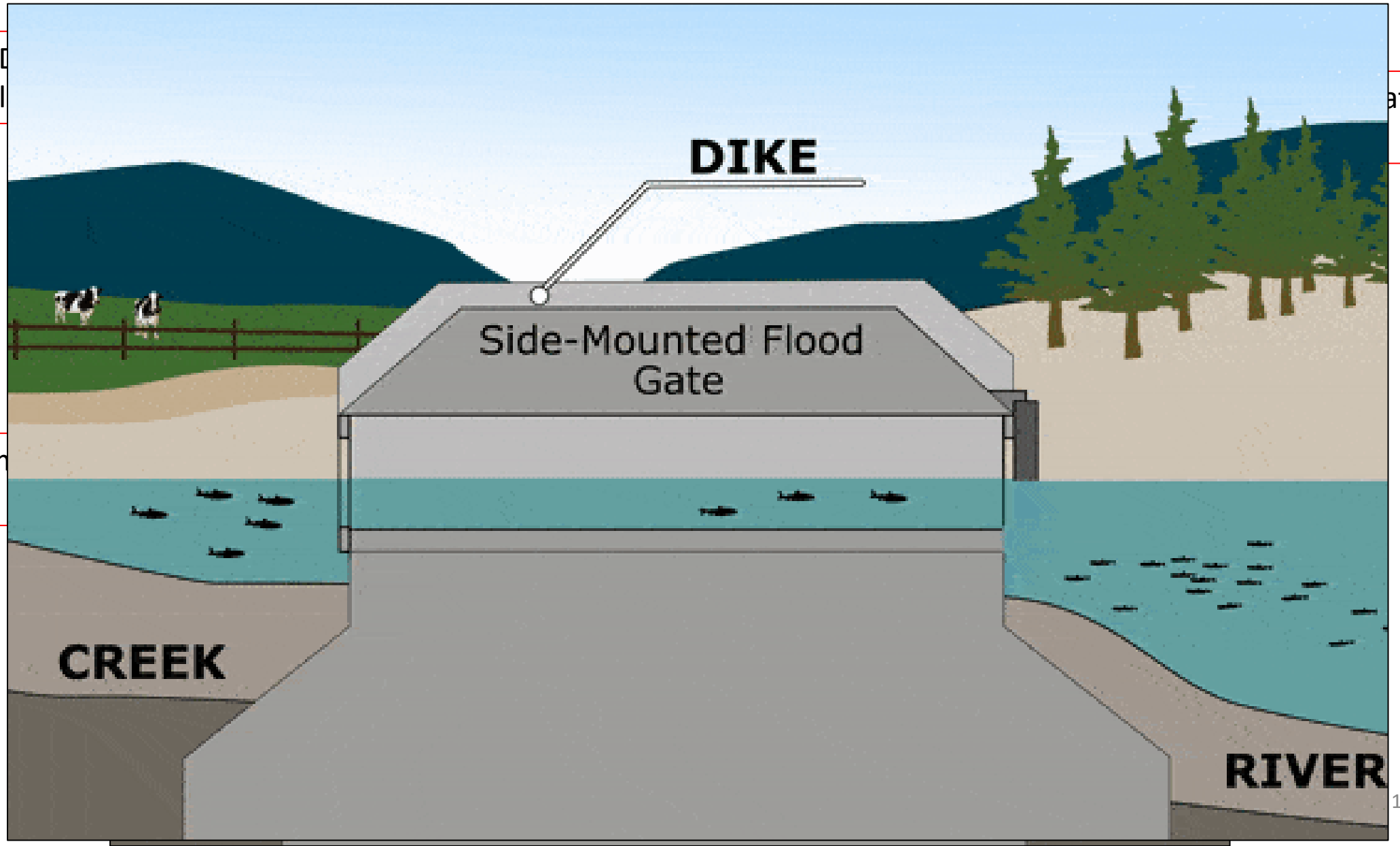
15
7B

Study Sites



Study Highlights

- All 12 antennas at the three floodgates operated without interruption from Nov 2022 - May 2023 (>90 % detection efficiency over this time)

- >800,000 detections at our antennas over that time

- 9,000 passage attempts documented at three floodgates (6,877 unsuccessful, 1,233 successful)

- Published a paper describing our novel, noise-resistant antenna design in the *Journal of Fish Biology*

PIT antennas

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PIT antennas

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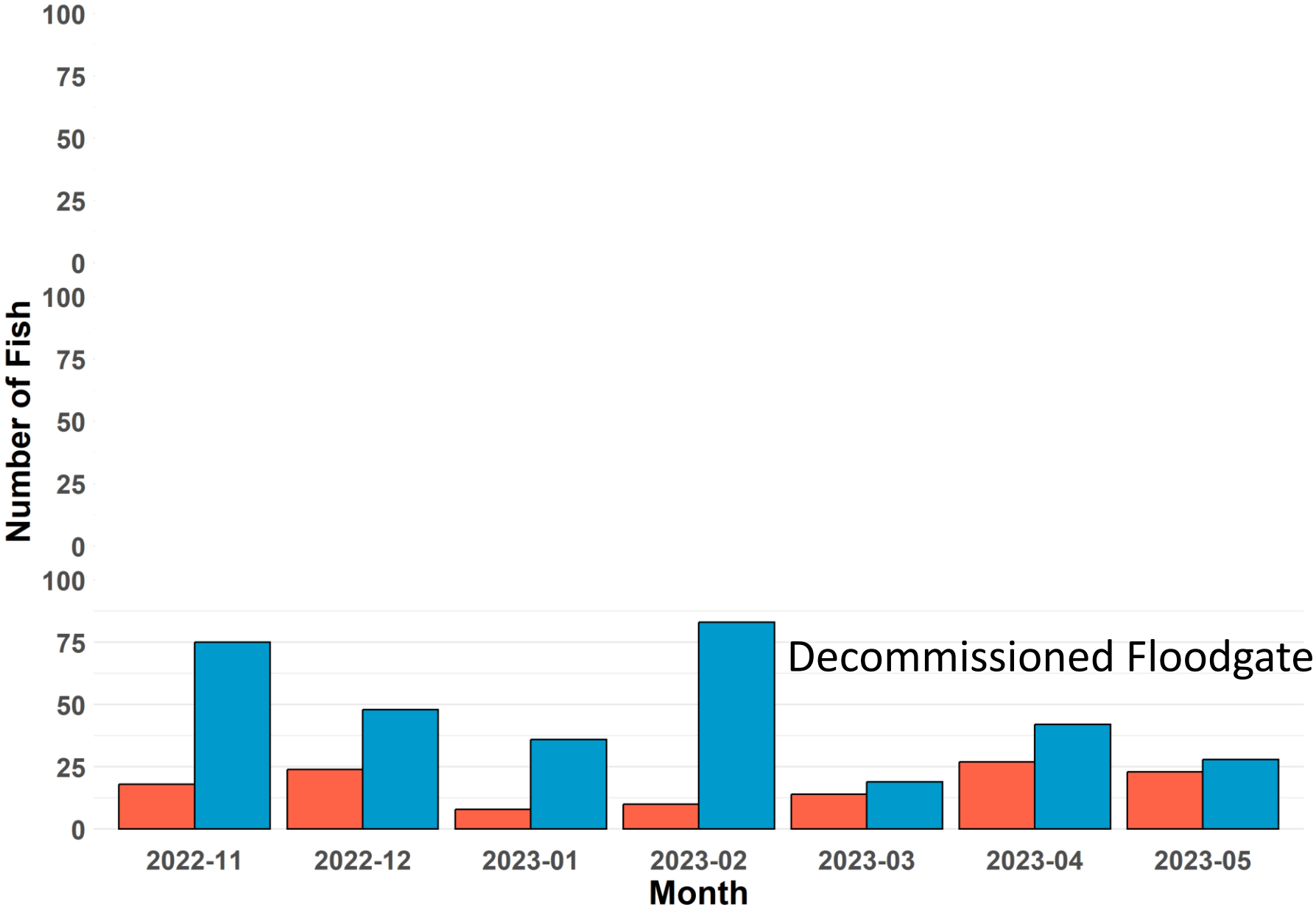
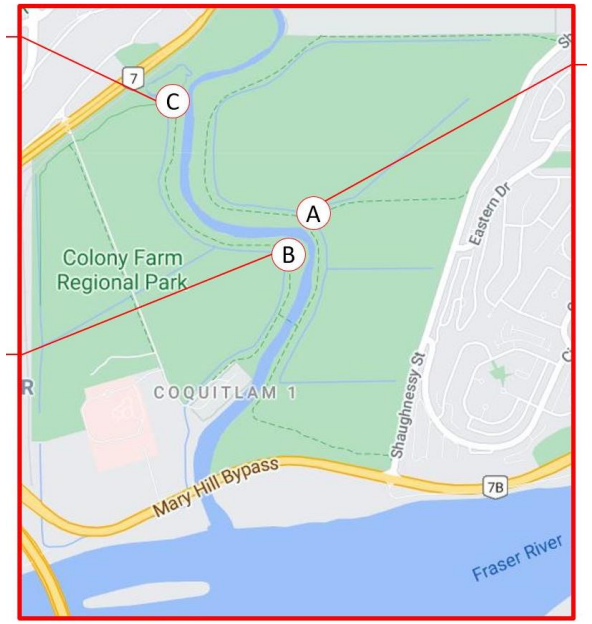
PIT antennas

Salmon passage between sites

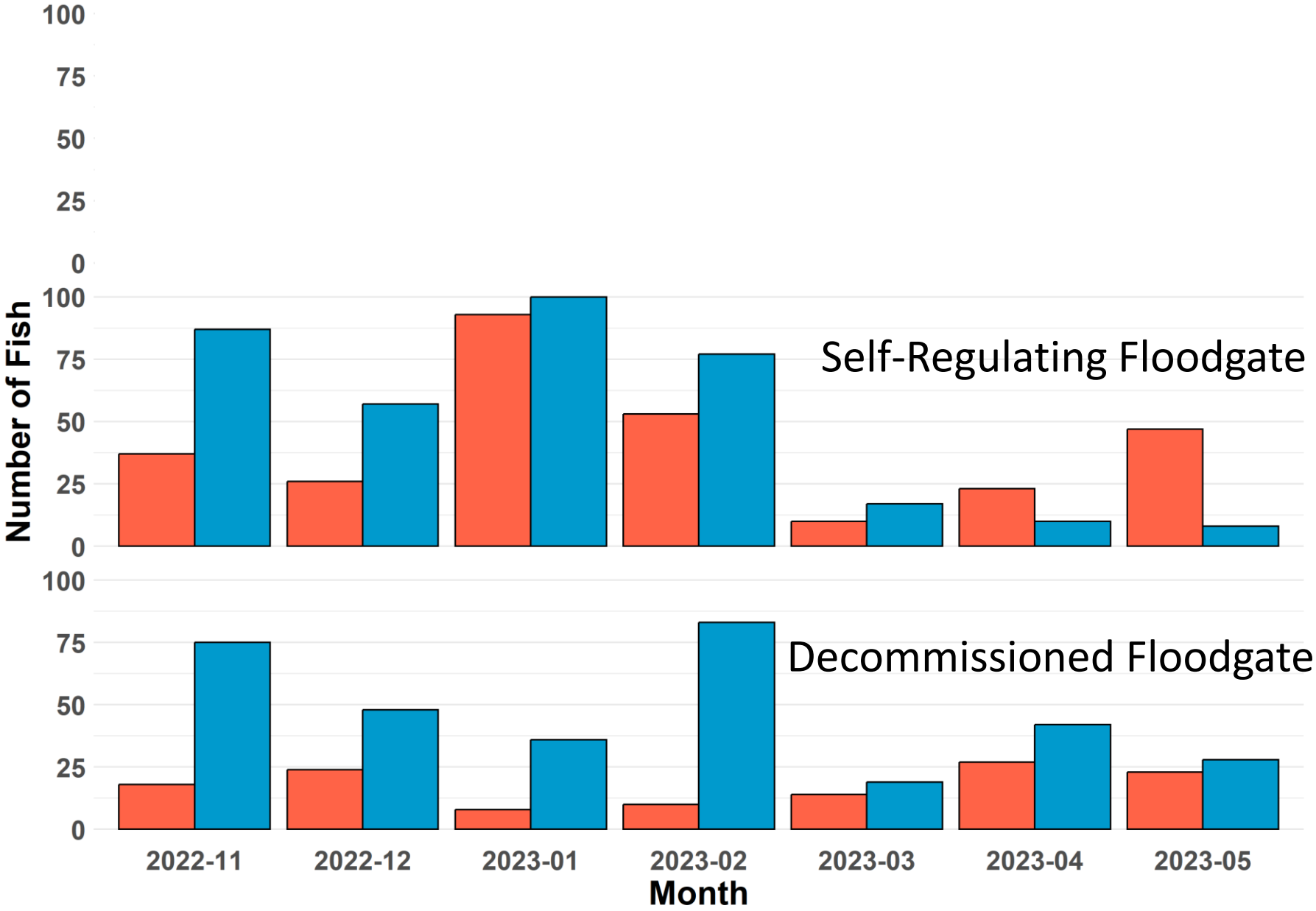


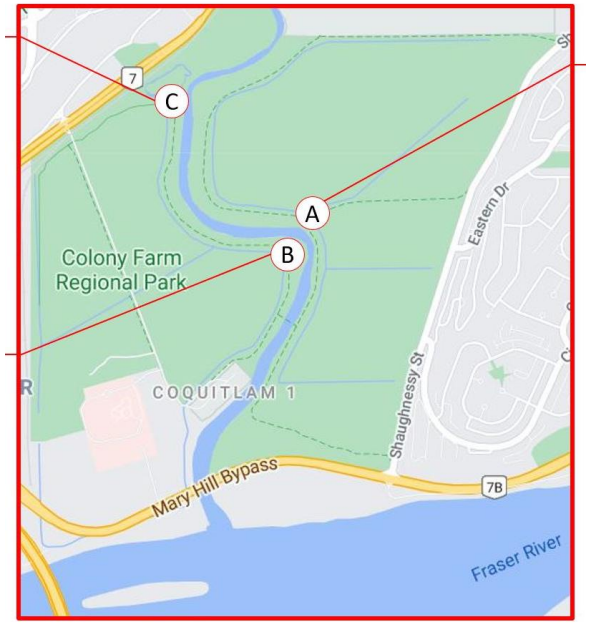


Unsuccessful fish

Successful fish

Salmon passage between sites





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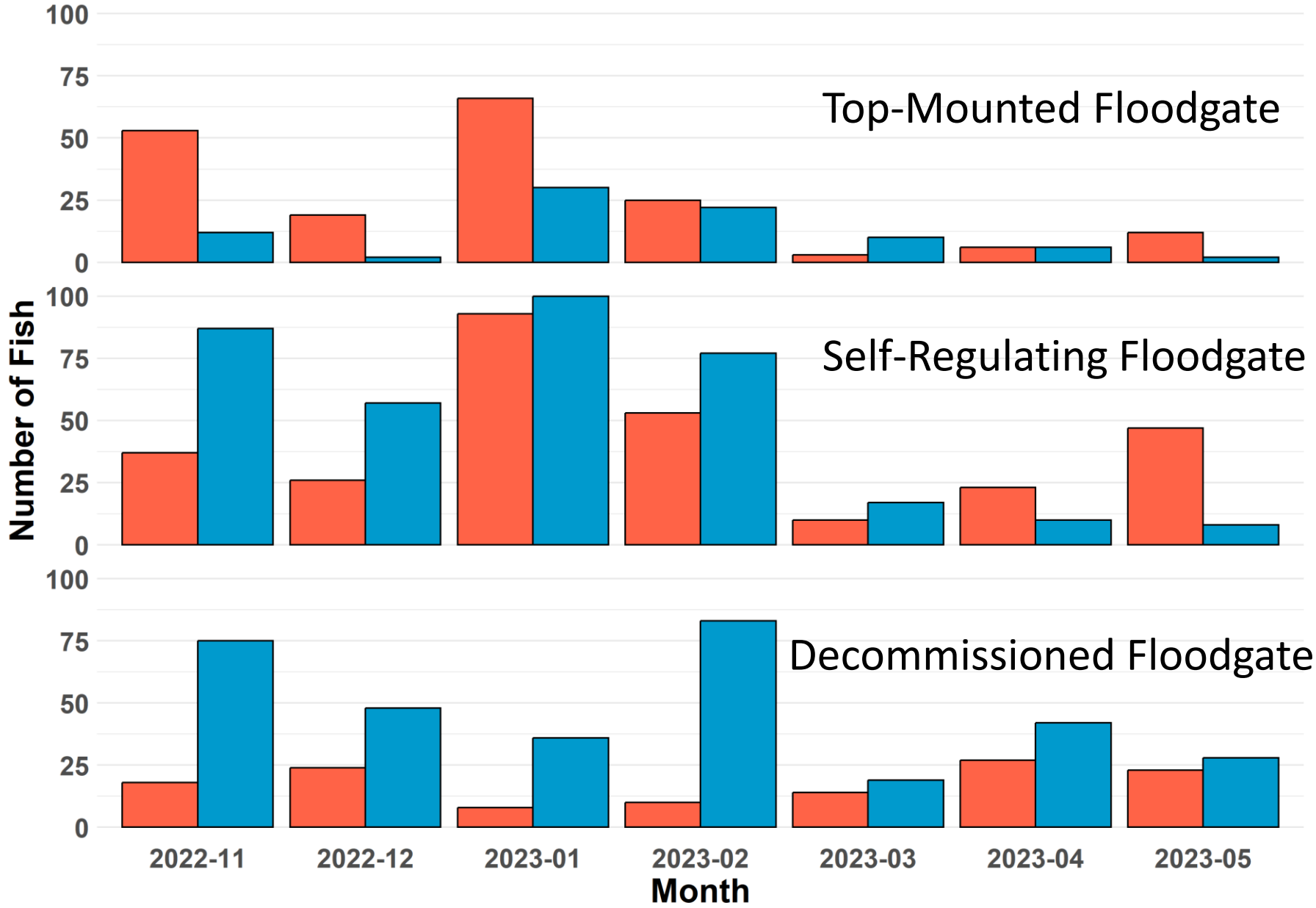

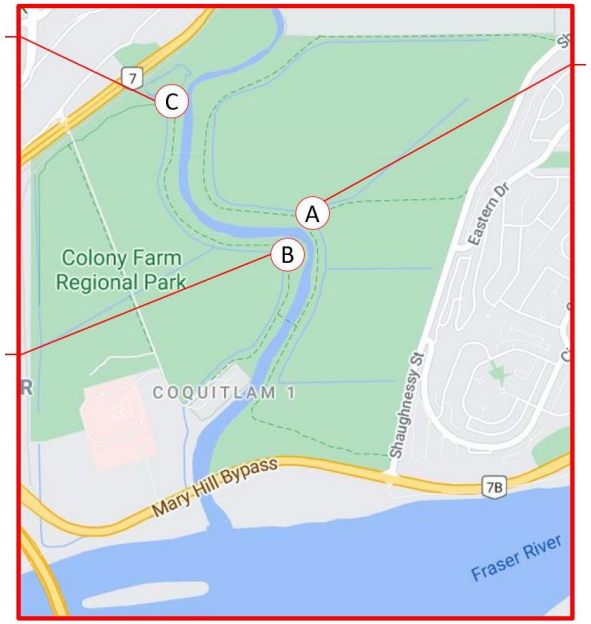

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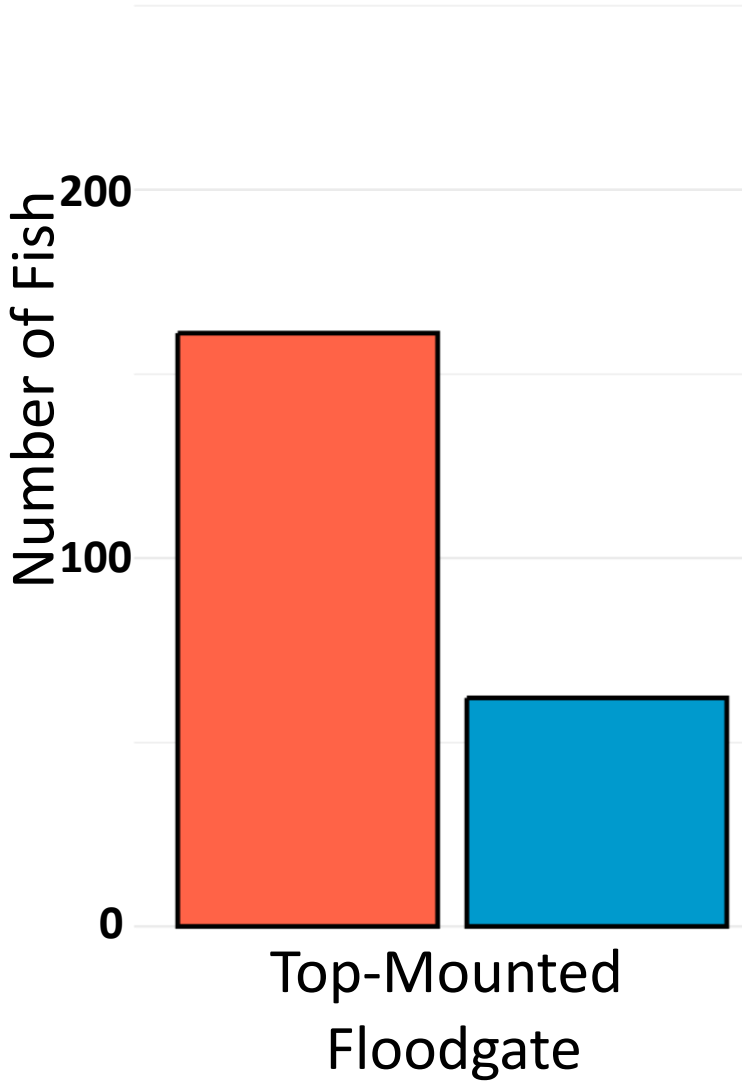

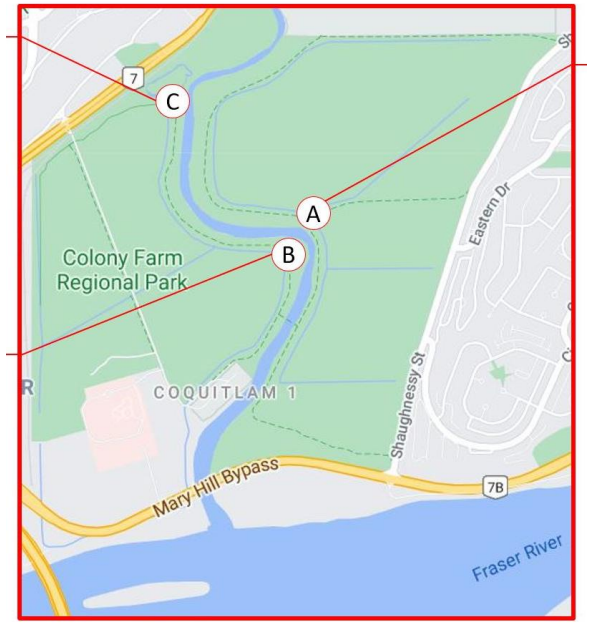

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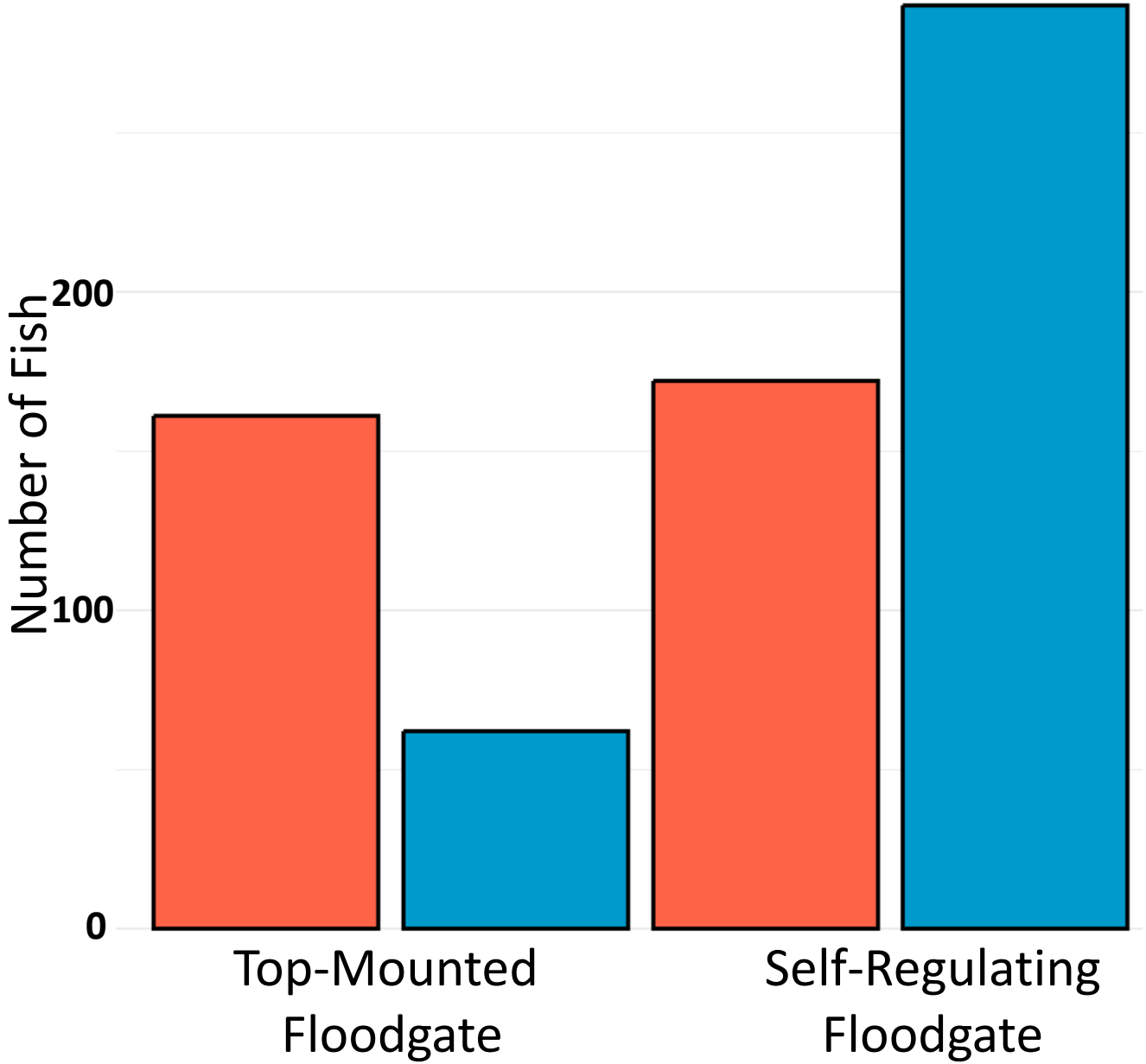

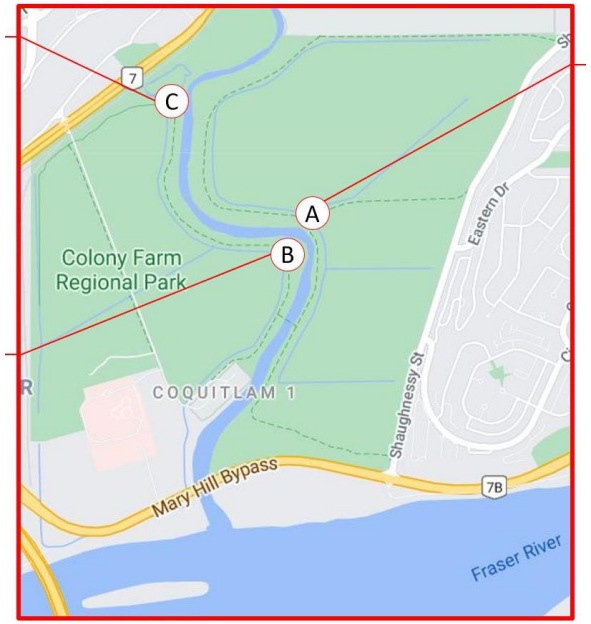

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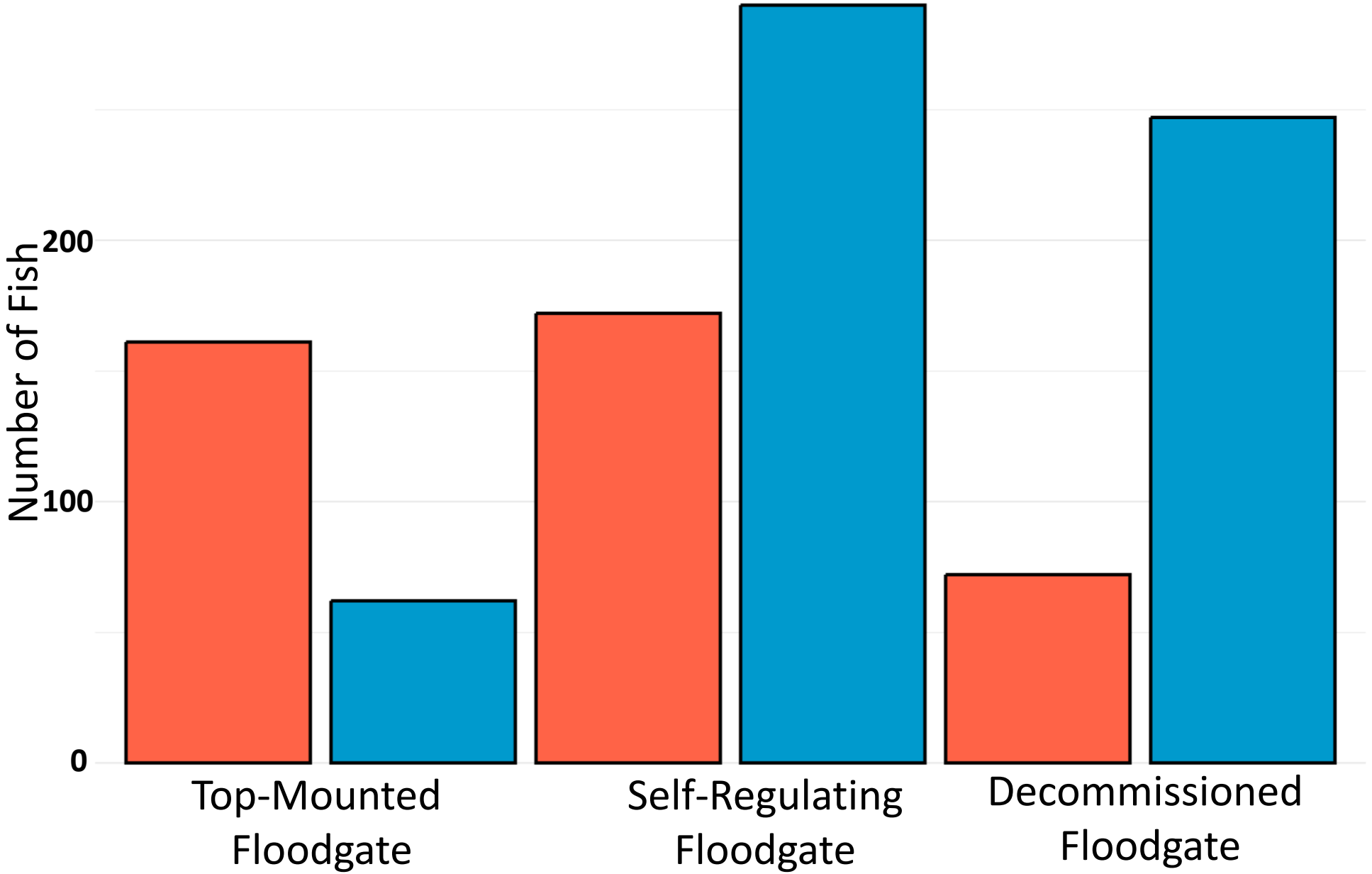
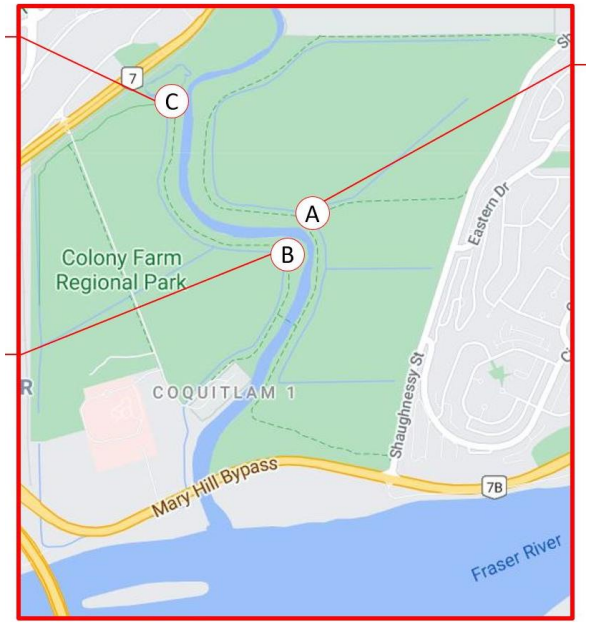
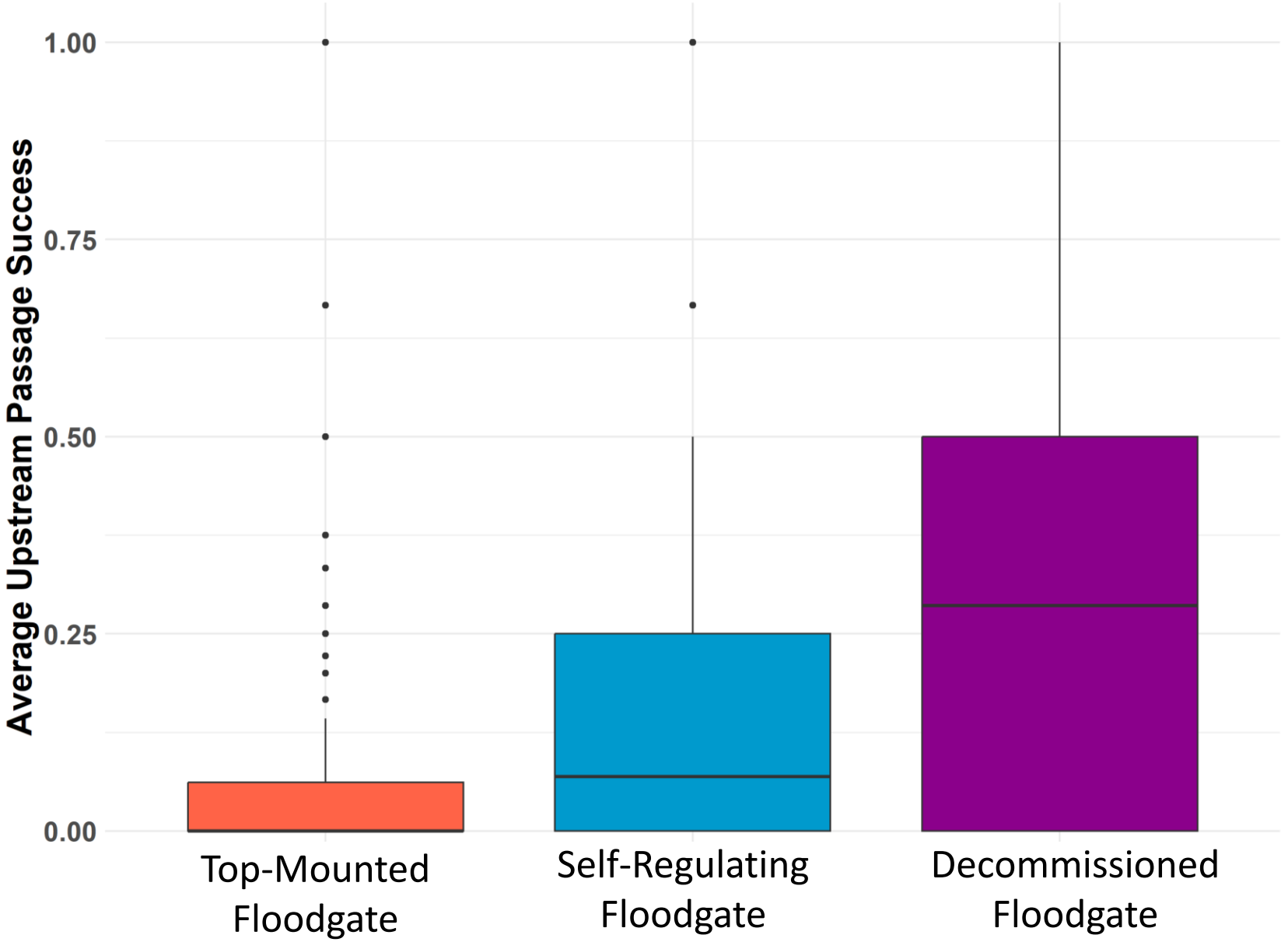


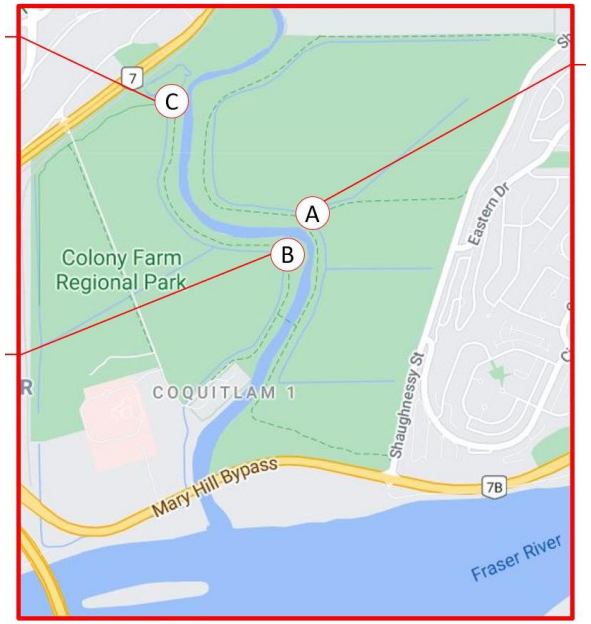


Unsuccessful fish

Successful fish

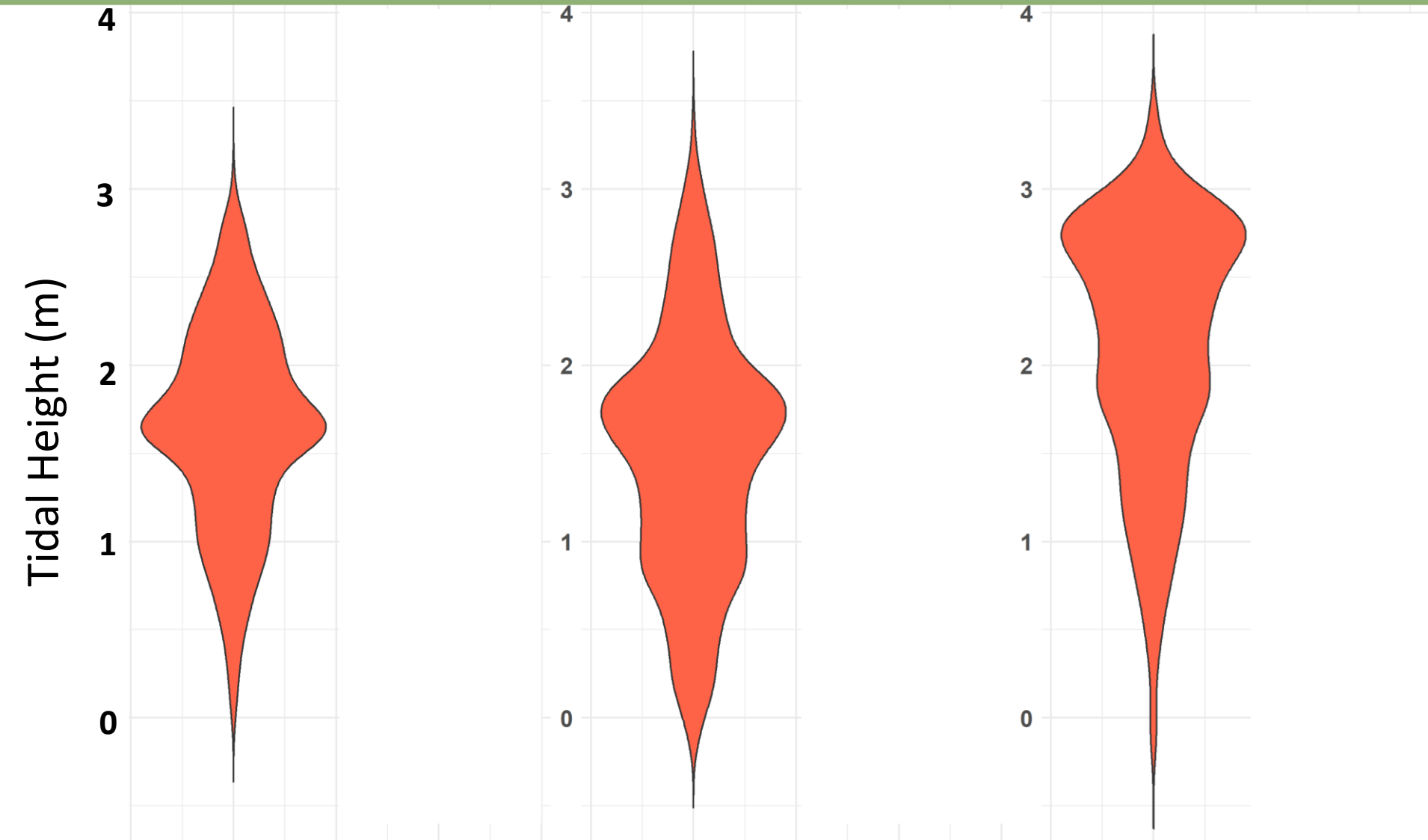
Salmon passage success rates





Salmon passage with the tides

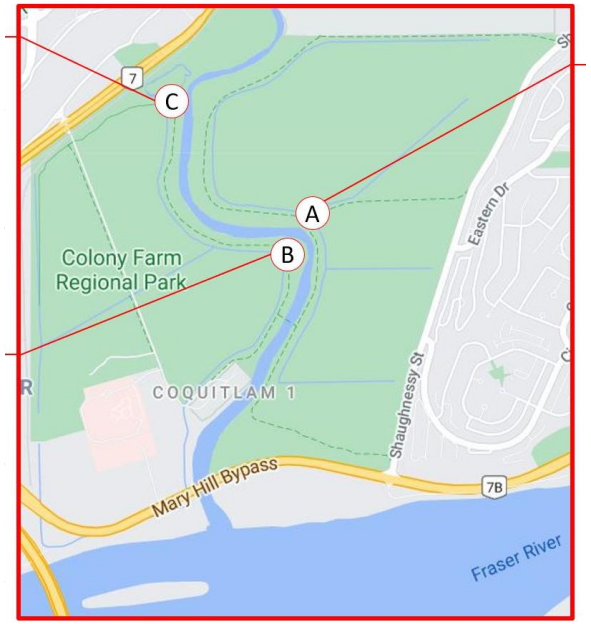
Tidal Height (m)



Top-Mounted Floodgate

Self-Regulating Floodgate

Decommissioned Floodgate



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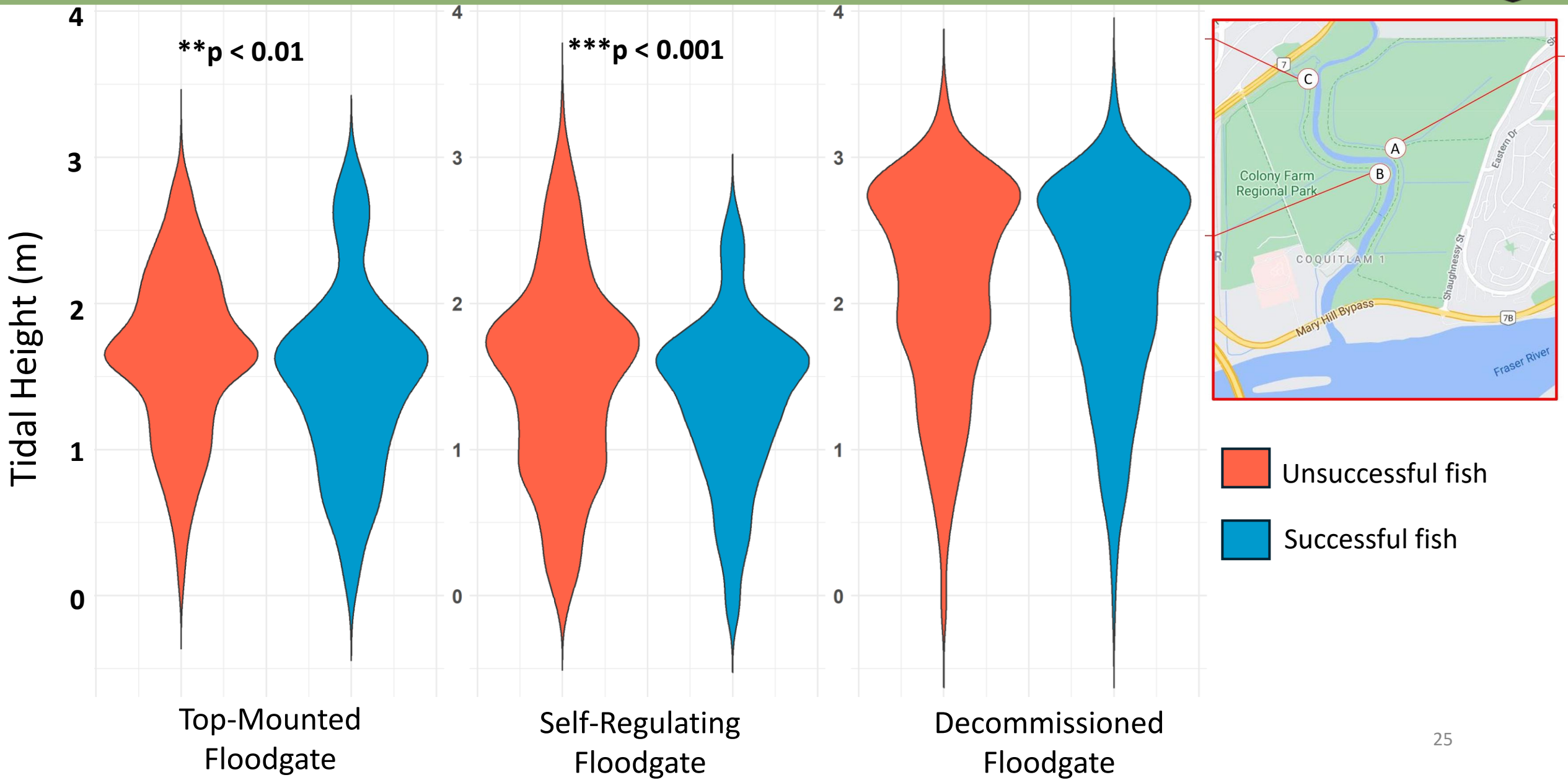
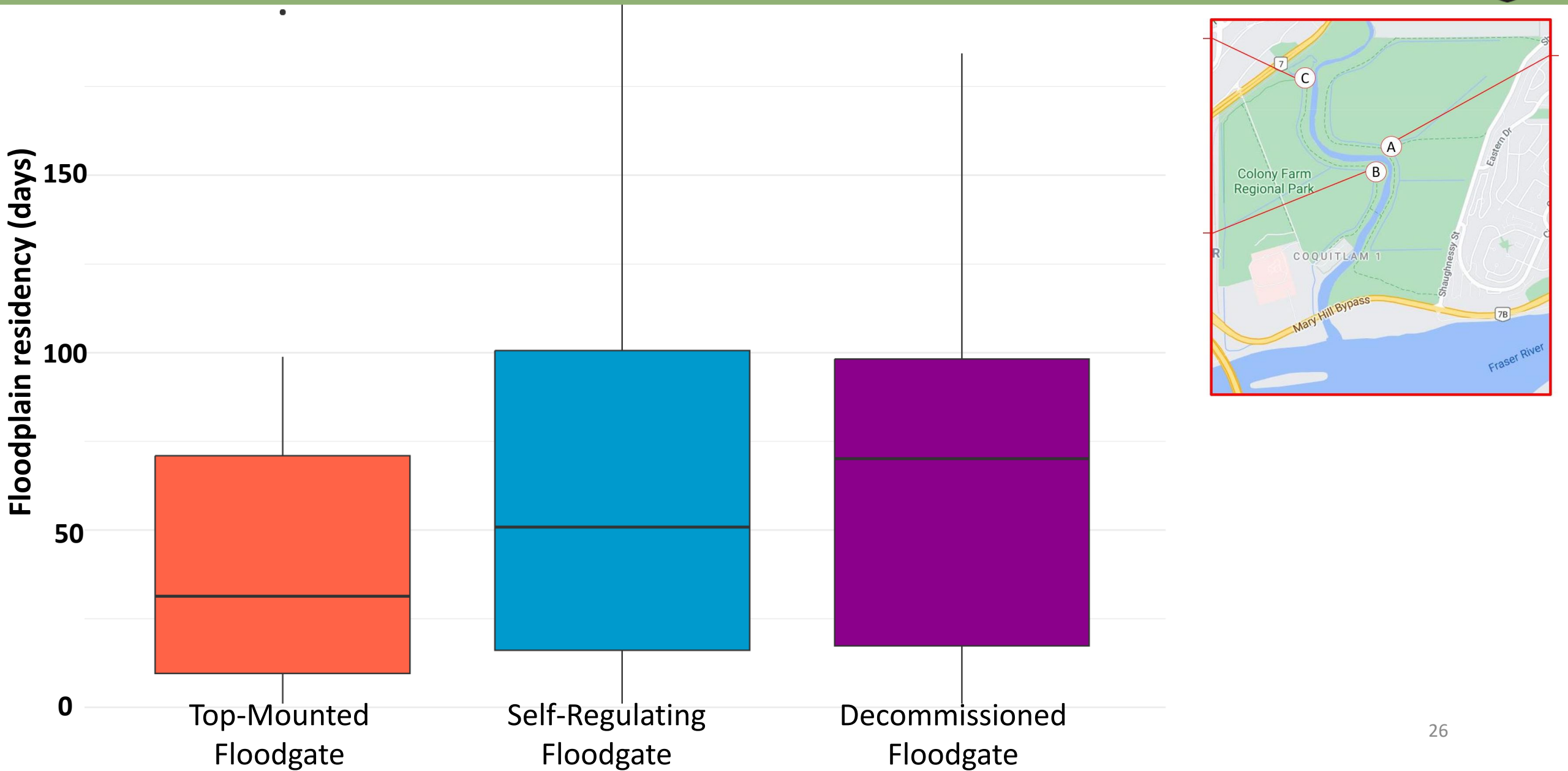
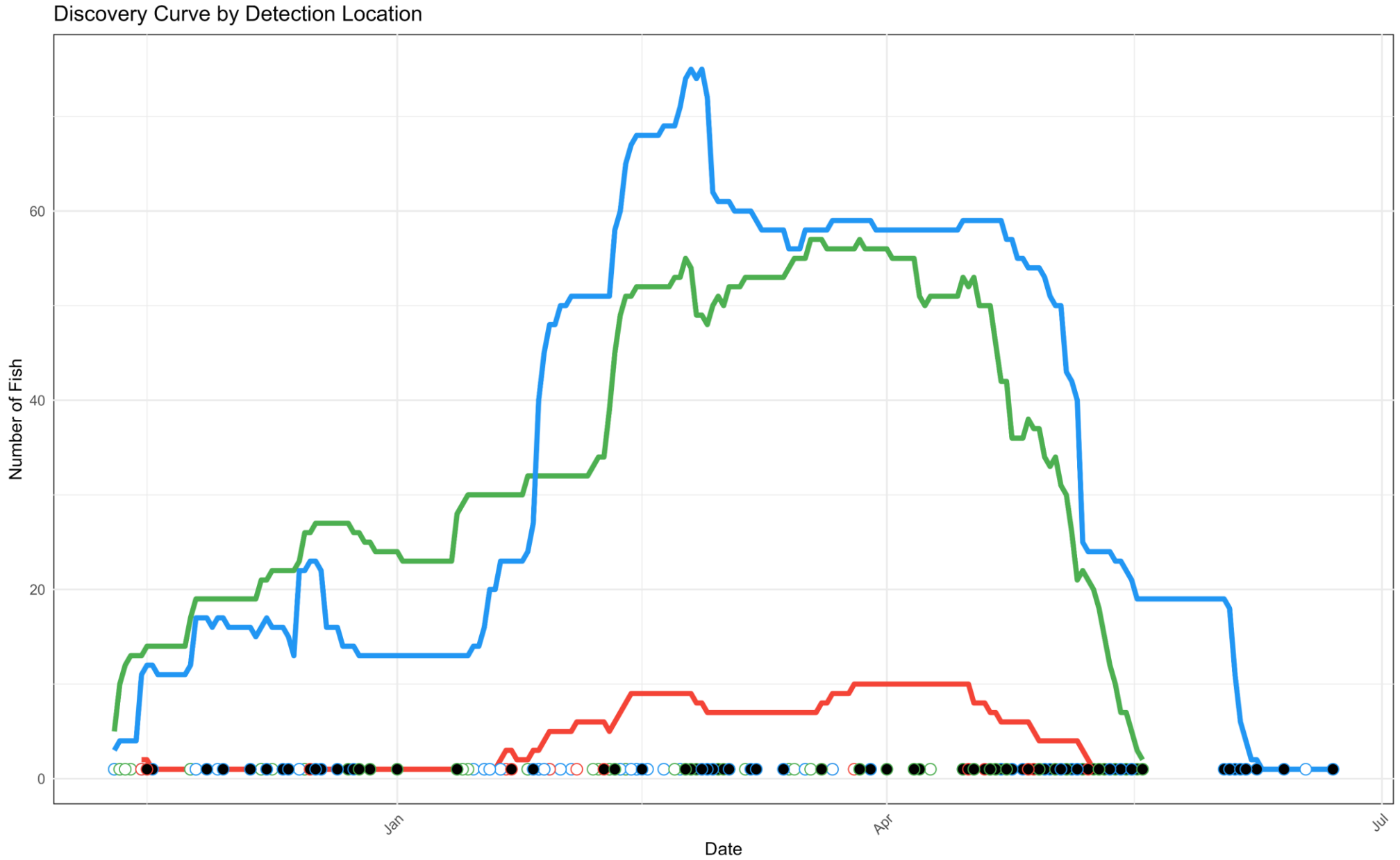


How long did fish stay in the floodplain?



Floodplain residency at floodgate sites



Gate type comparisons

Variable	Top-Mounted Floodgate	Self-Regulating Floodgate	Ungated Site
Approach success	47.5%**	63.9%**	73.5%

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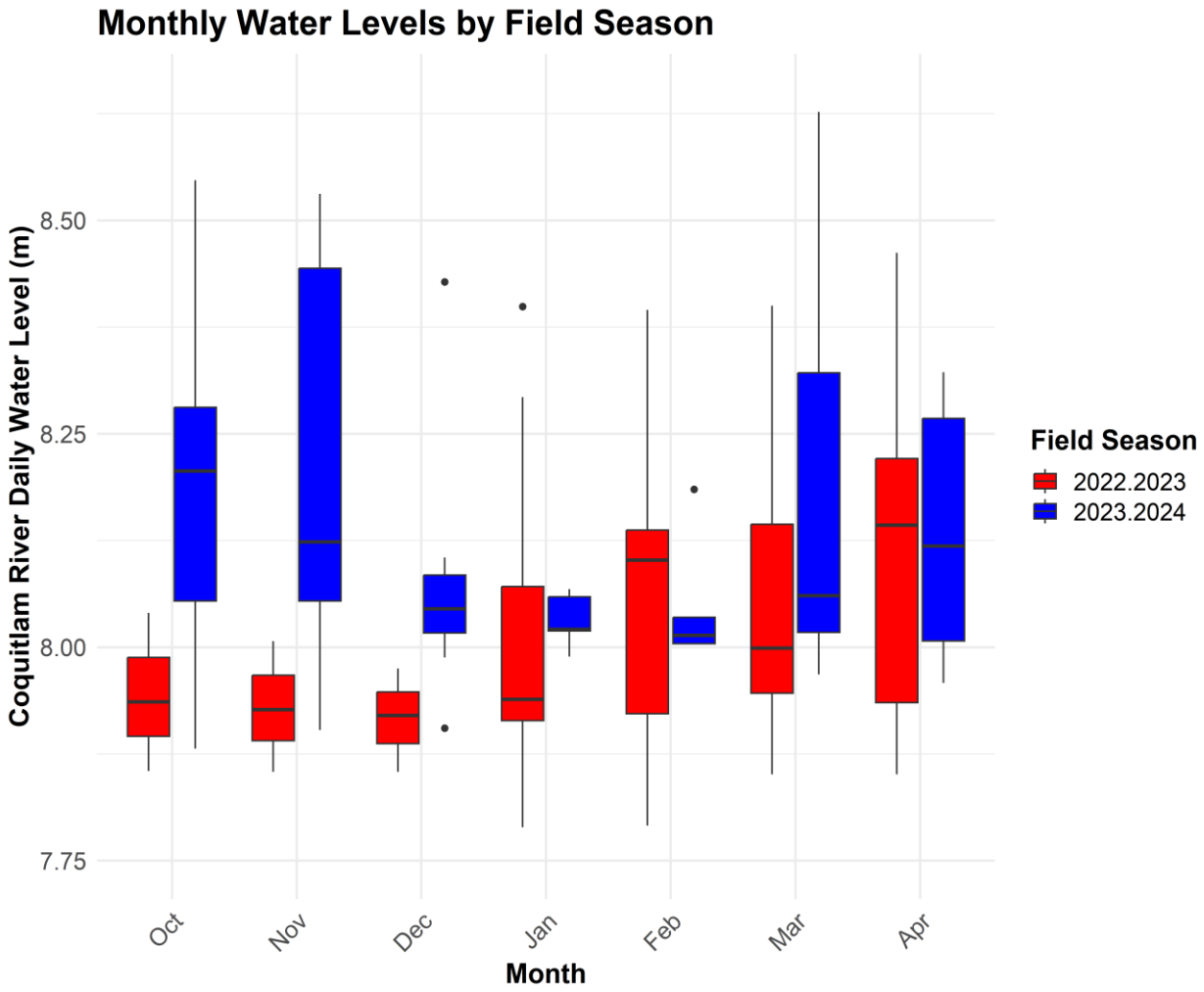
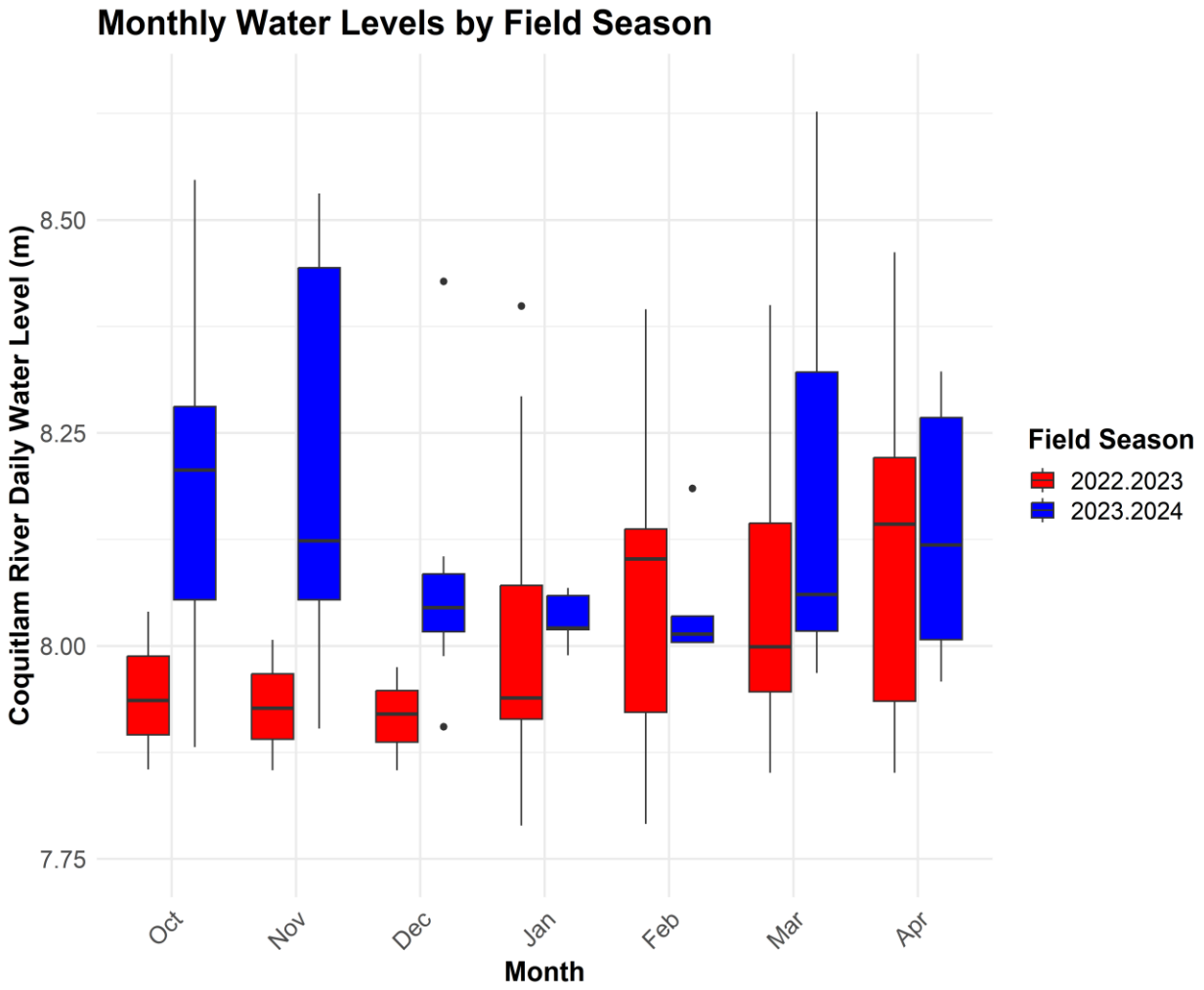
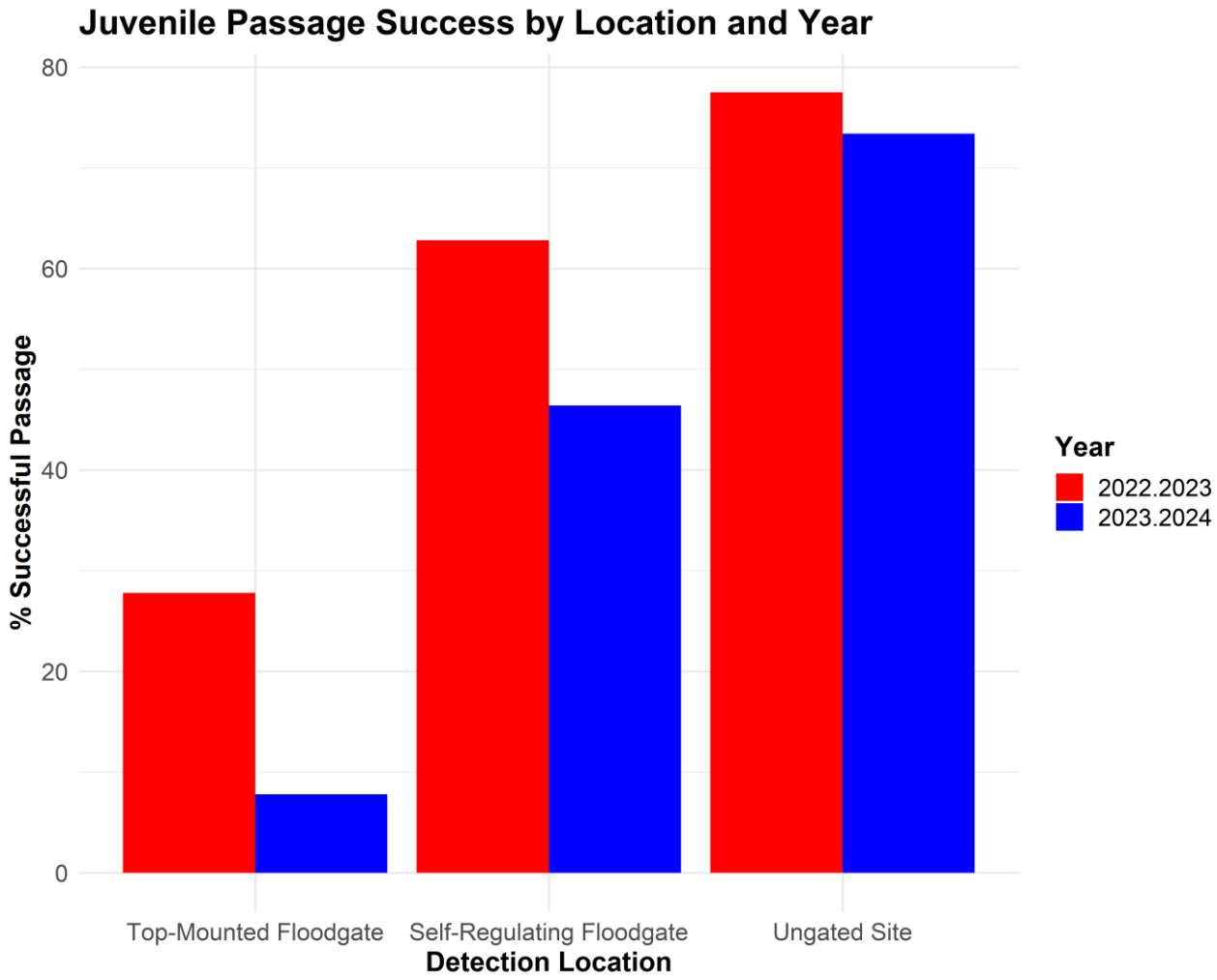
Survival to spring outmigration	34%**	50%*	64%
Duration of floodplain residence	42 days**	64 days*	70 days

2022-2024 Results



2022-2024 Results





Summary

- Clear passage issues for juvenile salmon navigating past un-remediated, top-mounted floodgates
- Self-regulating floodgates provide a significant improvement in fish access to off-channel overwintering habitat
- Self-regulating floodgates can be set to remain open longer on incoming tide to further improve juvenile salmon passage
- Operations of self-regulating floodgates can be adaptively managed in response to changing river conditions over their lifespan

Fin!

Zachary Sherker[1], Patrick Zubick[1], Dan Straker[2], Art Bass[1], Craig Orr[3], Mike Pearson[4], Michelle Bailey[5], Cole Martin[6] & Scott Hinch[1]

[1] The University of British Columbia, [2] Resilient Waters, [3] Kwikwetlem First Nation, [4] Pearson Ecological, [5] Bailey Environmental Consulting, [6] InStream Fisheries Research