

Performance of Subyearling Fall Chinook Salmon Tagged With 8-, 9-, And 12-mm Passive Integrated Transponder Tags in the Snake River

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Background

PIT tagging subyearling fall Chinook since 1991 in Hells Canyon
(9-mm tags: 50–59 mm fish, 12-mm tags: ≥ 60 mm fish)

Fish emigrating at smaller sizes now (Connor et al. 2013), hence the need to tag smaller fish

Objectives

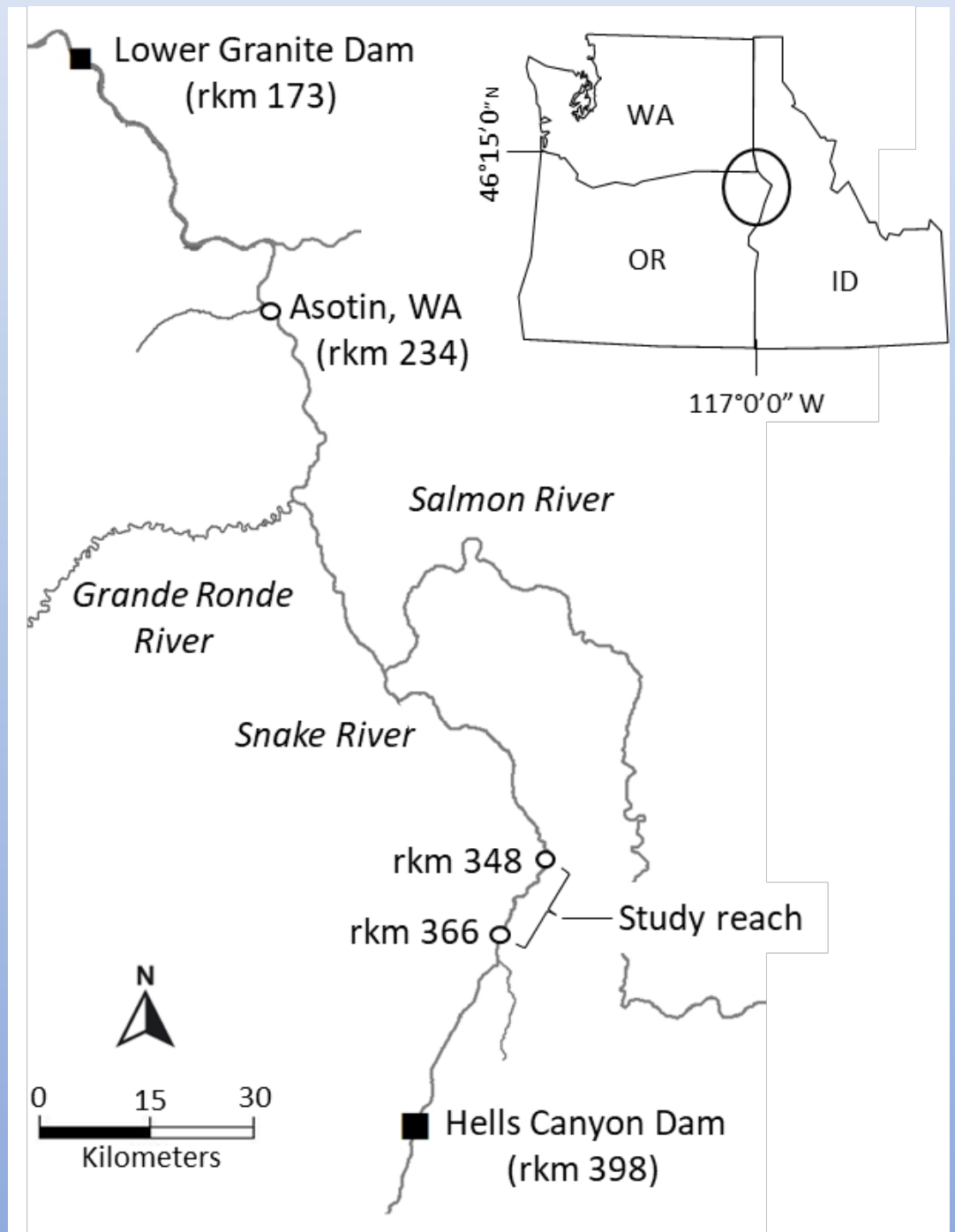
1. Determine whether post-tagging mortality higher for fish with 8-mm tags
2. Qualitatively compare healing of incisions made by 14- and 12-gauge needles
- 3a. Compare growth of different-sized fish tagged with 8-mm tags
- 3b. Determine if tag size (8, 9, 12) affected growth of similarly sized fish
4. Determine if tag burden affected growth of fish tagged with different sized tags
5. Determine whether 8-, 9-, and 12-mm tags were equally detectable at the dams
6. Determine whether survival from rearing areas to Lower Granite Dam differed by fish and tag size

Study Area

7 sites sampled

8-mm tags only implanted in fish at rkm 348;
9- and 12-mm tags used at other six sites

Habitat generally similar between sites



Methods

Collect fish late-Mar to early Jun, 2016-2019

Rkm 348

45–49-mm, 50–59-mm, ≥ 60 -mm fish: 8-mm tags only, 14-gauge needle

Rkm 352–366

50–59-mm fish: 9-mm tag, 12-gauge needle
 ≥ 60 -mm fish: 12-mm tag, 12-gauge needle



Methods

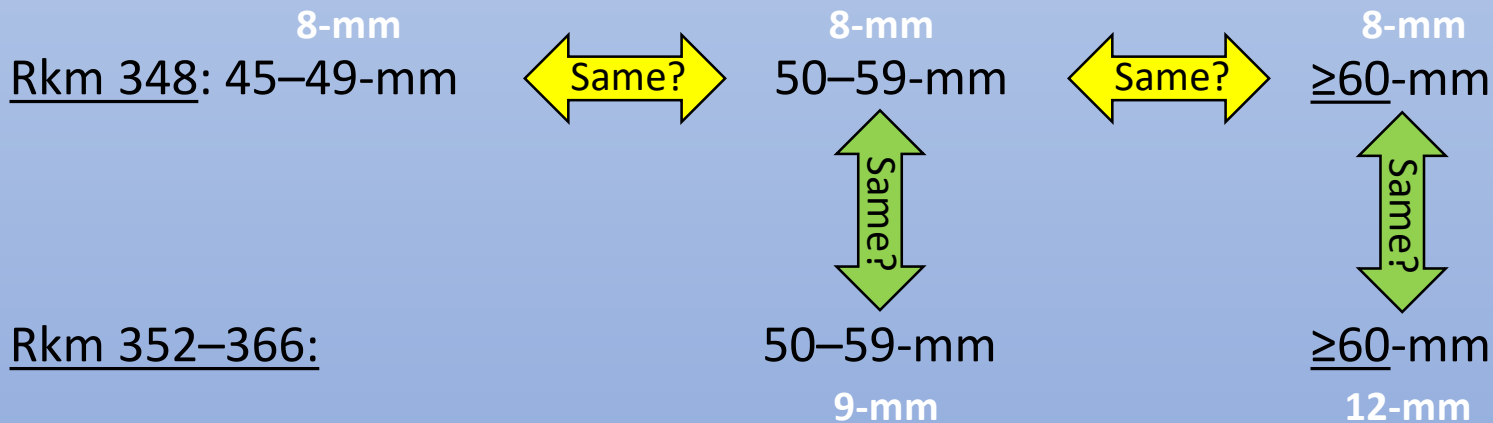
Post-tagging mortality: qualitatively assessed based on days at large (DAL) between release and recapture. Low recap rate + short DAL = high mortality or earlier than normal downstream dispersal.

Incision healing: qualitatively assessed based on photos of recaptured fish

Growth in FL and mass (recapture data):

Fish-size effect – compare between size groups w/8-mm tags at rkm 348

Tag-size effect – compare between rkm 348 and rkm 352-366 (combined) within each size class (50–59-mm and ≥ 60 -mm fish)



Methods

Tag burden & growth: linear regressions between growth and tag burden

Tag detection efficiency: tagged 3 groups of 74-78 subyearlings at LGR dam in both 2016 and 2017 with each tag type and released them upstream of the fish bypass facility detectors. Calculated percentage of each tag type detected.

Survival to LGR dam: single-release CJS model used to estimate survival for each size-class and tag type where sufficient detection data existed.

Rmark used to develop a series of models examining the effects of tag type and fish size on survival. QAIC and measures of deviance used to judge between models.

Results

Fish collection:

Year	Number collected	45–49-mm fish	
		Number	Percentage
2016	5,061	1,218	24.1
2017	1,018	63	6.2
2018	4,951	462	9.3
2019	1,393	248	17.8
Total	12,423	1,991	16.0

Mean tag burden:

45–49-mm, 8-mm tags = 3.0–4.2%

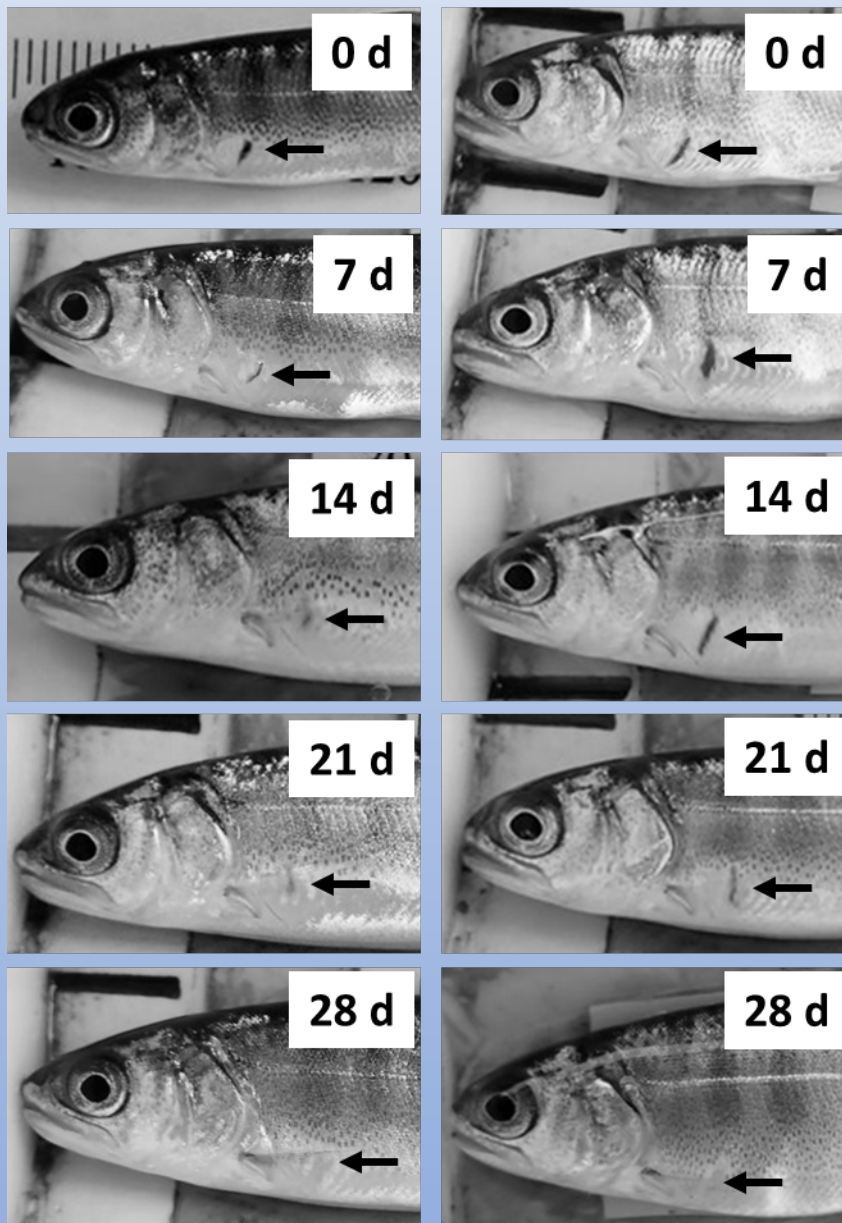
50–59-mm, 9-mm tags = 2.5–5.0%; 8-mm tags = 1.9–2.7%

≥60-mm, 12-mm tags = 3.4–4.4%; 8-mm tags = 0.8–1.4%

Post-tagging mortality: no evidence for higher mortality in small fish tagged with 8-mm tags. 96% of recaptured fish captured at their tagging site. Mean days-at-large was 7–14; longest was 35 days.

Incision healing:

The smaller the hole,
the faster it closes



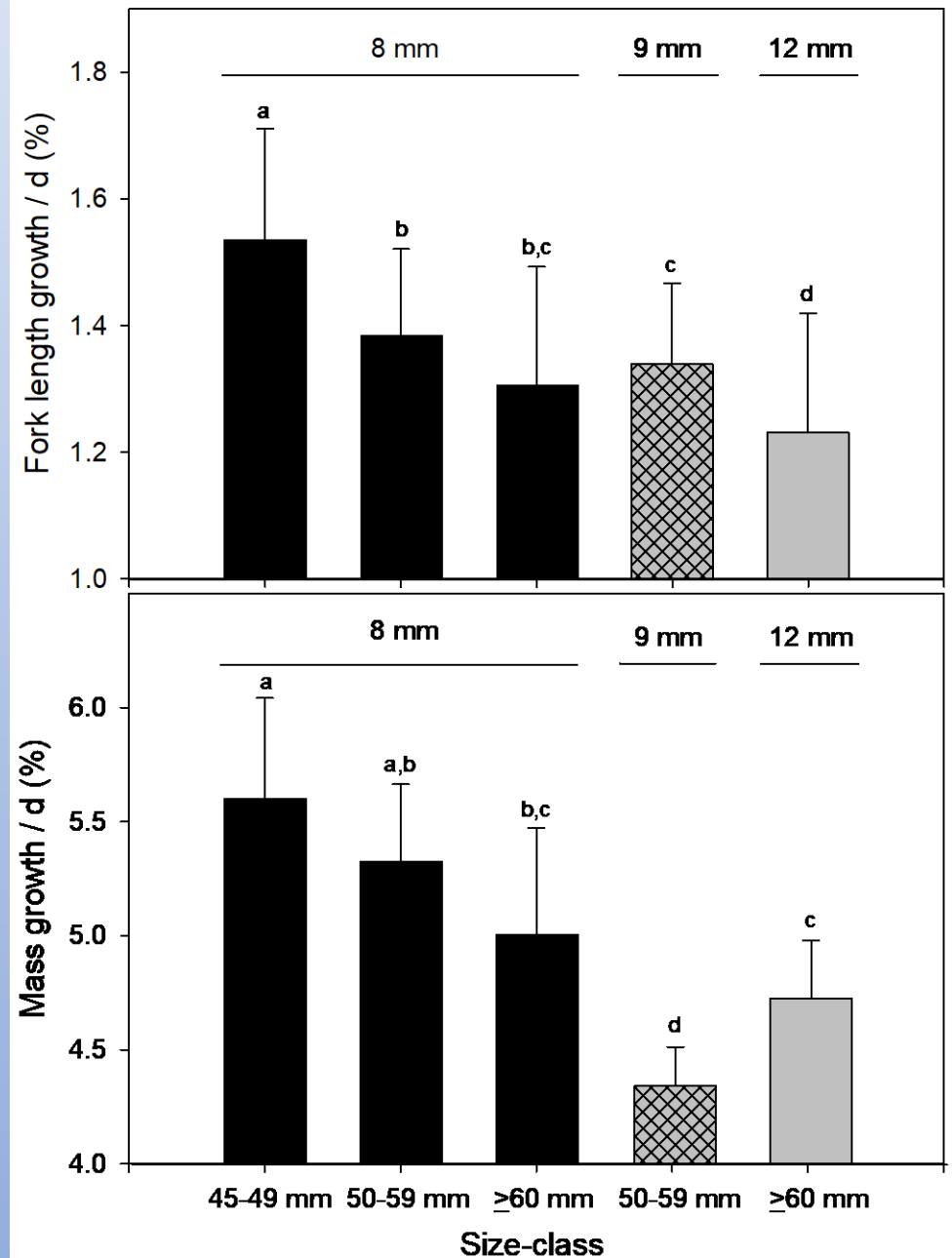
Growth:

Higher relative growth in length and mass of smaller fish tagged with 8-mm tags, but differences are small

Higher relative growth in length and mass of similar-sized fish tagged with different-sized tags, but differences are small

Tag Burden and Growth:

No relationships between tag burden at time of tagging and subsequent growth (r^2 s: 0–0.16)



Detection efficiency at LGR Bypass Facility:

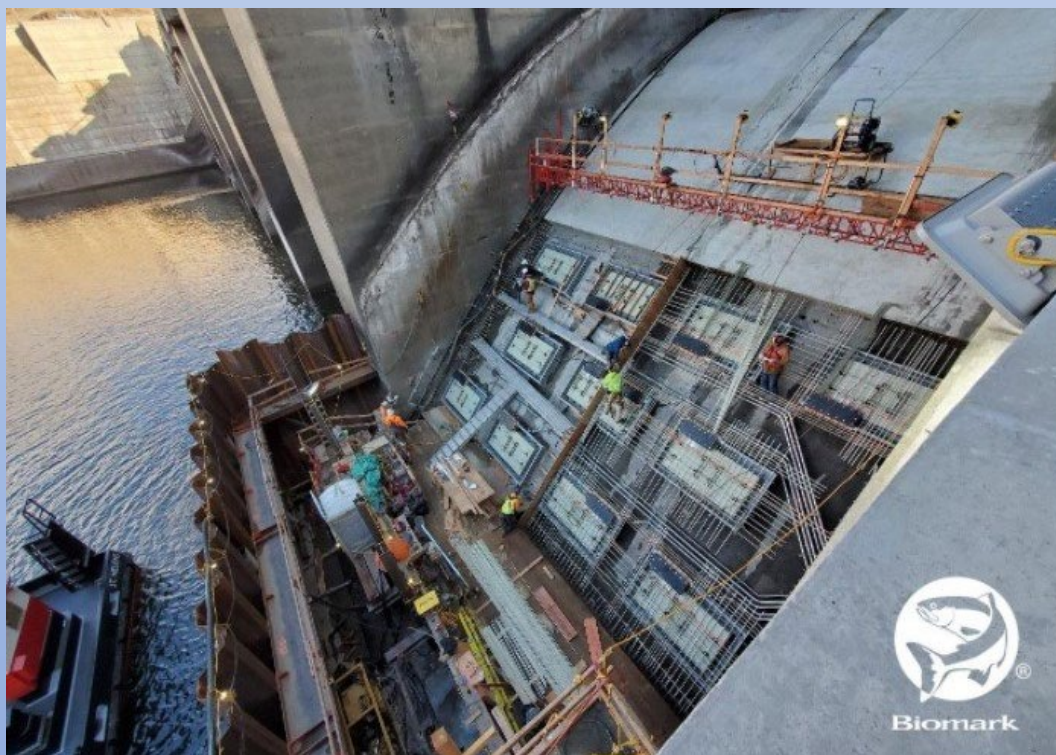
453 fish released, 450 detected on at least one antenna (99%)

One 8-mm tag not detected; two 9-mm tags not detected

Detection efficiency of 8-mm tags by LGR RSW Detector:

2020: 500 fish released, 41 detected = 8.2%

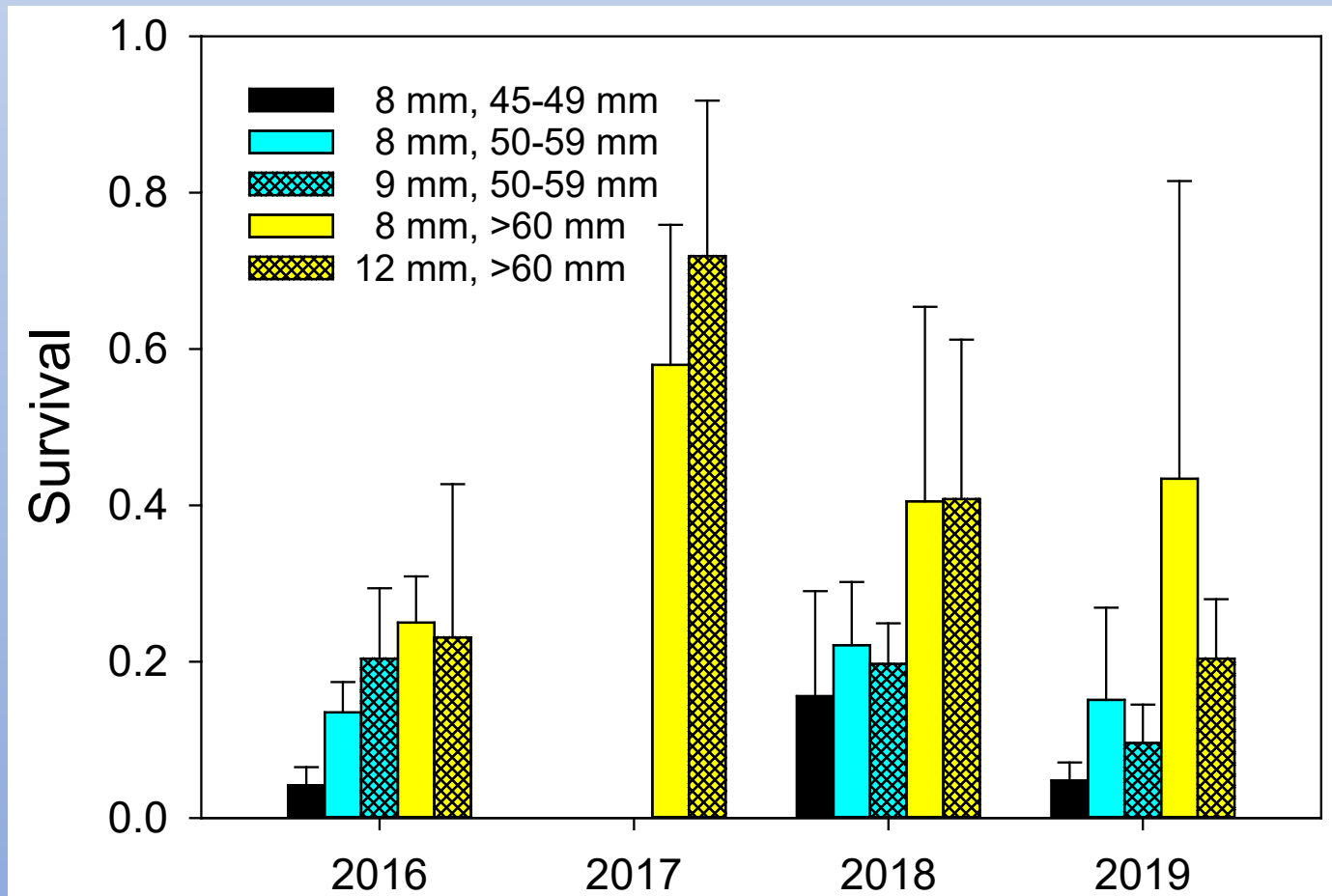
2022: 560 fish released, 32 detected = 5.7%



Survival to Lower Granite Dam:

Within size-class survival of 8-mm tagged fish equal to or higher than fish with larger tags, except in two instances

Best survival model included size-class and year. Little evidence that tag size affected survival



Discussion and Conclusions

Using 8-mm tags allowed us to tag 6.2–24.1% more fish that were 45–49-mm

No negative effects on post-tagging mortality, growth, or survival

Low survival influenced in part by low detections at Lower Granite Dam

Detection of 8-mm tags high in LGR fish bypass system but likely poor on stream-type antennas and the LGR spillway detector

Tagging 45–49-mm fish takes skill and practice

Questions?



Tiffan, K.F., T.N. Rhodes, B.K. Bickford, D.D. Lebeda, W.P. Connor, and F.L. Mullins. 2021. Performance of subyearling Fall Chinook Salmon tagged with 8-mm, 9-mm, and 12-mm passive integrated transponder (PIT) tags in the Snake River. *North American Journal of Fisheries Management* 41:176–186.