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# Development and Pilot Field Trial of a Juvenile Lamprey Acoustic Transmitter

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# Introduction

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- Hydropower has had major adverse impacts on the population of Pacific lampreys in the Columbia River Basin
- Knowledge of lamprey behavior and survival are critical for developing mitigation strategies for downstream passage
- The existing acoustic tag is too large to be implanted in juvenile lamprey and eel
- Started development for a new tag for lamprey tag with co-funding from USDOE and USACE in 2014
- Developed a procedure for implantation of the new tag in juvenile eel and lamprey in June 2016
- Finalized the design in September 2016
- Conducted pilot field trials in 2017

# First Generation Juvenile Eel/lamprey Acoustic Transmitter*

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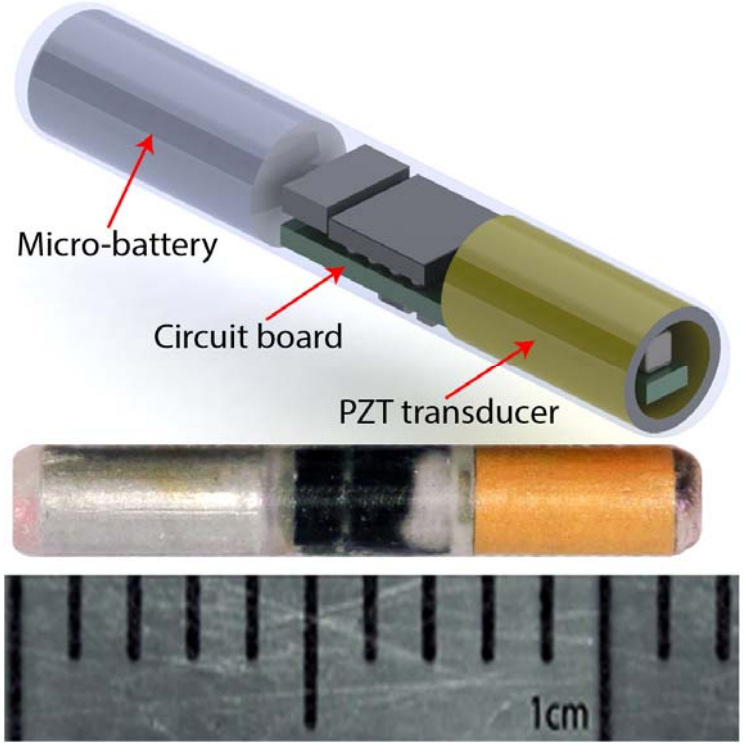
- Dimension: 12.0 mm x 2.0 mm
- Dry Weight: 80 mg
- Source Level: 147 dB
- Configurable pulse rate interval & tag code
- Optional temperature, alternating, and hibernation mode
- Tag life: > 20 days at 5-s pulse rate interval




*Available for licensing, patent pending

# Juvenile Lamprey Tagging Study in the Lab

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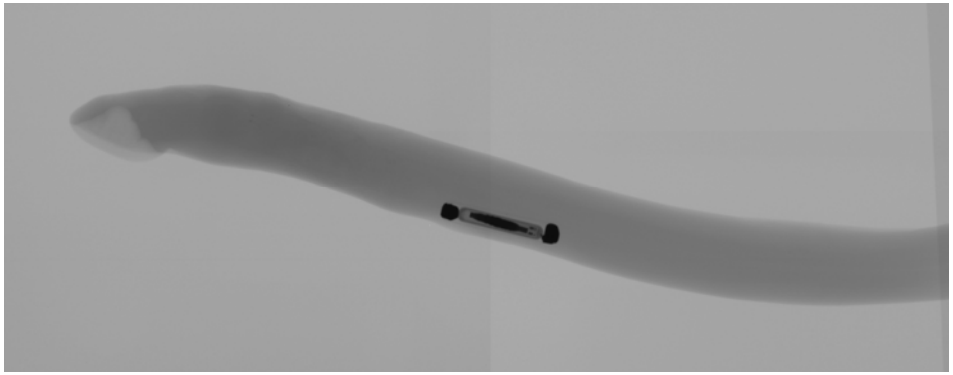
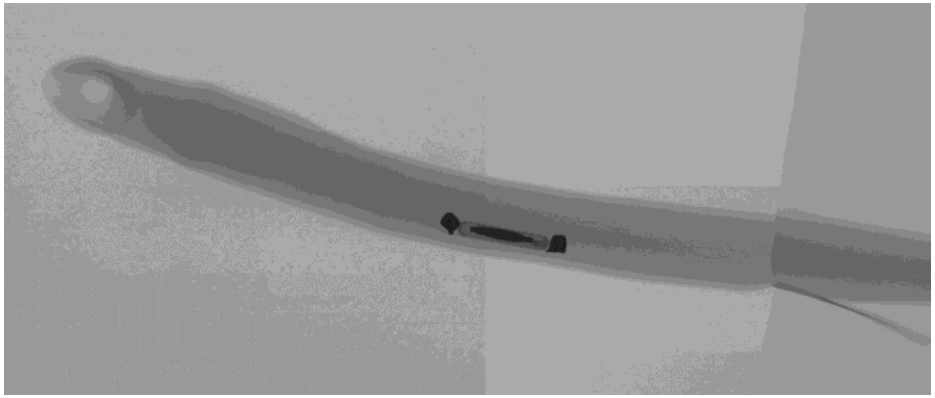
- The tag is likely to have little adverse impacts to fish survivorship over 28-day holding period with minimal tag loss due to shedding for fish greater than 130 mm.
- The surgical operation procedure was effective at placing tags in the body cavity without causing significant hemorrhaging or fungal infections at tagging site.
- The sustained swimming tests showed no significant differences in swimming ability between implanted and control groups for all size classes (120-160 mm).





# Approach: Tagging



- Acoustic tag only (No PIT tag)
- 25-35 fish tagged per day (3 or 4 tagging days)
- Anesthetize fish using buffered 250 mg/L MS-222
- Anesthetized fish assigned a tag with a unique tag code, weighed, measured
- A 2-3 mm incision ~20 mm posterior to the gill pores, along the left side of the body Mesa et al. (2012) and Mueller et al. (2006).

# Pilot Field Trial: Array Design

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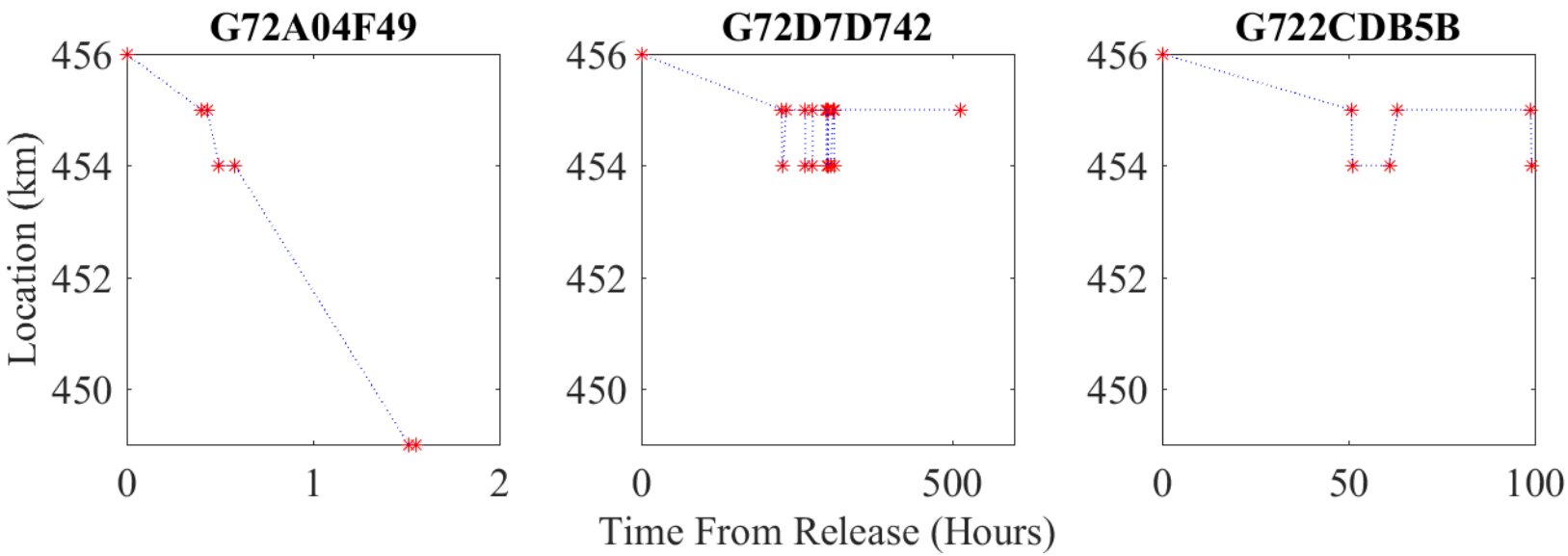
- A total of 41 JSATS autonomous receivers were deployed between McNary Dam and John Day Dam
  - 7 nodes at river km 449
  - 26 nodes at river km 454
  - 8 nodes at river km 455
- Fish were released approximately 1 km upstream of the array at rkm 456 at three lateral locations across the river

# Fish Tagging

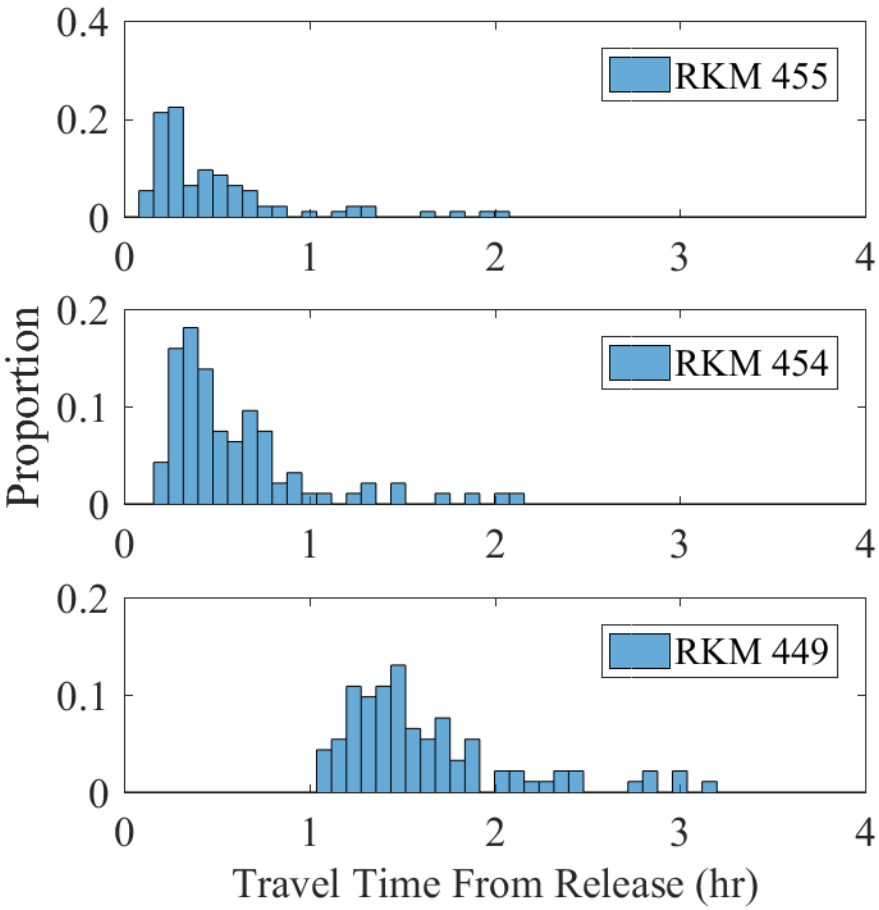
# Pilot Field Trial: Detection Summary

- Array at rkm 455
  - 98 out of 100 fish detected
    - Two tagged fish were never detected on any node
- Array at rkm 454
  - 98 out of 98 fish detected (100%)
- Array at rkm 449
  - 96 out of 98 fish detected
    - Two fish went back and forth between the 1st and 2nd array but never reached the 3rd array (shown below w/ a typical fish for comparison)



# Pilot Field Trial: Travel time from release to each array

- Median travel time from release to rkm 455
  - 0.35 hours
- Median travel time from release to rkm 454
  - 0.48 hours
- Median travel time from release to rkm 449
  - 1.51 hours



# Summary



- Developed the first acoustic tag for studying juvenile lamprey and eel
- Developed tagging protocols for juvenile lamprey and eel
- The pilot field trial demonstrated the feasibility of studying juvenile lamprey passage behavior and survival using the new tag
- The ability to implant acoustic transmitters and track the movement of sensitive species would help better understand behavior and survival to make more informed management decisions regarding new and existing hydro facilities.