

Comparative survival and behavior of acoustic and PIT-tagged yearling Chinook salmon in the Snake and Columbia Rivers

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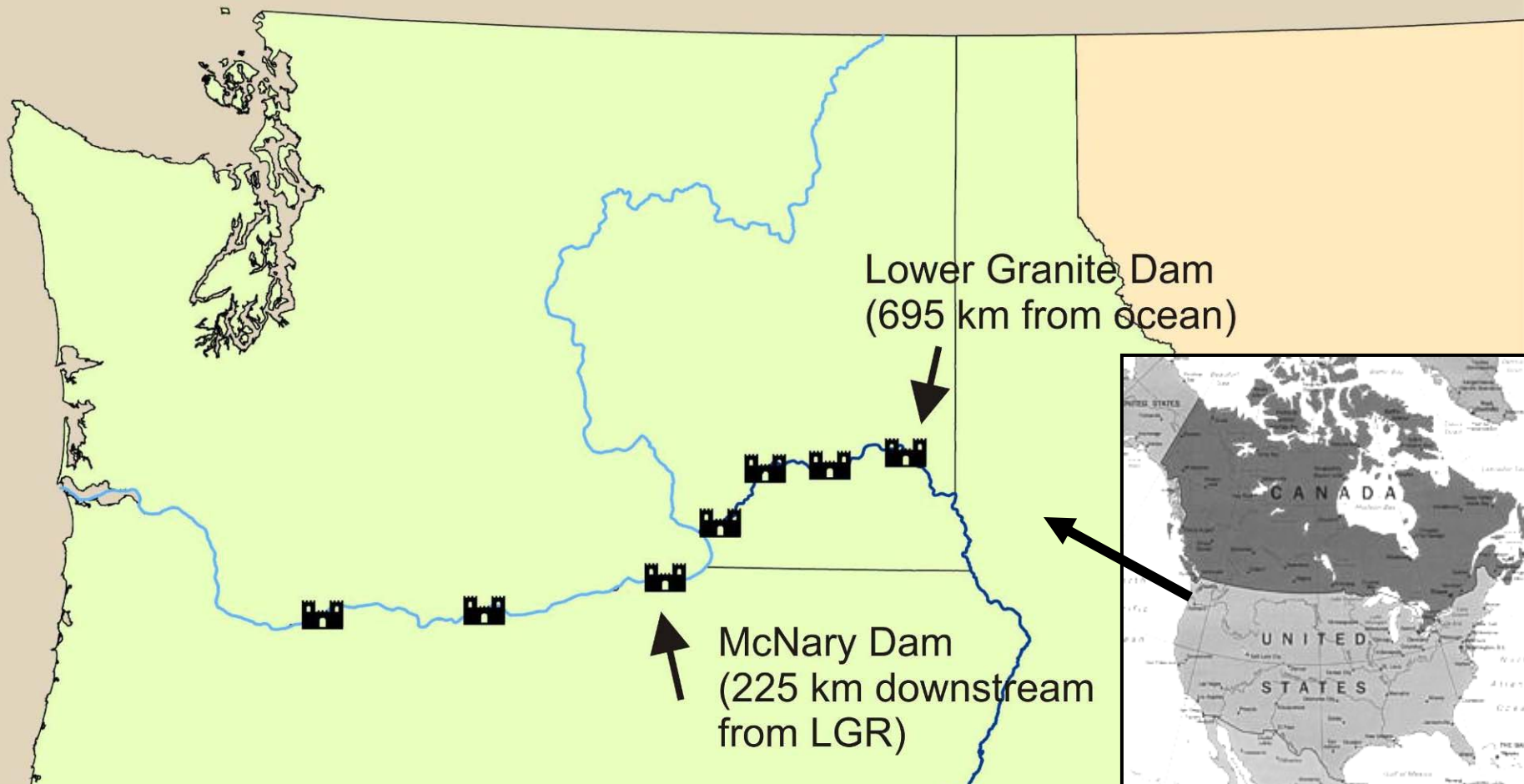


**U.S. Army Corps
of Engineers
Portland District**



**Pacific Northwest
NATIONAL LABORATORY**

Goal: Examine survival and travel time of yearling Chinook salmon from Lower Granite Dam through the lower Snake and Columbia Rivers



Specific Study Objectives

- ▶ Determine if survival differs between yearling Chinook salmon implanted with JSATS acoustic transmitters and fish implanted with PIT tags

- ▶ Determine if travel times differ between yearling Chinook salmon implanted with JSATS acoustic transmitters and fish implanted with PIT tags

Methods

Field Studies involved implantation of acoustic transmitters and PIT tags in 4,140 yearling Chinook salmon released downstream of Lower Granite Dam, Snake River

- ▶ Released on 10 days between April 23 and May 16, 2008
- ▶ Mean length 134 mm (range 95 – 202)
- ▶ Mean weight 23 g (range 7 – 50)
- ▶ Mean AT tag burden 2.3% (range 1.1 – 7.5)
- ▶ All AT fish also implanted with PIT tag
- ▶ Matched with 48,433 PIT tagged fish



Tag Specifications

- ▶ JSATS Transmitter
 - **0.43g in air**
 - 0.28g in water
 - Volume: 0.14 ml
 - 5.3 mm x 12 mm x 3.7 mm
 - 5s pulse interval
 - Required tag life 30d life

JSATS transmitter side view

JSATS transmitter top view

PIT tag



Yearling Chinook salmon release groups

	2006	2007	2008
▶ N	996	3,818	4140
▶ Releases	2	10	10
▶ Tag weight	0.66	0.60	0.43
▶ AT burden	3.2%	3.5%	2.3%

(% body weight in air)

Null hypothesis:

*No significant difference in survival between AT and PIT groups
to McNary Dam (225 km)*

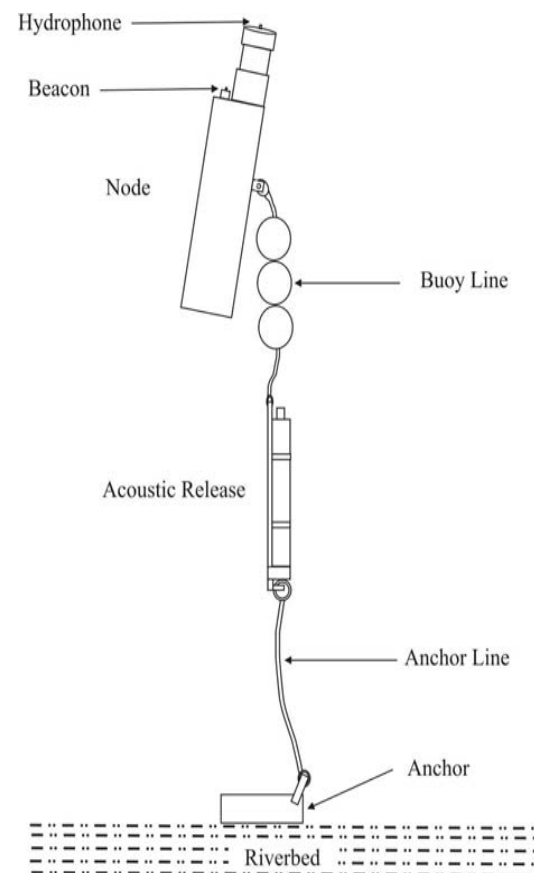
2006 and 2007: $\alpha = 0.1$

2008: $\alpha = 0.05$

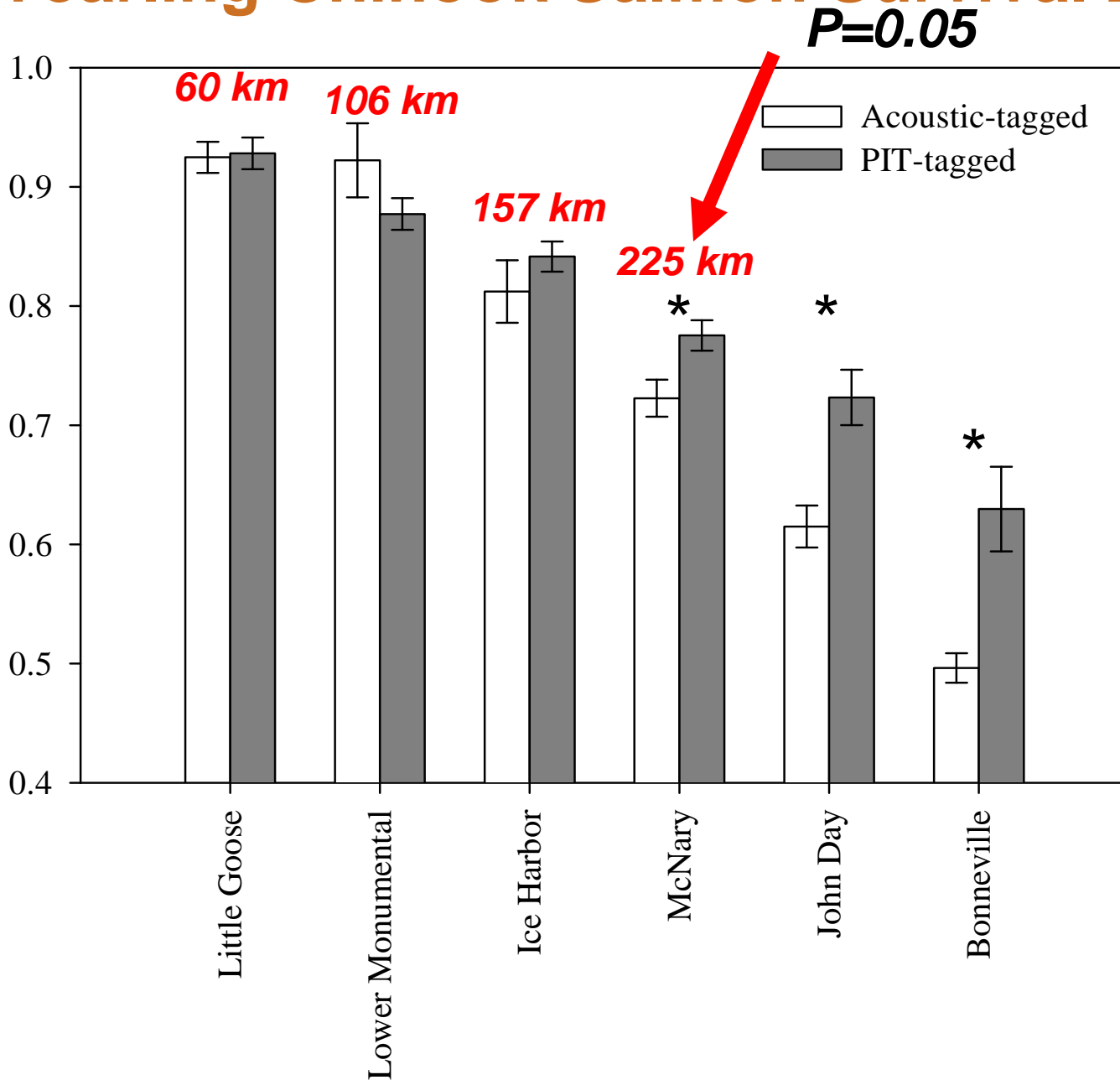


Analytical Methods

- ▶ Survival calculated using detections from PIT tag receivers at dams (for both AT and PIT fish)
- ▶ AT fish survival estimates augmented by several lines of autonomous receivers in Snake and Columbia River
- ▶ Survival calculated using a Cormack-Jolly-Seber single release model



Yearling Chinook Salmon Survival 2007

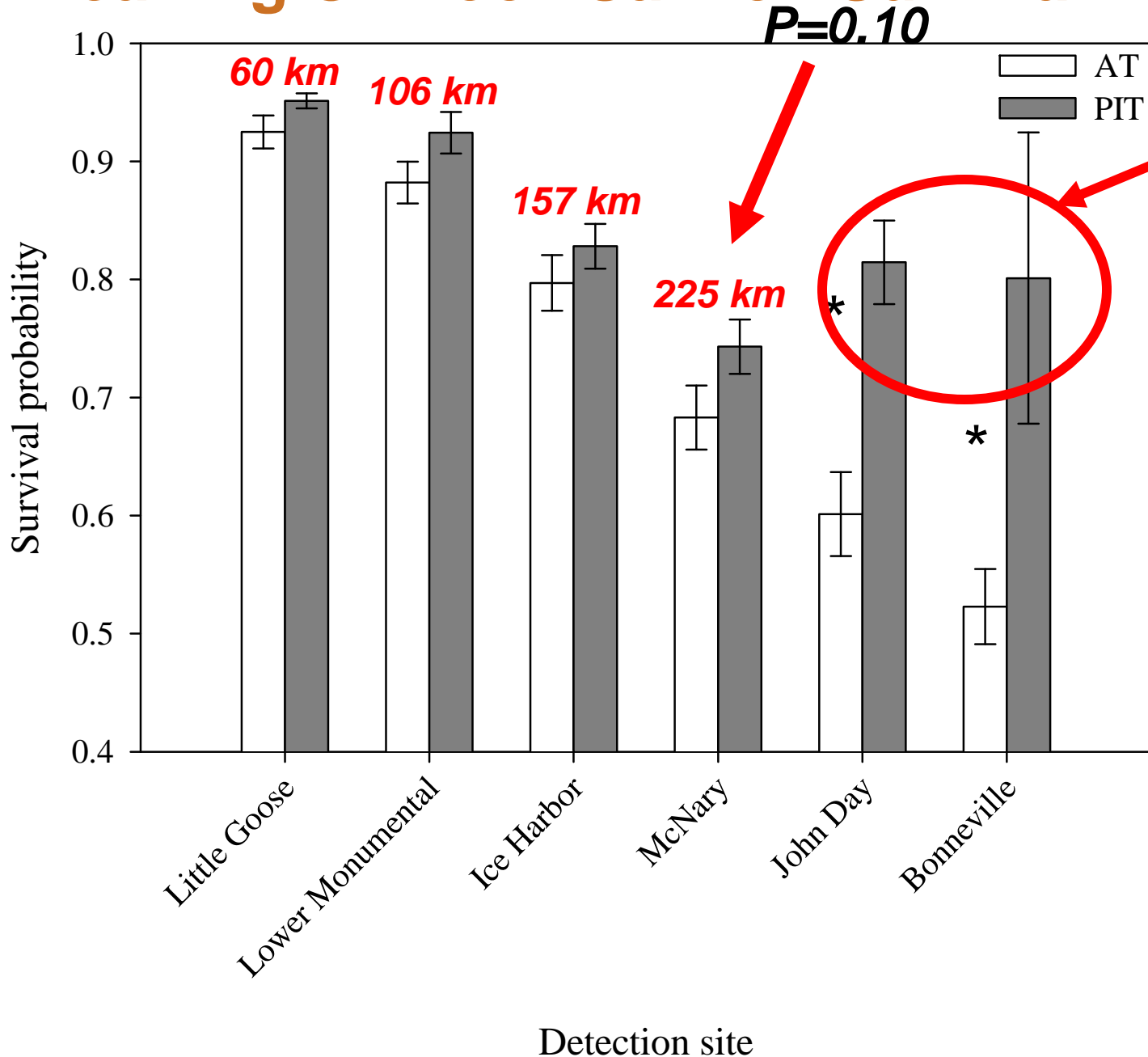


H_0 : no significant difference in survival between AT and PIT to McNary Dam ($\alpha=0.10$)

$P=0.05$;
hypothesis rejected – there was a significant difference

Differences associated with fork length, water temperature and river discharge

Yearling Chinook Salmon Survival 2008



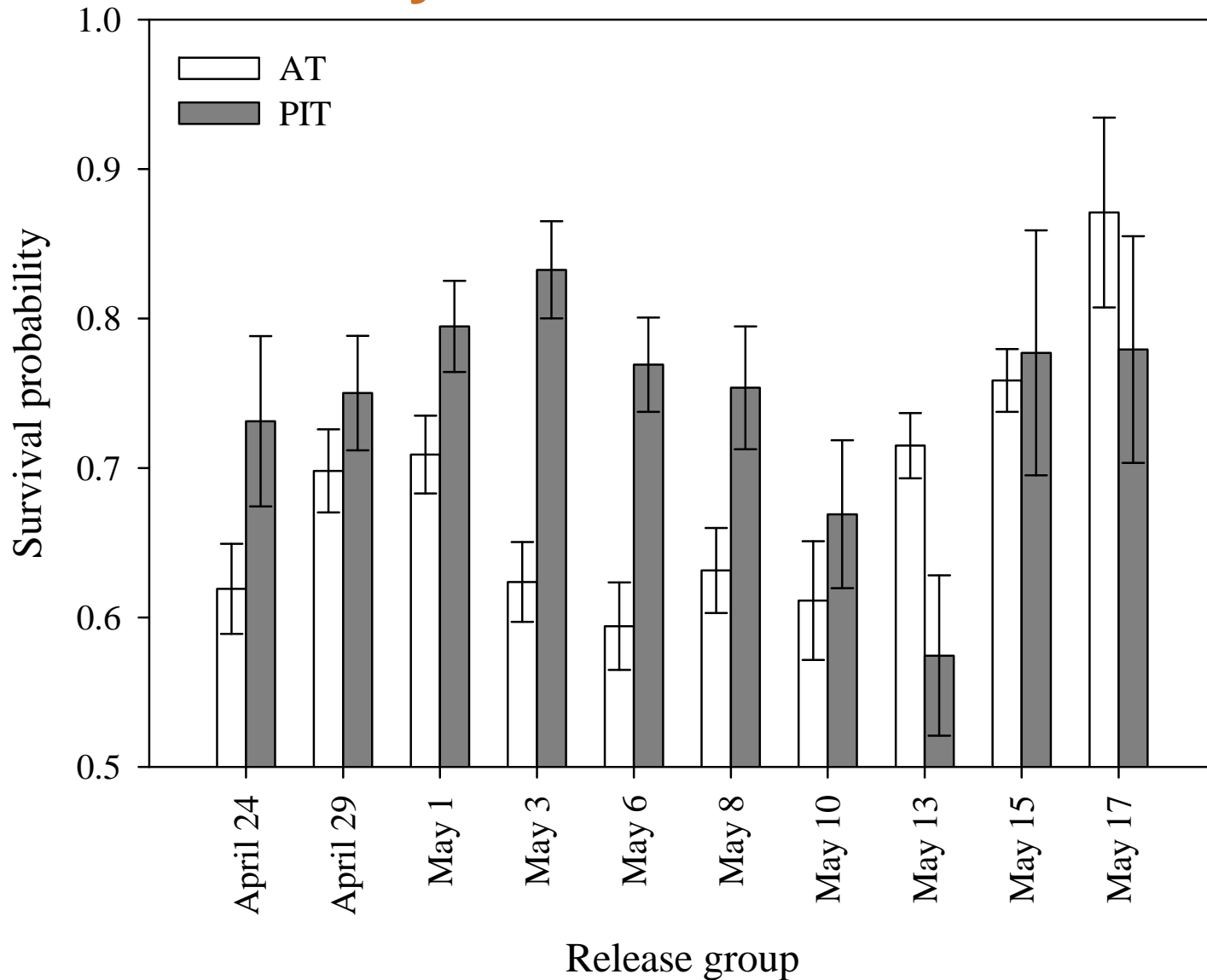
$P=0.10$

Questionable Estimates – violation of survival model assumptions – NMFS Sept. 8 memo

H_0 : no significant difference in survival between AT and PIT to McNary Dam ($\alpha=0.05$)

$P=0.10$; hypothesis accepted – there is not a significant difference

Yearling Chinook Salmon Survival to McNary Dam 2008



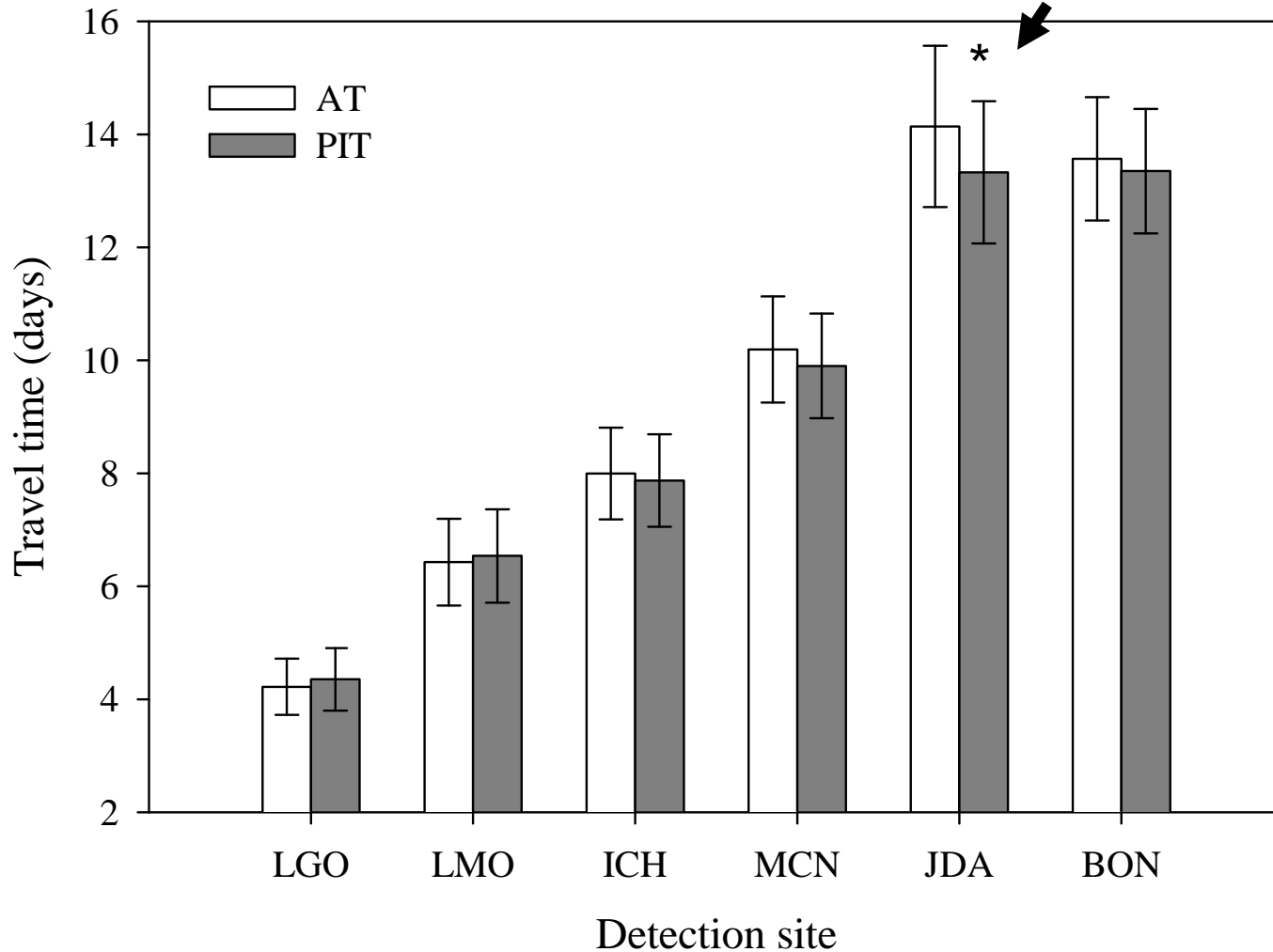
High variability in survival among release dates

Sample sizes too small to detect differences within daily releases

Error bars denote standard errors.

Yearling Chinook Salmon Travel time 2008

*Significant difference
seen at John Day in both
2007 and 2008*



Error bars denote standard errors.

Conclusions

- ▶ In 2008, no significant difference in survival occurred between AT and PIT fish migrating downstream past Snake River Dams or past McNary Dam
- ▶ In-season variance in survival noted between AT and PIT release groups
- ▶ In 2008, no significant difference in travel time between AT and PIT fish migrating past Snake River Dams or past McNary Dam



Future Plans

- ▶ **Continue to improve surgical implantation procedures**
 - Incision locations
 - Knot types and numbers / number of sutures
 - Alternative incision closure techniques
 - Anesthesia technique
 - Surgical protocol document

- ▶ **Recapture of returning adults**
 - examine tag expulsion

- ▶ **Need for field releases of both yearling and subyearling fish**

- ▶ **Determine if new surgical techniques influence survival and behavior. Determine if they are similar to PIT injection.**



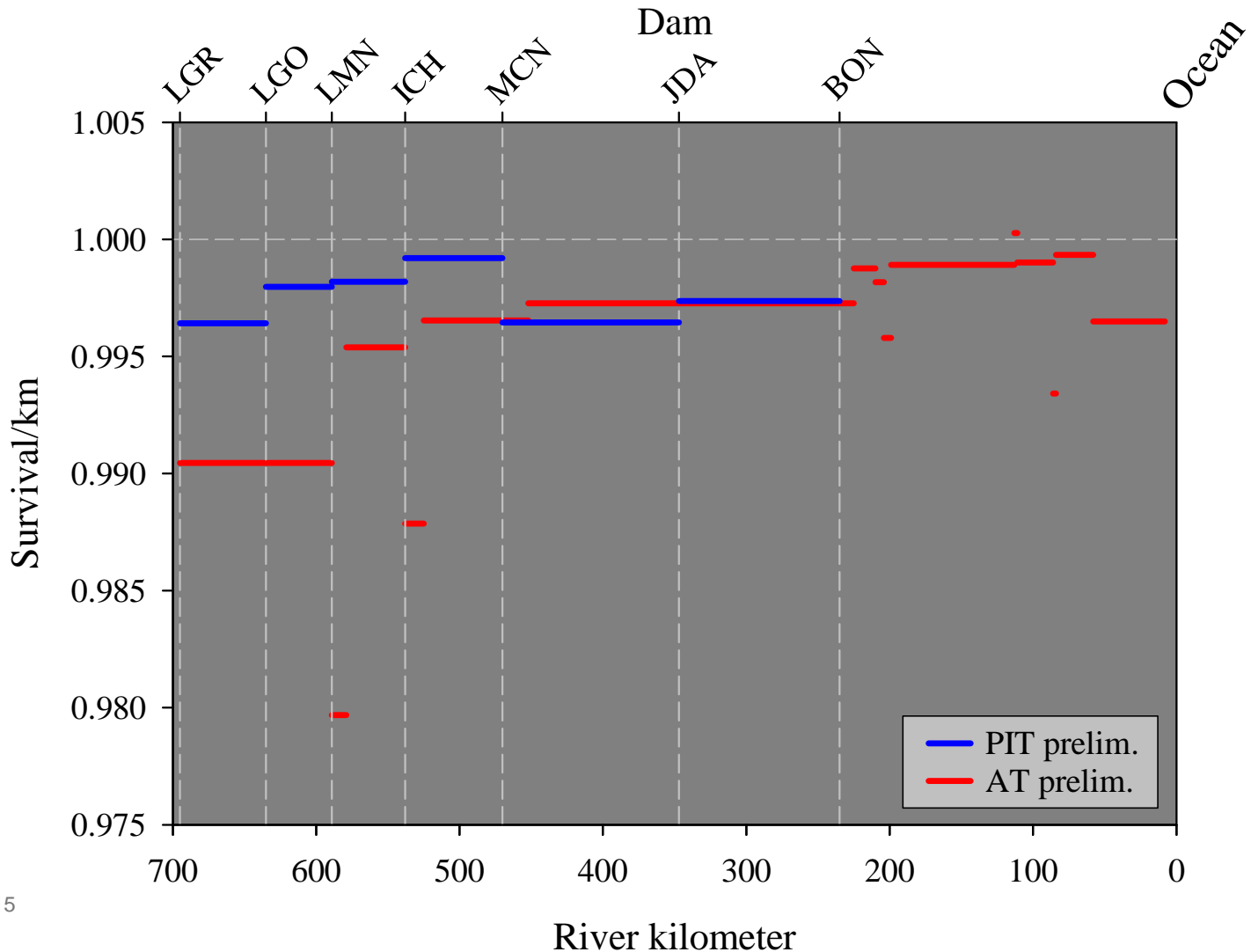
New Paradigm?

- ▶ **Smaller, longer-life tag provides opportunities to build from and improve on methods developed using radio telemetry technology.**
- ▶ **Fish could be tagged in hatcheries or other holding facilities and held until healed.**
- ▶ **Fish could be tagged at dams and survival monitored over longer distance – see where tag effect is manifested**
- ▶ **Flexibility provided by having both fixed and autonomous receivers allows for survival estimates to be obtained with knowledge of passage history and for “concrete” and project performance metrics.**



Future research – different perspective

Subyearling Chinook salmon survival by km in 2007



Differences in survival after release, then decrease

Preliminary analysis

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