



# Birds of a Feather Excrete PIT Tags Together: Twenty Years of Salmonid Mortality at an Eastern Oregon Great Blue Heron Rookery



**James Harbeck, Lora Tennant, Neal Espinosa and Ryan Rumelhart**

Nez Perce Tribe Department of Fisheries Resources Management, 500 North Main Street, Joseph, Oregon 97846



## Introduction

Salmon and steelhead serve as powerful cultural and social symbols for tribal and non-tribal people of the Pacific Northwest. Yet despite the significance of these icons, there have been widespread and dramatic declines in their populations. These declines were also witnessed in populations of northeast Oregon including in the Imnaha and Wallowa subbasins. We investigated a great blue heron (*Ardea herodias*) rookery located near numerous nursery tributaries and hatchery acclimation release sites within the Imnaha and Wallowa subbasins. Our study was motivated in part by the increasing attention directed toward avian predation and its impact on juvenile salmonid survival.

## Methods

We used PIT tag data from tags located within the heron rookery to examine the characteristics and magnitude of juvenile salmonid mortality from this specific source.

- We randomly sowed control tags under and around the rookery site. A six acre grid was established to guide the scanning effort in a systematic manner. We used Biomark BP Plus portable antennas connected to HPR Plus readers to acquire detections.
- Control tags were used to establish detection efficiencies.
- We queried PTAGIS, agency reports and databases to acquire tagged and total fish numbers released annually by species and locations in the Grande Ronde and Imnaha subbasins.
- Minimum predation rates equaled the number of PIT tags recovered divided by the total number of tags released.
- Per capita rates were calculated by dividing the annual predation rate estimates by the rookery size (# of adult birds). Known rookery sizes were only available from 2013 – 2017.

## Results

- Over a two-day period, we detected 2,402 tags within the six acre grid (Fig. 2). Detections were from fish tagged and released in the years 2000 through 2019.
- Tagged fish species consumed by the herons include hatchery and natural steelhead (*Oncorhynchus mykiss*), hatchery and natural Chinook Salmon (*Oncorhynchus tshawytscha*), hatchery Coho Salmon (*Oncorhynchus kisutch*), and natural Bull Trout (*Salvelinus confluentus*) (Fig 3).
- Herons foraged over a three-state area in northeast Oregon, southeast Washington and central Idaho. Distances from prey sources to the rookery ranged from 4 to 142 km (Fig 1).
- The herons preyed primarily upon hatchery steelhead within relative proximity of the rookery. 80% of all PIT tags were from sources released 20 km or less from the rookery (Fig 4).
- Annual minimum predation rates were consistently higher for the Wallowa Hatchery steelhead than for steelhead released from the LSC Acclimation facility (Fig 5). Detection sample sizes for other species were insufficient for valid predation estimates.
- The higher per capita predation rates for hatchery steelhead are likely due to their greater vulnerability and prevalence (Table 1).
- An apparent, but nonsignificant relationship exists between local hatchery steelhead predation rates and total mortality rates (1- survival) at Lower Granite Dam (Fig 7).

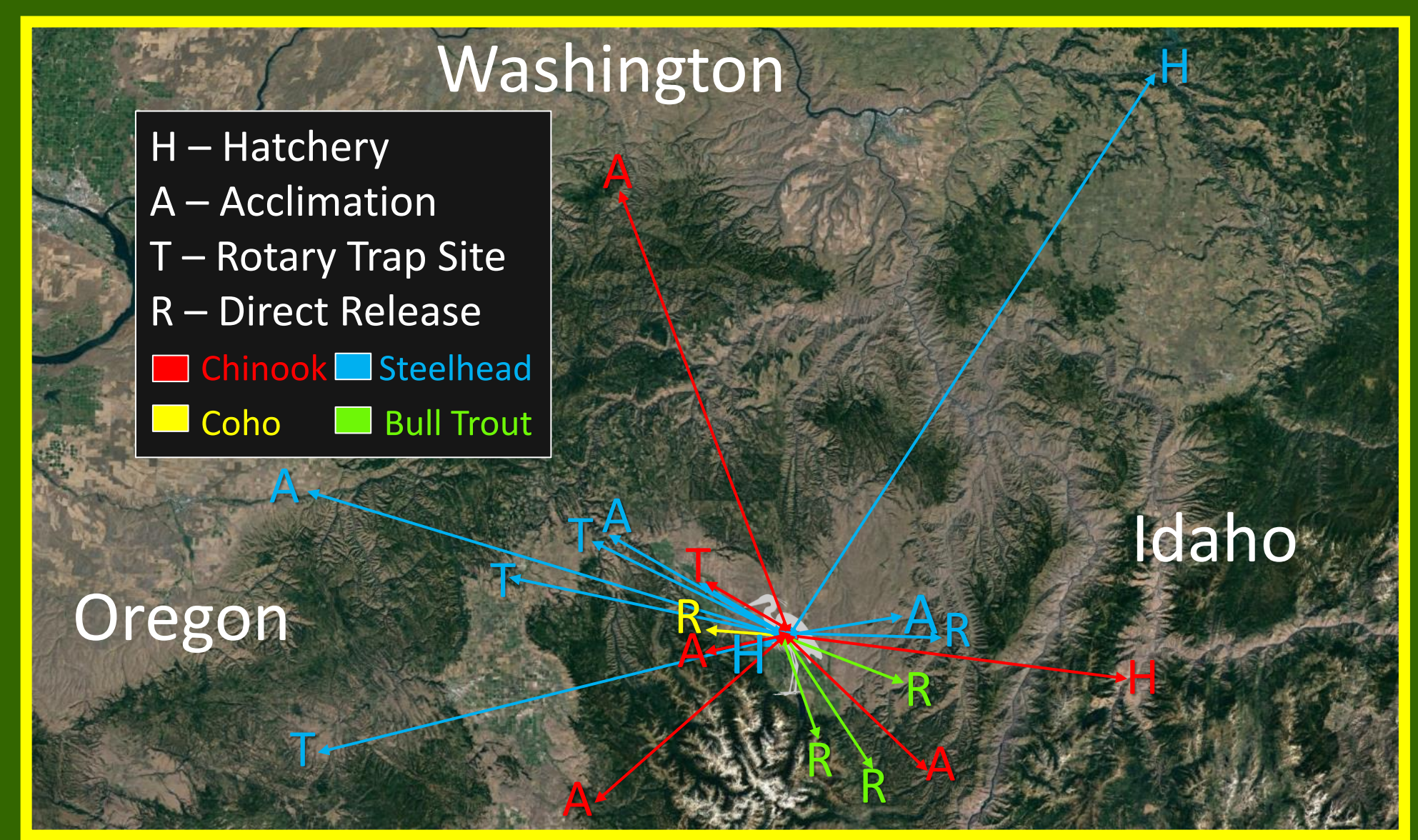


Figure 1. Three state forage area and PIT tagged prey sources of the Wallowa River Great Blue Heron rookery.

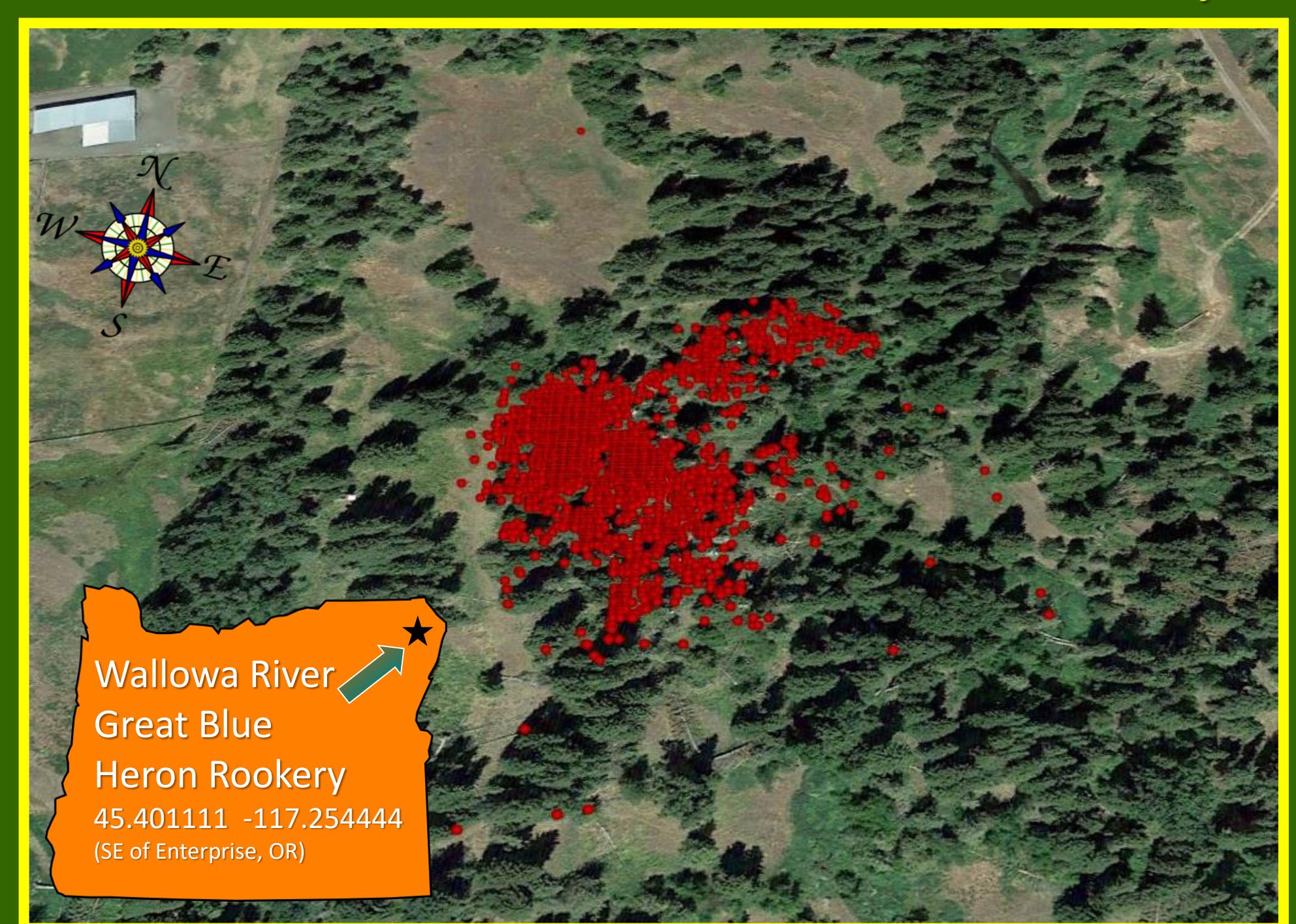


Figure 2. Location of the heron rookery study site and resulting plot of detected PIT tags.

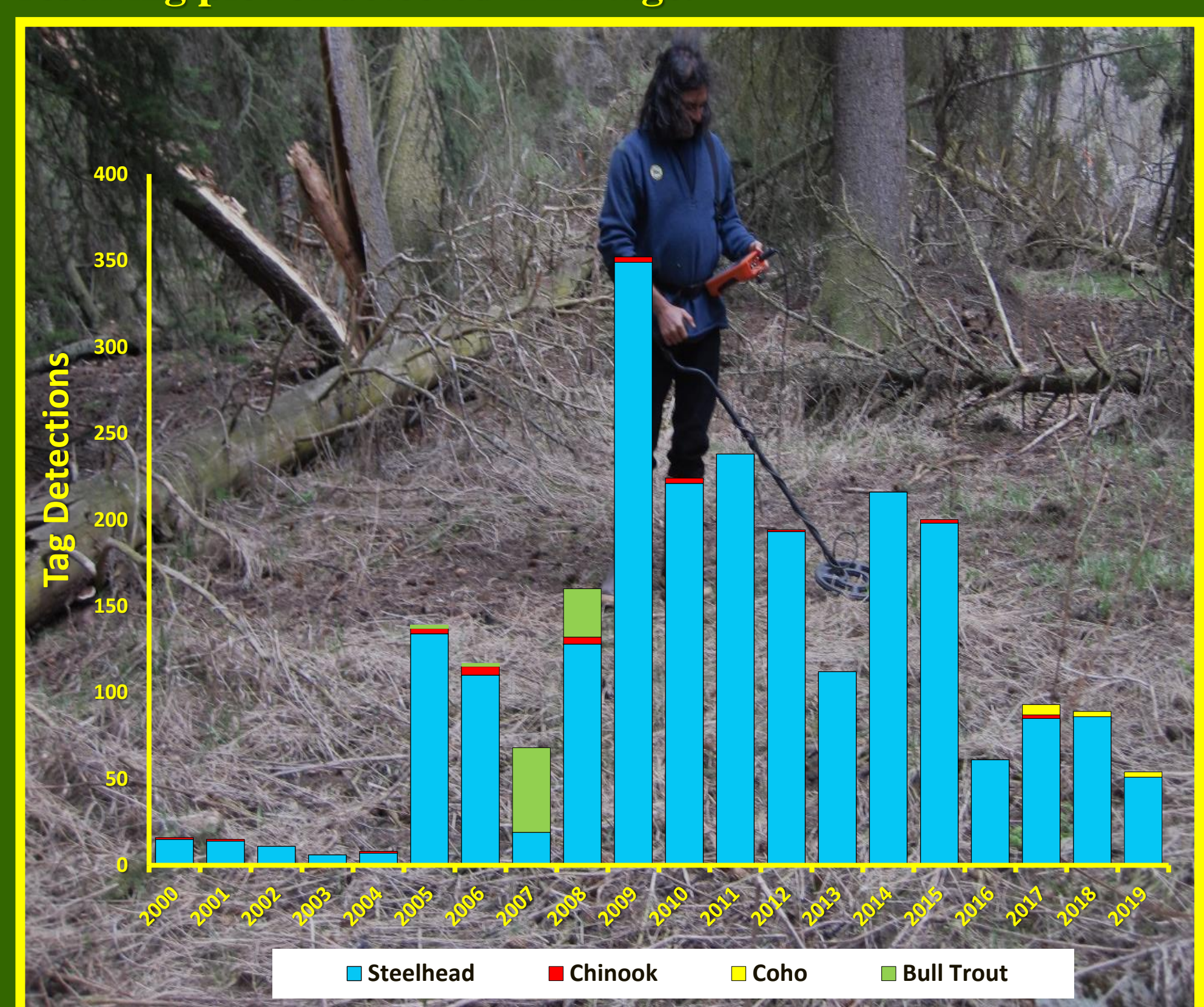


Figure 3. Number of PIT tags detected at the heron rookery according to species and year of release.

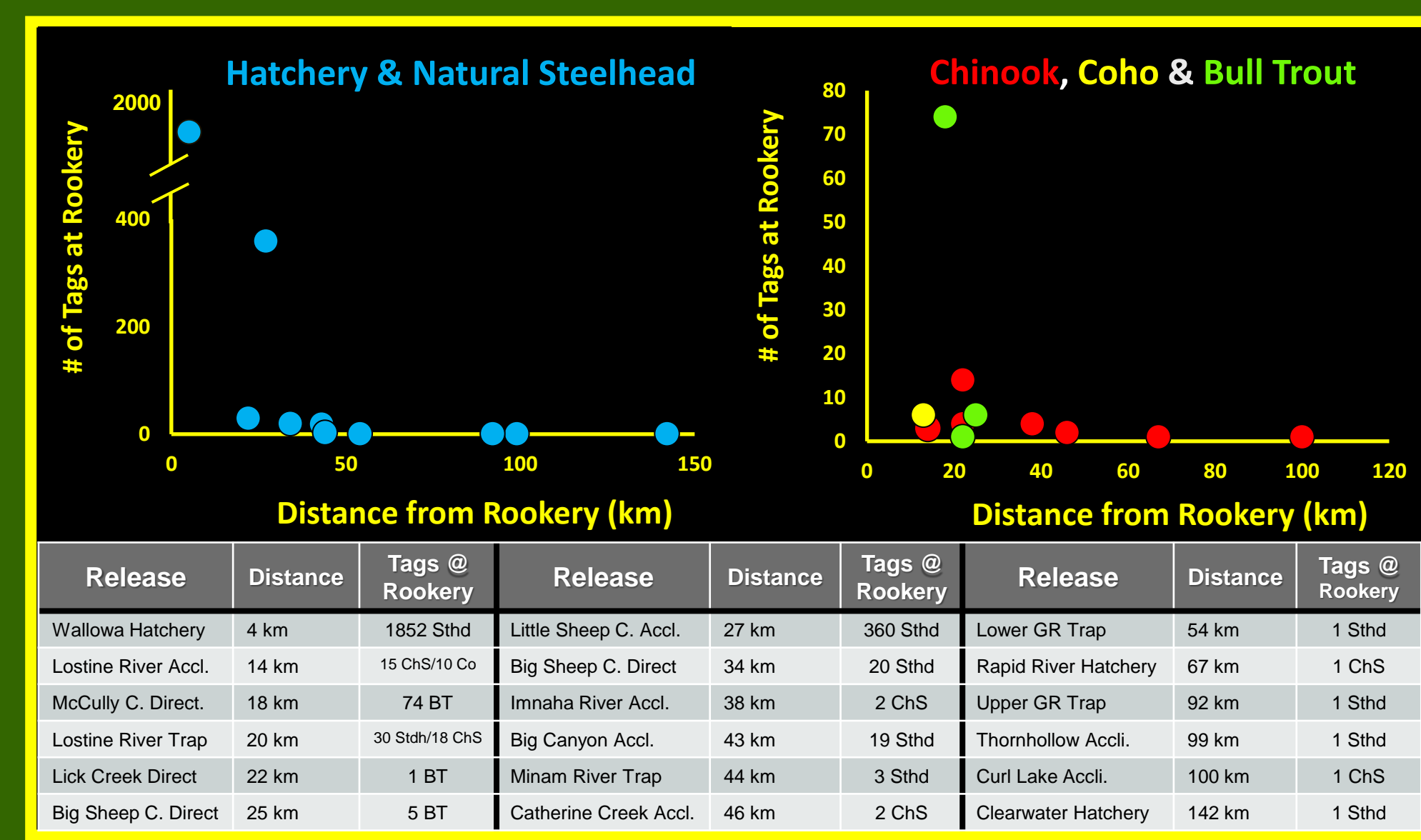


Figure 4. Relationship between predation and distance from the rookery.

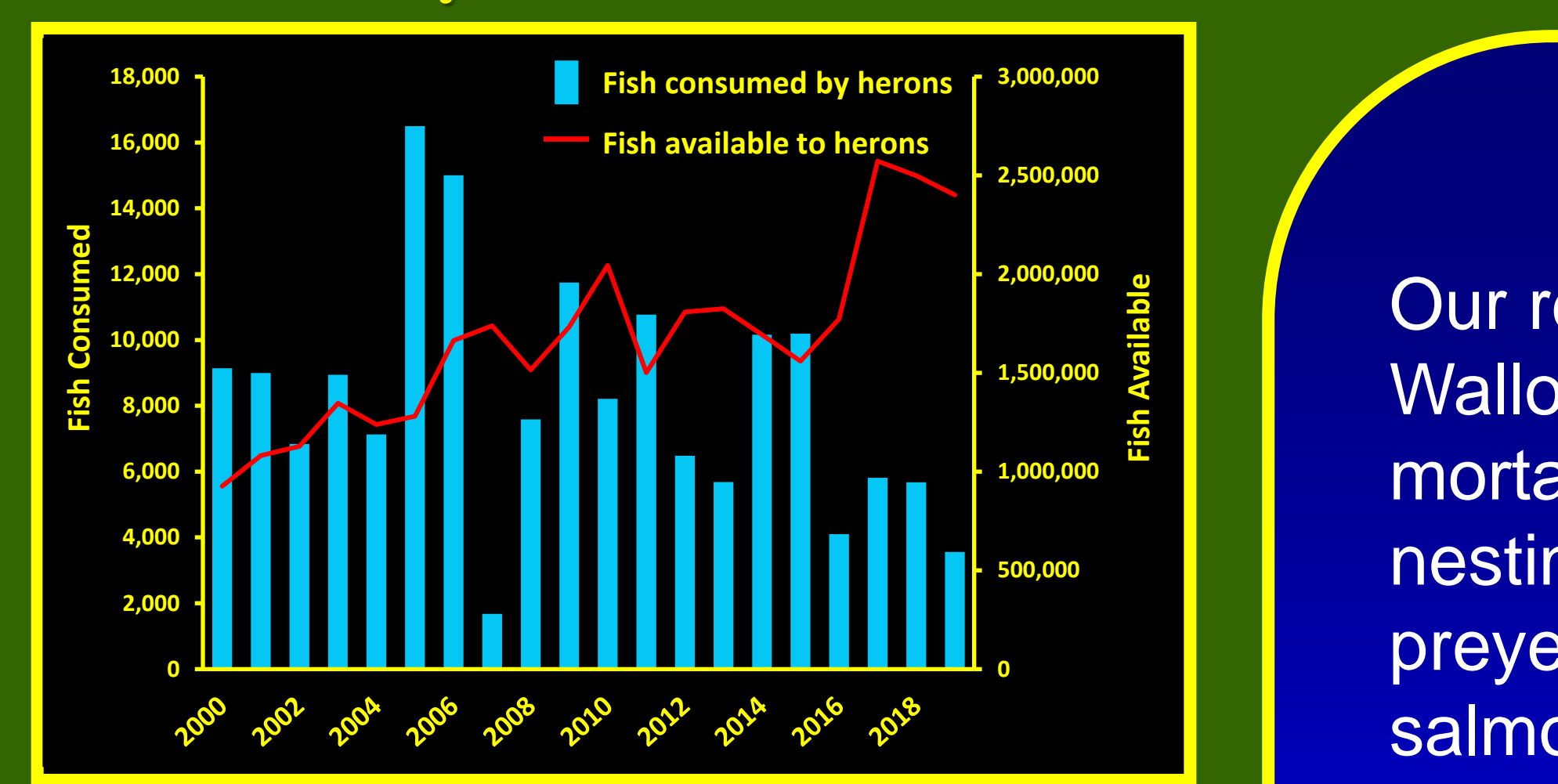


Figure 6. Estimated numbers of fish available to herons and estimated consumption.

Year	Wallowa Hatchery Steelhead	LSC Accl Hatchery Steelhead	Natural Steelhead	Lostine R. Hatchery Chinook	Lostine Hatchery Coho
2013	0.0003 (Non-ESA)	0.00005 (ESA listed)	0.00001 (ESA listed)	No tags detected	Prior to reintroduction
2014	0.0005 (Non-ESA)	0.00004 (ESA listed)	0.00005 (ESA listed)	No tags detected	Prior to reintroduction
2015	0.0006 (Non-ESA)	0.00002 (ESA listed)	0.00010 (ESA listed)	<0.00001 (ESA listed)	Prior to reintroduction
2016	0.0005 (Non-ESA)	0.00002 (ESA listed)	<0.00001 (ESA listed)	No tags detected	Prior to reintroduction
2017	0.0004 (Non-ESA)	<0.00001 (ESA listed)	No tags detected	<0.00001 (ESA listed)	0.00008 (Non-ESA)

Table 1. Minimum per capita (per adult heron) predation rates of ESA & non-listed populations

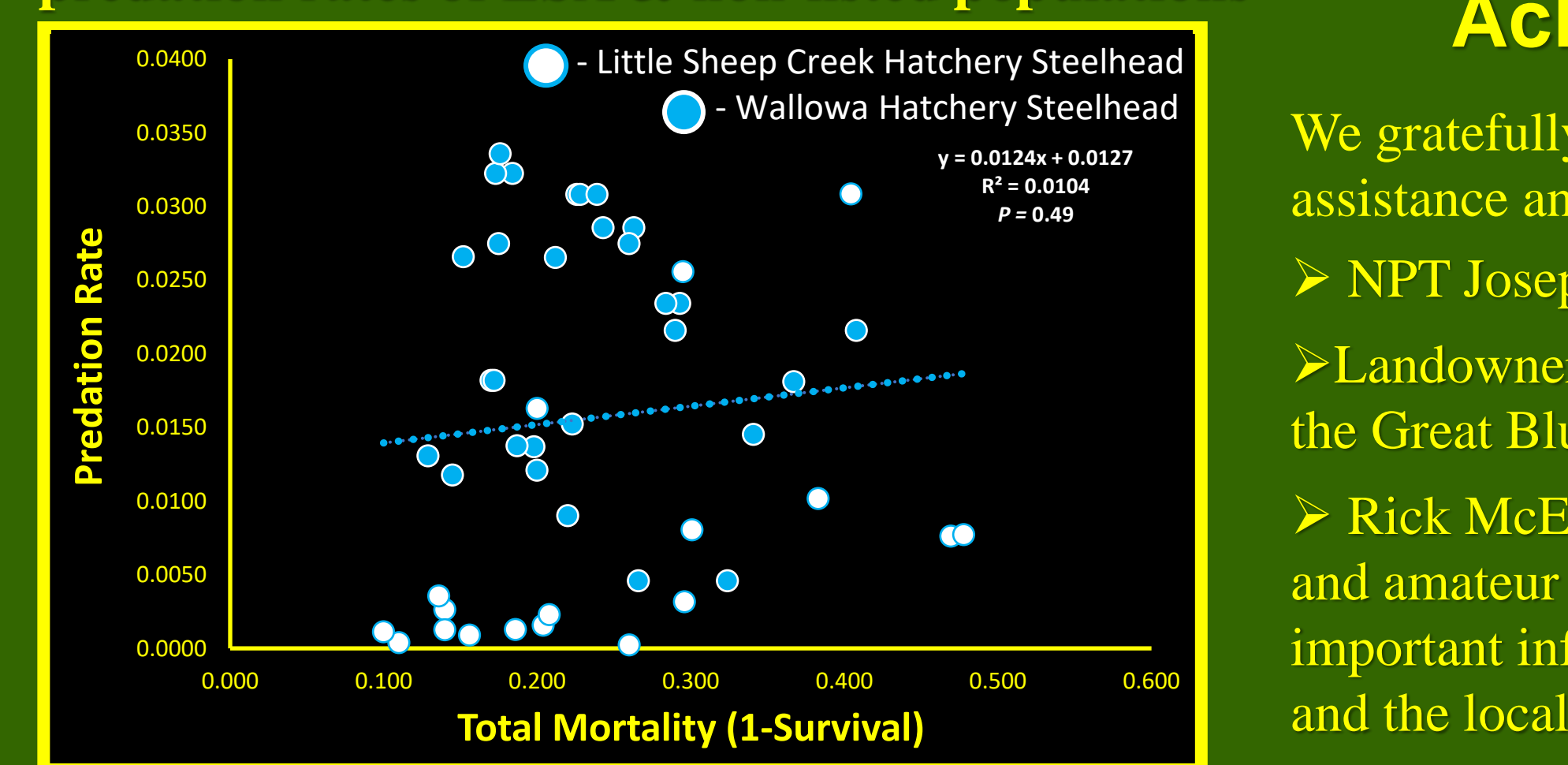


Figure 7. Relationship between heron predation rates and total mortality at Lower Granite Dam

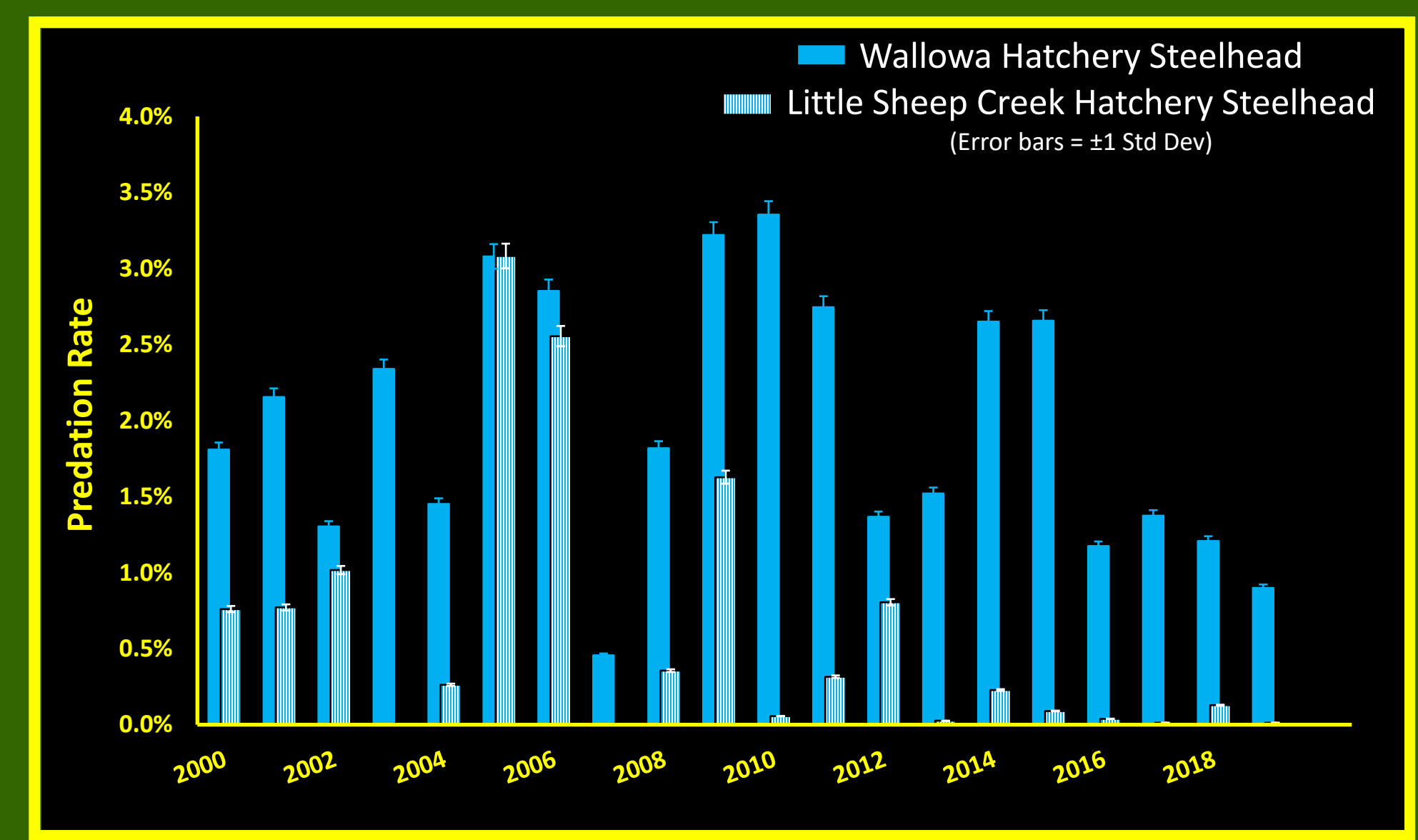


Figure 5. Minimum predation rates of hatchery steelhead released from the Wallowa & Little Sheep Creek facilities.

## Summary

Our results suggest great blue herons from the Wallowa rookery are a contributing source of mortality for hatchery steelhead during the birds' nesting season. To a lesser degree the herons also preyed against other ESA-listed and non-listed salmonids throughout a wide-ranging forage area. Therefore, proper due diligence would support continued monitoring of this source of mortality and whether it serves as a limiting factor impacting recovery.

To refine our results and more precisely estimate detection efficiencies and predation rates, we will visit the rookery again. In the future we also will investigate the rookery's contribution to total mortality estimated at Lower Granite Dam using a modeling approach.

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