Invasion of Exotic American Bullfrogs in the Billy Frank Jr Nisqually National Wildlife Refuge and Impacts to Threatened Oregon Spotted Frogs

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Introduction

THE GLOBAL AMPHIBIAN CRISIS

- Amphibians play a vital role in healthy ecosystems.[1]
- Global amphibian populations are declining due to habitat loss and invasive species.[2]
- The decline is particularly severe in some regions like the West Coast of the US.[3]

THE INVASIVE AMERICAN BULLFROG

- Native to Eastern North America, but introduced globally.[4]
- Adaptable, with high reproduction and outcompetes native species.[5]
- They can act as a reservoir for chytrid fungus and transmit it to native species.[6]

AMERICAN BULLFROG DIET

- Adaptable feeders, consume a variety of prey.[7]
- Diet varies with age and size, with younger bullfrogs targeting smaller prey.[8]
- Research shows a diet including insects, fish, reptiles, birds, rodents, and native amphibians.[9]

KNOWLEDGE GAP & STUDY FOCUS

- Limited understanding of bullfrog impact on Pacific Northwest amphibians.
- Oregon Spotted Frog (OSF) is a native amphibian of concern, potentially vulnerable.
- This study investigates bullfrog diet in an area with OSF co-occurrence.

STUDY OBJECTIVES

- Remove as many bullfrogs as possible
- Analyze bullfrog body size vs. prey composition.
- Assess potential impact of bullfrog predation on native amphibians.
- Provide insights for future management of invasive bullfrog populations.

Methods

Figure 1: The "Shooters Seat" with all the gear

FIELD METHODS

- Two-person team working from a 16ft canoe
- 22 nights
- July - September
- Remove up to 20 per night
- Net vs. Gig vs. Shot
- Ethical euthanization
- All frogs were frozen for future study

LAB METHODS

- Batch thaw in refrigerator
- Only stainless and glass tools used for dissections
- Autoclave between use
- Visual inspection of prey items
- Preserve stomach contents for eDNA
- Preserve bullfrog toes for future skeletochronology

Results

	Hunts	Frogs Observed	Frogs Removed	Average Size (mm)	% Juvenile	% Young Adult	% Mature Adult
2022	38	417	250	83.5	40%	44%	15%
2023	22	345	173	88.8	28%	58%	15%
Total	60	762	423				

Table 1: Stats and totals from 2022 and 2023 bullfrog removal at the refuge.

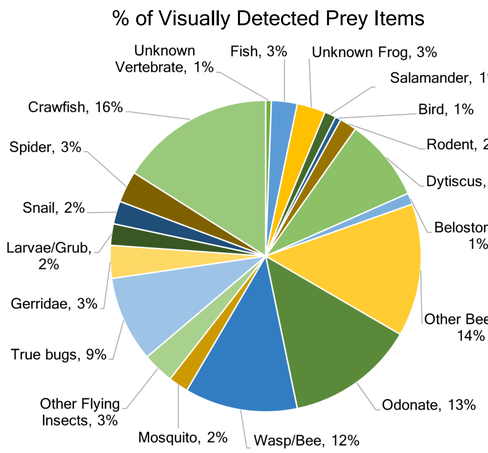


Figure 2: Visually detected prey from n = 316 bullfrogs

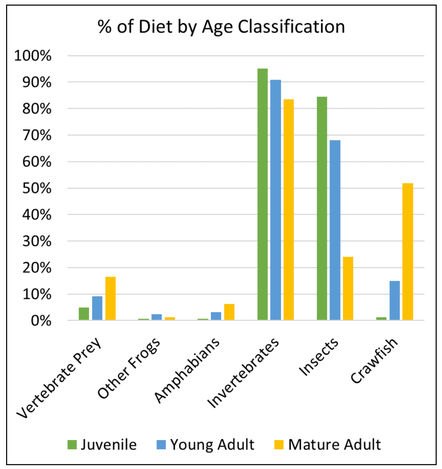


Figure 3: Comparison of diet composition across age classes

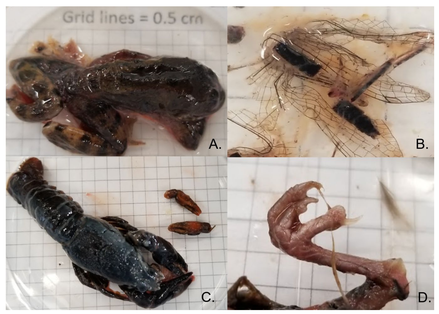


Figure 4: Prey items from bullfrog dissection
(A) Mature Oregon Spotted Frog (B) Dragonfly wings
(C) Large Signal Crawfish (D) Bird

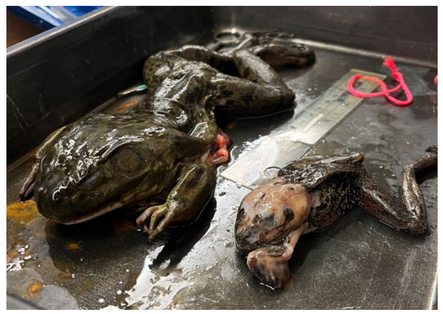
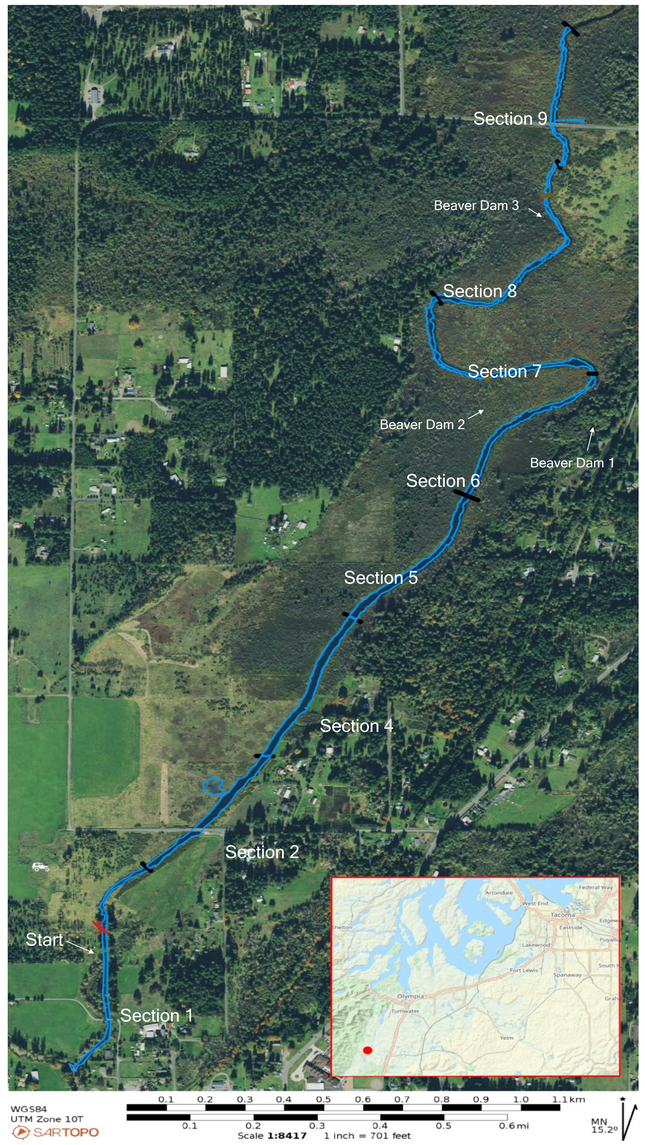


Figure 5: American bullfrog and Northern Red-legged frog. The prey item was 61% of the size of the predator

Black River Unit



Discussion & Future Study

- Bullfrog diet is only limited by the size of their mouth
- Mature bullfrogs eat large prey; up to 61% of their own body size
- Native amphibian populations are threatened by direct predation and competition for resources
- Bullfrogs shift the balance of any ecosystem where they are introduced
- Indicator species: Bullfrogs are willing to eat anything, monitoring their prey items can indicate the presence of additional exotic species
- Removal and mitigation efforts continue in 2024 with a full-time, 3-person team. June - Sep
- Stomach contents are being sent for eDNA testing which will reveal a more complete diet composition
- Bullfrog toes were sent to USGS Herpetological Research Team (FRESC) for skeletochronology

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References