The effect of Targeted Acoustic Startle Technology on the foraging success of individual harbor seals

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Introduction

- Pacific salmon *(Oncorhynchus* spp.*)* are important in the Pacific Northwest but are in significant decline.[1]
- Salmon recovery may be hindered by pinnipeds such as harbor seals *(Phoca vitulina)*.[2]
- Acoustic Deterrent Devices (ADDs) are common tools used to mitigate pinniped predation; however, they can cause harm and habituation.[3,4]
- A novel ADD, known as Targeted Acoustic Startle Technology (TAST), appears to decrease seal predation without these negative side effects (*Fig 1*).[4]
- However, the effect of TAST on presence and predation success of individual seals is unknown.
- A TAST device was deployed at Whatcom Creek in fall 2020, where harbor seals routinely prey on adult spawning salmon.

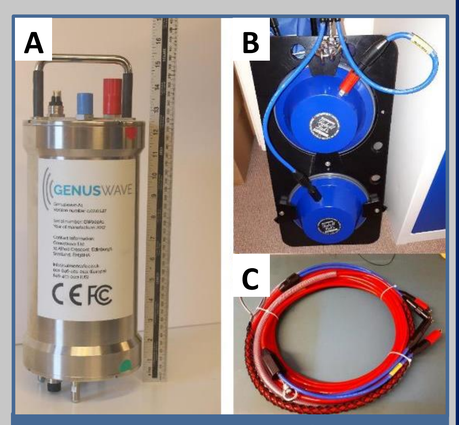

Figure 1. TAST control unit (A), transducer (B), and power cable (C).

Questions

1. Does TAST reduce individual harbor seal presence in Whatcom Creek?
2. Does TAST reduce individual harbor seal predation on adult salmon in Whatcom Creek?

Methods

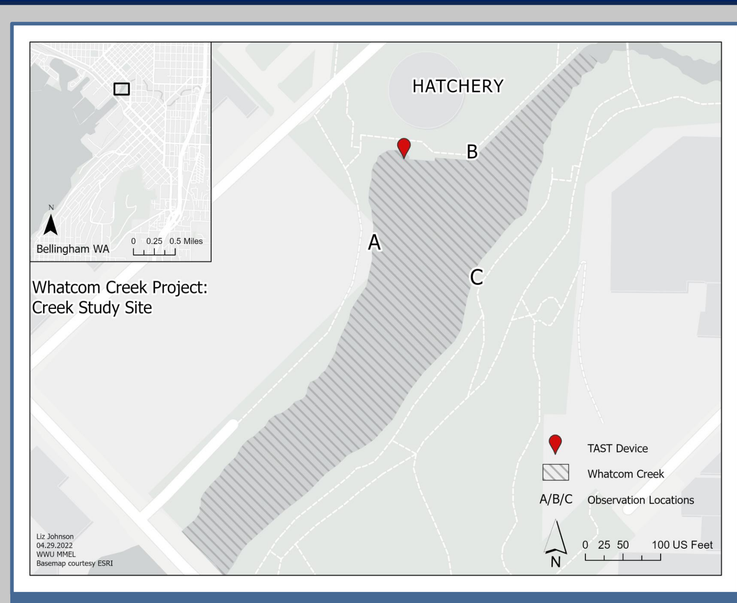

Figure 2. Location of Whatcom Creek in Bellingham, WA. Maps made by Elizabeth Johnson.

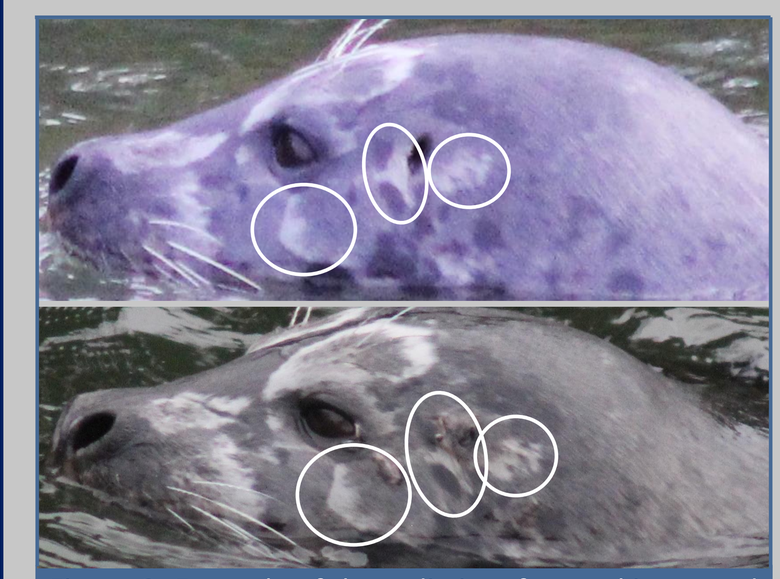

Figure 3. Example of three distinct fur markings used to confirm identification. Photos are of ID 0039 taken in 2015 (top) and 2020 (bottom).

Study Site:

- The mouth of Whatcom Creek is in Bellingham, WA (*Fig 2*).
- Hatchery Chum (*O. keta*) and Chinook (*O. tshawytscha*) salmon spawn in the fall, attracting harbor seals

TAST:

- Deployed by the non-profit Oceans Initiative (OI) Oct 29 to Nov 25, 2020
- Submerged at base of hatchery fish ladder (*Fig 2*), followed 3-days on, 1-day off schedule

Field Observations:

- Surfacing seals were photographed and predation events were recorded during 25 observations

Photo Identification:

- For each minute in an observation, photos of seals were selected and identified
- Seals were identified by matching three unique fur markings to our catalog of known seals *(Fig 3).*

Response Variables:

- Presence/absence and duration (mins) at the creek for each individual seal
- Foraging successes (number of fish caught) by each individual seal

Results

Presence and Duration:

TAST significantly impacted the amount of time seals spent at the creek (PERMANOVA approx., $F_{(1,23)}$=2.84, **p=0.001**).

On average, individuals spent 20% less time when TAST was on (*Fig 4*).

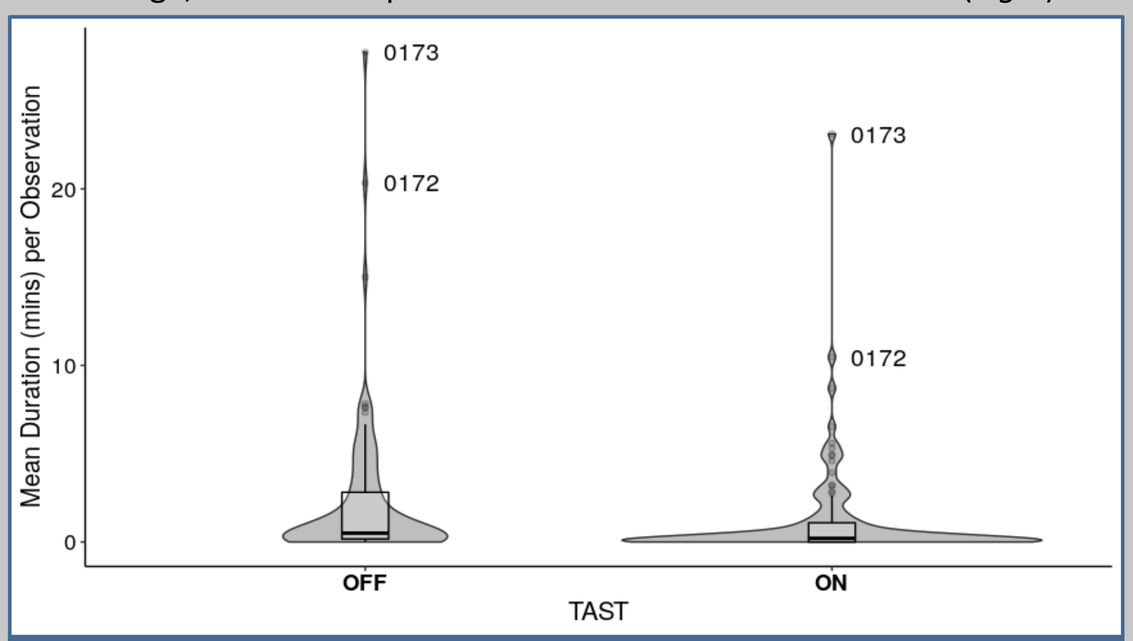

Figure 4. Violin plot showing the average duration (mins) that each individual seal was observed at Whatcom Creek across TAST off and TAST on observations. ID 0173 and ID 0172 are labeled as outliers.

Foraging Success:

Generalized Linear Mixed Models were used to predict number of catches per ID based on TAST status and number of days observed, with ID as a random intercept

- While TAST was on, foraging success of individuals decreased (P = **<<0.001**)
- The more days an individual was observed, foraging success increased (P = **0.003**)

There was strong variation among individuals, with some strongly affected by TAST and others seemingly not affected *(Fig 5).*

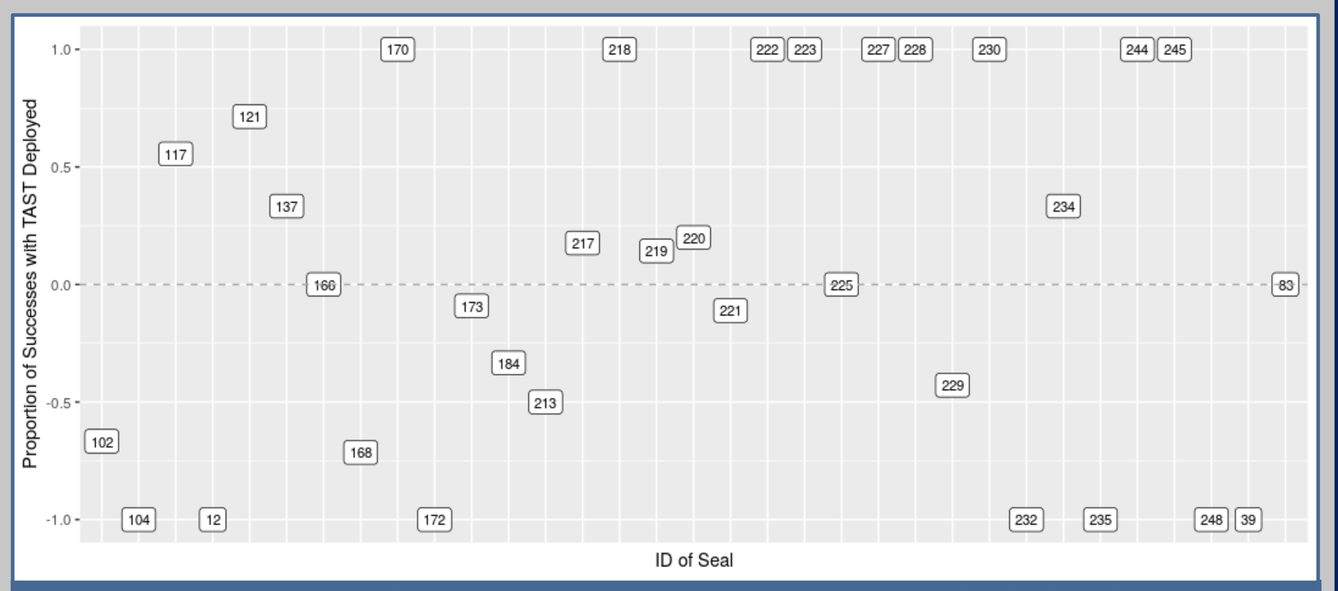

Figure 5. The proportion of foraging success across TAST status per individual seal. Positive proportion values indicate an increase in the relative predation success of that individual when TAST was on.

Discussion/Future Work

- Possible factors impacting TAST's effectiveness on individuals could include: deafness of seal, location of TAST, etc.
- Analyses in progress: assessing the long-term effect of TAST by comparing duration and foraging success of individuals from 2019-2021
- Studies should continue to be done to test the effectiveness of the device

Conclusion:

In the short term, TAST effectively decreases harbor seal predation pressures on depleted salmon stocks, however, individual variability should be considered.

References

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Acknowledgements

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