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Feeding success of harbor seals in relation to hunting technique at Whatcom Creek

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Feeding success of harbor seals consuming adult salmonids in relation to hunting technique

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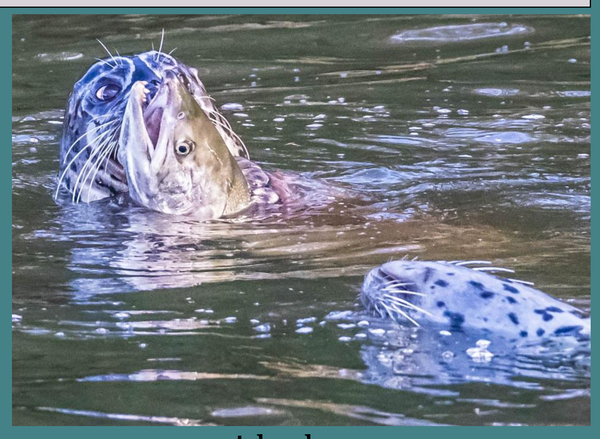
Introduction

- Foraging behavior in carnivorous marine mammals is poorly understood despite its ecological significance
- Studying patterns in individual foraging success may provide (1) predictive models and (2) insight to changes in ecosystem structure and function[1]
- Individual variability has been recorded in marine predators
- Harbor seals frequent an estuary in Bellingham, WA hunt primarily for hatchery Pacific salmon during the annual run[3]
- Are there certain hunting techniques and environmental variables that allow seals to have higher feeding success?
- Does feeding success of hunting technique vary at an individual level?

Methods

- Tied field behavioral data to photos from fall 2015 to winter 2017 using time
- Analyzed events that mentioned hunting behavior in one of three exclusive categories: rapid chase evidenced by a wake, scanning the surface upside down, and scanning the shallow bankside
- Up to 2015, catalog used to tie hunting events to numbered individual by manually matching unique spotting patterns
- Photos used to determine if hunting event lead to successful catch
- GLM used to test for the prediction of success by year, active hatchery chum salmon run, and location in creek

chase



upside down

upside down

bank

Results

- Average success rate of **chase** hunting technique across all years = **15.6%**±36.3% SD
- Average success rate of **bank** hunting technique across all years = **20.1%**
- ±40.6% SD
- Average success rate of **upside** down hunting technique across all years = **7.8%**± 26.9% SD
- Three-way interactive effect of technique, whether hatchery chum are running, and year is most influential on feeding success (Table 1)

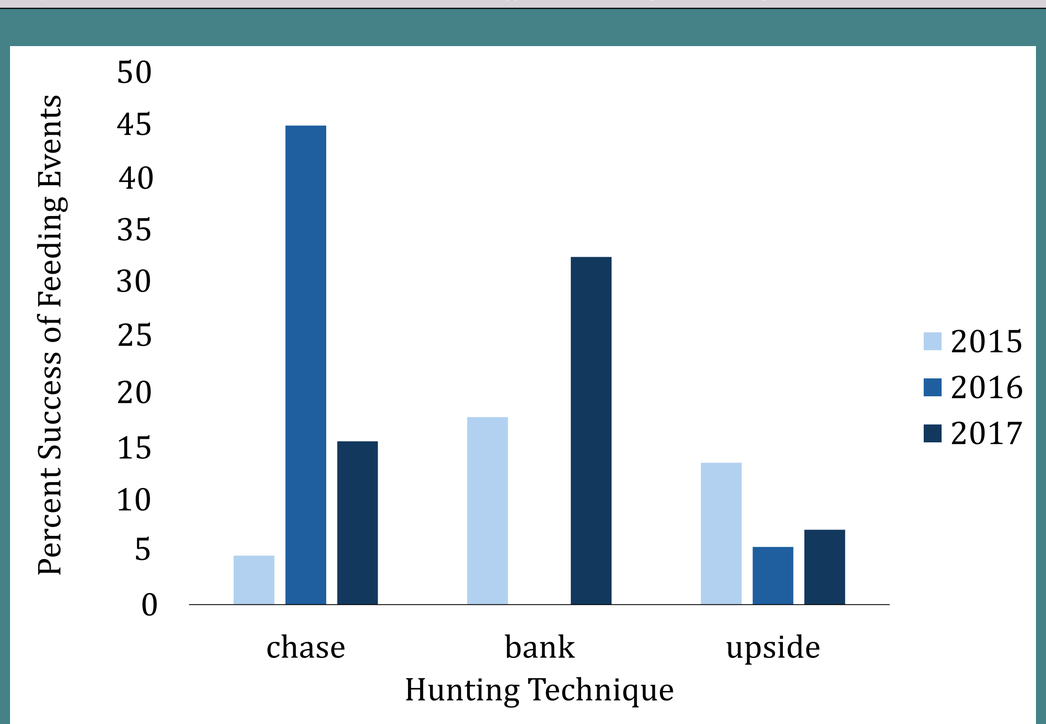


Figure 1. Percent feeding success for all harbor seals at Whatcom creek according to chase (n=64), bank (n=67) and upside down (n=166) hunting techniques by year.

Discussion

- Technique type does not reveal major patterns of success across years (Figure 1)
- Hatchery had ~90%[4] less salmon returns in 2017, no obvious effect on success (Figure 1)
- No successful bank behavior in 2016 possibly due to high success of chase; dominating behavior in each year (Figure 1)
- Technique plays a role in predicting feeding success (Table 1)
- Variation evident in feeding success for 2015 at individual level both in success of technique used and range of technique (Figure 3)
- Individuals 17, 56 and 105 have high success in one behavior, possibility of specialization or 'mastering' technique where other seals not as skilled (Figure 3)
- 5 & 6 are sight-reduced seals, upside down may help with vision (Figure 3)
- Future research will investigate the significance on individual specialization

Table 1. Generalized linear model examining variables most effective at predicting feeding success. Better predicted models have comparatively lower AIC values. Likelihood describes probability of model being the best of those tested.

Predictor	AIC	Likelihood
technique*salmon running*year	189.12	0.86
technique+salmon running+year	192.72	0.14
salmon running	200.01	0.004
technique	221.34	8.61931E-08
year	227.75	3.4959E-09

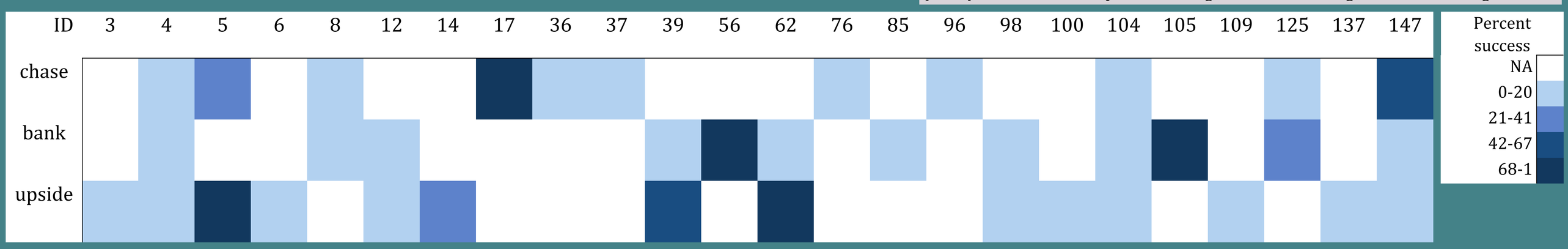


Figure 2. Heat map representing lower success rate (light) and higher success rate (dark) for three hunting techniques: chase (n=10), bank (n=9), and upside down (n=10) in 2015. X axis represents designated ID according to current catalog.

References

1. Austin, D., Don Bowen, W., McMillan, J.I., Iverson, S.J. (2006) Linking movement, diving, and habitat to foraging success in a large marine predator. *Ecology* 87: 3095-3108.
2. Bar-Hen, A., Monestiez, P. Gunet, C, Dragon, A.C., et. al (2012) Horizontal and vertical movements as predictors of foraging success in a marine predator. *Marine Ecology Progress Series* 447: 243-257
3. Woodrich, D., Acevedo-Gutiérrez, A. (2016) Effects of environmental variables on harbor seal (Phoca vitulina) occurrence at a seasonal foraging site in Bellingham, WA. Research Poster.
4. Whatcom Creek Hatchery (2015-2018) Salmon Escapement Data. Bellingham Technical College.

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