

ANIMAL-BORNE VIDEO LOGGERS OFFER A NEW LOOK AT THE UNDERWATER FORAGING BEHAVIORS OF ADÉLIE PENGUINS IN ANTARCTICA'S ROSS SEA

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Introduction

- The Cape Crozier Adélie penguin (*Pygoscelis adeliae*) colony located in Antarctica's Ross Sea is one of the largest for this species.
- Foraging range is restricted during the breeding period by energetic constraints of adults who must return regularly to the colony to provision chicks.
- Understanding the rate and type of prey being captured by breeding adults is key to link diet and foraging to breeding success.



Fig. 1 Adult Adélie penguin with chick

- Despite many studies of Adélie penguins at Cape Crozier, capture rate, prey type, and ecological context of prey capture events have never been measured directly.
- Advancements in the miniaturization of biologging technology allows us unprecedented ability to monitor the behaviors and environmental conditions associated with foraging in marine habitats.
- Using simultaneously deployed video loggers, accelerometers, and temperature sensors we will investigate foraging behavior, individual efficiency, and the environmental context in which foraging decisions are made.

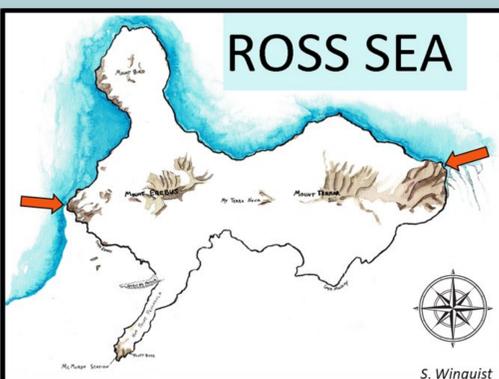


Fig. 2 Study sites on Ross Island, Antarctica. Cape Crozier on the right, Cape Royds on the left.

Pilot Study Methods

- During the 2018-2019 breeding season, Little Leonardo video loggers were deployed along with accelerometers on 27 chick-rearing adults at Cape Crozier. Deployments lasted for one foraging trip (~1.5-2 days)
- Devices were mounted along the dorsal line using Tesa tape with the video logger between the flippers (Fig 3B).
- Videos were reviewed manually and prey capture events were coded frame-by-frame.
- Preliminary analysis of 56 dives from 22 birds resulted in the identification of 937 prey capture events.

Preliminary Results

- 121 minutes of active diving was analyzed from videos. Of this, penguins spent 16% (20min) of their total active dive time in the dark where prey capture events could typically not be detected using video footage.
- Bioluminescent prey were recorded in 6 dives with a total of 76 detections.
- 44% of analyzed prey captures events were identified as krill, pteropods, fish, amphipods, gelatinous prey, or squid (fig. 4).
- Prey type was unknown or unidentified for 56% of prey captures due to poor image resolution.

Conclusions

This pilot study expanded our knowledge of the prey-base for Cape Crozier Adélie penguins and provided a new look at foraging behaviors including several examples of benthic foraging and foraging on bioluminescent prey.

Limitations to working with video loggers:

1. video data could only account for a portion of foraging trips due to low light at depths >70m and short battery life of loggers (~5hrs)
2. frame-by-frame review is time consuming
3. Automated methods of identifying prey capture events and prey identification are needed.

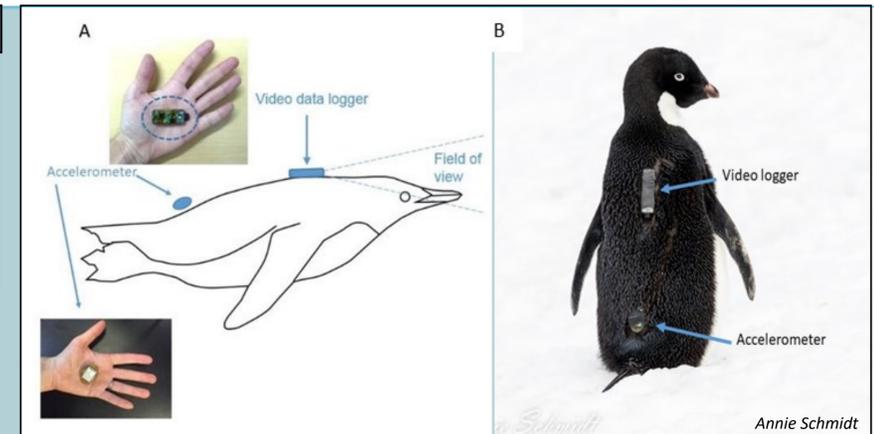


Fig. 3 A) Diagram of location and relative size of loggers deployed on Adélie penguins at Cape Crozier. B) Image shows approximate locations of loggers on real penguin.

Next Steps

- Annotate video classifying prey capture events vs swimming and train model to detect corresponding events in accelerometry signal using machine-learning (Support Vector Machine (SVM), Sutton et al 2020).
- Beginning in the 2021-2022 breeding season, 40 chick-rearing adults from two Ross Island Adélie colonies (Cape Crozier and Cape Royds) will be equipped with video loggers, accelerometers, and GPS.
- Additional data collection from equipped birds will allow us to address our research questions and expand our knowledge of the preyscape surrounding Ross Island, providing comparison between two colonies.

Further Research Questions

- Question 1:** Do Adélie penguins expend distinct amounts of energy and/or use prey-type specific capture techniques?
- Question 2:** Are spatial, temporal, or environmental characteristics predictive of prey type?
- Question 3:** Does foraging efficiency drive variation in diet composition between Cape Crozier and Cape Royds colonies?

Acknowledgements and References

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References:

Sutton, Grace, Lorien Pichegru, Jonathan A. Botha, Abbas Z. Kouzani, Scott Adams, Charles A. Bost, and John P.Y. Arnould. "Multi-Predator Assemblages, Dive Type, Bathymetry and Sex Influence Foraging Success and Efficiency in African Penguins." *PeerJ* 8 (June 30, 2020): e9380. <https://doi.org/10.7717/peerj.9380>.

Fig 4. Still frames from Adélie penguin foraging videos