

Deecke, Volker B. ORCID: <https://orcid.org/0000-0003-2781-5915> (2024) A sound approach to killer whale conservation: understanding and protecting the ocean's top predator. In: Inaugural Professorial Lecture Series 2024 - Professor Volker Deecke, 20 March 2024, University of Cumbria, Ambleside / online. (Unpublished)

Downloaded from: <http://insight.cumbria.ac.uk/id/eprint/7563/>

Usage of any items from the University of Cumbria's institutional repository 'Insight' must conform to the following fair usage guidelines.

Any item and its associated metadata held in the University of Cumbria's institutional repository Insight (unless stated otherwise on the metadata record) may be copied, displayed or performed, and stored in line with the JISC fair dealing guidelines (available [here](#)) for educational and not-for-profit activities

provided that

- the authors, title and full bibliographic details of the item are cited clearly when any part of the work is referred to verbally or in the written form
 - a hyperlink/URL to the original Insight record of that item is included in any citations of the work
- the content is not changed in any way
- all files required for usage of the item are kept together with the main item file.

You may not

- sell any part of an item
- refer to any part of an item without citation
- amend any item or contextualise it in a way that will impugn the creator's reputation
- remove or alter the copyright statement on an item.

The full policy can be found [here](#).

Alternatively contact the University of Cumbria Repository Editor by emailing insight@cumbria.ac.uk.

A Sound Approach to Killer Whale Conservation

Understanding and protecting the ocean's
top predator

Volker B. DEECKE

University of Cumbria

*Rydal Road, Ambleside,
Cumbria, LA22 9BB, UK*

volker.deecke@cumbria.ac.uk



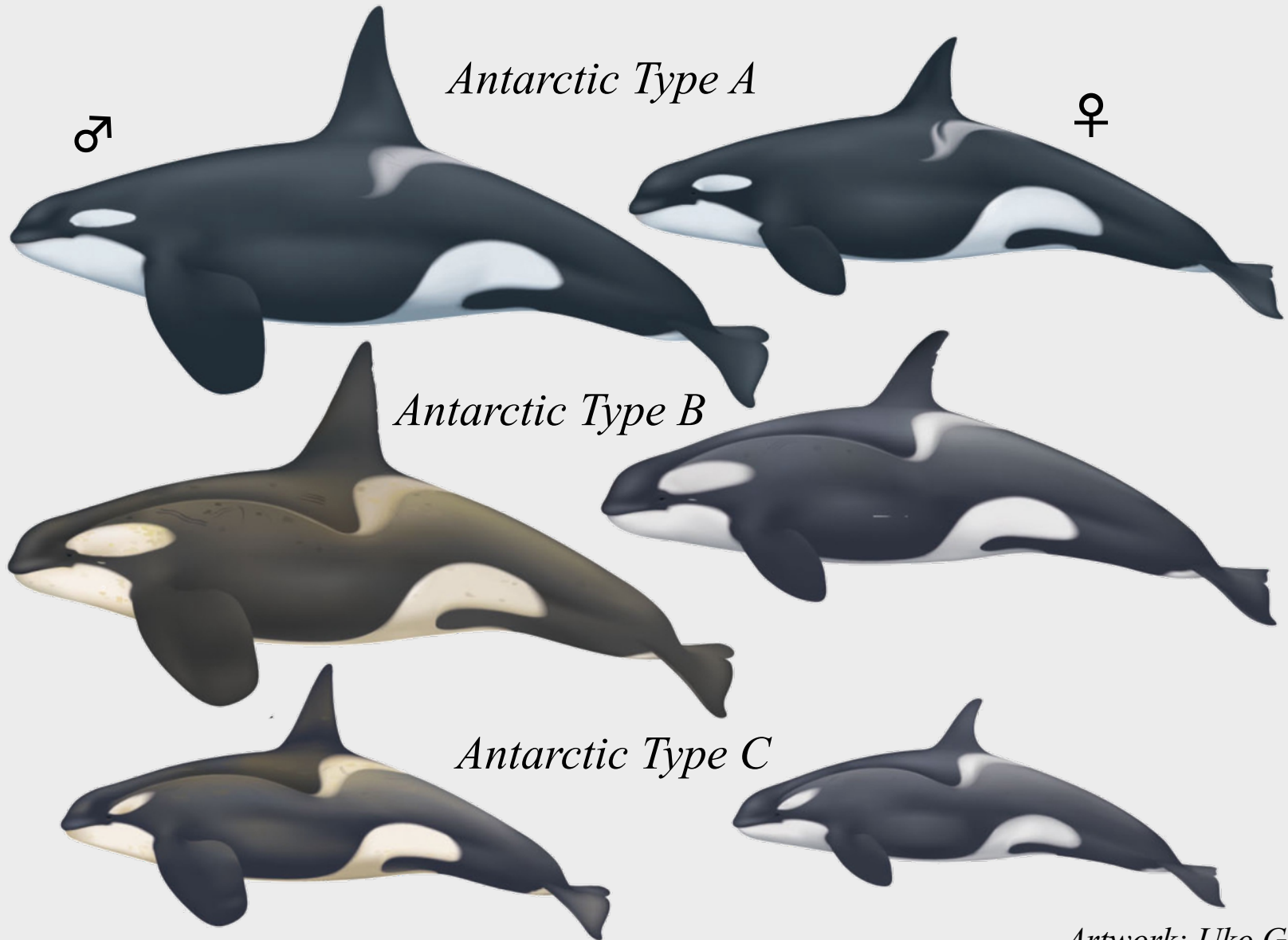
University of
CUMBRIA





Photo: Volker Deecke

INTRODUCTION: *Killer whale ecotypes in Antarctic waters*



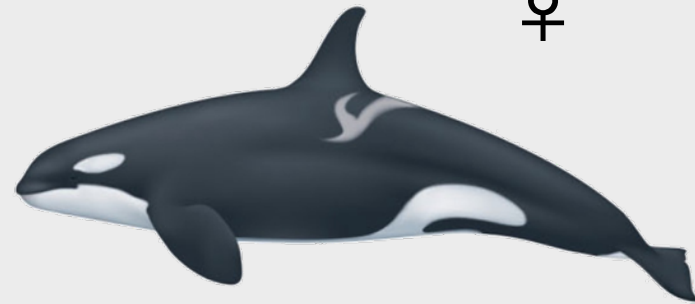
INTRODUCTION: *Killer whale ecotypes in the North Pacific*

♂



North Pacific Resident

♀



*North Pacific Transient
(Bigg's killer whale)*



North Pacific Offshore

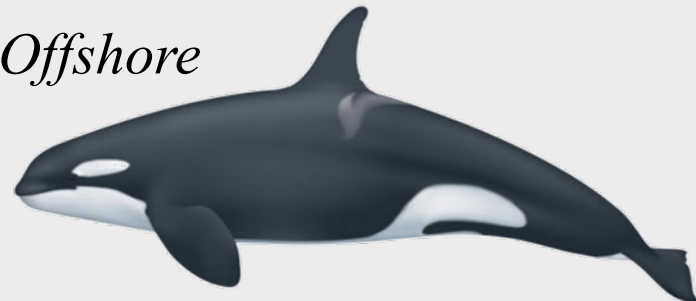




Photo: Jared Towers



Photo: Morgan Davies

INTRODUCTION: *Killer whale populations off British Columbia, Canada*

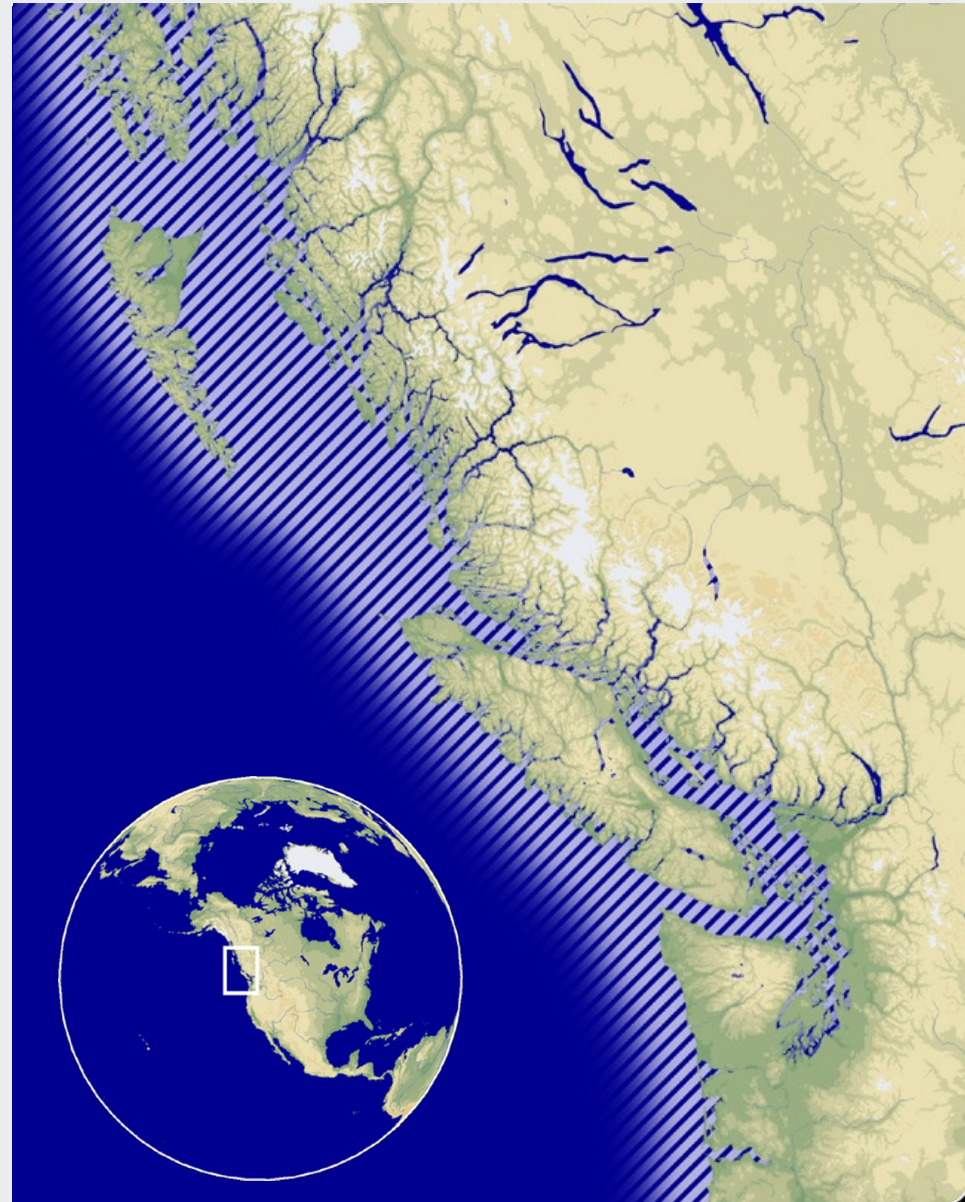
Fish-eating killer whales:

Northern Resident Population

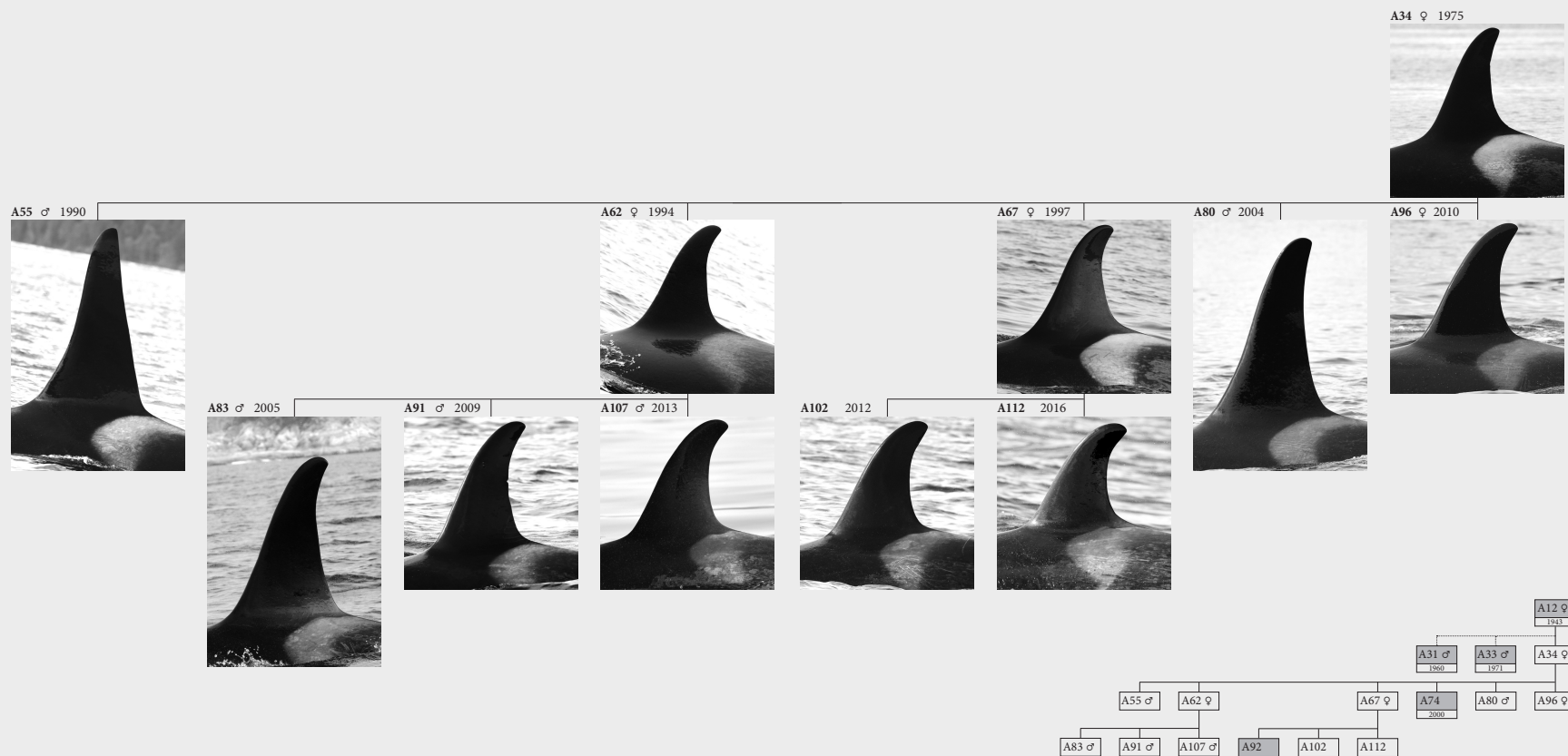
Southern Resident Population

Mammal-eating killer whales:

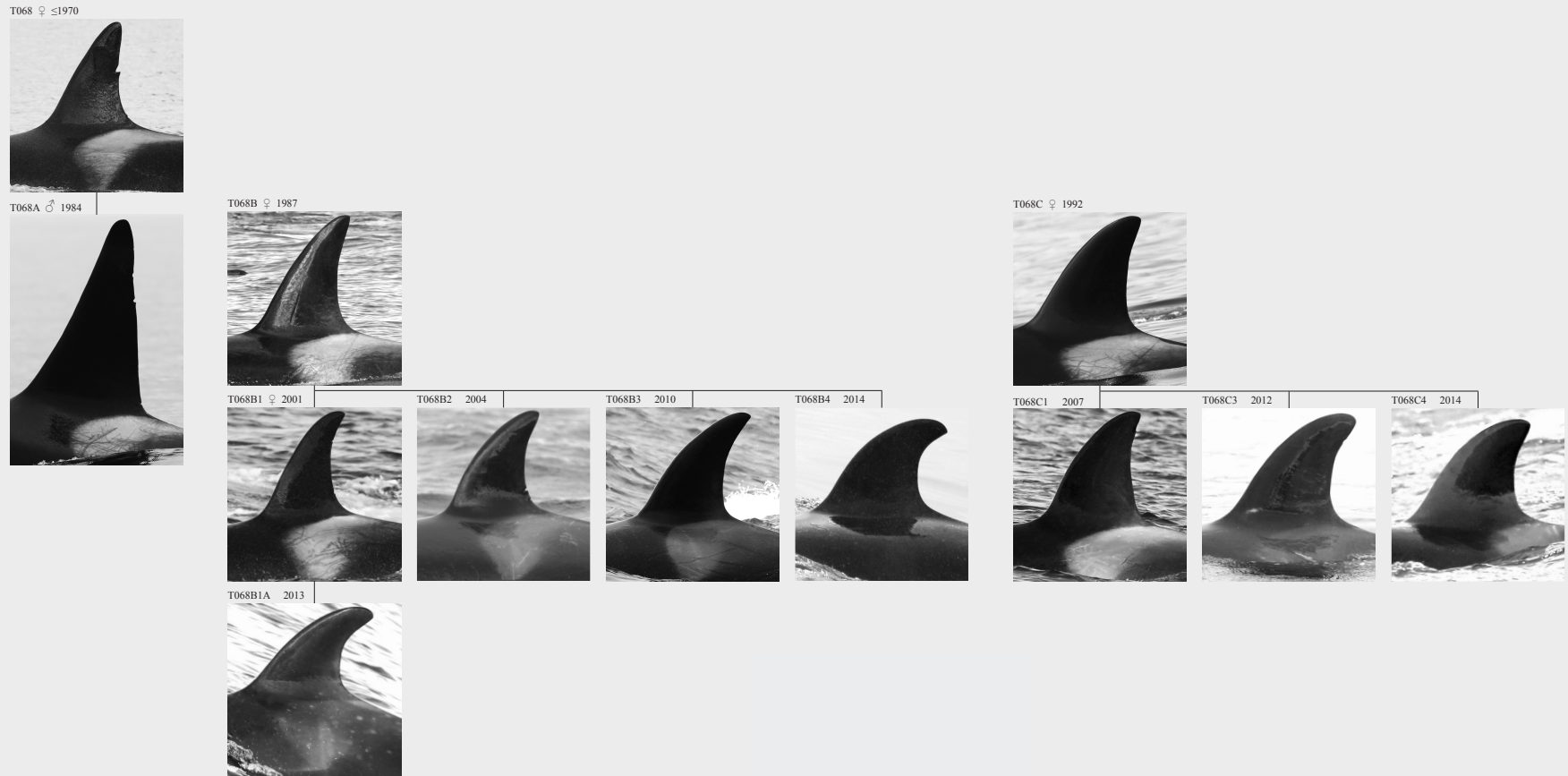
West Coast Transient Population



RESIDENT SOCIAL STRUCTURE: *Genealogy of A34 Matriline*



TRANSIENT SOCIAL STRUCTURE: *Genealogy of T068 Group*



Towers, J. R., Sutton, G. J., Shaw, T. J. H., Malleson, M., et al.. (2019). *Photo-identification Catalogue, Population Status, and Distribution of Bigg's Killer Whales known from Coastal Waters of British Columbia, Canada*. Canadian Data Report of Fisheries and Aquatic Sciences. Nanaimo, Canada: Fisheries and Oceans Canada.

METHODS: *Digital recording tags (Dtags)*

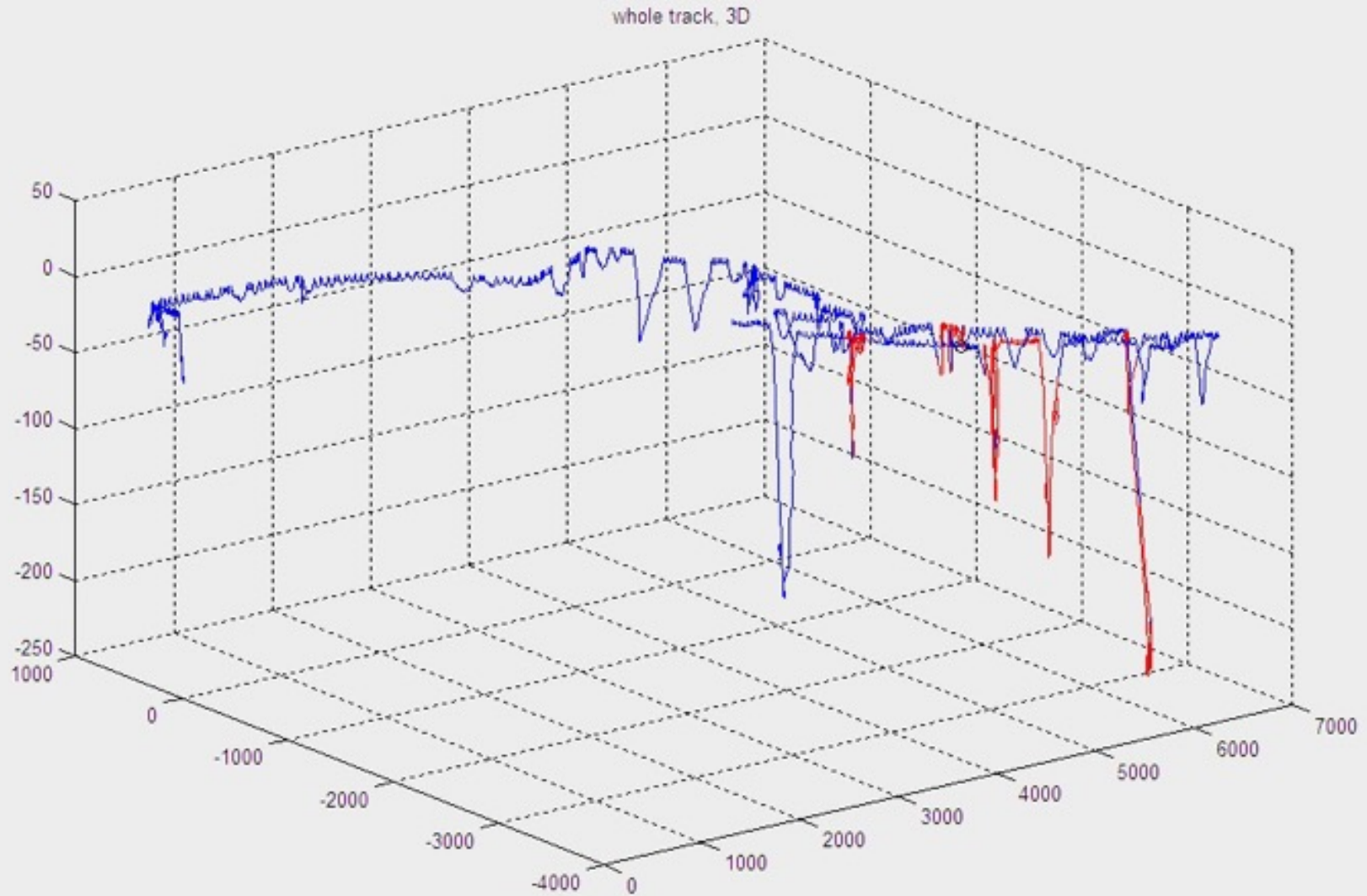


Volker Deecke

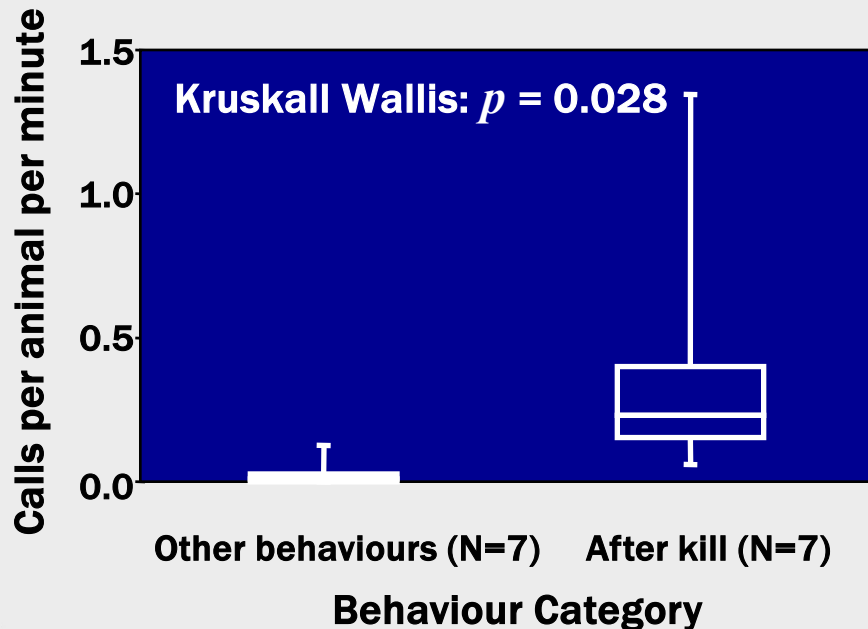
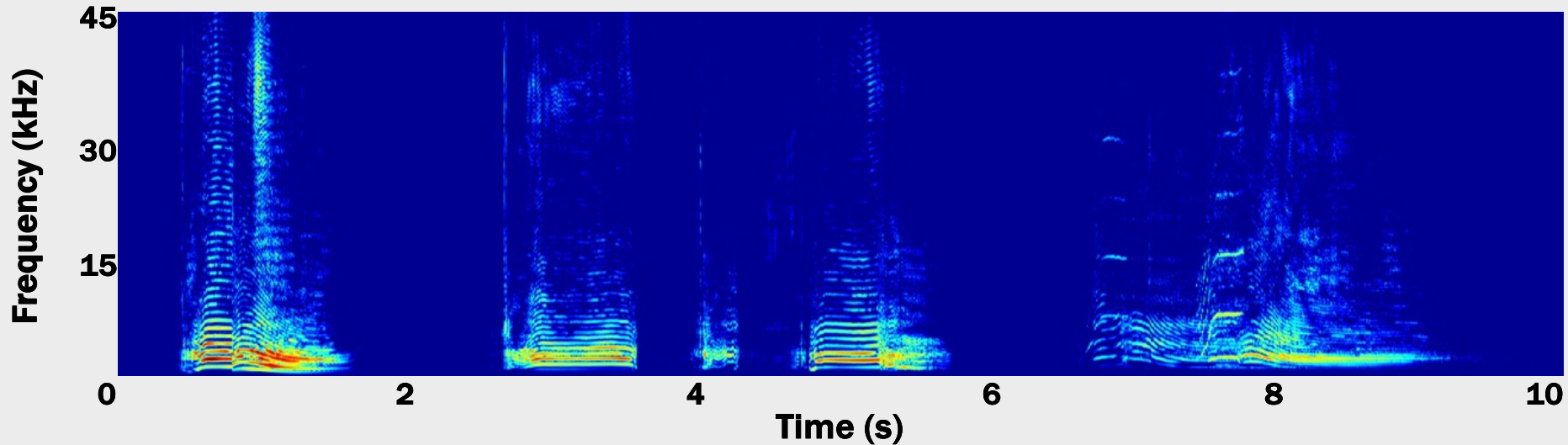
- This tag was developed at by Mark Johnson¹ at Woods Hole Oceanographic Institution to study underwater behaviour of marine mammals
 - The tag is deployed using a carbonfibre pole and attaches to the animal with 4 suction cups. Maximum deployment time is 16 hrs
 - It records the movements of the tagged whales, as well as any sounds this animal produces or hears
- The DTAG can provide information on underwater movements, predation, and sound communication, even at night-time or when the animals are out of visual range

¹ Johnson, M., Aguilar de Soto, N. and Madsen, P. T. (2009). 'Studying the behaviour and sensory ecology of marine mammals using acoustic recording tags: A review'. *Marine Ecology Progress Series*, 395, pp.55-73.

DTAG MOVEMENT DATA: *Dive profile of a resident killer whale*

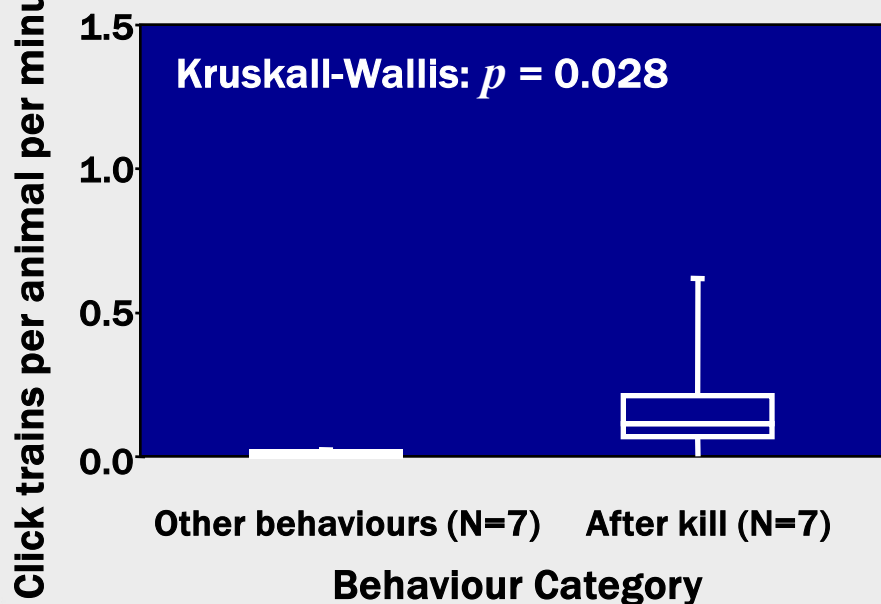
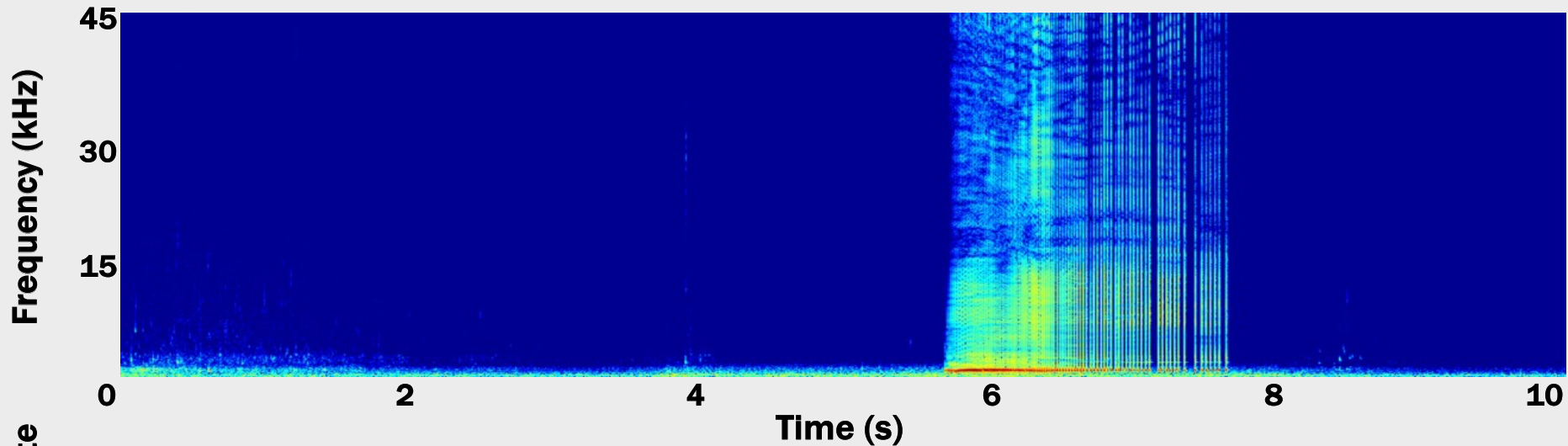


DTAG ACOUSTICS: *Recording of transient pulsed calls*



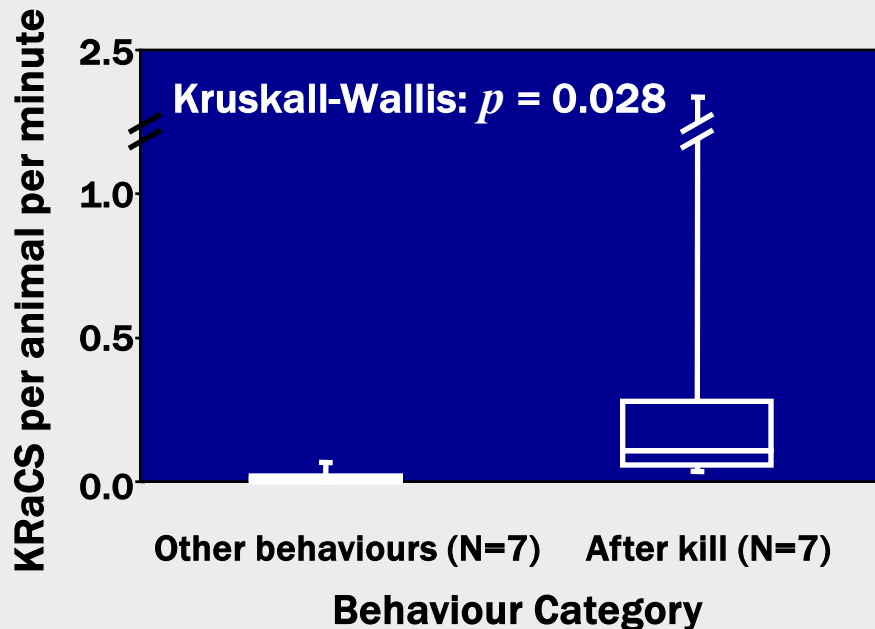
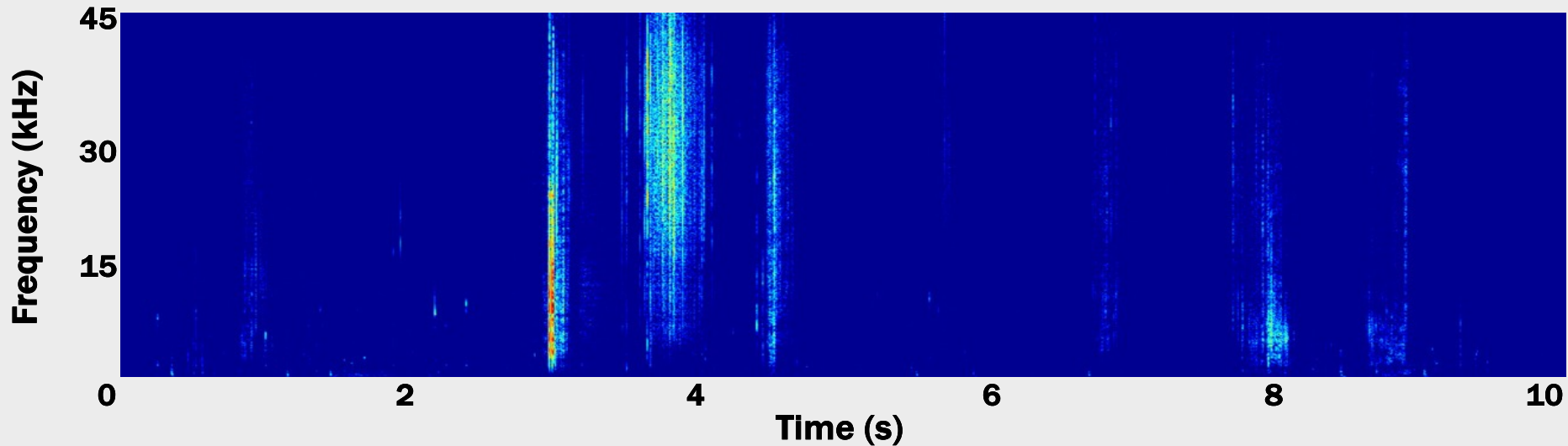
- ▶ *mammal-eating killer whales consistently emit pulsed calls after a kill and these are good indicators of predatory activity.*

DTAG ACOUSTICS: *Recording of transient echolocation*



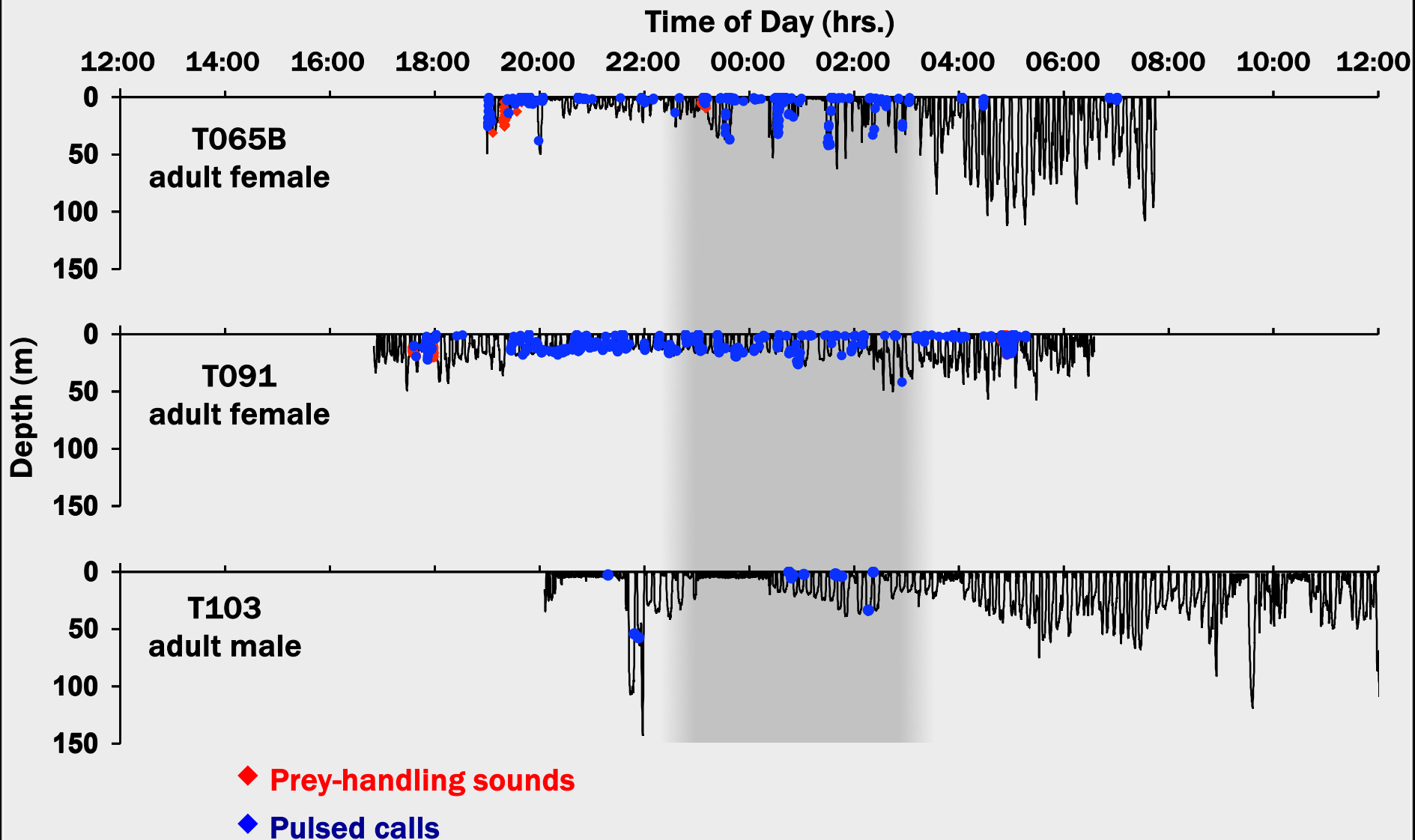
- ▶ *mammal-eating killer whales typically echolocate during and after an attack but rarely use echolocation while searching for prey*

DTAG ACOUSTICS: *Recording of transient prey-handling sounds*



- ▶ *prey-handling sounds are generated when killer whales break up a prey animal. They are some of the best indicators that an attack was successful.*

MAMMAL-HUNTERS: *Night-time feeding in West Coast Transients*



MAMMAL-HUNTERS: *Night-time feeding in West Coast Transients*

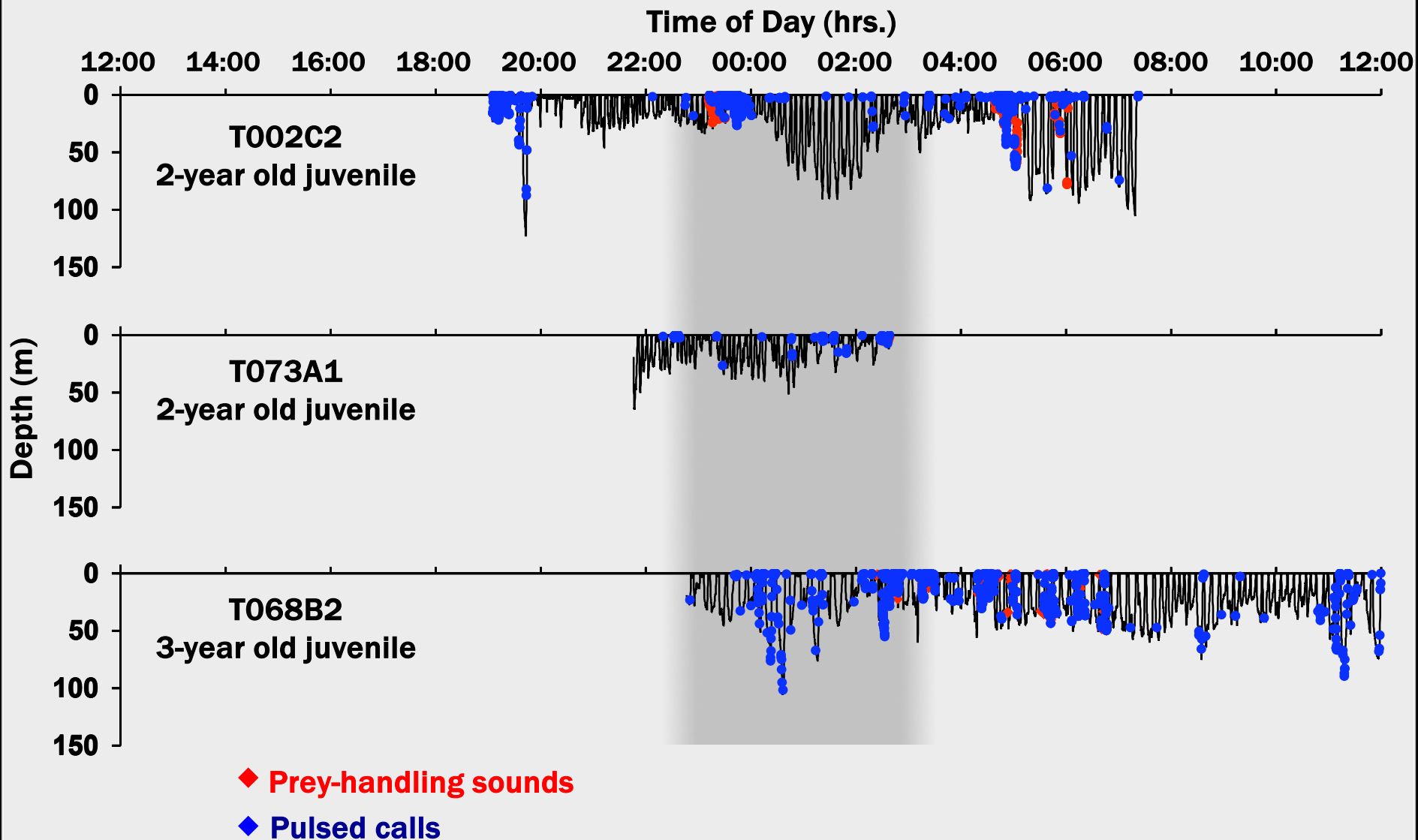




Photo: Jared Towers

FISH-EATERS: *Population trends of resident killer whales*

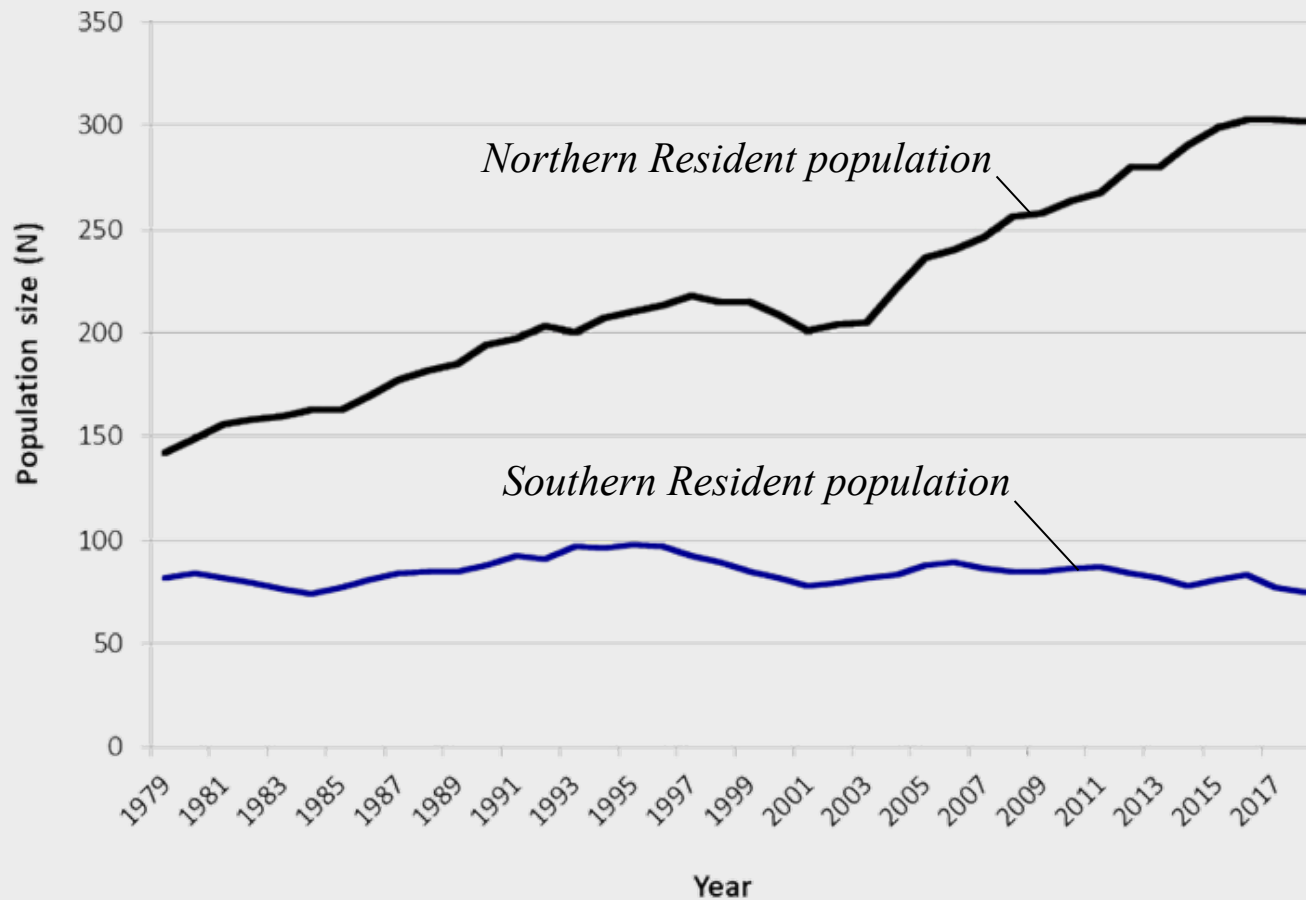


Figure 1: *Population trends of Southern and Northern Resident killer whales 1979-2018 based on annual photographic census data (from Murray et al., 2021)*

Murray, C.C., Hannah, L.C., Doniol-Valcroze, T., Wright, B.M., Stredulinsky, E.H., Nelson, J.C., Locke, A. and Lacy, R.C. (2021). 'A cumulative effects model for population trajectories of resident killer whales in the Northeast Pacific'. *Biological Conservation*, 257, pp.e109124.

FISH-EATERS: *Food limitation in an apex predator*

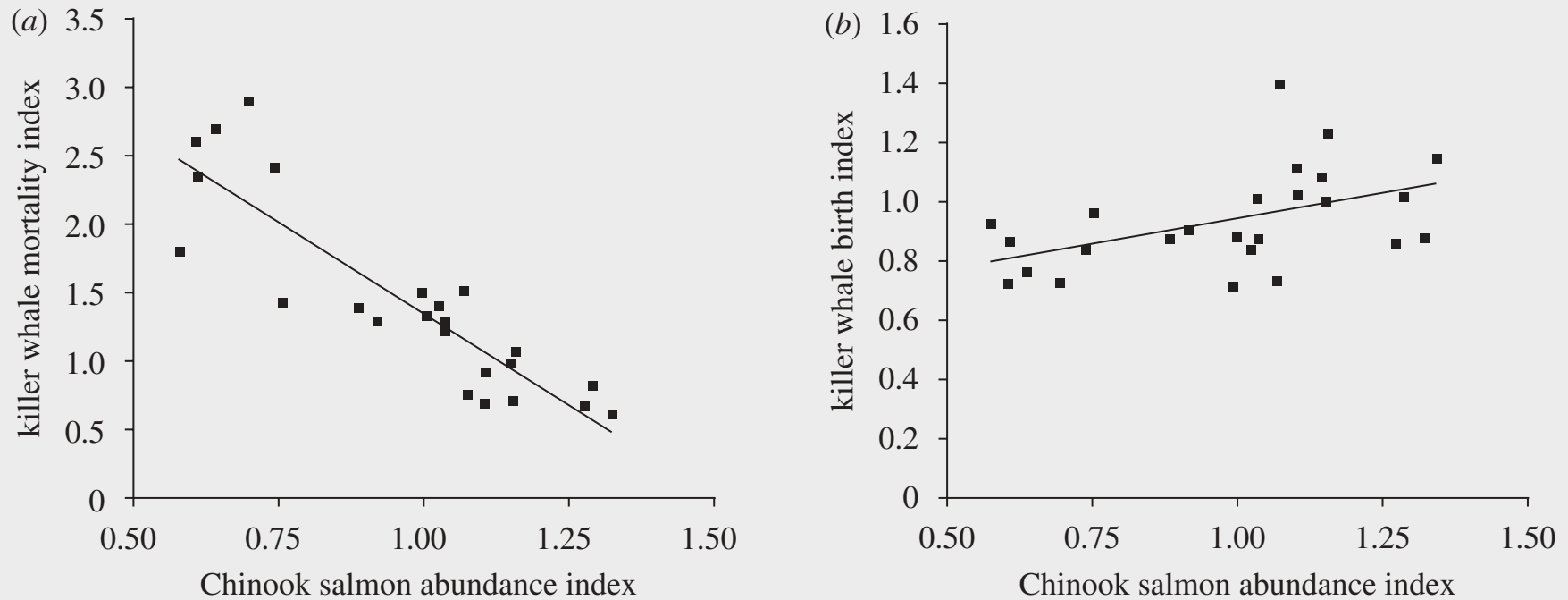
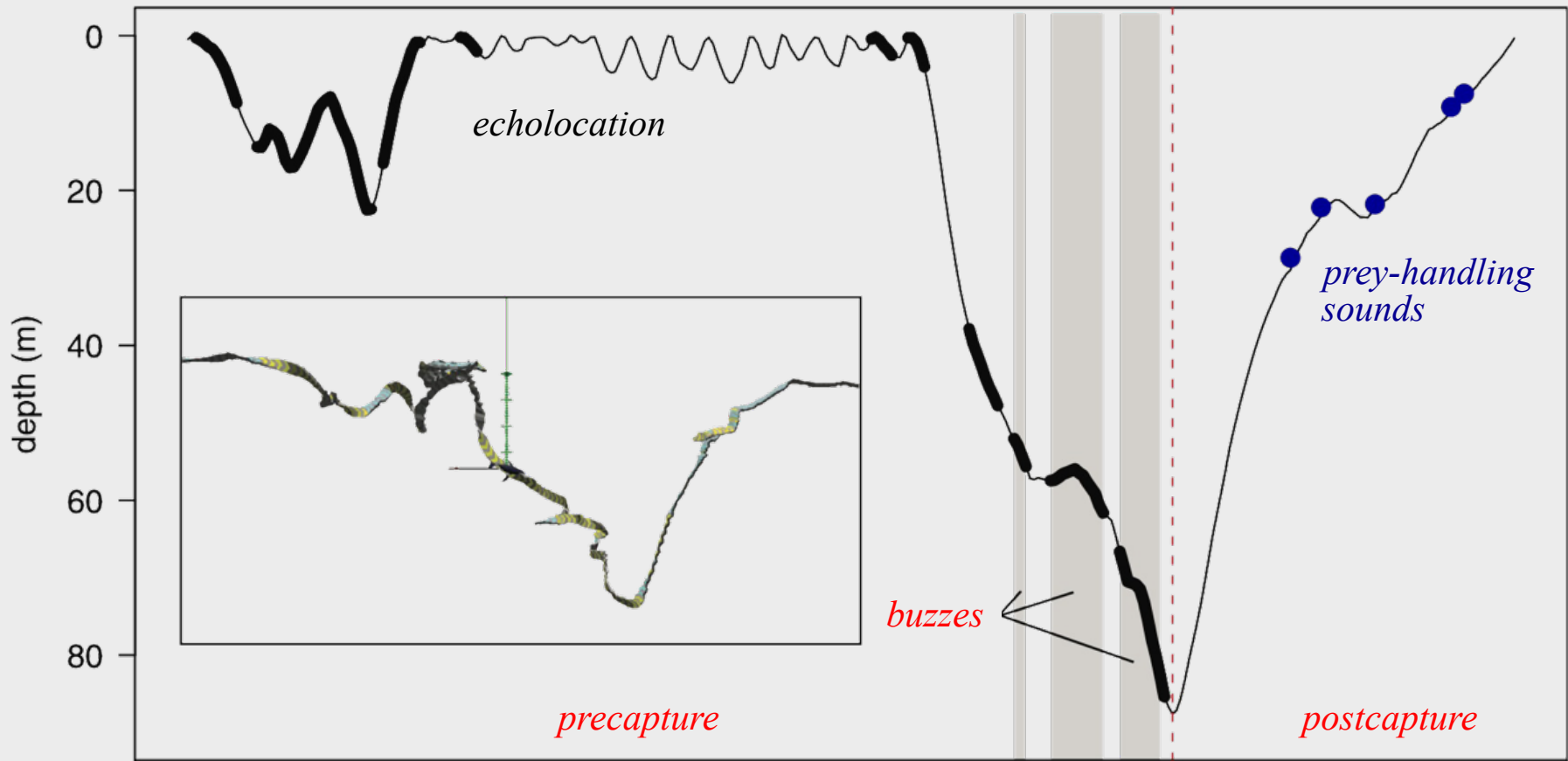


Figure 2: (a) Mortality and (b) birth indices of Northern and Southern Resident killer whales combined, as a function of coast-wide abundance indices for Chinook salmon over the period 1979–2003. Index values are expressed as 3-year running means and are lagged by 1 year after Chinook salmon abundance (from Ford et al., 2010).

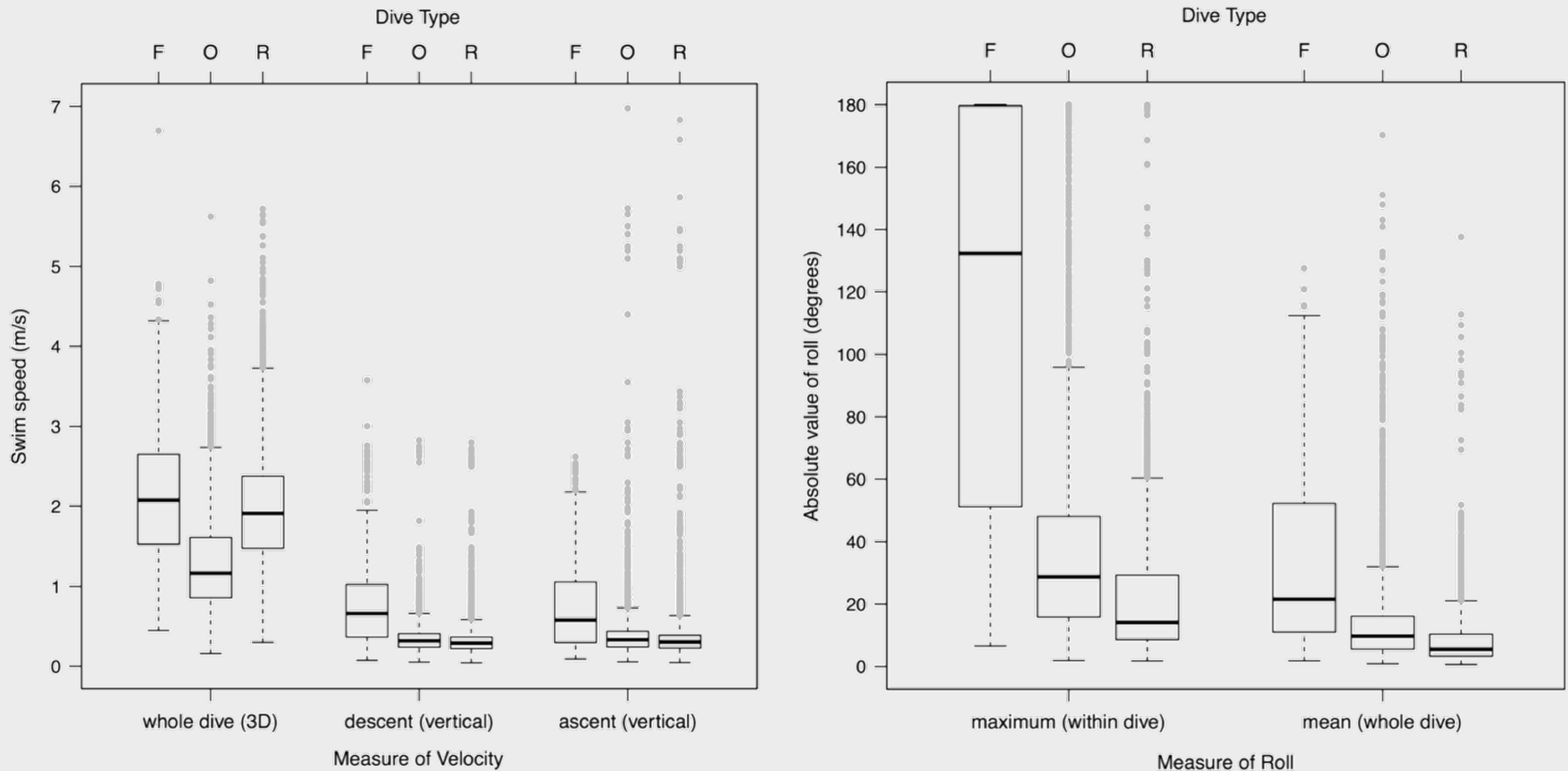
Ford, J.K.B., Ellis, G.M., Olesiuk, P.F. and Balcomb, K.C. (2010). 'Linking killer whale survival and prey abundance: Food limitation in the oceans' apex predator?' *Biology Letters*, 6 (1), pp.139-142.

FISH-EATERS: *Detecting feeding events from Dtags*



Wright, B.M., Deecke, V.B., Ellis, G.M., Trites, A.W. and Ford, J.K.B. (2021). 'Behavioral context of echolocation and prey-handling sounds produced by killer whales (*Orcinus orca*) during pursuit and capture of Pacific salmon (*Oncorhynchus spp.*)'. *Marine Mammal Science*, 37 (4), pp.1428-1453.

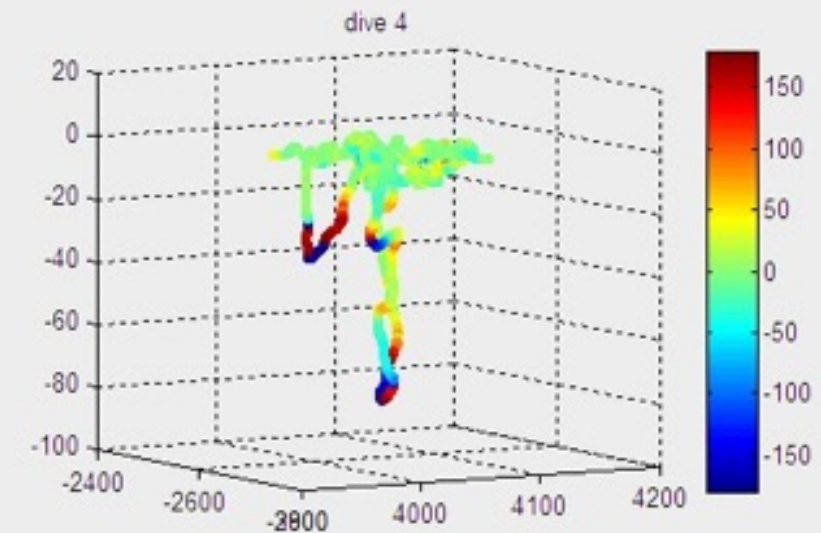
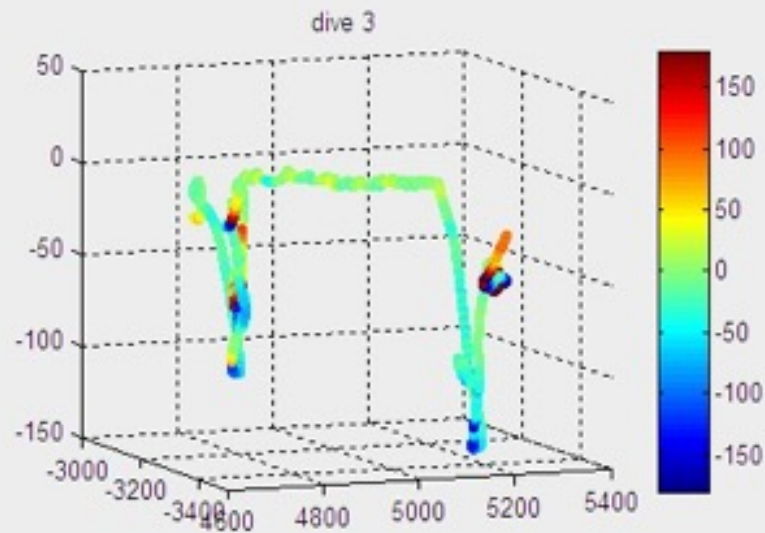
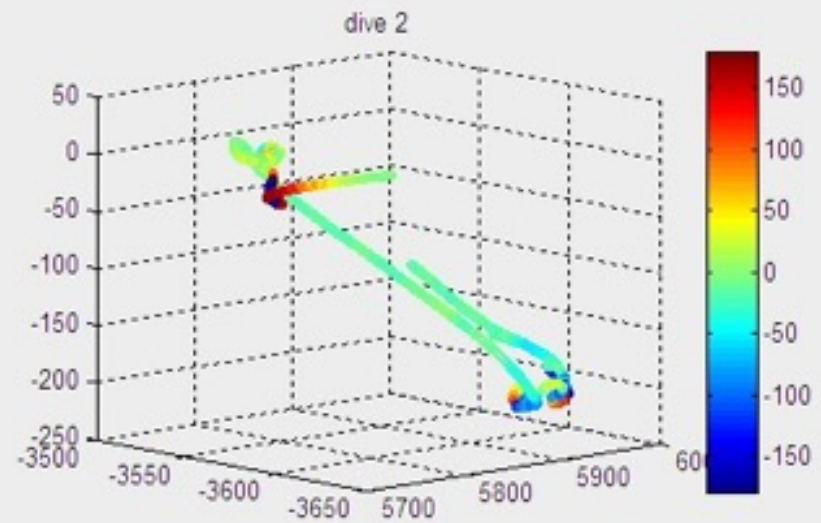
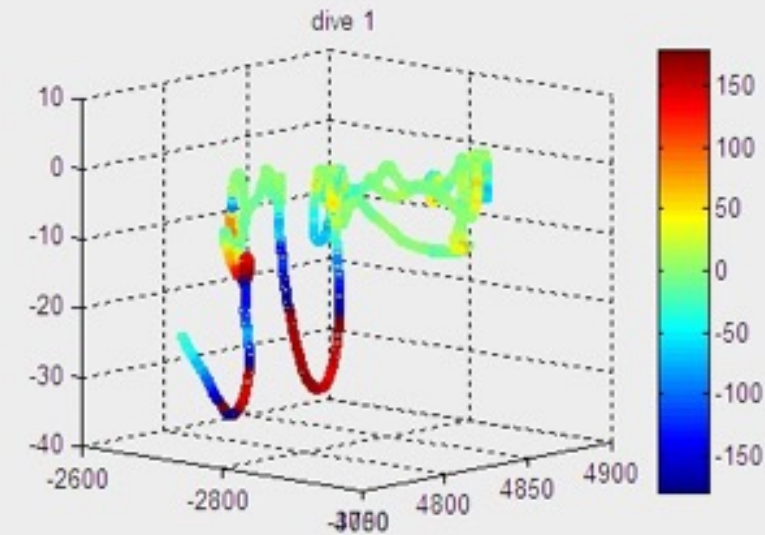
FISH-EATERS: *Identifying foraging dives*



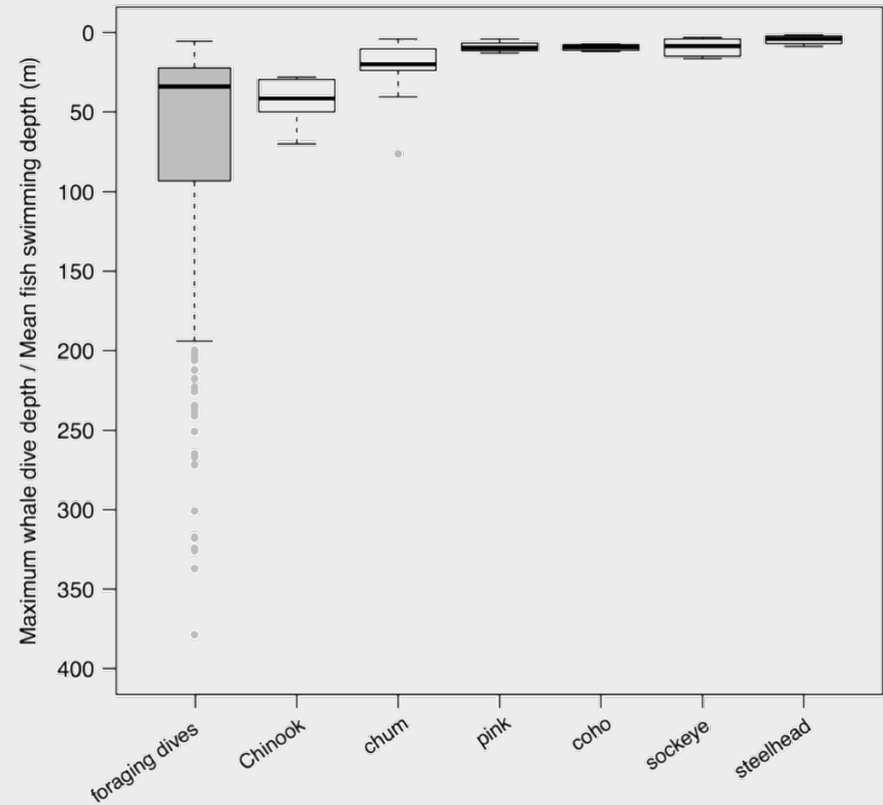
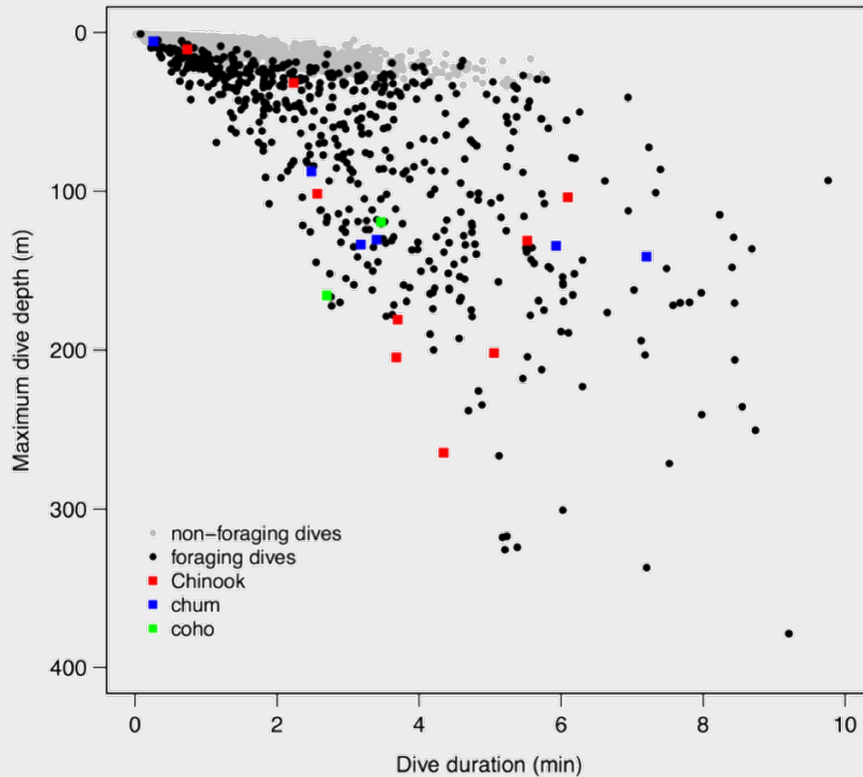
Figures 4,6: *Swim speed (left) and roll (right) of tagged killer whales during foraging dives (F), respiratory dives (R) and other behaviour (O)*

Wright, B.M., Ford, J.K.B., Ellis, G.M., Deecke, V.B., Shapiro, A.D., Battaile, B.C. and Trites, A.W. (2017). 'Fine-scale foraging movements by fish-eating killer whales (*Orcinus orca*) relate to the vertical distributions and escape responses of salmonid prey (*Oncorhynchus spp.*)'. *Movement Ecology*, 5 (1), p.e3.

FISH-EATERS: *Identifying foraging dives*



FISH-EATERS: *Prey-specific foraging tactics*



Figures 3,7: *Characteristics of killer whale dives during foraging and other behaviours (left) and comparison of foraging dive depth to swim depth of North Pacific salmonids (right)*

Wright, B.M., Ford, J.K.B., Ellis, G.M., Deecke, V.B., Shapiro, A.D., Battaile, B.C. and Trites, A.W. (2017). 'Fine-scale foraging movements by fish-eating killer whales (*Orcinus orca*) relate to the vertical distributions and escape responses of salmonid prey (*Oncorhynchus* spp.)'. *Movement Ecology*, 5 (1), p.e3.

FISH-EATERS: *Population differences in foraging success*

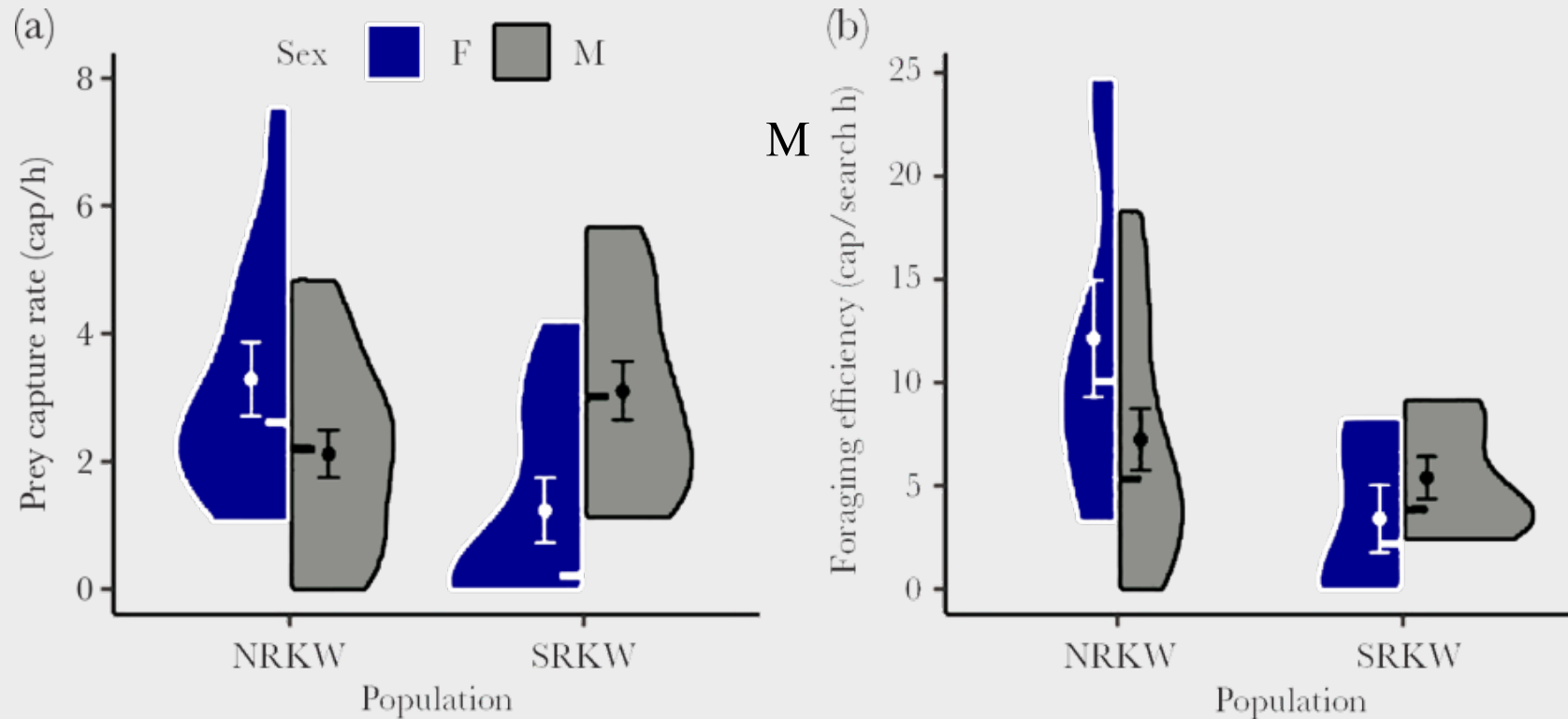


Figure 2: *The relationship between sex and foraging behaviour in Northern Resident (NRKW) and Southern Resident (SRKW) killer whales*

Tennessen, J.B., Holt, M.M., Wright, B.M., Hanson, M.B., Emmons, C.K., Giles, D.A., Hogan, J.T., Thornton, S.J. and Deecke, V.B. (2023). 'Divergent foraging strategies between populations of sympatric matrilineal killer whales'. *Behavioral Ecology* 34(3), pp. 373–386

FISH-EATERS: *Population differences in foraging success*

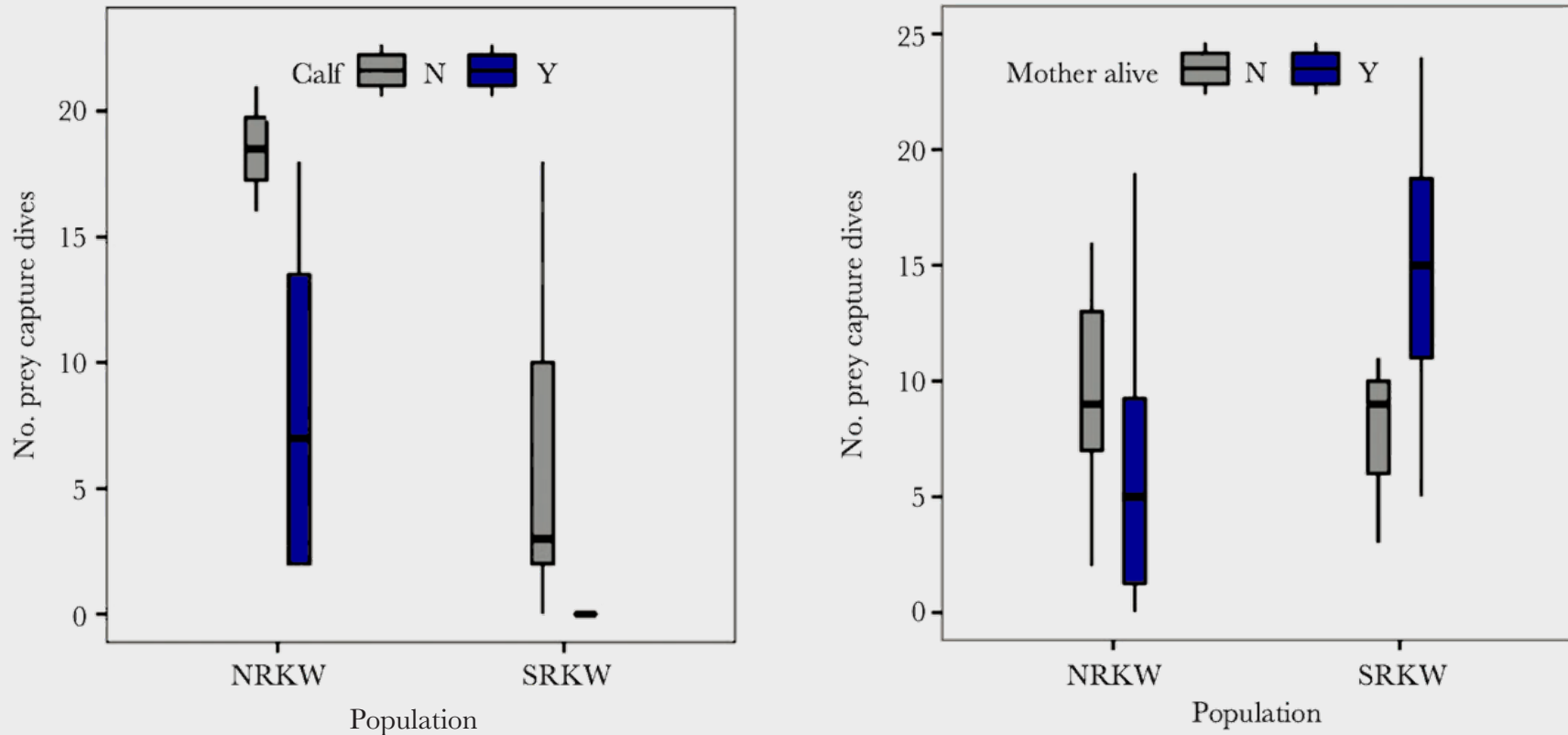
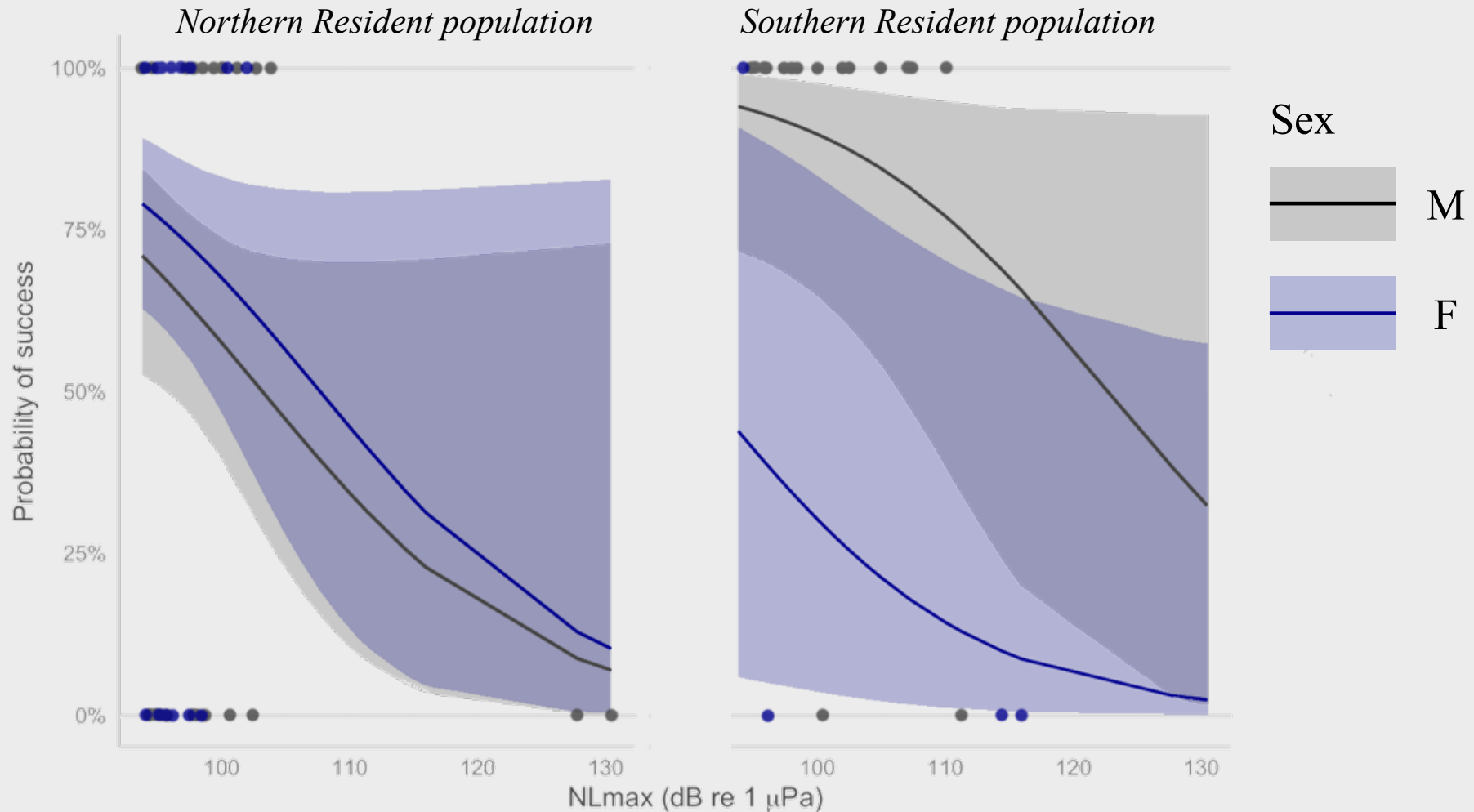


Figure 3: *Demography affected the number of prey capture dives. Left: effect of calf presence on female foraging success. Right: effect of living mother on adult male foraging success*

Tennessen, J.B., Holt, M.M., Wright, B.M., Hanson, M.B., Emmons, C.K., Giles, D.A., Hogan, J.T., Thornton, S.J. and Deecke, V.B. (2023). 'Divergent foraging strategies between populations of sympatric matrilineal killer whales'. *Behavioral Ecology* 34(3), pp. 373–386

FISH-EATERS: *The effect of noise on foraging success*



Tennessen, J.B., Holt, M.M., Wright, B.M., Hanson, M.B., Emmons, C.K., Giles, D.A., Hogan, J.T., Thornton, S.J. and Deecke, V.B. (in review). 'Males miss and females forgo: Auditory masking from vessel noise impairs foraging efficiency and success in killer whales'. Submitted to *Global Change Biology*

CONCLUSIONS: *Killer whales and underwater noise*



Volker Deecke

- Transient killer whales rarely use their echolocation. Because they can hunt in complete darkness, they likely rely on passive listening to detect their marine mammal prey
- Resident killer whales specialise on hunting Chinook salmon. They rely on their echolocation to detect and track them
- The foraging success of both killer whale ecotypes is impacted by underwater noise



Flip Nicklin

THANKS TO:



Flip Nicklin