Revealing the diet of Māui dolphins with stable isotope analysis

Courtney Ogilvy[1], Rochelle Constantine[1,2], Emma L. Carroll[1]

[1]School of Biological Sciences, University of Auckland/Te Kura Matauranga Koiora, Waipapa Taumata Rau;
[2]Institute of Marine Science, University of Auckland/Te Whare Takiura Matai Putaiao Moana, Waipapa Taumata Rau

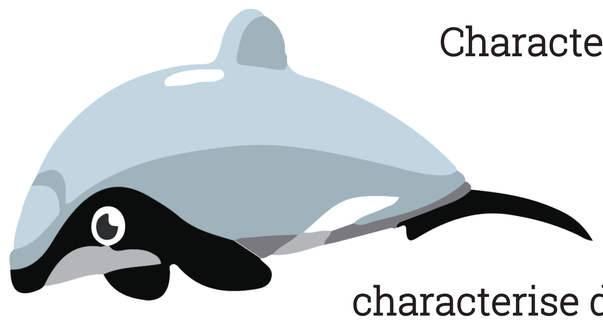
e: cogi870@aucklanduni.ac.nz

Marine Mammal Ecology Group

BACKGROUND

The Māui dolphin is the world's most endangered marine dolphin. Fewer than 63 individuals aged 1+ remain along the North Island's west coast. [1]

Information on diet is essential for informing conservation management decisions, yet the diet of the Māui dolphin is poorly understood. To date, the diet has been determined for only two beachcast animals.[2]



Characterisation of diet allows us to understand the impact prey availability has on species distribution and abundance.

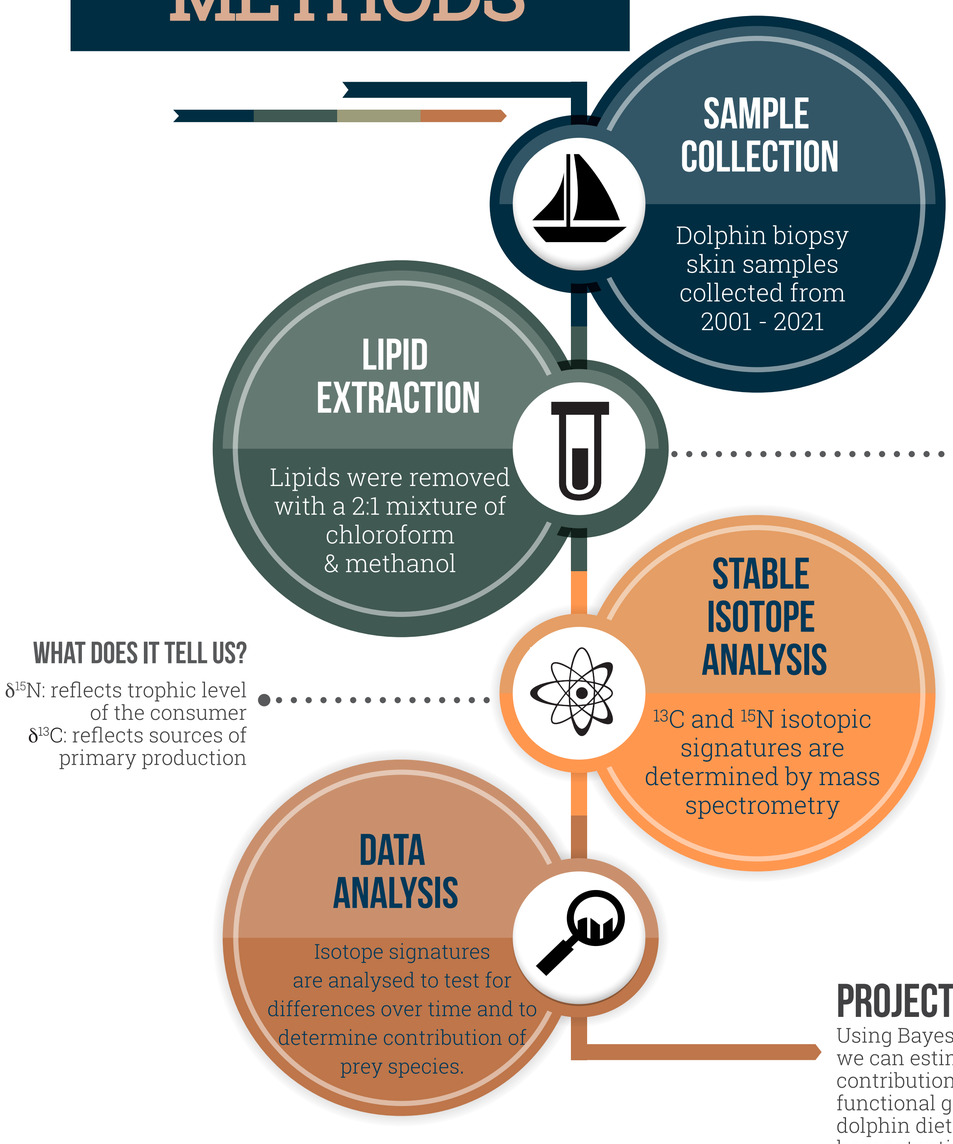
Stable isotope analysis is widely used to characterise diet and investigate foraging ecology; it can provide temporally integrated information on assimilated diet.

AIMS

Investigate how $\delta^{13}C$ and $\delta^{15}N$ isotope signatures of Māui dolphins have changed over time, including before and after the implementation of the Marine Mammal Sanctuary in 2008.

Estimate contribution of prey species/functional groups to Māui dolphin diet.

METHODS



RESULTS

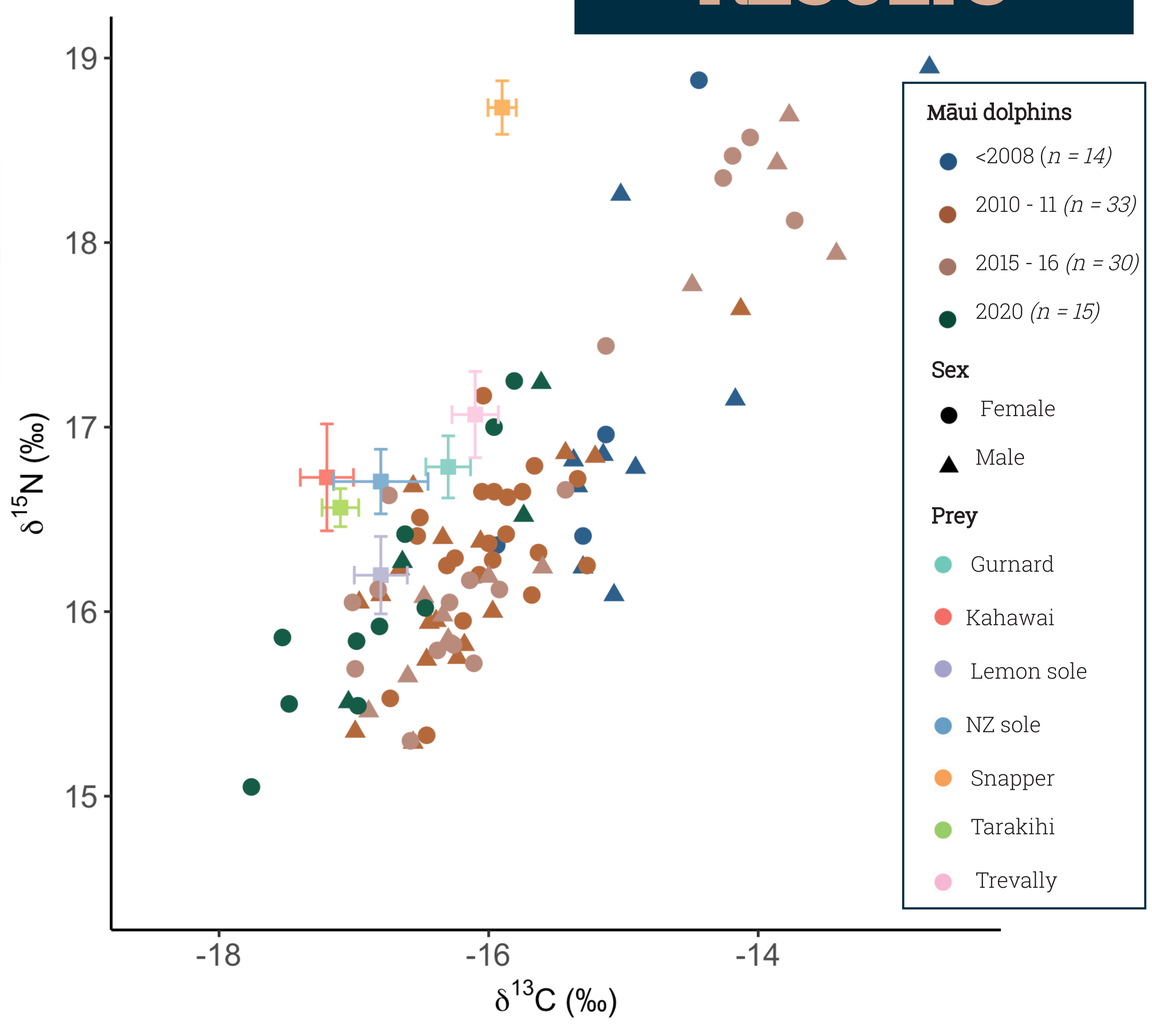


Figure 1: $\delta^{13}C$ and $\delta^{15}N$ values of Māui dolphin skin samples (n = 92) collected between 1993 and 2020, against mean $\delta^{13}C$ and $\delta^{15}N$ values of potential prey species. Prey values are corrected for trophic enrichment (TEF: 1.22 ‰ $\delta^{13}C$ and 2.24‰ $\delta^{15}N$)[3]. Māui dolphin values are grouped by year (colour) and sex (shape). The Kruskal-Wallis [K-W] test revealed significant differences in $\delta^{13}C$ and $\delta^{15}N$ values between the sampling year groups ($\delta^{13}C$: X^2 = 30.02, $p < 0.0001$, $\delta^{15}N$: X^2= 12.53, p=0.03). There were no significant differences between males and females ($\delta^{13}C$: X^2 = 1.20, p = 0.27; $\delta^{15}N$: X^2= <0.05, p=0.98).

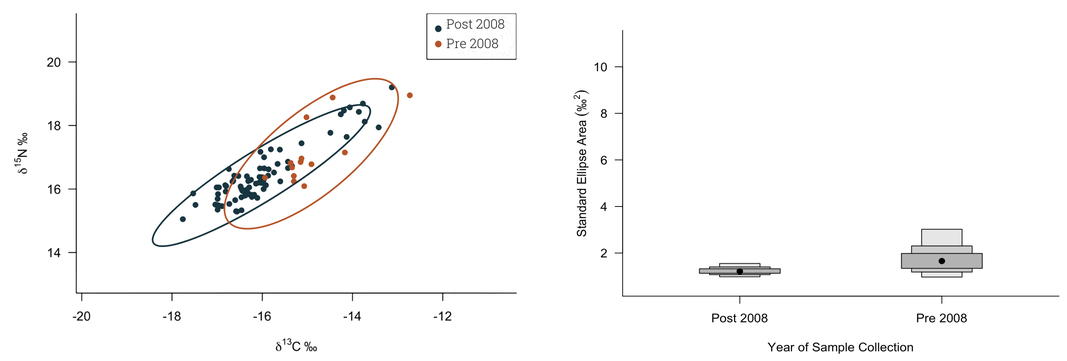


Figure 2A (left): 95% CI bivariate ellipses of Māui dolphin skin samples collected from 1993 - 2020, indicating a shift in isotopic niche space before and after the implementation of the Marine Mammal Sanctuary. **Figure 2B (right)**: Bayesian standard ellipse area (SEA_B) of isotopic signatures in Māui dolphin skin samples collected before and after 2008. Central black dot represents the mode and the shaded boxes represent 50%, 75% and 95% credible intervals from dark to light grey.

CONCLUSIONS

These analyses have shown there are significant differences in $\delta^{13}C$ and $\delta^{15}N$ values of Māui dolphins between sampling years **(Figure 1)**. They have demonstrated there is no relationship between sex and isotope signature, suggesting males and females consume similar prey. There is also evidence that the diet of Māui dolphins has changed since the implementation of the Marine Mammal Sanctuary. The contraction in isotopic niche space after 2008 **(Figure 2)** suggests Māui dolphins do not have to work as hard to find prey, compared to before 2008 when the current protection measures were not yet in place.

FUTURE RESEARCH

Overlap of potential prey and Māui dolphin isotope values **(Figure 1)** suggests Māui dolphins forage throughout the water column, similar to the Hector's dolphin.[2] Further investigation will focus on building the prey data set to include more specimens representative of different functional groups, and the use of mixing models to estimate contribution of these groups to overall diet.

The impact of climate change and environmental drivers which can influence prey distribution and Māui dolphin diet will also be assessed.

Acknowledgments

The sample collection and analysis were funded by the Ministry for Primary Industries and the Department of Conservation (DOC), and Courtney Ogilvy is supported by a University of Auckland Doctoral Scholarship. We thank the Māui dolphin teams at DOC and Oregon State University for their efforts collecting samples and providing genetic data, the team at Isotrace NZ Ltd for carrying out the stable isotope analysis, and local iwi.

References

1. Miller *et al.* (2013). *Marine Mammal Science.*
2. Baker *et al.* (2016). *Department of Conservation.*
3. Browning *et al.* (2014). *The Journal of Experimental Biology.*