Emaciated enigma: Decline in body conditions of common dolphins in the Celtic Seas ecoregion

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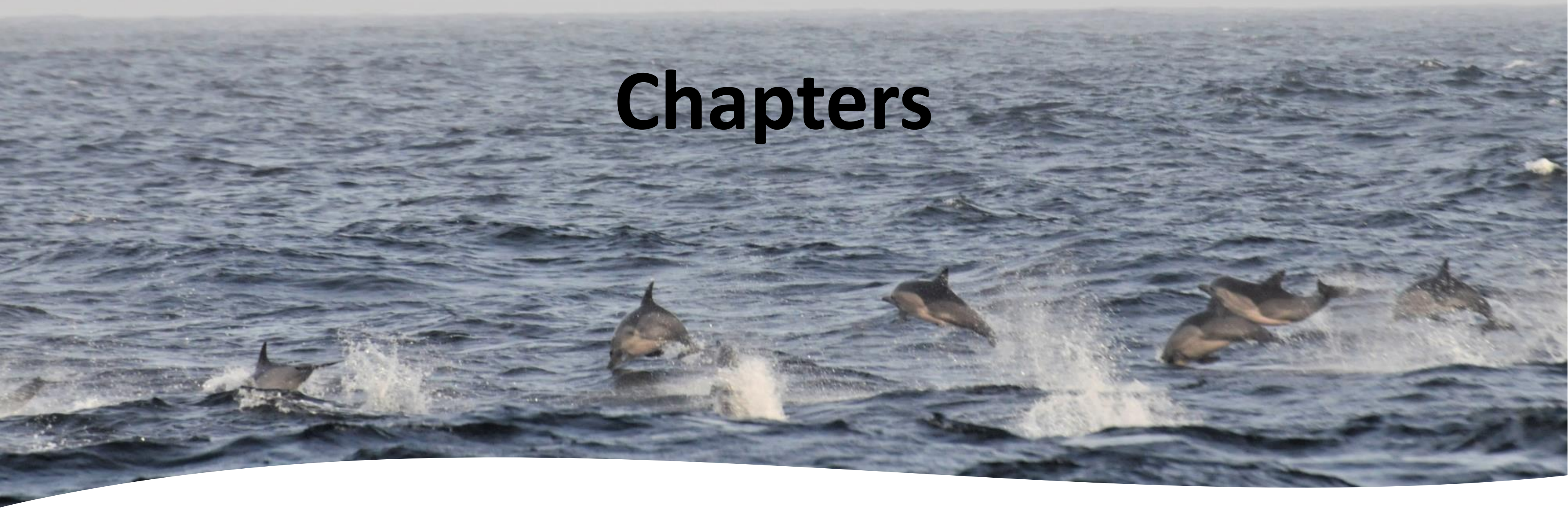
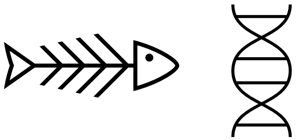
PhD: Impacts of anthropogenic activities and environmental change on the foraging ecology and nutritional status of common dolphin and its implications towards sustainable resource management

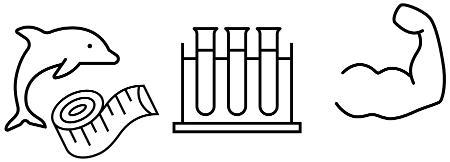
Chapters



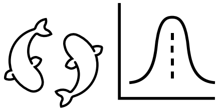
Identifying **dietary shifts** using stomach contents: Prey hard part ID & detecting prey DNA via metabarcoding



Developing **nutritional status indicators**: Body condition indices & blubber cortisol levels



Determining **bioenergetic requirements**: Energy requirements and consumption rates as predicted by a bioenergetic model

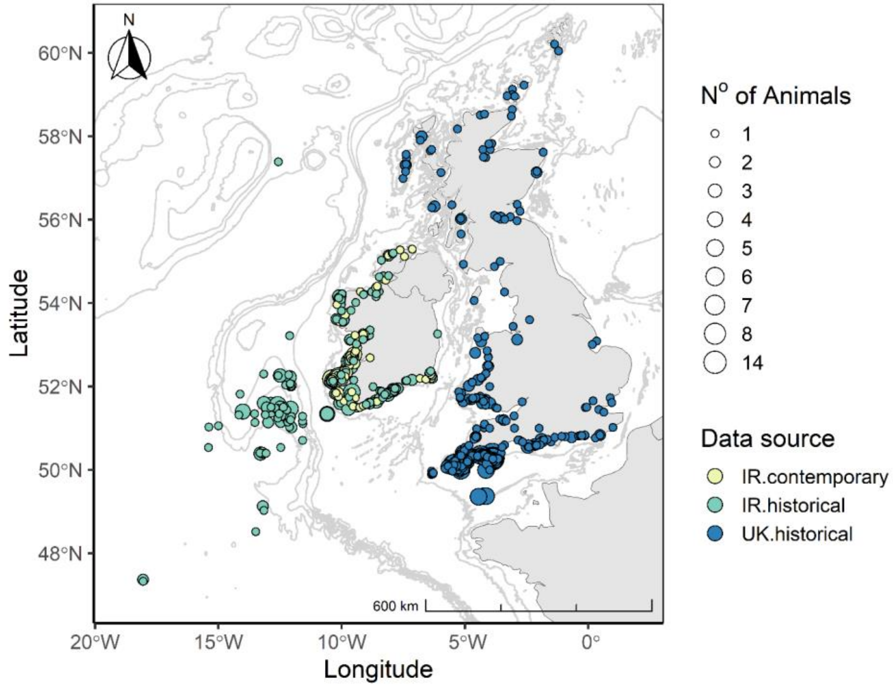


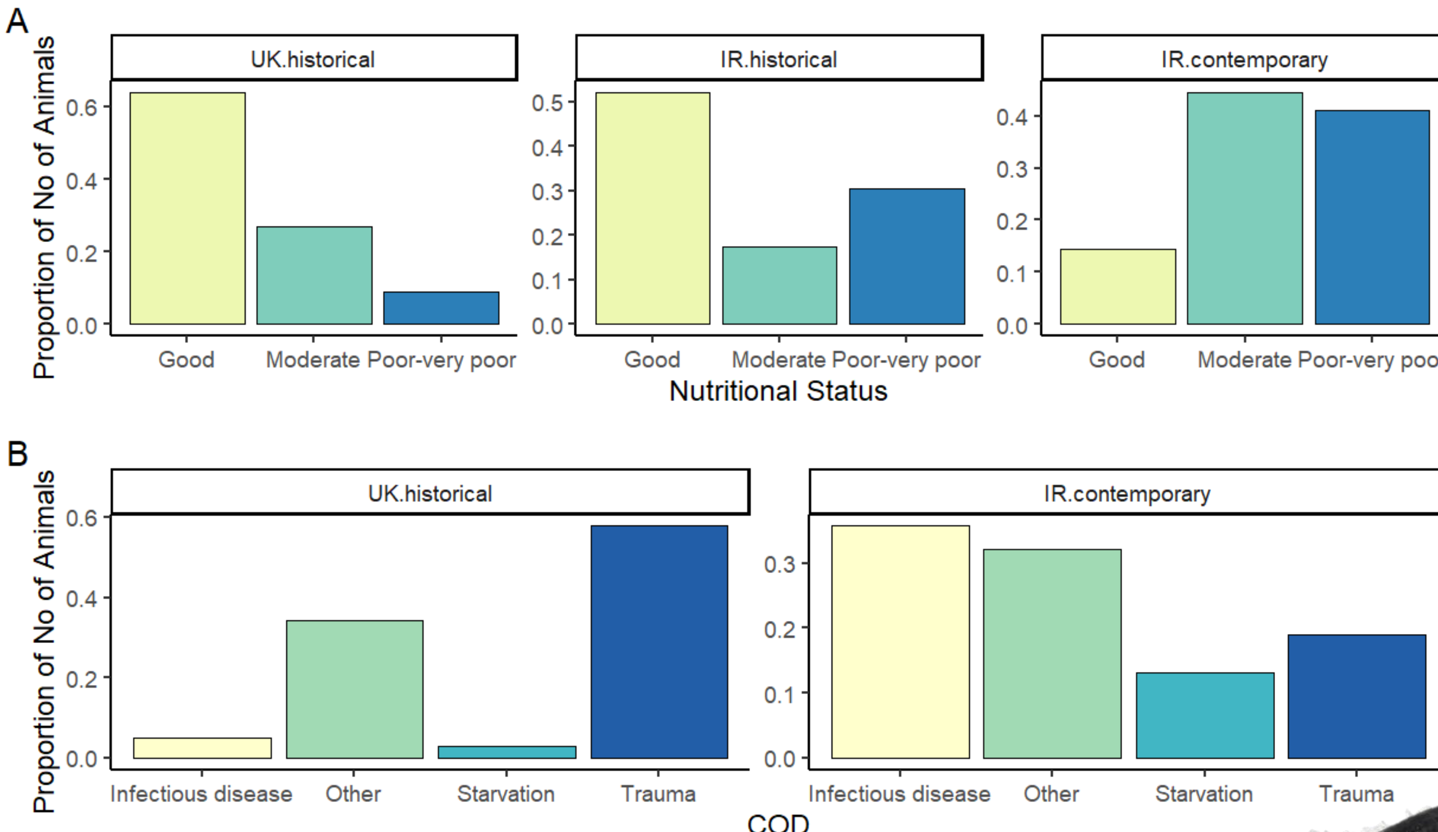
Samples

Marine Institute-EMFF funded Irish vertebrate necropsy project (2017-2019): **84 individuals**

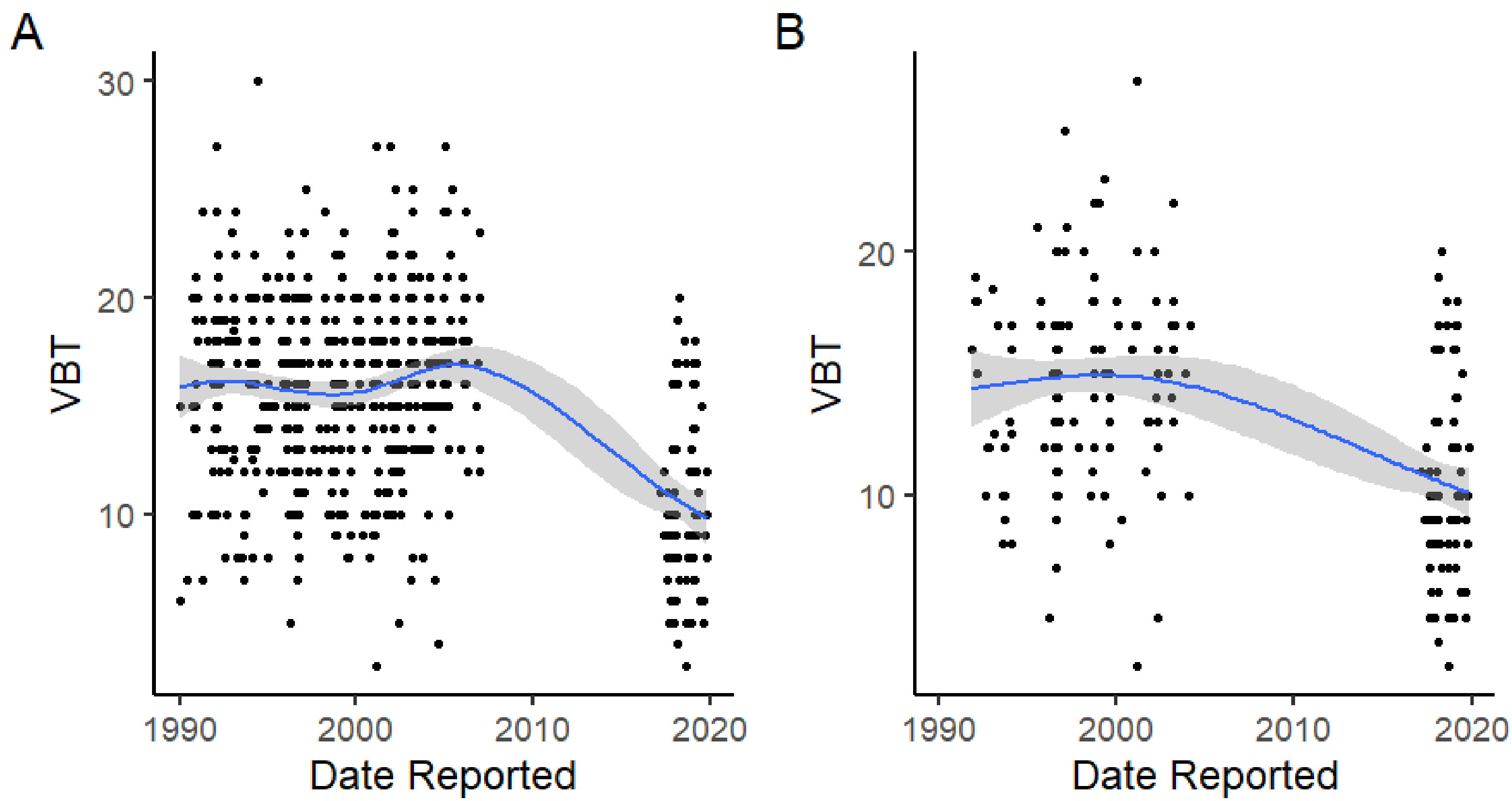
Historical Irish stranding and observer bycatch programme (1990-2004): **318 individuals**

UK Cetacean Strandings Investigation Programme (CISP 1990-2006): **525 individuals**





Relative frequency of A) nutritional status categories for each dataset, UK historical dataset (n = 392), Irish historical (n = 23) and Irish contemporary (n = 83) and B) COD categories for the UK historical (n = 467) and the Irish contemporary (n = 84).



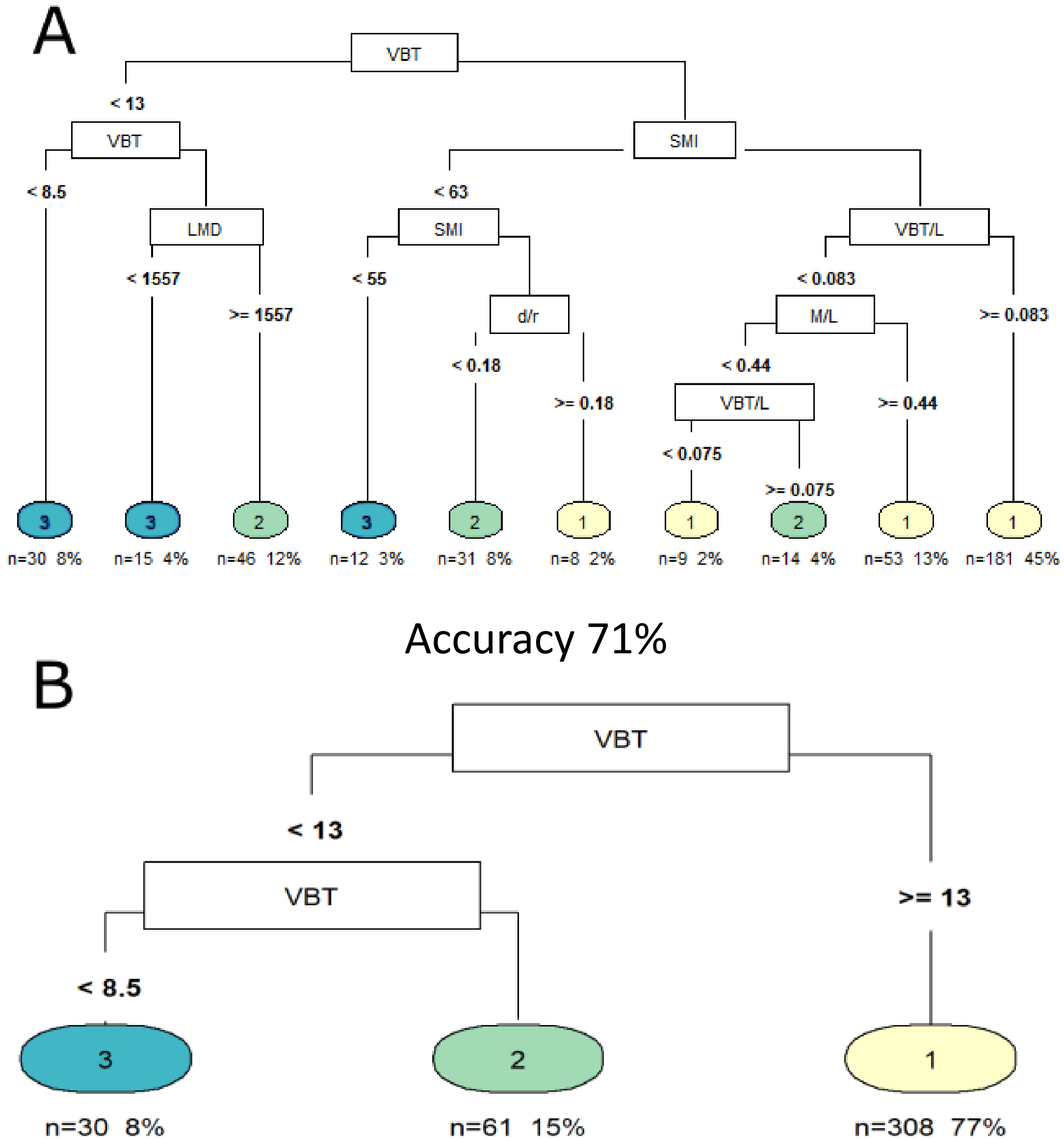
Ventral blubber thickness (mm) from 1990 to 2019 per A) All data, B) Irish historical and contemporary, only. A general additive model smoothed curve is displayed with 95% confidence intervals.

Body condition indices with their calculations and references.

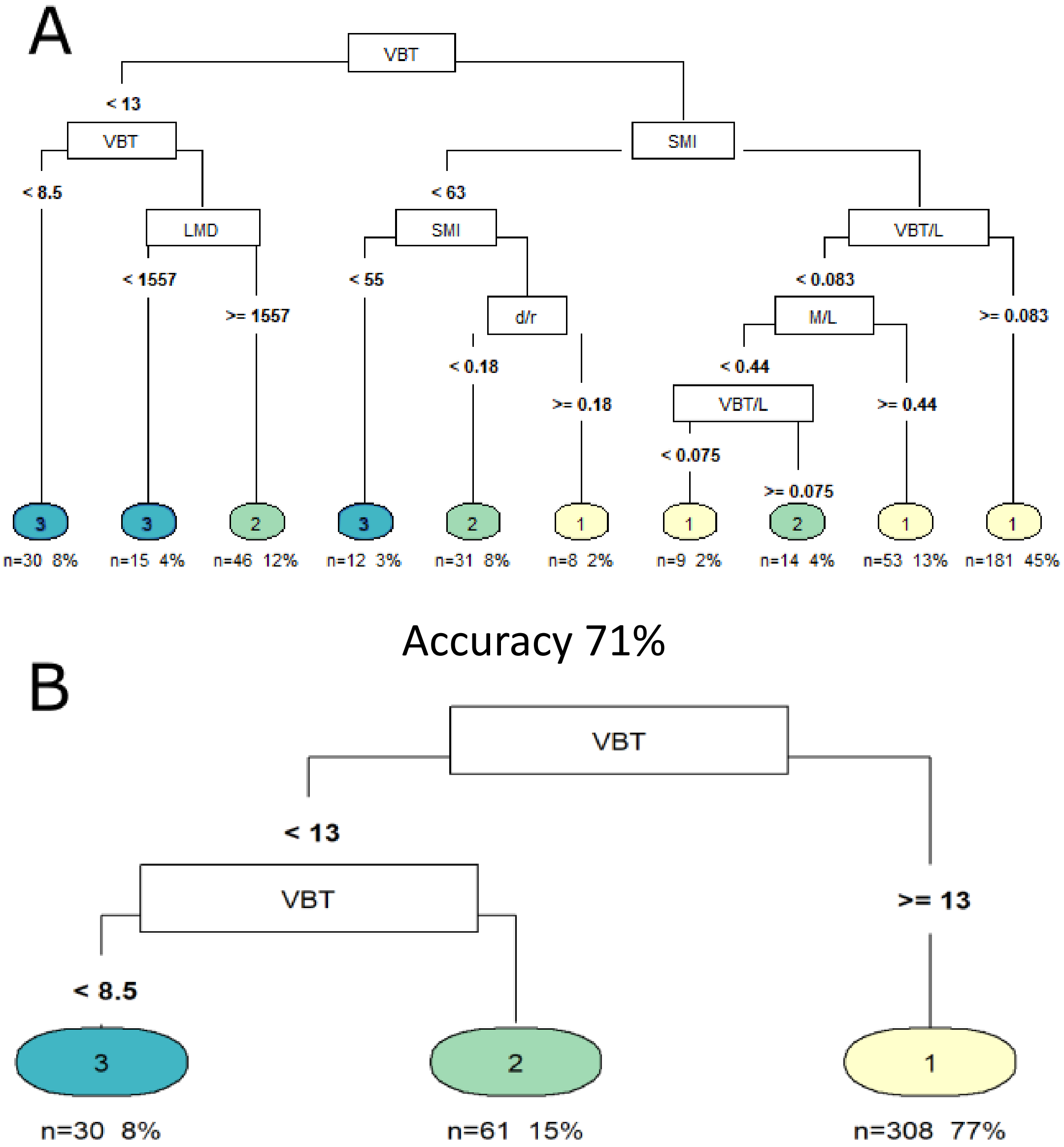
Index	Formula	Reference
Ventral blubber thickness (VBT)	Ventral blubber thickness	(Derous et al., 2020; IJsseldijk et al., 2021; Joblon et al., 2014; Kershaw et al., 2017; Koopman et al., 2002; Murphy, 2015; Siebert et al., 2022)
Mass to body length (M/L)	$\frac{Mass}{Length}$	(Karns et al., 2019; Kershaw et al., 2017; Williams et al., 2020, 2021)
Ventral blubber thickness to body length (VBT/L)	$\frac{Ventral\ blubber\ thickness}{Length}$	(Kershaw et al., 2017)
Girth to body length (G/L)	$\frac{Girth}{Length}$	(Castrillon and Bengtson Nash, 2020; Heide-Jørgensen et al., 2011; Kershaw et al., 2017)
d/r ratio (d/r)	$\frac{Blubber\ thickness}{Girth}$	(Kershaw et al., 2017; Murphy, 2015)
Body mass index (BMI)	$BMI = \frac{Mass}{Length^2}$	(Hart et al., 2013; Karns et al., 2019; Kershaw et al., 2017)
Residual index (Residual M/L)	The residuals from an OLS regression of Mass against Body length, after log transformation	(Kershaw et al., 2017)
LMD-index (LMD)	$\sqrt{\frac{Body\ length}{Body\ weight}} \times Blubber\ tickness \times 100$	(Heide-Jørgensen et al., 2011; Murphy, 2015)
Scaled mass index (SMI)	$\widehat{Mi} = Mi \times \frac{L0^{bsma}}{Li}$ where Mi is the mass of an individual, Li is its body length, L0 is an arbitrary fixed body length and bSMA is the slope coefficient estimated from an SMA regression (Peig and Green, 2009)	(Kershaw et al., 2017; Larrat and Lair, 2021)

Package ‘rpartScore’

Classification Trees for Ordinal Responses



CART Trees for assessing the best predictor indices for Nutritional Status. A) The optimal tree. B) The reduced tree. The index that defined a split was labelled at each split along with break values labelled at the branch. Nutritional status classifications were at the terminal nodes, where good = 1, moderate = 2 and poor – very poor = 3. Below the nodes, the number and percentage of observations are displayed.



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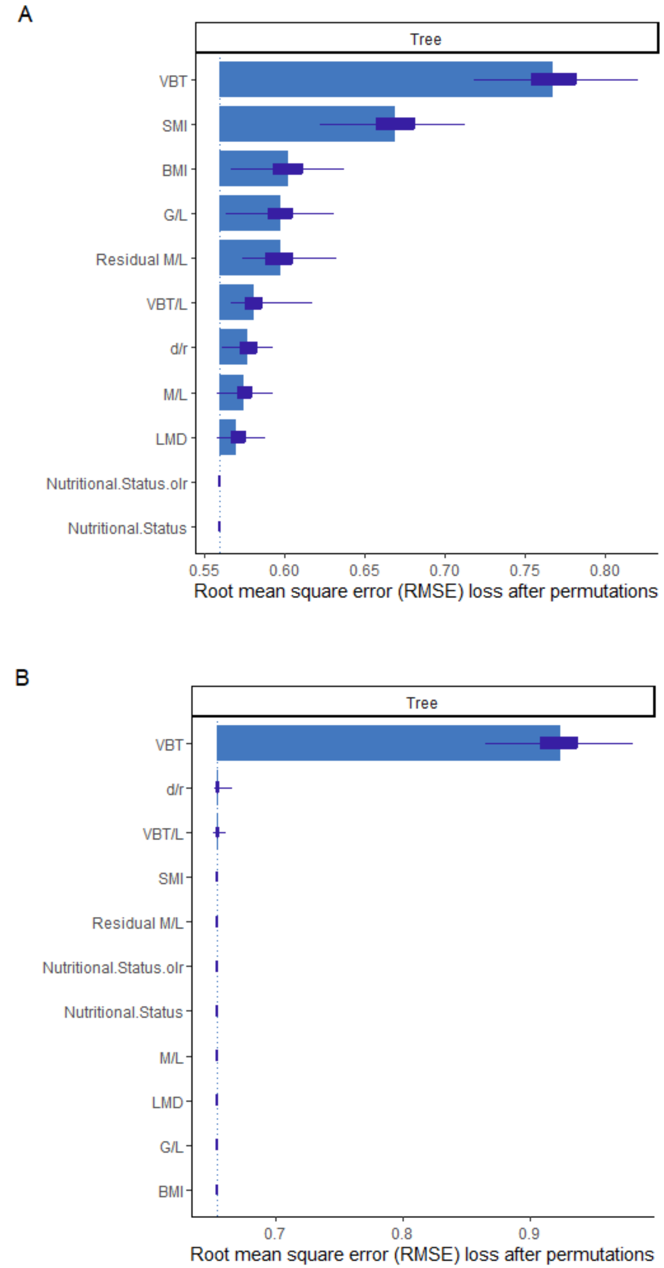
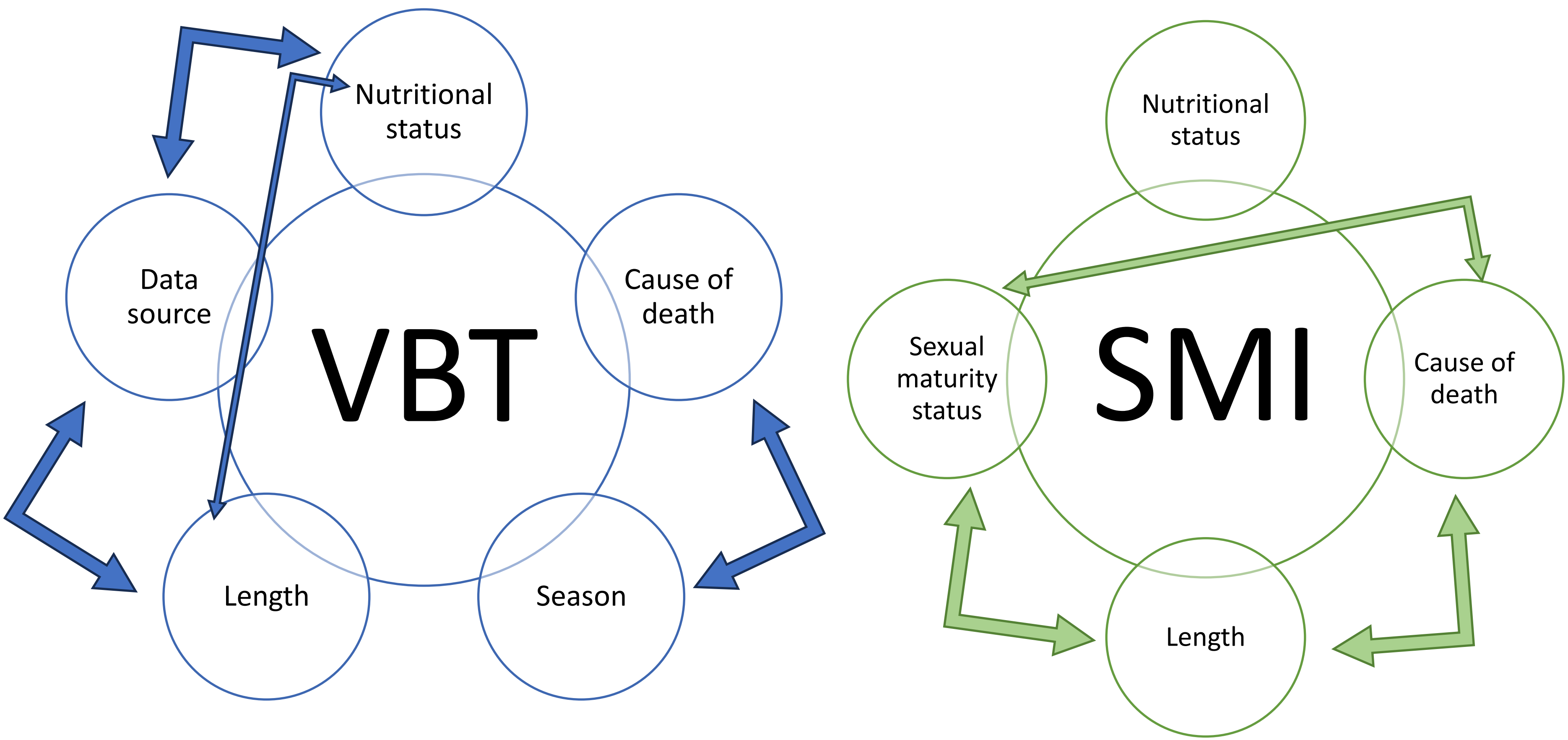


Variable importance plot for A) all variables fed into the optimal tree model and B) all variables of the reduced tree model .

GLMs:

Index ~ NS, COD, sex, sexual maturity status, total body length, country, month, season, quarter of the year, data source, and date reported



Thank you very much!

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- Placement and thesis students that completed the post mortem data and samples
- The UK Cetacean Strandings Investigation Programme (CSIP)
- Regional veterinary laboratory in Cork
- MFRC Team for practical advise
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