Optimal values for *fr, maxf, mr and maxm* varied more across bootstrap iterations of the models fit with *NRdorsal* than *NRflipper* (**Table 2**), resulting in generally higher levels of uncertainty associated with models based on *NRdorsal* than *NRflipper* (**Figure 3**). ), although some iterations of *NRdorsal* models resulted in distant outliers of the male-specific parameters (*mr* and *maxm*; **Figure 4**).

**Table 2**. Bootstrapped means and 95th percentile confidence intervals (95% CI) based on 1000 iterations for parameters relating sperm whale length (m) and nose-to-body ratio (NR) metrics based on snout to the caudal base of the dorsal fin (NRdorsal) and on snout to the flipper insertion point (NRflipper). Parameters reflect the growth rate of females and small males (≤ 6 m) (fr), the female asymptote of R (maxf), the growth rate of larger males (> 6 m) (mr), and the male asymptote of R (maxm).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *R* Metric | *fr* [95% CI] | *maxf*[95% CI] | *mr* [95% CI] | *maxm*[95% CI] |
| *NRdorsal* | 2.8 (0.63 - 14.9) | 0.65 (0.64 - 0.65) | 0.2 (0.01 - 0.62) | 0.89 (0.22 - 4.79) |
| *NRflipper* | 2.26 (0.5 - 33.64) | 0.3 (0.3 - 0.3) | 0.05 (0.01 - 0.16) | 2.05 (0.45 - 6.89) |

A comparison of a line graph

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**Figure 4.** Bootstrapped logistic curves of the total length (m) and the nose-to-body ratio of sperm whales based on measures of the snout to the caudal base of the dorsal fin (a) and snout to the base of the flipper (b). Theoretical male curves are shown in violet and theoretical female curves are shown in green. The average NR values across iterations are shown by light violet dashed and green solid lines for males and females, respectively. The dashed vertical lines indicate the minimum body lengths associated with sperm whale sex and age classes as follows: length at birth (4 m; NB), juvenile (J; 5.5 m), sub-adult (SA; 7.6 m ), adult female (AF – 8.5 m), adult male and mature female (AM/MF – 10 m), maximum female length (Fmax – 12 m), and mature male (MM – 13.7).

A diagram of a graph

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**Figure 5.** Distribution of bootstrapped parameter estimates (x axis) for NRdorsal and NRflipper models.

Models based on *NRflipper* metrics resulted in reasonable individual estimates of the probability of being female than *NRdorsal* based models. For example, individual ID74 (mean *TL =* 10.78 m, 95% *CI =* 10.63 – 11.06 m), which was observed receiving peduncle dives, was classified with high confidence as female by *NRflipper* models (mean *P(f)* = 0.99, 95% *CI =* 0.99 – 1.00), yet received low and uncertain estimatesfrom the *NRdorsal* model(mean = 0.12, 95% *CI* = 0 – 0.44). Similarly, individual ID04, a large male (mean *TL =* 15.2 m, 95% *CI =* 14.9 – 15.5 m), was confidently assigned a near-zero probability of being female by the *NRflipper* model (mean < 0.001, 95% *CI width =* 0), but received an uncertain and intermediate probability estimate based on the *NRdorsal* models (mean = 0.50, 95% *CI* = <0.001 – 0.97).Given that *NRflipper* models resulted in more certainty and consistency with context, behaviour, and whaling data, we explore the peduncle dive patterns in the following section considering the predictions made by *NRflipper* models.

A diagram of a graph

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**Figure 6.** Bootstrapped mean Length (m) and nose-to-body ratio (NR) for individual sperm whales based on (a) snout – dorsal fin distance (NRdorsal) and (b) snout – flipper distance (NRflipper). The solid green line and dashed violet line show the bootstrapped mean modele NR for females and males, respectively. Point colours show the mean posterior probability of individuals being female (P(f)), and point sizes indicate the bootstrapped 95th percentile confidence interval (95% CI) width for P(f). Point shape denotes whether individuals were observed involved in peduncle dives (triangles = receiving, squares = doing, circles = none). Individuals that were observed receiving peduncle dives and mature males (> 13.7 m) are labelled for reference. Dashed vertical lines indicate the minimum body lengths associated with sperm whale sex and age classes based on Best 1979, Best et al. 1984, and Mendes et al. 2007 as follows: calf (4 m; NB), juvenile (J; 5.5 m), sub-adult (SA; 7.6 m ), adult female (AF – 8.5 m), adult male and mature female (AM/MF – 10 m), maximum female length (Fmax – 12 m), and mature male (MM – 13.7).

Conversely, in models fit with *NRdorsal*, only two individuals that could be assumed to be mature males based on their sizes (ID01 & ID81) were consistently assigned low probabilities of being females. No individuals were consistently assigned a high probability of being female consistently based on *NRdorsal* models.