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Supplementary material

Appendix 1

MEASURING FORAGING EFFORT

To construct a metric that reflected foraging effort rather than actual prey capture, we fitted a piecewise regression consisting of three contiguous line segments to each dive, constraining the first and last segments so that the fitted dive began and ended at the surface, with the middle segment representing the "bottom phase" of the dive (see Halsey et al. 2007). The piecewise regression was fitted using the solver NL2SOL (Dennis et al. 1981), which was configured to minimize the least squares error between the three line segments and the observed sequence of depths (Fig. 2)**.**

In the case of U-shaped dives, the bottom phase was nearly horizontal, and in the case of V-shaped dives the bottom phase was non-existent or else only a few seconds in duration (Chappell et al. 1993, Schreer et al. 2001; Fig. 2). We assumed that when the bottom phase is horizontal, all bottom time is spent foraging (pursuing and capturing prey), whereas if the bottom phase is vertical, inconsequential time is spent foraging. Based on these assumptions, if ***D*** is the distance moved during the bottom phase (in meters), $\boldsymbol{\vartheta}$ is the angle (in degrees) formed with the surface (assuming a horizontal movement rate of 2 m/s), and ***C*** is the dive classification criterion, then:

$$C = -((\vartheta - 90) / 90) * D,$$

where the term -(***ϑ – 90)*** **/90** adjusts for the variation in the angle of the bottom phase, tending to 1.0, as the angle of the bottom phase becomes horizontal, and 0.0, as the angle becomes vertical. This takes into account the Ropert-Coudert et al. (2001; see also Watanabe et al. 2014) observation that some foraging occurs during the ascent phase, assuming that foraging is more likely on shallow as compared to steep ascent phases. Dives were classified based on ***C***, which is the duration of the bottom phase (in seconds) diminished by a proportion of the angle of the bottom phase. As the bottom phase becomes more steeply angled or of shorter duration, the likelihood that a dive will be classified as a foraging dive decreases. Based on visual inspection, dives were placed into four categories:

$C \geq 64$	Foraging dive
$C < 64$ and $C > 32$	Foraging / Exploratory dive
$C \leq 32$ and $C > 16$	Exploratory dive
$C \leq 16$	Traveling dive

Classified in this way, foraging dives are typically U-shaped with varying numbers of undulations occurring during the bottom phase (Fig. 2 bottom), whereas exploratory dives fit the classical V-shaped pattern (Fig. 2 top). Foraging/exploratory dives represent an intermediate situation where bottom time is short, but some undulation and foraging undoubtedly occurs (Fig. 2 middle). Traveling dives are typically shallow (<10m) V-shaped dives without undulations (see also Ropert-Coudert et al. 2001).

For these analyses, we chose to use a strict definition of foraging dives, $C \geq 64$, so as to ensure that other kinds of dives were not co-mingled with foraging dives. Most of these analyses were repeated using either foraging dives alone or using foraging dives plus foraging/exploratory dives. Inclusion or exclusion of the foraging/exploratory dive category had little effect on the results. We further evaluated the robustness of this dive classification method by comparing classifications provided by program DIVESUM (Lescroël et al. 2010).

Considering the above, we found that the dive classification criterion was highly correlated with the number of undulations occurring during the dive (see Lescroël et al. 2010 for further elaboration). Based on the linear regression of ***C*** on the number of undulations for 125,435 dives from all colonies, ***C*** accounted for 63% of the variation in the number of undulations per dive. When the average number of undulations per trip was regressed against the average bottom time per trip for each season and colony combination, ***C*** accounted for 82% of the variation in the number of undulations.

We also compared dive classifications using program DIVESUM, as in Lescroël et al. (2010), on a dive by dive basis with dive classifications based on ***C*** (i.e., dives were foraging or *not* foraging dives) for the entire dataset. This included 60,578 paired dive classifications based on 137 tag recoveries. Of these, 79.6% were classified the same and 19.7% were cases where DIVESUM classified them as foraging dives but the ***C*** criterion did not. In only 0.7% of dives did ***C*** indicate a foraging dive but DIVESUM did not. From this we conclude that the two classification systems are generally similar in outcome, but that ***C*** is more conservative than DIVESUM in that it is less likely to classify a dive as a foraging dive.

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