# **Appendix S1.** Determining logger tolerance based on breeding stage

A preliminary field season was conducted in 2014 at Machias Seal Island, New Brunswick, Canada (44.50˚N, 67.10˚W) to determine at which stage of breeding Puffins and Razorbills would best tolerate logger attachment. We deployed Ecotone® loggers (ALLE-68 on Puffins, 5 grams (1.3% average body mass, including attachment material, n=11), 26x16x10mm, antenna ~52mm; and URI-120 on Razorbills, 8 grams (1.8% body mass, including attachment material), 35x16x11mm, antenna ~70mm, n=10) at four stages during the breeding season: incubating, and early, mid, and late chick-rearing in 2014; and only in late chick-rearing in 2015 (see results). The chick-rearing period of Razorbills is so short (17-23d, Lavers *et al.* 2008) that only two periods of chick-rearing were recognized (early and late). Loggers were attached to the birds’ back feathers, between the wings, using cable ties and TESA® marine tape (Wilson *et al.* 1997; Figure 1).

We found a difference in chick survival based on chick age at the time of logger attachment (Table 1); nests with older chicks had higher fledge success than those with younger chicks. Small sample sizes precluded testing the significance of this result, but acting on the precautionary principle we focused our 2015 tagging efforts on adults with chicks that were at least halfway through their linear growth period (~20 days for Puffins and ~7 days for Razorbills) and used results from mid- and late-chick rearing adults in 2014. Observations were made at nests during the three to four days that loggers were attached to adults.

**Table S1.** Mean growth rates during the linear growth period (± sd) and number of chicks fledged for Atlantic Puffins and Razorbills tagged at different breeding stages during preliminary field season in 2014. Adults of control burrows were not manipulated and chicks were measured throughout their development in the same way as chicks belonging to experimental burrows.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Breeding stage** | **Chick age** | **n** | **Number of chicks fledged** | **Mean ± sd growth rate (g.day-1)** |
| Puffin | Control | - | 31 | 30 | 6.70 ± 2.35 |
|  | Incubation | On eggs | 4 | 1 | 7.57 |
|  | Early chick rearing | 0 - 10 days | 3 | 0 | - |
|  | Mid chick rearing | 11 - 20 days | 3 | 2 | 5.47 ± 4.70 |
|  | Late chick rearing | 21 – 30 days | 1 | 1 | 7.86 |
|  |  |  |  |  |  |
| Razorbill | Control | - | 18 | 18 | 4.94 ± 3.87 |
|  | Incubation | On eggs | 4 | 1 | 1.66 |
|  | Early chick rearing | 0 – 7 days | 2 | 2 | 7.46 ± 5.95\* |
|  | Late chick rearing | 8 – 15 days | 4 | 3 | 3.42 ± 0.81 |

\*The larger growth rate observed for early chick rearing in Razorbills is likely to be due to small sample size effects. The growth rates of the two chicks were 3.3 and 11.7 g.day-1. The 3.3 g.day-1 falls within the mean growth rate for Razorbill chicks regardless of breeding stage, however, the 11.7 g.day-1 measure is the second highest growth rate observed for Razorbill chicks in 2014. Large fluctuations in chick weight are observed when chicks have recently been fed or have excreted feaces.

# **Appendix S2.** Example images of identified food delivered to nestlings by Atlantic Puffins and Razorbills

The following are images taken from video footage recorded on Machias Seal Island, New Brunswick, Canada.



**Figure S1.** Razorbill pair in front of burrow entrance. This image, taken from a video recording, shows a Razorbill with GPS logger attached (left) and its ringed mate (right).



**Figure S2.** Razorbill pair at their burrow. This image, taken from a video recording, shows one Razorbill brooding its chick within the burrow and its mate returning to the nest with 4 Herring (size: 3 bill-lengths).

**(a)**   
**(b)** 

**Figure S3.** Razorbill pair at their burrow. This image, taken from a video recording, shows one Razorbill within the burrow and its mate returning to the nest with (a) 1 Krill (size: 1.25 bill-lengths) and (b) 1 Haddock (size: 1.5 bill-lengths). These two images show how video recordings reveals multiple views of a bill-load delivered to the nest.



**Figure S4.** Atlantic Puffin returning to its burrow with 2 Sandlance. One Sandlance is 1.5 bill-lengths and the other is 2.5 bill-lengths.

**References**

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