A 127(1):195–203, 2010

Printed in USA.

J., A HI F E ,[1,3] A A A., CFA A E-

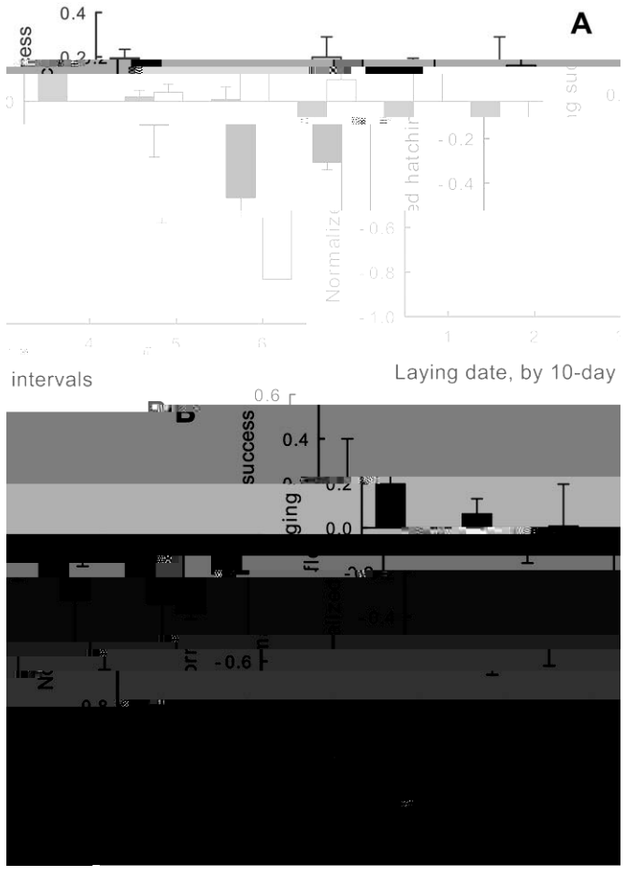
E idencia E e imen al de e el Tiem o la Calidad Pa en al Afec an el E-i o Re od c i o de n A e Ma ina Zoo lanc o a

A , Vol. □□□, Number □, pages □□□–203. ISSN □□□□-□□□□, electronic ISSN □□□□-□□□□. DOI: □□.□□□□/auk.□□□□.□□□□□

success as the proportion of eggs laid that hatched, and fledging success as the proportion of chicks that survived ≥ days before disappearing. Breeding success and fledging mass were defined as the proportion of eggs laid that produced fledged chicks and the last mass recorded before fledging, respectively. Re-laying intervals were defined as the period that elapsed between removal of the first egg and the appearance of the second egg in the same burrow. As a measure of egg size, we used an index of volume (length × maximum breadth), which is very strongly related to fresh egg mass in Cassin's Auklet (= .; Hipfner et al.).

In the laboratory, we aliquoted ~-mL samples of yolk into Eppendorf tubes. Lipid-free prepared samples were sent to the stable-isotope facilities at the University of Saskatchewan () or the University of California, Davis (–), for analysis of $\delta^{}$N values. Results are reported in delta notation in parts per thousand (‰) relative to air. Nitrogen stable-isotope ratios can be used to assess the trophic level at which a consumer has fed, because $^{}$N becomes systematically enriched at successive trophic levels (Peterson and Fry).

replacements (Fig.), and re-laying rates were –% in all



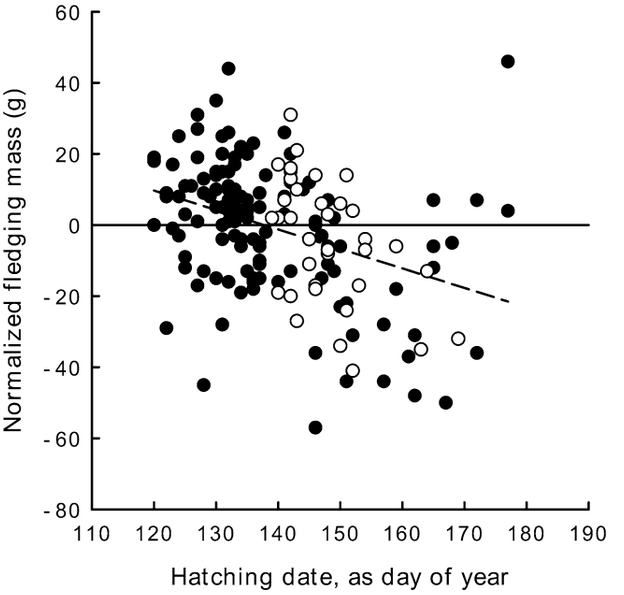


FIG. 5. Fledging mass in relation to hatching date in control (solid dots) and experimental (open dots) Cassin's Auklets at Triangle Island, British Columbia, in 2002–2006. Fledging mass varied among years, so to standardize across years, raw data were converted to the difference between

However, the situation for fledging mass is somewhat complicated by the fact that models that included the date*treatment term also received substantial support ($\Delta AIC_c \leq$) and improved the Log$L$ of the model appreciably (Table). us, although the weakness of the treatment e ect indicates that the elevations of the lines were similar, the interaction term reflects a steeper slope of the line relating the decline in fledging mass to hatching date for experimental (– . ± . g day^{-}) than for control pairs (– . ± . g day^{-}) over a narrower range of hatching dates (Fig.).

DISCUSSION

As expected, breeding success was strongly linked to laying date in Cassin's Auklets at Triangle Island in – , both at the individual level (females that laid later bred less successfully) and at the population level (breeding was less successful in years in which laying was later and less synchronous overall). We will consider the population-level pattern first, then return to the individual patterns and the implications of our experiments to assess the relative importance of date and parental quality in driving the seasonal declines in success.

I a a a ia i i a i da .—In all years, Cassin's Auklets began laying eggs in late March, which is very early in the spring at the latitude of Triangle Island. e constancy probably reflects the influence of an invariant photoperiod (Dawson). ereafter, the population proceeded to lay very synchronously in

H□□□□□□, J. M., L. A. M□F□□□□□□-T□□□□□□□□□, □□□ B. A□□□□□□. □□□□. Do marine birds use environmental cues to optimize egg production? An experimental test based on relaying propensity. Journal of Avian Biology □□:□□□–□□□.

K□□□□□, J., M. S□□□□, N. J□□□□□, M. Å□□□□□□, S. B□□□□□, B. H□□□□□□, □□□ D. H□□□□□□□□□□. □□□□. An analysis of hatching

A ci,a Edi; : R. G. C a