

TRANSIENT STEATORRHEA MAY BE RESPONSIBLE FOR PRE-FLEDGING WEIGHT LOSS IN CHICKS OF LEACH'S STORM-PETREL, *OCEANODROMA LEUCORHOA*

Allen R. Place, Nina Stoyan and Robert Ricklefs  
Department of Biology, University of Pennsylvania, Philadelphia,  
PA. 19104

Chicks of most procellariiform birds (albatrosses, fulmars, shearwaters and other petrels) grow slowly and accumulate large quantities of lipid. The lipid reserves of petrel chicks are thought to provide energy during intervals between feedings that commonly last from one to several days, depending upon the species, and longer when storms make foraging more difficult. Ricklefs et al. (*Auk* 97:768-781, 1980) have found that Leach's storm-petrel chicks accumulate an average of about 20 g of lipid during the course of the nestling period. This energy store is equivalent to about 760 kJ, or approximately eight-times the total daily maintenance requirement. Like other procellariiforms, petrel chicks lose mass rapidly during the last week of the nest period when, presumably, most of the accumulated lipid is metabolized. It is argued that without this weight loss the fledgling would never be able to become airborne. Figure 1 below presents the mass versus age relationship for chicks on Kent Island illustrating this pre-fledging weight loss.

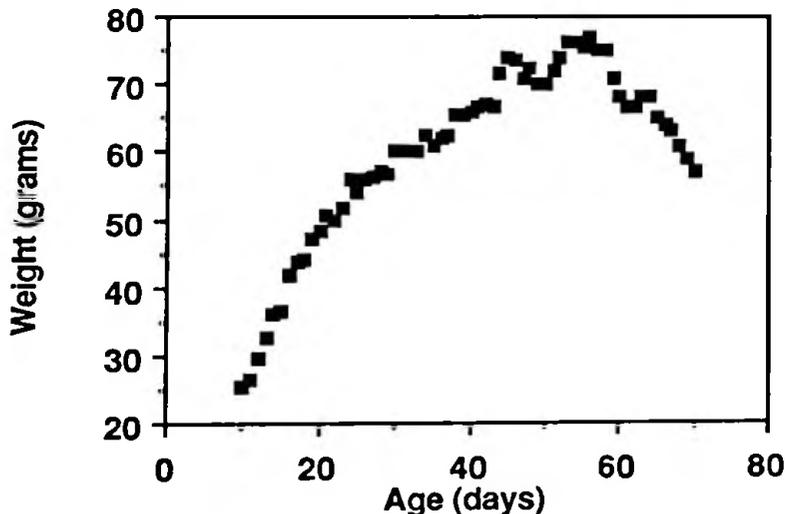


Figure 1. Relationship between mass and age based on 19 Leach's storm-petrel chicks (from records kept by C.E. Huntington on Kent Island in 1962. )

The physiological basis of this weight loss is unknown. There does not appear to be an elevation in basal metabolic rate (as

evidenced by increase in body temperature). Also, although the frequency of feeding by parents appears to diminish, the chicks retain considerable stomach oil, and hence metabolizable energy, in their proventriculus. During our studies on the importance of bile salts to wax ester assimilation in this species we noticed that as our control chicks approached the age of 65 days there was a drop in lipid assimilation efficiency. To document more accurately this finding, we repeated our studies on chicks who were entering or in the prefledging weight lost period. We assessed the assimilation efficiency for glucose, proline, and triolein using the previously documented isotope ratio technique (Place and Butler, *Bull. MDIBL*: this volume). Figure 2 presents the findings from these experiments.

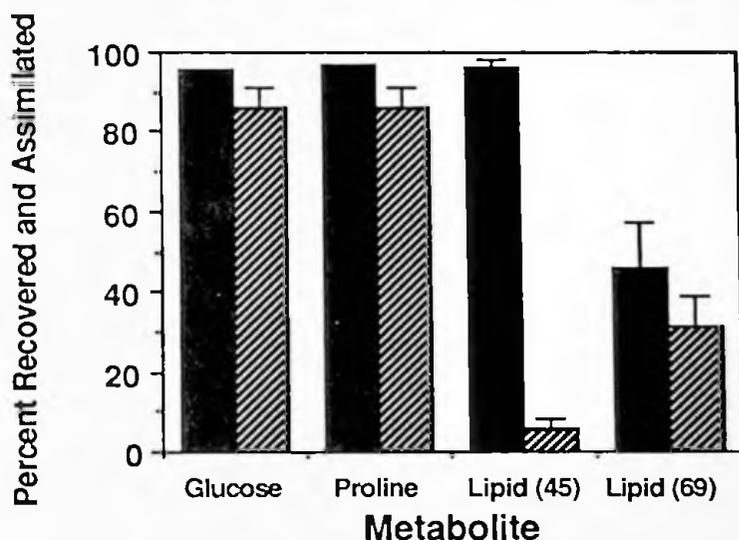


Figure 2. Comparison of metabolite assimilation efficiencies and percent marker recovery in Leach's storm-petrel chicks of 45 and 69 days in age. The solid bars represent assimilation efficiencies while the cross-hatched bars represent percent marker recovered in a 24 hour period. The glucose and proline assimilation efficiencies and percent marker recovery for 45 and 65 day old chicks were statistically indistinguishable and are presented as averages (n = 6).

As shown in Figure 2 the lipid assimilation efficiency in chicks 45 days old was nearly quantitative. The aqueous phase marker was nearly completely recovered in 24 hours, but only 5% of the lipid phase marker was observed in the same time period. This corroborates our earlier finding on stomach oil formation in this species (Place, Stoyan and Ricklefs, *Bull. MDIBL*: this volume). When we examine the lipid assimilation data for the 65 day old chicks, we see a nearly two fold lower assimilation efficiency

and nearly a six fold higher transit time for the lipid phase marker. The chicks are exhibiting a classic example of steatorrhea. Since the absorptive capacity of the intestine for water soluble metabolites (glucose and proline) appears to be unaffected, we hypothesized that this temporally restricted steatorrhea might be the result of reduced or stopped biliary secretion. We have shown that biliary secretion is essential for normal lipid assimilation in this species. Thus, the chick may be able to control gall bladder emptying, perhaps by modulating the effects of cholecystokinin. With this type of control over gall bladder secretion, the chick can metabolize excess body fat while still receiving meals from the adult. This phenomenon must be reversed at sometime after they have fledged so normal feeding and assimilation can occur. Further studies on the effect and titer of cholecystokinin in Leach's storm-petrel chicks will help determine whether this control mechanism exists. This work was supported by a Markey Fellowship from the Lucille Markey Charitable Trust to A. R. Place during the summer of 1986.