

# GROWTH AND SURVIVAL OF ARTIFICIALLY TWINNED ROCKHOPPER PENGUIN CHICKS

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## INTRODUCTION

The normal clutch of penguins in all genera except *Aptenodytes* is two eggs (Williams 1980a). In *Eudyptes* the first-laid (A) egg is markedly smaller and lighter in weight than the second-laid (B) egg (Gwynn 1953) and only one chick is raised from a clutch (Warham 1975, Williams 1980b). In *Eudyptula*, *Megadyptes*, *Pygoscelis* and *Spheniscus* the two eggs differ little in size and weight and two chicks may be reared from a clutch (Williams 1980a).

I investigated egg weights and egg and chick mortality of Rockhopper Penguins *Eudyptes chrysocome* at Marion Island (45 54S, 37 45E) in 1974 - 75 and 1976 - 77. A-eggs averaged  $76,0 \pm 6,9$  g and B-eggs  $109,1 \pm 9,1$  g. Egg dimorphism was related to differential mortality and I found that : (1) chicks could be raised from A- and from B-eggs; (2) 68 % of B-, but only 12 % of A-eggs hatched; (3) both eggs hatched in only 6 % of the clutches; (4) only one chick was raised from two-chick broods, the other chick, almost invariably from the A-egg, died through starvation 2 - 12 days after hatching; and (5) the period in which two chicks coexisted was extended if the A-egg chick hatched on the same day as the B-egg chick (Williams 1980b).

This paper reports an experiment aimed at testing the chick raising ability of Rockhopper Penguins when two eggs of similar size hatch in the same nest on the same day.

## METHODS

Eggs from six nests were exchanged on the days of laying to produce three clutches of two A-eggs and three of two B-eggs. Both eggs hatched at only two nests, one with two A-eggs and one with two B-eggs. At all the other nests one egg was lost during incubation. In both nests where two eggs were retained both eggs hatched on the same day. The chicks at these nests were weighed and the foot, flipper and culmen were measured within 24 h of hatching. Each chick was given a distinctive paint mark on the culmen so that siblings could be distinguished. Subsequently chicks were weighed daily and the three appendages were measured every fifth day.

## RESULTS

Within 24 h of hatching the two A-egg chicks weighed 50 and 51 g. One chick had gained a weight advantage by the second day and remained heavier than its sibling which died 14 days after hatching. The heavier chick died when 19 days old. These

chicks therefore coexisted longer than the 2 - 12 days observed when two chicks hatched from dimorphic eggs.

The two B-egg chicks weighed 84 and 79,5 g within 24 h of hatching and coexisted for at least 57 days. Thereafter the heavier chick moved into a deep cranny and subsequently disappeared. I believe it attained independence successfully. The less vigorous chick was killed by a predator when 65 days old. These siblings coexisted for at least 45 days longer than any twins hatched from dimorphic eggs.

Weight and growth of Rockhopper chicks are affected by the division of parental duties during the first half of the chick rearing period. The male parent guards the chick(s) for the first three weeks after hatching, then after a fast of 4 - 5 weeks (Warham 1963) goes to sea to feed and does not return with food until the chick is 30 or more days old (Williams 1980a). Before the male's return all the food received by the chick is brought by the female. Later the parents bring food alternately,

The artificially twinned B-chicks were fed the same number of meals by the female parent during the first 30 days but one chick was always heavier than its sibling. The heavy chick weighed only a little less than the mean weight for B-chicks raised singly. Its sibling, however, weighed generally well below the mean weight of single chicks (Fig. 1). Thirty-two days after hatching the heavy chick received a large meal whilst its sibling went unfed. From this day onwards the weight of the two chicks diverged (Fig. 1). This change was caused by the male parent which, arriving with food for the first time, fed only the more vigorous chick. Thereafter, the heavy chick grew at the same rate as single B-chicks (Fig. 1). The undernourished chick's weight remained at about 600 g. It survived for 65 days, five days less than the mean chick-rearing period of  $70,4 \pm 2,9$  days of Rockhoppers at Marion Island (Williams 1980a).

Differential feeding also affected the growth of the twinned B-chicks' appendages (Fig. 2). The undernourished chick's feet ceased to grow at 35 days, when well short of normal size, but its flippers continued to grow in spurts following occasional large meals. Flipper length remained far shorter than that of singly raised chicks of the same age. The heavier chick's appendages attained a size well within the range for singly raised chicks.

#### DISCUSSION

This experiment demonstrates that, given eggs of similar size and synchronized hatching, some Rockhopper Penguins are capable of maintaining a brood of two chicks for far longer than is usually the case. It also shows that in two-chick broods maintained for long periods, only one chick grows at a rate similar to that of chicks raised singly. The weaker of the two chicks is likely to die through starvation or, weakened by undernourishment, fall prey to a predator.

This experiment indicates that were Rockhopper Penguins to lay and hatch two eggs of similar size the period of chick coexistence

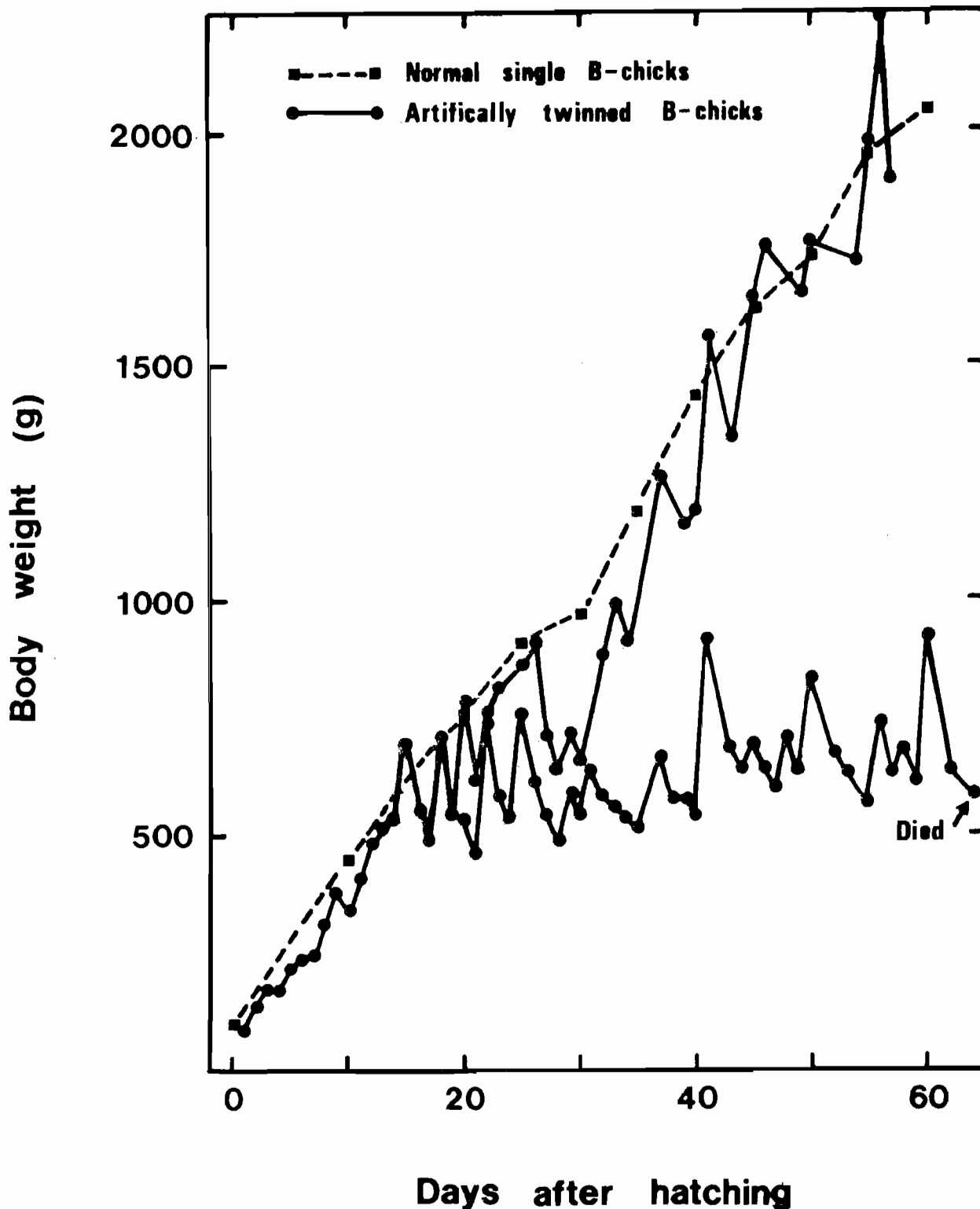


Figure 1

Comparison of body weights of two Rockhopper Penguin *Eudyptes chrysocome* B-chicks raised as siblings with the mean body weight of B-chicks raised singly. Mean body weight data from Williams (1980a). To avoid confusion the weight of the lighter sibling during the first 20 days has been omitted.

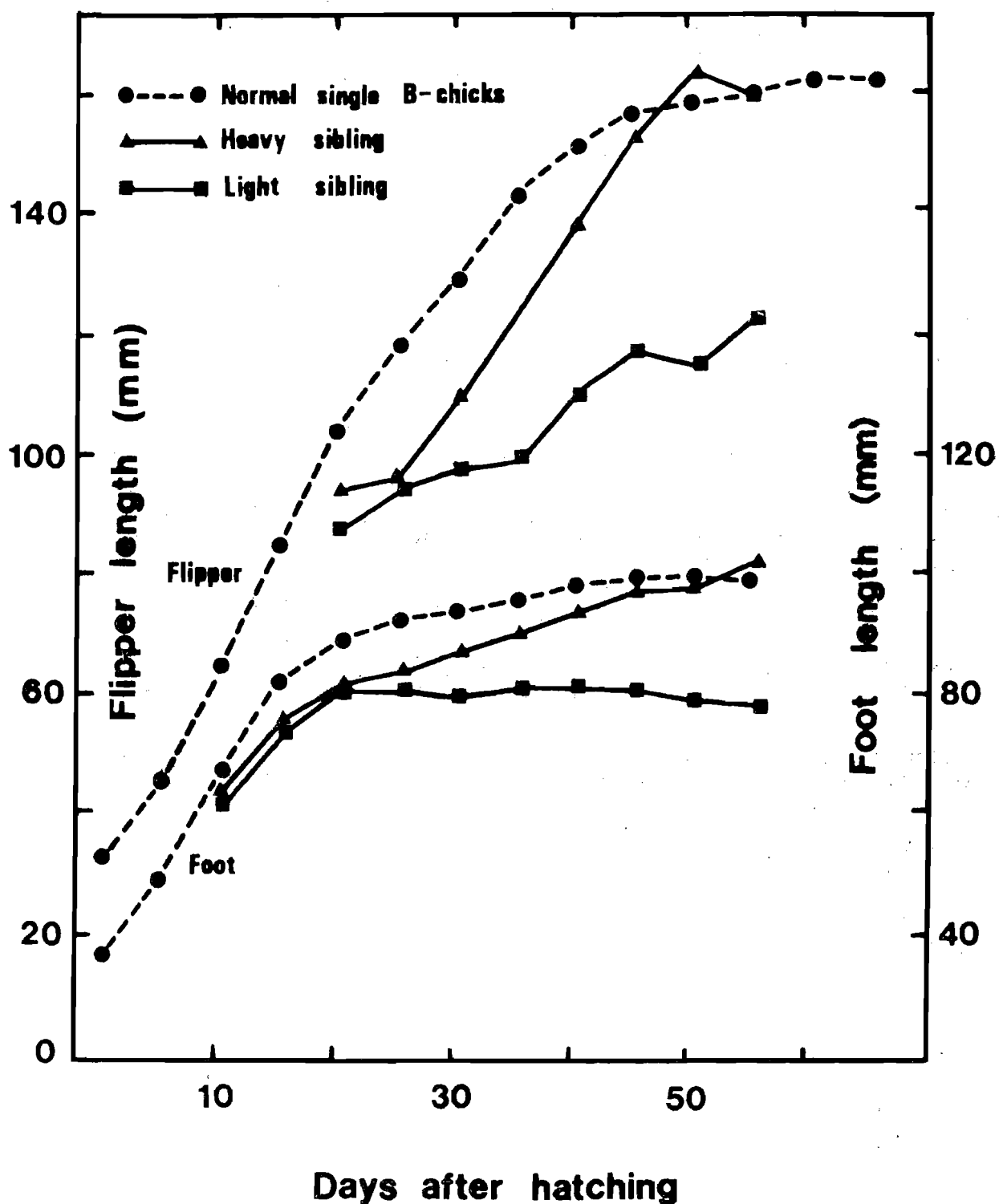


Figure 2

Comparison of growth in length of the foot and flipper of two Rockhopper Penguin *Eudyptes chrysocome* B-chicks raised as siblings with the mean growth of B-chicks raised singly. Mean growth data from Williams (1980a).

could be longer than is the case when the eggs are dimorphic. The longer the period of coexistence the more food is wasted upon a chick which cannot be raised. Furthermore, the sharing of food may reduce the growth and jeopardise the chances of survival of the stronger chick. If extra parental effort is required to feed two chicks, the long term reproductive capacity of the female parent, which brings all the food in the first half of the chick-rearing period, might be reduced. Egg dimorphism in Rockhopper Penguins, by disadvantaging one chick, leads to an early reduction in brood size if both eggs hatch.

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