MULTIPLE FISH-CARRYING IN SWIFT TERNS *STERNA BERGII*

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Seabirds nest on land but take their food from the sea, so they face a problem of transporting food efficiently to their nesting sites, often over great distances. Delivery of food to young may limit brood size and growth in seabirds (Ricklefs 1983). Several methods of transport have evolved. Many species carry food internally, in the stomach or gular pouch, regurgitating for their young (e.g. Ashmole 1971, Speich & Manuwal 1974). Food may be delivered more or less intact, perhaps with the adult delaying digestion (Ashmole 1971). Still other species carry prey externally in their beaks, transporting single items or as many as 62 (Harris 1984). Although multiple-fish carrying is common in some alcids (e.g. Harris 1984) and the Fairy Tern *Gygis alba* (Ashmole & Ashmole 1967), such behaviour is rare in other terns (e.g. Hays *et al.* 1973).

For species that carry prey externally, multiple-prey carrying would seem to enhance efficiency, because it would reduce the number of trips required to carry food by the inverse of the number of prey carried; however, multiple-prey loads may have drawbacks, such as increased chance of food piracy, or decreased aerodynamic ability. This report describes the frequency, ease of delivery, prey-size, and species of multiple-fish loads compared to single-fish loads brought to young by adult Swift Terns *Sterna bergii*.

METHODS

During 19-21 February and 24-27 March 1986, I observed food delivery at a nesting colony of approximately 2 000 pairs of Swift Terns at Marcus Island, 33 03S, 17 55E, southwestern Cape, South Africa. During 580 min in February and 270 minutes in March, I recorded the size and number of fish per bird brought to the colony by adult terns. In February, most of the colony had small, downy young, probably less than a week old; whereas in March the young were large, and many had already fledged but were still being fed by their parents.

In February, for birds carrying more than one fish, I recorded the number of times the bird attempted to land and deliver its prey. I compared this with the number of attempts required by 100 birds carrying single fish.

Fish size was estimated in comparison to Swift Tern culmen length (*c.* 61 mm), scored in one-quarter culmen divisions (cf. Hulsman 1984). Although size estimation can be difficult for prey carried by flying birds (Duffy & Jackson 1986, but see Hulsman 1984), all the estimates were done by myself, so that any bias would have applied uniformly to all my estimates.

RESULTS & DISCUSSION

Nine of 1 303 (0,7 %) adult Swift Terns carrying multiple fish to the colony in February, and seven of 1 336 (0,5 %) did so in March. In February, of the multiple loads, six were of two fish, two of three fish, and one of five fish. The mean number of fish for all birds was 1,01. All the fish carried in multi-fish loads in February appeared to be Cape Anchovy *Engraulis japonicus*. The median length of such fish was 1,0 culmen-lengths (n = 20), similar in size to anchovy brought in singly (median = 1,0 X culmen; Fig. 1a).

In March, two fish were carried in all seven multi-fish cases. Ten were Cape Anchovy and four were Sauries *Scomberesox saurus*. No mixed-species loads were observed. The frequency of anchovy carried multiply was 1,5 % (n = 1 295) but 3,4 % of Saury (n = 117) were carried in two-fish loads. Seven of the anchovy were 1,25 X culmen length and three, 1,5 X culmen length. These were the two commonest size classes brought in on single-fish loads Fig. 1b). Three of the Saury were 1,5 X culmen length; one was 1,75 X culmen. These were again the two commonest sizes for Saury in single-fish loads (1,5 X culmen = 45 %; 1,75 = 25 %; others < 20 %; n = 117). This suggests that terns did not select smaller fish when carrying more than one fish.

Swift Terns nested very densely (9,6 $\pm$ 1,2 nests/m^2; n = 12 one-m^2 samples). An adult returning to a nest thrust its prey into the culmen of its single nestling. Swift Terns clearly had greater difficulty delivering multiple than single loads to their young; neighbouring adults attempted to steal fish while the nestling swallowed the first fish. The mean number of attempts needed to deliver the first fish in a multiple-fish load was 2,8 $\pm$ 1,7 S.D. (n = 6; distribution: one attempt = 2; two attempts = 1; four attempts = 2; five attempts = 1), compared to 1,14 $\pm$ 0,35 SD attempts by 100 terns carrying single fish (distribution: one attempt = 86; two attempts = 14). The difference is significant (G = 7,95; P < 0,01).

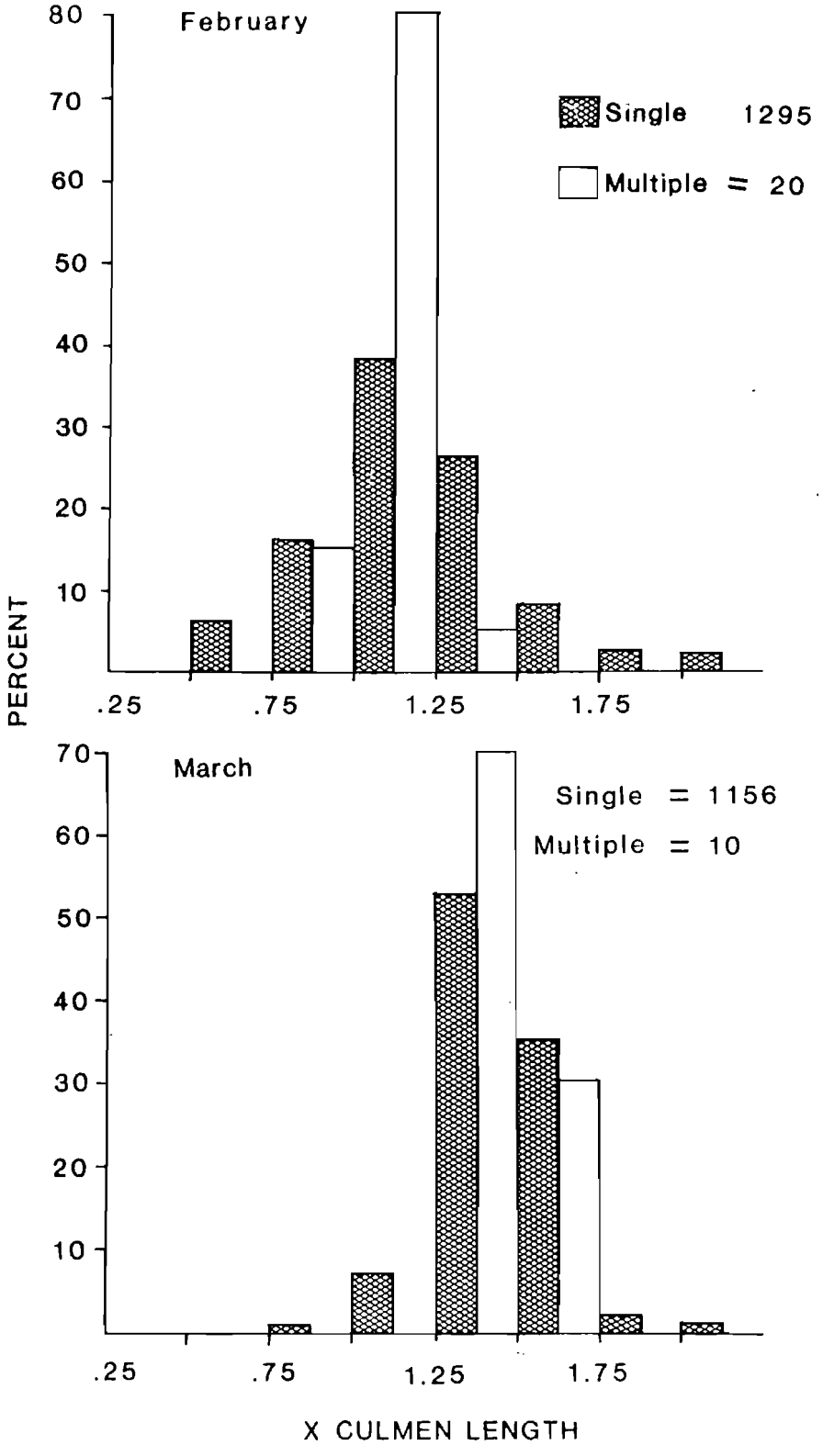

FIGURE 1

Percentage size distribution (X culmen: 61 mm) of Cape Anchovy brought back by Swift Terns to Marcus Island as single and multiple fish loads in February and March 1986.

Swift Terns rarely carried more than one fish back to the nest from a foraging trip. Multiple-fish loads are similarly rare in Common *S. hirundo*, 1,7 %, Arctic *S. paradisaea* 1,7 %, Roseate *S. dougallii* 1,5 %, and Sandwich *S. sandvicensis* 2,19 %, terns (Hays *et al.* 1973). Multiple fish loads are, in contrast, common in Fairy Terns and some alcids, ranging from 1,3 fish/load (Fairy Tern: Ashmole & Ashmole 1967) to 22,4 fish/load (Atlantic Puffin *Fratercula arctica*: Harris 1984).

Swift Terns must have captured prey very close to the colony since many fish were still alive when brought to the young. The costs of making short additional trips carrying single prey would have been minor, especially if the benefits of multiple loads were offset by increased risk of piracy. A similar mechanism may, in part, explain the prevalence of single-fish loads in inshore-foraging terns.

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