

Predation on the angulate tortoise *Chersina angulata* by the kelp gull *Larus dominicanus* on Dassen Island, Western Cape

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The kelp gull (*Larus dominicanus*) is an important predator on the angulate tortoise (*Chersina angulata*) on Dassen Island, Western Cape, South Africa. Tortoise shell fragments ($n = 142$) were collected and measured. Using regression curves based on 184 live tortoises measured on the island, the size class of tortoises eaten by kelp gulls was determined to include tortoises from 38–124 mm (mean 84 mm) total length (mass 25–350 g; mean 130 g). It is probable that very small tortoises were also eaten, but totally consumed. It is suggested that predation on tortoises occurs during the autumn–winter by the small population of resident gulls (approximately 50 individuals).

Die swartrug-meeu (*Larus dominicanus*) is 'n belangrike roofvoël wat jagmaak op die ploegskaarskilpad (*Chersina angulata*) op Dassen-eiland, Westelike Kaap, Suid-Afrika. Skilpaddopfragmente ($n = 142$) is versamel en gemeet. Deur middel van regressie-grafieke gebaseer op afmetings van 184 lewende skilpaaie op die eiland is die grootteklas van die skilpaaie wat deur die swartrug-meeu gevreet is, bepaal. Dit sluit skilpaaie van 38–124 mm (gemiddeld 84 mm) totale lengte (massa 25–350 g; gemiddeld 130 g) in. Dit is waarskynlik dat baie klein skilpaaie ook gevreet word, maar dat hulle heeltemal opgeëet word en dat daar dus geen oorblyfsels is nie. Daar word voorgestel dat die roof van skilpaaie gedurende die herfs–winter plaasvind, deur die klein bevolking meeu wat die eiland bewoon (ongeveer 50 individue).

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The angulate tortoise, *Chersina angulata*, is distributed throughout most of the Cape coastal regions, extending inland as far as Cradock and the Kouebokkeveld, with a relict population at the foot of the Nuweveldberg escarpment near Beaufort West (Branch 1989). Dassen Island is irregularly shaped (2,5 km at its longest axis and 1,05 km at the widest) and is situated 9 km off the Malmesbury coast in the south-western Cape (33°26'S/18°05'E, 222 ha, 19 m a.s.l.). The date of introduction of *Chersina angulata* to Dassen Island is undocumented, but it appears to have occurred early this century (Branch 1990). It is now known to be present in high densities on the Island.

As part of an ecophysiological study on the angulate tortoise, Dassen Island was visited to collect blood and urine samples for comparison with material from eastern Cape tortoise populations (Els 1989). During these visits numerous broken and empty tortoise shells were discovered. Most were found on the expanses of bare granite in the centre of the Island. The clean nature of the breaks on the tortoise shells, and the occasional presence of attached limbs and blood stains, indicated that the shells were the remains of predation. The most likely predator was the kelp gull (*Larus dominicanus*), and we present here the first description and analysis of this interesting phenomenon.

The Island was initially visited for seven days (4–10 April 1987), with a subsequent brief visit (4 November 1988). Live tortoises were collected opportunistically by walking slowly over the island and searching beneath vegetation, rock slabs and litter. Individual tortoises were marked, weighed and measured according to techniques detailed elsewhere (Branch 1984). Measurements were collected

from 184 live tortoises (eight unsexed juveniles, 98 males and 78 females). The size distribution for all tortoises measured is shown in Figure 1.

Broken tortoise shells were collected, and their distribution noted. A total of 142 tortoise shells was discovered, of which 118 were sufficiently intact to be measured. Measurements were taken of the plastron length or plastron width (depending on the extent of the remains). Regressions of plastron length against various other shell parameters were prepared from the 184 living Dassen tortoises. As noted before (Branch 1984), there is a very strong correlation between plastron length and total length in *Chersina*

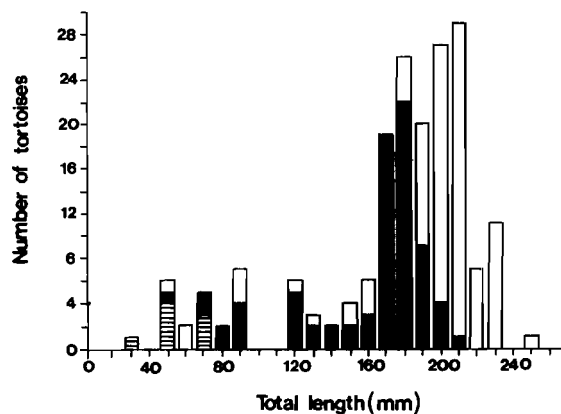


Figure 1 Size distribution of all angulate tortoises ($n = 184$), Dassen Island. Note: different sizes attained by females (black shading) and males (unshaded), and the absence of tortoises in the 90–110 mm TL size class (unsexed juveniles, hatched shading).

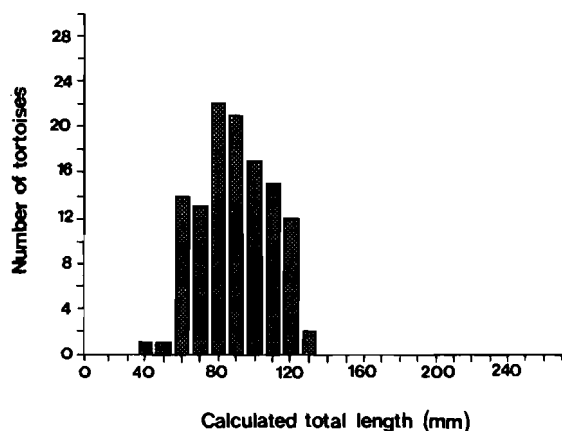


Figure 2 Size distribution of angulate tortoises eaten by kelp gulls on Dassen Island.

($r^2 = 0,986$ for Dassen population), and this regression curve was used to determine the size class of shattered tortoise remains (Figure 2). These were found to have a total length of from 38–124 mm (mean 84 mm). Using a similar regression curve of plastron length / mass it is evident that the dead tortoises weighed between 25–350 g (mean 130 g).

After measurement, many of the broken shells were placed in a mound on the granite bedrock. During a subsequent brief visit to the island (4 November 1988) the main sites where broken shells were found were revisited to collect further material. However, only one fresh shell was present and no trace could be found of the previous shells, left in April 1987. It is presumed that all had been broken up and dispersed by the wind in the intervening period.

Potential predators on tortoises on the Island include the domestic cat and the kelp gull (*Larus dominicanus*). Feral domestic cats were common on the Island and a colony estimated at 37–50, and expanding rapidly, was present in 1980 (Apps 1983). In 1985 the Department of Sea Fisheries initiated a cat extermination programme to protect the Island's declining penguin colony, and during the visit in 1987 only three individuals remained. The low number of cats at the time of the tortoise survey, makes it unlikely that they could have been responsible for the tortoise deaths. In addition, although Apps (1983) calculated that each cat on the island killed 105 rabbits and 13 birds each year, neither he, Cooper (1977a), or Berruti (1986) found any evidence of cat predation on tortoises. The concentration of shells on the expanses of bare rock also makes it unlikely that cats were responsible for the tortoise predation as they are more likely to have taken the carcasses back to their lairs.

There are few reports of avian predation on tortoises in southern Africa, and these are mainly anecdotal (e.g. Tarboton & Allan 1984; Steyn 1982, 1984). We observed no instances of predation on the tortoises during the study trip. However, B. Richardson (lighthouse keeper on Dassen Island from 1981–1982) noted (*in litt.* to G. Ross May 1986) that 'Tortoises up to about 120 mm in length are heavily preyed upon by the black-backed gulls of which there are thousands. They lift them into the air and drop them onto rocks'. It thus seems likely that the kelp gull is responsible for the predation on the tortoises, although this has not

previously been recorded.

In southern Africa the kelp gull is mainly restricted to the coastal regions (Brooke & Cooper 1979), making only limited excursions inland (Ryan & Furness 1982). It is known to be an intelligent and opportunistic predator and is known to kill crayfish (Berruti, Miller & Silbernagl 1979), fish (Duffy, Duffy & Wilson 1984) and even other gulls (Cooper 1977b), as well as feeding on carcasses (e.g. Brooke & Cooper 1979; Shaughnessy 1980). In addition to being an aggressive scavenger, it is also a kleptoparasite on other birds (e.g. ospreys, Boshoff & Palmer 1982; African black oystercatchers, Hockey 1980).

With respect to predation on tortoises, however, of more importance is its well-known habit of breaking open bivalve shells by dropping them on rocks. Siegfried (1977) describes the mussel-dropping behaviour of kelp gulls, and notes that along the west coast of South Africa there are drop sites that must have been used for many generations and in which substantial middens of black mussel shells have accumulated. Large mussels were selected (average approximately 85 mm long, 50 g mass) and dropped from 2–3 m onto hard surfaces until broken.

Dassen Island is the major breeding locality of the kelp gull in southern Africa [2892 nests recorded in October 1979 (Crawford, Cooper & Shelton 1982); 2424 nests, October 1985; 3311 nests, October–November, 1988 (Crawford pers. comm., November 1988)]. No breeding was observed on trips to the Island in June 1979, July 1987, and March 1988 (Crawford pers. comm.). Apps (1986) notes that the 'Eggs of the kelp gull were routinely destroyed in large numbers by Sea Fisheries staff until 1980', but that this has now ceased. It may explain the recent increase in the kelp gull population. During winter the majority of the kelp gulls leave the Island to forage on the mainland, although a small resident population of 50–100 gulls remains.

The absence of shells in November (at the height of the seabird breeding season) indicates little tortoise predation at this time of the year. This is somewhat paradoxical as the greatest predation therefore occurs in autumn–winter, when kelp gull numbers on the Island are lowest. Several factors may account for this:

1. The vegetation cover dies back during the summer drought making the tortoises easier to see and catch in autumn.
2. The resident kelp gulls may switch to tortoises when other food is unavailable. During spring large numbers of cormorants and other seabirds breed on the Island, and at this time the gulls have a ready food supply of eggs and chicks, as well as opportunities for kleptoparasitism.
3. The high density of gulls on the Island during the breeding season in early summer, may lead to increased piracy thus making tortoise predation unrewarding. Siegfried (1977) noted that owing to the loss of prey to piracy by other gulls, mussels are seldom dropped from heights above 3–4 m or if other gulls are closer than 10 m. Although it has not been studied, it is possible that tortoises can only be opened by repeated dropping from heights in excess of 3–4 m (see below).

The absence of very small hatchling tortoises (shells < 34 mm TL) from the middens is probably due to their soft shells; they can be torn apart and eaten whole at the capture site. If the broken tortoise shells collected in April 1987 and absent in November 1988 were dispersed naturally, it is probable that the large number of shells found in April (142) reflects a single season's predation on the tortoises by resident gulls. It is unlikely that the absence of tortoises in the 90–110 mm TL class (Figure 1) is an artifact of collecting. No such dip is present in a similar length frequency distribution plot for angulate tortoise from the Eastern Cape (Branch 1984). It is therefore probable that this depression is a reflection of high juvenile mortality from gull predation on this size class on Dassen Island (Figure 2). Seigfried (1977) concluded that kelp gulls are highly adaptive food generalists, but that individuals tend to specialize in making maximum use of particular foraging techniques. The apparent exploitation of tortoises as a food resource during autumn–winter on Dassen Island is a further indication of the kelp gull's adaptability as a food generalist.

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