# Observations on prey-dropping behaviour by Sooty Gulls *Larus hemprichii* near Sohar, Oman

ABDUL SHAKOOR NOOR ALAM, ALEX ATKINS & JOHN ATKINS

Small numbers of Sooty Gulls *Larus hemprichii* (up to 18 birds/day) were observed prey-dropping at Sallan and Majees, both near Sohar, Oman, on 16 dates January–March 2017, cracking open and consuming bivalves, apparently of the same species, apparently a venerid. Prey items were dropped onto wet sand, never onto rocks or stony ground, from heights varying normally between five–ten m. Birds were seen consuming the contents of the shells they had dropped, but experienced considerable kleptoparasitic competition from other Sooty Gulls which attempted to steal the prey both in the air and once it had landed on the sand. To our knowledge this is the first time Sooty Gulls have been recorded prey-dropping onto sand.

## INTRODUCTION

Prey-dropping behaviour, described in detail by Beck (1982) and Gamble & Cristol (2002), is known in at least 25 species of birds (Fraticelli 2014, Cristol & Switzer 1999). The first evidence of prey-dropping behaviour by Sooty Gulls *Larus hemprichii* was described by Strickland (1973), who recorded turtle hatchlings and shellfish being dropped onto rocks and pebbles from 9–10 m at Masirah island, Oman (Jennings 2010). More recently Fraticelli (2014) described an observation in 2009 of two adults exhibiting prey-dropping behaviour that ended in consumption of food, at Hamata in Egypt. Fraticelli noted that, "The bivalve belongs to the family Verenidae [sic, presumably Veneridae] and has a particularly thick shell and a considerable weight". These characteristics, combined with the presence of rock outcrops, are thought to be the requirements needed for this type of behaviour (Switzer & Cristol 1999). This behaviour is more complex than most foraging behaviours and demonstrates a particular level of cognitive ability (Emery 2006).

Switzer & Cristol (1999) studied height of drop and concluded that this may be influenced by a range of identifiable characteristics of the prey (*eg* breakability, weight) and social environment (*eg* alone or in the presence of kleptoparasites). Their results indicated that quantitative and qualitative differences in item breakability and potential kleptoparasitism should have a significant effect on the height and pattern of prey dropping. Cristol & Switzer (1999) reported that crows dropped nuts with harder shells from greater heights and dropped them from greater heights when over softer substrates. The height selected decreased in the presence of other crows, indicating crows were sensitive to the risk of kleptoparasitism when selecting drop heights. Drop height decreased with repeated drops of the same walnut, suggesting that crows adjusted for the increasing likelihood that a repeatedly dropped nut would break on subsequent drops. Davenport *et al* (2014) studied the likelihood of shell breakage from drops at different heights, and the effect of shell size on breakability. They found that dropping shells from a minimum height that guarantees breakage reduces handling time and reduces the risk of parasitism. Grey *et al* (2005) studied five prey trait variables in bivalves, thickness, length, width, inflation and volume. They concluded that bivalves with thicker shells are more likely to survive predation than those with thinner shells.

## METHODS AND RESULTS (PLATES 2–5)

On 16 occasions January–March 2017 small numbers of Sooty Gulls (mean 4, range 1–8) were observed prey-dropping at Sallan, coastal northern Oman near Sohar, and at nearby Majees. The bivalves they were dropping, apparently all the same species, seem to belong to the Veneridae. All observations were made by the first author, occasionally with Mohammed Javed, and once with John Atkins. Observations were normally in the late

afternoons, occasionally in the early morning, on days when there were low tides. The prey-dropping behaviour occurred at the edge of the sea, at low tide, in an area of beach *c*300 m in length adjacent to Khor Sallan, Sohar. No prey was available during periods of high tide. Prey items were always dropped onto wet sand, from five–ten m high, once from 15 and once from an estimated 20–30 m. Birds were then seen consuming the contents of the shell, though not on all occasions. Birds experienced considerable competition from other Sooty Gulls attempting to steal the prey once it had landed on the sand, but also by harassing a bird with prey while in the air. The last date on which prey-dropping was observed was 25 March 2017. Perhaps the food source was only temporarily available and in a restricted area.

During the observation period of *c*8 weeks, as the sand became exposed at low tides, small numbers of molluscs were washed by the waves onto exposed sand or into shallow water at the edge of the sea. Groups of Sooty Gulls would congregate in relatively close proximity on the shoreline, waiting for bivalves to appear. Gulls (mean 55, range 1–300) were seen to be concentrated in the relatively small area of shoreline where the molluscs were being washed ashore.


**Plate 1.** 'Shell 9' of the sample of 10 collected from the beach at Sallan for shell morphometrics (Table 2).

A bird that found a bivalve would pick it up, fly up and away from the other gulls to a height of 5–10 m, occasionally higher, and drop the shell onto the wet sand at the edge of the sea. Then, once the shell had been cracked, the bird would remove the bivalve, and consume it. However the prey did not seem to be abundant and there was always

**Plate 2.** *Larus hemprichii* taking flight with a bivalve near Sohar, Oman. © *Abdul Shakoor Noor Alam*

**Plate 3.** Individuals that found a bivalve would fly up and away from the other gulls. © *Abdul Shakoor Noor Alam*

**Plate 4** (above)**.** The gulls would typically fly to a height of 5–10 m, occasionally higher, before dropping the bivalve onto the wet sand at the edge of the sea. © *Abdul Shakoor Noor Alam*

**Plate 5** (left)**.** Gulls adopted kleptoparasitic behaviour to take advantage of prey-dropping by others. © *Abdul Shakoor Noor Alam*

competition. Up to three birds might try to steal a prey item, either by harassing the prey-dropping bird, or by diving onto the prey when it landed. In this way, the bird that dropped the prey was often not the one that ended up consuming it. This threat appeared to have influenced the height from which a shell was dropped. The greater the height, the greater the risk of losing the prey to a rival once it struck the wet sand. If no attacker was nearby, the prey was not dropped from a low height and the prey dropper followed the bivalve down slowly and calmly. If there was an attacker, the prey tended to be dropped from a lower height and the prey dropper shot down with high speed to grasp the shell, but even then was not always successful. Birds were normally successful in cracking open the shell with the first drop, but sometimes it needed two or more drops. The maximum number of attempts observed before a shell was cracked open was 5. However on a few occasions a bird was unsuccessful in cracking open a shell and left it on the sand. Lack of success may have been influenced by the nature of the substrate as well as other factors such as breakability, prey weight and competition from kleptoparasites (Switzer & Cristol 1999). The success rate, *ie* how many birds were observed to be successful in cracking the shells and eating the contents, is indicated in Table 1.

Birds were only seen dropping the molluscs onto wet sand, because no rocks or stones were available nearby, and because the wet sand had higher density than the surrounding dry sand, so a shell dropped onto wet sand would encounter more resistance than when landing in dry sand. Each bird would eat the contents of the shell once cracked. After a

**Table 1.** Prey-dropping data.

| Date (2017) | Location | Observations start (local time) | Observation end | Total count of Sooty gulls | Number of gulls successfully dropping and consuming prey | Typical height of gull when prey dropped (m) |
|---|---|---|---|---|---|---|
| 1 Jan | Sallan | 17.00 | 17.35 | 20 | 3 | 5–10 |
| 3 Jan | Sallan | 17.00 | 17.35 | 15 | 3 | 5–10 |
| 4 Jan | Sallan | 17.00 | 18.00 | 26 | 6 | 6–10 |
| 17 Jan | Sallan | 17.00 | 17.35 | 22 | 5 | 5–10 |
| 18 Jan | Sallan | 17.00 | 17.35 | 20 | 5 | 5–10 |
| 29 Jan | Sallan | 17.20 | 17.35 | 1 | 1 | 6 |
| 1 Feb | Sallan | 17.20 | 17.35 | 1 | 1 | 7 |
| 3 Feb | Sallan | 09.30 | 10.45 | 35 | 4 | 5–10 |
| 4 Feb | Sallan | 09.00 | 10.00 | 40 | 5 | 5–10 |
| 12 Feb | Sallan | 17.00 | 18.00 | 75 | 7 | 5–20 |
| 13 Feb | Sallan | 17.10 | 18.05 | 100 | 8 | 5–30 |
| 14 Feb | Sallan | 17.00 | 17.40 | 60 | 18 | 10–15 |
| 15 Feb | Majees | 08.00 | 08.30 | 300 | 2 | 5–6 |
| 19 Feb | Majees | 07.40 | 07.50 | 70 | 1 | 5 |
| 27 Feb | Sallan | 17.30 | 18.00 | 18 | 1 | 6 |
| 25 Mar | Sallan | 09.30 | 09.45 | 70 | 1 | 5–8 |
| 4–10 Mar | Sallan | 17.30 | 18.00 | 10–50 | — | — |
| 12–15 Mar | Sallan | 17.30 | 18.00 | 5–50 | — | — |
| 16 Mar | Majees | 07.35 | 07.45 | 60 | — | — |

**Table 2.** Shell morphometrics of a sample of 10 collected from the beach at Sallan. Plate 1 shows 'Shell 9'.

| Shell | Length (mm) | Width (mm) | Height (mm) | Anterior thickness (mm) | Posterior thickness (mm) |
|---|---|---|---|---|---|
| 1 | 33.3 | 45.7 | 23.5 | 1.01 | 1.65 |
| 2 | 26.6 | 38.7 | 17.7 | 0.53 | 1.87 |
| 3 | 24.3 | 32.5 | 11.6 | 0.84 | 1.34 |
| 4 | 30.0 | 40.0 | 20.4 | — | — |
| 5 | 31.3 | 45.0 | 22.2 | 1.25 | 2.04 |
| 6 | 32.5 | 44.5 | 22.8 | 1.35 | 1.9 |
| 7 | 36.5 | 48.6 | 22.5 | 1.00 | 1.80 |
| 8 | 33.7 | 42.3 | 23.8 | 1.16 | 1.6 |
| 9 | 36.0 | 48.7 | 22.6 | 1.18 | 2.04 |
| 10 | 35.2 | 50.0 | 17.7 | 1.64 | 2.02 |

period during which molluscs were being washed ashore had ended, the beach in this area would be littered with opened bivalve shells from which molluscs had been taken and eaten, as well as a few shells that remained unopened. Only adult birds appeared to be involved in prey-cracking behaviour.

On two dates, 15 and 19 February 2017, prey-dropping activity was observed on the beach at Majees, *c*5 km away from the main site. On the first occasion there were *c*300–400 Sooty Gulls in an area of beach *c*800 m in length, but the number of gulls engaged in shell dropping was only 3–4. On the second occasion there were *c*70 Sooty Gulls in the same area, but the number of gulls engaged in shell dropping was only 2–3.This low level

of activity may be attributed to a lower availability of fresh bivalves. Again, they were observed dropping the prey onto wet sand.

All shells appeared to be of the same species, apparently of family Veneridae, presumably one of the reasons being that the shells of this particular species were relatively thin and could be more easily cracked. Since the behaviour was only noticed in January, February and March 2017, it appears that these shells are only periodically washed ashore, presumably by tidal movements. The author had been observing the same beach for more than three years, but no such prey-dropping behaviour had been observed there or anywhere else in the Sohar area before.

Morphometric data were obtained from a sample of these shells collected from the beach at Sallan. Measurements (Table 2, Plate 1) were made using a micrometer and Vernier caliper by following the procedure outlined by Smith & Jennings (2000) who measured prey shells for shell length, shell width and shell height using digital calipers. Dimensions were obtained to an accuracy of 0.01 mm. The average shell thickness (anterior 1.1 mm, posterior 1.8 mm) suggests that the shells used by the gulls are relatively thin. This characteristic is likely to be a factor that limits its ability to survive predation, which supports the previous findings by Grey *et al* (2006) that bivalves with thicker shells are more likely to survive predation than those with thinner shells.

## DISCUSSION

This is the first extended study of shell-dropping behaviour by Sooty Gulls. The observations further disprove the assumption that prey needs to be dropped onto rocks, since the species of shell concerned could be cracked open after impact on wet sand. The observations are also interesting because they show that Sooty Gulls adopt kleptoparasitic behaviour to take advantage of prey-dropping by others. The collection of data on a daily basis was restricted by time constraints.

The observations appear to support the conclusion of Switzer & Cristol (1999) that differences in item breakability and potential kleptoparasitism have a significant effect on the height and pattern of prey dropping. There was some evidence that drop heights decreased with repeated drops (Cristol & Switzer 1999) and to avoid kleptoparasitism (Davenport *et al* 2014). All the prey items were from a thin-shelled mollusk species, supporting the view of Grey *et al* (2006) that thinner shelled species are less likely to survive predation.

A longer term study of birds along the shoreline would be desirable to determine whether the prey-dropping behavior is being learnt over time. The rate of success in consuming prey needs to be further investigated, as well as the percentage of prey lost to competition.

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*Abdulshakoor Noor Alam, International Maritime College, Sohar, Sultanate of Oman. abdulshakoor@imco.edu.om*
*Alex Atkins, Percy Fitzpatrick Inst Afr Ornithol, Rondebosch, Cape Town, South Africa. alex.zander.atkins@gmail.com*
*John Atkins, International Maritime College, Sohar, Sultanate of Oman. pmleeds@hotmail.com*