

## Broken *Littorina littorea* shells: predation by birds?

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*Littorina littorea* shells found broken on a cycle-track next to where they lived, are thought to be broken by shell-dropping birds. Shells broken experimentally by dropping them from 6 m height on a concrete floor showed very similar damage: a hole in the last whorl, whereas the aperture rim remained intact. Examples from the literature indicate this shell damage to be characteristic for shell-dropping by birds. We suspect carrion crows as the culprit, but field observations have to prove this.

Key words: Gastropoda, *Littorina*, birds, predators, shell-dropping.

### INTRODUCTION

Some broken shells of the periwinkle *Littorina littorea* (L., 1758) were found on the cycle-track next to the Canal through Zuid Beveland (province of Zeeland, The Netherlands) (fig. 1). How did they arrive on the road, on land next to where they live, and how were they broken?

### RESULTS

Although one needs to see the culprit to be quite sure, the most probable solution is that birds dropped the periwinkles on the road to crush them. To test whether *L. littorea* specimens are easily broken by shell dropping the first author dropped 6 living specimens collected on Texel from about 6 m height on a concrete floor at his home as he did earlier with Pacific oysters (Cadée, 2001). Four of the shells were broken during the first trial, the other two were broken with the second trial. In five of the six a hole was made in the last whorl, whereas the shell opening remained intact (fig. 2). This compares well with the specimens found in Zeeland reported here (fig. 1), as well as with those broken by birds (gulls or hooded crows) on the rocky shore of the Island of Mull, Scotland (fig. 3). Also other gastropod shells dropped by hooded crows (whelks *Buccinum undatum* L., 1758, and dogwhelks *Nucella lapillus* [L., 1758]) showed a comparable damage of a hole in the last whorl, whereas the aperture rim remained intact (Cadée, 2006).

### DISCUSSION

Avian prey dropping is already known for a long time and well reviewed (Cristol &



Fig. 1 Three broken *Littorina littorea* shells found on a cycle-track in Zuid Beveland

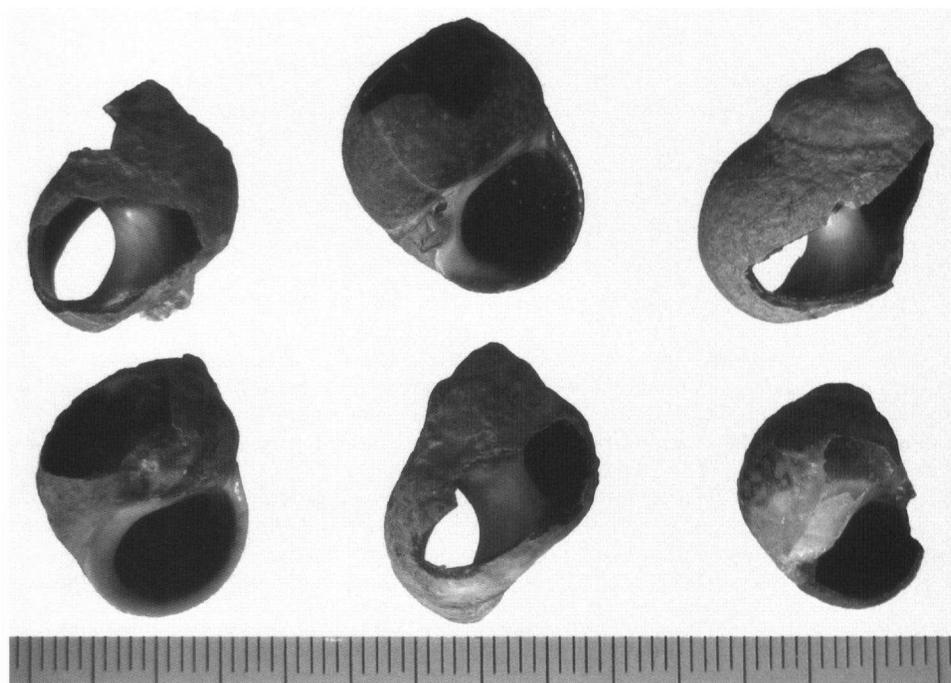


Fig. 2 Experimentally broken *Littorina littorea* shells by dropping them from 6m on a concrete floor.



Fig. 3 Broken *Littorina littorea* shells found along the rocky coast of the Island of Mull, Scotland, broken by shell-dropping birds (diameter of coin 2 cm, picture made by Niels Cadée).

Switzer, 1999; Switzer & Cristol, 1999; Lebeuvre et al., 2002). In the Netherlands such shell dropping is now mainly performed by Herring gulls (Cadée, 1995, 2001 and references therein). However, crows also know the trick. Hooded crows (*Corvus corone cornix*) have become rare in our country, but may be observed dropping shells along the coast in Norway, Ireland and the U.K (Berrow, 1991; Berrow et al. 1991, 1992; Cadée, 2006). Broken *L. littorea* shells can there be found regularly along rocky coasts (see fig. 2). In former years hooded crows were still frequent in winter in the Netherlands. Tinbergen (1950) reports on shell dropping hooded crows in 1917 in the province of Zeeland, and Hulscher (in Hulscher & Driessen, 2005) remembers having seen them some fifty years ago shell dropping on the Frisian Island Schiermonnikoog. This habit seems to be taken over in the Netherlands now by carrion crows (*Corvus corone corone*). In recent years I observed carrion crows dropping shells along the Wadden Sea on the Island of Texel (Cadée, 2006, 2007 a,b), which I had not seen them doing here earlier. Hulscher & Driessen (2005) observed once a carrion crow dropping a freshwater mussel *Anodonta* sp. Earlier records of this behaviour were published by Whitely et al. (1990), who studied the strategies of shell dropping in carrion crows and Coombs (1978), who reported dropping shellfish on rocks both for hooded and carrion crows.

Zach (1978) studied 90 freshly broken shells of the whelk *Thais lamellosa* (Gmelin, 1791) dropped by northwestern crows (*Corvus caurinus*) in Mandarte Island (British Columbia, Canada) and observed a hole in one whorl or including the next one in 24% of the shells, the majority (76%) had the spire broken off. He suggests that the holes are

formed first and that crows continue dropping till the spire is broken off, to enable the crows to extract the entire animal. Also in his broken whelks the aperture rim remained intact. This may be significant in distinguishing shells broken by shell-dropping birds from those broken in different ways, either by other predators or physical factors. Crabs e.g. often start crushing gastropod shells at the aperture rim (Vermeij, 1987; Cadée et al., 1997).

### CONCLUSION

In conclusion, we think, that the periwinkles were dropped by birds, most probably carrion crows, to enable them to eat the animals. However, only the observation of crows in the act of dropping periwinkles will give the conclusive answer. The intact aperture rim seems characteristic for gastropod shells crushed by shell-dropping birds.

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