Belichnus. Note for Ichnos revised version 3 July 2012

**_Belichnus_ traces produced on shells of the bivalve _Lutraria lutraria_ by gulls.**

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ABSTRACT

February 2011, after a storm, thousands of adult, articulated and still living common otter shells *Lutraria lutraria* (L. 1758) stranded on the North Sea beach of the Island Texel (NL). These 9 to 12 cm long bivalves were rapidly found and consumed by both herring- and lesser black-backed gulls. Holes, irregular in outline, were observed in some 10% of the articulated shells of these bivalves. These holes were always smaller on the outside of the valves than on the inside and varied in size from 1 to 20 mm (outside) to 4 to 22 mm (inside). Often the other valve was crushed indicating consumption by gulls. We conclude that these holes were made by the gulls probing the shells: in a few cases we observed that valves were broken starting from such a hole. Such traces are described in the literature as the ichnogenus *Belichnus* and were up till now attributed to Stomatopoda only. We also suggest not to use a separate ichnospecies name for two *Belichnus* holes in one shell, we see them simply as a double injury due to two blows. Our findings stress once more the importance of avoiding premature phylogenetic interpretation of traces, and the use of a separate ichnotaxonomy.

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INTRODUCTION

Bromley (1981) offered good reasons to use a double system in trace fossil classification using ichnotaxon names to describe morphology and structure of traces, whereas the biological taxon represents the interpreted phylogenetic position of the causative organism. The ichnogenus *Belichnus* was proposed by Pether (1995) to describe a ballistic trace (traces of pointed impacts) on molluscan shells. As makers of these traces shell smashing Stomatopoda (mantis shrimps) are mentioned in both Recent and fossil molluscan shells (Geary et al., 1991; Kohn, 1992; Baluk and Radwanski, 1996). They use their enlarged raptorial claws to punch holes in the skeleton of their prey (see also Caldwell and Dingle, 1976). On YouTube are several interesting movies where you can see (and hear!) mantis shrimps cracking bivalves.

Here we report on gulls, which made holes, exactly like *Belichnus* traces, in shells of the bivalve *Lutraria lutratria* stranded alive on a Dutch beach. The otter shell *Lutraria lutraria* (L. 1758) has become common in Dutch coastal waters in the last decades. Van Benthem Jutting (1943) reported only (sub)fossil valves from the Dutch coast and no living specimens. Now they are regularly reported alive and form a new addition to the food available for gulls. During our regular visits to the coast of the Island Texel (The Netherlands), we did observe an increase in numbers of fresh, articulated *Lutraria* shells in the last decade (e.g. Cadée et al. 2006). After a storm in February 2011, these 9 to 12 cm long bivalves stranded in such large numbers alive on the North Sea beach of the island of Texel (Fig. 1) to make front page news in the local newspaper (Texelse Courant of 11 February 2011). They were rapidly detected by the gulls as food.

MATERIAL AND METHODS

Early February 2011, thousands still living bivalves of the species *Lutraria lutraria* stranded on the North Sea beach of Texel after a storm . These bivalves live in near shore waters and were apparently dislodged and transported during the storm (Fig. 1). They were rapidly dying on the beach and a welcome food for the herring- and lesser black-backed gulls feeding here as observed by biologists from Ecomare on Texel Arthur Oosterbaan en Pierre Bonnet (pers. comm. September 2011). Herring gulls usually fragment large mollusks by dropping them from the air. Those not too thick they can open by blows with their beak (Cadée, 1995). Later in February, we collected all empty *Lutraria* shells on a

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stretch of 1 km of the beach of Texel after the gulls had consumed them. We observed not only entire and fragmented *Lutraria* valves, but also valves with interesting irregular holes punched in them. We counted the entire valves showing such punched holes. At home the maximum diameter of these holes was measured with vernier callipers to the nearest 0.1 mm, both on in- and outside of the valves. We also made some holes in valves with hammer and nail, to study whether the holes were made from the inside or outside of the valves.

## RESULTS

In total we collected 296 valves (some with still adhering fragments of the other broken valve) and observed holes in 37 (12.5%) of these valves. The holes were irregular in form and variable in size (Fig. 2). We measured the largest diameter of these holes on both sides of the valves. The holes were always smaller on the outside of the valves than on the inside (Fig. 3).

Gulls consume *Lutraria* by breaking one (or both) of the valves. In a few cases we observed that a valve started fracturing from a hole in the shell (Fig. 4). We suggest that the holes in the shells are due to gulls probing the bivalves with their beak. The fact that the holes are smaller on the outside of the shell than on the inside indicates that they were made from the outside, as we showed also experimentally. To prove that herring gulls can make such holes with their beak, holes were made in the shells with nail and hammer. They had the same form: a small hole on the outer side of the shell widening on the inner side. Making a hole with hammer and nail on the inside of the shell had the opposite effect; the hole on the inside was smaller than that at the outside. This indicates the holes were made from the outside of the shells (Fig. 5). This also shows that gulls breaking one valve of an articulated *Lutraria* do not reach and damage with their blows the inner side of the opposite valve.

Probing marks by birds are frequently observed on other objects stranded on the Dutch beach such as cuttlebones of *Sepia officinalis* and various plastic objects (Cadée, 2002).

## DISCUSSION

Our observations indicate once more that one type of traces can be produced by quite different organisms, but also that one kind of predator on shells preys in different manners on a single prey type. Herring gulls ingest small (< 3 cm long) bivalves and crush them in their gizzard. They produce thereby relatively coarse shell fragments in regurgitated pellets and finer fragment in their faeces (Cadée, 1995). Larger and stronger mollusks (*Crassostrea gigas, Mytilus edulis*) they crush by dropping, producing thereby larger fragments (e.g. Cadée, 1995, 2001; Stempien, 2007); or by hammering them open on the shore as we observed now with *Lutraria* and also with *Ensis directus* on Texel (Cadée, 2000) The *Belichnus* traces reported here are predation traces made by herring gulls, not earlier reported on.

Pether (1995) introduced the ichnotaxon *Belichnus* for traces on shells made by mantis shrimps. Mantis shrimps cannot have made the holes in our *Lutraria* shells. Probably all *Lutraria* arrived alive on the coast of Texel (Fig.1), without holes in the valves. Stomatopoda live subtidal, not in the intertidal area of beaches. Shell smashing Stomatopoda are not reported from the North Sea. Most observations of stomatopoda in Dutch coastal waters refer to larvae in the water column, partly produced outside this area (Verwey, 1966). Moreover, they belong to the soft-prey spearing species *Squilla desmaresti* and *Heterosquilla eusebia*. The only record of a benthic adult *Squilla desmaresti* in our near coastal water (Brown Bank, some 50 km offshore) is more than 100 years old (Van Breemen, 1905). Marine biologist of the Royal Netherlands Institute for Sea Research (NIOZ), currently studying benthos in the Dutch part of the North Sea, have never observed adult stomatopods in their samples (Magda Bergman, Rogier Daan and Maarten Mulder, pers. comm. September 2011).

The *Belichnus* traces produced by gulls cannot be distinguished from those reported to be made by stomatopods. These also have a larger diameter on the inside than on the outside of the shells (see in particular pictures by Pether, 1995). They also show a similar large range in size: Pether (1995) gives a range of 0.2 - 3.5 mm for the diameter on the outside of the shells of *Tellina* and figures a hole

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of 11 mm diameter in a *Lucinoma* valve. Baluk & Radwanski (1996) give a large set of natural size pictures of gastropods with *Belichnus* holes from which a range of 1 – 18 mm hole diameter can be measured.

Pether (1995) suggested to use two ichnospecies names *Belichnus monos* for a single hole, *B. dusos* for two together. We suggest that two holes in our *Lutraria* valves were due to two successive blows by a gulls beak. This makes a different ichnospecies name for two holes together in valves unnecessary. Also in Pether's valves we suggest that the two holes might be made by two successive blows by a stomatopod. Pether (1995) suggests that the two holes were made by the two frontal spines of the raptorial appendages of a spearing stomatopod. However, they use their 'spears' to collect soft-bodied prey such as fish. We suggest that holes in shells are made by stomatopods called 'smashers', which have blunt raptorial appendages (see excellent pictures in Caldwell and Dingle, 1976).

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