

preferred woodland habitat is disappearing, it appears that some human activities might favor the new species, which is often found in road verges. The tracking of butterfly species is a favorite activity of naturalists throughout the world, with the group, Butterfly Conservation, having 10 000 members in Europe alone (<http://www.butterfly-conservation.org>). The happy excitement that greeted the discovery of a new butterfly in the UK reminds us that there sometimes appears to be 'good biodiversity' and 'not so good biodiversity.' One has to wonder whether, if it had been a new mosquito rather than a butterfly that had been discovered, we would not instead be telling horror stories about invasive species... PK

## Dutch Wadden Sea might not be doing so well

The Wadden Sea of The Netherlands, a country that prides itself on its environmental policy, is one of the world's most frequently visited wetlands, and is also among Europe's highest priority conservation sites. Unfortunately, recent reports suggest that cockle dredging might be altering this sea in irreversible ways, with severely impaired bivalve recruitment (*J. Appl. Ecol.* 38, 976–990). Other signs of ecosystem degradation include the death of at least 20 000 eider ducks in the winter of 2000, declines in oystercatchers, and increases in some aromatic hydrocarbons (<http://www.interwad.nl>). This extraordinarily valuable ecosystem is visited on foot by >75 000 people each year, and is meant to be under the protection of the Dutch Government. Several ecologists, however, feel that the Government has been remiss in its policy, because it is unwilling to take necessary actions, such as restricting cockle dredging, without incontrovertible proof that dredging is causing serious harm. Thus, instead of being precautionary in its protection of this remarkable wetland, the Government is being precautionary about protecting an important fishery. This is an old story, but one that nevertheless deserves the attention of ecologists and conservation biologists. PK

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Letter

## Penis-biting slugs: wild claims and confusions

The occasional habit in hermaphroditic banana slugs *Ariolimax* of biting off their partner's penis after copulation (apophally) seems to catch biologists' imaginations (Fig. 1). Unfortunately, their imaginations can go beyond the facts. Thus, in a recent book review in *TREE*, Steve Jones [1] mentioned that slugs bite off their own penises and insert them into their own female aperture to avoid alien sperm. Earlier, he claimed that the severed penis was left in the partner to act as a mating plug [2]. In fact, the everted penises are inserted reciprocally or unilaterally into the other's female tract, but published accounts describe slugs trying hard to retract their penis before one or both partners resort to biting [3]. The female reproductive tract has a special muscle that appears suited to gripping the penis [4], and the severed penises are eaten by the recipient (J.L. Leonard, pers. commun.). So, if getting stuck is an adaptation, it would seem to serve the recipient rather than the amputee, either as a nutrient source, or by preventing the amputee from mating for the period during which sperm competition is a risk, or at least from mating as a male, which could divert resources from egg production.

This is what Birkhead [5] proposed, but he confounded apophally in banana slugs, whose sperm exchange is internal, with the external sperm exchange between intertwined penises in certain other slug genera. *Deroceras laeve* is a species with external sperm transfer in which some individuals lack a penis. In such species, because the penis is needed for sperm receipt, it seems likely that aphillics can reproduce only uniparentally. So, it is misleading that some authors call aphillics of *D. laeve* female [6] and make the blanket assumption that aphillics of all species have the option to mate as females [7,8] (this is possible in some species with phally polymorphisms). This relates to apophally, because the only reported example other than the banana slugs is *D. laeve*: an intriguing but overlooked paper describes how, after copulation, some individuals bite off their own penis, which is then eaten



Fig. 1. Penis biting in slugs. After a double penetration mating, two banana slugs *Ariolimax dollichophallus* are taking turns gnawing off the one stuck penis. Reproduced, with permission, from Dan and Alice Harper.

by their partner [9]. The paper further suggests that this is the origin of aphillics in this species. However, in other populations of *D. laeve* studied, the aphillic individuals have never grown a penis (V. Barth and H. Reise, pers. obs.), and it looks possible that a congener was misidentified as *D. laeve*. †

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