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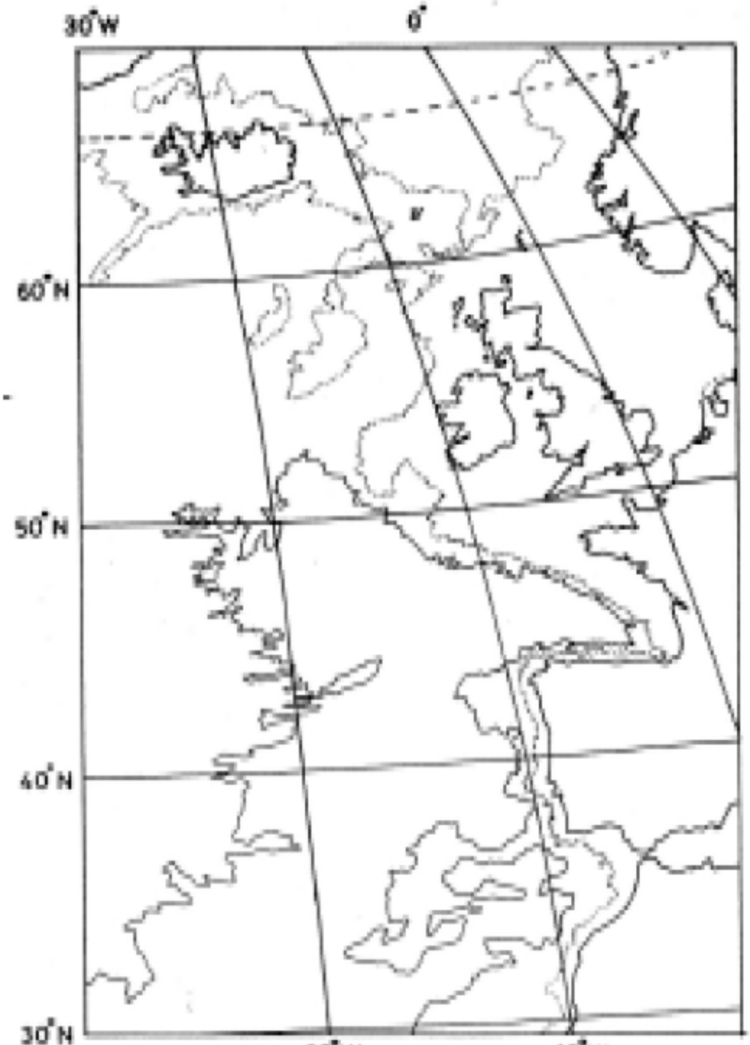

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CREATURE FEATURE

Notes on the natural history of the sea-slug, *Aeolidia papillosa* (Linnaeus, 1761)

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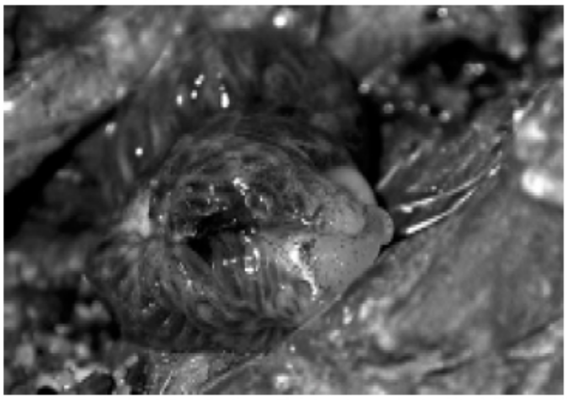


Classification:

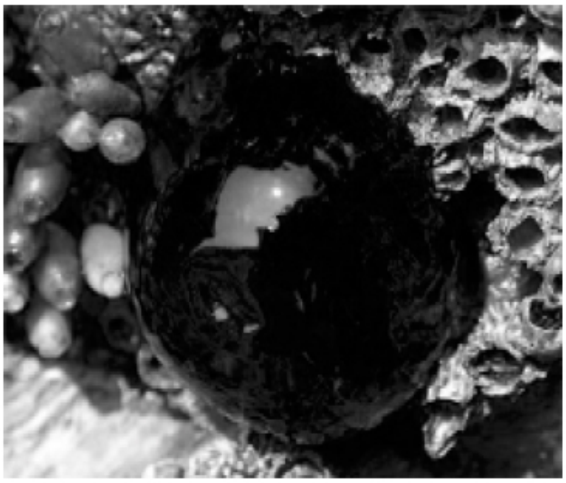
Phylum	Mollusca
Class	Gastropoda
Subclass	Opisthobranchia
Order	Nudibranchia
Family	Aeolidiidae
Genus	*Aeolidia*
Species	*papillosa*

Aeolidia papillosa (Linnaeus, 1761), or the common grey sea-slug, is found on shores and in shallow water all around the UK. The animal pictured was at around the mid-shore level having been uncovered by the ebbing tide on the north coast of Cornwall on a sunny day in February 2003. As the colouration indicates the common grey sea-slug may not be grey at all and identification guides note a range of possible colour types from white to purple-brown.

Distribution:

The common grey sea-slug has a wide geographic distribution globally, occurring on most north temperate shores. It is the largest member of the aeolid family (aeolidiidae) we have and can grow up to 120mm in length, though this is the exception rather than the rule. Despite the fact that it is large, widespread and common I rarely encounter this beast on my trips to the north coast. But then *Aeolidia papillosa* is a predator, with a position higher up the food chain and therefore its abundance is inevitably less dramatic than those animals which dominate this exposed coast. It is thought to live for about one year.

Caught out of water the slug appears thoroughly unimposing. The real drama does not begin until the flood tide once again covers the shore beneath a cloak of seawater…



Food:

Aeolidia papillosa feeds on sea anemones showing a clear preference for beadlets, especially *Actinia equina*, the radially beautiful and deep-red anemones that pepper the shores of north Cornwall. *Aeolidia* will also feed on other anemones such as the strawberry anemone, *Actinia fragacea*, the snakelocks anemone *Anemonia viridis*, the Dahlia anemone *Urticina felina* and *Sagartia elegans*, though it is much less partial to these last two. Unless otherwise stated the description which follows is based on an encounter of *Aeolidia* with *Actinia equina*, its favoured prey in UK waters.

Hunting:

Aeolidia papillosa has a chemosensory ability and it uses this to hunt out its prey. Using specialised sense organs such as the dorsally prominent paired rhinophores ('rhino' is Greek for 'nose') and the oral tentacles each side of its mouth, as well as other chemo-receptors, also on its head, it will seek to get a lock onto the scent of its prey and then swivel towards it. Even weak trails can be followed as this sea-slug is skilled at detecting small increases in chemical concentrations and tracking up these invisible gradients to the source. When it finds a tell-tale trace it will swing its raised head from side-to-side, rhinophores quivering forwards and upwards, oral tentacles stretched out laterally and also searching forwards. The thread of a scent detected, *Aeolidia* begins to move rapidly towards the source.

First contact:

Its out-stretched oral tentacles may well be the first to touch the anemone. The sea-slugs reaction is too move its head back, contract the oral tentacles, whilst defensively pivoting the finger-like 'cerata', which cover its back, up and forward in the frontal region. At the same time the sensitive rhinophores are shortened and bent back and downwards to lie protected amongst the cerata. It is likely to have been stung in this brief engagement, especially if the oral tentacles happened to touch the anemones own tentacles rather than its stout column. Both of these areas on the anemone house some of the specialised stinging cells or nematocysts with which it defends itself, but they are more numerous in the tentacles. Meanwhile the anemone swings these tentacles in and back onto the oral disc.

Unperturbed the hunter re-extends its head, oral tentacles, and out through its mouth shunts a proboscis tipped with a set of jaws. This eversion heralds the imminent start of feeding. For a short while the oral tentacles and proboscis slide over the column, perhaps seeking for a suitable place for the first bite.

Actinia bends in the column where it has been touched so that the top bows over towards the aeolid.

Defence:

The sea-slug's primary defence against the stings from the anemones nematocyst cells is mucus. It secretes a thick and sticky sheath of mucus, particularly centred around the head area. The mucus is an effective barrier, into which nematocysts may discharge harmlessly, flecking this colloidal screen with little patches of lightning white in the process. This is especially useful in attacks on *Anemonia viridis,* which does not cease in its attempt to sting the attacker with its tentacles.

Remarkably *Aeolidia papillosa* can ingest the sting-cells, or nematocysts, of anemones and then transfer these to the tips of the finger-like processes, or cerata, along its back, using them in its own defence.

This gives a clue to understanding the scientific name, *Aeolidia papillosa*, for this sea-slug. In Latin 'Aeolus' means changeable (according to Homer, Aeolus was god of the winds, hence also, perhaps, the saying, 'as changeable as the wind') and *papillosa* is a nipple or teat.

Feeding:

Aeolidia maintains contact with the column of *Actinia* and the open jaws try to bite onto a part of it. It's not entirely clear if the jaws cut or rasp off tissue but when they succeed the abrasion on the column is clear.

Not surprisingly the anemone's reaction to being bitten is more dramatic than at first contact. The tentacles are violently withdrawn back onto the oral disc and covered by the closing of a sphincter. The column shortens as the anemone seeks to withdraw the area bitten from contact with the aeolid. In this semi-protective 'beadlet' state the pedal disc also begins to withdraw away from the sea-slug. This action is often followed by the anemones gradual movement away from its attacker on small waves of contraction that ripple slowly across the pedal disc.

Bites are taken at 10-20 second intervals but as feeding continues *Aeolidia* will pause for several minutes and these pauses increase in duration and may last up to several hours. If the anemone doesn't escape then *Aeolidia* feeds until satiated. Within the mouth a chitonous cuticle protects many aeolids from being stung there.

Aeolidia can move up to 100 times faster than *Actinia* but because of the increasingly long pauses it takes during feeding the *Actinia*'s attempt to escape is not as futile as it appears. Unfortunately a damaged anemone is more easily tracked.

Moving also benefits the anemone in another way and perhaps, in terms of its evolution, this is an additional reason why locomotion is favoured in *Actinia equina*. In order to move, the anemone uses its hydrostatic skeleton, inflating itself in the process. This inflation makes it harder, in a very physical, practical sense, for the attacking *Aeolidia* to bite the anemone. When an attack stops the anemone may keep moving for several hours.

If, despite its attempts to escape, the attack continues for a long time the anemone will, as a last ditch effort to evade being further consumed (!), detach itself from the substrate under-foot. This is a drastic measure because once detached it may be swept into wholly unsuitable habitat and thus die anyway. However, once left alone a detached anemone can re-attach in 10 minutes.

Reproduction:

Sea-slugs are hermaphrodites and *Aeolidia papillosa* is no exception. Although hermaphrodites can self-fertilise this is rare in nudibranchs and most will copulate. During the reproductive period *A. papillosa* continues to direct a lot of energy to somatic growth. This may be in part because a larger body size makes it easier to prey on the available food items. Spawning adults survived until mid-July when mean water temperatures were 14.3 C°. The larvae are planktotrophic free-swimming veligers. Life in the plankton is very hazardous and mortality is high in this phase of development and dispersal. The warmer the conditions the faster the development process. By spawning during a period of increasing water temperatures *Aeolidia* decreases the time its offspring will have to spend in the plankton. To ensure successful spawning *A. papillosa* will undergo 'de-growth', using the breakdown products from this autolysis (in Greek, 'lysis' means loosening) to support reproduction. The onset of death may therefore be precipitated not least by the action of spawning.

Curiosity:

On the Canadian pacific coast *Aeolidia papillosa* feeds preferentially on *Anthopleura elegantissima*, an anemone that is not found on our own shores. *Anthopleura elegantissima* has a symbiotic relationship with two types of algae that live within its tissues. The algae photosynthesize in this protected and stable environment and the anemone receives some of the products generated by these tiny plants. The two types of algae present are collectively known as zooxanthellae and zoochlorellae. The latter is a unicellular green algae and the former are diatoms of the genus *Symbiodinium*.

When *Aeolidia* consumes *Anthopleura* the ingested algae are not digested but transferred to the sea-slugs finger-like 'cerata'. In this new environment the algae continue to live and photosynthesize to the benefit of their new host though at no time are *Aeolidia* dependent on the symbionts that they briefly house. Indeed the aeolid is unable to control these temporary tenants, by either expulsion or retention, even in starvation conditions. However by feeding frequently on *Anthopleura* the population of symbionts in the cerata can at least be maintained. There is no discernable impact on the algae during this passage from one host to another and out again. It should be noted that the zoochlorellae may behave parasitically in low light conditions and could therefore be detrimental to the host during winter.

The snakelocks anemone, *Anemonia viridis*, in our waters is also home to algae of the genus *Symbiodinium*. As *Aeolidia papillosa* can feed on *Anemonia viridis* in our own waters does it develop a similarly symbiotic relationship with the algae as a consequence of this?

References:

The following references were consulted in the production of much of the above material, though any mistakes, musings and misapprehensions are (as ever!) entirely my own. The key paper was Edmunds *et al* (1976).

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The Farne Islands Marine Life Log, 2003

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Introduction

The Farne Islands, off the Northumberland coast (Figure 1), have been owned by the National Trust since 1925. The islands are managed by the Trust primarily to protect their internationally renowned seabird and grey seal colonies. However, in recognition of the fact that these important populations are dependent on the health of the sea around them, the 'Farne Islands Marine Monitoring' programme was established in 1996 in an attempt to provide an understanding of the state of the local marine environment and the extent to which it is being used, both commercially and for recreational purposes (Foster-Smith & Foster- Smith, 1996). The marine monitoring programme now forms part of the Farne Islands Management Plan (Walton, 2000). Much of the data for the monitoring programme has been collected by the Farnes' seasonal wardens (usually 9 in number), who reside on the islands between March and December each year. Apart from dealing with visitors to the islands, the wardens' work is primarily concerned with maintaining the seabird and seal colonies and, not surprisingly, they are selected for the post on the basis of their interest in these groups. However, since the establishment of the

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