



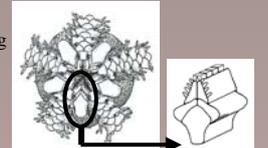
Dental insights into ophiuroids: Feeding mechanisms and life style



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Ophiuroid echinoderms are highly specific towards different habitats reflecting lifestyles and feeding mechanisms. Previous studies have considered ophiuroids to be generally omnivorous macro- or microphagous feeders. According to their lifestyle, however, different feeding mechanisms may have evolved e.g. deposit feeding, filter feeding or predation. Most ophiuroids typically show more than one feeding mechanism along with their main feeding mode. In the present study, the morphology of teeth and associated papillae on individual jaw elements (see figure right) from ophiuroids performing different lifestyles (epibenthic, infaunal or epibenthic-cryptic) are compared and discussed in relation to reported feeding mechanisms and diets (for explanation on teeth and papillae see numbers in the pictures and adjacent text sections).



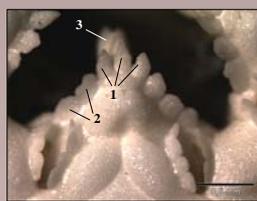
Schematic overview of the 'mouth' side of an ophiuroid (from Hayward and Ryland, 1996) and a single jaw element.

MACROPHAGEOUS

The epibenthic: predators, scavengers and deposit



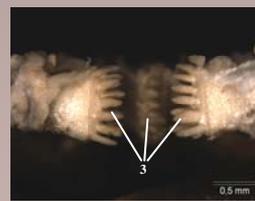
Epibenthic lifestyle of *Ophiura albida* Forbes, 1839; Photo by Encyclopedia of Marine Life of Britain and Ireland



Top view of one jaw element in *Ophiura albida*.



Oblique view on the mouth in *Ophiura albida*.



Lateral view of jaws with teeth in *Ophiura albida*.

Ophiura albida has three conical infradental papillae¹ and two or three broadened oral papillae² located along the lateral sides of the jaw plates. Long and strongly pointed sharp teeth³ are found down the vertical jaw edges.

MICROPHAGEOUS

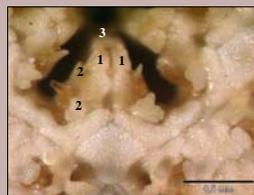
a) The infaunal: surface and sub-surface deposit feeders, filter feeder, suspension



Filter feeding posture of infaunal living *Amphiura filiformis*. Photo by R.Rosenberg.



Top view of jaw element with teeth in *Amphiura filiformis* (Müller, 1776).



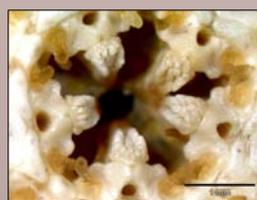
Top view of jaw element with teeth in *Acrocnida brachiata* (Montagu, 1804).

Amphiura filiformis and *Acrocnida brachiata* both have a pair of slightly rounded infradental papillae¹, as well as two pairs of long and pointy (*A. filiformis*) or one pointy pair and one leaf like (*A. brachiata*) pair of oral papillae² along the sides of the jaw plates. The teeth³ along the vertical jaw edges are broad, almost square and flattened on the surface.

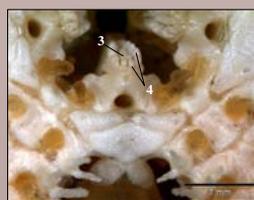
b) The epibenthic-cryptic: filter feeder and suspension feeder



Epibenthic cryptic lifestyle of *Ophiothrix fragilis* (Abildgaard, 1789). Photo by Encyclopedia of Marine Life of Britain and Ireland.



Top view on the mouth of *Ophiothrix fragilis*.



Top view of jaw element with teeth in *Ophiothrix fragilis*.

In *O. fragilis* no oral or infradental papillae are present along the lateral jaw sides. A row of short and flat teeth³ located along the vertical jaw edges is surrounded by numerous dental papillae⁴, which are slightly longer than the teeth and have tapered tops. The front row of the dental papillae is shorter than the rest, seemingly representing infradentals.

Macrophagous epibenthic ophiuroids

Most representatives of the genus *Ophiura* live on different soft bottom sediments. They have been characterised to chiefly predate on epibenthic or infaunal organisms and to scavenge. Hunted or encountered prey is mostly gripped in arm slings or dug out of the sediment. Jaws, heavily armoured with strong and pointy teeth may be used in gripping or tearing flesh of captured prey. Interestingly, reports have designated *Ophiura* spp. to feed as surface and subsurface deposit feeders as well. In fact, stomach content analyses of *O. albida* revealed comparably high amounts of sediment (> 75%) in comparison to remains of small benthic organisms. Dabbing their tube-feet over the sediment surface looking for food particles may contribute to the active intake of sedimental particles. However, due to their predaceous dental equipment, the reported high amounts of deposit material are more likely the result of burrowing while searching for food and predated on infaunal organisms.

Microphagous infaunal ophiuroids

Infaunal lifestyles, e.g. as in *A. filiformis* or *A. brachiata*, typically reveal a rather stationary feeding mode, making active hunting for prey or scavenging unlikely, although this has been reported a probable feeding habit. In fact, *A. filiformis* has been designated to feed predominately as podial suspension feeder. By protracting three arms out of its burrow it can filter particles out of the water column or dab them up from the sediment surface. Grinding teeth for processing smaller organisms or deposit material, as opposed to raptorial instruments, best reflect the species' microphagous feeding habits, and make predation or scavenging an unlikely feeding mode.

Microphagous epibenthic- cryptic ophiuroids

Similar results to its infaunal relatives were found for *O. fragilis*, a rheophilic epibenthic suspension feeder. Yet, both grinding and carnassial teeth were found in *O. fragilis*. These may enable the animal to process larger particles or prey organisms by crushing or cutting them. This intermediate type of dental morphology between its epibenthic and infaunal living relatives presented here, confirms predation and scavenging, reported as a probable feeding mode in the cryptic *O. fragilis*, likely to occur.