Part 11
Friend or Foe
The Echinoderms Part 2

TRISTAN LOUGHER B.Sc. graduated from Manchester University in 1992 with a degree in Zoology. He has worked at **Cheshire Waterlife** for five years.

We began to look at the Echinoderms in the last issue of *Marine World*, concentrating on two of the Classes within this group that are referred to as "starfish" the Asteroidea and the Ophiuroidea (true starfish and brittle starfish). Of the remaining three Classes the aquarist is likely to experience only two of them, and these will be focused upon here.

Class Echinoidea

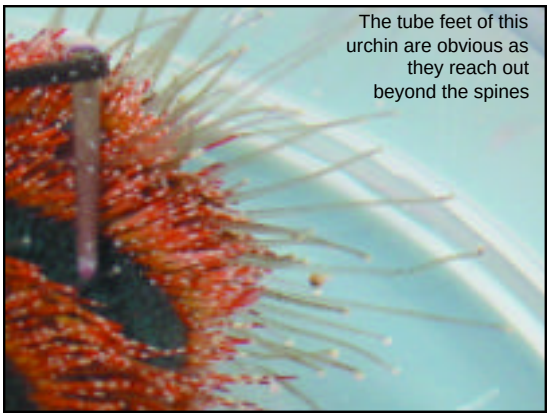
One of the most unmistakable groups of marine invertebrates the echinoids, or sea urchins, are a very successful group numbering some 900 described species which have colonised all of the worlds oceans from shallow waters to several miles depth. The typical body plan is that of a hard exterior, usually spherical or ovoid, often covered in spines, which protects the soft internal organs of the animal. Despite the fact that most of the individuals of this echinoderm class experienced by the aquarist will follow this loose body plan it is worth mentioning some departures from this.

In U.K. coastal areas dominated by sandy beaches we can locate the aptly named "sea potato" (*Echinocardium caudatum*). This yellowish urchin lives life completely buried in sand, sometimes to a depth of several feet. That this species is present is sometimes only obvious to the casual observer, as beaches will often have their exoskeletons or tests washed up on them. Many visitors to Florida will be aware of the sand dollar test, which is often seen for sale in souvenir shops. This is another sand dwelling Echinoid, which is specialised for an existence on top of sandy substrates (see Figure 1). Due to their flattened shape sand dollars and their relatives are referred to as irregular urchins.

The spines of regular sea urchins are calcareous extensions of the test which are able to move with a simple ball and socket joint at their base, thus they are able to act as the main source of "rapid" locomotion in many urchin species or wave around menacingly in the direction of a potential predator (or aquarist trying to remove one from an aquarium). However, due to specialised tendons in the socket joint, the spine can be made totally rigid which is an essential defence adaptation. Projecting from the test are also specialised structures called pedicellariae and the tube feet both powered by the water vascular system unique to echinoderms. Pedicellaria are organs that resemble tube feet with pincer-like endings. They are used primarily to clean the surface of the animal although they also have a secondary role in protecting the urchin from small predators to whom the defences offered by the spines are no problem to breach.

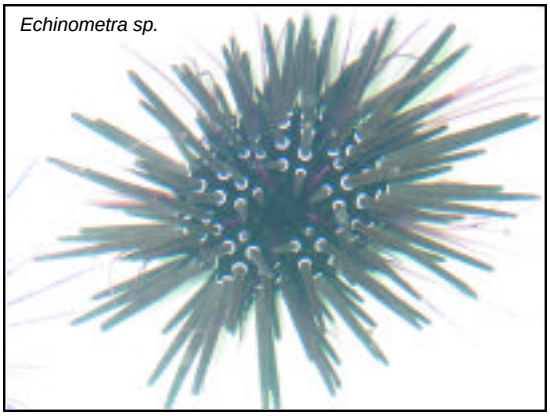
Given the relative abundance of sea urchins in natural reefs it is unsurprising that specimens make their way into the hobby by accident. However, live rock is unlikely to be the origin of these animals in our aquaria as most will be too sensitive to survive the shipping and curing processes. Live rock from Vanuatu (Pacific storm rock/South Pacific Rock) is particularly rich in the dead tests of urchins. Some species do make it as accidental arrivals on the base rock associated with soft corals and polyps.

Fig. 1
Sand dollar test

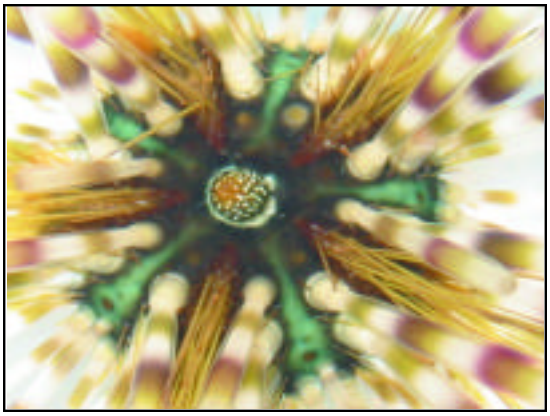


The tube feet of this urchin are obvious as they reach out beyond the spines

The commonest of these imports seems to be *Echinometra* spp., most of which that we are likely to encounter are characterised by a white disc surrounding the base of each spine.


Echinometra sp.

These species are perhaps the only ones we may experience as an accidental introduction on what could be called a "regular" basis. Superficially they resemble the long-spined sea urchins *Diadema* spp but the latter have much longer spines and a prominent anal bladder (this is the large structure on top of the urchin which some aquarists believe to be its "eye"). In fact this structure surrounds the anus and is an extension of the intestines. It is certainly true however, that the majority of regular sea urchins have light sensitive organs on their aboral surface.


The anal bladder of this Zebra urchin is clearly visible in the centre of this image. It is perhaps less eye-like than those possessed in other species

Echinometra presents no more problems to the aquarist than those demonstrated by the vast majority of ornamental urchin species that are readily imported for the aquarium hobby. In nature, shallow water regular urchin species are grazers of algae. The mouth, which is located underneath the animal has five separate "teeth" (one for each sector of the body – remember, all echinoderms exhibit pentamerous symmetry) which are articulated and supported by small bone-like structures and specialised muscles called collectively "Aristotle's lantern". These teeth are extremely robust and in many species can articulate in a number of ways. Their ability to graze algae from rock is incredible and often the aquarist can determine the route an urchin has taken by the clean rock left in its wake. This is great news for the person inundated with nuisance algae, or so you would think if it wasn't for the fact that urchins are a little more cosmopolitan in their tastes than nuisance algae. A grazing urchin may remove large amounts of calcareous algae that in most aquaria will not be able to recover quickly enough to withstand the grazing pressure. The desire of an urchin for calcium carbonate is such that you can supplement their uptake with pieces of cuttlebone, which will be grazed to nothing in no time at all.

Many Echinometra species demonstrate their ability to consume calcium carbonate substrates in their rock-boring activities. Some will excavate a depression into the rock that they occupy during the day or in times of low tide when they might be vulnerable to predation. Thus the less well-protected oral surface of the urchin is firmly in contact with the substrate and cannot be levered or wafted free by triggerfish or other predators and the only exposed surface is extremely prickly.

In reef terms the grazing of sea urchins is extremely important in the production of sand. Estimates of up to 90% of all the erosion of coral reefs caused by animals, plants and bacteria in certain parts of the world may be due to urchins.

So, are the little Echinometra urchins suitable for marine aquaria? Well, it depends on your feelings about calcareous algae. If you like the latter forget about obtaining an urchin – they are just too destructive to this beautiful alga. In their defence, however, they make interesting and hardy introductions to marine aquaria. Urchins are clumsy creatures too – they can knock over unsecured sessile invertebrates and even "pick up" polyps and rubble that is an adaptation to concealment in some of the urchins.

Symbionts

If you have an urchin you might want to have a look and check for the presence of commensal or symbiotic creatures on the body and in between spines. There are several small bivalve species that can be found around the underside of the urchin. Recently there have been some small, elongated shrimp available in the trade that live on the spines themselves. It is always possible to find the seemingly ubiquitous bristleworm family on urchins too, but they are unlikely to be harmful to their host in most cases.


A *Diadema sp*. urchin utilising the calcium carbonate in the test of another species of urchin

Figure 2
The so-called edible cucumber (*Holothuria edulis*)

Class Holothuridea

Having rattled-on in the Echinoderm related *Friend or Foe* articles about the phylum exhibiting pentamerous symmetry we conclude this fascinating group with a class in which this characteristic is not at all obvious. The Holothuroidea are commonly known as sea cucumbers and many marine aquarists will be familiar with their more decorative or useful species. The former include the sea apple and candy cucumbers. In these species it is possible to discern five body sectors but species such as the edible cucumber (*Holothuria edulis*) shown in **Figure 2** the body has lost this radial symmetry.

There are around 1200 species of extant sea cucumbers found in marine habitats all over the world. It is thought that they are the commonest animals to be found in deep ocean environments and the stresses of living in this environment have given rise to some incredible body forms.

Deciding whether sea cucumbers are suitable for reef aquaria is likely to cause much disagreement. However, it is a fact that most species can release a toxin called holothurin when stressed which is deadly to fish. In the confines of a reef aquarium this is seriously bad news and could be the cause for some seemingly inexplicable wipeouts. However, I have experienced many situations when cucumbers have been physically damaged (usually after disagreements with circulation pump intakes) and they have not released holothurin. Some species have another, perhaps even more alarming, defence mechanism at least in the short term. Some Holothurians can eject special tubules from the anus. Called "Cuverian tubules" these sticky processes are extensions of the respiratory system and will smother potential attackers with a rather unpleasant network of membranous "string".

Some cucumbers can actually eviscerate themselves through the anus but this phenomenon is much more stressful physiologically to the cucumber than tubule ejection. Here the gonads and digestive tract may be expelled and is usually the result of stress brought on by poor husbandry in a reef aquarium – e.g. Poor water quality etc. Such an incident could seriously jeopardise fish stocks. Fortunately, cucumbers have remarkable powers of regeneration and can often recover from such, seemingly suicidal, acts.

The popular sea apples (*Pseudocolochirus* spp.) are another potential source of poisoning in the aquarium. They, too, have the capability of holothurin release but this is not the commonest threat. Every aquarist likes to see natural reproduction occurring in their system but in the case of the sea apples this is not the good news it first appears. Unfortunately the eggs of sea apples are toxic to fish that, unfortunately, decide that this is the best food they have ever tasted and gorge them. The result can be large-scale fish deaths.

Accidental introduction of cucumbers to reef aquaria is commonplace although perhaps not often noticed by the aquarist.

Another mobile suspension-feeding sea cucumber

Figure 3
A small but highly mobile suspension-feeding sea cucumber

This is because many species are largely sessile and their feeding tentacles, when expanded, resemble the food capturing apparatus of fan worms. Close observation of a suspected cucumber will reveal a characteristic of these species that relates to their feeding method. As owners of sea apples will be aware, as the cucumber feeds it slowly and methodically pulls one of the ten feeding arms into the mouth where detritus and suspended food is removed. This process is repeated sequentially for all tentacles and repeated throughout the feeding period.

Other cucumbers are free-living and highly mobile. One small species is a common import on the base rock of soft corals and polyps. This species feeds in the same way I have just described but it is highly mobile. The specimen in Figure 3 moved over 12 inches within 20 minutes of this image being taken. It is a harmless suspension feeder and is an interesting specimen to keep in a reef aquarium.

There are several other different types of sea cucumber that may be experienced by reef aquarists although they may not arrive accidentally. The variety of feeding techniques used by these animals is fascinating. Some, such as the commonly

Edible cucumber feeding. Note the apparent random distribution of the tube feet compared to the more ordered rows in sea apples

Another substrate dwelling species with the oral tentacles everted

A feather cucumber moving rapidly over the substrate constantly "mopping" the substrate with its oral tentacles

imported black cucumber, has tentacles like a sea apple only they are much shorter and are used to "mop up" detritus from various substrates. The genus, *Holothuria* is likely to be revised at some stage in the future as it contains many species that are significantly different but all feed in much the same way as the black species.

The edible cucumber (much as I enjoy seafood I have never been tempted to tuck-in to one of these animals. Indeed, Fossa and Nilssen state that there are several species more widely consumed than this and that they taste better too!) is another such species which performs this earthworm-like consuming sand and its associated fauna and digests the latter as it passes through the gut. They can perform a useful role in marine aquaria (Sprung 2001 states that the stocking rate for this and similar species should be around 3 inches of cucumber per 20 gallons of aquarium water so that they don't starve). Faecal pellets form long chains and can sometimes be seen draped over corals.

Possibly the most bizarre of the sea cucumbers are the so-called medusa worms or feather cucumbers of the order, Apodida. These creatures are capable of reaching over a metre in length and are extremely manoeuvrable. A thin membrane-like skin very unlike that of other cucumbers encloses the body. In the latter the leathery skin contains sclerites that form a sort of skeleton. Thus out of water they are unchanged in appearance. Medusa worms lose all body shape when removed from the aquarium. This lack of body "rigidity" makes the worm highly mobile and they are capable of getting in and through some very narrow spaces. They do possess sclerites in the skin, however, but these are modified into tiny hook-like projections that make the body surface seem sticky to the touch. These replace the tube feet possessed by other cucumbers that are not present in the Apodida.

As feather cucumbers move they rapidly move their oral tentacles over the substrate and into the mouth. They have often been touted as "ideal" scavengers and detritivores for marine aquaria. However, their potential large size apart, they are not as robust as many cucumbers when it comes to surviving physical damage. Given that all cucumbers can release toxins to a greater or lesser extent as described earlier this is not a good thing.

Despite not being altogether well represented in our look at accidental arrivals in marine aquaria the sea urchins and cucumbers are fascinating creatures in their own right. For those of you that have them already I hope that they continue to behave themselves. For those that don't – do not dismiss them out of hand either. For invert only aquaria there are many species that are well worth owning particularly if you fancy a non-photosynthetic coral/invert aquarium. Next issue we will be looking at a group of invertebrates to which we are most closely related – the Tunicates or Sea squirts.

Bibliography and suggested further reading

Barrett and Yonge. 1985. *Guide to the Seashore*. Collins.

Debelius. 1999. *Crustacea Guide of the World*. Ikan Publishing

Debelius and Baensch. 1994. *Marine Atlas Vol I.* Mergus Publishing.

Debelius and Baensch. 1994. *Marine Atlas Vol III.* Mergus Publishing

Fossa & Neilson. 2000. *The Modern Coral Reef Aquarium. Vol 3.* Birgit Schmettkamp Verlag.

J. G. Walls (Ed.). 1982. *Encyclopaedia of Marine Invertebrates*. T.F.H. Publications

Picton. 1993. *A Field Guide to the Shallow-water Echinoderms of the British Isles*. Immel Publishing.

Ruppert and Barnes. 1994. *Invertebrate Zoology Sixth Edition*. Saunders College Publishing

Sprung. 2001. *Invertebrates – A quick reference guide*. Ricordea publishing