Friend or Foe

Part 7 - The Crustaceans

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DIGITAL IMAGES BY THE AUTHOR

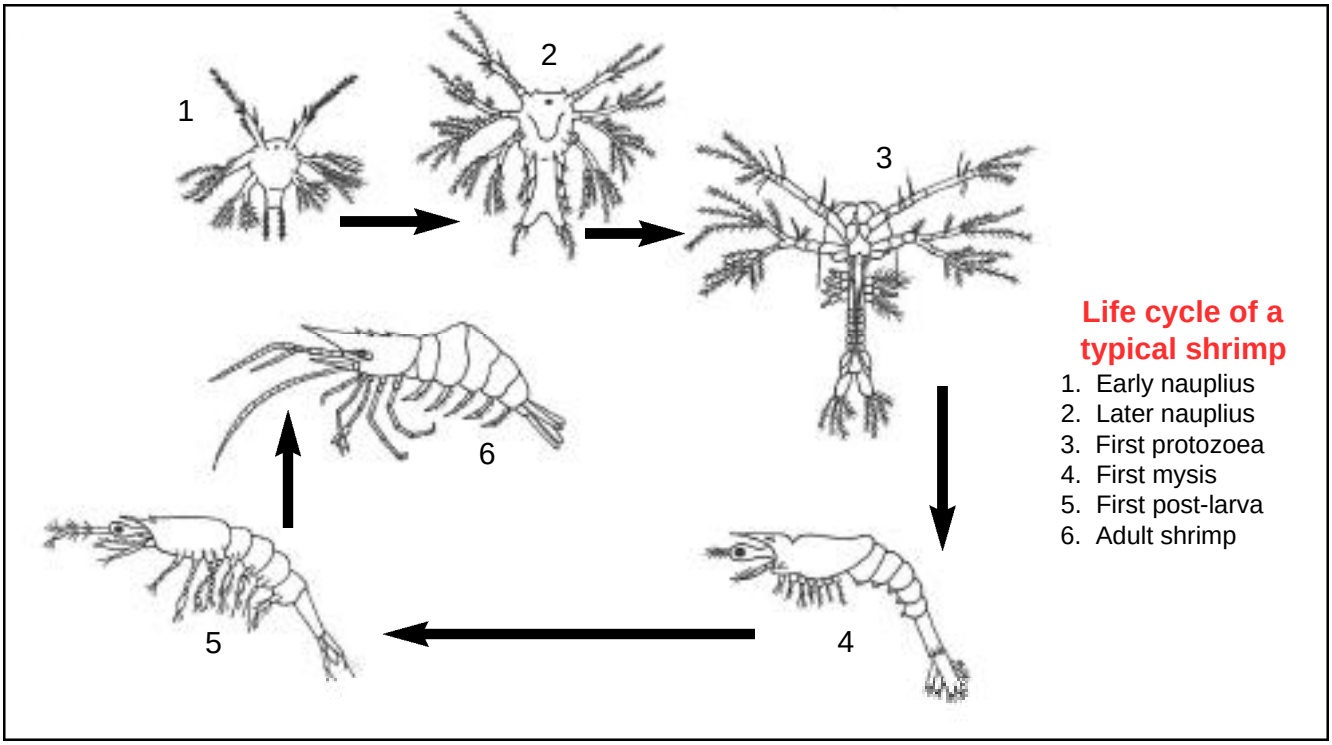
Many moons ago I was sitting in a drab lecture theatre in the University of Manchester's School of Biological Sciences waiting for the next lecture in the "Invertebrate Diversity" series as part of my degree course in Zoology. The lecturer then appeared at the door, uttered the words "Crustaceans – too many legs" and then left! After the initial confusion at the actions of the distinguished Doctor John Dalingwater we eventually established that the reason for this peculiar behaviour was due to the incredible array of forms within the crustacean assemblage which renders their classification an absolute nightmare!

This was brought home to me some years later when I was working as part of a research team studying Britain's deepest lake, Loch Morar in the Northwest Highlands of Scotland. Part of the project's study was to identify all the species of invertebrate life found there. These included several planktonic crustaceans called copepods whose classification to species level can centre on many features of their anatomy but to cut a long story short I found myself counting the hairs on the legs of these copepods in order to correctly identify them! When you consider that these animals are sometimes only a couple of millimetres long you can appreciate the difficulty of this task (and they've got loads of legs!)

Consequently, in this instalment of the *Friend or Foe* series I am not going to mention species names unless I am absolutely certain they are correct. Indeed, in some cases my knowledge is sufficiently sparse for me to attempt to classify them beyond even their Order assignation.

Phylum Arthropoda

Crustaceans are part of a larger assemblage of animals called Arthropods. Arthropod means "joint footed" and alludes to the fact that all arthropods have jointed appendages used primarily for locomotion. Like the Annelid polychaetes we looked at in the last article, arthropods are segmented but they have one further major adaptation and that is the exoskeleton or cuticle. This is a usually hard exterior to the animal's body which affords muscle attachment and protection. Because this external layer is essentially dead it must be shed in order for the animal to grow. In crustaceans and all arthropod groups this is done through a process called moulting or ecdysis. In many groups of arthropod the body form changes with each successive moulting which makes their correct identification that bit more difficult. Each individual stage between moultings is termed an Instar.



Life cycle of a typical shrimp

1. Early nauplius
2. Later nauplius
3. First protozoea
4. First mysis
5. First post-larva
6. Adult shrimp

Sub-phylum Chelicerata

The Chelicerates are a group which contains only one sub-class that the marine aquarist is likely to come across by accident in a reef aquarium, and a single species that they may purchase. This Sub-phylum's name comes from the specialised feeding structures termed chelicerae which can be alikened to the pincers of crabs. The main characteristic that separates this group from other arthropods is their lack of antennae.
Chelicerates include the extinct Trilobites, spiders, mites, scorpions and little known groups such as sun spiders and whip scorpions.

It is important to recognise that these are distinct groups from the crustaceans with which they share a common ancestor but, for example, the extinct trilobites did not evolve into anything else, they simply died out.

Subclass Xiphosaura

Common Name : Horseshoe crabs
Latin Name : *Limulus polyphemus*

The Horseshoe crabs are often referred to as "living fossils" due to their ancient ancestry and primitive looks. There are four known species belonging to 3 genera. *Limulus polyphemus* is the American species, the other three are Asian. Horseshoe crabs are generally kept by aquarists requiring them for their novelty value or indeed in a sand-shifting role. Their spade-shaped carapace acts like a plough as it shuffles through the sand. This is a fascinating creature but as marine aquarists will only acquire this species by purchasing it there is no need for further description here.

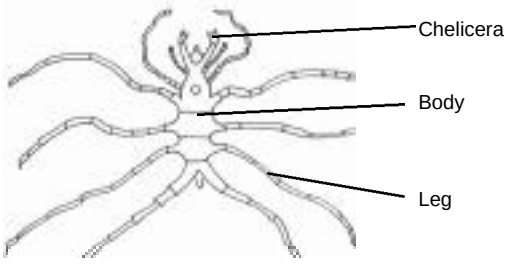
Sub-class Pycnogonida

Common Name : Sea Spiders

This group of chelicerates is given its common name due to the fact that most species have 8 walking legs much like spiders. However, they are a strange group that most aquarists may overlook or never experience in their aquarium as they are liable to be short lived and usually very small (<10mm). I have found several dead specimens in association with Live Rock but am yet to see a living one in an aquarium situation. They can be found feeding on bryozoans, colonial anemones and other encrusting organisms but are easily removed if so desired.

Sub-phylum : Crustacea

Crustaceans are the second largest sub-division of the Arthropod Phylum with around 38,000 described species. Only the insects have a greater number of species



(one million described species) than the Crustacea. Taxonomists believe that crustaceans are amongst the most primitive extant arthropods due to the vast majority of species retaining the ancestral marine existence. Perhaps one of the reasons the crustaceans have had continued success for many millions of years is the fact that insects have not conquered this environment. Most of the insects encountered on rocky shores in the U.K. are primitive species that are not truly aquatic and will die if submerged for long periods. An aquatic existence opens many niches for crustaceans. For example, they can achieve larger sizes due to the buoyancy provided by water.

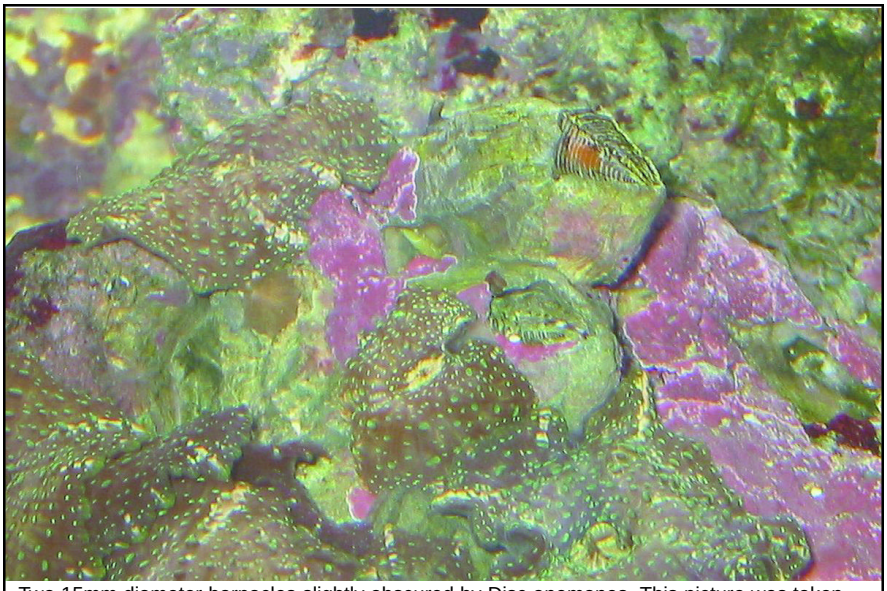
Because of the space limitations I must adhere to this article I will include some of the larger crustacean species that can be encountered by aquarists. Subsequent articles will continue this theme and then will focus on some of the smaller and more unusual species of crustacean that one may experience.

The defining feature of crustaceans is that they all possess two pairs of antennae on the head. Insects have a single pair, spiders and their allies have none. Most species also have a number of appendages on their body segments plus gills for respiration under water.

Class Cirripedia

No sooner have I declared that I will concentrate on large crustaceans in this article I immediately start with a group of animals that are usually smaller than the 10mm maxiumum size! This is for good reason as the Cirripedia represent a group of crustaceans that are significantly different from the rest of the crustacea. Many temperate species do not reach more than 5mm in diameter but it is common to have accidental imports reaching our minimum size. We know them as barnacles and they represent a group of crustaceans that have given up the ability to move freely. Instead, they remain in a fixed position with the body surrounded by a number of calcium carbonate plates. This means that a barnacle must rely on food to reach it. Thus we find them associated with areas with a strong flow and/or much suspended food particles such as phyto or zooplankton. By using barnacles as a guide we can deduce the type of area a specimen came from.

Barnacles have specialised feet – the name cirripede means "hair foot" and they use the fan-like feet to collect food. Sessile barnacle are called Balanomorphs and it is these that are most prevalent in our aquaria and can be recognised by their distinctive shape. Some species are found in association with hard corals such as *Porites* sp. and *Euphyllia* spp. It is likely that the corals have overgrown specimens in these cases but due to the repeated feeding actions of the barnacle they are not capable



Two 15mm diameter barnacles slightly obscured by Disc anemones. This picture was taken just after the lights came on for the first time. Only a few minutes later the barnacles were smothered thus any attempts at feeding had to occur when the lights were off.

of smothering the barnacle completely. This works to the barnacle's advantage as it is obscured from attack by many of its enemies plus the stinging cells of the corals provide an excellent deterrent for creeping predators such as whelks which enjoy nothing better than drilling a hole in the barnacle and sucking out the contents. Have a look at Plume rock (*Porites* sp.) as along with the abundant tubeworms it is not uncommon to have barnacles present.

Due to their feeding habits barnacles are unlikely to survive for long in marine aquaria unless they are supplied with sufficient particulate food such as Plancto or Marine Snow. Most species of barnacle are entirely harmless but it is worth mentioning a group which, although unlikely to bother the aquarist greatly, may present a significant problem to the other crustacean inhabitants of the aquarium.

Parasitic Barnacles

Many species of barnacles live commensally on other animals. Some species are found only on the tough skin of whales whereas others will settle on sea urchin spines or lobsters to name but a few. Other species can be found on corals including gorgonians where the marine aquarist may find he/she experiences them frequently. Generally speaking, these have no significant impact on their "hosts", neither good nor bad (although one could argue that the "fouling" of a whale with barnacles could increase the amount of drag it experiences and therefore reduce its swimming efficiency – studies of boats fouled by barnacles have shown that some 30% reduction in fuel economy can be experienced.) Some species have evolved into parasites however and rely on their hosts to provide them with food.

The Rhizocaphalidae are parasitic on many types of crustaceans – particularly crabs and their relatives. The larval barnacle arrives and enters the crab though a convenient opening such as a gill aperture. Development usually occurs beneath the tail in true crabs and hermit crabs where it appears as a non-granular, amorphous presence, yellow-brown in colour. A granular mass in this position is likely to be an egg mass and will only be carried by females. The barnacle, as it matures, sends out nutrient absorbing structures throughout the body of the crab called the interna. Presence of these and of the barnacle itself can be quite debilitating to the host and result in, amongst other things, sterilisation and inhibition of moulting. The ramifications for other crustaceans sharing an aquarium with a parasitic barnacle and its host are probably not that severe as the chances of the parasite becoming fertilised are small but they can be avoided completely by careful scrutiny of any crab purchases particularly porcelain crabs (*Petrolisthes* spp.).

The head and thoracic region of a mantis shrimp. This is a "smasher". Note the very large compound eyes and club-like second appendage which are a pale purple colour in this species.

Class Malacostraca

Malacostracans make up the majority of species within the Crustacea with over 22,500 species currently described by science. Most of the larger forms are represented within this class although the size extremes range from the largest arthropod of them all; *Macrocheira kaempferi*, the Japanese spider crab with a bulk so great its legs cannot support it out of water, to the pea crabs such as *Dissodactylus* at 4mm maximum size. The group also contains the hermit crabs, shrimp, true crabs, gammarids and other more obscure assemblages.

Subclass Hoplocarida

Order Stomatopoda

Common name : Mantis shrimps

There is no other two words that when put together strike fear through the hearts of marine aquarists like mantis and shrimp. They have been ruthlessly pursued by reefkeepers for years due to their penchant for killing the odd fish and crab. I don't wish to excuse their behaviour but we need to clear up a few things about these troublesome terrors. Firstly, I have experienced several instances when an aquarist has been convinced that his/her aquarium has such a shrimp in residence due to a loud clicking sound. Now, let's get one thing straight. If you hear a sound like cracking or splitting glass, or a metallic click this is extremely unlikely to be a mantis shrimp. What you generally have is a pistol shrimp (see below). When a mantis shrimp strikes its prey it makes a much duller, less sharp sound. Plus, you are much more likely to see a mantis shrimp than a pistol shrimp and be able to make a positive ID based on their most obvious features:

Not a great photograph but a typical shot of a mantis shrimp as you might experience it in an aquarium - a pair of antennae and a pair of big compound eyes poking out of a hole. This little chap doesn't miss a thing.

A mantis shrimp has two very large eyes which afford great vision. It also has a long body with a number of appendages beneath which it uses to propel itself at high speeds across rock and sand surfaces. Perhaps the most obvious feature is the pair of enlarged thoracic appendages. The structure of these divides the mantis shrimps into two distinct categories – the smashers and the spearers. Smashers have enlarged and very solidly constructed appendages that remain folded when they strike. They are capable of breaking the shells and carapaces of

A specimen measuring around 10cm

snails and crabs which they hunt for food. Spearers unfold the appendages as they strike releasing the barbed terminal digit which punctures the flesh of the primarily fish prey.

It goes without saying that either of these types of mantis shrimp is undesirable for the marine aquarium but this should not mean that any you manage to remove should be killed. Indeed, mantis shrimps can make excellent pets in their own right and a small aquarium set up for them alone can be very rewarding.

In order to remove a mantis shrimp from your aquarium you must be extremely vigilant. Unsuccessful attempts at trapping will only serve to educate your quarry and repeated attempts with the same technique are unlikely to be successful. The easiest way by far is to remove the rock that the shrimp has chosen as its home.

Part of the reason that people get mixed up between mantis and pistol shrimp is that the latter produces a clicking sound akin to that of breaking glass whereas the mantis shrimp is capable of actually breaking glass up to 1/4 inch thick! This is unlikely to happen in an aquarium as the shrimp has no need to break the glass, and most glass will be too thick anyway. But remember, these animals did not get their nickname of "thumbsplitters" for nothing!

Subclass Eumalacostraca

Superorder Eucarida
Order Decapoda
Infraorder Caridea
Family : Alpheidae
Common Name : Pistol or snapping shrimp

Features of a burrow digging pistol shrimp. This species is a common import and will prove a hardy and interesting specimen.

Despite being regularly confused with the mantis shrimp the members of the Family Alpheidae are one of the commonest large crustaceans experienced by marine aquarists as accidental arrivals. Many species encountered are over 2-3cm long when first noticed visually by their unwitting new host. However, I have experienced loud snapping sounds made by individuals only 10mm long!

A 1cm pistol shrimp. This is the size at which most specimens arrive in aquarists aquaria. You may notice that this specimen has relatively much larger, better developed eyes than the previous individual which appears to be a characteristic of free living species.

The clicking sound of pistol shrimps is generated by an enlarged pincer. The shrimp "winds up" the movable part of the pincer by contracting strong muscles housed in the overdeveloped claw. This then fits into a notch ready to fire. When ready to click another muscle pulls the claw out of its notch where the muscle tension pulls it back to meet its opposing claw. When they meet the loud cracking sound is produced. The shrimp usually uses this in defence as it can be so loud and piercing that potential aggressors can be stunned or at least deterred. Large individuals may use the snapping sound for predation but I am yet to experience this in a home aquarium.

Pistol shrimps inhabit holes, tunnels and crevices in the aquarium in addition to the species that live in association with other invertebrates such as sponges, corals and anemones. Many aquarists will be aware of the symbiotic relationship between Alpheid shrimps and so-called watchman or prawn gobies e.g. *Amblyeleotris* sp. The relationship is a relatively simple one. Many pistol shrimps have poor eyesight but can dig excellent burrows and tunnels. Watchman gobies have excellent eyesight and can provide an early warning of approaching predators but they have no tunnelling skills. Thus by sharing the retreat both the fish and the shrimp have something to gain.

I am a great fan of pistol shrimp as they are one of the crustacean groups that will be completely at home in a reef aquarium. Their tireless work in improving their burrow is fascinating to watch particularly if a goby is in residence too. As with all crustaceans, a pistol shrimp is unlikely to turn down an easy protein meal so slow moving or injured/poorly fish are potentially threatened by such a shrimp but I have never experienced any problems with any of the numerous specimens I have kept. One of the only problems with the introduction of these fascinating creatures is that they often decide to set up home where you can't see them!

Order Decapoda
Suborder Pleocyemata
Infraorder Palinura
Family : Scyllaridae
Common Name : Spanish or slipper lobsters

In a world of bizarre crustaceans this family still manages to throw up some even more remarkable body forms. The slipper lobsters are the bulldozers of the crustaceans world due to their modified antennae which are

Illustration reproduced from a photograph taken from the subject's above right

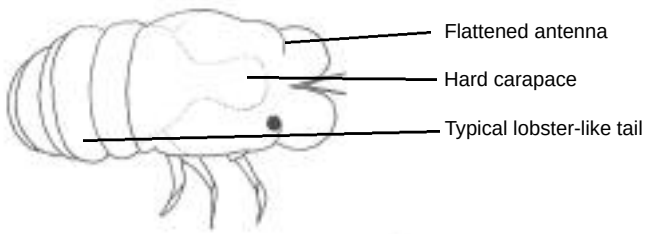


Illustration of the body shape of a typical slipper lobster

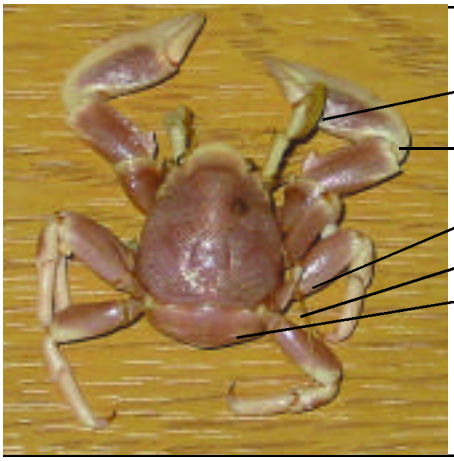
flattened and resemble a shovel. The antennae are used to move sand and rubble in pursuit of their prey which can consist of polychaete worms, molluscs and even small sea urchins.

Slipper lobsters are shy creatures seldom venturing into the open during the day and so it was with some great fortune that I spotted one retreating into its hole in a piece of African live rock. This is a very unusual find but so far I have been unable to coax it into the open for long enough to take a photograph so the diagram will have to suffice. Although this animal will not present a problem to your aquarium it will grow large and so should be removed alive and transferred to an aquarium with plenty of room and large pieces of rock that cannot be undermined by its foraging behaviour.

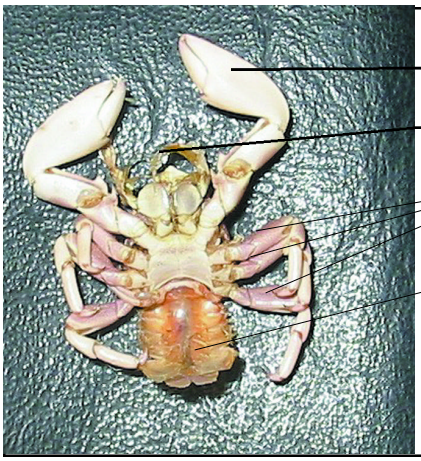
Order Decapoda
Suborder Pleocyemata
InfraorderAnomura
Superfamily Galathoidea
Family Porcellanidae
Common Name : Porcelain Crabs

Once a very common import along with live rock from Florida and the Caribbean we don't see as many free-living porcelain crabs as in times gone by but these fascinating little crustaceans can still be obtained from dealers. Porcelain crabs are not true crabs – they are related much more closely to the squat lobsters. The main clue to this is the use of the tail in rapid locomotion. True crabs have relatively immobile tails whereas the porcelains can use their broader tails to swim – as anyone who has dropped one into an aquarium will tell you. The widely kept anemone crabs are species of porcelain crab that have adapted to life in or around anemones. This affords decent protection when feeding which can expose the crabs to danger. This is because porcelain crabs are primarily filter feeders. One of their maxillipeds (the cheliped) has a specialised structure in the form of a bristly fan which catches plankton upon which the animal feeds although larger pieces of "fishy" food will be accepted in the aquarium. As a result they are ideal inhabitants for almost every marine aquarium. But, a word of warning, do not mistake a free-living porcelain crab for an anemone crab. I have heard of a couple of instances where free-living specimens have been placed caringly in the centre of a carpet anemone which has taken great pleasure in eating the poor thing. If in doubt, let the crab find the anemone on its own.

This article has been a mere taster of what the crustacean world has to offer us in the way of marine hitch-hikers. The next article will focus on the True crabs or Brachyurans of which several species are represented in marine aquaria.



Dorsal view of the Anemone/Porcelain crab



Ventral view of Anemone / Porcelain crab-tail unfolded

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Acknowledgements

Lisa Birchall for illustrations.
Mark Scott for specimen provision