more than MEETS THE EYE ... & the PALATE!

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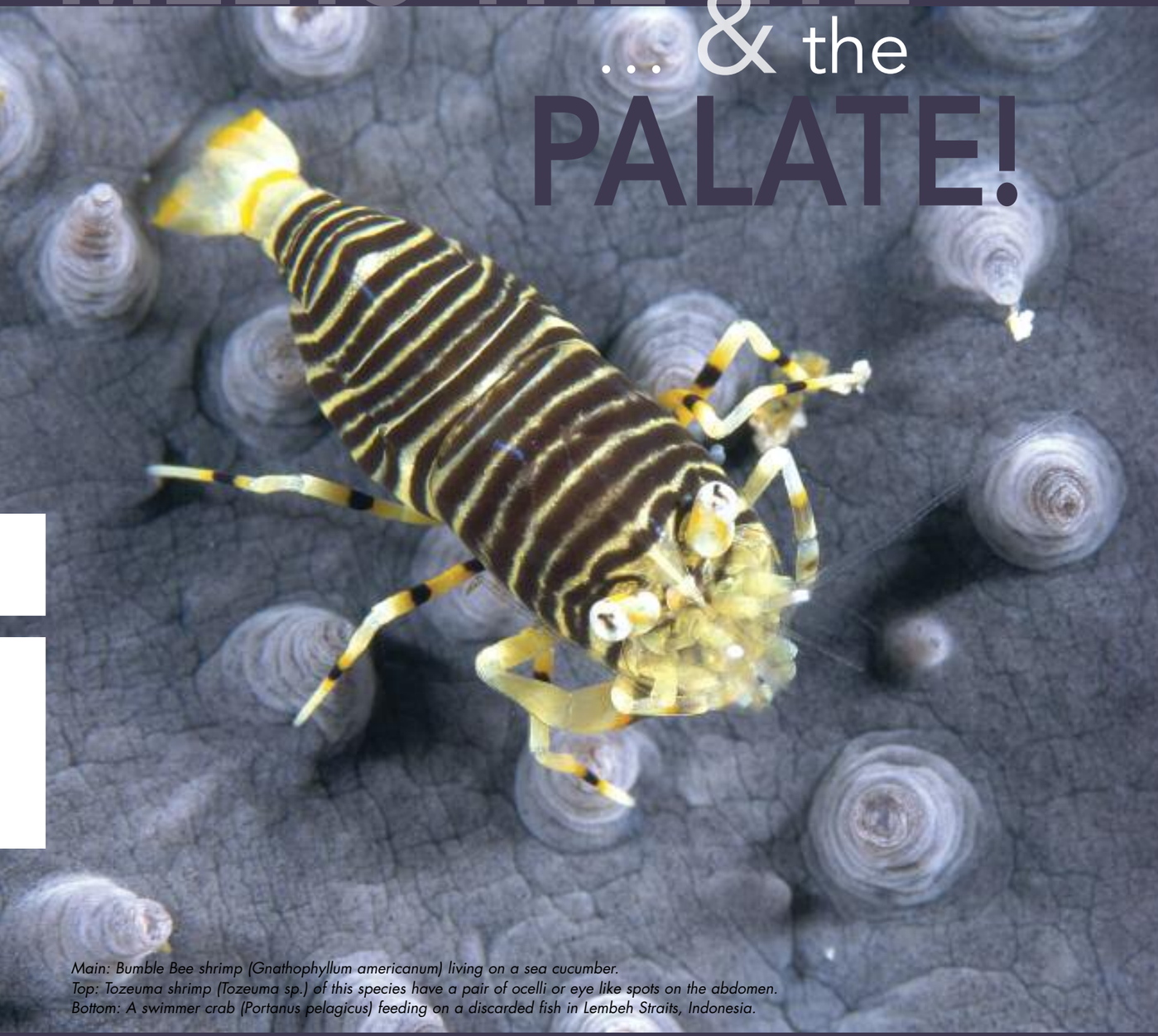
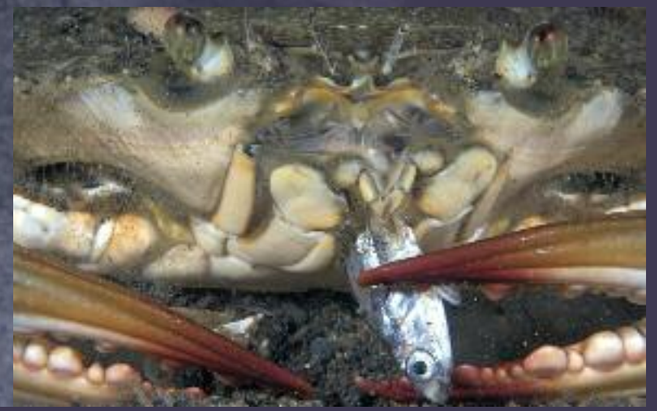
> CRUSTACEANS ARE EXTRAORDINARILY RICH IN TERMS OF NUMBER OF SPECIES, SHAPES, COLOURS, SIZES AND ROLE IN THE ECOLOGY OF MANY MARINE ECOSYSTEMS. WHICH OTHER ANIMAL GROUP HAS MEMBERS THAT CARRY ANEMONES AROUND LIKE POM-POMS, CAN EXIST ENTIRELY ON ANOTHER ANIMAL AS SMALL AS A SEA CUCUMBER, OR SPEND THEIR ENTIRE ADULT LIFE STUCK TO A ROCK? WE MAY NOT NOTICE THEM ON EVERY DIVE, BUT YOU CAN BE SURE THEY'RE PRESENT IN SOME FORM.





Main: Bumble Bee shrimp (Gnathophyllum americanum) living on a sea cucumber.
Top: Tozeuma shrimp (Tozeuma sp.) of this species have a pair of ocelli or eye like spots on the abdomen.
Bottom: A swimmer crab (Portanus pelagicus) feeding on a discarded fish in Lembeh Straits, Indonesia.

Crustaceans are closely related to insects, spiders and other 'creepy crawlies' which make up the phylum Arthropoda. This group is the most species-rich in the animal kingdom, with insects alone estimated to number in the tens of millions of species. Crustacea account for a more modest 30,000 species and are second only to molluscs as the most biodiverse marine animal group. They range in size from the enormous giant spider crab, which has been measured with an arm span of 11 feet, to many tiny planktonic species. The most well known to divers are the shrimp, crabs, mantis shrimp and lobsters, but barnacles are also an unexpected member of the group that have evolved hard plates to protect the soft animal from predators and desiccation from the sun's rays.

Crustaceans are typified by a segmented body and jointed limbs; they also have a hard exoskeleton of calcium carbonate, which must be shed to allow the animal to grow – the body expands in size immediately after shedding and before the new shell hardens. Many female crustaceans are able to mate only whilst their shell is soft and it's thought that during the moult pheromones are released that attract a male.

Shrimps – Symbiosis and Specialisation
Symbiosis with another species is a common theme within crustaceans, especially shrimp. One of the most well known is the association between signal gobies and the blind alpheid shrimp. This association is very common on coral reefs and requires a little patience to see; since, if scared, both the shrimp and goby will retreat into their hole. The goby's role is to act as sentinel for the shrimp, which actively digs and takes care of the pair's hole. The two remain in

An Imperial shrimp (Periclimenes imperator) hiding in the gills of a large spanish dancer nudibranch (Hexabranchus sanguineus).

L to R:
Hairy squat lobster (Lauriea siagiani) living on a barrel sponge.
A bubble coral shrimp (Vir philippinensis) with eggs visible under the abdomen.
The timid white cap shrimp goby (Lotilia graciliosa) shares it's hole with the much larger alpheid shrimp (Alpeus rubromaculatus).

Right: Small porcelain crabs (Porcellanella triloba), and a host of other crustceans, can be found on sea pens.

contact through the shrimp's long antennae which touch the surface of the fish at all times and can sense small vibrations indicating danger is coming and warning the shrimp to return to the safety of the hole.

Some of the most colourful and photographer-friendly crustaceans are the bumble bee, tiger, and harlequin shrimp. These stunning little creatures all share a taste for echinoderms such as starfish, sea cucumbers and urchins. The harlequin is the most well-known, both for its colouration and habit of creating a living larder from a starfish. The shrimp usually lives with its partner and together they seek out a tasty looking starfish, which they attempt to pry off the reef and carry back to a hole. Here they'll slowly consume it over several days, keeping it alive during this time. It all sounds easy enough but when you consider their prey has at least five very sticky arms, the shrimps must work pretty hard to get their dinner home before it makes a run for it!

The imaginatively named bumble bee shrimp is equally stunning as its harlequin relative, but only reaches about 1.5 cm in length compared to around 5 cm. I'd only ever glimpsed one on a night dive, but recently on a dive near Walea Resort in Indonesia's Togian Islands I saw a dozen living on a large sea cucumber and another eight on a nearby sea cucumber.

It may be that these shrimp are a parasite feeding on the cucumber or they live on its surface feeding on debris.

The shrimp genus *Periclimenes* are some of the most interesting you're likely to see on coral reefs and are usually found living on the surface of another animal rather than freely. Many of these species are very highly adapted for life on their specific host and match them exceptionally well in colour and surface texture. Some, such as the imperial shrimp *Periclimenes imperator*, are cosmopolitan in their host choice and can be found on various invertebrates such as nudibranchs and sea cucumbers. Other species like the stunning Coleman's shrimp *Periclimenes colemani* live exclusively on one host, in this case the venomous fire urchin. More unusually still, *Periclimenes magnificus* can occasionally be seen living on the head of a snake eel where they actively run around unafraid that their host may consider them a tasty snack. These shrimp are known as commensals, which means they live on another organism without harming the host by their presence.

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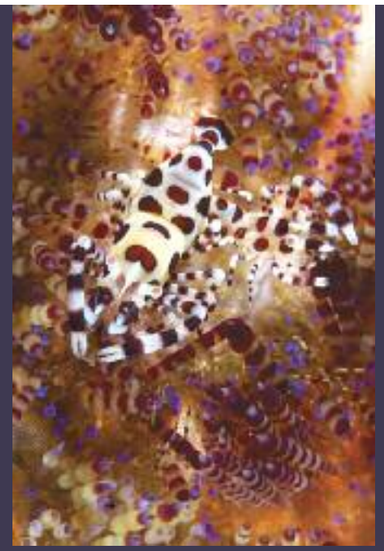
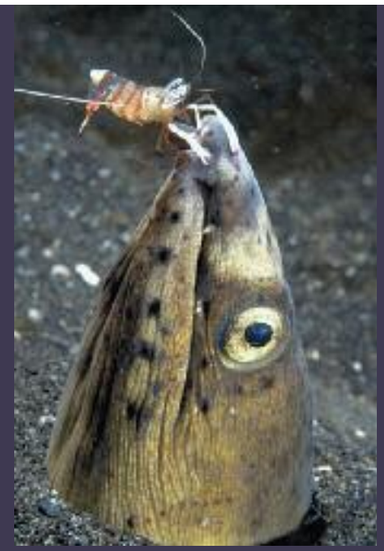
Crabby Capers
Many crabs are also commensal in their habits such as the candy crab which lives on soft corals, harlequin crabs on many different host organisms and Xeno crabs which live with whip corals and gorgonians. The free-living Mohammed Ali of the crab world, the boxer crab, is seldom seen but a very rewarding find. Measuring only a few centimetres across they appear at first glance like a common crab but a closer look reveals tiny anemones on the tips of its pincers. The boxer waves these at potential predators while swaying back and forth, hence the name, threatening a sting from the urchin. They really pack a punch!

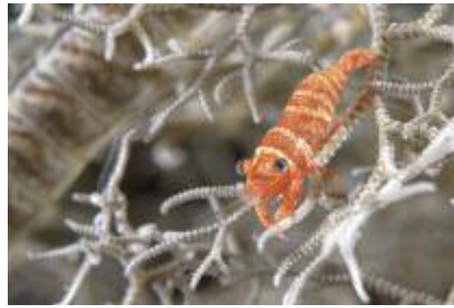
Squat lobsters belong to one of the two groups of crabs, and aren't actually lobsters at all. The group containing squat lobsters, hermit and porcelain crabs group is the anomura and can be identified by an obvious tail section. The other group is the brachyurans or true crabs, which lack a tail. Two of the most well known squat lobsters are the hairy and crinoid species, which both live as commensals on another species; barrel

Right
Top: The basket star shrimp (Periclimenes lanipes) lives exclusively on these large nocturnal echinoderms and is very hard to find amongst the swirling mass of arms.
Bottom: The Tiger shrimp (Phyllognathia ceratophthalmus) has much in common with its more well known cousin the harlequin shrimp. Often living in pair they feed on starfish and are voracious predators of the echinoderm.

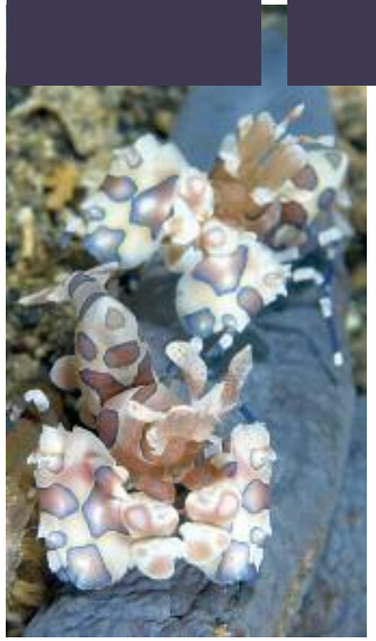
L to R:
A pair of Coleman's shrimp (Periclimenes colemani) on a fire urchin.
The commensal shrimp (Periclimenes magnificus) can often be found living in association with snake eels such as this black-finned snake eel (Ophichthus melanochir).
The body of this long legged squat lobster (Chirostylus ortmanii) reaches only 0.6 cm but including legs the animal reaches 8 cm.







Richard Smith Bio:
As a child, British-born Richard was enthralled by the ocean and its inhabitants. This passion led to his completing a degree in marine studies. In search of warmer seas he moved to Australia where he completed a Masters degree in marine ecology and evolution. He now studies for a PhD on the social behaviour and ecology of the pygmy seahorse Hippocampus denise. Richard has been diving for over 10 years and has travelled the world photographing and studying the ocean realm.



A pair of Harlequin shrimp (Hymenocera elegans) on their blue starfish prey.

sponges and feather stars respectively. Guides will often manipulate feather stars to allow photographers access to the centre where the squat lobsters hides, but this should be discouraged as it damages both the host and the crab and a hands-off approach to photography is always best.

Mantis Shrimp – A Force to be Reckoned with!
These are a fascinating, and to some degree, terrifying group that split from other crustaceans 200 million years ago. Their common name comes from their sharp multiply-barbed forelimbs, which are virtually identical to those of terrestrial praying mantis. These two animals are not related but have evolved the same limb structure due to their efficiency at capturing active prey. Some species of mantis shrimp move freely around the reef whilst others live in soft sandy bottoms and make large burrows where they await prey to ambush. Its the latter of these two that makes me glad I have such a significant size advantage. Having said that, it's worth noting that the force by which mantis shrimp are able to attack their prey is sufficient to smash the glass on the front of a camera housing!

Another interesting feature of mantis shrimp, or stomatopods as they're also known, is their eye. It's made up of many thousands of visual elements, somewhat like the compound eye of a fly. The highly evolved eye of the mantis is divided into three parts giving it exceptional visual acuity and, given that each eye can move independently of the other, the animal is able to gather a huge amount of information from the surrounding environment. The eye also has within it 10 different pigments that allow it to see in many colours beyond our own which have only three distinct pigments.

Crustaceans Condensed
With so many species of crustaceans already known from virtually every marine habitat, it's somewhat surprising that new species continue to be found. If you spend enough time searching a given species of soft coral, gorgonian, starfish or practically any other animal, you'll find a species of crustacean that exists only there. Since many crustaceans are very rarely observed let alone scientifically studied, there remains much to be learnt about their biology such as distribution, behaviour and reproduction. They are a fascinating group and it's definitely worthwhile spending some time searching for and observing them on your next dive.

Three imperial shrimp (Periclimenes imperator) hitch a ride on a nudibranch (Nembrotha milleri).

> ***LINK: www.crustacea.net***