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LIGHTING
HOW IT WORKS

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SAVE OUR REEFS

There are many reasons why the coral reefs are suffering, and human waste is one of them. When our trash and pollutants enter the water, it causes physical damage to corals, blocks sunlight from reaching polyps, and harms the coral reef animals. An example of this would be discarded fishing nets which can catch on reefs, or strangle wildlife. It's our garbage! Shouldn't we take responsibility for it? In this image, the Thai government recruit volunteers and divers to clean-up hundreds of miles of their coastline around Phi Phi Island.

Fish Junkies supports conservation projects like this through it's donations, funded from a percentage of magazine sales and other activities.

BY MARINE HABITAT

Image courtesy Lawrence Alex Wu.

Cover image: Yellow Tang.

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Image courtesy of John Clipperton.

ON THE COVER

REGULARS

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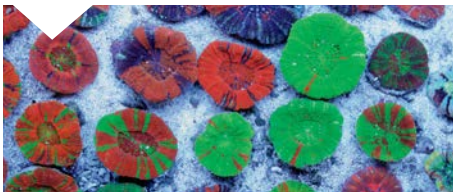


COMPETITION

ISSUE 07

COMPETITION WINNERS

1st – Steve Hardy, Northampton
2nd – Carl Kay, Manchester
3rd – Conway Stedham, Blandford
4th – **Terry Maloney**, Liverpool; **Rodger Bassett**, Sheffield; **Michael Davies**, Port Talbot; **Rodger Jones**, Corby; **Amy Pearson**, Manchester; **Nicola Wilcock**, Helston.

WELCOME TO MARINE HABITAT

Image shows the coral display tanks at Rock N Critters, a local fish shop.

As fellow marine fishkeeping hobbyists, joint editors-in-chief **Dave Pitt** and **Andy Gascoigne** share their thoughts on this issue, together with an insight into what they have been up to since the time.

THIS ISSUE

DAVE: This issue is of particular significance to the magazine because it is the launch issue for the British newsstand (i.e. WH Smiths, etc.). Following an extremely positive response, the decision was taken to make the magazine available to a wider audience, and hopefully encourage newcomers to explore this absolutely fascinating hobby. If you are a regular reader, then we hope you enjoy this issue, however, for those of you who haven't previously read Marine Habitat and have maybe purchased your first copy off the newsstand, then it's a very warm welcome to you, and thank you for taking an interest in the magazine and the hobby.

So let's take a look at what we have going on this time round.

ANDY: It's hard to know where to start with this issue because it's crammed with so much great content. If you're a complete newbie and you're wondering what sort of fish would be a good choice for a starter tank, then check out this issue's Top of the Rocks countdown. You might just be surprised with some of the top 10 entries. Scott Michael tells us all about the captivating Harlequin Shrimps and their unique dietary requirements. Also, we have a new contributor joining us for a six-part series about the corals reefs of Indonesia. Patrick Blanche has spent some considerable time working on projects in the area and now he shares his experiences with us. As always, we've got an absolute corker of a hobbyist profile, so check out what Kieran McBride has done with his aquarium. Bob Goemans brings us his thoughts on the concept of sandless aquariums, a less-common approach in marine aquaria.

DAVE: For the record, for those of you who know of Wharf Aquatics (Nottingham), they have a number of fine examples of sandless aquariums.

ANDY: In additional to all this, we've got the usual step-by-steps, Q&As, and news, plus much more. One last thing I really must mention is the massive competition this time around. Check it out on page 36!

WHAT HAVE WE BEEN UP TO?

DAVE: Both Andy and I are everyday hobbyists, and over the years have experienced many of the same ups and downs as you may have. I mention this because I thought I would take this opportunity to tell you a bit about some of the downs I've personally experienced, so perhaps you can avoid the same situations.

I use a temperature control unit which turns my heating and cooling on and off as required. Unfortunately, it went wrong overnight, decided the tank was too hot, turned all the heating off and put the cooling on, and lowered the temperature to 20°C. This has now been fixed but it's perhaps worth considering this type of problem and mitigating the risk where possible for example, in winter, disconnect the cooling completely as a fail-safe. Another option might be to fit a digital thermometer with a built-in alarm.

My system relies heavily on the skimmer, and so when the pump decided to break, it didn't go down well. I contacted the retailer and requested a replacement, which ended

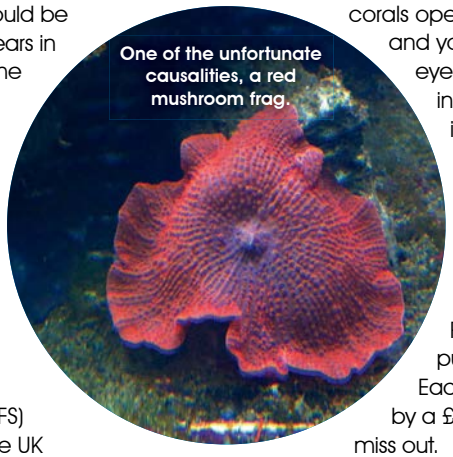
A turbo snail with an algae coating.

up taking 4 weeks. The knock-on effect of no skimmer for so long was a build-up of rubbish in the tank. This in turn fuelled an aggressive algae bloom which quickly took hold. It covered most of the live rock and many corals. If like me you have a system that relies heavily on a single piece of equipment, it may be worth having a backup option readily available.

One of the ways to tackle a build-up of waste is by doing bigger and more frequent water changes. Please, however, ensure you always check your refractometer, as they do require recalibration and on occasion go faulty, as did mine. I'll admit a little complacency, and as such my salt level was allowed to rise. If this does happen, remember to reset the salt level very slowly to avoid a shock to the livestock.

The routine check of my UV unit identified that the bulb needed replacing. To do this, I have to remove the unit from its location, during which I managed to break the seal. My water returns from the sump via the UV back to the display tank, which meant I had to turn off my sump overnight to reseal the joint. I awoke to find some of my livestock a little docile, and it immediately hit me. I had turned the sump system off, which meant the tank wasn't collecting enough oxygen. The lesson here is to consider how suitable levels of oxygen enter the water, even if the equipment experiences a planned or unplanned power outage. I am sorry to say there were casualties as a result of one or more of the above; a couple of smaller coral frags and a couple of turbo snails.

My advice is to remain positive throughout difficult situations. It would be hard to get through years in this hobby without some kind of problem, but I think I speak for most hobbyists when I say that the pros outweigh the cons. Happy reefing.


One of the unfortunate causalities, a red mushroom frag.

YOUR LOCAL FISH SHOP

ANDY: This leads on nicely to mention the Local Fish Shop (LFS) community. Across the UK there is a strong LFS community, and it really is worth remembering the benefits they can offer. Firstly, as a hobbyist it's very useful to locate your nearest LFS, visit and make yourself known. The owners and staff are always keen to help and hobbyists should take full advantage of this. Get to know the staff at your local shop because they can offer advice based on years of experience. They can help you out when you're in trouble with something, like the situations Dave has described and they have dry goods on hand should you need anything.

> it's much easier and cheaper for companies to sell dry goods online, but without the fish shops there is **no hobby**. Stick together, and support your LFS!

Most importantly, the LFS is the absolute cornerstone of this hobby because they are the ones who put the time, effort and expense into maintaining rows of tanks full of nice fish, inverts and corals for you to study and buy. There is no better way to purchase livestock than through your LFS; you can ask about the history of the stock, you can witness a fish feeding, you can physically see the corals opening up during the day, and you can see with your own eyes the conditions in which all the livestock is kept, which gives you confidence in your purchase.

We try to introduce a number of the great LFSs from around the country in our Shop Profile section, which is published in every issue. Each profile is accompanied by a £10 off voucher, so don't miss out.

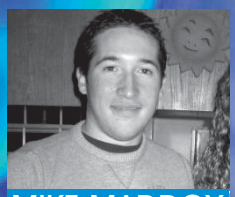
The final point I'd like to make here is that it's much easier and cheaper for companies to sell dry goods online, but without the fish shops there is no hobby. Stick together, and support your LFS!

FEEDBACK

DAVE: Before we leave you to enjoy the mag, it's always great to receive constructive feedback because this allows us to act. Off the back of issue 1, you told us that you wanted more pages, and since then we've more than doubled the page count. In recent issues, you've told us you'd like slightly bigger font, and so this time we've increased the font size. We cannot, however, do anything about it if you don't tell us. Please let us know what you think about the mag and we promise we'll listen.

Once again, from all the team at Fish Junkies, welcome to the newbies, and we hope you enjoy this issue. Take care.

Dave & Andy



MIKE MADDOX

Age: 26.

Hometown:
Australia (East Coast).

Full-time occupation:
Aquatics business owner, aquatics consultant, aquatics author.

Marine experience:
17yrs.

Aquarium size: 200-gallon FOWLR system, 34-gallon intertidal reef biotope, 550-gallon freshwater biotope for a Mbu Puffer.

Favourite
fish: Puffers!
coral: None in particular.
other: Carpet Anemone (*S. haddoni*).

Specialist areas:
Pufferfish, anemones, lighting, biotopes.

LIGHTING
HOW IT WORKS

In this issue we welcome back previous contributor **Mike Maddox.** Mike jumps straight into the thick of things, explaining how lighting works, what PAR ratings are needed, and all the photosynthetic requirements invertebrates need to grow healthy.

Like a lot of things in our hobby, lighting isn't implemented in a very scientific manner. There is a lot of discussion about the best type of lighting for a reef aquarium, or the ideal lighting for a given invertebrate species, and a lot of lighting terms are used incorrectly or out of context. Taking a best (scientific) approach to lighting photosynthetic invertebrates isn't easily done by the average hobbyist, and for hobby purposes, is an unnecessarily lofty goal. However, that doesn't mean that the hobbyist shouldn't have a basic understanding of light, how photosynthesis works, and how to apply this knowledge for the benefit of captive invertebrates.

WHAT IS LIGHT?

There is an incredible amount to know about visible light, and I will just be scratching the surface of the subject as I attempt to explain a few basic definitions that are of use to reef aquarium hobbyists.

> Visible light is simply a small frequency range in a very large range of occurring energy frequencies

Visible light is simply a small frequency range (frequency means how often a full wave propagates with a full crest and trough) in a very large range of occurring energy frequencies (including microwaves, radio waves, x-rays, and all other energy forms). Energy can be associated with wavelength, or the distance between the crest and trough of the wave. Most of the visible light spectrum, which is energy with a wavelength between 400 and 700 nanometres (one billionth of a metre, abbreviated nm) will affect or stimulate chloroplasts, meaning that the energy delivered by the light will be converted into chemical energy in the cell, resulting in photosynthesis. Wavelengths shorter than 400nm carry too much energy and can damage or destroy living tissues, while wavelengths longer than 700nm do not carry enough energy for photosynthesis to occur.

There are many ways to produce visible light, but all visible light, no matter what method is used to produce it, is just that – visible light. Nothing complicated about that! Because of this, the typical lighting sources used by an aquarist (VHO, T-5 HO, metal halide, LED, or natural sunlight) are all effective options for lighting a reef aquarium because they all produce visible light energy.

However, lighting photosynthetic marine invertebrates is less simple than merely producing visible light. Every hobbyist who wishes to house photosynthetic invertebrates should have some very basic information about light and the measurement of light, so one can provide best practice care for their inhabitants. There are many ways to measure light

Good lighting is not only essential for coral growth, but also helps bring out the colours. Image courtesy of Kieran McBride.

energy, and a few of these methods, as well as a few more terms that hobbyists are likely to encounter, are defined below. Some are of more practical use than others, but I feel a basic comprehension of the terms will be helpful to all reef hobbyists.

PHOTOSYNTHETICALLY ACTIVE RADIATION (PAR)

PAR is the only easy way to measure useable light energy and quantity for home aquarists, and is much simpler to define and measure than any other form of light measurement. For the aquarists' purpose, PAR is the number of photons (a unit of measurement for light) per metre squared per second of light that falls between ~400nm and ~700nm in wavelength, as measured by a quantum/photon flux meter. To put it simply, it is the measurement of how much visible light energy reaches a square metre in one second. Although longer wavelengths (the short end of the infrared spectrum) are sometimes photosynthetically useful, the PAR definition doesn't account for these wavelengths. However, infrared energy is virtually useless to home aquarists, as it doesn't penetrate the water column to a significant degree, so does not need to be measured.

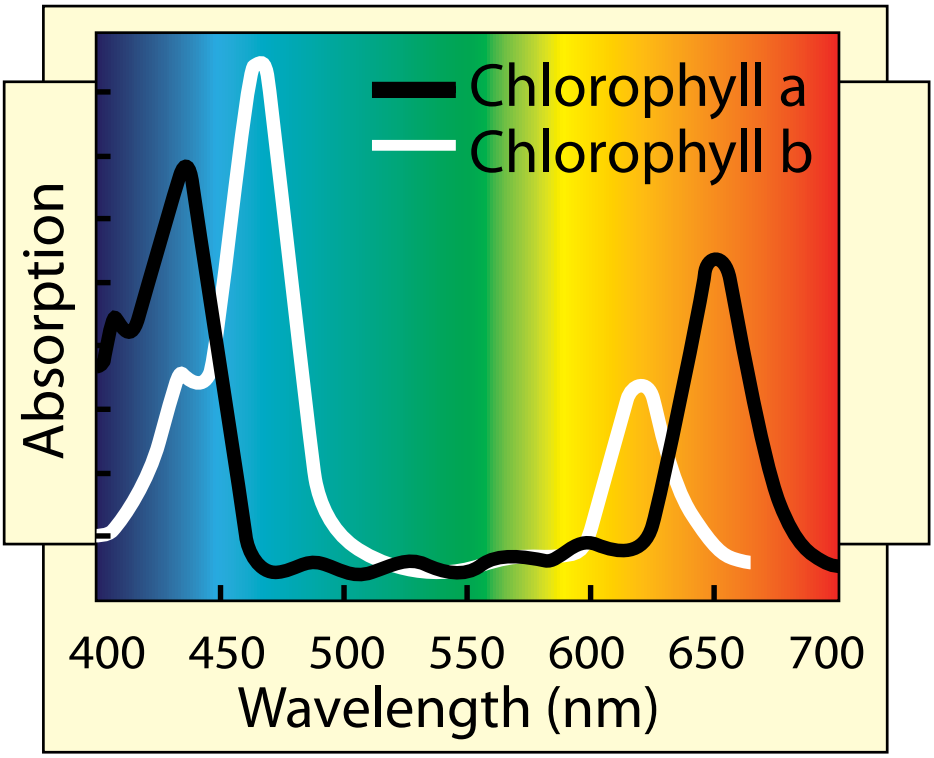
When aquarists refer to light intensity in an aquarium, PAR is what they are actually referring to, even if they do not know it. PAR is literally the amount of light energy that is potentially usable for photosynthesis per square metre per second.

PHOTOSYNTHETICALLY USEABLE RADIATION (PUR)

PUR differs from PAR because the basic definition of PAR is any light in a specific frequency range. PUR is the useable portion of PAR, and different photosynthetic species will have a different PUR range to which they respond. How do you determine the PUR for a given species? This is difficult, and requires detailed analysis of the chloroplasts of the species in question. Fortunately, the spectral absorption curves of the two most common chlorophyll types in eukaryotic organisms are known.

For example; you are given a choice to illuminate the coral with two different lights, each with the same PAR value. However, one of these lights produces energy that peaks at 450nm, or the blue spectrum, and one peaks at 590nm, or the yellow spectrum. For zooxanthellae in the coral's tissue, the light peaking at 450nm will have greater PUR than the light that peaks at 590nm, which is not in the PUR range for marine invertebrates, although a PAR meter will read the lights as virtually identical.

PUR is much more useful, but much less simple, to determine than PAR, and requires a spectrograph with milliwatts-per-nanometre measurements to determine. Because of these challenges, PUR was mostly overlooked and largely unnecessary until the recent popularity explosion of LED lighting. For example, most broad spectrum LEDs emit excellent PAR, but often only ~50% or less of the output energy is PUR. The more energy that falls in the useable spectrum for coral (check the spectrograph), the more effective and efficient the light will be for lighting photosynthetic marine invertebrates. It is for this reason that a PAR measurement alone on any light source with an unknown spectral profile is misleading.



Graph by David L. McCulloch, Ph.D

INTENSITY

Intensity is defined as 'the measure of the time-averaged energy flux', meaning the energy transferred from one medium to another (traditionally a waveform, such as light, to another object) per amount of time (in seconds). So, intensity is a measurement of how much energy is transferred via light from a source (say, a bulb) to an object (the coral, for example) averaged over a certain amount of time.

The human eye cannot accurately distinguish intensity, and there is no easy or practical way to determine the intensity of a light source at a given depth and

spectrum in an aquarium. Intensity is much misused in the hobby, is not applicable to our aquariums, and as a measurement is essentially useless for home aquarists. Good to know, isn't it?

> The human eye cannot accurately distinguish intensity, and there is no easy or practical way to determine the intensity of a light source at a given depth

Due to the adaptable nature of most photosynthetic marine organisms, a wide variety of species can grow under a single light source.

KELVIN TEMPERATURE

Kelvin temperature (abbreviated as K), is the scientific unit for temperature, and is often used to measure the colour temperature of light, or more accurately, the measurement of the temperature of an object emitting black body radiation, also known as thermal radiation, or radiant heat in the visible light spectral band.

All objects at a temperature greater than absolute zero emit some form of thermal radiation, although at room temperature the wavelength of this radiation is too large for the human eye to perceive. Think of it this way: at room temperature, a stove burner doesn't emit any visible light, because the black body radiation being emitted by the burner is not in a frequency visible to the human eye. However, if you turn on the stove, the energy associated with the burner increases and the black body radiation the burner is emitting changes frequency. When that energy being emitted enters the frequency of visible light the burner glows, and that's when you know it's hot. The black body radiation being emitted is measured in kelvin, and in the hobby we use the rating to compare the colours of different light sources.

There is a great deal to know about kelvin temperature and thermal radiation (most of it mathematical) that exceeds the scope of this article, but kelvin temperature is a very useful way to measure the colour spectrum of a bulb or other method of producing light via a thermal method (metal halide bulbs or incandescent bulbs, for example), and less useful for comparing the colouration of fluorescent and LED lighting.

Kelvin temperature in the hobby is used virtually interchangeably with spectrum. Spectral range is more useful for determining PAR and PUR, but kelvin temperature has become the norm among bulbs produced for the hobby. Kelvin temperature is often associated with PAR; a light source with a given intensity from an object with a colour temperature (kelvin) of 6500K usually has more PAR than light emitted from a source of the same intensity but having a colour temperature of 20,000K.

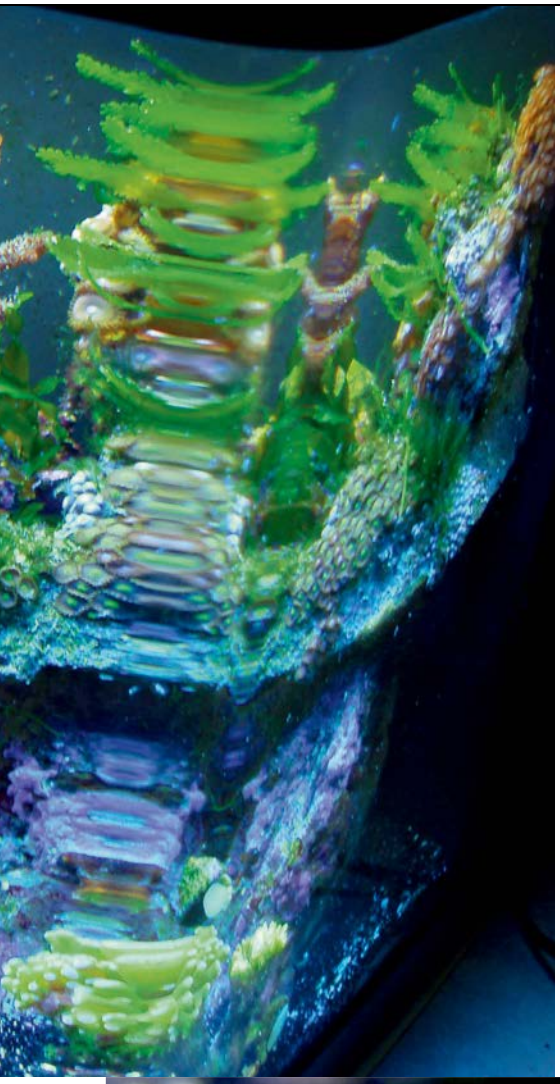
While being somewhat useful in the past, kelvin temperature is not necessarily very useful as a comparison tool between newer lighting technologies.

S. haddoni and host Periclemenes Anemone Shrimp under metal halide lighting.

SPECTRUM

The colour spectrum of visible light is well known by most: red, orange, yellow, green, blue, indigo, and violet. These colour spectrums represent wavelengths of light energy, measured in nanometres. Photosynthetic animals require a broad spectrum lighting to fully utilise the energy from light. The spectral range useful for photosynthesis is cited as PAR, as you'll recall. To be the most useful for photosynthesis, aquarists should use bulbs that have a peak spectral output of ~430nm and ~680nm.

In the early days of reef aquarium lighting, spectrum was very important because most bulbs and light sources at the time were not designed to illuminate photosynthetic marine invertebrates. When the reef aquarium hobby became more mainstream, spectral outputs were not generally needed because manufacturers realised the need for broad spectrum output and ensured their products emitted sufficient PAR and PUR to maintain marine organisms. However, with the advent of LED lighting, spectrum has become important once again, as history has repeated itself. Many broad spectrum



diodes used in the aquarium hobby are not designed for the hobby, and thus have varying spectral outputs, often with a less than desirable amount of energy being emitted as PUR. Because of this, spectral profiles are once again of importance for those considering LED lighting.

The spectral output of a broad-spectrum (a 'white') light source also has an impact on the colour rendering index ability of the light.

COLOUR RENDERING INDEX

The colour rendering index, or CRI of a light source, describes how accurately a given light will portray colour to the human eye when compared to a reference light of the same colour temperature. While not typically used or measured for aquarium lights, this term has gained renewed interest due to the recent growth in the popularity of LED aquarium lighting.

CRI is measured on a scale from 1-100, and reference light sources for the measurement of CRI vary on colour temperature, as determined by the International Commission on Illumination. Because spectral output can vary across a given colour temperature, it is the kelvin (black body radiation) temperature that is used for comparison, and the CRI of two or more sources can only be compared if they have the same colour temperature.

> If the information is available for comparison, choose the lights that emit a CRI of 89+

The closer to 100 a light source's CRI is, the more accurately it will portray colours. If the information is available for comparison, choose the lights that emit a CRI of 89+. CRI can suffer if the light source is lacking a broad-spectrum output. For example, if the violet portion is missing from a light source, purple will appear blue-grey.

LUMEN/LUMINOSITY

The lumen measures luminous flux, or the perceived power or brightness of light by the human eye. This is purely a term used for the human eye, not a measurement of light energy that is, say, reaching the coral. For example, it is possible for two light sources to have the same intensity (same energy transfer) but emit a different number of lumens. The source that emits a higher number of lumens will appear brighter to the eye, but the intensity will be the same. This can also be somewhat useful for aquarists, because higher lumen count can equate to a higher PAR count, depending on the spectrum.

While lumens are a useful measurement for household light bulb comparison, because you use that light to see, this measurement usually only serves the energy conscious hobbyist by comparing lumen per watt count on the bulbs used (assuming that information is available from the manufacturer). Keep in mind that lumens has absolutely no correlation to the PUR of a light source, and, in fact, a light source emitting light mostly in the PUR range will appear dimmer to the human eye than a light emitting more light in the yellow and green spectrums, which are virtually useless to marine invertebrates. You and the coral are two completely different organisms!

All photosynthetic organisms require light energy by definition, including anemones. Image courtesy of Sarah Beggerly.

LUX

LUX is a unit of measurement of lumens per square metre, sometimes (and incorrectly) used synonymously with light intensity. Instead, LUX is the measurement of apparent intensity (how bright it looks), as viewed by the human eye, per square metre. Similar to lumens, except how bright something seems when illuminating an area rather than viewing the bulb, or source. Because the human eye weighs certain parts of the spectrum (certain wavelengths) as brighter than others, two light sources can have the same intensity but a different LUX. LUX was somewhat useful to aquarists before PAR meters became relatively affordable, but now a PAR meter can be purchased for the same price, and is much more useful.

PHOTOSYNTHESIS

Photosynthesis is the 'synthesising by organisms of organic chemical compounds (Oxford Dictionary of Biochemistry and Molecular Biology [1997]), mainly carbohydrates, from carbon dioxide

***T. maxima* thriving under Power Compact lighting.**

using energy obtained by light rather than the oxidation of chemical compounds'. Instead of consuming carbohydrates like we do for energy, photosynthesis can create carbohydrates for invertebrates and plants. More simply, this means that plant cells can use energy gathered from light to produce cellular chemical energy (ATP) and carbon products (carbohydrates) when combined with carbon dioxide. Photosynthetic efficiency peaks at around a wavelength of 430 nanometres and 680 nanometres.

In order for the photosynthetic process to take place, the chloroplast (the organelle of the cell where the light energy to chemical energy conversion occurs) must receive sufficient PAR and/or PUR. If the saturation or compensation point of the chloroplast isn't met, the organelle will not produce the optimum amount of carbon bi-products (carbohydrates), and this excess energy will not be transferred to the host invertebrate. Obviously, the compensation point is something every aquarist will want to meet at all depths in the aquarium.

In attempting to meet the compensation point, however, aquarists must avoid photoinhibition. Photoinhibition is the result of an excess amount of light energy reaching the chloroplast, causing photosynthesis to stop completely! As we know, photosynthetic invertebrates have a host of light-inhibiting pigments to protect themselves from tissue damage and their symbiotic zooxanthellae sp. algae from photoinhibition, which is where all the pretty colours in corals and clams come from; photoinhibition occurs much more frequently than insufficient light energy both in nature and in aquariums.

Under good lighting, corals should thrive in the right conditions. But be wary, corals grow and may need pruning to allow light around the tank.

Some aquarists believe that some corals only need light to survive, but this is absolutely untrue. No animal known to science can survive solely on light energy! There must always be a phosphate and nitrogen source for a living cell to create the compounds needed to function, even if these organic chemicals are simply dissolved in the water column. Photosynthesis is the process used to gain the necessary energy to convert these phosphate and nitrogen sources into ATP from light, which can be used directly by the cell. Photosynthesis does not 'invent' something from nothing – it is simply an energy conversion process, using light energy to turn compounds in the water column into more advanced and useable compounds for the algae, and, in turn, the host invertebrate.

> While the superiority of the sun cannot be replicated in captivity, short of skylights and/or windows, photosynthetic invertebrates are adaptable to a wide range of lighting conditions

WHICH LIGHTING METHODS ARE BEST?

This is a hot topic amongst hobbyists, but a discussion about which lighting method is superior is a misplaced discussion. For the most part, artificial methods are inferior to sunlight (yes, even in home aquariums, so use those windows!), and there isn't a way for the vast majority of hobbyists to scientifically compare lighting methods.

Instead of concentrating on a misplaced and unscientific debate over which lighting method is best, hobbyists should focus their efforts on achieving a proper PAR range at a given depth for the animals they wish to keep, with knowledge of the output spectrograph. My advice to hobbyists is to achieve proper PAR/PUR in the most electrically efficient manner. Traditionally, metal halide was the most efficient form of lighting in terms of energy-to-light ratio, but now has been vastly outstripped by LED lighting. However, LED lighting is most definitely still in its infancy, and many prefer to stick with methods they are familiar with for the time being.

While the superiority of the sun cannot be replicated in captivity, short of skylights and/or windows, photosynthetic invertebrates are adaptable to a wide range of lighting conditions. Basic knowledge regarding lighting and the photosynthetic process are necessary to understand what is actually occurring in a reef aquarium every day. It's very helpful in maintaining healthy animals in the long term, and helps alleviate debates over lighting methods, which are almost always based purely on speculation and opinion. I hope this article has given you a greater insight into the care of photosynthetic invertebrates. MM

EXPERT ADVICE

Welcome to Expert Advice – in each issue we invite a panel of the industry's best experts to answer your troubling questions, and give you sound advice on how to tackle them.

IN THIS ISSUE

A BIT ABOUT DAVE
Dave Hawkins is a northwest sales rep based at TMC Manchester, and he has a particular interest in water quality and ULNS systems. He is involved in product development and testing, and has a thorough knowledge of aquatic technology.

A BIT ABOUT WAYNE
Wayne Oxborough is a geologist based in Norway. He has 8 years experience with marine aquaria (though more with freshwater) but remembers them from 'when they were hard'. His current tank is a 600-litre mixed reef, and while he's interested in the technical aspects of the hobby, his motto is K.I.S.S.

A BIT ABOUT LEVI
Levi Major is a UK-based engineering geologist by trade, but he also has over 21 years of experience in marine fishkeeping. Levi's specialist areas are on the technical side and include marine chemistry, general reef mechanics and gadgetry.

A BIT ABOUT BEN
Ben Woodward has been a hobbyist since the age of 8. He is the director of Fishkeeping.EU, who install some of the most beautiful aquariums and water features in the country. He has studied marine and freshwater biology at Aberystwyth University, and he has a BSc (Hons) in aquaculture and fishery management.

A BIT ABOUT DAVE
Dave Hulse is a teaching fellow at Keele University. He specialises in fish biology, health and management. He is also a consultant for Tetra, the global leader in ornamental fish care.

GOT A QUESTION?

Our expert panel can help solve any queries you may have, so send in your questions to Fish Junkies Ltd., PO BOX 4838, Sheffield S12 9DU, or alternatively email: info@fish-junkies.co.uk

Hello,
I have an established tank which appears to be running perfectly fine, but I want to rescape slightly, and to do so I want to add more rock. Can I do this by simply putting in new rock and letting it colonise with bacteria from the existing live rock, or will I need to add live rock?
Thank you,
Scott Smith, Mansfield.

Hi Scott,
To answer your question, firstly, it is worth establishing what 'live rock' is. The rock itself is not live, but rather it provides a place for bacteria and other beneficial organisms to live. It is the large surface area and porous nature of live rock that allows a massive amount of bacteria to live in it and act as the major element of biological filtration in most modern marine aquariums. The rock itself is made up of layer upon layer of skeletons of long-dead corals, which are then colonised by all manner of life. The rock that TMC brings into the UK is storm-damaged rock that has broken loose of its own accord, thereby having minimal impact on the reef. Whenever possible we also ship in cultured rock. This is artificially-made aquacultured rock that is moulded and then left for a year or more to encrust in coralline algae and natural reef fauna.

If you are looking to add extra rock once the tank has cycled, make sure you use cured rock. Cured rock has been heated, circulated and protein-skimmed to extract any harmful dead organisms, which ensures the rock will not release any harmful ammonia or nitrite into the tank. Either make sure you use a reputable LFS that will have cured the rock fully, or ask if they can check ammonia and nitrite levels. I am sure most shops would be happy to do this to give you peace of mind. If using uncured live rock, then make sure you cure the rock fully in a separate tank or container away from the tank the rock is intended for. Test for ammonia and nitrite every few days, and only when both these tests read zero is the rock ready for placing in the tank. At all our holding facilities in the UK and Portugal, TMC uses Salifert and Tropic Marin test kits, which provide very accurate and reliable readings.

As I mentioned above, the rock itself is not live, but gives a home to bacteria, giving it its great biological filtering capacity. With this in mind, it is possible to use so-called dead rock (for the purposes of this question I am talking about things like reef bones). This rock still has great filtering capacity, because it is essentially the same material as live rock but is completely devoid of bacteria and other microorganisms. This dead rock could be used in combination with live rock, and would very quickly seed the bones or plates with bacteria, so they would then also become live. Whichever type of rock you decide to use to add to your aquascape, make sure any changes you make are made slowly, and add rock little by little. That way, if any problem does arise it is much easier to rectify.

The last thing to mention is aquascaping. There are many different ways to design your aquascape, and this is such a broad area that it really requires its own discussion in a separate article. But no matter what style of aquascape you go for, try to ensure that it provides as realistic an environment as possible for the type of animals you want to house in it. For example, space for those that need plenty of swimming room, or crevices and places to hide for shy species. It is also vitally important that the structure is secure, in order to ensure that heavy rocks cannot be knocked over by boisterous fish and crack the bottom of the tank. A great way to help reduce this risk is to use egg crate to create a base that will evenly distribute weight and provide a protective layer. It is also worth investing in some epoxy putty such as Milliput or TMC Reefers Epoxy Putty. This allows you to quickly and easily attach rocks together, and helps create a visually interesting aquascape and a more interesting home for the fish to swim in.

In summary, it comes down to personal preference, and which rock you prefer for the look of the overall aquascape. Whatever you use, make sure you are patient and make any changes slowly.

Dave Hawkins, TMC.

Hi Marine Habitat,
I have carbon running in my tank, but because of mixed advice from different sources, I'm not entirely sure if I should have it. Is running carbon a good thing, or is it a bad thing, because many reefers suggest that it may suck out a lot of good stuff. Finally, how should I use it and is there any length of time I should run the carbon for?
Thanks for any helpful advice.
John Seamore, Nottingham.

Hi John,
I personally would not like to run a reef system, or even a fish-only system, without using carbon, ozone, strong UV, and a few other similar chemical removers (e.g. Purigen). They are the only ways, apart from water changes, to remove annoying and polluting yellowing chemicals that will not break down easily and will not skim out.

There are, however, a number of issues with carbon usage. The first is its uptake of useful compounds, notably iodine. This has to be accepted as fact, but the solution is active dosing of iodine if you think this is going to be a problem for you; if, for example, you plan to grow macroalgae as another source of nutrient export. This is an interesting scenario because those using macroalgae are often obliged to use carbon heavily to remove nuisance yellowing organics released by the caulerpa, and to a lesser extent chaetomorpha, commonly employed in such systems.

The second problem to bear in mind is release of phosphates. There are a variety of ways of preparing activated carbon, but acid washing with phosphoric acid is sometimes employed, and leftover acid can be a nuisance in some brands. Test it by leaving some in water, and after a while test with a phosphate test kit; if you find it a problem, try washing it or change brands.

Selection of brand is tricky. While really cheap carbon is rarely good, a very high price is no guide to performance. Europe, sadly, does not have an equivalent to the US bulk carbon that is also very high performing (or at least I haven't seen it). Experience, research, and to an extent reputation, all need to be considered.

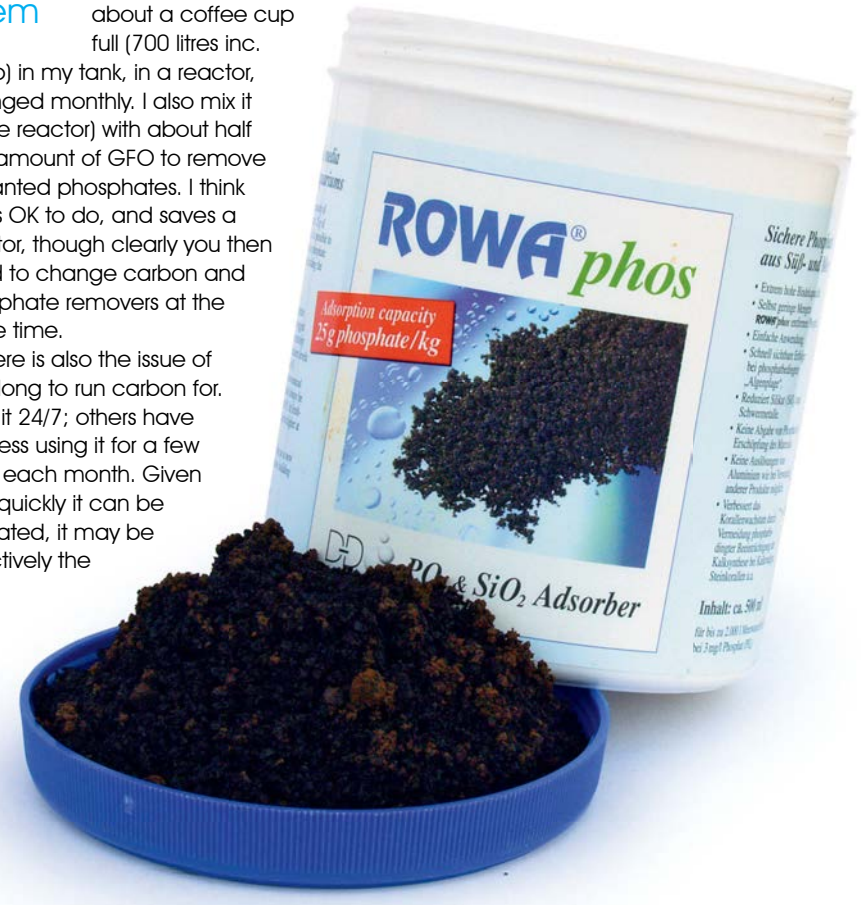
You can use it either in a fluidised reactor or in a mesh bag. I have done both, and much prefer the former for consistent and efficient use. If you're going to use it in a reactor, I've got the best results with a small grained carbon like Fauna Marin or Seachem. If you're going to use it in a bag, try to get something with a larger grain size (e.g. Rowa), because you are likely to get better flow to the centre of the bag, and take care to clean the bag properly when you change the carbon. Using it in a bag is reputedly gentler than using a reactor, but could also be considered less efficient. The systemised nanos are helpful, as water is forced to flow through various compartments, encouraging some active flow. The quantity to use can be tricky to decide – I would start by taking the manufacturer's recommendations, and build up to those over a couple of months because the sudden use of a lot of carbon can be a large change for a system. In some tanks the removal of a lot of yellowing compounds, and the increase in clarity, has produced light shocks. I personally use about a coffee cup full (700 litres inc. sump) in my tank, in a reactor, changed monthly. I also mix it (in the reactor) with about half that amount of GFO to remove unwanted phosphates. I think that's OK to do, and saves a reactor, though clearly you then need to change carbon and phosphate removers at the same time.

If you're going to use it in a reactor, I've got the best results with a small grained carbon like Fauna Marin or Seachem

There is also the issue of how long to run carbon for. I use it 24/7; others have success using it for a few days each month. Given how quickly it can be saturated, it may be effectively the same. Again, personal experience and a small starting dose will help you.

There are other chemical alternatives to carbon. Purigen reputedly does a fine job, and can be recharged to save on costs, and aluminium-based phosphate removers also reputedly remove organics as well as phosphates (which can be an issue if you're trying to tidy up a messy tank and it removes the organics rather than the phosphate). With the use of all these chemicals, it's always good to remember that the aim of them is to produce a functioning tank that isn't insanely hard to maintain. Do what works for you, rather than being dogmatic about dosages and product brands.

Wayne Oxborough,
Stavanger, Norway, Ultimate Reef.



Hi, I wonder if you could provide some clarification on bubbles in the marine aquarium. Should they be avoided, and if so and why? Thomas Cunning, Reading.

Thomas, of all the questions I have been asked to date, this one has had me racking my brains the most, simply because while the majority of things you have heard or read are likely to be mistruths, they may have an element of truth behind them.

Over the years I have heard people saying that bubbles, and this mainly relates to micro-bubbles, cause problems to fish and corals alike. I have heard and read that the air can get lodged in the fish's gills, it can cause pop-eye due to stress, and it has even been suggested that it can cause bubble algae – all of which I consider to be utter tosh!

I would firstly like to set the scene of a reef, where large waves tumble and crash, drawing down with them large volumes of air, which form bubbles of varying sizes beneath the surface. If the air bubbles were that dangerous to the wellbeing of the corals that make up the reef, and the fish and other inverts which reside there, then surely these regions would be devoid of life.

You then need to consider other processes such as photosynthesis, where corals and algae produce oxygen, which in well-illuminated regions can literally bubble up from the corals and algae; this can be observed even in the home aquarium. My strand of zostera, or eelgrass, for example, literally pearls with bubbles of oxygen for about 5 hours every day, often with a steady stream of bubbles every 3 seconds or so. Therefore how could the life forms we keep have evolved if the presence of air bubbles was so dangerous, and we had to do all we could to prevent them from entering our aquariums?

Image shows bubbles entering the water through surface disturbance.

On the flip side, however, we need to realise that our closed systems are not a true representation of the oceans from which our stock hail. Although we employ wavemakers and have relatively high turnover rates, we can never replicate the currents, eddies and flows that happen in nature, and it is here that I can see some credence to the fact that air bubbles can damage corals. It is plausible that with bushier corals, air bubbles can become trapped, or with plating corals, air pockets can form on the underside, which in essence would be like removing the coral from the water, resulting in damage to tissue and potentially leading to the death of the colony.

> If the air bubbles were that dangerous to the wellbeing of the corals that make up the reef, and the fish and other inverts which reside there, then surely these regions would be devoid of life

Air bubbles within an aquarium can cause other issues such as salt creep, where the bursting action of the bubbles at the surface splashes water onto the aquarium sides, over the sides, or onto light fixtures. Not only can this result in fluctuating salinity, it can also damage equipment or curtail the life span of light tubes.

It could be said that air bubbles can cause reflection or refraction of light within the aquarium, however, there are pros and cons to this argument that far exceed the space available here to discuss them. It is safe to say that ultimately, air bubbles in the marine aquarium can be unsightly in large quantities, and while we generally do all we can to prevent them from entering the aquarium, by installing baffles in our sumps or using filter socks, they are not something we should generally fear.

Levi Major.

Hi Marine Habitat,
Obviously, fish stocking levels are different for every system, but I wonder if there is a general rule of thumb, and if so, what is this based on? Is the main consideration the oxygen levels in the tank, and if it is, can this be increased to boost the fish allowance?
Regards, Ben Dalton, London.

Hi Ben,
Greetings from the depths of the jungle. I am currently working in Brazil, monitoring water quality for a charity, so your question is quite relevant to the works we are doing at the moment. The main parameters we are testing for are dissolved oxygen (DO) and BOD (biochemical oxygen demand).

The number of fish in a system is known as the 'stock density', and the guide for the ornamental trade is to not exceed over 6kg of fish per cubic metre. If you work it out, this is still a huge number of fish to have in a metre cube, almost tail to nose, and unrealistic in most hobbyist circumstances.

Typically a system will hold around 6mg/l of oxygen, and usually the hobbyist won't exceed this. That said, oxygen levels in aquariums are fish specific; we need to look at the fish's evolutionary adaptations. For instance, marine reef species require a lot more dissolved oxygen than, say, the opposite side of the scale, the mudskipper, which has evolved to use 'highly vasularised opercular buccopharyngeal cavities' to deal with the lack of oxygen in their natural environment.

So to simply answer the question: 'can I increase oxygen levels to increase fish allowance?' Yes and no! Yes because the more fish you have, the more dissolved oxygen you need; but no in the sense that if you have species that require 5 or 6 mg/l of oxygen, you should provide that for them. Keeping fish in aquariums is all about replicating the natural environment the animals are indigenous to. It is also worth noting that oxygen levels have a direct correlation with temperature. Colder water species often require a lot more oxygen, because cold water can carry a lot more oxygen. So, briefly touching on your point of almost 'forcing' more oxygen in the water is definitely an application that exists. The practice involves injecting purê oxygen into the water to stabilise the environment and prevent oxygen dips, thus enabling more fish to be squeezed into an area. As you have probably worked out, this application is overkill and specialised for the marine aquarium hobby.

"Keeping fish in aquariums is all about replicating the natural environment the animals are indigenous to

So, what is the best way to keep oxygen levels up in the home aquarium? The two most important things to consider are:

1 The surface area of the aquarium – when I design aquariums, I am often asked to make them, deeper, because the client makes the assumption that they can have more fish; this is not always the case. The greater the measurement from length x front to back = the greater the surface area for oxygen transfer with the atmosphere, and thus more fish can be kept.

2 Surface movement – direct powerheads and filtration inlets to create as much movement as possible on the surface. This enables a better oxygen transfer between aquarium and atmosphere.

It is also important to note that oxygen (although a key parameter for stock density of fish) works hand in hand with everything else. There is no point in having lots of oxygen in an aquarium and insufficient filtration to deal with nitrogenous wastes. So, in conclusion, to get more fish in a system it needs a highly efficient filter, and the maximum amount of oxygen for the particular type of fish you are keeping.

All the best,
Ben Woodward, www.fishkeeping.eu

A shoal of fish can look amazing in an aquarium, but stocking levels must be considered.

Image courtesy of Lee Cheesman.

What is the best thing to do with new corals to kill off any little hitchhikers before adding them to the tank?
Regards,
Tom Gosling, Chester.

Hi Tom,
The addition of live rock, either alone or associated with sessile invertebrates, can bring a wide variety of hitchhikers into the reef tank; many are welcome occupants, either enhancing the beauty of the tank or performing a vital role such as algal control or feeding on detritus.

There are a minority of these travellers which are most unwelcome though, due to their predatory nature, feeding either on motile fishes or invertebrates (in the case of the Mantis Shrimp), or feeding on sessile inverts (as shown by whelks or bristleworms).

Unfortunately, there is no simple treatment that can be added to live rock or invert specimen to free it from these troublesome hitchhikers. There is no common biological characteristic that can be targeted by any treatment, as most phyla of marine life are represented in the rock. For example, if all crustaceans were problematic in the reef tank, a crustacean-specific treatment could be added. However, as there are only a minority of troublesome crustaceans, eliminating them all from the incoming rock would deprive the tank of many beneficial occupants. Thus with no magic bullet, we can only rely on effectively curing the live rock. If you purchase pre-cured live rock, question the retailer about the curing process. Was the rock cleaned before curing, how long was the curing process, what volumes of water held what quantity of rock, how were water quality parameters managed over the curing process, and most pertinent to your question – how were undesirable animals managed?

Unfortunately, there is no simple treatment that can be added to live rock or invert specimen to free it from these troublesome hitchhikers

For complete peace of mind, to prevent undesirable hitchhikers entering the main display tank, incoming live rock should be cured (or further cured) at home, so any undesirables can be spotted and removed. There is a very slim chance of troublesome hitchhikers coming in on the rock or exoskeletons of new invertebrate additions. Curing the rock here is not an option because this will likely harm the animal you are seeking to add to the reef. So again, quiz the retailer on the shipping and holding processes of the specimen. Remember, it is not in the retailer's interest to have these undesirables in their invert systems. How long have the inverts been in the supply chain, and what action has the retailer taken to remove hitchhikers? Finally, selecting a specimen on a smaller piece of rock reduces the risk of introducing unwelcome guests.

To summarise, unwanted hitchhikers are a risk of reef tank management, so effectively curing live rock yourself is the best way of reducing the most likely portal of entry. Additions via invert stocking are a less likely route.

Dave Hulse, Tetra consultant.

Many hitchhikers are only visible at night.

Bristleworms may look a pest, but can prove to be excellent scavengers of left over food.

GETTING STARTED

NATIVE

PART 2

HOW TO KEEP TEMPERATE REEF SYSTEMS IN AQUARIA

Gary Wallace continues his series explaining the basics to help you get started in the less documented native fishkeeping.

GARY WALLACE

Age: 44.

Hometown: Bournemouth, Dorset, UK.

Full-time occupation: Plumbing and heating installation and design. Also a semi-professional photographer .

Marine experience: 12 years.

Aquarium size: L1.8 x H0.75 x W1m with a 182-litre (40 imperial gallon) sump.

Favourite fish: I love native wrasse species; intelligent, interesting and often very colourful. In tropical tanks I was always very proud of my anthia shoal.

Specialist areas: British native marine reefkeeping.

Whilst many tropical reef aquariums require only a chiller to be rendered suitable for the keeping of temperate marines, there are a number of fundamental differences to bear in mind. Most obviously is the temperature; a tropical aquarium at 26°C sits comfortably in the living room. A temperate aquarium at 16°C cools the room considerably, and a glass aquarium at this low temperature may be subject to condensation in a nice warm house. I don't want to put you off – but think carefully about where you will put your temperate reef before going any further. Fifty gallons of cold salty water in the lounge, dripping with condensation, may not be quite what you had in mind.

However, a compromise can be reached. Whilst 16°C is optimum, the majority of rock pool creatures are happy enough at 18°C, a temperature that is not uncomfortable for humans, and provided you can keep a room at this temperature, you may get away without needing a chiller for much of the year. In the summer months though, it's quite common for the air temperature to be over 22°C for weeks on end, and this will not be tolerated by many of the native flora and fauna. A chiller is more or less essential, I'm afraid. Condensation can be further reduced by using thick acrylic instead of glass for the aquarium; 1ins acrylic won't sweat, even at 10°C difference between the room and the water inside.

Another major difference between temperate and keeping tropical in a temperate country is the sheer biodiversity of the animals and plants you are able to obtain. There are over 600 seaweeds found around Britain, and they form the primary producer of the shore ecosystem. They replace corals as the main feature of the native reef, with one exception – the angiosperm Eelgrass; all seaweeds are macroalgaes and present the greatest challenge to creating a realistic biotope within a captive environment. Luckily, technology is catching up with temperate requirements, and keeping seaweeds is now becoming more realistic.

We are fortunate in Britain to have an excellent road network, and proximity to thousands of miles of coastline. Access to fresh seawater, sand and live rock allows us to create a microhabitat from scratch with only a few trips to the beach. All the bacteria, algae, meiofauna and plankton necessary to process wastes and biological processes are present, allowing instant reasonable stocking of fish without cycling.

I believe in a low-tech, low-maintenance, and natural approach to reefkeeping. Sensible stocking, live sand, rock and seawater, nutrient utilisation rather than mineralisation (the conversion of organic compound to inorganic), and replicating a biotope as closely as possible allows us to create beautiful, dynamic, healthy and sustainable home aquaria with the minimum of fuss, bother and maintenance.

So, to get started you will need:

AQUARIUM – Preferably acrylic, but glass will do just fine if the condensation issue can be overcome. As in any system, the bigger the better, and a sump makes life much easier in the long term. Native reefs have lots of seaweed; seaweed grows and dies off, creating a lot of rubbish that blocks up pump intakes in the display tank. If you can keep skimmers, chiller pumps and filters in the sump, you will have far less tedious maintenance cleaning-out equipment.

CHILLER – Unfortunately, none of the aquarium chiller manufacturers seem to make a chiller that is capable of maintaining temperatures around the 16°C that our native flora and fauna require. Aquarium chillers are designed to keep aquariums at about 24-26°C when external heat sources threaten to raise the temperature above tropical levels. Therefore we need to look elsewhere for a suitable chiller.

Beer chillers with stainless steel cooling coils do a fine job for not a lot of money. Second-hand Cornelius beer chillers can be found for around the £50 mark on eBay, and will cope with systems up to about 200 gallons under most conditions. The coil MUST be stainless steel; some are copper and must obviously be avoided at all costs.

Connecting a pump to the chiller is relatively easy. I use 20mm plastic hose from the pump to about 4ins above the sump high-water level, and then insert 15mm Speedfit plastic pipe into the hose; a jubilee clip makes a good connection. The Speedfit can then be run to the chiller, which needs to be remote from the aquarium (they are noisy and generate a lot of heat); reduce the 15mm Speedfit to 10mm via a 15mm tee and two 10mm reducers. Into each 10mm fitting you can push a short length of regular 8mm plastic air hose; heat the end in boiling water to soften it and force in a 10mm Speedfit insert. This allows it to make a good seal in the fitting. Heat up the other end and force that over the stainless steel 8mm inlet tube on the chiller. Repeat for the outlet pipes.

The chiller should be kept higher than the water level of the sump. It should be left on at all times and the thermostat adjusted to maintain the required temperature.

This needs adjusting according to the air temperature of the room housing the display tank. It's also very important to keep the chiller reservoir topped up with water. It will be quieter and far more effective when topped up correctly. Performance is severely impaired when the reservoir is allowed to evaporate. The coils run through this reservoir of chilled water, and if the reservoir is empty the chiller simply doesn't work very well at all.

Generally, I top up about once a fortnight; the thermostat on the chiller stays around the '2' mark, and that's about all I need to do with it. If the chiller pump intake is in the display tank, you need to screen it from particles – the 8mm coil (OD) is very easily blocked by debris. It's far less trouble to keep a dark sump with the pumps in there.

> Access to fresh seawater, sand and live rock allows us to create a microhabitat from scratch with only a few trips to the beach

LIGHTING – Somewhat surprisingly, our native reefs require intense light to thrive. At the very least, full spectrum tropical marine reef lights are required to grow native algaes. The plants we collect will generally be less than 2ft below the surface at low tide, so they are used to full sunlight, and many species will fail under anything less. Reproducing

Beadlet Anemone.

Visible species include Goldsinny, Corkwing, Two Spot Goby and Mullet.

intense, full spectrum light suitable for plant photosynthesis that is aesthetically pleasing and doesn't generate too much heat remains a significant challenge. However, there are a number of lighting options:

1. METAL HALIDE – still the best artificial light source available to aquarists. Halides are readily available at colour temperatures that are useful for photosynthesis at reasonable cost; they are intense, powerful and proven. However, a significant drawback is the amount of heat that metal halides generate. In the summer months a regular chiller will struggle to cope with ambient temperature, and under metal halides it could prove rather difficult to regulate temperature.

2. FLUORESCENT – available in all spectrums, cheap, and far cooler than halides, fluorescent lamps can be useful. Unfortunately, they rapidly lose output power and require changing at least every 9 months or so. A 3ft x 2ft x 2ft native reef needs at least six 30ins lamps at £20 each, so it can work out rather expensive.

> The plants we collect will generally be less than 2ft below the surface at low tide, so they are used to full sunlight, and many species will fail under anything less

3. LED – the exciting new kid on the block. Light-emitting diodes are rapidly replacing traditional lamps in all manner of application, and reefkeeping is no exception. Manufacturers claim a life of around 50,000 hours – that's over 11 years at 12 hours a day! They generate little heat, consume a fraction of the power of all other options, and marine reef LEDs are attracting favourable reviews already. Although they don't appear as bright as halides to our eyes, it is claimed that they provide comparable amounts of useable light, even at the bottom of the tank. LEDs are getting cheaper and better every year – they are rapidly becoming the light source of choice.

Whichever option you decide upon, you need to ensure that some provision is allowed for plant photosynthesis. Marine lamps are generally in the 10,000K to 20,000K temperature. Pleasing to look at, crisp, cool, and typical of sps coral reef aquariums, often sold as Marine White, these temperatures are enormously popular for a number of reasons – one of which is that they are unsuitable for algal growth. Lacking anything in the red spectrum, the light most readily used by plants, they inhibit algal growth, which is obviously attractive to many tropical reefkeepers.

However, we need to promote plant growth, and therefore something in the 6,500K temperature range is required. Usually sold as some kind of plant lamp, less attractive to look at, with a yellow or even pink tinge, they can be mixed with regular marine lamps to good effect.

Getting the right balance is dependent on a number of factors. You want a light that is attractive and shows off the colours of the plants and animals to the best advantage. It needs to contain something in the lower temperature ranges to promote plant growth. It must be as heat efficient as possible – running a chiller can be expensive, so keep heat sources to a minimum. Consideration must be given to maintenance – how long will it last before a change is required?

A mixture of LEDs at various temperatures seems to be the best option. In my own aquarium I have 30 x 10W 6,500K, 10 x 10W blue actinic, and five 10W red. I am able to keep Bladder Wrack, the dominant plant found in rock pools, for the first time. However, the red lamps introduce a rather unattractive colour cast and may not be necessary. There is scope for much experimentation; I am tempted to replace the red lamps with something of a higher temperature, possibly 20,000K to favour coralline algaes a little more.

SKIMMING – Protein skimmers, otherwise known as foam fractionators, are possibly the most useful tool available to maintain water quality. Soluble proteins, such as faecal matter, plant and food juice, and all manner of unmineralised soluble organic waste are attracted to the surface of air bubbles. They stick to them. Using this property to its best advantage, a skimmer creates vast numbers of tiny bubbles in a cylinder through which aquarium water is pumped. Soluble waste in the water is picked up by the bubbles, which rise to a collection cup at the top of the cylinder.

The disgusting thick brown sludge that ends up in the collection cup can be periodically disposed of.

GLOSSARY

MACROFAUNA – animals over 1mm.

MEIOFAUNA – between 0.05 and 1mm.

MICROFAUNA – below 0.05mm.

INFAUNAL – animals that live within the substrate.

LIVE ROCK – any rock that has spent enough time in the sea to become a habitat for plants and sessile animals, including bacterias beneficial to biological processes.

SUBSTRATE – sand or gravels forming the base covering of the tank. In a native reef, substrate should be collected from as low down the shore line as possible. Containing vast numbers of meiofauna, the substrate is the basis of the natural filtration of the aquarium.

LIVE SEAWATER – in this context it refers to freshly collected natural seawater complete with plankton.

BIOTOPE – A captive habitat based on a specific area or type containing only flora and fauna from that area. For example: an Amazon biotope would contain only plants and fish from the Amazon.

Although skimmers require a reasonable amount of tinkering to work efficiently, they are, by and large, simple, easy, effective, and remarkably efficient at removing wastes from the water. As an added bonus, they also aerate the water and increase the REDOX potential.

Native marine reef aquariums, with the constant cycle of plant growth and subsequent die-off, benefit enormously from constant, heavy skimming. I'm not sure that it would be possible to over-skim a native reef. It is claimed that iodine can be stripped from the system by skimming. Iodine is essential to seaweed growth, so as a precaution I add a small amount of iodine to my reef, in the form of Lugols Solution, at regular intervals.

Another concern frequently voiced is that skimming removes plankton. I have not noticed any fall in plankton density whilst skimming, and others who have employed skimming specifically to remove phytoplankton blooms in temperate aquariums have reported that skimming appeared to have little or no effect.

Native marine reef aquariums, with the constant cycle of plant growth and subsequent die-off, benefit enormously from constant, heavy skimming

CIRCULATION – Whilst a rock pool at low tide is a still and placid environment, it is a different story at other times. The incoming tide, often with strong wave action, brings far more circulation than we are able to reproduce in a home aquarium. Strong, chaotic, and turbulent water movement is essential to native reefs. Fine branching algaes trap sediments, rapidly attracting undesirable slime algaes unless washed clean on a regular basis. I use a plastic spatula to paddle stronger currents across the rocks a couple of times a week or so.

Water movement assists in dissolving wastes into the water column, where the skimmers can remove them. It brings food to sessile organisms, such as keelworms and squirts, often found colonising the hidden areas of the aquarium. It keeps plants and animals clean, so it's vital to get as much movement in the display tank as possible.

WATER – Freshly collected natural seawater is teeming with planktonic life. Its chemical make-up, biological load and specific gravity is exactly what the animals and plants we collect are used to. There is no better water for a native reef than natural seawater. Rapid transit is essential; if the plankton dies off it needs removing, so get it home as soon as possible and use it straightaway.

Some aquarists have thriving planted aquariums entirely seeded by plankton from seawater. Take a bare aquarium, add some oyster shells to the base, fill with freshly collected seawater, light and chill, move the water around, and wait. Within days you will see the first signs of settlement. Many animals and plants can be grown this way, including mussels, barnacles, crabs, hydras, soft corals, sponges, squirts, and seaweeds. It's a fascinating experiment.

All aquariums, no matter how balanced, benefit from regular partial water changes,

Spiny Starfish eating cockle .

and native reefs are no exception. Many animals and plants have planktonic stages at different times of the year, and it's a great benefit to biodiversity within the aquarium to carry out a partial change at monthly intervals, to gain the greatest chance of introducing the widest range of organisms.

With luck you may find that sponges and soft corals colonise the areas of the system where algaes do not grow, such as the sump.

SUBSTRATE – Broadly speaking, the shores of the British Isles can be divided into two main categories – sandy or rocky. Rocky shores are characterised by cliffs, large, immobile rocks, and numerous rock pools. This is the hunting ground for native aquarists. Rich in macrofauna and seaweeds, full of interest

Plumrose Anemones.

and colour, rocky shores are the habitat we are trying to replicate in the aquarium.

Sandy shores, ranging from fine muds to large pebbles, on the other hand, are, at first glance, barren of plants and animals. However, appearances can be deceptive. Whilst rocky shores may have all the macrofauna and plants, the greater biomass may be on a sandy shore where infaunal meiofauna can number in the thousands of species, and the newly settled juveniles of just a few species of bivalve mollusc can occur in the thousands per square metre. The particle size of the sand has a massive effect on the biomass it is able to support; the finer the particle, the higher the biomass. Large pebbles, for instance, create a virtual desert. A very fine mud, on the other hand, consisting of the very finest particles, can support a huge biomass.

A fine sand, collected at low tide from as far down the beach as possible, and transported rapidly to the aquarium, will be teeming with benthic animal life. There are 22 known Phyla of meiofauna alone, and who knows how many microfauna is to be found in fine sediment in Britain. Lacking a primary producer, sandy shore ecosystems are based upon detritus, in the form of dead and decaying plant matter as a primary food source, or filter feeding on water-borne plankton.

A few centimetres below the surface of a fine yellow sand is a thin grey layer marking the Redox Potential Discontinuity (RPD), above which it is relatively rich in oxygen and supporting aerobic processes, below which it is largely deficient in oxygen and therefore anaerobic. The finer the sand particle, the closer to the surface is the RPD. The layer beneath the RPD is often dark grey or black with iron sulphides, rich in organic content and teeming with life. Often a bit odiferous, this is actually the good stuff. A 5-6ins layer of sand, including plenty of this anaerobic black layer, seems to be remarkably effective at consuming wastes in a captive environment. It's probably best to keep it in a section of the system with lower flow than the display tank, because a fine sand will be blown all over the place, as I have found in my own aquarium.

My evidence is entirely anecdotal, based only on the observations of ammonia, nitrite and nitrate levels in a number of native marine aquariums over a number of years. I have found that using a very fine sand with plenty of the deeper black layer allows instant stocking with no recordable mineralised product. Waste either does not mineralise, being constantly retained in the biomass in one form or another until exported via the skimmer, or if it does mineralise, it is either taken up effectively by algal growth or is mineralised completely to harmless nitrogen gas deep in the sand bed. Whatever the case, and I suspect probably a little of all the above is the case, I am firmly convinced that freshly collected fine sand, rich in organic content and benthic meio and microfauna, is of the utmost use in creating an instant filter in a captive environment.

> A 5-6ins layer of sand, including plenty of this anaerobic black layer, seems to be remarkably effective at consuming wastes in a captive environment

If the sand bed is to be kept in a different part of the system than the display tank, then a much coarser sand can be used in the display. If it's heavy enough to resist being blown around, you will appreciate the improvement in water clarity.

AQUASCAPING – The base layer of rock within the aquarium can be any rock that doesn't contain metal ores. Sedimentary rocks are preferable to igneous, limestone and chalk are the best. Being composed of the skeletons of marine organisms, porous, and offering some capacity for buffering, they act in much the same way as coral rock in a tropical aquarium.

Once the base layer has been established, it is possible to place a layer of live rock on top. Any rock encrusted with life, fresh from the sea and transported under water as rapidly as possible to the aquarium, can be regarded as premium live rock.

Planted rocks create an instant underwater garden, and once in the aquarium you will notice many more inhabitants than was first apparent. Brittle stars, barnacles, squirts, sponges, coralline algaes, anemones and bryozoans are all likely inhabitants.

Collecting live rock is hard work; the rocks weigh far more when you have to carry them up a cliff! But it's immensely rewarding, and once in place you will have an instant reef. All you need to do now is catch some critters and fish. GW

Dahlia Anemones.

NEXT TIME

The shallow, temperate waters around the British Coast are teeming with life. Finding livestock for a native reef is not going to be a problem for most people. Perhaps the easiest places to start looking are rock pools. In part 3 of this native marines series, Gary will give us a run-down of the species you may find here.

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YOUR ULTIMATE SPECIES GUIDE

In each issue we will provide three or more in-depth guides on marine species found in the home aquarium. Profiles will be full of facts, photos and guidelines to keep the species in tip-top condition.

THIS TIME...

Yellow Tang

Black Sea Urchin

Torch Coral

WHY NOT?

Tear out these profiles and start creating your own archive. Each issue will have three profiles which will be available to download from our website should you want to keep the magazine intact.

JOHN CLIPPERTON

Age: 36

Hometown: Chester, Uk

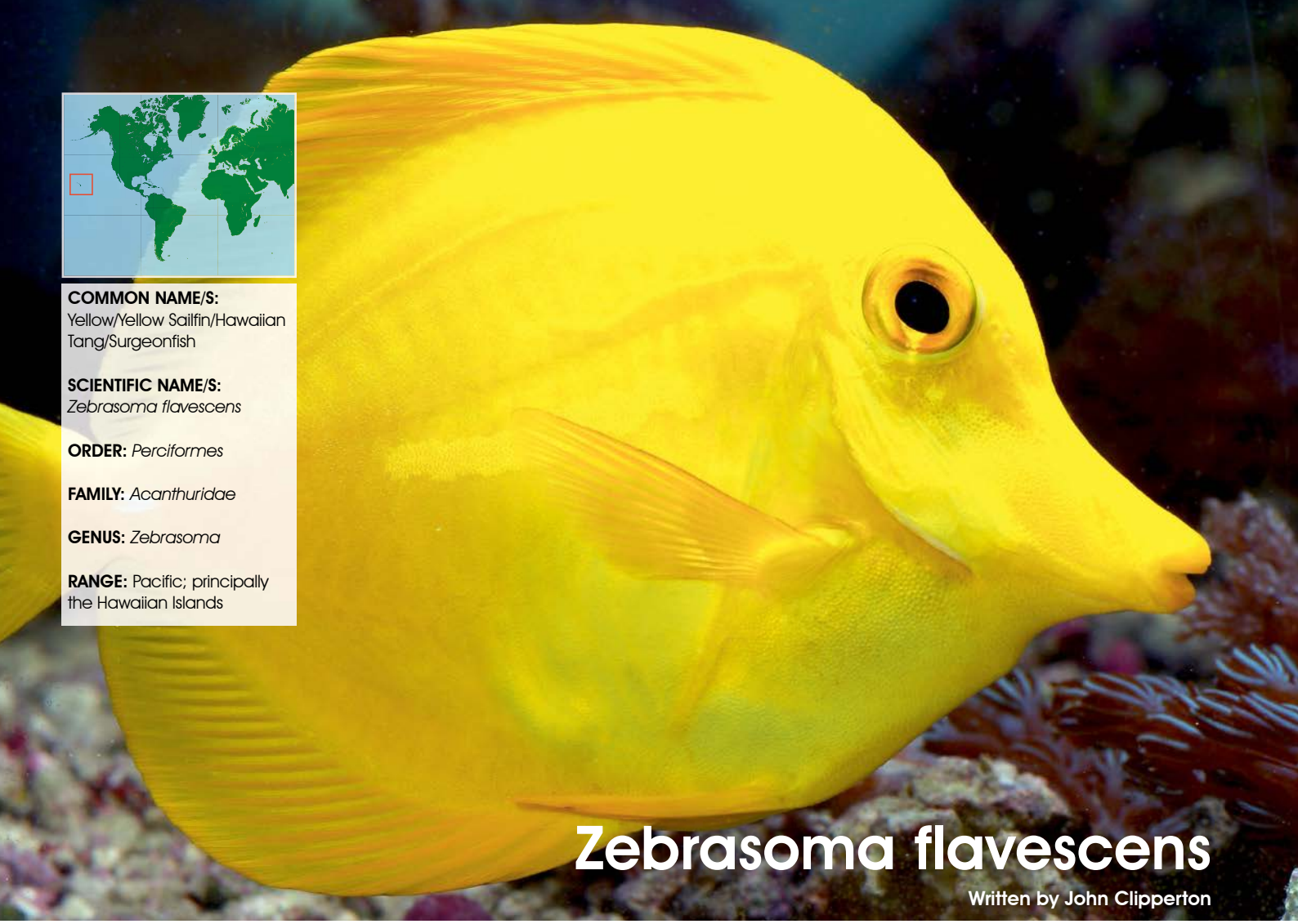
Full-time occupation: Office worker, photographer

Marine experience: 10yrs

Aquarium size: 205 litres (45 imperial gallons)

Favourite fish: Clipperton Angelfish
coral: Can't choose just one... sorry!
other: Peacock Mantis Shrimp

Specialist areas: Aquarium photography, species identification and runs Digital Reefs website



COMMON NAME/S:
Yellow/Yellow Sailfin/Hawaiian Tang/Surgeonfish

SCIENTIFIC NAME/S:
Zebrasoma flavescens

ORDER: *Perciformes*

FAMILY: *Acanthuridae*

GENUS: *Zebrasoma*

RANGE: Pacific; principally the Hawaiian Islands

Zebrasoma flavescens

Written by John Clipperton

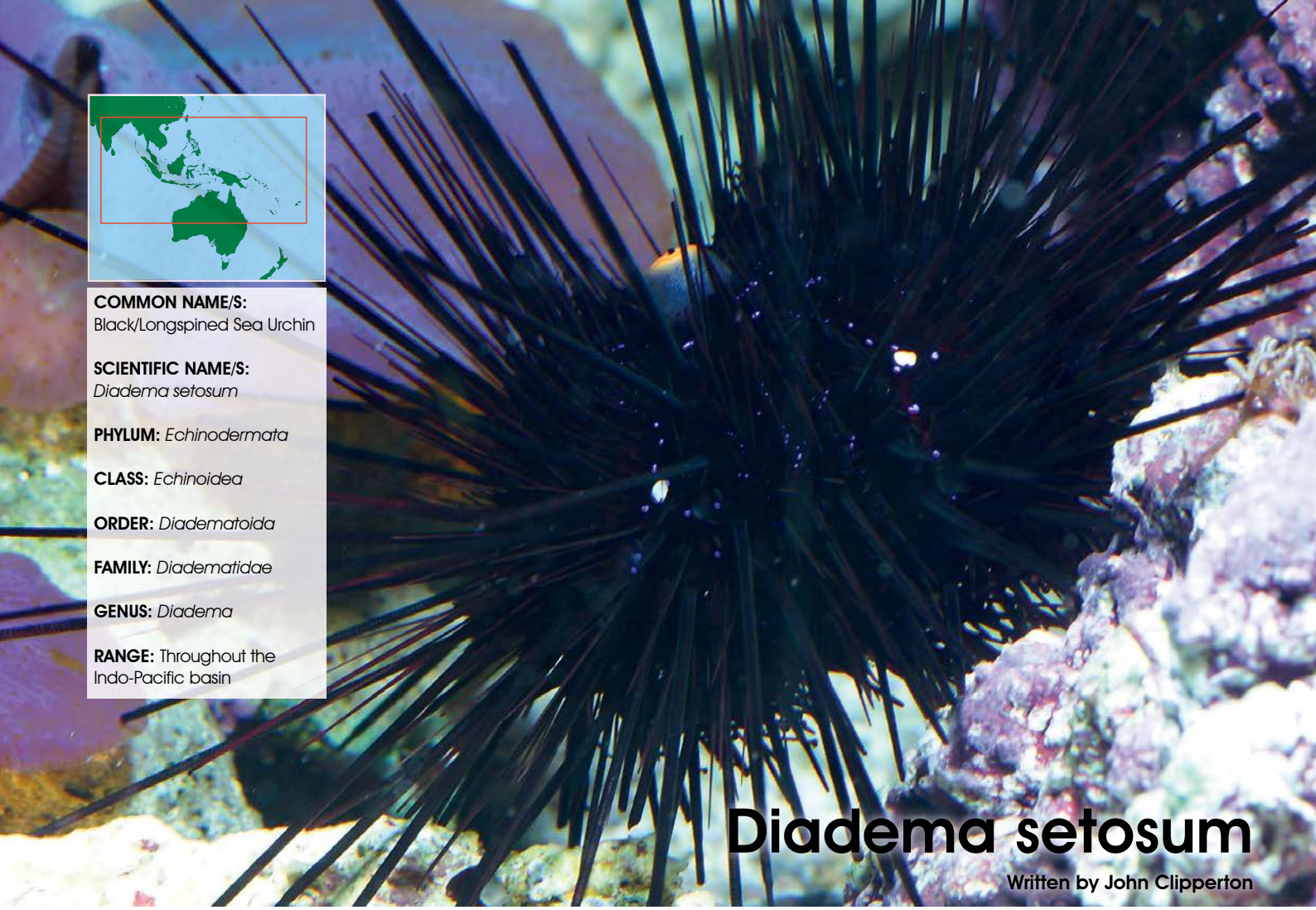
NATURAL ENVIRONMENT: Preferring areas with abundant coral growth such as lagoons and outer reefs, the Yellow Tang occurs in brightly–lit waters ranging from around 3-46m in depth. As herbivores which roam widely and browse mainly on benthic turf algae, they live singly or in loose aggregations. They spawn in pairs or groups, and this activity is linked to seasonal and lunar cycles. Their vivid canary-yellow daytime colouration fades slightly at night, and a darker patch with a horizontal white band develops in the middle of their flank. At this time they typically seek shelter within crevices or amidst coral thickets. For protection, they are also equipped with a sharp spine at the base of their tail, which can be used as a slashing weapon in extreme circumstances.

Yellow Tangs are an iconic species that most hobbyists admire and own. With the current situation in Hawaii and the difficulty in breeding them, make sure you give yours the best care possible.

CAPTIVE CARE: Growing to around 20cm (8ins), and being extremely active and rather territorial by nature, the principal concern when housing such a fish in captivity is to provide it with plenty of swimming space and suitable tank mates. A tank of at least 200 litres (45 UK gallons) should be considered the minimum for a single juvenile specimen, rising to at least double this for a single adult or group. Ideally, the tank should also be at least 120cm (48ins) long in one dimension, and possess an aquascape that allows for relatively unimpeded swimming. Unless introduced as a group, it is best to house only one specimen, as while they are peaceful with most other species, they will fight with their own kind. Actually, other similar-sized Zebrasoma species will usually not be tolerated by an established specimen.

As well as physical space and suitable tank mates, water quality is also very important. They do not tolerate high levels of nitrogenous wastes well, and will be first to show signs of stress through loss of condition or disease if exposed to such conditions. An effective filtration system and a high level of circulation should deal with the relatively large amount of pollution generated by this fish, while keeping levels of dissolved oxygen high enough to satisfy their high performance metabolisms. Constant feeding opportunities are also recommended, and this can be achieved by offering sheet algae on a clip (or other device) as often as possible. They will also graze on filamentous algae growing on live rock, but unless the tank is very large it is likely that this will be consumed quite rapidly, necessitating the inclusion of artificial foods. Plant matter of marine origin is considered most appropriate and may be supplemented with frozen meaty foods or flake.

It is worth noting that most specimens offered in the trade are likely to have been collected from Hawaiian waters. Actually, around 70% of the yellow tangs for the aquarium industry are sourced from this area (as of the date of writing this piece, certain parties are actively attempting to bring an end to such activities in this area). When choosing a specimen, look for well-rounded individuals that do not appear emaciated. They should also show good colouration and be inquisitive, active, and keen to feed. Although a high rate of respiration is normal, look out for abnormal gill traits such as uneven or obviously laboured breathing. Also check for parasites, abrasions or other markings, which may indicate physical trauma or disease. Herding the specimen into a container underwater is better than using a net because the tail spine may become entangled.



COMMON NAME/S:
Black/Longspined Sea Urchin

SCIENTIFIC NAME/S:
Diadema setosum

PHYLUM: *Echinodermata*

CLASS: *Echinoidea*

ORDER: *Diadematoida*

FAMILY: *Diadematidae*

GENUS: *Diadema*

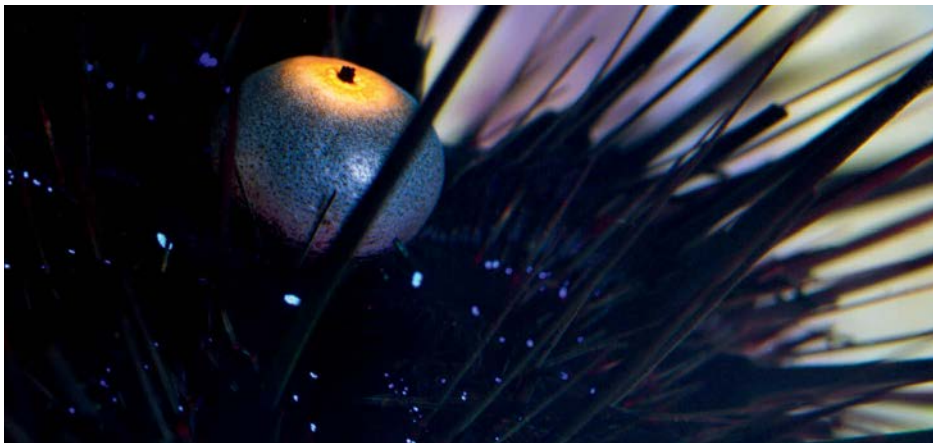
RANGE: Throughout the Indo-Pacific basin

Diadema setosum

Written by John Clipperton

NATURAL ENVIRONMENT: Widespread across the Indo-Pacific region, this species of urchin forms colonies in the shallow tropical waters of coastal habitats such as sand flats, seagrass beds and coral reefs. During the day they shelter in crevices and caves, and emerge during darkness to graze. They feed using a beak-like structure called the Aristotle's Lantern, which consists of five sharp wedges that can be moved using different muscles. This complex structure allows the urchin to scrape algae from hard surfaces, and the wedges grow constantly to avoid wearing down. They feed on a variety of algal species common on tropical coral reefs, and are regarded as being ecologically important to these systems for this reason. Some fishes, triggers and puffers particularly, may attempt to predate urchins by flipping them over and attacking their softer body parts. However, the urchin's long spines offer a very effective deterrent. Growing to over 1ft long, these barbed spines can be directed towards aggressors, and being hollow, can deliver mild venom. Many creatures have recognised the effectiveness of this defence mechanism, and various species may be observed sheltering within the protective shield in the wild, or even in captivity if suitable species are chosen. With overall colouration generally variable, the presence of a bright orange ring around the urchin's periproctal cone (anus) can be used to positively identify the species.

CAPTIVE CARE: Although potentially extremely useful in controlling algal growth in a reef aquarium setting, it should be noted that this species, particularly large specimens, may dislodge corals or rockwork. They are perhaps better suited to large 'fish only with live rock' systems, where their long protective spines even allow them to be kept with certain aggressive/predatory species who would make a meal of less robust janitors (avoid species that are known to predate on these urchins, of course!). Their sensitivity to the presence of copper and high nitrate levels should also be noted, and this does present a dilemma in that in ideal conditions, the food source of the urchin is likely to be overgrazed eventually. This means that supplementing the urchin's diet with dried seaweed may be necessary. Poor water quality may result in the shedding of spines, as may improper acclimatisation. Being Echinoderms, these creatures have a sensitive hydrovascular system that may be affected by exposure to air, or by rapidly fluctuating salinity. As such, they should not be removed from the water and acclimatisation should be undertaken with care. Of course, the aquarist should be careful not to impale him/herself on the urchin's spines. If this occurs, the first course of action should be to immerse the wound in non-scalding hot water. Any visible spines should be carefully removed, but take care not to dig around or crush spines (dye from the spines may make it appear as though fragments still remain, when in reality the dye normally disappears after 48 hours). If any markings remain after this time, or if swelling is evident, professional medical assistance should be sought.



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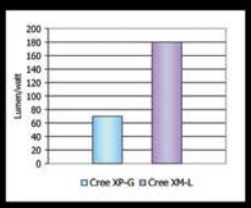

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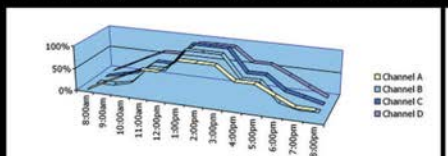
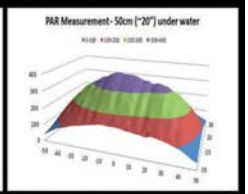


This diagram illustrates how the LED channels would cycle through different intensity throughout the day.



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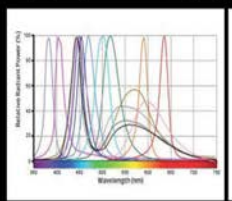

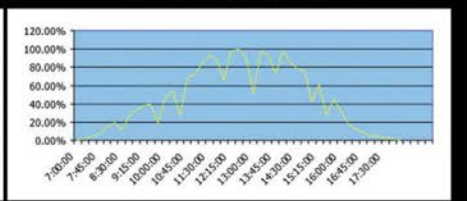

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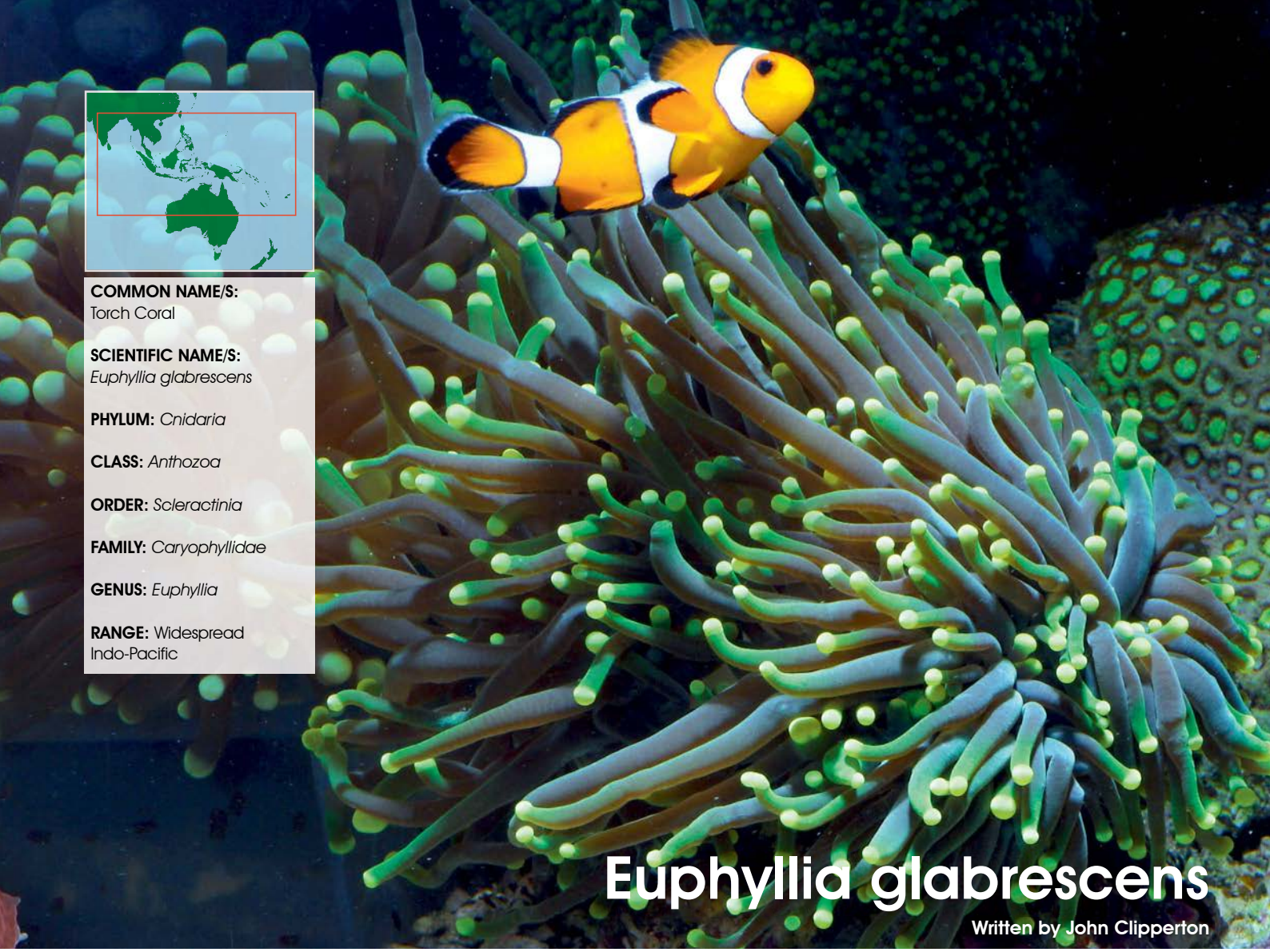


COMMON NAME/S:
Torch Coral

SCIENTIFIC NAME/S:
Euphyllia glabrescens

PHYLUM: *Cnidaria*

CLASS: *Anthozoa*

ORDER: *Scleractinia*

FAMILY: *Caryophyllidae*

GENUS: *Euphyllia*

RANGE: Widespread Indo-Pacific

Euphyllia glabrescens

Written by John Clipperton

Generally, the Torch doesn't need to be fed and gets most of its energy via photosynthesis. If you can, target feed the coral to encourage faster growth, but hand feeding can be fairly difficult to achieve.

NATURAL ENVIRONMENT: Thriving in a range of reef environments in the Red Sea, Indo-Pacific, Australian and Indian Oceans, and off Eastern Africa, the Torch Coral is most commonly observed at depths of 1-35m. Although widespread geographically, it is not particularly conspicuous in the wild, instead forming colonies of a modest size that exhibit a phaceloid structure (each corallite forms an individual tube, joined together at the base). The head of each skeleton stalk is crowned with ridged corallite in which a fleshy polyp sits, exhibiting long tubular tentacles that are often grey in colour, but can also be green or even orange with pale tips. Each polyp has a central mouth and the long tentacles can be retracted tightly into the corallite if the coral is disturbed. This species relies primarily on photosynthesis for energy but may also feed on zooplankton. In nature, various shrimp species have been observed living commensally within the polyps.

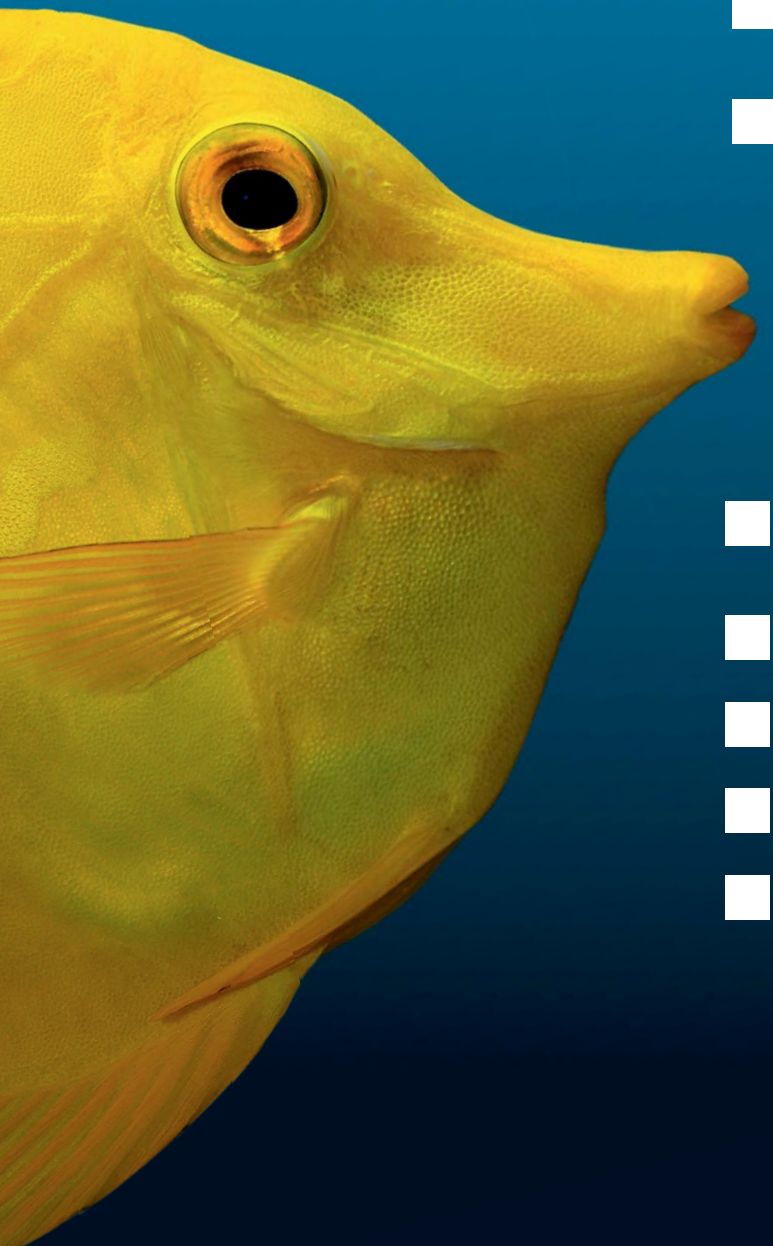
CAPTIVE CARE: Aside from choosing a specimen which shows no recession (no parts of white corallite should be exposed), special care should be taken to ensure that damage to the delicate fleshy tissue does not occur during handling, transport and introduction. Such damage can often lead to the coral succumbing to a bacterial infection (consider dipping corals before introducing them to your system). It is also worth noting that Caryophyllid corals generally are often susceptible to photo-shock, so a new specimen should be placed in a shaded area, at least initially. Actually, Torch Corals can do well in medium light situations permanently. If located in this way, take into account that a reduced ability to generate energy from photosynthesis may lead to the requirement for regular feeding (small meaty seafoods). Conversely, specimens acclimatised to high light intensities may not need to be fed directly at all. Medium chaotic or alternating flow is also preferred, indeed direct laminar flow at high velocities may lead to stripping of the delicate polyp tissues. Incorrect flow can also cause the long tentacles, which are tipped with powerful stinging nematocysts, to contact other corals and damage them. For this reason, it is also advisable to leave a clear perimeter around a colony. Clownfishes may set up home in a Torch Coral, but note that this activity may have a detrimental effect on the coral, particularly if the colony is small.

This species usually does well once settled and may develop new heads quite rapidly. Fragging colonies is also a fairly simple operation, usually achieved by either snapping or sawing off stalks, or groups of stalks. In light of this, always try to obtain new colonies from a captive source.

NEWBIE CHECKLIST

Completely new to the hobby? Never had a tank before? Not sure where or how to begin? Well take a look at our checklist to help you get started.

Marine fishkeeping can seem a little daunting to complete newcomers, with many areas to consider, and the potential cost of getting it wrong, so we thought we'd draw up a very simply checklist of things to ask when considering joining the hobby and setting up your own tank. We cannot provide the answers to any of these questions as part of the list, but if you take some time to research each of the points, then you'll be off to a great start. And of course, don't forget that some of these points will be covered by articles in the magazine.



- [ ] **ADVICE & SUPPORT**
  Where is your nearest local fish shop? Do you know anyone else with a tank that can help you? Do you have any books/mags?
- [ ] **BUDGET**
  What is your budget for setting up? How much can you afford for ongoing running costs?
- [ ] **TIME**
  How much time do you have available to maintain a tank? What happens when you go on holiday?
- [ ] **LOCATION AND SIZE**
  Where could a tank go (consider things like radiators, sunshine, condensation, etc.)? How big could the tank be?

***NOTE**: All of the above must be thoroughly considered, and decisions made before continuing*

- [ ] **LIVESTOCK CHOICES**
  Fish only or reef setup? What types of species would you like to keep (soft/LPS/SPS corals? Communal/aggressive fish? Delicate/robust inverts? Will your chosen species live happily together?)
- [ ] **TANK EQUIPMENT CHOICES**
  The above livestock choices will influence your choice of equipment, so please make sure you have considered that first.
  - [ ] **WATER FLOW**
    Direction? Volume?
  - [ ] **HEATING/COOLING**
    Smaller water volumes fluctuate more. Will you use a central temperature controller or manage manually?
  - [ ] **FILTRATION/SKIMMING**
    What size skimmer? Do you need an external filter? Mechanical/biological filtration techniques?
  - [ ] **LIGHTING**
    Type of light required (T5/halide/LED)? Amount of light required? Physical light position and fixing?
- [ ] **SAND AND ROCK CHOICES**
  Do you want sand; if so what type? Are you having rock; if so, cured/uncured? Live/not live? Natural/manufactured?

- [ ] **AQUASCAPING**
  How will you fix rocks together? How will you lay them out? Ensure you create the required environment for your chosen species.
- [ ] **CYCLING THE SYSTEM**
  A very important stage, so ensure you understand what this is, and why you do it.
- [ ] **RO AND SALTWATER**
  Where will you get your RO and saltwater from? Do you understand the difference? Maybe you want to make your own?
- [ ] **TESTING**
  What tests are required? Which test kits should you use? How do you fix problems that are identified?

SUMMARY

During the planning and research process, you will have loads of questions. If you would like to get an expert response, why don't you consider sending your question in to us and we'll look at getting it included in the Expert Advice section of a future magazine.

MYTH-BUSTER

The passage of time can distort information, and Chinese whispers begin to emerge. Now it's time to reassess our beliefs, bust myths and reveal the real truths.

Caulerpa sertularioides has a nice feathered leaf which could look nice in any aquarium.

DR NICK BRYAN

Age: 27.

Hometown: Liverpool, UK.

Full-time occupation: Research; my primary interest is prediction of the immune response to implantable devices.

Marine experience: 12yrs.

Aquarium size: Sumped 3x2x18 (Approx 300L).

Favourite fish: Addis Butterfly, Crosshatch Trigger, Yellow Tang, Ventralis Anthias, Epaulette Shark.
coral: *Acanthophyllia, Trachyphyllia.*
other: Harlequin Shrimp.

Specialist areas: Aquatic chemistry and molecular biology.

Dr Nick Bryan joins us this time to dispel some of the myths about macroalgae, a very useful item in the aquarium for naturally removing or balancing nitrate levels... but are there problems in using this form of natural filtration? Nick explains all.

We live in an age where a new product which claims to reduce dissolved organics hits our fish store shelves on a monthly basis. We're bombarded with potions to deplete this and molecules to chelate that, or novel uses of carbon sources that enrich the bacteria in a system. All these methods share a common goal; to remove substances such as nitrate and phosphate from aquarium water, which may fuel unfavourable algae growth and drive the colouration of the corals towards the brown end of the spectrum. More often than not, these cure-alls come and go, while fundamental system components with defined proven track records live on, and look on sceptically as the next big thing hits. One of these fundamentals is macroalgae.

In this instalment I'd like to focus on an old friend of marine aquarists – macroalgae. I'll discuss its two main guises in the fight for minimal nutrient levels: caulerpa and chaetomorpha, and dispel a number of the myths associated with the former algae, which have caused hobbyists to somewhat fall out of love with this brilliant organism over the last few years, despite its insatiable thirst for unsavoury aquarium molecules. Just a side point; there are dozens of macroalgae that crop up in the hobby, mainly as live rock hitchhikers. In this instalment, however, I'm just going to concentrate on the biology of a couple of species routinely utilised for nutrient export.

> The macroalgae locks up the nitrate and phosphate in its tissues as it grows

We're all familiar with the consequences of excess dissolved nutrients in systems; algal growth of various green shapes and forms happen on most, if not all, aquarium substrata. This is because algae utilise some of these dissolved organics, particularly nitrate and phosphate, to grow. So, with this in mind, this is exploited to expel these molecules from systems in the form of macroalgae, the bigger cousin of the microalgal sputtering, which call rocks, sand and glass home. Macro in a scientific context literally means large, as opposed to micro, meaning small. The term macroscopic is broadly used to refer to things that can be seen by the naked eye, as opposed to microscopic, which requires additional magnification beyond our own vision. The macroalgae locks up the nitrate and phosphate in its tissues as it grows, therefore can be removed from aquaria by a simple harvest of the sump's green bounty.

Briefly, here's how macroalgae works. Much like land plants, the algae utilise the green pigment (chlorophyll) in their cells to carry out photosynthesis. The green macroalgae discussed in this article are referred to broadly as chlorophyta, in reference to this green pigmentation. Other pigments exist, which colour macroalgae various hues of reds and browns, however, for the purpose of staying on track, I'll discuss

Chaetomorpha is a firm favourite of the hobbyist. Instead of branching off around an aquarium, it intertwines and makes a dense ball.

these another time. Photosynthesis (photo-light, synthesis-assembly) is the process in which plants, algae and some other organisms use the energy from sunlight to combine carbon dioxide and water into useful cellular sugars (carbohydrates).

So what are they doing with the nitrate and phosphate? Nitrogen is a pivotally important element in all cells, not just plants. It is crucial in the formation of proteins, the polymers which keep every single metabolic process in a cell ticking over. In proteins, the nitrate is reduced to form the amino group found in every single amino acid, the building blocks of proteins. Nitrogen is also in DNA, and in the case of plants is vital in forming the structure of that all-important chlorophyll molecule. Nitrogen (N2) in its atmospheric form is difficult for organisms to work with, and only specialised groups of things can metabolise it. So, combining some oxygen to it and giving it a charge in the form of nitrate (NO3-) makes it much more bio-available.

Looking inside a cell, the roles of phosphorous seem never–ending; it is used in human cells much for the same things. Like nitrogen, phosphorous in the form of phosphate is very important in maintaining the structure of DNA, which is a long polymer of building blocks called nucleic acids, held together via a phosphate molecule. It is also important in a molecule called ATP (adenosine triphosphate), which stores and redistributes energy in cells (nitrogen is also in this molecule). Furthermore, enzymes and proteins inside cells are often switched on and off by the process of the addition or removal of a phosphate molecule from their structure, carried out by a large family of enzymes called kinases. Phosphate can also be added to fats to make substances called phospholipids, the bricks which hold our cell membranes together. Similar to nitrogen, phosphorous is difficult to metabolise, but the addition of a charge in the form of phosphate (PO43-) makes it relatively straightforward.

So, macroalgaes are excellent. They lock up unwanted nitrate and phosphate; these molecules are so metabolically important because without them the algae would fail to exist.

> Caulerpa is an absolute machine at destroying nitrate and phosphate; you can literally watch this stuff grow

ON TO THE MYTH...

Caulerpa 'goes sexual'. I think possibly for the first time in my articles, this myth is true (does this still make it a myth by definition?!), although I think it's misunderstood. This genus of macroalgae does possess the ability to undergo a sexual phase, I can't deny that. It is, however, a relatively rare process, and I hope I can explain some of the reasons and misconceptions behind it.

Caulerpa is an absolute machine at destroying nitrate and phosphate; you can literally watch this stuff grow. In the '80s and '90s caulerpa was a workhorse of the marine aquarium hobby – every sump was full of it. Then all of a sudden, word started to spread about the potential of the algae to 'go sexual', and the macroalgae baton was passed to, in my opinion, the much less consistent chaetomorpha. Typically, we encounter *C.rasemosa* (Bubble Caulerpa), Taxifolia (Feather Caulerpa) and Prolifera (Broad Leaf Caulerpa), all which are excellent nutrient scavengers.

Multi-phasic life cycles are a staple on the reef, and caulerpa is no exception. In addition to the high-profile growing (vegetative) stage, these algae can also produce spores which undergo free-floating (pelagic) and resting (benthic) phases, before beginning to propagate into another vegetative organism. This is much like biofilms jumping ship when times are hard (as discussed in the previous instalment), resulting in water cloudiness; caulerpa possesses similar mechanisms. It's a response that says, 'something's not right in my present location, I need to get my genes somewhere else, I'll sporulate'.

In this process the algae produce spores. These spores appear as small dots or speckles, either on the leaf surface or surrounding it, attached by tiny fronds. This process is extremely energetically demanding, so as a result the plant typically dies, which coincides with the spores being released.

So what causes sporulation? It's a genetic shuttle response. In a situation of environmental stress the plant can't run away, it can't physically migrate to fairer pastures, but it can shuttle its genes elsewhere by packaging them up in a gamete and releasing them into the environment.

These stresses mainly focus on nutrient starvation. The algae continue to grow until they eventually completely deplete the water column of essential molecules required to grow, including, but not exclusively, nitrate and phosphate (other things that make the list could be iron, calcium, potassium and magnesium). At this point it becomes sexual, and ups sticks and finds food elsewhere. This is easily avoidable; if you prune the macroalgae regularly (and brutally), sporulation is eliminated by starvation, by always maintaining the cultivation at a size which does not →

exceed the nutrient bioavailability.

Outside of nutrients, in my experience, the most likely candidate parameter to drive caulerpa sexual is temperature. All but the most intricately controlled of reef tanks bounce about a degree or two per day – this isn't going to drive caulerpa sexual. It goes sexual in the case of power cuts, when tanks drop a dozen or so degrees and water is physically chilly to the touch. If you get it from a fellow reefer and forget about it in a bag in the car overnight, whilst you acclimatise your much more valuable corals, it's probably best to just discard it. Chances are the drop in temperature will have been enough to make it sporulate fairly rapidly after it's included in the system.

Specific gravity can do it too. However, those of us without the luxury of an auto top-up, who may see the specific gravity move between 1.022 and 1.025 over a couple of days, need not worry. It'll go sexual in the case of an auto top-up jamming or dropping specific gravity to 1.012 or so. However, in this instance the macroalgae will be the least of your worries.

Lastly – light. Again, this isn't something that is going to happen as a result of a typical lighting cycle. If you go on holiday without noticing the sump light has blown, leaving the algae in darkness for a fortnight, it may well go sexual. The risk of light-associated sporulation can be reduced by lighting the sump 24/7; personally, this is how I maintain my caulerpa.

So how detrimental to a system is an algal population going into a sexual phase? Remember, when the algae goes sexual it typically dies, and just like losing a fish, dying results in the expulsion of organic compounds contained within the cells of the organism into the water. All those nitrates and phosphates are going to come right back out again, along with other unfavourable compounds like ammonia. You need to be doing regular water changes to clear these unanticipated organics, in addition to skimming wet and regular skimmer cup empties.

One final thing to bear in mind is a molecule called caulerpin. Caulerpin is a toxin contained within the leaves of some caulerpa species, which could be released as it dies. Not much is known about this molecule or its effects on fish and corals. Keep an eye on the fish particularly; look for signs of listlessness, panic, unawareness of surroundings, the kind of symptoms associated with cyanide catching. Run carbon as a precaution.

Image shows macroalgae growing in a frag tank. This has to be regularly pruned.

Caulerpa going sexual is a rare event, but if you're keeping it, and I recommend you do, it's just something to be aware of

Caulerpa going sexual is a rare event, but if you're keeping it, and I recommend you do, it's just something to be aware of.

Also, and this is a biggie, check the algae daily. Don't just leave it in the sump and shut the door, taking the occasional peek on water change day. The telltale signs of caulerpa going sexual are clear to see. The algae starts to go pallid, the leaves lose pigmentation and turn white. In conjunction with this, they take on a speckled appearance (the spores), and as mentioned previously, may even dangle these spores into flow by small threads from the leaf surface. At this point, remove the algae to save the upcoming water changes. The period of algae deciding it's going to go sexual, to actually decomposing and releasing spores, takes several days.

Earlier I said I would mention chaetomorpha, which has taken the hobby by storm. It is a tumbling algae which grows in a ball in suspension in the water column (unlike caulerpa, which produces roots and adheres to substrate). Chaetomorpha lacks the sexual phase of its life cycle, so does not present the problems associated with sporulation. However, in my experience it's considerably more temperamental than caulerpa. It grows well in perhaps one-in-five aquaria, as opposed to caulerpa, which does well in most. I also find its growth rate and nutrient removal capacity much slower than caulerpa.

So there is macroalgae in a nutshell. Hopefully I've clarified some of the myths associated with my favourite macroalgae genus, caulerpa. These algae have the propensity to cause damage to a system as a component of their reproductive cycle. However, with a small amount of maintenance this can be something hobbyists will never observe in several decades of reefkeeping. The plus side is a nutrient export machine unrivalled by any other strategy available to the hobby. NB

Do you have a troubling myth for our expert to solve? Why not send us an email to editor@marinehabitatmagazine.com

DID YOU KNOW?

ACANTHURIDAE

Tangs belong to the family Acanthuridae, named in reference to their common characteristic of one or several blade-like appendages located externally at the point where the fish's tail joins its body (caudal peduncle). In homage to this, the family name Acanthuridae is derived from the Greek word acantha, which translates as thorn or spine. The presence of this anatomical modification has also earned this group of fish the name surgeonfish, due to the similarity to a surgeon's scalpel. These largely herbivorous fish use their spines to ferociously defend valuable grazing areas against potential competitors, including parrotfish, butterflyfish, and other tangs.

BY DR NICK BRYAN

TIP-TOP COMPETITION!

Useful and affordable, TMC has done it again! Launched in January 2012, the V2Auto Top Up unit is brand new to market, and it could be yours!

Tropical Marine Centre (TMC) has recently launched its range of V2Auto Top Up units. There are two versions of the V2Auto Top Up system available: the Standard option, which uses a single float, and the Plus option, which utilises a twin float. Suitable for any size tank.

AUTO TOP-UP SYSTEMS

An auto top-up system is a key piece of equipment that can be used by any hobbyist on any size tank. It is easily fitted and immediately saves loads of time. In marine aquatics, one of the most important parameters to maintain accurately is the water:salt ratio. The reason this ratio can easily change is because water evaporates out of the tank and into the atmosphere, whereas salt doesn't. This means that over time, if left unattended, the percentage of salt in the water would increase. A small change in salt level can have a big impact on livestock, and an auto top-up unit can instantly solve this problem.

Rather than topping up the water in the tank every day, the auto top-up unit is connected to a water reservoir (a tub of RO water), which can be stored discreetly in the tank cabinet (or similar). The unit then monitors the water level in the tank using a float system, and as the water level goes down, a pump in the reservoir is turned on and the RO water is used to top up the tank. This unit is permanently turned on, so the salt level is much more accurately maintained.

> The unit then monitors the water level in the tank using a float system, and as the water level goes down, a pump in the reservoir is turned on

An auto top-up unit is one of the most useful pieces of equipment you can buy for a marine aquarium, and is well worth the money. However, you may not have to buy one,

> It is ideal for topping up evaporated water in both marine and freshwater aquariums, and is simple to install using the unique mounting bracket

because there are 15 units up for grabs as prizes in this massive competition.

V2AUTO TOP UP UNIT

This product is a safe, low-voltage, auto top-up system which incorporates a high-quality float switch. It is ideal for topping up evaporated water in both marine and freshwater aquariums, and is simple to install using the unique mounting bracket. The V2Auto Top Up is supplied complete with an energy efficient 3.5W 12V DC pump, capable of 200 l/hr (max head 2m), and 2m of flexible hosing, and there are two versions available: Standard, incorporating one float switch, and Plus, incorporating two float switches (the extra float switch functions as a backup, giving additional peace of mind). A full range of spares and accessories is available, which allows for additional components, such as a solenoid valve (available separately), to be easily integrated into the system. The RRP for the Standard system is just £39.99, and the Plus system is £59.99, so the option of an auto top-up system is an affordable one.

MAIN FEATURES:

- Safe, low-voltage auto top-up system
- High-quality float switch
- Simple to install
- Unique mounting bracket
- Float switch guard
- Securing clamp to hold top-up hosing in place

SPECIFICATION:

- Energy efficient 3.5W 12V DC pump capable of 200 l/hr (max head 2m)
- 2m of 6mm/9mm flexible top-up hosing
- Two float switches

Tropical Marine Centre™

WHAT'S UP FOR GRABS

15 prizes for **15 lucky winners**; each winner will receive a **V2Auto Top Up PLUS**.

TOTAL VALUE £900

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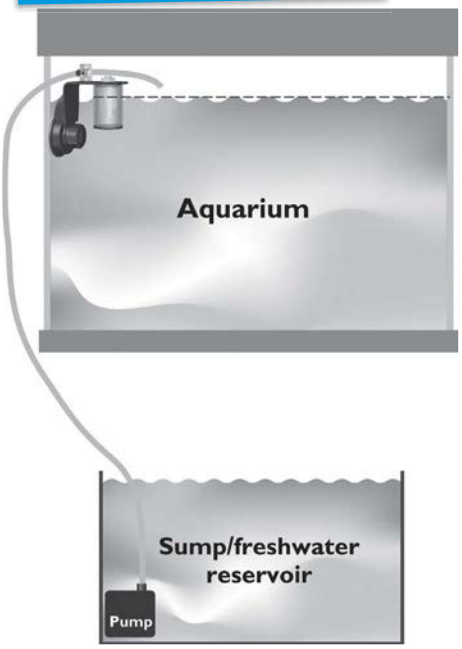

To win this fantastic prize, just answer this question;

What is the main reason for using an auto top-up unit? To maintain the...

A) water:calcium ratio B) water:salt ratio C) water:nitrate ratio

Name:

Daytime delivery address:

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Competition closing date: 16/04/12

Please complete this entry form and post to:
Fish Junkies Ltd.,
TMC Comp,
PO BOX 4838,
Sheffield S12 9DU,
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Please photocopy this page to avoid spoiling the magazine.
Winners will be notified in writing. Once notified please allow 28 days for the delivery of your prize.
If you do not wish to receive further information from Marine Habitat or its associates, please tick here ☐

JOHN DAWES

CHINESE MANTA MEDICINE

ALL PHOTOGRAPHS REPRODUCED COURTESY OF MANTA RAY OF HOPE/WILDAID/SHARK SAVERS

We all know about these fascinating creatures, but are humans calling time on the manta population with the recent discovery of the manta gill rakers black market.

Everyone on the planet knows that shark fins and dried seahorses are widely used in Traditional Chinese Medicine (TCM). Growing numbers are gradually becoming aware that dried pipefishes are also employed in TCM, as are seamoths, though to a lesser extent. Their use is well documented in Chinese literature going back many generations. Human ailments and conditions as diverse as sexual potency, kidney stones, phlegm production, tissue regeneration, and numerous other afflictions are all said to benefit by being treated with one or other of the above.

But have you heard of manta and mobula ray gill rakers being employed in TCM? I hadn't. If you haven't either, rest assured that you are not alone. Not even a number of TCM practitioners interviewed by researchers working on the recently published report, The Global Threat to Manta and Mobula Rays, could 'locate any references in TCM texts', and one practitioner confirmed that gill rakers are not included in the official TCM manual. It's worth noting that there are 6,400 remedies in this official reference manual!

Yet recent years have seen the alarming development of a market for ray gill rakers, mainly centred around Guangzhou (the old Canton) in Guangdong Province, Southern China, which accounts for as much as 99% of the global market in gill rakers. Secondary, but much smaller markets exist in Macau, Hong Kong and Singapore, while the countries most frequently identified as sources are China, Indonesia, India and (possibly) Sri Lanka.

It is estimated that the gill raker trade is worth US$11 million annually, which is significant, bearing in mind the very recent 'birth' of the industry over the past decade or so. A large oceanic ray can yield around 7kg of dried gills, which can fetch US$200-500 per kilo in a Chinese market. Considerable profits can therefore be generated at the retail end by a single large ray.

On first reading about this remarkable market development, I couldn't quite see the logic behind it. Why, for example, would such a perceived need for ray gill rakers suddenly explode onto the scene, especially in an industry that is steeped in tradition and doesn't generally take kindly to modern trends? What could possibly ignite such a dramatic fever for rakers?

It didn't take long to find possible answers, though. It appears that as shark populations have continued to decline (one of the contributing factors being the fin trade), shark fin trade networks have exploited the opportunity to profit from the gill rakers. In other words, they've begun turning their attention to manta and mobula rays as alternative or supplementary sources of income.

Undoubtedly, clever and imaginative marketing lies behind the gill raker 'success story', which has been linked to some Asian (and world) health issues that have hit hard in recent years. Prominent among these are potentially deadly diseases such as swine flu and bird flu, both of which provide excellent opportunities for the launch of suitably tailored campaigns. Understandably, therefore, if someone comes up with a remedy for these, or a means of helping to prevent infection, it's likely to hit home with a population that is already highly receptive to TCM.

JOHN DAWES

Age: 66

Hometown: Gibraltar (now living in Spain).

Full-time occupation: International consultant, author, editor.

Marine experience: Over 25 years.

Aquarium size: Have had numerous aquaria, but owing to my travelling schedule, I now have a number of ponds.

Favourite fish: In no specific order; Tomato Clown, Leafy Seadragon, Twinspot Wrasse, Yellow Tang, Red Lionfish… plus many others! **other:** All forms of shore life.

Specialist areas: Marine life in nature, ecology, evolution, fish behaviour, conservation, the ornamental aquatic industry.

Consequently, it comes as no surprise to learn that manta and mobula ray gill rakers are being pushed as a means of reducing toxins in the blood by purifying and cooling it, reducing body temperature, aiding blood circulation and, perhaps most significantly, as boosting the body's immune system.

Strangely, there's been very little publicity in the West regarding this new market trend. The Manta Ray of Hope Project's website says: 'It seems, with all the attention sharks are now getting, we have collectively forgotten about their magnificent cousins – the rays.' However, it appears (I'm delighted to say) that this is about to change.

I first came across the 'breaking news' of the gill raker trade in a disturbing article written by John R. Platt and published on the Scientific American website (17th January 2012), just a few days before I began writing this piece. The URL of the article link is exceptionally long, so I won't repeat it here. However, search for: Manta Rays Endangered by Sudden Demand from Chinese Medicine, plus one or two of the above details, and you'll get there without any problem. From there you can subsequently get to the MROH Project page, and take things further. I strongly urge you to do so, since all I can do in this article (owing to lack of space) is alert you to what is a distressing state of affairs that is affecting the continued survival of some of the most majestic fish in our planet's oceans.

It's ironic, and sad, that while a large manta ray can generate US$200-500 when its rakers are sold, the same ray can generate as much as US$1 million during its lifetime if allowed to live and be admired by eco-tourists. It is also estimated that while the gill raker industry is worth US$11 million annually, the manta and mobula ray eco-tourism industry generates around US$100 million. So, manta and mobula rays are worth more – much more (!) – alive than dead. This, of course, matters little to those who don't share our belief in, and love for, nature in all its living glory.

But all is not lost! As the MROH Project emphasises, while the shark fin industry is a long-established one, the gill raker one isn't (although it did make a short and unimpressive appearance a long, long time ago, only to fade into total obscurity). This makes it easier, relatively speaking, to tackle the new trend. Many consumers, for example, don't know that the rakers come from rays, since the Chinese term 'peng yu sai' translates as 'fish gills'. In fact, even many young TCM practitioners are unaware of the existence of this 'remedy', indicating that the subject does not form part of modern-day TCM curricula. Furthermore, gill rakers are not considered prestigious. These and other factors therefore give some cause for hope, but will the potentially disastrous trend be reversed? We can only hope that this will prove to be the case, but only time will tell.

ACKNOWLEDGEMENT

I would like to extend my most sincere thanks to Erik Desatnik, Communications Manager, WildAid, San Francisco, CA, for his prompt and constructive responses to my requests, and for granting us permission to use the spectacular pictures that accompany this piece. JD

BOB GOEMANS

Age: 75.

Hometown:
Tucson, Arizona (USA), and Bahia de Kino (Mexico).

Full-time occupation:
Marine aquarium consultant, public speaker, and writer/author.

Marine experience:
40 years

Aquarium size:
Due to travelling requirements, I maintain two 30-gallon nano systems, one at each home, and also continue to consult and help maintain many client systems.

Favourite
fish: *Enchelycore pardalis* (Dragon Moray).
coral: *Acropora youngei* (Bali Green Stony Coral).
other: Basically all inverts.

Specialist areas:
Providing an educational marine aquarium website at www.saltcorner.com

SANDLESS MARINE AQUARIUMS

Sometimes we take it for granted that a sand bottom is totally necessary in the aquarium habitat… but is it? **Bob Goemans** takes a look at sandless aquariums and what they have to offer.

When anyone mentions not using sand in a reef aquarium, it results in odd looks! In fact, I discussed this very aspect with some friends and business associates recently, and it became quite clear there were some strong opinions, especially from those who thought that a sandbed was absolutely necessary. Odd looks and somewhat combative remarks convinced me this article was necessary, even though some controversy may result; if it did occur, I would see that as a positive aspect, as different viewpoints, hopefully professionally voiced, are always welcome. Furthermore, in today's world of fishkeeping, when one thinks about how we go about replicating past practices without thinking about some of the details surrounding them, it could be that some of what is read here may be of value to those wanting to begin a new aquarium.

As for the replicating thought, 99.9% of the hobbyists I work or chat with seem to take it for granted that their new aquarium must have a sandbed! I can understand their desire to have an aquarium environment that duplicates the natural reef, where lagoon sandy bottoms surround reef structures; environments where that sand also provides valuable biological processes that help

SPS can be grown with great success, as seen in a tank located upstairs in the Wharf Aquatics shop.

Located on the counter in the marine section of Wharf Aquatics. Check out their MEGA Candy Cane!

maintain associated creatures. I have, however, had reef aquariums that functioned quite efficiently without sandbeds, and in the long run, these bare-bottom low-tech reef systems seemed to have water quality at least equal to some of the more high-tech systems with sandbeds! This was the point I made when this subject was discussed with friends. Nevertheless, I almost always came away from discussions such as these with the question: Would that really be possible?

The question requires a long answer, one where I had to go back in time and discuss my first sandless system, which occurred in the late-'80s. It was a 1,200-litre (266 imperial gallons) reef/invertebrate system, and it was the largest in my hometown at the time. As word got out, people from all walks of life and businesses would come to our home to view it. They often came early in the evening and stayed late, until the lights went out about 10.30 at night, which made my significant other always very happy (ho ho!), and after first sitting quietly for many minutes in front of the aquarium, appearing to be mesmerised by its environment, the first question most visitors asked was: ' Why no sand on the bottom?'

That was my opening and I would begin by explaining that there are major water-quality differences between what occurs in the wild and those that take place in most captive systems. This brought on positive head nods! I would then go on to say that in the ocean the water exchanges due to tidal effects are extremely large,

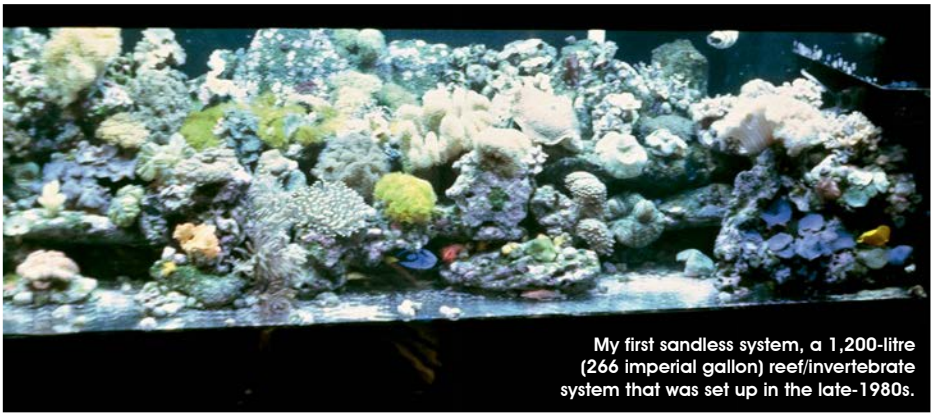
Wharf Aquatics have really amazing examples of how good a sandless aquarium can look.

but those in aquariums are the opposite, quite marginal. And in trying to remain fair, I noted that wastes generated by the life living in natural reef areas are either used by other life forms or swept away by currents into the ocean depths. Where there was insufficient natural water exchange, such as in bays and inlets, pollution of some level would occur and create fertile areas for unwanted forms of algae and/or various organisms. I then added that since major water exchanges as occur in the wild are not feasible for closed systems, another possible way to limit pollution in aquariums should be explored. I told them that this system was an experiment to see if the needed good bacteria would exist in large enough numbers on the available other various surfaces to keep the system healthy. This always got raised eyebrows and resulted in positive head nods, and opened the door, so to speak, so I could explain in general terms what occurs in the sandbed and how this area could easily become an accumulation area for animal wastes (detritus). Again, to be fair, I explained that even though these wastes were partly used as foodstuffs for various bacteria and infauna, most accumulated, as could be seen in my previous systems with sandbeds. If this wasn't cleaned by vacuuming the bed monthly, the sand simply got filthy! Eyebrows would again be raised and I would see positive head nods. I would then go further and say that if rocks were sitting on the sand, or they were too close to side panels, it was impossible to clean the sand under them or near them. Therefore, those areas continued to accumulate detritus and would detract from keeping a clean and efficient sandbed. More positive head nods.

> "...if rocks were sitting on the sand, or they were too close to side panels, it was impossible to clean the sand under them or near them

This allowed me to express my thoughts that if I could only keep a small percentage of the sandbed clean and operating efficiently, why have it in the first place?! Yes, it may look nice to those viewing the aquarium, but if its dirtiness worked against its keeper in trying to maintain an overall efficient system, I wanted to see if success could be had without it. Keep in mind that at that time there were no calcium reactors, phosphate, or nitrate reactors. Even chillers, which were basically nothing more than lobster chillers from food markets and restaurants, were just beginning to become available to aquarium hobbyists. In fact, the only high-tech pieces of equipment were home-made trickle filters and 6500K metal halides. Therefore, I felt justified in trying the no-sandbed aspect because my previous systems clearly indicated that a means to keep a system free of accumulating detritus was a must-try.

With that point across, I shifted to how I was using the collecting detritus on the bare bottom. First, whatever a siphon tube could reach was sucked out and the removed water was replaced with newly-made seawater, and these were actually my



My first sandless system, a 1,200-litre (266 imperial gallon) reef/invertebrate system that was set up in the late-1980s.

water changes. As for what was impossible to reach, a water pump was used to stir it up into the aquarium's currents. I noted that this detritus actually fed some of the corals in the aquarium and the remaining was mostly carried to the system's mechanical filters, which were cleaned after each stirring. I also noted how easy it was to siphon out unwanted bristleworms, of which my rock had many, as I personally collected it in nearby Mexico waters during those years.

The no sandbed reasoning became quite plausible to guests, and since it was an experiment, it was well accepted by almost all who heard the reasoning. Most of what was said to these guests occurred in the system's 6-52 month time frame, and even though sandbed processes in those days were not as well known as in today's time frame, the system did extremely well, with various frags of somewhat rare corals (for those days) being sent to various companies and well-known individuals. Unfortunately, we had a personal tragedy in the family and the aquarium was given to a local friend. Hopefully, Marine Habitat can use the low-quality photo of this system that I sent them, as it's the only remaining photo I have of this far-past system.

As mentioned in the opening paragraph, a sandless reef aquarium is something not many hobbyists give thought to these days, as most think a sandbed is necessary for biological and scenery purposes. As for the biological aspect, it should suffice to say that different classes of bacterium that colonise the sand grains reduce the toxicity of animal wastes and uneaten foods. Yet almost all aquariums also use live rock in various amounts to accomplish not only the same biological processes, but also to decorate the interior. To what degree the biological aspects are provided depends on their amount and porosity, nevertheless, they are often initially used to provide the same bacteria so that some animal life

Handi-Foam is a non-toxic polyurethane foam that is often used to seal the stonework areas around Koi ponds.

Handi-Foam was used to decorate the interior walls and bottom area of this Red Sea Max 130D.

can safely and quickly be added to the new system.

The question then is if the bacteria solely living on/in live rock can be sufficient to maintain a fully up–and-running system. Before answering this, one should also realise that some of these bacteria exist on any coral specimens brought into the system, flourish on the inside aquarium panels, and, in general, on anything that comes in contact with its water, even the sides of its fishes! Therefore, it's now necessary to phrase that question somewhat differently, and say, 'Will a system with no sandbed and some live rock that's crowded and overfed have sufficient bacteria to process all wastes?' Past experience with sandless systems shows that it varies, as exceptionally overcrowded and overfed systems did not seem to contain enough bacteria to adequately reduce the incoming ammonia-laden compounds, and the levels became dangerously high. But in well-managed sandless systems with reasonable amounts of live rock, water quality remained excellent and the lack of a sandbed did not impact animal health. Therefore, it was simply a matter of common sense when it came to the bioload that sandless systems could maintain.

> "Will a system with no sandbed and some live rock that's crowded and overfed have sufficient bacteria to process all wastes?

As for the lagoon-like appearance, that's an aspect difficult to overcome when there's no sandbed. Nevertheless, even that can be tweaked to the point that it may be acceptable by placing various shell pieces at different locations, or 'foaming' the bottom, as I did in the system discussed below. In keeping with the sandless bottom, there's one other aspect I found quite interesting, and that was they seemed to have far less problems with unwanted algae growths because their owners were always monitoring visible detritus accumulations and removing excesses. That's something that occurs very little in systems with sandbeds!

After gluing several zoanthid frags to the Red Sea Max 130D overflow, it became almost entirely covered within 6 months.

In one of my more recent past ventures into sandless systems, the goal was to keep it small, simple and easy to maintain – 60+ years of aquarium keeping is taking its toll on my body! I chose the Red Sea Max 130D for the aquarium, and once it was up and running I added branching rock, which provided a platform for most corals and easy access to all bottom areas. I also coated the inside back wall and most of the side panels with the non-toxic polyurethane foam called Handi-Foam. The overflow was covered with zoanthid frags and they grew quite quickly, as they liked the location's water flow and light.

The foam, which is used on koi ponds to seal areas between finishing stone surfaces, creates a black lava-like environment, almost identical to some found in Hawaiian waters. With my office being a two-storey glass structure, and one that experiences wide temperature changes, the foam helped provide a more insulated enclosure/more stable water temperature. Furthermore, different frag species can easily be attached/cemented to foamed areas, making the interior look even more realistic. I also added a FLO rotating deflector to one of the aquarium's pump outlets, because a constantly changing direction of water flow would benefit all corals in the aquarium.

As for basic bottom-dwelling low-light/gentle water movement corals, I placed a Dendrophylliidae (Dendro) species in a shady area, a green/orange Scolymia australis on the bottom left front, and a T. squamosa clam on the bottom right front area. On the raised area there was a large green Acanthastrea lordhowensis and a red Micromussa amakusensis specimen, separated by a miniature growing blue 'Clove' Clavularia species (which spawned numerous times). At the back of this Clove species was an Australian orange-edged Lobophyllia hemprichii specimen. To the far right was a green Clove specimen that was rapidly spreading new runners/new polyps up the right wall. In the upper rear right corner was a frag of the Acanthastrea lordhowensis, a small blue T. maxima clam, and Ricordia and Zoanthid polyps were glued at various wall places.

> The foam, which is used on koi ponds to seal areas between finishing stone surfaces, creates a black lava-like environment, almost identical to some found in Hawaiian waters

As for fishes, at the time this photo was taken, I was waiting until copepods and amphipods were in plentiful supply, and I would then order two Banded Pipefish. In fact, at this time there were some sexy shrimp and I was hoping they would spawn, as another office aquarium at that time had them multiplying in such great numbers that the fishes in the small system rarely had to be fed. Finally, some shell pieces, collected along various beaches in Mexico, were placed on bottom areas. As the aquarium aged, detritus was easily siphoned out, and the under rear areas were stirred up with a turkey baster; this was either drawn off by the overflow or fed most of the corals in the aquarium. This aquarium thrived for well over 2 years and was finally sold to a client who made an offer I could not turn down.

I have also helped two aquarists, one in Hong Kong and the other in Australia, set up their large no-sand systems, and both report they are extremely happy with the ease of maintenance and the health of the inhabitants as they enter the 1yr+ stage of their systems.

If sandless systems are of interest, how and what to feed corals, or you have any questions on the foam product and how to use it, please feel free to send in your questions and we'll pass them onto Bob, who has kindly offered to provide answers. BC

MANY THANKS
www.wharfaquatics.co.uk

Many thanks to Wharf Aquatics (Nottingham) for kindly supplying images showing some wonderful examples of sandless aquariums. If you get the chance, we highly recommend you check out their mouthwatering sandless setups, an inspiration for anyone!

PATRICK BLANCHE

Age: 44.

Hometown:
Paris, France.

Full-time occupation:
Photojournalist.

Marine experience:
5yrs.

Favourite
fish: clown fish / Mola Mola.
coral: Soft Coral Tree Fan.
other: Staghorn (*Acropora cervicornis*).

Specialist areas:
Togians Island, North Sulawesi / Nusa Lembonga, Bali / Surin islands, Thailand.

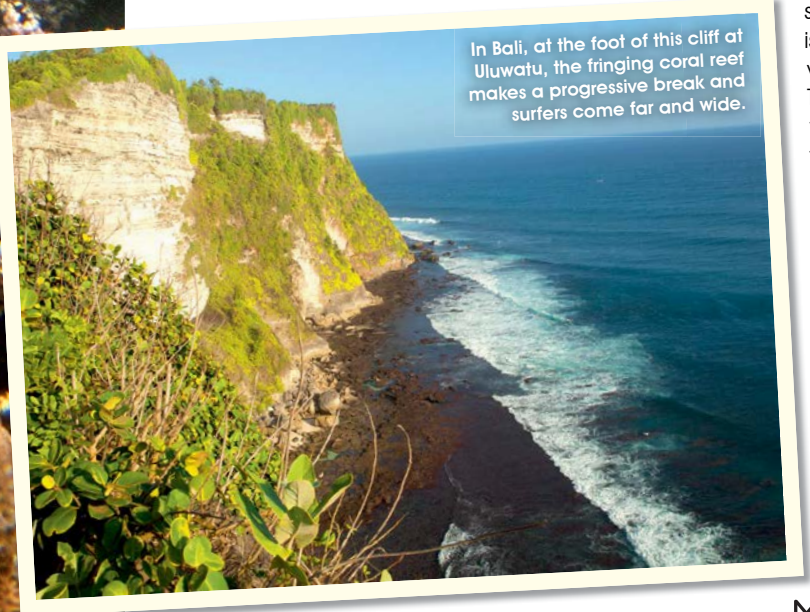
The Coral Reefs Of Indonesia

These coral reefs are the largest archipelago in the world, offering idyllic coral development conditions. Patrick Blanche begins this new series with an introduction to Indonesia's coral reefs.

Looking at a map of Asia, you can't help but be awestruck by the shapes of Indonesia, the largest archipelago in the world. Officially, it counts 13,677 islands, from microscopic ones to giants such as Borneo (Indonesian part: 539,000 sq.km.) and Sumatra (473,000 sq.km.), scattered over more than 5,000 kilometres from east to west, and of which barely half are populated. An archipelago of this sort offers ideal conditions for the development of coral. In fact, Indonesia is home to 16% of the world's coral reserves. Forming just a few metres from the beaches, the reefs cover a surface area of 51,020 km. In terms of coral reefs, the country comes in first place, in front of its neighbour Australia (48,960 sq.km.).

The archipelago's configuration is not the only factor in the coral's development; coral is confined mostly to warm waters. Straddling the equator, Indonesia's tropical climate keeps the water temperature above 21°C/70°F. These conditions combined make Indonesia the world's largest coral 'producer'. The coral reefs have been developing in the oceans for over 450 million years, and it is living organisms that form these massive structures. Coral is an animal in the Cnidaria phylum, living generally in colonies of individuals (the polyps). The calcareous external skeleton of coral is formed by the polyps' symbiosis with single cell vegetal species, the zooxanthellae, in warm waters or other phytoplankton species in colder waters. The accumulation of these skeletons forms the coral reef.

Reef-building coral, or hermatypical coral, needs lots of sunlight, warm water, and salinity above 20°C, relatively low sediment, and finally a hard and stable floor to which to attach itself. The most well-developed reefs can be found in shallow tropical waters. They grow in areas with strong waves, rich in dissolved nutrients and particles in suspension. This habitat is favourable to very varied flora and fauna. The coral reef is, along with the tropical forests, the ecosystem with the richest biodiversity, as well as being the most complex and most productive. The reefs house tens of thousands of species belonging to all zoological groups: fish, sea invertebrates (molluscs, crustaceans, sponges, corals, worms), mammals, etc. In the richest areas, like in



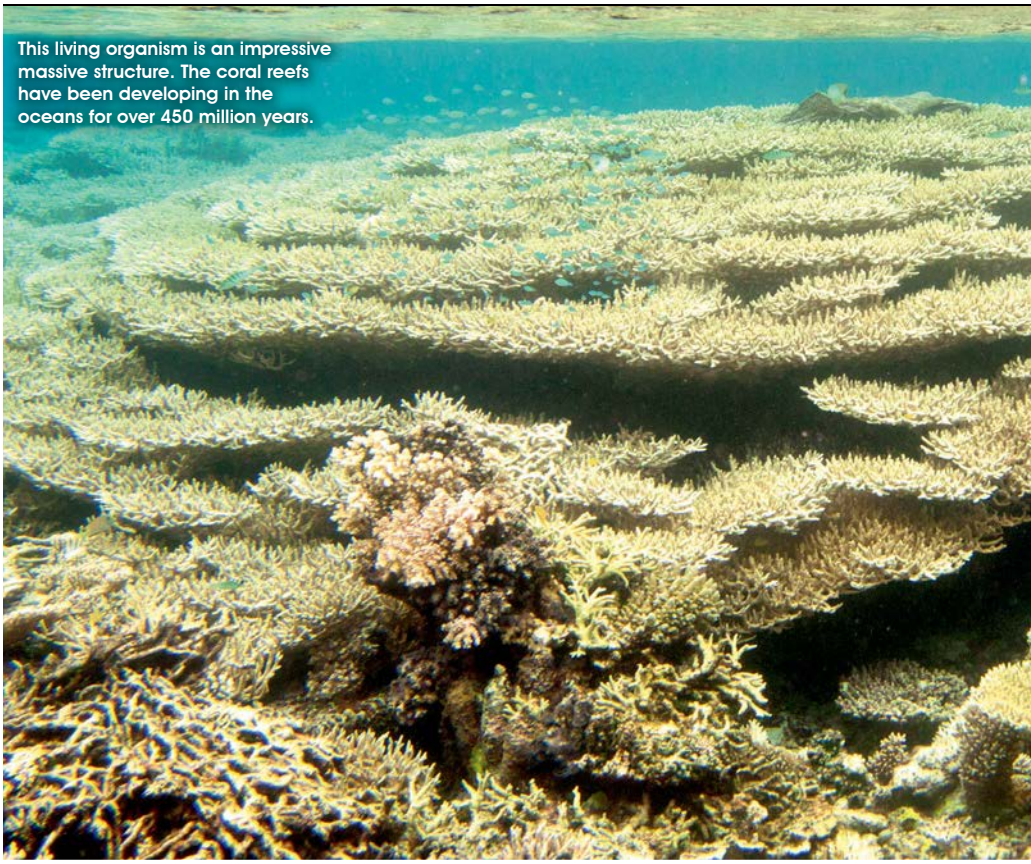
In Bali, at the foot of this cliff at Uluwatu, the fringing coral reef makes a progressive break and surfers come far and wide.

In various Indonesian remote archipelagos there's an impressive variety of coral. Lembeh district, North Sulawesi, Indonesia.

Indonesia, there are more than 700 species of coral, more than 6,000 species of molluscs, and nearly 4,000 species of fish.

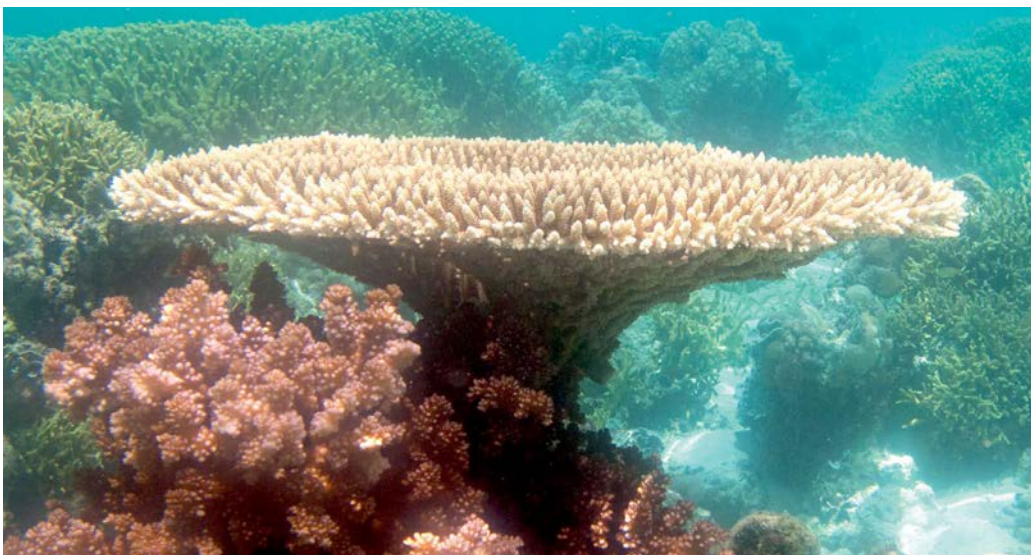
A coral zone feeds between 5-15 tons of fish per sq.km. per year. It also serves as a hiding place that is safe from predators and a protected egg-laying ground. 25% of the planet's fish can be found in these reefs, which nonetheless cover only 0.01% of the sea and ocean surface areas.

The reefs present a great geomorphological diversity. In Indonesia, we can distinguish the fringing reef (narrow and bordering the coast), the high seas annular reef (surrounding a main lagoon), and the bank reef (a coral structure in deep waters on a high seabed). A complex geological phenomenon links volcanic activity to the creation of coral reefs. An atoll, for example, is formed from the collapse of a volcanic island. Indonesia is a region where coral will proliferate. Volcanoes formed by the subduction zones between the Eurasian and Indo-Australian plates dominate Indonesia's geography. Other factors of a geological nature (variations



This living organism is an impressive massive structure. The coral reefs have been developing in the oceans for over 450 million years.

In various Indonesian remotes archipelagos we can find an impressive variety of coral. Lembeh district, North Sulawesi, Indonesia.

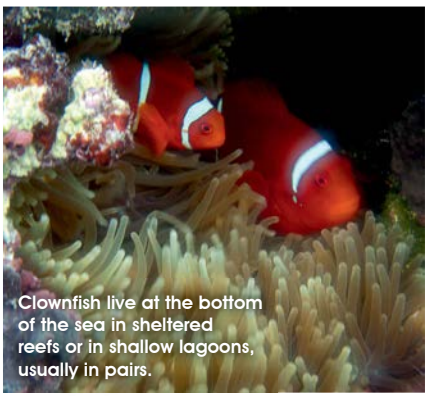


In the Togians archipelago, North Sulawesi, Indonesia, we can find coral reef in perfect condition. A dream for snorkelers.

Coral is confined mostly to warm waters, here in the Gili island, Lombok, Indonesia.

in sea level, rising and sinking of the sea bottom) or oceanographical (temperature fluctuations or the intrusion of fresh water) affect the construction of reefs, giving them diverse shapes.

The Raja Ampat archipelago of Indonesia, situated in the heart of the Coral Triangle, to the west of Western Papua, is considered by specialists as the world's heart of coral biodiversity. The Coral Triangle covers all or part of six countries: Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands and East Timor. With over 30% of the world's coral reefs – or 76% of reef-building coral – and more than 35% of coral fish species, the Coral Triangle is a treasure as remarkable as it is invaluable.



Clownfish live at the bottom of the sea in sheltered reefs or in shallow lagoons, usually in pairs.

It is the source of income and food for many populations, and most particularly for the coastal communities. The coral reefs and their environments play a major social, economical and cultural role in Indonesia. With a population estimated at 270 million people, it's the fourth most populated country in the world. More than a third of this population live near coral reefs, on which their living depends: subsistence and commercial fishing, tourism, traditional and crafts activities. Thus, these resources contribute directly to the survival of over 100 million people living in this region of the world. A great part of the animal proteins consumed in the coastal areas of Indonesia are of marine origin.

Unfortunately, the coral reefs are deteriorating rapidly; 30% of them have already disappeared in the course of the last 40 years.

The small Togians archipelago, situated in the Bay of Tomini in the northern part of the sprawling island of Sulawesi, is another example of this incredible biodiversity. This picturesque archipelago is made up of 56 islands. These volcanic islands are covered in forests and surrounded by coral reefs. More than 200 coral species form the three major types of reef: the barrier reef, the atoll, and the fringing reef – a rarity to see all in the same area. The undersea life is also very rich there, with dolphins, turtles, dugongs, giant sponges, and reef sharks.

As their name indicates, the barrier reefs protect the coastline from nature's caprices. They slow down the waves and mitigate the colossal destructive force of typhoons and tsunamis, thus limiting erosion of the shores. We can also thank them for the fine sandy beaches. But coral's virtues do not stop there. Medicine also benefits from it. Coral allows for the production of genetic materials for new medicines. The structure of the exoskeleton, similar to the spongy bones in humans, is used in some bone grafts, and as a substratum in bone reconstruction. Coral also enters into the composition of certain AZTs.

Finally, coral provides the most beautiful landscapes in the whole undersea world. Every year these 'aquatic gardens' attract more and more tourists practising deep-sea diving. In consequence, they are the backbone of tourist and leisure activities essential to the economy of some countries, including Indonesia.

This constitutes an economic alternative that Indonesia should take into account to improve the sorry state of its economy. The country is becoming progressively more aware of it, and each year gives great priority to ecological problems.

The presidents of Indonesia, the Philippines, Malaysia, Papua New Guinea, East Timor and the Solomon Islands met together in May 2009 in Manado, for the first summit called the Coral Triangle Initiative, to envision better protection for the Coral Triangle. In particular, they announced the designation of protected marine areas (20% of the Triangle's coastlines) and tough measures in the battle against marine poaching. For its part, Indonesia has proposed creating a 3.9 million hectares sanctuary in the Savu Sea.

> The structure of the exoskeleton, similar to the spongy bones in humans, is used in some bone grafts, and as a substratum in bone reconstruction

CONCLUSION

This article, which is part one of a new series, is intended to provide an insight into Indonesia, and an understanding of the scale and significance of the treasure that is the coral reefs. PB

NEXT TIME

Patrick Blanche returns with the second part of his series and looks more closely at the fact that these coral reefs are in great danger of being lost forever.

GearGuide

1. TMC – V2React 300 Compact Calcium Reactor
RRP: £99.99
MORE INFO: www.tropicalmarinecentre.co.uk

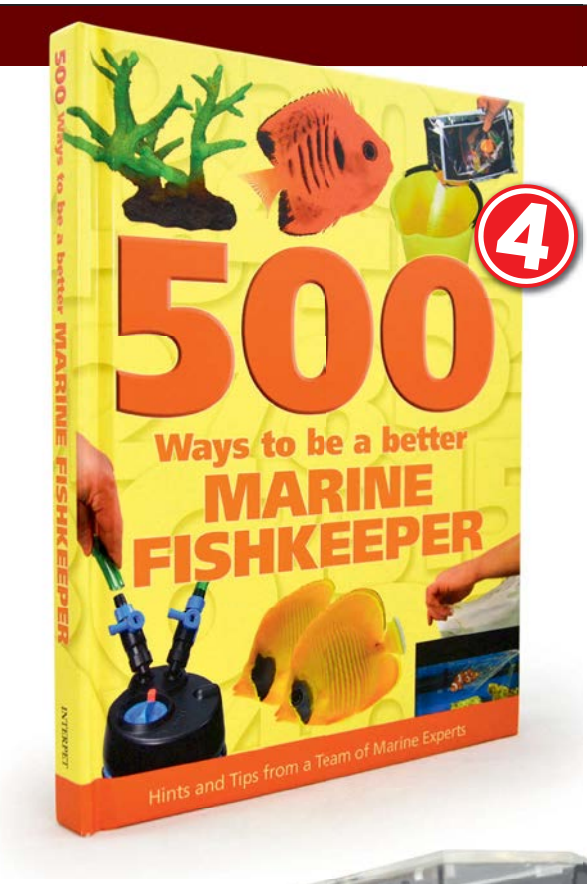
This reactor offers all the qualities of the V2React Calcium Reactor range but in a space-saving, hang-on design. It is slimline, so can be discreetly and conveniently positioned on the back or side of any aquarium or sump up to 300 litres/66 UK gallons. An integral pump acts as both a supply and recirculation pump, so there's no need for a second pump or any modifications to existing pipework. A unique integrated bubble counter makes it easy to measure the level of CO^2 being dosed to the calcium reactor. Ideally it is used with the TMC Calcium Reactor Media (not supplied), but can be used with other similar types of filter media.

2. Reef Culture – 12 Hole Frag Rack
RRP: £12.99
MORE INFO: www.reefculture.co.uk

A UK-manufactured and retailed product that solves a common problem and makes fragging corals much easier. The product is available with either 12 or 24 holes, or you can have one custom-made. High-quality materials are used, resulting in a product that will provide many years of service. The dimensions of the 12 hole frag rack are L14.5 x W7.5cm. The racks are made from acrylic which is 0.4cm thick, and come with two suction cups on the back, which means an easy fit to the inside of the aquarium.

3. BCUK Aquatics – Calanus® Pellet Food
RRP: £10.99
MORE INFO: www. food4fish.co.uk

The Calanus® soft sinking pellet food is packed with loads of superb properties, particularly the all-important omegas EPA, DHA and SDA. It also includes a dedicated vitamin and mineral formula to ensure that the fish are getting the best nutrition available. Calanus® pellets can be loose-fed into the aquarium, moulded into bigger pellets for feeding to larger fish, or made into a ball and adhered to the side of the aquarium. They are also perfect for use in automatic feeders. As a general rule, feed the fish two to three times per day with as much food as they can consume within 3 minutes. The pellet size is 1mm, and this food is available in 150g containers or 1kg pails.



4. 500 Ways To Be A Better Marine Fishkeeper

RRP: £12.99
MORE INFO: www.amazon.co.uk
ISBN: 978-1842861080

Sometimes you need a snappy tip to solve a problem, or give you an idea for trying something new. This book is full of snappy tips – 500 of them! These are presented in logical sections that cover a wide range of practical topics, including buying fish, setting up an aquarium, filtration and water quality, lighting, feeding and regular maintenance – in fact, all aspects of becoming a successful marine fishkeeper. The book also features a selection of the best fish available for a community aquarium, along with ideas for a variety of species tanks, featuring fish that are just a little special. The emphasis throughout is on providing valuable guidance in bite-sized chunks, with bullet-point text and clear photos and graphics. Experience from many expert fishkeepers has been compiled into this compact volume.

> The emphasis throughout is on providing valuable guidance in bite-sized chunks, with bullet-point text and clear photos and graphics

5. All Pond Solutions – Sump Overflow Box SOB-02

RRP: £79.99
MORE INFO: www.allpondsolutions.co.uk

This siphon overflow box, made from acrylic, is designed to hang over the outside of the aquarium (suitable for rims up to 30mm width), and enables water to travel from the aquarium into the sump, eliminating the need for drilling messy holes. Water can then be pumped from the sump back into the aquarium. Each unit is designed to reduce noise and features a removable safeguard comb to prevent the fish from entering the overflow box. Dual air-draining tubes can be connected to the skimmer air-silencer dual nipple to enable air to be sucked out faster and more safely. It has two outlet pipes (38mm/1.5ins), flow rates of up to 5,000 l/h, and the dimensions are L237 x W197 x H260mm (9.3 x 7.8 x 10.2ins).

6. NEW Majano Wand

RRP: £79.99
MORE INFO: www.majanowand.com

The purpose of the Majano Wand is to eliminate Majano and Aiptasia Anemones in hobbyist aquariums, because these anemones are pests. Such pest anemones are inadvertently added to aquariums and can multiply very quickly in a closed aquarium system. When the probe of the Majano Wand touches the anemone tissue, it causes the water in the cells to turn into hydrogen. These animals are mostly made up of water, so they are forced to expand from the inside out at a rapid and drastic rate, which literally disintegrates any living tissue instantly.

Quick look

Manufacturer
Maxspect

Product
Mazarra 120W LED Lighting System

What is it?
LED lighting system (P Series)

Price
RRP: £949.99
(Two module system)

Availability
Brand new product but will soon be available from most good retailers

Further info
www.maxspect.com

GEAR GUIDE REVEALED

ULTIMATE FLEXIBILITY

Once you've come to the conclusion that LED lighting is the way to go, the next step is choosing from the range of units that have been launched in the last couple of years, each of which seems to offer different key selling points. In this case, it's flexibility and customisability!

The Maxspect Mazarra LED Lighting System is an innovative solution to modern aquarium lighting. It has a splendid contemporary design, elegantly crafted from aluminium, and every detail appears carefully attended to. It comes in matt black, and is not only a lighting fixture for the aquarium, but also a centrepiece for any living space. The Mazarra is designed with one goal in mind, that being customisability, letting you take full control over the lighting system. It also utilises state-of-the-art technologies, from a wireless controller to the latest LED chips, offering optimised performance and unparalleled energy efficiency.

TECHNOLOGY

The Cree XLamp® XM-L chip is capable of producing up to 180 lumens/watts. This means that at the same wattage it can produce up to 250% more luminous output than the older generation models. With this advanced technology, a standard Mazarra system consuming a mere 120W of power will be able to out-perform the previous generation 160W model. Mazarra is the only LED lighting system available on the market that offers both a plug-and-play LED bulb replacement design and LED bulbs covering the entire colour spectrum, allowing maximum customisation and flexibility. Unlike traditional metal halides, T5HO fixtures, or even typical LED systems that predetermine the spectrum, Mazarra allows you to pick the right spectrum for your aquarium, and bring out the colour from your corals exactly like you have always dreamed of.

> The weather mode simulates the effect of clouds slowly moving across the sky and casting shadows over the ocean

FEATURES

The modular Mazarra System offers unprecedented scalability to all your lighting needs. With its wireless connectivity, adding a module is as easy as plug-and-play. With the new Cree XLamp® XM-L chip, higher efficiency means less power is consumed and the Mazarra runs cooler than its predecessors. Together with an ingenious aerodynamic design, the Mazarra is passively cooled when warm air passes through its aluminium chassis. The uniquely designed support frame fits aquariums of all sizes and shapes, and it has an adjustable platform mount, so by sliding and mounting the LED module at an angle, you can take full control of the lighting system and direct light exactly where you want it.

PERFORMANCE

Utilising the latest Cree high-performance high-intensity XLamp® XM-L chip, the Mazarra consumes less power yet produces more PAR (Photosynthetic Active Radiation) for even the most demanding corals. Each individual LED bulb is fitted with swappable optics, so lets you choose between spread and intensity.

PROGRAMMABLE

The Mazarra can be programmed to control the photoperiod and brightness of the system throughout the day. The weather mode simulates the effect of clouds slowly moving across the sky and casting shadows over the ocean. As this happens, the amount of sunlight received near the surface of the ocean is dramatically reduced. By changing different parameters such as the thickness of clouds and the speed they move at, you can programme the Mazarra LED Lighting System to simulate any given day as sunny, cloudy, windy, overcast or rainy. When more than one Mazarra LED module is connected to the controller unit, you can activate the dawn/dusk mode and it simulates the effect of the sun slowly rising and setting over the horizon.

SPECIFICATION

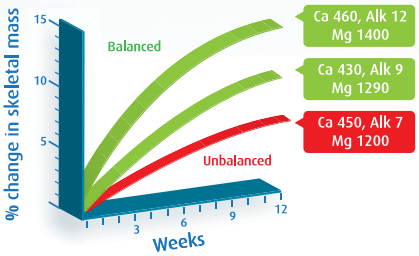
The Mazarra P Series has four LED channels, while the S Series has two LED channels.

NEW

IT'S ALL IN THE BALANCE

The new formulas of Red Sea and Coral Pro salts are the product of years of research into the physiological demands of corals in the reef aquarium, and the basis for a complete program of professional reef care.

Unlike natural reef water which has an immense reservoir of all of the 57 elements, a reef aquarium is an artificial environment that is constantly affected by the numerous ongoing biological processes such as coral growth.



Red Sea's scientists have discovered that in a reef aquarium an optimal balanced ratio between what we call the "Foundation Elements" (Calcium, Magnesium and Carbonates) makes coral growth and other biological processes more energy efficient, ensures the formation of a robust aragonite coral skeleton and improves coral vitality.

Using salts which are made according to this balanced ratio eliminates the need to adjust the levels of the Foundation Elements when making water changes and will significantly improve the well-being of all corals.

RED SEA SALT

The all new formula provides the exact parameters of tropical reef water with a slightly elevated alkalinity as needed in a closed marine system. Red Sea salt is ideal for fish and invertebrate systems, mature or low-nutrient SPS tanks.

Reef Foundation Elements

Salinity ppt	Ca ppm	Mg ppm	Alk/KH meq/l °dKH
33.5	410	1230	2.8/7.7
35.5	440	1310	2.9/8.2

RED SEA CORAL PRO SALT

Contains elevated levels of the foundation elements necessary for sustainable, accelerated coral growth. Coral Pro salt is ideal for reef aquariums, in particular for LPS and SPS corals and growing out coral frags.

Reef Foundation Elements

Salinity ppt	Ca ppm	Mg ppm	Alk/KH meq/l °dKH
33.5	450	1340	4.3/12.2
35.5	475	1420	4.5/12.7

The Red Sea is an oasis of living creatures and coral formations with many unique animals found nowhere else. Of all the tropical reefs around the world, the Red Sea supports the largest diversity of marine fauna and has the highest density of corals.

Over 72% of the formula for both of **Red Sea's salts** is Sodium Chloride (NaCl) harvested from the Red Sea itself. During the solar evaporation process each crystal of this unique NaCl captures 45 of the trace and other elements from the natural reef waters giving us part of **the living reef in every harvested grain**.

This natural element-enriched NaCl mixed with Calcium, Magnesium, Potassium, Boron and other elements provides a complete artificial sea salt mix with unparalleled homogeneity of all 57 elements, formulated in the optimal ratios for reef aquariums.

YouTube | Discover what makes us unique. look for "Red Sea Salts"

Red Sea U.S.A.
18125 Ammi Trail Houston, TX 77060
Tel: 1-888-RED-SEA9
redseainfo@redseafish.com

Red Sea

Quick look

Manufacturer
Tunze

Product
Nanostream 6095

What is it?
Aquarium water circulation pump

Expect to pay
£150-£200

Availability
Available from most good retailers

Further info
www.tunze.com

GEAR GUIDE REVEALED
SMALL BUT POWERFUL

Turbelle Nanostream is the expression of an idea and a concept; a small ball that can be placed in every aquarium or tank, 3D adjustable, compact, and uncomplicated. The new Nanostream 6095 is smaller than previous models, but manages to provide a wider jet of water and a greater output.

Want more flow in a smaller unit? Don't we all! A vast improvement on previous models, this small revolution of only 70mm (2.7ins) in diameter combines aesthetics and function, producing a new way of thinking. The Nanostream 6095 is the latest addition to the Nanostream series. Its entrance onto the Nanostream stage brings with it an interesting broadening of this series' applications. The term broadening is being used both figuratively and literally; the notable change in the 6095's design is a shortened outlet nozzle which produces much wider, lower velocity flow. It's an excellent choice for the squarer (or less rectangle) aquariums.

The 6095 works well in aquariums that house a larger proportion of soft and large polyp stony (LPS) corals. If used for a biotope aquarium it excels at recreating flow patterns seen in deeper areas, around bombora (bommies) and other features between the reef and shore, as well as near-shore beach and algal zones.

Apart from its wide water jet, the small Nanostream® 6095 provides the output of distinctly larger pumps. The innovative microprocessor-controlled motor is based on the latest state-of-the-art technology and offers very high reliability, requiring less servicing and current consumption. The new propeller housing has been designed specifically for resistance-free flow. The Nanostream 6095 is one of, if not the smallest pump on the market with this output, and like all TUNZE propeller pumps, it has been fitted with a 3D setting, silence holder, magnet holder and a fish-care function.

> If used for a biotope aquarium it excels at recreating flow patterns seen in deeper areas

The 6095 can move 9,500 l/h (2,090 imperial gallons) using only 21 watts of power. Of course that's when it's running at full speed, but the 6095 is a controllable pump, so the flow rate can go all the way down to about 2000 l/h (440 imperial gallons) and it uses only 5 watts of power.

SPECIFICATION:

- Turbelle® Nanostream® 6095
- Aquarium size: For aquariums from 100 to 1,000 litres (22-220 imperial gallons)
- Flow rate: 2,000 to 10,000 l/h, (440-2,200 imperial gal/h)
- Energy consumption: 5-21W
- Voltage/frequency: 100-240V/50-60Hz
- Cable length: 5m (196.8ins)
- Dimensions: diam. 70mm (2.7ins)
- Output: diam. 50/10mm (1.96/.39ins)

TOP OF THE ROCKS

FISH FOR BEGINNERS

If you're just starting out then this will be a very interesting read. **Tristan Lougher** takes a look at what he considers to be the top 20 fish for beginners.

TRISTAN LOUGHER

Age: 39.

Hometown: Northwich, UK.

Full-time occupation: Zoologist.

Marine experience: 15yrs.

Aquarium size: None at home; I'm responsible for many aquaria at Cheshire Waterlife.

Favourite fish: Yellow Eye Tang. (*Ctenochaetus strigosus*).
coral: African Blue Coral (*Cespitularia*).
other: Anything but sea urchins.

Specialist areas: Species knowledge.

Image courtesy of Dave Spencer.

In each issue of Marine Habitat, I am lucky enough to list my favourite animals from ten to one in order of preference. The criteria that I use to determine the rank of each species are arbitrary and quite subjective in some ways, but they must be of relevance to aquarists. This time around I take a look at fish that suit beginners or relative newcomers to the hobby. There is a huge amount of information concerning the best fish for new marine aquarists, and narrowing down initial selections to a compatible and harmonious group of individuals can be daunting.

Many species of marine fish commonly available in dealers' systems are familiar to aquarists, almost iconic within the hobby, and for good reason, as they have proved their suitability and hardiness over many years. However, it would be negligent of me not to consider that many people contemplating their first marine fish for a brand new aquarium quite possibly haven't purchased a 400-litre (85 imperial gallons) system (that might have been considered the norm 10 years ago), or even something half that size. Indeed, their new aquarium might be a 30-litre (7 imperial gallons) nano-reef, and therefore aquarists have a much shorter list of fish available to them. The list I have compiled hopefully has something for everyone, and yet skipping the explanations and reading the list alone might lead to some confusion. Hardiness is only one of the possible considerations for me when I select a fish for a particular aquarium.

RESEARCH

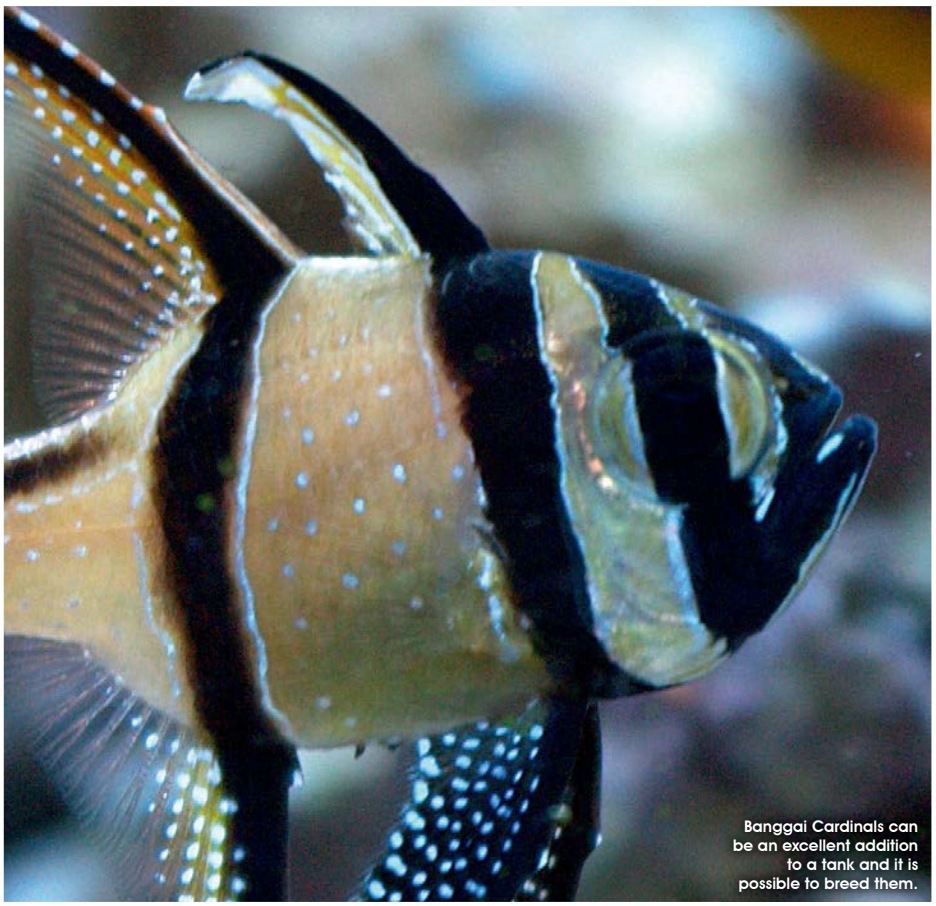
Beginners should do their homework. The marine aquarium hobby has an enormous wealth of accumulated knowledge that newcomers can dip into. Try to deal in facts rather than opinion, although a certain amount of information is bound to be subjective. Where possible, look for sources that have experience with a number of individuals rather than just one. These can give valuable insights into how your choices might behave under a number of different circumstances, and with a variety of different species.

Damsels can be relatively cheap to buy and there are many colours available. But be aware of their temperament and do some research before you buy.

STOCKING LISTS

Researching potential acquisitions should always include a visit to local dealers. Regardless of the thoroughness of your investigations, you often come across species you hadn't necessarily considered, and talking through your theoretical choices can result in certain facts becoming known that you hadn't already come across. Given that you are highly unlikely to purchase all the species that will ultimately reside in your system in one go, unless it is very small, it is very useful to compile a wish-list of fish. Show this to experienced aquarists and dealers for their opinions, where possible. What this can lead to is not just a list of compatible species, but it can be further refined by working out a stocking order for the species on the list.

Many marine fish are territorial, at least to some extent. This can be manifested in a number of ways, and to a greater or lesser extent, depending on the circumstances. Selecting less territorial individuals as the first species to be introduced is wise, and yet not always possible. Where sometimes-aggressive fish are already in residence, perhaps in the case of tangs stocked to prevent problems with algae, potential territorial aggression can be reduced by stocking significantly different species, or those that are larger, or indeed smaller. By having a stocking list that is well researched, with a stocking order in place, the problems of bullying and aggression within the aquarium can be largely avoided.



Banggai Cardinals can be an excellent addition to a tank and it is possible to breed them.

SELECTION CRITERIA

HARDINESS: Many off-the-shelf marine aquarium systems, from the very small to the very large, contain hardware that can be trusted to maintain quite stable water parameters, when coupled with the kind of diligent maintenance that new aquarists are known for. Many plug-and-play marine aquaria are quite forgiving when it comes to looking after the livestock they contain, but common sense dictates that the first additions should be robust species that are straightforward to feed and hopefully not too reclusive, although if the first fish stocked, even normally gregarious species can be timid. Hardiness is difficult to define; some species appear able to live in quite awful water quality, for example. Others settle quickly, and some may tolerate swings in water quality. The majority of marine aquaria actually remain quite stable once the maturing/cycling process is completed; it tends to be in the medium to long term when pollutants accumulate and maintenance is less regimental that problems occur.

I am not advocating that the first fish stocked should be a species known for demanding excellent water quality, such as certain butterflyfish, but it certainly doesn't have to be a bulletproof damselfish either. Indeed, I would counsel against the latter choice, as is reflected in the Top 10.

DISPOSITION: It should be obvious that the fish you stock into a new aquarium should all get along. All fish bicker on occasion, but relentless aggression and bullying often leads to stressed fish, resulting in diseases such as oodinium or cryptocaryon (marine velvet and white spot respectively) – that's if the physical damage doesn't see them off first. Try to work on the aforementioned stocking list to identify potential conflicts, and add the more aggressive species last to help minimise problems. It should be clear that those species with less aggressive natures are likely to prove more suitable for beginners to stock, particularly as the first few fish into the new aquarium.

SIZE: The growth potential of a fish that may be of interest to new marine aquarists must be a fundamental consideration before buying. The vast majority of species available in marine aquaria are sold at only a small percentage of the size they may reach in their natural environment. Depending on the system into which they are stocked, individuals may achieve their maximum size, or a significant proportion of it, and this can occur in a matter of months for some individuals, given sufficient access to food. There is little point in stocking a fish which will show prodigious growth in a nano-reef aquarium, regardless of its suitability at the time. Again, research is the key for avoiding future problems.

> For me, one of the most fundamental considerations when selecting fish for a new aquarium is what they can offer

USEFULNESS: For me, one of the most fundamental considerations when selecting fish for a new aquarium is what they can offer. A few popular aquarium fish select themselves, as they will earn their keep, at least to some extent, and can assist in the maintenance of a thriving aquarium. I include two in the Top 10 that have similar uses in the aquarium, in that both species graze algae, yet they complement each other beautifully because each consumes a different range of algae to the other. In many live rock-based aquaria, macroalgae in the main system, rather than in a sump or refuge, can be problematic because they smother sessile invertebrates and have the potential to die off en masse, dumping nutrients into the water. Both species in the Top 10 graze algae and yet they are different forms of algae, which is why they complement each other. I stock these, or closely related species,

into most reef aquaria, where space and other fish species allow.

LONG-TERM ATTRACTIVENESS: Marine aquariums are a long-term commitment to be enjoyed over many years. Most of the fish species available in the hobby are stunningly beautiful throughout their lives, and yet a significant few may appear to be good buys. For example, small and hardy damselfish species such as Cross's Damselfish (*Neoglyphidodon crossi*), with stunning red and blue colouration as a juvenile. It is robust and hardy, and inexpensive. On the face of it, it ticks many boxes for new aquarists. However, as it (and many other members of this genus) grows, it fades to a dull uniform colour, often going completely brown. Few people would choose to keep such a drab fish in their aquarium, given the plethora of stunningly beautiful species available. Although potentially fascinating in terms of their behaviour, they often court and breed in captivity, and many aquarists regret their initial purchase. A little research can avoid such problems in the future.

PRICE: The cost of a fish, particularly in these economic times, must be a consideration for new marine aquarists, not least because they are likely to be a little nervous about how their new acquisitions will fare in their brand new aquarium. One or two of the species listed in the Top 10 are relatively expensive, whereas others are far less so. Some species in the list may have more, or less, expensive, closely related alternatives, which could be substituted if desired.

> Aquarists should ensure that they take note of the individual condition of a fish before stocking

INDIVIDUAL VITALITY: Aquarists should ensure that they take note of the individual condition of a fish before stocking. Although a particular species may have been decided upon, it is always worthwhile to check that it's feeding, and inspect it thoroughly before purchase. Take note of the overall condition, and yet be aware that long-term captive individuals may fade a little in colour when maintained in dealers' aquaria. They usually regain these colours once stocked into live rock-based aquaria, and can be a better choice for aquarists than a recently imported brightly coloured individual that may not have had enough time to settle.

REEF COMPATIBILITY: The fish listed in the Top 10 are generally considered to be reef safe, which we take to mean of little or no threat to sessile invertebrates, such as stony and soft corals. Having an idea of the direction an aquarium might take, with regard to future invertebrate additions, in order to prevent problems occurring, is a good idea. Some species may present a threat only to soft corals. Others may nibble at large polyp stony (LPS) corals. Choosing benign species of fish means you will have few problems, regardless of the direction you want to take with your system.

10

Common and Percula Clownfish
Amphiprion ocellaris and Amphiprion percula

The first species in the Top 10 are the popular clownfish. Hardy and relatively peaceful, they are also inexpensive and reef-safe. What must be stressed is that this only applies to tank-raised or long-term captive individuals. Beginners to the hobby could be opening themselves up to a whole raft of problems if they attempt to stock newly imported, wild-collected specimens of either species, due to the potential issues with protozoan parasites such as brooklynella hostiles, often referred to as clownfish disease. Captive-bred individuals must be checked for congenital deformities before purchase, but once one or two individuals have been selected they generally settle quickly. Of course, captive-bred hardy marine fish should justify a higher position in the Top 10 rankings, and I only have a couple of reasons why they don't in my personal selection. The first is due to the familiarity of the species; I like to choose less obvious fish where possible. The second is due to the slightly disconcerting habit that some clownfish individuals display when introduced into systems where few, if any other fish are present. In the absence of an anemone – and most new marine aquarists are sufficiently prudent not to attempt a host anemone species until they have a little experience – *A.percula* and *A.ocellaris* may limit their use of the aquarium to a certain area, often at the very top of the system, hugging rockwork or the aquarium glass. Although not actually a major problem, provided they are in good health and will feed, this behaviour can cause concern of those not familiar with it. There is also a risk in certain systems that they may be pulled over weirs or into filters.

9

Spot-tail Blenny
Ecsenius stigmatura

Marine fish do not come much sturdier than many members of the blenny genus Ecsenius. Once upon a time I might have included the Red Sea endemic *E.gravieri* for their beauty, but these are seldom encountered in the hobby these days, due to limited collection ranges in this region. I could also have chosen the Bicolour (*E.bicolor*) or Lividanalis Blenny (*E.lividanalis*) as excellent choices for new aquaria, as both species are hardy, relatively peaceful and have interesting behaviour in the home aquarium. I chose *E.stigmatura* for no other reason than it is often overlooked in favour of more familiar or brightly coloured species, and yet I think it has a subtle beauty that should endear it to more aquarists. It is also inexpensive and small enough, peaking at 6cm (2.5ins) to be successfully accommodated in a modestly proportioned nano-reef (30 litres or so).

8

Royal Gramma
Gramma loreto

This iconic Western Atlantic species should be well settled and feeding before purchase, and may be initially secretive when stocked, but if introduced before more boisterous species, it should prove an excellent and hardy addition to most new marine aquaria. Familiar fish may be overlooked, and I am often guilty of this myself, and yet the Royal Gramma is so stunningly beautiful that it will always be amongst the most popular saltwater aquarium fish. There are few issues with this fish other than potential territorial aggression, which can be more prevalent in smaller systems, but where larger peaceful fish are stocked, this is rarely a problem. Peaking at around 8cm (3ins) in length, they can be stocked into smaller aquaria, although they may occasionally jump from uncovered aquaria.

> the Royal Gramma is so stunningly beautiful that it will always be amongst the most popular saltwater aquarium fish

7

Allen's Damselfish/Star Damselfish
Pomacentrus alleni

The traditional first fish for beginners in the marine hobby has always been one of the various genera known collectively as damselfish. The majority of species are widely available and hardy, often being tolerant of less than ideal water quality. The resilience of most species comes at a price, with most, if not all, being highly territorial, particularly as they grow. Even the apparently benign Green Chromis (*Chromis viridis*) undergoes a significant change in personality as it grows, with male specimens becoming highly aggressive when spawning. Some commonly sold species grow relatively large and are quite capable of killing similar-sized fish stocked after them. I tend to avoid all damselfish, with the exception of Allen's Damselfish, also known as the Star or Metallic Star Damsel. Although still capable of bickering amongst themselves, this stunning fish is one of the most easy-going and widely available damselfish in the hobby.
There is one minor drawback with this species, and that is its ability to turn off its colours, seemingly as a means of telegraphing its position within the pecking order of the species. Such individuals are not ailing in any way, and will continue to feed and behave entirely naturally.

6

Coral Beauty
Centropyge bispinosus

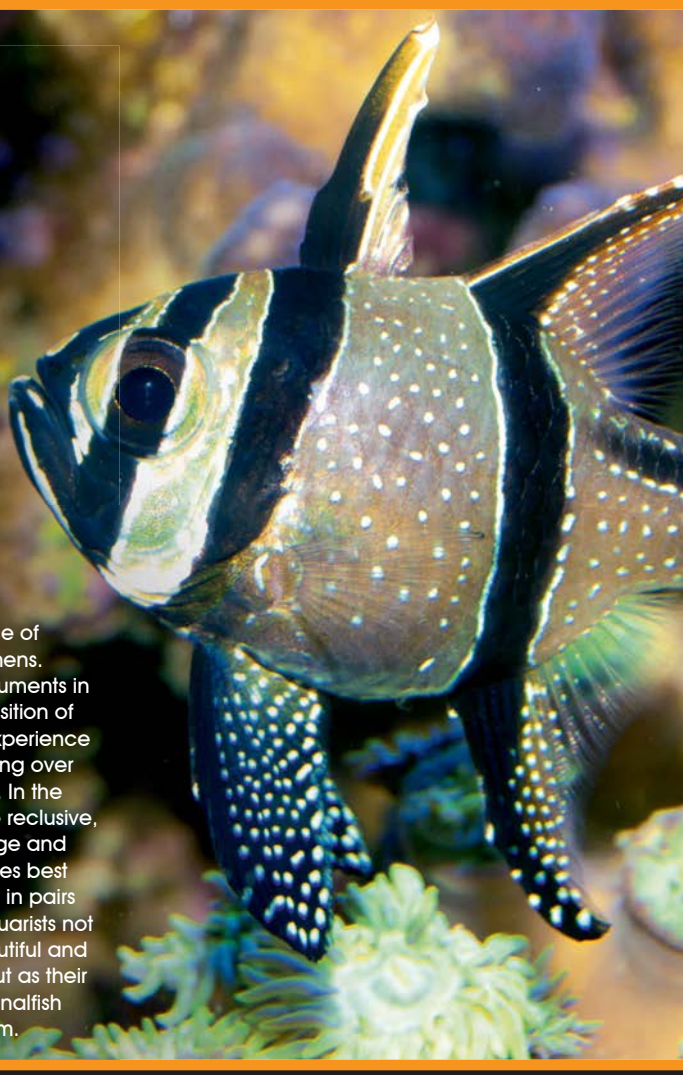
As regular readers of this column will be aware, the choice of species and their rank within the Top 10 and the online Top 20 are entirely subjective; they are my personal selection, and yet must be of relevance to aquarists. On another day the Coral Beauty might reach a much higher position in this list, because it is difficult to find fault with this wonderful marine fish. Perhaps the most reef safe of fish in the popular genus, Centropyge, the Dwarf Angelfish, it is also one of the least territorial, and is undeniably beautiful with its orange and purple pigmentation. It is one of the most commonly stocked marine fish, particularly in suitably-sized relatively new aquaria, and if this was a list of the fish most commonly bought by new hobbyists, it is likely to make the top two or three.

It is perhaps that this fish is, like the common and percula clownfish, too obvious that I have not placed it higher in my personal rankings, because it is difficult to find fault with it in any way. It is not a fish for smaller nano-reef aquaria, however, and aquarists should always assess the vitality of an individual before purchase.

5

Banggai Cardinalfish
Pterapogon kauderni

It's hard to believe that such a modest yet beautiful species of marine fish can court so much controversy, and yet this unique cardinalfish divides opinion in the hobby. The reason for this is its limited range within the Indonesian Islands, being found in a few collection areas around Banggai. Male cardinalfish incubate an egg mass in their mouths, and the Banggai is no exception. However, unlike the rest of its close relatives, it retains the eggs until the fry are fully formed and ready to settle onto the reefs it calls home. Indeed, the male releases the youngsters into the protection afforded by the spines of sea urchins, as miniature facsimiles of their parents. The tiny range of this species has come under intense scrutiny from the scientific community, governments, and the aquarium industry. Collection pressures on the population of wild Banggai Cardinalfish are great. Some argue too great. Others point to the benefits of harvesting the species, and the necessary protection of the wider reef environment required in order to make the collection sustainable, and its benefits to the local economy. Such debates are ongoing. The good news for aquarists is that we have choice. The very reason for the isolated range of the Banggai – the lack of a planktonic larval stage – has meant that this species is ideal for captive propagation. The availability of tank-spawned and raised Banggais is improving consistently, with very little difference in the price of captive and wild-collected specimens. Although I fully understand the arguments in favour of wild collection, the acquisition of specimens that have not had to experience the rigours of collection and shipping over large distance must be preferable. In the aquarium, Banggais can be a little reclusive, particularly when stocked after large and boisterous species. In general it fares best in peaceful systems, when stocked in pairs before assertive fish, and offers aquarists not only the chance to care for a beautiful and fascinating fish in the short term, but as their fishkeeping skills develop this cardinalfish may be bred in the home aquarium.



4

Yellow Forktail Assessor
Assessor flavissimus

A small and often overlooked species of marine fish originating from Australian waters, the Yellow or Golden Assessor ticks many boxes for new marine aquarists. If it wasn't for its price, something that has almost doubled over recent years, it would be vying for number one spot in the Top 10. With its modest maximum size, 5.5cm (2ins), peaceful disposition and interesting behaviour, it is suitable for inclusion into most aquaria at almost any time. Add into the equation that this species is occasionally available as captive-bred specimens (males brood the egg mass in their mouths), and to me it is worthy of being in the top five of my favourite fish for those new to marine fishkeeping. There are a few words of caution that it would be negligent not to mention. These are fish that tend to form aggregations in their natural environment, and so a single individual may not thrive as well as a pair in the aquarium. Costing significantly more than any other species in the Top 10, this represents a serious investment that apprehensive new hobbyists may be reluctant to make. This species also has a potentially disconcerting habit of swimming upside down, as they frequent caves and overhangs in their natural environment. This is not necessarily a problem, but for aquarists unfamiliar with this behaviour it can lead to concerns regarding the health of the fish.

> With its modest maximum size, 5.5cm (2ins), peaceful disposition and interesting behaviour, it is suitable for inclusion into most aquaria at almost any time

3

Image courtesy of Guido & Philippe Poppe www.poppe-images.com © 2012

Gold Rush/Tomini Tang
Ctenochaetus tominiensis

The genus Ctenochaetus is arguably my favourite group of marine fish. The problem for me in compiling the species list for this article is that many species in this group can prove to be highly territorial (I have a specimen of the Dusky Bristletooth (*C.striatus*) that frequently gives a larger and very robust Powder Blue Surgeonfish (*A.leucosternon*) a good battering, despite them having coexisted in the same aquarium for many years). The popular Kole Tang (*C.strigosus*) is a wonderful fish, and yet it can be sensitive to being moved, with outbreaks of marine velvet (*Amlyoodinium ocellatum*), and is therefore not a fish for the Top 10. However, another member of the genus makes the list due to its relative hardiness. The Goldrush or Tomini Tang is an attractive species of fish that has become a familiar fish in the hobby over recent years. Although not a fish for the nano-reef aquarium due to its maximum size potential, the Goldrush is available in a wide range of sizes, from very small 2-3cm (1.5ins) to almost fully grown 16cm (6ins), giving aquarists the option to select individuals that complement existing fish in the system, and therefore reduce potential territorial aggression. The reason for my love of the genus Ctenochaetus, apart from the obvious beauty of most, if not all species, is that they can undertake a highly useful role in the aquarium. Named for their hair-like teeth they possess, the bristletooth tangs are natural grazers of microalgae and detritus. Sediments in any aquarium can be problematic. Where they settle onto rockwork in the aquarium, they can reduce biological filtration and lead to growth of undesirable algae, such as filamentous forms and cyanobacteria. An active, busy fish that scrapes rock surfaces free from such deposits is to be welcomed, and for this reason the Goldrush not only makes the Top 10, but also achieves number three status.

2

Yellow Sailfin Tang
Zebrasoma flavescens

The only reason I can give for the Yellow Sailfin Tang not achieving number one spot in the Top 10 is that it grows too large to be of realistic interest to beginners with new aquaria. Yes, it can be territorial, but potential conflicts can be avoided with the aid of a considered stocking list, and even when aggression does occur, it is seldom long-lived. Undoubtedly beautiful when small or fully grown, the Yellow Tang sometimes suffers by being a little too familiar to aquarists seeking something different for their aquarium, but look at it again, and marvel at the amazing body form and small mouth located at the end of a downward slanting snout. The degree of lateral compression of the body is typical of many coral reef fish, and the beauty of the colouration means that this species will always have its fans. For me, the added value comes in the benefits to the aquarium when this species is stocked. A natural grazer of macroalgae, such as *Caulerpa spp* and the brown leafy *Sargassum sp* that is commonly found on live rock imported from the Indo-Pacific (particularly Fiji), the Yellow Tang can control or prevent the growth of these potentially problematic seaweeds before they become an issue. The Yellow Sailfin Tang is perhaps best not introduced as the first fish into a beginner's aquarium, due to potential territoriality (I tend to avoid such issues by introducing similarly-sized individual fish beforehand, and significantly smaller or larger, or markedly different species subsequently), but its relative hardiness means it can thrive when stocked quite early in the life of a well-cycled aquarium and the benefits of its grazing can be maximised; it is easier to prevent growth of macroalgae than control it once it begins to grow. I particularly enjoy stocking these fish with a member of the genus Ctenochaetus, such as number three in the Top 10, as their grazing behaviours complement each other beautifully.

1

Hifin Banded Goby
Stonogobiops nematodes

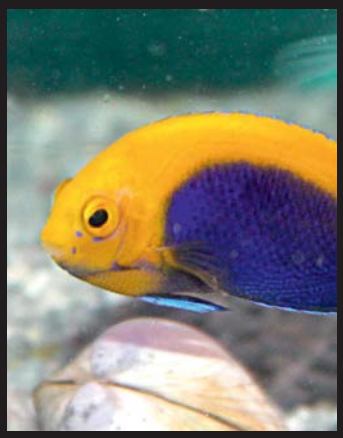
Small enough to be stocked into aquaria as small as 30 litre (7 imperial gallon), and yet capable of holding its own in much larger systems, the Hifin Banded Goby or Antenna Goby is a member of a small and highly desirable genus of gobies belonging to a much larger collection of species that are known to naturally live with Alpheid snapping or pistol shrimp. The least expensive member of the genus *S.nematodes* includes the stunning Yasha (*S.yasha*) and Dracula (*S.dracula*) amongst its congeners, and despite being more commonly encountered and less gaudily coloured, it has much to offer any aquarist, let alone newcomers to the hobby. The relationship these gobies share with the pistol shrimp is remarkable to behold; the highly skilled burrowing of the shrimp creates a refuge for the goby to retreat into when danger threatens. The myopic, indeed nearly blind, crustacean relies on the excellent eyesight of the goby to look for potential threats. Together they make a wonderfully complementary pair, but perhaps more importantly, they represent a hardy and fascinating addition to relatively new aquariums. This, coupled with their modest size potential, beauty, and relative hardiness, justifies the position of this species at number one.

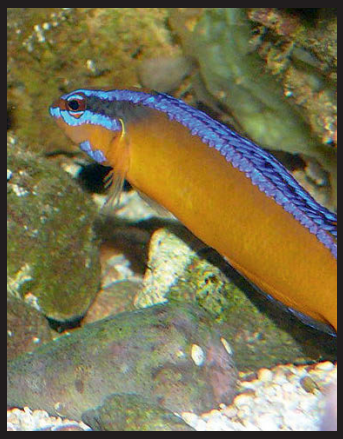
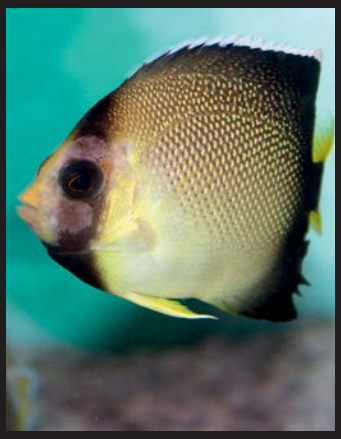
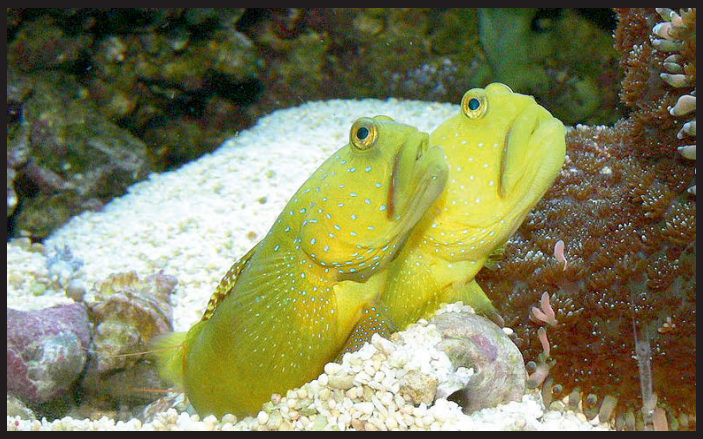
CONCLUSION

Looking back at the Top 10 list, I am happy with how it looks. Many of the species listed would be at home in most aquaria, and all could be compatible with each other, given a sufficiently large system and a well-planned stocking order. This is perhaps the best information that this article could get across – a well considered stocking plan can make the difference between experiencing problems and having a relatively stress-free time when introducing new fish to the aquarium. There are a huge number of marine fish available for marine aquaria, and a substantial amount are suitable for new aquarists. As the Top 10 shows, many species are interchangeable with others that are closely related. New aquarists armed with information from reliable sources that is then applied to a stocking regime are likely to experience fewer problems than those who select species that simply look nice or interesting. There are many pitfalls that await the unsuspecting new marine aquarist but taking ones time and doing as much research as possible will help enormously. The end result of a little forethought and planning should be the ability to enjoy your aquarium with minimal stress. TL

DON'T FORGET

Check out the ones that didn't make the Top 10 on our website. Here's is a quick look at what you will find.





MY CALMING WATERS

KIERAN McBRIDE

Age: 49.

Hometown: Lurgan, County Armagh.

Full-time occupation: Mac operator.

Marine experience: 18 years.

Aquarium size: 60x20x24.

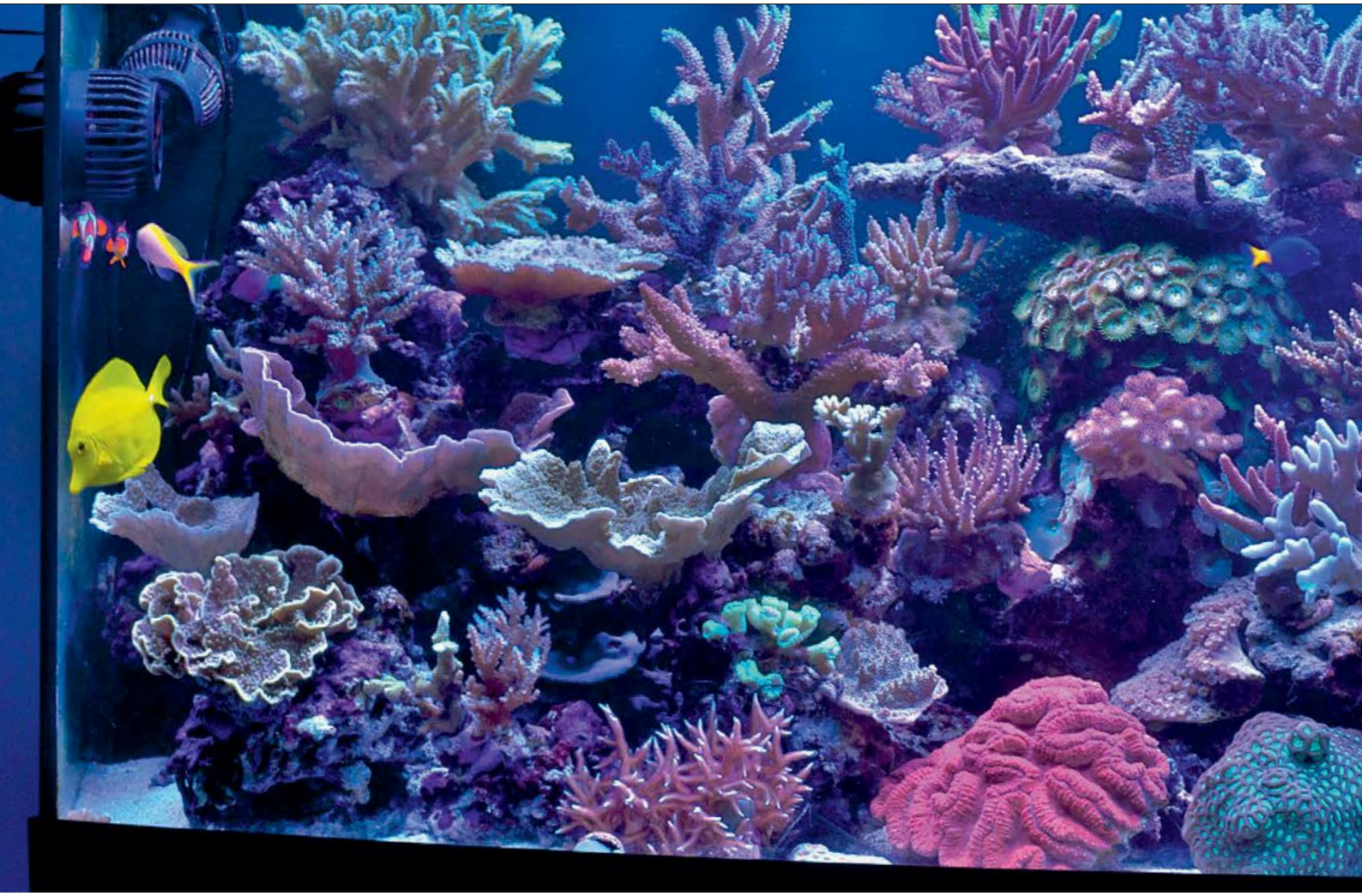
Tanks start date: May 2010.

Favourite fish: Queen Angel, Emperor Angel, Moorish Idol.
coral: Purple or Blue Gorgonia.
other: Maxima Clam.

In this issue we have a very interesting story lined up for you. Irish hobbyist **Kieran McBride** has enjoyed fishkeeping since an early age, but what made him jump to the salty side of the fishkeeping world?

From the age of 10 I've always been intrigued by the colours, varieties and characteristics of the numerous types of life in the waterways and oceans of the world. My older brother had a 3ft tropical setup in 1973, and since then I've wanted my own. In 1982 I set up a small 18x12x12ins tropical tank with the usual guppies, swordtails and platys, etc., with the basic internal filter. I then progressed to a 36x12x18ins tropical with under gravel filter. After 2 years' experience I met a person who would change my outlook on fishkeeping for the rest of my life.

While working night shift, I met a real good guy, Maurice, who told me he had



KIERAN'S TANK SPECS

TANK: Juwel 450 bow front

DIMENSIONS: 60x24 (at its widest) x24

LIGHTING: ATI 8x54 Powermodule linked to a GHL Profilux II

WATER DISTURBANCE: Two Koralia 4000s, two Koralia 4s and one Vortech MP40W ES

SKIMMER: Deltec APF 600

CAPACITY: 520 litres before displacement

CAPACITY WITH ROCK: Approx. 440 litres

ROCK AND SUBSTRATE: Approx. 60kg live rock and fine sand approx 1ins

SUMP: 36x15x15

WATER: Four-stage Ro/DI

ADDITIVES: Fauna Marin Balling with FM Trace Elements, Zeo amino acids

LIVESTOCK:
FISH: Two Wild Common Clowns, one Yellow Tang, one Bartletts Anthias, one Pink Anthias, two Yellow Tail Blue Damsels, one Neon Dottyback, one Jade File Fish, one Sixline Wrasse

INVERTS: Two Cleaner Shrimps, one Blood Shrimp, one Maxima Clam

CORALS:
SOFT: Venus Fly Trap Buttons, Green Spotted Mushrooms

LPS: Various brains, pineapple, rhodactus

SPS: Hydnophora, various acropora, various pocilopora, seriatopora, hystrix, montipora digitata and plating montipora

FEEDING REGIME: Once a day mysis, brine shrimp or Cyclop-eeze, and Coral Snow once a week

TANK STATS
SALINITY: 1.026
CALCIUM: 420
DKH: 8
PH: 7.7-8.0
PHOSPHATE: 0-0.03
NITRATE: 0
MAGNESIUM: 1350

kept marine fish. At the time I didn't even know what they were, but he brought in a few books and showed me, and they blew me away. I had seen them on TV, but never imagined anyone being able to keep them in captivity. I thought he was a genius to have had them and to have been able to keep them. I wanted them too. We arranged to visit the only place in Northern Ireland at that time to have marines, and seeing them in real life just left me with my mouth wide open in awe. I did try to be patient and follow the guidance from a great author, Martin Moe, but in the end I rushed things a bit and got a couple of fish too soon, and I've regretted it to this day.

So, in 1984 I set my first fish-only marine tank into operation. Two T8s were all the light I had, both about 40W output. The tank had an under gravel filter with powerheads, and the latest in technology at the time, an external filter to be used as a reverse flow under gravel filter, and the cream of the crop – a Sander air-driven protein skimmer. I was in the big league then. I kept that tank running for a few years, and unfortunately had my fair share of losses and heartaches, before deciding to go a step further; a customised system with sump and trickle filter, which I built myself. All these setups gave me heartache and disappointment, but I persevered and kept marines for approx.

15 years until 1998/99.

Some of the problems that arose for me in those early years were mainly caused by me being too complacent and rushing things; over feeding, not enough maintenance and cleaning, and not enough care and attention to keeping parameters good. I guess salinity was a major thing, and the quality of sea salt was not as good then, and pH, nitrate and ammonia kits were inaccurate and unreliable. The valuable nutrients and filtering capabilities of live rock wasn't available then. It was crushed shell, various grades of coral sand, sponges, powerheads with venturies for extra oxygen, filter wool, and for decoration it was Tuffa rock, dead coral, limestone, clam shells and Dead Sea fans.

In 2009 I thought a wee trip to the same retailer I'd used all those years ago would be a good idea; they had moved closer to where I lived and I was curious to see how things might have changed. I had health issues then, which still affect me now, and I felt I needed to have an interest. And boy, was I surprised. Corals were being sold – all shapes and colours – just beautiful. That visit was a mistake because it refreshed and allowed an interest to resurface. Little did I know then that it was a blessing in disguise. My 24-gallon nano was the first of a list of tanks I saved, begged and borrowed for and purchased. The technology had advanced so much, and it was so much easier to be a marine aquarist than I could ever have imagined in the mid-'80s. Live rock, motorised and powerful skimming, balling, high output T5 lighting, supplements galore, bio-pellets, miracle muds, calcium reactors, kalk stirrers, etc., etc. – the choice was unlimited.

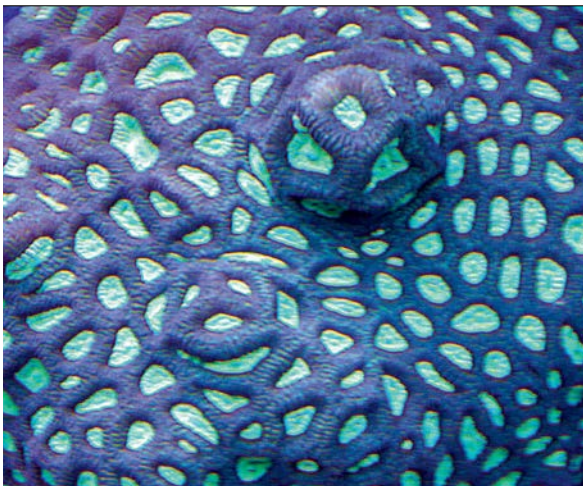
So, I went from a D-D 24-gallon nano to a Juwel 260 bow front with HOB refugium and Miracle Mud, and then to a Percula 90; three upgrades later and a lot of Internet and forum reading, I have what I had always wanted, but it is a work in progress and still has its demands. This hobby has helped me, and continues to help me, by providing an interest and keeping the stormy waters in my life calm. I retain a certain amount of sanity, and my goal is to protect all the life within the tank. Well that's not entirely true. My goal is to end up with a similar setup as Krzysztof Tryc. Google him – he has what I feel is the nicest tank around.

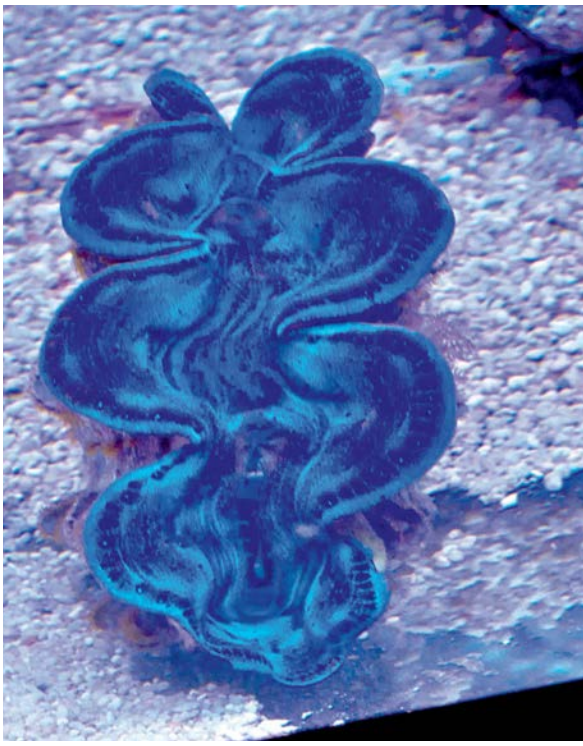
> The technology had advanced so much, and it was so much easier to be a marine aquarist than I could ever have imagined in the mid-'80s

As with most reefers, I had problems with all setups, from Aiptasia breakouts, to flatworms and green hair algae. Again, the good old Web came to my rescue with advice on how to cure these problems. Extra flow, more water changes, maintaining stable parameters, reducing light period and amount of feeding, changing T5 tubes, Po4 remover, carbon, etc. – they all add up to a better environment and less headaches.

The biggest problem I had to deal with was finding out why the polyps weren't as noticeable as other reefers' tanks. I changed the lighting, added bio-pellets, added the balling light system, and upgraded the skimmer, and all this after removing a deep sand bed and chaeto with a home-made algae turf scrubber. After all that nothing seemed different, until I read an article about Fame Angels nipping polyps, so I removed the angel, and lo and behold, a few days later the polyp extension was as different as night and day. It was a costly learning curve that could have been avoided by better research and not going for a fish that tugged at my heartstrings.

So what do I have now? Well, after loads of reading and seeing others' experiences on forums here and the mainland, I opted for a converted Juwel 450 to include a sump. I have a GHL stand-alone





dosing system for balling, a Deltec APF 600 skimmer, an ATI 8x54 Powermodule linked to a GHL Profilux II for full lighting control with temp and pH monitor, two Koralia 4000s, two Koralia 4s and one Vortech MP40W ES on random reef mode, a reactor for phosphate reduction and a further reactor with NP Bio-Pellets. Calcium reactors seemed to confuse me, so my logic was telling me that balling was simpler and more stable. After using halides and LEDs, I found that T5s did the job of both, but unfortunately provided no skimmer, but I can live with that.

During my last 3 years in the hobby, and by chance, or maybe even fate, through a mutual friend I rekindled my friendship with my mate after not seeing him for over 20 years – the person who got me started in marines back in 1984. Maurice had also recently got back into the hobby, and we started to share our experiences, both good and bad. We supported each other and spurred each other on during the disappointments and pitfalls, and shared our enjoyment when things were good or when a new inhabitant was purchased.

We were a good help to each other, and Maurice helped me more than he will ever know, in ways over and above our shared joy of marines and reefkeeping. Unfortunately I never got a chance to let him know. My friend Maurice died on 1st July 2011 after a short and crippling illness that came literally from nowhere. I am still in disbelief about his passing. Maurice will be sadly missed in so many ways, and I'm sure he's looking down on us all, smiling, with his weird but wonderful sense of humour. I can imagine him sitting up there in heaven, on a chair in front of his amazing tank, with a cup of coffee and a cigarette, saying: "You wanna see the tank I have up here mate!" RIP Maurice, you are so sadly missed.

> For anyone interested in this hobby, the Web-based forums and magazines, such as Marine Habitat, are an invaluable source of information

I have found that SPS and the different colours, formations and polyp differences are, of all the corals in the ocean, the ones that intrigue me most. There are also many LPS and softies which I also dream of keeping, but we can't have it all. I have learned not to take any unnecessary risks and stick to what works. I believe that chemical warfare between the various corals is a risk not worth taking.

For anyone interested in this hobby, the Web-based forums and magazines, such as Marine Habitat, are an invaluable source of information, and without them I would have been lost. I can safely say I would not be in the hobby without the guidance and experience I have read along the way from the more experienced reefers worldwide. Many thanks to you all. **KM**

EDITORS' NOTE:

The team here at Marine Habitat really enjoyed this touching story. From many lows came many highs, and a beautiful tank to show for it. I think even Maurice would be proud of the great-looking tank you have achieved, and it's a fantastic credit to his memory. We wish you all the best in the future, and don't forget to keep sending us a few updates now and again.

HARLEQUIN SHRIMPS

Beautiful but Barbarous!

SCOTT MICHAEL

Age: 49.

Hometown:
Lincoln, Nebraska, USA.

Full-time occupation:
Photojournalist. Also involved in consulting for an aquarium maintenance business (Reef Tectonics).

Marine experience:
38yrs.

Aquarium size:
58 US gallon aquarium at home. Also involved in maintaining over 100 marine and freshwater aquaria.

Favourite
fish: Wobbegongs, Epaulette Sharks, Frogfishes (aka anglerfishes), Shrimp Gobies.
coral: Euphyllia, Goniopora and *Alvepora spp.*
other: Reef lobsters and decapod shrimps.

Specialist areas:
Behaviour ecology of Elasmobranches (sharks and rays) and reef fishes.

These beautiful shrimps are often considered difficult to care for. In actual fact, they are very easy to keep as long as you meet their specialised nutritional needs – that is, provide them with sea star flesh!

The Harlequin Shrimp is a member of the family Hymenoceridae and the genus *Hymenocera*. Some crustacean experts think there is only one species in this genus, while others split the Indo-West Pacific and Central and Eastern Pacific forms (the former is recognised as Hymenocera elegans, while the latter would be H. picta). Both species of Harlequin Shrimp are white to cream overall, with large purplish blotches with blue margins (*H. elegans*), or maroon with yellow margins (*H. picta*). Not only are the colours spectacular, the appendages on the thorax are very ornate. There are several pairs of anterior appendages that have flattened expansions. For example, the chelipeds are

large and shield-like. The maximum length is approximately 5cm.

FEEDING

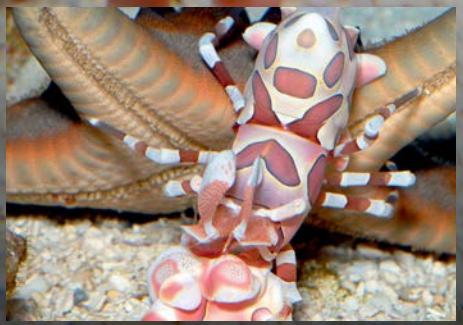
What is particularly interesting about the *Hymenocera spp*. is that they feed on sea stars. A pair of these beautiful beasties (the adults are almost always found in pairs) drag sea stars to their lair or incapacitate them where they find them. These shrimps vigorously stab their sea star prey with the spike-like end of one pair of legs. It may be that the shrimps are puncturing the water vascular system of the sea star so that it cannot move. In this way, they would be able to control some of the large asteroids that they typically feed on. That said, some sea stars do escape, even after having an appendage removed.

When you add a sea star to the tank, the harlequin shrimps typically begin waving their appendages from side to side and begin searching for their prey; I assume they locate their prey by smell. It may take several minutes before they find the unfortunate echinoderm, and when they do they leap on it and begin flipping the sea star over on its back.

Their feeding behaviour is somewhat Hannibal Lector-like. When they consume sea stars, they begin feeding at the end of the arms, working their way towards the central disc. In this way, they can keep their 'living buffet' fresh for longer. In some cases, the shrimps amputate an arm and let the rest of the sea star escape. Although it depends on the size of their echinoderm prey, the harlequin shrimps can take several days to several weeks to consume an entire sea star. They prefer sea stars in the genera Fromia, Linckia, Nardoa and Archaster, but will eat other species as well (including the crown-of-thorns sea star, *Acanthaster planci*). In the aquarium, they occasionally feed on sea urchins and brittle sea stars – they need a ready supply of sea stars if they are going to survive in the aquarium. A medium-sized chocolate chip sea star should last a pair of harlequin shrimps about one week, but you only need to feed the shrimp a sea star once every 3-4 weeks. Make sure you remove the uneaten portions of the sea star so that it does not pollute the aquarium. These shrimps also eat Asterina sea stars, which can get out of control in some reef systems. Some reef aquarists have even employed harlequin shrimps to decimate Asterina populations.

If fed well, they should moult about once per month, and you'll know when moulting is eminent by the appearance of the integument. The colour will not be as vibrant and look opaque. Moulting does not always go perfectly and the shrimp may end up losing an appendage during the process. These are often repaired during future moults. All crustaceans are more vulnerable just after moulting, and as a result usually hide until the exoskeleton has hardened up.

TIME FOR LUNCH



This photo shows the *Hymenocera picta* variety of Harlequin Shrimp - note the yellow margins around the spots.

Although it is possible to keep these shrimps with fishes that don't eat crustaceans, I think they are best kept in a nano-reef aquarium. If you decide to keep harlequin shrimps in a community aquarium, do not keep them with crustacean-eaters (of course) or overly aggressive fishes. Suitable tank mates would include seahorses, pipefishes, anthias, small gobies, dartfishes and dragonets. Of course, in a small tank you would have to make sure to promptly take out any sea stars remains that are beginning to decompose, in order to prevent pollution problems.

While harlequin shrimps can be kept in heterosexual pairs, males spar with one another and eventually have to be separated. (If you have a large enough aquarium, you may be able to keep two pairs together, as long as there is enough room for them to avoid one another.) When they do combat, they splay their chelae apart and then begin pushing against each other. The sexes are easy to separate. Females have spots on the ventral surface under the abdomen, while there are no markings on the male; also, females tend to be larger than males.

The Bongo Shrimp is a tiny crustacean that may get lost in a large reef aquarium.

MATING OCCURS JUST AFTER MOULTING

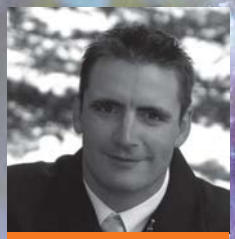
The eggs are attached to the female's pleopods (appendages under the abdomen). She rapidly beats these structures to aerate the eggs and cleans them frequently. Depending on the water temperature, hatching occurs within 14 to 28 days (incubation period is less if water is warmer). The female facilitates dispersal of the pelagic larvae by rapidly beating the pleopods. Just after the eggs hatch, the female will moult. A female can produce from 200-5,000 eggs in a month's time – she produces more eggs if she is well fed. Fortunately, the larvae are phototactic and can be attracted to the surface with a torch beam and removed from the adult tank by dipping them out with a cup. Larvae are 1.4mm long at hatching, and for the first few days food is not required. However, after the first moult, planktonic foods (*Artemia nauplii*, copepods, rotifers) will be required.

> A female can produce from 200-5,000 eggs in a month's time – she produces more eggs if she is well fed

There is another member of the family *Hymenoceridae* that shows up in aquarium stores. This is an odd little shrimp that is known in the aquarium trade as the Bongo Shrimp, or the Spiny Tiger Shrimp. It is rarely seen in the wild or in the aquarium trade – this is probably more because of its small size (it only gets to just over 2cms long) and its reclusive habits than it being a rare species. I have only seen three of these shrimps during years of diving in locations where they are known to occur (the Western Pacific from Okinawa south to Queensland, Australia).

Little is really known about this species, but aquarium expert Kevin Kohen was able to fill in some gaps. Kevin has been keeping a specimen of *P. ceratophthalma* for several months now, and has observed some very interesting things about its natural history. Up until now, data on the feeding habits of this little crustacean was not available. It has been assumed they are echinoderm-eaters only because of the relationship with *Hymenocera*, but I haven't found any direct observations of this published in the literature. Thanks to Kevin we know they eat asteroid sea stars (namely the little Asterina stars that often pop up in reef tanks), as well as ophuroids.

That ends the brief examination of two fabulous shrimp species. If you are willing to meet their very specialised dietary requirements, these crustaceans can make fascinating additions, especially in a nano-reef aquarium. SM



JASON THRESHER

Age: 35.

Hometown:
Bookham, Surrey, UK.

Occupation:
IT manager; owner of Reef Culture.

Marine experience:
18 years.

Tank size:
24g D-D Nano Cube.

Favourite
fish: gobies and blennies.
coral: zoanthids and palythoa.
other: Pistol Shrimp.

Specialist areas:
Coral propagation.

FRAGGING LEATHERS

SCIENTIFIC NAMES: *Sarcophyton; Lobophyton; Sinularia*
COMMON NAME: TOADSTOOL; MUSHROOM; FINGER; COLT

Is your Finger Leather ready for a prune? In this issue, **Jason Thresher** gets his scissors out for the common Finger Leather. He describes some tried, tested and successful techniques, and provides the care guides you'll need to create your own little frags.

This month I will be demonstrating how to frag leather corals. While there are many different types of leather corals, the same technique can be used to frag them all.

Leather corals are so-called for a reason; they are probably the toughest, hardiest and most forgiving coral available to the hobby. They thrive in virtually every marine aquarium and tolerate a wide range of less than perfect water conditions. Having said that, it is no excuse to forgo the water changes or usual tank maintenance! Good husbandry is absolutely key to succeeding in this hobby. A dirty tank also means more bad bacteria, and that increases the chance of infections of the mother colony post fragging, and the new frags you have created.

Out of every coral I have covered so far in the tutorials, the leather coral is probably the easiest to frag, and I will show you two different techniques you can use to attach the coral to its base.

TOOLS OF THE TRADE

Cutting blade: Personally I prefer slim-bladed scissors, but anything sharp will do. If the mother colony is really large, you will need something more robust to make the cuts. A Stanley knife with a new blade works perfectly. I have been known to sneak into the kitchen to use the stainless steel carving knife, but do so at your own risk!

Frag plugs or coral rubble: The frags are mounted onto these. I will be showing you two ways of mounting the coral, so you will also need:

Toothpicks, mesh and elastic bands: Leather corals become very slimy after being cut, and cyanoacrylate will not work well if used for attaching the coral to the mount.

Containers: As always, it is useful to have a couple of containers to house the corals before and after fragging.

HOW TO FRAG LEATHER CORALS

Essentially, all you need do is take cuttings of the coral and they will grow into new colonies. It is as easy as that! When fragging the coral, it depends what type of leather you have, as they roughly show two different growth patterns:

- A finger growth pattern.
- A mushroom growth pattern.

Leathers that fall into these rough categories require different techniques, but are equally easy to frag. The shape does, however, influence how to mount the coral at the end. When working with finger leathers, you simply need to take a cutting and snip off the finger. I prefer to leave a little stump behind (like with the Xenia tutorial), because it promotes

growth to continue at that point. A flush cut more often than not heals flat. Depending on how many frags you want determines how to frag the mushroom leathers. If you only want a few frags, you can just cut a few good pieces from the mother colony. For more frags, cut about a 5cm incision toward the centre of the coral, then turn the scissors perpendicular to the first cut and follow it parallel to the outside rim until you have enough. Remove the strip of leather coral with another 5cm incision towards the centre of the coral. (Imagine you are trying to cut a strip of paper and you get the idea)

You can cut the strips as large or as small as you like. I like roughly 5cm x 5cm sections because this gives a nice manageable piece to work with when mounting the coral.

MOUNTING THE FRAGS

Once you have removed the frags, you need to decide how to mount them to the frag plugs. My preferred method is to use a toothpick for the finger leathers, and mesh for the flatter mushroom leathers.

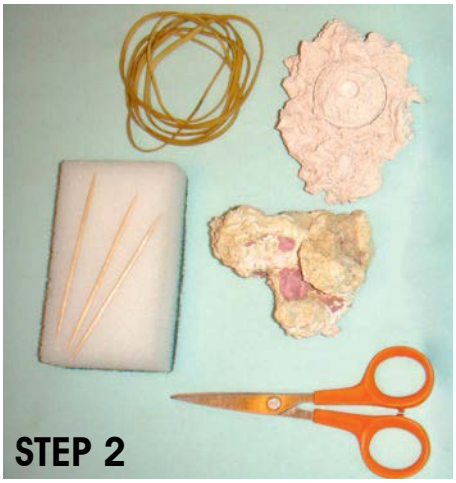
- If working with a finger leather, push a toothpick through the coral about 2cm above the cut where you removed it from the mother colony. If the coral is a little slimy, use foam as a base, as I demonstrated in the Xenia tutorial. Place the coral with the cut section against the plug and use the rubber band to secure it. Don't make it too tight because this could potentially damage the new frag.
- If working with a mushroom leather, place the leather onto the frag plug and put the mesh around it. Secure the mesh to the plug with a rubber band. It is helpful if the frag is smaller than the actual frag plug because it makes securing the mesh easier.
- If you are less keen to use the above hands-on approach, fill a container with small bits of rubble and place the frags in the container. The next step is simply to cover the container with the mesh. The frags should attach to the substrate within about a month, and then you can use cyanoacrylate glue or epoxy to attach the rubble to the plug. For those of you who have been following the series, it is the technique used with the mushroom corals.

POST FRAGGING CARE

The mother colony and the new frags will both benefit from good water flow; this removes slime or debris build–up, which can result in bacterial infections. With good water conditions and flow, the frags and the mother colony should recover quickly. As always, keep an eye on the frags, and if any of them start deteriorating, remove them from the tank. It is better to lose a frag or two in the short term to avoid infecting the entire tank long term! JT

JASON'S STEP-BY-STEP GUIDE TO...
FRAGGING LEATHERS

Make sure the mother colony is healthy and ready to be fragged. This may stress the coral, so please ensure the leather is ready for the experience.



Here are all the tools needed to successfully frag a finger leather coral. Make sure you have everything to hand for quick execution.

Take the scissors and cut a few centimetres above the chosen finger, and place it into a cup of tank water. The coral will soon shrink after the first snip, so snip quickly.

Pierce the bottom of the frag with the toothpick and secure down on a coral plug or rock using the elastic bands.

Place the coral in good flow to allow it to quickly heal. Within a few months you coral should start to grow.

MARIA GROGAN'S

NEWS ROUNDUP

NEWS FROM AROUND THE WORLD THAT MATTERS TO YOU

SUPERGIANT AMPHIPOD DISCOVERED IN DEEP SEAS OF 20,000 FEET

The amphipod is a common crustacean and can be found in great numbers in deep oceans around the world. The vast numbers are usually around 2-3cm long, with the exception of the 'giant' amphipod found in Antarctica, which grows to around 10cm. However, a newly discovered amphipod has recently been discovered by UK and New Zealand scientists from the University of Aberdeen in Scotland and the National Institute of Water and Atmospheric Research (NIWA) based in New Zealand on a joint expedition. It has now been named the 'supergiant' amphipod, and measures 28cm – nearly 1ft longer and ten times bigger than an average amphipod. These can be found at a depth of around 20,000ft (approx 4 miles) using ultra-deep submergence technology. The search was originally intended to catch specimens of deep sea snailfish, which the team had photographed before but which have never been captured since the early-1950s.

> "...now been named the 'supergiant' amphipod, and measures 28cm – nearly 1ft longer and ten times bigger than an average amphipod

DEEP SEA CREATURES – NOCTURNAL HUNTERS

An amazing series of short videos by Dr Alan Jamieson, from the University of Aberdeen's Oceanlab, shows us that life thousands of metres below the surface of the sea does in fact exist with great vibrancy. In the most recent news item from the BBC, we discover the rat-tail fish, which was found at 5,500m below sea level on the edge of the Marianas Trench, in the western Pacific Ocean. This fish finds food in the dark, and the video shows the bait used to capture the brilliant evidence. The deepest parts of the ocean are some of the least hospitable places on Earth, yet footage from recent expeditions carried out by scientists at the University of Aberdeen's Oceanlab reveals that life in the oceanic trenches is thriving. At 6,000m below sea level in the Kermadec Trench, which is off the coast of New Zealand, a red crustacean called a decapod grabs its food, and run at 7,700m below sea level in the Japan Trench in the Pacific, the team filmed a large shoal of snail fish. Dr Alan Jamieson explains that this was the first time fish had been filmed at these depths. The series covers a range of sea level depths from 5,500 to 10,000 metres, and we see with short clips exactly what life has been discovered and its role within the environment.

You can visit http://news.bbc.co.uk/1/hi/sci/tech/8459732.stm to view the series.

THE WHALES, DOLPHINS AND PORPOISES NEED YOUR HELP!

Please give a minute of your time and help give them a future. Please act now. The Scottish government is creating a network of protected areas for Scotland's amazing marine life. This should be great news, but there is a real risk that whales, dolphins and porpoises will not be included for protection. You can help us change this – please add your name to the campaign calling on the Scottish government to make sure that its marine-protected areas include these remarkable and vulnerable animals who make their homes in Scottish waters.

For further information please go to www.wdcs.org

WARNING FOR LOCAL SEA LOVERS

A warning for surfers and other bathers was issued just 15 miles from a popular surfing destination in Newquay; 100 yards off the coast of Padstow, Cornwall has been sightings of two killer whales, believed to be a mother and calf, bringing the threat of human attacks. The fact that there is a calf could make the mother more protective, therefore more likely to attack anyone who seems to pose a threat.

Several people had reportedly seeing the whales in December 2011, a rare sight in the area, off the coast between the popular tourist towns of Newquay and Padstow. According to the Sea Watch Foundation, killer whale sightings are rare in the waters off the coast of southwest England, with most sightings being between March and September – so keep your eyes peeled!

CHINESE LANTERNS PROVE TO BE AN EVER INCREASING ENVIRONMENTAL HAZARD

Chinese lanterns have been common place in Asian countries, most notably Thailand for many years and more recently in the UK. They are used for celebrations and are believe to bring good luck. Made from rice paper and wire, they use a naked flame from a candle creating warm air to rise, and then they float off into the sky. An estimated 200,000 are released each year and although beautiful to look at, they present a risk to the environment and wildlife, and the UK government are under pressure to ban their manufacture and sale. Other countries including Australia, Germany, Austria, and more recently Spain have already put the ban in place.

The UK Marine Conservation Society (MCS) have recently joined the campaign to highlight to problems that arise when the lanterns descend into rivers and oceans, where they pose a threat to marine life such as turtles, seals and whales when the wire frame is ingested or becomes entangled around the animal. There are raised concerns this year given the numbers that are likely to be released due to the Olympics and the Queen's Diamond Jubilee.

NEWS IN BRIEF

GLOBAL WARMING UP OR DOWN?

As oceans warm due to climate change, water layers will mix less and affect the microbes and plankton that pump carbon out of the atmosphere. But researchers say it's still unclear whether these processes will further increase global warming or decrease it.

COLD EFFECT FOR CORAL BLEACHING

Coral reefs around the world are facing threats brought by climate change and dramatic shifts in sea temperatures. While ocean warming has been the primary focus for scientists and ocean policy managers, cold events can also cause large-scale coral bleaching events.

SOUNDS OF THE DEEP

University of Massachusetts Amherst fish biologists have published one of the first studies of deep-sea fish sounds in more than 50 years, collected from the sea floor about 2,237ft (682m) below the North Atlantic. Rodney Rountree, Francis Juanes and colleagues are exploring the idea that many fish make sounds to communicate with each other, especially those that live in the perpetual dark of the deep ocean.

'SEA' LIFE ON MARS?

Discoveries made in some underwater caves, by Texas A&M University at Galveston researchers in the Bahamas, could provide clues about how ocean life formed on Earth millions of years ago, and perhaps give hints of what types of marine life could be found on distant planets and moons.

MAKE LOVE FOR LIFE

The mating habits of marine turtles may help protect them against the effects of climate change, according to new research led by the University of Exeter.

FOOTBALLER PLANS TO BUILD VERY IMPRESSIVE TANK

Thierry Henry (former Arsenel striker) has submitted controversial plans to demolish his £5.9 million home and re-build to include an extravagent four storey (5,000 gallon) aquarium system covering W15xD3xH40ft. The aquarium is estimated to cost approx £250,000 to build and £12,000 per year to run.

BIRCH AQUARIUM RESEARCHES CORAL DAMAGE

BIRCH AQUARIUM
Scripps Institution of Oceanography
UC San Diego

A new study by scientists at Scripps Institution of Oceanography at UC San Diego compared damage to corals exposed to heat as well as cold stress. The results reveal that cool temperatures can inflict more damage in the short term, but heat is more destructive in the long run. Climate change is widely known to produce warming conditions in the oceans, but extreme cold-water events have become more frequent and intense as well. In 2010, for example, coral reefs around the world faced one of the coldest winters and one of the hottest summers on record. During a unique experiment conducted by a Scripps Oceanography student and a Scripps scientist, corals subjected to cold temperatures suffered greater

> "The symbiosis is an essential component for reef-building corals because the symbionts provide corals with most of their energy

growth impairment and other measurable damage in just days, compared with heat-treated corals. Yet the researchers found that corals were eventually able to adjust to the chilly conditions, stabilise their health, and continue to grow.

During the investigations, conducted inside Scripps' Experimental Aquarium, the researchers tracked the overall coral health and the stress of their symbiotic algae, sometimes called zooxanthellae. The symbiosis is an essential component for reef-building corals because the symbionts provide corals with most of their energy. Deheyn, a project scientist in Scripps' Marine Biology Research Division, commented: "These results are important because they show that corals react differently to temperature differences, which is critical for future management of coral reefs in the realm of climate change."

ORKNEY'S BRAINLESS FISH!

Scotland's biggest horse mussel bed and a 'faceless and brainless' fish-like creature were recorded during government-backed surveys in late 2011. The work covered almost 2,200 square miles, which is equivalent to an area one and a quarter times the size of the Cairngorms National Park. WWF Scotland said the results highlighted the need to better protect the marine environment. Scottish Natural Heritage and Edinburgh's Heriot-Watt University were among the organisations that carried out the work. Several rare species were recorded, and off the west coast, fan mussels were found growing up to 48cm long; the mussels are Scotland's largest sea shell. Around the Small Isles, more than 100 specimens of marine life were noted. Off Tankerness on Orkney, the government said the prehistoric 'faceless and brainless' amphioxus was recorded. The Scottish government said that the rarely-seen species was regarded as a modern representative of the first animals that evolved a backbone. Other finds included flame shell beds in Loch Linnhe in Argyll, and new communities of northern feather star off the Sound of Canna. Environment secretary Richard Lochhead described the finds as 'weird and wonderful.' He added: "The waters around Scotland are rich in such fascinating biodiversity, and it's our responsibility to protect this fragile environment. That's why we have ramped up our marine survey work, with plans being prepared for new surveys in 2012 to further our knowledge of what lies beneath Scotland's seas."

AMAZING 'LIVING FOSSIL' UNCOVERED

Due to the primitive features of this distinctive new discovery, the Protoanguilla palau is now known as the 'living fossil' and resides in the Pacific Ocean. In order to classify the new animal, the researchers had to create a new family, genus and species, bestowing on the animal the Latin name Protoanguilla palau, first discovered by researchers when diving at a 35m-deep cave in the Republic of Palau.

The team, including Masaki Miya from Chiba's Natural History Museum in Japan, Jiro Sakaue from the Southern Marine Laboratory in Palau, and G David Johnson from the Smithsonian Institute in Washington DC, drew up a family tree of different eels, showing the relationships between them. This allowed them to estimate when the ancestors of P. palau split away from other types of eel. Their results suggest this new family has been evolving independently for the last 200m years, placing their origins in the early Mesozoic era, when dinosaurs were beginning their domination of the planet. The researchers say the Protoanguilla lineage must have once been more widely distributed, because the undersea ridge where its cave home is located is between 60 and 70 million years old.

T-5 REVOLUTION

INTRODUCING

Zoo Med's **NEW** full range of **T-5 LAMPS.**
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CL5-24E	T-5 Coral Sun HO Actinic 24W	599 mm	
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OL5-24E	T-5 Ocean Sun HO Actinic 24W	599 mm	
OL5-54E	T-5 Ocean Sun HO Actinic 54W	1168 mm	
OL5-39E	T-5 Ocean Sun HO Actinic 39W	830 mm	Available Soon!
UL5-24E	T-5 Ultra Sun HO Actinic 24W	599 mm	
UL5-54E	T-5 Ultra Sun HO Actinic 54W	1168 mm	
UL5-39E	T-5 Ultra Sun HO Actinic 39W	830 mm	Available Soon!
FL5-24E	T-5 Flora Sun HO Actinic 24W	599 mm	
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In this issue...

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Closed (Mon), 12.00-16.00 Bank Holidays
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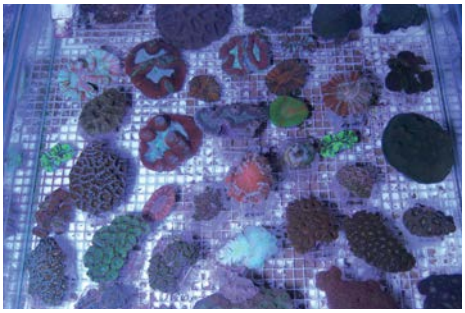
EMAIL: info@dreamreef.co.uk
WEBSITE: www.dreamreef.co.uk

Dreamreef is Leicester's premier marine aquatics specialist. It offers one of the UK's best selections of rare and colourful corals and an unusual array of fish and inverts, along with an extensive range of dry goods from all the top brands. Dreamreef is a marine enthusiast's one-stop shop. It is owned and run by John, a trained cytologist with over 30 years of fish and coral keeping experience, and he is always on hand to answer any questions. There is a newly opened marine tank showroom stocking a good range of aquaria, from all the popular nanos and plug-and-plays to the larger tanks and one-off builds. Skimmers, reactors, lighting, etc. are all on display in the new showroom. If it's used in marines you will find it at Dreamreef, from fragging kits, live phyto and copepod cultures, to complete systems. Soon to open is a breeding facility, and clownfish, Banggai Cardinals, and shrimps will be the first livestock to be bred at the premises.



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W14 York Eco Business Centre, Amy Johnson Way, Clifton Moor, York YO30 4AG

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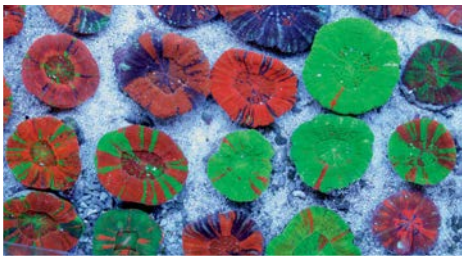
TELEPHONE: 01904 691704
EMAIL: paul@oceancorals.co.uk
WEBSITE: www.oceancorals.co.uk

Ocean Corals is a highly respected LFS, dedicated to sourcing quality marine fish and corals. Based in York, it stocks over 300 corals and over 200 fish at any given time, making it one of the largest stockists of marine fish and corals in the north. In addition to an extensive range of soft and SPS corals, this really is the place to be if LPS corals are your thing. Ocean Corals prides itself on sourcing some of the most elite, high profile and sought after LPS corals available in the UK. If you are looking for something a little special, pay a visit. Dry goods are also in stock, including brands such as TMC, Deltec, VorTech, Korrellan Zucht, New Era, D-D, and many more. Full tank setups are available and can be fully modified to the customer's needs. Tanks can be viewed in the showroom, as well as hundreds of samples of cabinet finishes to choose from. Ocean Corals also run a nice website.

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Paraquatics is a family business which prides itself on a friendly, informal atmosphere where people can browse, enquire, be informed and inspired to enjoy the full diversity and reap the enormous rewards of this amazing hobby. It is many things to many people, but all have one thing in common; fish need caring for, and Paraquatics has everything you need to successfully run an aquarium and have the delights of these colourful and intriguing creatures in your home all year round. Paraquatics has been specialising in marine fish since 1980, and during that time has built up a firm reputation for consistent quality. The team at Paraquatics is headed by Gary and Karen, who are both keen enthusiasts with long-standing experience in this area, comprising over 28 years of fishkeeping experience. The shop also stocks many top brands, such as Tunze, Deltec, and TMC.



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DID YOU KNOW?

MOON JELLYFISH

Jellyfish are the oldest multi-organ animal, having possibly roamed the seas for 700 million years or more. Moon Jellyfish (*Aurelia aurita*), found worldwide and all around the coast of Britain, are the most commonly captive kept species of jellyfish. They are easily recognised by their four, horseshoe-shaped gonads, clearly visible through the transparent flesh. Although they can sting, it is not dangerous to humans, with severe cases experiencing some stinging sensation on the surface of the skin. The Jellyfish body consists of over 95% water and most of their umbrella mass is a gelatinous material. They also lack respiratory, excretory, and circulatory systems.

BY DAVE PITT

WORDSEARCH

K	R	E	H	T	A	E	L	R	E	G	N	I	F	S
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FIND THE WORDS

~~Hitchhiker~~	Jellyfish	**Live Rock**
Caulerpa	**Blue Planet**	Auto Topup
Sandless	Carbon	**LED Lighting**
Indonesia	**Urchin**	Native Marines
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Sea	**Gold Rush Tang**	Finger Leather
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THE BLUE PLANET AQUARIUM

ELLESMERE PORT UK

IGGY TAVARES

Age: 62.

Hometown: London.

Full-time occupation: Scientist.

Marine experience: 7yrs.

Aquarium size: None at the moment.

Favourite fish: Powder Blue Tang (*Acanthurus leucosternon*).
coral: Elegance Coral (*Catalaphyllia jardenei*).
other: Blood Red Fire Shrimp (*Lysmata debelius*).

Specialist areas: Photography.

The Caribbean Tunnel. Image courtesy of Blue Planet.

The Blue Planet Aquarium at Ellesmere Port, Cheshire is one of the largest public aquariums in the UK. It has more than ten different shark species, such as sand tiger sharks and nurse sharks, which swim within feet of visitors in their 70m (230ft) long Aquatunnel in the huge Caribbean Reef display. There is also a programme for children and adults to dive with the sharks. The Blue Planet encompasses some freshwater habitats that include European rivers and streams, an Amazonian river and African fish, before hitting the marine scene of Mangrove Swamp, Rocky Shoreline and beyond.

FRESHWATER

The Blue Planet journey begins on the ground floor with the Freshwater Rivers and Streams display of fish that are found in Britain and Europe. Here there are three large exhibits and


A beautiful Regal Angelfish, *Pygoplites diacanthus.*

a smaller one, furnished to represent various habitats, giving visitors a chance to view these fish swimming in their underwater world. One of the open-top exhibits houses carp, perch and pike. The most eye-catching display here though, contains large, beautiful Russian Sturgeons (Acipenser gueldenstaedtii) and Sterlet Sturgeons (*Acipenser ruthenus*).

Tropical Rivers within the Amazon display houses giant freshwater fish such as *Arapaima gigas*, predatory Red-tailed Catfish, Granulated Dora, which is a vegetarian catfish, and a shoal of Black Pacu that are also vegetarian, although related to piranha. The Blackwater display, which depicts the wet season in the Amazon, when the water level rises up among the trees, has a healthy population of Festive Cichlids among the fish collection. Separate exhibits house reptiles, some really large electric eels, and piranhas, which always attract a lot of attention. Moving away from the Amazon, there is a nice display containing two endangered Madagascan Cichlids species, *Paretroplus maculatus* and *Ptychochromis oligacanthus*.


A nice uncommon fish on display was the Golden Spotted Rabbitfish *Siganus punctatus.*

Lakes and ponds contain two displays, the larger of which houses several large Nile Perch, whose introduction to Lake Victoria decimated the cichlid population in the lake. Here, huge *Distichodus sexfasciatus,* Giraffe Catfish and Vundu Catfish (*Heterobranchus longifilis*) swim untroubled by the Nile Perch. The Lake Malawi exhibit is a riot of colour and motion; this crowded tank holds several hundred cichlids from dozens of different species of the 600 found in the lake.

The Amphibians display contains several small glass enclosures, which are heavily planted to reflect the South American rainforest, where the frogs in this collection originate. Among them are several dart frogs, including the Blue Dart Frog, the Regina Frog, and the Rococo Toad. The Blue Planet has a very successful breeding programme for the endangered Blue Dart Frog.

> A rather popular display here is the 2,000-litre free-standing tank containing a hundred or more clownfish

SALTWATER

On the lower ground floor are the marine exhibits. The first display of the Mangrove Swamp contains very shallow water, where four Eye Fish (*Anableps anableps*) share this habitat with crabs and Mudskippers (*Periophthalmus barbarus*). The other deeper display, with stilt-like mangrove roots, has a mixed population of Archer Fish (*Toxotes jaculatrix*) and Scats (*Scatophagus argus*), and Tete Sea Catfish (*Hexanematichthys seemanni*). Adjacent to the Mangrove Swamp, the Cuvier's Dwarf Caiman (*Paleosuchus palpebrosus*) are attracting a lot of attention because they have recently produced offspring.

The Coral Magic 4,000-litre display reflects the coral reefs found in the Red Sea, which provide food and shelter for swarms of small, brightly coloured fish, as well as bigger fish. Among the 20 different types of coral and lots of different species of fish in this colourful display are fish that marine hobbyists are familiar with, such as various tangs (Powder Blue Surgeon,


Everyone's childhood favourite in the hundreds. A stunning display not to be missed.

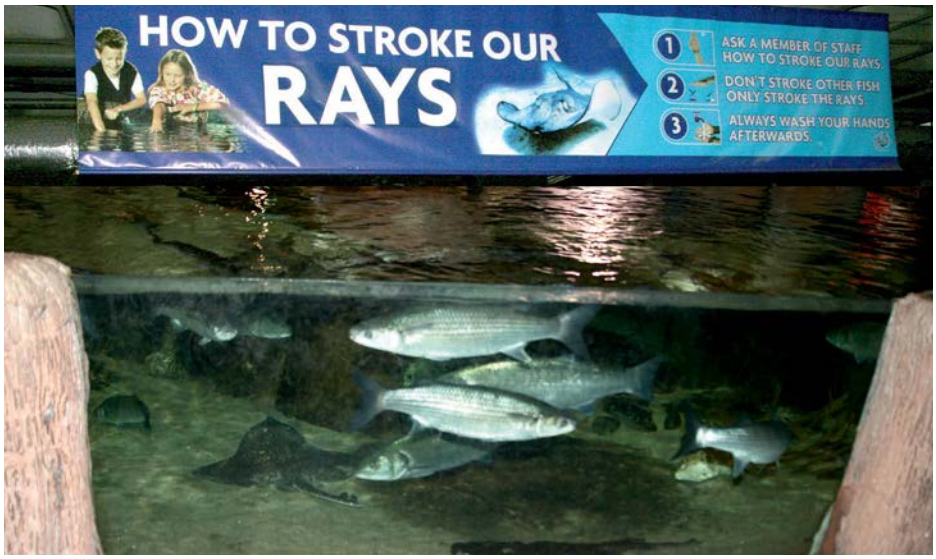
The new Coral Cave. Image courtesy of Blue Planet.

Acanthurus leucosternon; Unicorn Tang, *Naso annulatus*; Foxface Rabbitfish, *Siganus vulpinus*; Golden Spotted Rabbitfish, *Siganus punctatus*), angelfish (French Angelfish, *Pomacanthus paru*; Koran Angel, *Pomacanthus semicirculatus*; Regal Angelfish, *Pygoplites diacanthus*; Emperor Angelfish, *Pomacanthus imperator*), groupers (Panther Grouper, *Cromileptes altivelis*; Peacock Grouper, *Cephalopholis argus*; Black Tip Grouper, *Epinephelus fasciatus*), as well as smaller fish such as Lyretail Anthias (*Pseudanthias cheirospilos*), blennies (Midas Blenny, *Ecsenius midas*), clownfish, damsels, and many more.

A rather popular display here is the 2,000-litre free-standing tank containing a hundred or more clownfish. This display seems like a magnet to children, who love walking round the exhibit, exclaiming "Nemo". Smaller 500-litre tanks in the vicinity now house nice displays of Reidi Seahorses (*Hippocampus reidi*), Pyjama Cardinals (*Sphaeramia nematoptera*), and Firefish (*Nemateleotris magnifica*).

Coral Cave is a new display, consisting of a 20,000-litre circular tank set inside a darkened giant rockwork cavern. Several hundred brightly coloured tropical reef fish species, such as tangs (Regal Tang, *Paracanthurus hepatus*; Lipstick Tang, *Naso lituratus*; Orange Shoulder Tang, *Acanthurus olivaceus*; Desjardini Tang, *Zebrasoma desjardinii*), puffer fish (Blackspotted Puffer, *Arothoron nigropunctatus*), parrotfish, boxfish, Moorish Idol (*Zanclus cornutus*), Blue Spotted Stingrays (*Neotrygon kuhlii*) and Epaulette Sharks (*Hemiscyllium ocellatum*), to name but a few, swim in and around realistic-looking corals in this reef. This display has state-of-the-art lighting effects, where the dripping ceiling creates a rippling reflection across the whole of the cave, giving a magical feeling while offering tantalising glimpses of the reef that is enjoyed by visitors young and old.

> under supervision from staff, visitors actually get to touch the rays in their special waist-high pool



The Rocky Shoreline display is a firm favourite with children and adults alike, because here, under supervision from staff, visitors actually get to touch the rays in their special waist-high pool. The rays also seem to like being stroked, as they keep coming to the surface, or perhaps they are just expecting to be fed. Rays in this pool include Thornback Rays (*Raja clavata*), Undulate Rays (*Raja undulata*) and Spotted Rays (*Raja montagui*), which often breed in this facility, depositing eggs in mermaid purses.

The second larger pool is divided into several sections, and contains various fish, from pollock, mullet, sea bass and gurnard, to cod, spider crabs and spotted

dogfish that belong to the shark family. All these fish and crabs inhabit the rocky coastlines of the British Isles, and many of these fish are eaten by us. Another fish also found in this display is plaice, which can be hard to spot because they like covering themselves with sand.

The Caribbean Reef is the highlight of the Blue Planet visit. The first stop is the Aquatheatre, with rows of seating in front of a huge 4 x 4.5m window, where one can see the sharks and rays and shoals of fish as they swim past. The large window is made of 23cm thick acrylic to withstand the pressure of the 3.8 million litres (836,000 gallons) of water of the Caribbean Reef. There are regular 20-minute shows at the Aquatheatre, where a presenter talks about the fascinating fish swimming past. Two divers inside the tank enliven the show with their antics, and also create an exciting feeding frenzy when they offer food to the fishes, which fortunately the sharks do not participate in! During the festive period leading up to Christmas, a scuba-diving Santa Claus made regular diving trips in the shark-infested waters, to the amazement and enjoyment of both children and adults.

The Blue Planet Aquarium offers visitors the chance to walk among the 1,500 fish in the Caribbean Reef via a 70m-long Aquatunnel. Visitors don't really have to walk here, as one side of the tunnel is equipped with a moving walkway that slowly takes you through, past the shark feeding station, the blue lagoon and the shipwreck. In the tunnel, within touching distance, are several fearsome-looking, toothy, 3m-long Sand Tiger Sharks (*Carcharius taurus*), which weigh close to 150kg. There are ten species of shark in this reef, including Nurse Sharks (*Ginglymostoma cirratum*), Bull Huss (*Scyliorhinus stellaris*), Guitar Sharks (*Rhina ancylostoma*), Blacktip Reef Shark (*Carcharhinus melanopterus*), Leopard Sharks (*Triakis semifasciata*), Lemon Sharks (*Negaprion brevirostris*) and more, as well the recently arrived Zebra Shark (*Stegostoma fasciatum*) called Dotty, which is proving to be a popular addition among visitors.

There are also several different species of large rays, which appear to elegantly 'fly' through the water, while quite often, moray eels swim through the water column in their own peculiar style. Shoals of Golden Trevally (*Gnathanodon speciosus*), Crevalle Jacks (*Caranx hippos*), and Horse-eye Jacks (*Caranx latus*) are constantly swimming past as visitors move along the tunnel, making for a busy display. Yet there is quiet place in this reef, where large fish such as triggers and parrotfish stand quietly in line at the 'cleaning station', awaiting their turn to be rid of parasites by cleaner wrasses.

A stunning *Balistes vetula* Queen Triggerfish in all its glory.

Junior Shark Encounter at Blue Planet Aquarium. Image by Kelly Timmins

Some of the smaller fish include large French Angelfish (*Pomacanthus paru*), Atlantic Spadefish (*Chaetodon faber*), often found around shipwrecks, Stoplight Parrotfish (*Malacosteus niger*), with their strong beak-like jaws, big-eyed Squirrel Fish (*Myripristis species*), Lookdown (*Selene vomer*), with incredibly thin, silvery bodies, and a friendly, photogenic Queen Triggerfish (*Balistes ventula*).

> The Blue Planet Aquarium offers visitors the opportunity to swim with sharks in the spectacular Caribbean Reef display

SHARK ENCOUNTER AT BLUE PLANET AQUARIUM

The Blue Planet Aquarium offers visitors the opportunity to swim with sharks in the spectacular Caribbean Reef display. The Shark Encounter programme is geared not only to qualified divers who have a minimum certification PADI Open Water or equivalent, but also to absolute beginners, and even children. The children's Shark Encounter session runs for 3 hours, during which each

One of the many sharks displayed at the aquarium. Here is a 3m-long Sand Tiger Shark.

The main Coral Bay display.

New to the aquarium, Asian Short Clawed Otters.

child receives full training from a team of qualified instructors, and then spends time getting comfortable in a training pool before meeting the sharks. The cost of £140.00 includes full instruction and expert supervision, guaranteed close-up shark encounters, as well as one free accompanying adult. Prices for adults vary, and include Shark Awareness and Digital Underwater Photography for qualified divers. All these packages are really cost-effective, since one does not have to travel to the Red Sea or beyond to enjoy swimming with colourful marine fish, while also enjoying the thrill of having large sharks almost within touching distance. They are all very popular and should be booked well in advance to avoid disappointment.

For children who do not want to dive, Blue Planet Aquarium also offers organised children's parties, such as a shark party or clownfish party, which includes a guided shark fact-finding mission, or reef magic explorer tour, aquatheatre show and animal feed, mini face paint for all, party games, and a choice of hot or cold food. Other party options include pirate party or mermaid party, which offer slightly different options.

OTHER ACTIVITIES

As well as fish, the Blue Planet also has an outdoor enclosure for a family of Asian Short Clawed Otters (*Aonyx cinerea*). Recent additions are a group of Canadian Otters (*Lutra canadensis*), which have settled in well. This enclosure offers quite a natural habitat, with a pond and lots of logs for the otters to swim and roam around. They are fairly playful and often come along to see what the visitors are up to.

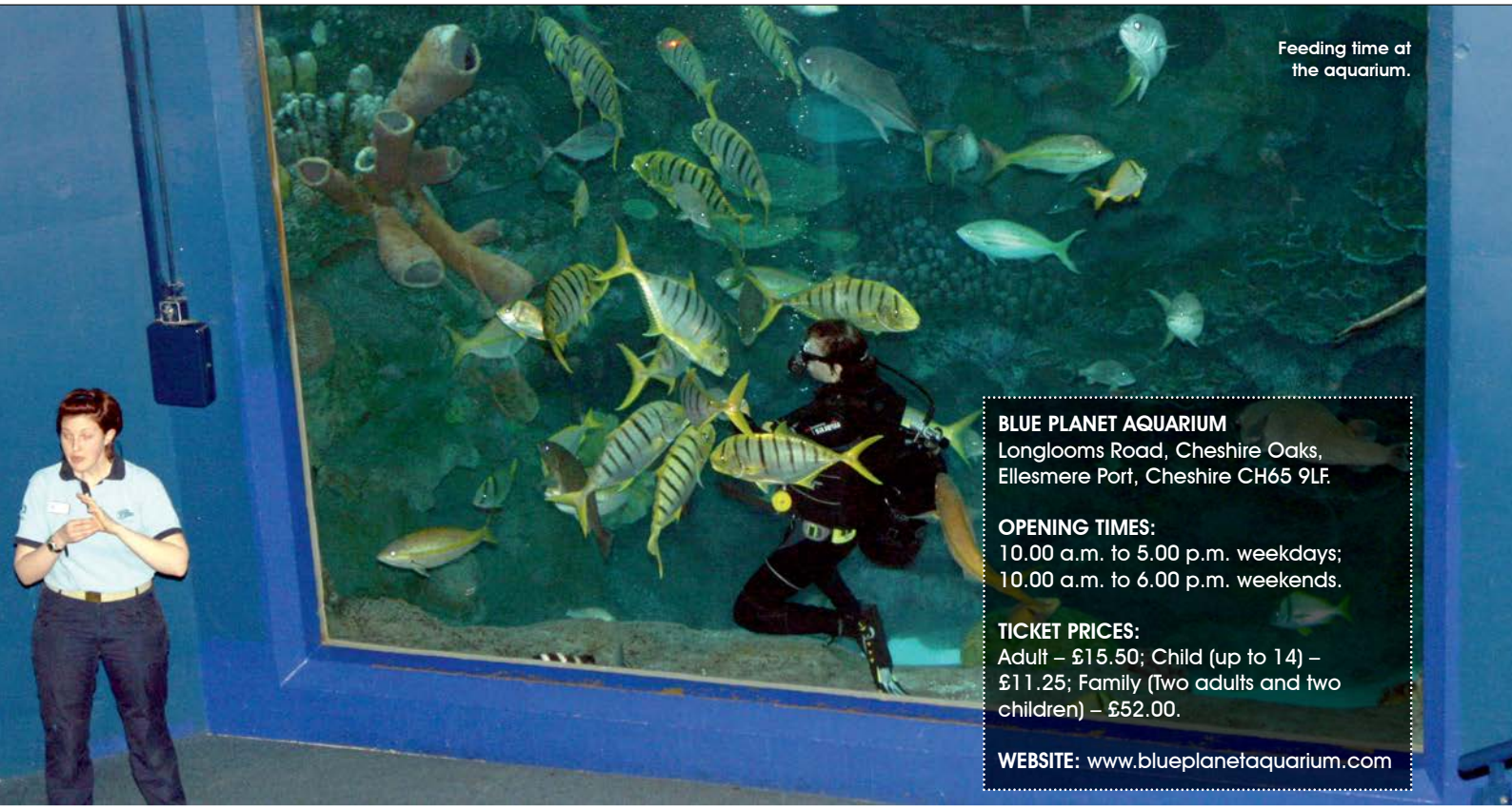
Pirate Playground is an adventure play park, where children can have a lot of fun exploring the shipwreck or having a go on the wobbling whales, bouncy crocodiles, monkey bars and slippery slides.

> Recent additions are a group of Canadian Otters (*Lutra canadensis*), which have settled in well

Blue Planet Aquarium does have a souvenir gift shop offering a wide range of gifts, as well as a café-type restaurant serving hot and cold meals and snacks; the restaurant has six portholes looking into the Caribbean display. Additionally, there is lift access to each floor, and ramps throughout the attraction, allowing use of wheelchairs.

AQUARIUM MAINTENANCE AT BLUE PLANET

Water quality: Blue Planet Aquarium uses 20 tons of synthetic sea salts every 8-10 weeks to make up the saltwater, using tap water that has been processed through various resins to make it fish-safe. The large displays have sand pod as well as a bio tower filtration powered by external 1-2.5hp pumps. Additionally, the large marine systems have protein skimmers powered by a large external pump. Smaller displays are maintained by external canister filtration and hang-on skimmers. The Reef Magic zone also has an algae scrubber containing caulerpa and chaetomorpha.



Feeding time at the aquarium.

BLUE PLANET AQUARIUM
Longlooms Road, Cheshire Oaks,
Ellesmere Port, Cheshire CH65 9LF.

OPENING TIMES:
10.00 a.m. to 5.00 p.m. weekdays;
10.00 a.m. to 6.00 p.m. weekends.

TICKET PRICES:
Adult – £15.50; Child (up to 14) – £11.25; Family (Two adults and two children) – £52.00.

WEBSITE: www.blueplanetaquarium.com

Regular small water changes keep the water parameters stable, while removing nitrates and constantly replenishing much-needed minerals within the water in freshwater and marine systems.

Feeding the fish: All the fish in the Blue Aquarium have special feeding programmes to keep them healthy and in peak condition. In the main Caribbean Reef display, apart from the small regular feeds by divers at the Aquatheatre show, the large sharks and rays are fed four times a week on vitamin-enriched pieces of trevally, whiting, or octopus. The smaller fish are fed once daily on a varied and vitamin-enriched diet of small fish, squid, marine pellets, fresh vegetables, seaweed, and a gel diet.

The marines in the Coral Magic displays, which contain live corals and invertebrates, are fed numerous times throughout the day, while fish-only systems such as Coral Cove are fed once or twice each day. They get a varied diet, including mysis, brine shrimp, rotifers, calanus, herbivore and omnivore diets, and seaweed. Again, all food is vitamin-enriched for optimum dietary requirements. All displays containing corals are fed on phytoplankton, which is cultured on site. The larger fish in these displays also receive a diet that includes small fish, squid, marine pellets, and seaweed.

> All the fish in the Blue Aquarium have special feeding programmes to keep them healthy and in peak condition

In the freshwater displays, smaller freshwater fish are fed once or twice each day on a varied diet of bloodworm, brine shrimp, daphnia, herbivore and omnivore gel diet, beef heart, and small freshwater pellets. Larger fish receive vitamin-enriched chopped freshwater fish, freshwater pellets, omnivore gel diet, and fresh vegetables once a day.

A lovely patterned Russian Sturgeon fish.

Breeding at the aquarium: The Blue Planet Aquarium has various breeding projects that include several poison dart frog species, the endangered live-bearing fish *Allotoca goslinei*, and endangered Madagascan Cichlids (*Paretroplus maculates* and *Paretroplus menerambo*). On the marine side, Southern Stingrays, Thornback Rays, Banded Bamboo Sharks, Dogfish, various seahorse species and Bangaii Cardinals have bred at the aquarium. Additionally, in the huge Caribbean Reef display, mating activity has been observed at certain times of the year from the Sand Tiger Sharks and Nurse Sharks, but offspring are yet to be produced.

CONCLUSION

The sharks pull in the crowds to the Blue Planet Aquarium, but once inside there are a lot of other things to see, learn and enjoy. In the freshwater section, large fish such as Russian Sturgeons, *Arapaima gigas*, *Distichodus sexfasciatus* and Nile Perch add to the awe-factor, while smaller creatures like colourful frogs draw the visitors closer. The touch sections in the Rocky Shoreline give visitors a sense of participation, while Coral Magic and the new Coral Cove, with all the small colourful fish, make visitors feel at home with what they are familiar with. The highlight though, is the Caribbean Reef display with its huge window, which offers a first glimpse of the sharks, rays, jacks and more that visitors are about to see as they walk through the fantastic Aquatunnel, and don't forget the opportunity to dive with sharks, which does require prebooking. The Blue Planet Aquarium offers a fantastic half-day out for the whole family. **IT**

TOP TANKS

Brought to you by reef-face.co.uk

Our regular Top Tanks spot will feature three of the best hobbyist tanks, brought to you by **Reef Face** forum. In each issue, the top three entries from the online competition will be published in **Marine Habitat**.

MARK'S CUBE SUCCESS

This is my Godiva Premier 2ft cube. It's been running since the middle of May 2011 and was a forced downgrade from my 5x2x2 SPS reef tank. Saying that, I love the size of this tank because it's very easy to manage. The setup is very simple; I have around 35kg of live rock supported on egg crate sitting on 10mm pieces of pipe, just over 1ins of araganite sand and a single Vortech MP40 for circulation. The sump has a 6ins deep sand bed and I use an air pump driven skimmer which is a compromise to running skimmerless. Maintenance is a 60-litre water change religiously every fortnight and I dose Prodibio, using one ampoule of Biodigest and one ampoule of Bioptim fortnightly. I had pretty good results using Prodibio on the last tank, so I thought why change?

TANK STATS

MAIN TANK SIZE: W24 x H24 x D24 ins
MAIN DISPLAY VOLUME: 220L
SUMP SIZE: W20 x H15 x D18 ins
SUMP VOLUME: 60L
LIGHTING: Dimmable ATI 6 x 24w
FAVOURITE....
FISH: My pair of Peacock Leopard Wrasse
CORAL: Acans
OTHER: Red Bubble Tipped Anemone

JONATHAN'S JUWEL IN THE CROWN

My tank is a Juwel Vision 450 tank, which has now been running for 2 years. I don't have a sump but run an Eheim Professional 3 external filter, in which I only have floss. In the future i will be upgrading and I would love a sump for extra filtration.

Currently I keep a mix of different corals sps, lps and zoas and I keep my fish stock as low as possible for better water quality, so I have just seven fish: Yellow, Sailfin and Regal Tangs, Mandarin and Scooter Blennies and a pair of Maroon Clowns.

Along with regular 50-litre water changes, I keep my water parameters stable through balling fm salts. I will be considering the calcium reactor route when I eventually upgrade.

TANK STATS

TANK SIZE: 5ft bow front
Water volume: 450 litres
FILTRATION: Eheim Professional 3 external filter
LIGHTS: 6x54 watt ATI light unit
SKIMMER: Deltec MCE 600
POWERHEADS: Two x mp40 WES
REACTOR: Kent Nautilus Phosphate Reactor (change 500 ml rowa phos every month)

SAMURAI SARAH'S SUCCESS

The flow in the tank is coming from the three Vortech MP40wes and one Vortech MP10wes. Skimmer is the Hydor Performer Series 2 1250 with Newjet 2300 feed. The tank is currently lit by 1 TMC 1000HD plate, two marine white strips, two reef white strips and one K3 LED unit. I believe in keeping things pretty low-tech, and have found regular water changes have kept the levels stable, and corals growing well.

TANK STATS

MAIN DISPLAY SIZE: 2500cm x 57cm x 60cm
MAIN DISPLAY WATER VOLUME 1100L
SUMP SIZE 125cm x 45cm x 60cm
LIGHTING Two K3 LED units
FAVOURITE...
FISH Orange Shoulder Tang
CORAL Pink *Seriatopora hystrix*
OTHER *Catalaphyllia jardinei*

Well done to the winner, who wins a fantastic prize from The Aquarium @ Cockfields Farm

ABOUT THE PRIZE

The Aquarium @ Cockfields Farm are giving away one of their fantastic frags to this month's winner. Owners Mark and Duncan have over 20 years of combined marine retail experience and produce all their frags in-store. All frags are well settled and grown out prior to sale, and Cockfields often demonstrate their fragging techniques live during their 'Frag Nights'.

Image courtesy of Mito Paz/Marine Photobank.

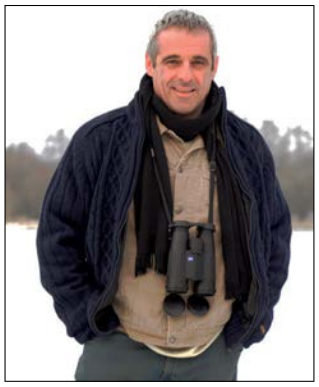
ZANTE

The tiny village of Gerakas, at the most southerly tip of Zakynthos, is home to one of Europe's most charismatic conservationists. Mark Oakley tells us how a hero of conservation could be the saviour of Europe's loggerhead turtles.

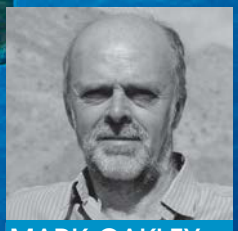
Yannis Vardakastanis has lived on the island (dubbed the 'jewel of the Ionian') since he was six, and remembers all too well the peaceful days before the tourists arrived. As a youngster he would often swim out from beautiful Gerakas beach, with just turtles and monk seals for company. He also remembers the occasion in the early-'70s when the first holidaymaker from northern Europe arrived.

"He was a tall blonde-haired German, and every kid in the village turned out to gape at him," said Yannis. From that point on, the number of visitors swelled rapidly, most heading for Laganas, where the longest stretch of sandy beach was located. Hotels and bars sprang up almost overnight, and a vast area of marshland just behind Laganas, once a key staging post for migrant birds, was drained and levelled to accommodate an international airport. Later, Yannis signed up for the merchant navy and travelled the world. By the time he returned, his idyllic island home was utterly transformed. The eldest of half a dozen boys and one sister, Yannis was initially beguiled by the opportunity to make money from this new phenomenon. While his siblings cashed in with a restaurant and beach beds, Yannis built a bar on the beach and served drinks and snacks to the hordes of sunbathers. It wasn't long, however, before the disturbance to the once peaceful turtle-nesting beaches began to trouble him. The night-time revelry in the main resorts, where beach parties and vehicles churned up the sand, were a serious deterrent to egg-laden female loggerhead turtles desperate to haul out and make their nests, and this convinced him to take action.

He moved his bar off the beach, persuaded other family members to scale back their beach operations, and launched Earth, Sea and Sky, a conservation body dedicated to preserving the flora and fauna of this lovely island. He began lobbying at every opportunity to restrict the tourism business, which was making many islanders comparatively wealthy, but was also doing irreparable damage to the environment. All too often he found himself a lone voice, at odds not just with the island authorities, but with friends and relatives he had grown up with, who resented his efforts to put the brakes on their entrepreneurial ventures, whether they were beach bars, sunbeds, pleasure craft, or any of a hundred other enterprises.



Yannis chose to launch a modest holiday business providing secluded, tasteful accommodation in Gerakas, for tourists in search of natural getaways. Many of those who sought the relative peace and tranquility of the Gerakas villas have returned year after year. All are happy to heed Yannis's advice to 'leave nothing behind but your footprints in the sand.' Many have willingly given up relaxation time to help him clean rubbish off the beaches. Yannis and Earth, Sea and Sky have largely succeeded in safeguarding Gerakas beach as a haven for nesting loggerheads. They have been less successful, however, in stemming the horrors in nearby Laganas and its neighbouring resorts. In spite of Laganas Bay being declared a National Marine Park, the accompanying legislation designed to safeguard the turtles has not been effectively enforced. As a result, nest numbers on Laganas and most other beaches on the island are in sharp



MARK OAKLEY

Age: 54.

Hometown: Worsley, Manchester.

Full-time occupation: Head of PR for Sea Life network

Marine experience: 20 years.

Favourite fish: Cuttlefish
coral: Mushroom Corals
other: Masked Crabs

Specialist areas: None really… though have authored childrens' books on Sharks and Ceteaceans

decline. On Gerakas beach – historically one of the least significant nesting beaches – numbers are climbing. The overall picture remains depressing, but Yannis is a genuine eco-warrior and refuses to accept defeat. And one beacon in the darkness has been his collaboration with the European network of Sea Life centres, to build a turtle-rescue and wildlife information centre on the island.

Sea Life first crossed paths with Yannis and Earth, Sea and Sky in the early-1990s, after Yannis returned from a visit to the only existing sea turtle rescue facility in Greece – at Glyfada, Athens. There he had met volunteers working for the Sea Turtle Protection Society of Greece – now known simply as Archelon – valiantly tending to a dozen or more injured turtles. Three of the casualties were so badly damaged that their return to the wild was never going to be feasible. They were Fotini, missing both front flippers; Lefteris, missing one front and one rear flipper, and Antiopi, who had been found with a deep head-wound inflicted either by a boat propeller or a fisherman's gaffe hook. These three were languishing in shallow tubs and facing possible euthanasia to free up space for new arrivals with a better prospect of complete rehabilitation. A frequent visitor to the UK, Yannis was aware of Sea Life, and contacted the company to set up a meeting. So it was that one frosty winter morning at Scarborough Sea Life Centre, plans were laid to bring Fotini, Lefteris and Antiopi to the UK.

Protracted negotiations with Archelon followed, but eventually the three turtles boarded a plane and were delivered several hours later to Sea Life's main collection facility at Weymouth. Each was subsequently given a very rigorous health check by the company's specialist vet, who discovered that poor Fotini was suffering progressive bone disease in the stumps where her front flippers used to be. Realising that she would be in constant pain, and with not enough bone left to carry out further amputation, the difficult decision was taken to put Fotini painlessly to sleep. Lefteris and Antiopi were in much better condition, and eventually found their way, via Great Yarmouth Sea Life centre, to Scarborough Sea Life, where they became sterling ambassadors for their species, helping the

centre promote turtle conservation to its many visitors. Lefteris survived more than 10 years, but eventually succumbed to long-term side-effects of her original injuries. At the time of writing, Antiopi was still swimming happily around Scarborough's ocean tank. Her head wound has left Antiopi with permanent brain damage, but she enjoys a good quality of life and is naturally doted on by the Sea Life displays team.

This whole venture initiated a long-term relationship between Sea Life and Earth, Sea and Sky, which later spawned the ambitious rescue centre project. Sea Life visitors have now donated sufficient funds for a modest facility to begin operating this coming spring. "Any loggerheads found injured around the island have until now faced a day-long journey to Athens for treatment and care," says Yannis. "Now they can receive attention much more quickly." He added: "Whenever possible, they will be restored to full health and freed back into the sea here in Gerakas. And Sea Life has promised to provide a permanent home for any that are too badly damaged to be rehabilitated."

> Sea Life displays staff from across Europe will visit periodically and help care for any recuperating patients

Sea Life centres contribute to conservation and welfare in many ways, but the establishment of a fully operational, independently run rescue station will take its endeavours to a new level. As well as rescuing stricken loggerheads, it will also strive to educate holidaymakers and help them enjoy their vacations without jeopardising wildlife.

Sea Life displays staff from across Europe will visit periodically and help care for any recuperating patients. They will also help Earth, Sea and Sky carry out vital nest monitoring on several of the beaches in the Marine Park. "We are rightly proud of all our own rescue and rehab work with seals and other sea creatures over the years," said Sea Life marine biologist Rob Hicks. "The day the Sea Turtle Rescue Centre opens will nevertheless be a very special one in the Sea Life annals. As far as we know, there is no other aquarium operator in the world who has helped set up this kind of facility."

Antiopi, Lefteris and Fotini not only paved

the way for this ambitious project, they were also the catalyst for Sea Life to take on other sea turtle projects.

In the last 20 years, they have successfully cared for and returned to the wild no fewer than five loggerheads which washed up on UK beaches. All recuperated in Sea Life tanks before being flown to Gran Canaria, to rejoin the migration which takes loggerheads born on the Atlantic coast of the US right across the ocean, round the Canary islands, and back again to breed. A couple of years ago, a rare Kemp's Ridley turtle was discovered close to death from exhaustion, hunger and hypothermia on a beach in Devon. Christened Willy, this beautiful animal was nursed back from death's door by dedicated staff at Weymouth, and after more than a year building strength and stamina, was flown back to the States to a rescue centre in North Carolina. BBC's The One Show filmed the whole event, and were there a week later for Willy's triumphant return to the ocean, cheered by hundreds of delighted onlookers. At the time of writing, a second Kemp's Ridley is recovering after straying thousands of miles off course, at the Sea Life centre in Scheveningen, Holland.

A dedicated Turtle Sanctuary has now been established at Weymouth for several years. It includes a sizeable facility for freshwater turtles and terrapins, the majority rehoused there after being abandoned or donated by owners who no longer wanted them, or simply couldn't cope with them any longer. Others, including a large number of Mississippi Map Turtles, were seized by specialist HM Customs officers at Heathrow, when they were either illegally imported or arrived without proper documentation.

> In the last 20 years, they have successfully cared for and returned to the wild no fewer than five loggerheads which washed up on UK beaches

The sanctuary also features a huge ocean tank, in which some of the strangest-looking sea turtles ever seen are enjoying as near normal a life as possible, given that all suffered serious spinal injuries in collisions with boats in Florida Keys. Their injuries rendered them unable to use their rear flippers, or to dive beneath the surface. The latter is a particularly serious handicap for a sea turtle, which spends most of its life swimming, feeding and sleeping underwater, only surfacing to breathe, or in the case of females, to haul out and make their nests. The enterprising and dedicated team at the Florida Turtle Hospital had restored at least a modicum of diving ability to these sad creatures by affixing weights to their shells. The Florida hospital had only a converted outdoor swimming pool to accommodate them, however, which meant staff could only observe their swimming from above. When Sea Life learned of an overcrowding problem at the Florida facility, it quickly offered space in the Weymouth ocean tank, and five of the weight-aided turtles were duly flown over.

"As soon as we were able to watch them from the vantage of our underwater tunnel, or the big viewing windows around the tank, we realised they were swimming at extraordinary angles," said Sea Life park curator Fiona Smith. "We are now experimenting with additional weights and subtle adjustments to help them swim on a more even keel, but in the meantime they seem to manage extremely well, even at 45 degrees." MO

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