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JASON THRESHER

HOW TO SET UP A FRAG TANK

MATT PEDERSEN

FISH ROOMS

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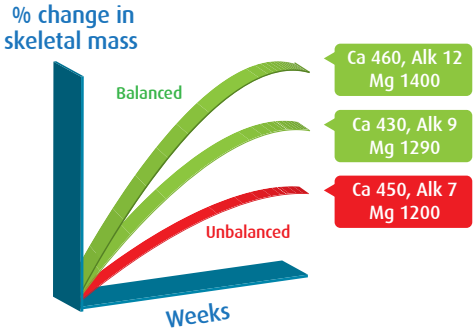

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DID YOU KNOW?

SAY IT WITH COLOURS

Where we use flowers to convey love, condolences, or to make a personal statement, squid, cuttlefish and octopuses use lightning-fast colour changes to communicate fear, aggression, sexual arousal, and other moods. Yet these colour changes don't involve the creation of new pigments. These are present all the time, but are switched on and off by rapid expansion and/or contraction of colour cells, or chromatophores. I don't know what the Caribbean Squid (*Sepioteuthis sepiodea*) shown here was telling me, but whatever it was, the colour changes occurred within a second or less. This squid is also remarkable in that it can fly out of the water when threatened!

BY JOHN DAWES

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ON THE COVER

REGULARS

FEATURES

REVIEWS

COMPETITIONS

ISSUE 12 COMPETITION WINNERS

RED SEA COMPETITION
Viki Ringham (Devon); Peter Bodak (Birmingham).

Runners-up: Brian Johnson (Kent); Sharon Cornwell (Essex)**; Songyang Jiang (Manchester);** Paul August (London)**; Claire Farrer (Leeds).**

NEW ERA WORDSEARCH WINNERS
Antony Burgess (Norwich); Mr. L. Day (Brighton)**;**
Alan Brown (N. Ireland).

BEGINNER TIP

WHAT IS RO WATER?

Tap water is notoriously inconsistent in its composition, which may depend on where it has originated from. Generally speaking, UK tap water is chlorinated, but it also has a number of compounds present that marine aquarists perceive to be pollutants, such as nitrate and phosphate. Levels of these may fluctuate depending on the time of year and where in the country you are located. In most modern reef aquaria, tap water isn't used because the concentrations of pollutants are higher than desired by aquarists for their aquaria.

One of the most popular methods of producing better quality water for use with marine aquaria is to treat it with a reverse osmosis (RO) unit. Here, tap water is first treated by passing it through a fibre-based micron filter that removes suspended sediments, before being passed through a carbon-based pre-filter that removes the chlorine and a proportion of the heavy metals. Then the pre-filtered water is passed through a semi-permeable membrane – essentially a flat sheet that is rolled tightly to allow water molecules through but not other compounds. The rejected water is diverted to waste, and the treated water is directed to a collection vessel. The efficiency of RO membranes can depend on their structure, and differs for various impurities. Water treated by reverse osmosis is usually between 92% and 98% pure. Some aquarists employ another stage of filtration after RO treatment, in the form of a deionising resin. This retains the trace pollutants left after RO filtration, and results in practically pure water being produced.

BY TRISTAN LOUGHER

WELCOME

Welcome to the January/February issue of Marine Habitat magazine.

2012 SUMMARY

With the positive feedback received, in our second year we've really pushed hard to make the magazine available in as many geographical areas as possible, so that hobbyists don't miss out. This has included launching the printed magazine into the newsagent community, in particular the major high street retailer WH Smiths. We are stocked in 350+ Smiths stores spread around the UK.

We also launched a digital version of the publication. Personally, I like to hold a printed copy, but we fully appreciate that some people prefer the digital format. We have always aimed to give hobbyists what they want, not what we want, and so we delivered a digital version.

In order to accommodate our followers from other English-speaking countries, we decided to start distributing the printed format overseas. Marine Habitat, in paper format, is now on the shelves in 10 countries.

THANK YOU TO OUR TEAM

On behalf of Andy (co-publisher and designer) and myself, I would like to take this opportunity to publicly acknowledge our team. We have a small but very hard-working team behind the scenes, who you may not ever come in contact with, but they make this magazine what it is today. Publishing is a very pressurised business at the best of times, but they don't let us down. We are very proud of each and every one of them.

THE PERFECT LFS?

I would like to throw this question out to you all, and invite you to drop us an email or letter with any thoughts/ideas you may have on this. A few thought provokers:

- When you go to your LFS, what do you think compared to shops in other industries?
- If you were to start your own LFS and money was no object, what would you do?
- Do you think there are any drawbacks/problems with existing LFSs generally?
- Do you value the support you can get from the staff at LFSs?
- Do you prefer an LFS to be independent or set up within a garden centre, for example?
- Do you prefer dedicated marine fish shops or ones selling other fish types?
- Are there any services you think LFSs could offer that they don't currently?

REEFERS EVENT (2ND-3RD MARCH 2013)

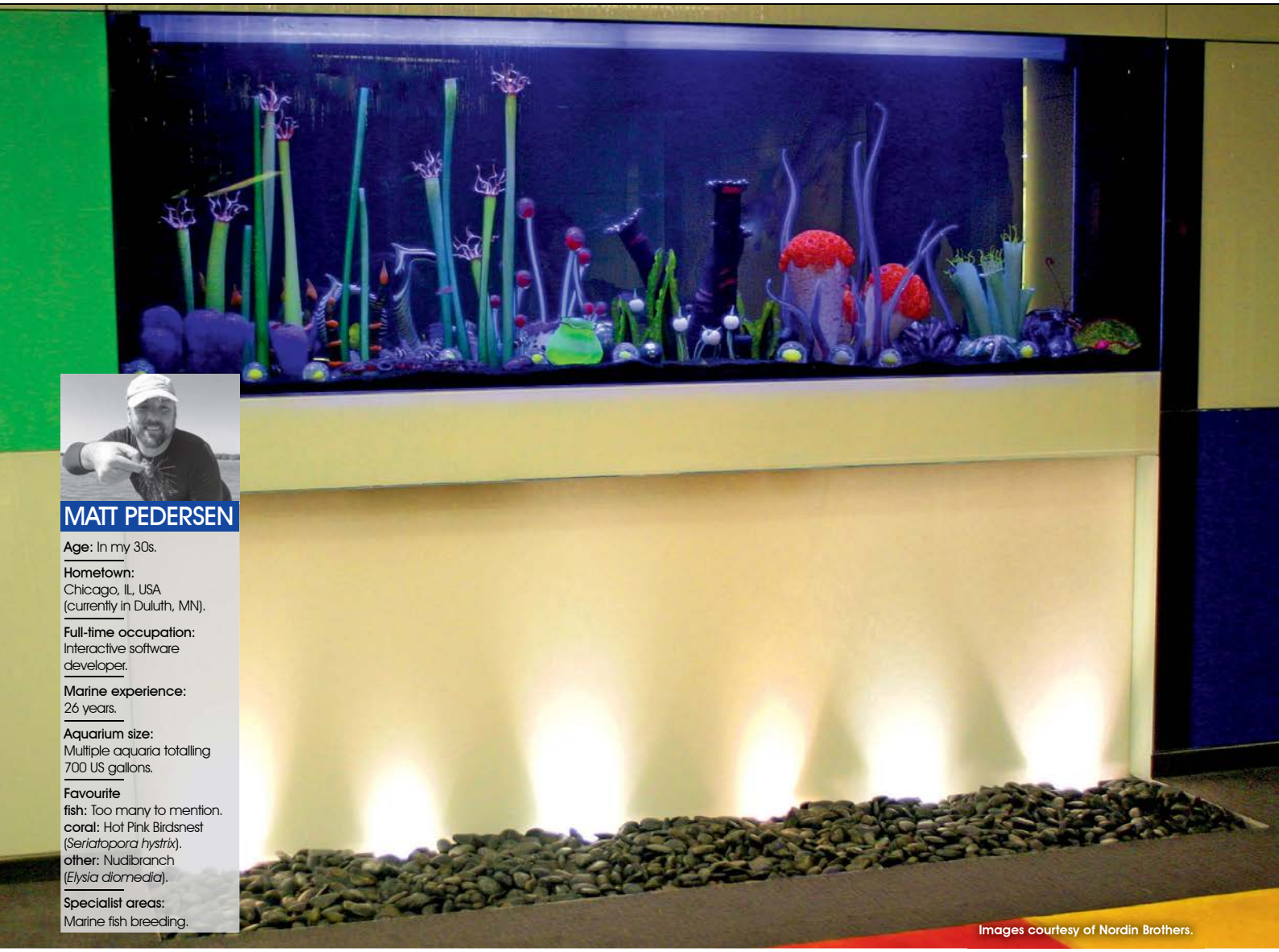
You may know the name Cain Burn from the last issue, and remember the Liverpool Museum event that we attended. One of the key supporters of Cain's raffle was Northfield Aquatics. Since the event, they have decided they want to do more, and have put plans in place to organise a reefers event on 2nd-3rd March. At this stage the plans are still pretty fluid, but from what I gather, it certainly sounds like a whole lot of fun, and it's for a great cause. Although only pencilled in at the time of writing, activities being suggested include: discounts on everything in store, a donation of 10% of all takings to Cain's fund, a car boot sale, a fishing match, something called 'Them Who Dare', which sounds painful because it involves male waxing. Also an auction, raffle, bonfire and barbecue. We'd love to see this event be a resounding success, both as a hobbyist meet and also as a charitable venture.

READER SAM IGO

Amongst the mail we get from readers, we received one from Sam Igo. He was writing to ask if we did any kind of holder for the mags because he wanted to keep his copies organised, given that he regularly refers back to them. As it happens, we now sell a magazine slipcase purposely designed for this job. Check out fjshop.co.uk for details.

In Sam's message, he also mentioned he had a newborn son, Archie Igo, so congratulations to Sam and his partner Carly. Hopefully, with Sam's enthusiasm, we may have a little marine aquarist in the making, which is always great to hear. With all that said, I'll let you crack on and get reading. The issue, as usual, is packed with great stuff which I hope you enjoy. Finally, congratulations to Andy and his partner Jane, who have recently purchased their first house. I wonder if any new fish tanks will be in store... hmmm?!

Dave Pitt, editor



MATT PEDERSEN

Age: In my 30s.

Hometown: Chicago, IL, USA (currently in Duluth, MN).

Full-time occupation: Interactive software developer.

Marine experience: 26 years.

Aquarium size: Multiple aquaria totalling 700 US gallons.

Favourite fish: Too many to mention.
coral: Hot Pink Birdsnest (*Seriatopora hystrix*).
other: Nudibranch (*Elysia diomedia*).

Specialist areas: Marine fish breeding.

Images courtesy of Nordin Brothers.

GLASS REEF

There are aquariums, and then there are mind-blowing aquariums! **Matt Pedersen** takes a look at a truly unique aquarium on a different level... or maybe planet!?

"Wow… that's stunning. And I hate stuff like this!" Verbatim, this was my initial private reaction to images of a massive aquarium filled with hand-blown glass in February of 2012. Other reactions among my peers were not as tolerant or mediated: "Inhumane," was used by one aquarist to describe the fact that this aquarium contained living fish.

Aquarists are generally discouraged from providing unnatural settings for their fish – we're told that the bright chartreuse substrate and neon-pink fake plastic plants that we might have chosen in our early years are, in fact, downright harmful to our aquarium inhabitants. In veteran aquarists that belief certainly creates an ingrained disapproval for all things artificial when it comes to aquarium décor, be it the bleached white coral skeletons of the 20th century marine aquarium, or the latest toy anemone or jellyfish. While the aquarium world has not been without controversy over mainstream aquariums recently (season two of the *Animal Planet* series *Tanked*™ is in full swing, and *Fish Tank Kings*, a TV show, is also running on Nat Geo TV), the glass reef aquarium created by the Detroit Design Center, Aquarium Shine, Rossetti, and Sachse Construction, for the new Detroit, Michigan-situated Quicken Loans world headquarters, is a jarring and unparalleled artistic and aquatic statement that challenges our sense of what is decent and acceptable for a marine aquarium.

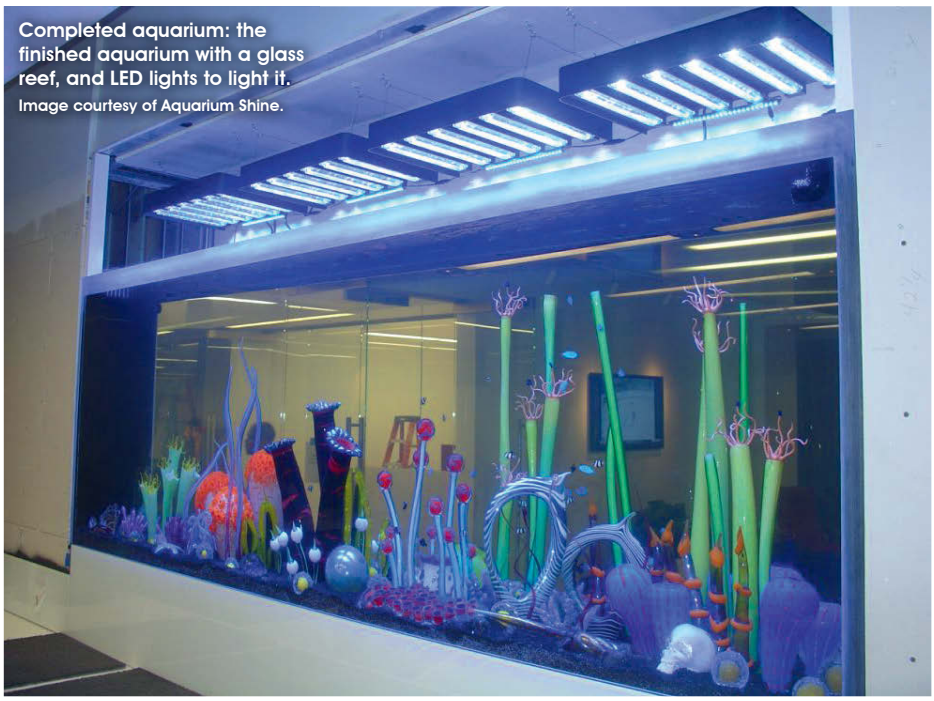
Erik and Israel Nordin are the creators of the glass reef. Erik and his brothers are artists, and were also childhood aquarists, having grown up with five siblings, and at any time, five to ten aquariums in their home. Erik has also been an avid scuba diver for years; he loves fish, corals, and everything underwater. The Nordin clan shares a common bond, with all Erik's siblings being involved in the arts. Erik and his brother Israel founded the Detroit Design Center in 2000. It creates aesthetic and functional sculptures in glass, metal, wood, cement, and probably

anything else that fits their creative vision.

It's easy to say that the Nordin brothers have a passion for their hometown. Both live in downtown Detroit, where Erik recognises that artistic employment is harder to come by – Detroit (probably best known for automobile manufacturing) lacks the funding and opportunities which artists can find in east and west coast cultural hot spots. With Detroit on everyone's minds following the economic collapse of the past few years, Quicken Loans started to develop multiple properties in the city, including the decision to situate their world headquarters there. With that decision came the opportunity for the local artists of the Detroit Design Center to work with Quicken Loans to create something unique for the world headquarters.

Detroit Design Center has a mission to innovate, to do new things. Rossetti, who is in charge of interior designs, created a space in the new office for an aquarium, along with a water feature situated in front of it. The concept of the aquarium, featuring glass coral species, is the fusion of Israel and Erik's passion for glass, and their ongoing relationship with water and all things aquatic. Once the concept was agreed, the Nordin brothers assembled their team; Erik likened the process to writing a symphony, and then hiring a world-class orchestra to perform it. The creation would take months to complete.

Erik and Israel developed the coral species list and planned the landscape. They found inspiration in nature (each glass coral species is inspired by real reef life), and spent the earlier times doing colour studies with real glass and lighting options in aquariums to see what worked best. They worked side by side with Furnace Design Group, led by brother Chris Nordin; his specialities



Completed aquarium: the finished aquarium with a glass reef, and LED lights to light it.
Image courtesy of Aquarium Shine.

are Venetian techniques. Giddian Rockwood, a brother-in-law of the family, was responsible for doing the smaller macro coral pieces using lampworking techniques, with Louie Sanchez and Adam Thomas functioning as additional team members in this massive glass sculpture undertaking. With 4½ months of R&D and production time (including 3 months of algae growth studies in real aquariums, conducted by Detroit Design Center and their aquatics partner, Aquarium Shine), this was no small task.

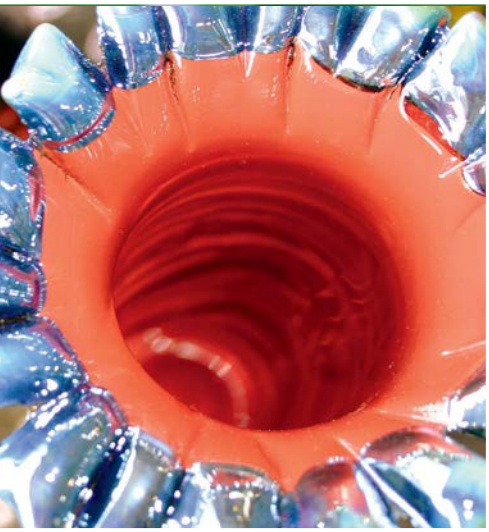
As the project neared completion, the team had created 22 distinct glass coral species, and had pushed the limits of glass with corals approaching 30ins in height. For each individual glass sculpture created, there was at least one other that was broken during production. The final layout for the aquarium was created in CAD on a grid, and the tank was mocked up for layout testing before the final installation.

The actual aquarium system design, installation and setup was handled by Lee Fiema of Aquarium Shine, an aquarium service company also based in Detroit, who worked in conjunction with Sachse Construction on the overall aquarium installation that ultimately houses Detroit Design Center's glass reef. The acrylic tank's volume is roughly 550 US gallons. It measures 10ft in length, 29¼ins front to back, and 42ins in height, and was constructed by the business behind the aforementioned *Animal Planet* TV Series *Tanked*™, ATM (Acrylic Tank Manufacturing). Fiema refers to this tank by the name 'Abstract Reef' when describing the melding of glass corals with living fish in this unique presentation.

The Nordin Brothers.

Hoisting the aquarium: Aquarium Shine's tech John Paye assisting with hoisting the aquarium into its location.
Image courtesy of Aquarium Shine.

Fiema explained the live support systems for the Abstract Reef. It includes a 6ft-long baffled sump that houses a 10ins diameter x 30ins tall bio reactor, along with a 10ins diameter x 26ins tall needle wheel protein skimmer. There is an 80-watt UV sterilizer plumbed into the manifold of the main circulation pump. A closed loop system provides additional circulation, with intakes and outflows



hidden by the Nordin's glass coral artwork. Influenced by the algal growth studies, the ultimate lighting design includes four (4) Ecoxotic Panorama LED systems, with each panorama fixture augmented by two additional 12.5-watt 445nm stunner strips. These lighting systems are on timers to simulate the dawn to dusk transition.

Erik recalled that installation day was extremely long and nerve-racking – the actual aquarium was taken to its location on the roof of the building's elevator. Erik spent much of the day standing in the aquarium – every specimen of the 120 individual corals was hand-delivered to the tank, and they made extra pieces to insure the best fit. After 14 hours the system was finally up and running, and it is now a fully functional marine aquarium housing approximately 40 fish.

Without a doubt, the first thing that came to my mind when seeing this aquarium was algae – if this aquarium had been set up with water but without any living creatures, any number of chemicals could be utilised to prevent algal growth, keeping a 'like new' look to the sculptural reef that had been created. But apparently the months of algae studies paid off, and Quicken Loans was aware that algae, a component of every aquarium, would be present and an ongoing maintenance challenge to contend with.

Still, a lot of maintenance is required. Fiema reports that the aquarium requires weekly maintenance, which includes a 10% water change every 2 weeks. On a quarterly schedule, Aquarium Shine drains two-thirds of the tank to remove certain glass pieces for a thorough cleaning, which does include a bleaching process.

Total hours spent on the aquarium in a month can be anything from 10-12 hrs.

Stepping back from their work now, Erik shared his impressions and thoughts on the project: "I cannot tell you how many people don't realise that the coral is glass," said Erik. Meanwhile, Fiema joked, "I'm waiting for these glass structures to start growing and/or reproducing." When asked about the use of glass coral as a habitat for the reef fish, Erik shared this story. "It was a huge eye-opener for my brother and me – we were looking at a smaller fish that was sitting inside a white brain with an orange crackle. The fish blended right in to look just like it. What was so cool was that the life was adjusting to and interacting with the environment." Erik does hope that other people will be inspired by the glass reef, and perhaps want their own glass coral species for their home aquariums.

We're well aware of the criticism that a project like this is sure to get, and I discussed this with Erik early in our interview. Towards the end of our phone call, Erik provided an interesting viewpoint. "This aquarium takes me back to every time I dive – I'm a cautious and respectful diver. Hopefully this artwork pays respect to nature. Nature is the most beautiful art – impossible to beat. We can only attempt to pay homage to it."

I personally grew up with the notion that art often does serve a purpose. It can be a catalyst for conversation and debate, and an attempt to elicit an emotional response. What it stirs in you may not be what it stirs in your neighbour. So too, the artist behind a piece often has a message, or a meaning, that may be interpreted in different ways by each audience member. And most importantly, art often aims to make a connection with its audience. For this author, something about the glass reef harkens back to the days of my youth; my first aquarium had a bubbling sunken paddlewheel ship and brightly coloured gravel, something many of us are told to reject in our mature hobby in favour of a more natural environment. Likewise, this glass reef instantly screams 'artificial', and thus may raise an ingrained visceral, almost preconditioned response that it must be bad for the fish and is somehow wrong. But is it?

I needed to only turn to my own tanks – the ceramic tile spawning substrates, random PVC pipe segments, and terracotta flowerpot caves of some breeding tanks are standard procedure in the breeding world. Bare glass bottoms are completely functional too, and the fish truly don't seem to mind. The bright white egg crate frag-rack in another tank certainly isn't natural either, and yet it hasn't prevented my group of pygmy angelfish from spawning nightly for years now. This is all commonly accepted functional décor in the aquarium world, and that got me thinking – is there something truly wrong with Detroit Design Center's glass reef?

> "Hopefully this artwork pays respect to nature. Nature is the most beautiful art – impossible to beat. We can only attempt to pay homage to it

Owing to the natural forms and colour palette of the glass reef, I must admit that this artistic aquarium has made me pause to reconsider and re-evaluate the conventions and beliefs that have me preconditioned to automatically reject such a creation as bad. Certainly, the natural beauty recreated in this glass reef is a closer approximation to the reef the fish once came from, at least when compared to my own terracotta and PVC wonderland.

Writing about the glass reef created by the Nordin brothers forced me to check my preconceived notions at the door. While I still understand that chartreuse and hot-pink gravel is a truly bad idea, and not in the best interests of the fish housed with it, the glass reef has caused my own line in the neon sand to be redrawn. When sharing this aquarium with another veteran aquarist, he remarked: "A real reef tank could have been much more beautiful." Perhaps, but almost by definition, beauty is entirely subjective from the start. If Quicken Loans and the Detroit Design Center had opted to simply create yet another coloured stick reef tank, would anyone have even cared? Would Detroit Design Center have created anything innovative and new? The answers to those questions cut to the very heart of the creativity that gave rise to the glass reef in the first place. From an artistic standpoint, challenging the audience and leaving the viewer forever changed may be the highest form of praise. In that respect, the glass reef is a complete success.

While the glass reef may not be to my own personal tastes, it is a reminder that just because something is different at first glance, it doesn't mean we ought to reject it as wrong or bad without first investigating further and challenging our pre-existing biases. Time and again, I have learned that conventional wisdoms and preconceived notions are not what they seem in the aquarium world, and by keeping an open mind, the aquarium community advances. Where art and aquarium have collided yet again, this glass reef gives us an example that forced this author to at least consider the relationship between the two. Whether you love to hate it, hate to love it, or even if you're somewhere in the middle, we'd love to hear how the glass reef affects your point of view. MP

The Perfect Storm

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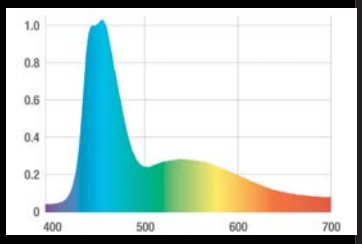

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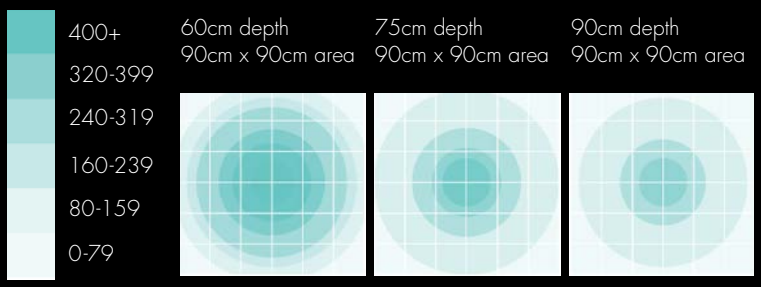

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EXPERT ADVICE

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 IAN

Ian Hallam is TMC's northern sales representative who has worked in the aquatics industry for many years. He is currently in the process of setting up a new Signature Tank and has been using the TMC Wishlist feature on the company's website to compile a dream stocking list. He loves sharks and rays, and the more weird and wonderful species of the aquatics world.

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 BOB

Bob Goemans has been a hobbyist for over 60 years, with at least 40 of those in the marine hobby, and has collected specimens for some of his aquariums from the South China Sea to the Caribbean. He is a retired environmental contracting manager, a public speaker, author, consultant, and has written for many magazines, both here and in the US.

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 NICK

Nick Stevenson is the managing director of BCUK Aquatics Ltd. and he has been involved in the manufacture of fish feed for the last 14 years. The business has been operating in the aquatic industry for the last 8 years, supplying a vast range of aquarium and hatchery diets under the brands BCUK, Calanus, First Bite and Mysis RS.

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

Hi,
When people talk about running their skimmer wet or dry, could you help me understand exactly what this means and what the pros and cons of each are? Why would someone chose one approach over the other?
Thanks, Jules Hollis.

Hi Jules,
Thank you for your question, which I shall now attempt to answer for you.

When people talk about wet or dry skimming, it refers to the bubbles that the skimmer is producing (skimmate). The denser the column of bubbles or foam, the drier it tends to be. When there is more water in the foam it makes it wetter, hence wet foam or wet skimming. As to which is better and the pros and cons for each, this is a debate that can divide aquarists!

Having a dry foam or skimmate means that it takes longer to skim and you will get a much richer, darker and thicker end product (a treacle-like colour and consistency).

Wet skimming is quicker and produces an end result which is much lighter and clearer. Generally speaking, a wet skim is useful for pulling out more dissolved organics, or for in an emergency, such as if you had overdosed with additives. Obviously, because it's wetter you are pulling out more water from the aquarium, so top-ups will be more frequent (the use of an auto top-up system, such as the V2 Auto Top-Up, would save time and effort). It's also wise to keep an eye on salinity, perhaps with the use of a V2 Refractometer. What you should be looking at is to adjust the amount of air that is entering the skimmer (there is usually a knob or valve that easily adjusts this, as in the case of the V2 Skim). When you add more air, you should see the column of bubbles rise or fall accordingly. What you should be aiming for is a group of bubbles which are breaking on top of one another, and pushing the detritus to the top of the column and over the rim of the column into the collection cup. This is something you will need to experiment with depending on the size and stocking density of the aquarium. I hope this serves to shed some light on the issues and answers your question.

> Generally speaking, a wet skim is useful for pulling out more dissolved organics, or for in an emergency, such as if you had overdosed with additives

Ian Hallam, TMC.


Pictured here are the large-scale skimmers at TMC London.

Dear Marine Habitat,
I have heard from many sources that it's impossible to compare the light from an LED fixture to that from a metal halide or T5 fixture. It is said that the light has a different spectra and it can't be measured accurately. Can you please clarify this?
Thanks in advance,
Tony Briggs, Portsmouth.

Hi Tony, and thanks for your question. I've also seen that claimed on several occasions, but it's not exactly true. The photons from an LED are no different to those from any other light source, and can be measured with a PAR meter. There is a problem with measuring blue light sources, such as those from blue LEDs, but also blue T5 tubes or blue MH, alias 20K metal halides.

The stock definition of PAR is a count of any photons falling in the range between 400 and 700nm wavelength. Thus, a photon with a wavelength of 450nm (blue) should have a value the same as one of 550nm (green) or 650nm (red). The issue is with the PAR meters that most of us outside of university laboratories have access to. These don't weigh the measurements properly, and tend to assign most value to red and green photons, and underestimate the number of blue photons. In a daylight light source this is a trivial issue, but in a source with a lot of blue, or a blue-only source, this becomes a major issue, with underestimation of measured light of 30-50% being possible. This sort of problem would apply to blue, or blue-heavy LED fixtures, but also to things such as blue T5s (both aquarium tubes like the ATI blue plus or generic tubes like the Narva blue), or blue-heavy MH such as the Radium 20K.

The stock definition of PAR is a count of any photons falling in the range between 400 and 700nm wavelength

With a copy of the PAR meter response curve, and the spectra of the light source, it should be possible, in theory, to correct the PAR value by reweighing the spectra, but this is difficult and unnecessary for all bar the most dedicated researchers. It is, however, something that should be kept in mind when trying to compare various light fixtures.

The above may seem to devalue the use of PAR meters like the Apogee MQ200 when the results are prone to such error. I would prefer to think it's still one of the most useful tools a serious aquarist can own, and who wants to understand what's going on in his tank. The data just requires a degree of interpretation to gain best advantage from it. Equally, the meters are capable of being used to compare different light fixtures with something more than appearance and gut-feeling.

Wayne Oxborough,
Norway, Ultimate Reef.

Pictured here is an example of a LED lighting unit.

Hello Bob,
Thank you for your very informative website.

Hopefully you can help me, as I am designing a Vivarium and I was thinking of using polyurethane sealant spray foams in its construction. I read your article on your website a few times, but there still remains a question – the toxicity of the product I would like to use. You mentioned a polyurethane foam designed to be used in ponds in your article, such as Handi Foam, but I'm afraid the only type of spray foam I can get (here in Iran) is the ordinary sealants used in construction works. It's a yellowish foam, unlike what you have mentioned in your article, and it appears that the colour is due to 'diisocyanate of diphenylomethane'. The cautions discussed about the product also apply to this mentioned substance.

I was wondering if you have any further information about the toxicity of this product since you posted that informative article; I really need to use it as a coat or covering on pieces of granite stones and polyethylene foams, as a column to support my land area on the top.

Thank you very much for your time in advance.

Regards from thousands of miles away,

Babak Kavousi,
Shiraz, Iran.

Hi Babak,
Since these construction-type foams were also of aquascaping interest to marine aquarists several years ago, it led to some research on my part. Use of the Material Safety Data Sheets (MSDS) found them to be highly questionable products when it came to the health of aquarium inhabitants. The same holds true for the product mentioned in your letter. I contacted a scientist friend of mine who is involved in hydroponics, and explained your goal and the product in question, and was informed that it should not be used. Furthermore, the use of the product, which contains cyanide and methane, will, over time, morph animals/frogs, etc. He suggested researching a hydroponic supply manufacturer by the name of OASIS, which builds foam-planting cubes.

Otherwise, that's the best I can do. I hope this helps and I wish you success with your project.

Bob.

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

Hello Bob,
Thank you for doing the research and your very informative letter. I'm surely not going to use that to make underwater stones, but do you still think it would morph my plants if I use the polyurethane foam I mentioned to pour on my vase to make a stone-shaped thing? Also, would it still affect in any form (i.e. gas or something) if it's exposed to the highly humid conditions of my Vivarium?

I really wish I could use it somehow, just to not let it waste. The concept was very good, but the consequences may be destructive! I have doubts I can get my hands on any specific brands since we are facing severe sanctions, but thanks for the hint! It was very helpful and I really appreciate your help. Thank you very much.

Babak.


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

Hi Babak,
As to construction-type foams, past research has shown all to be harmful to animal life, yet where plants are concerned, the only danger that I know of is if the plants are to be consumed by humans/animals. Therefore, if staying with only plants, and realising I'm not a scientist and that other avenues are not open to you, you might want to try it. However, that's the best I can do.

I wish you the best, and stay well.

Bob.

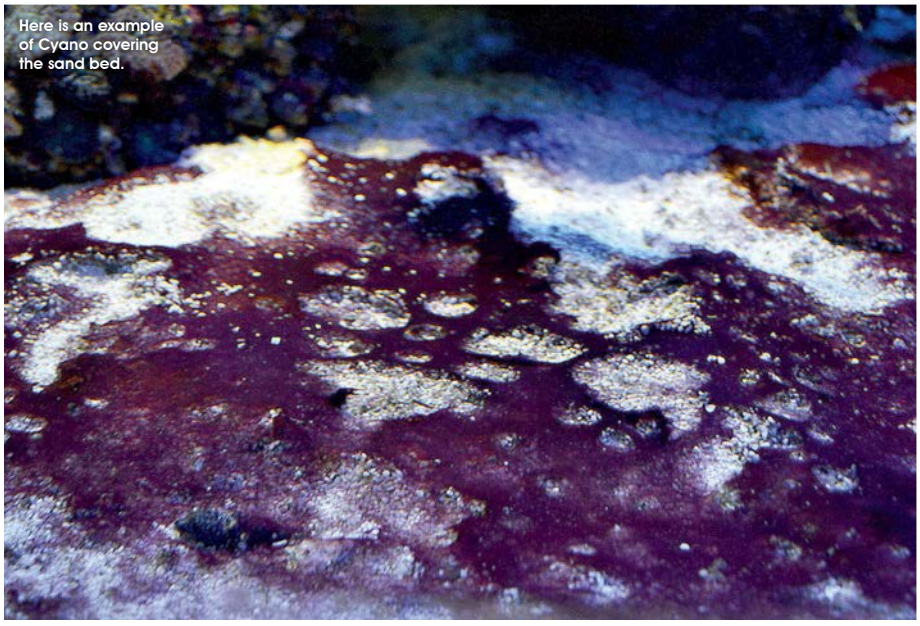
Please help! I'm plagued with cyanobacteria. I have a Fluval Venezia 190, a Fluval 405 filter running with H2Ocean Nutri-Fix NP 120ml, Fluval Biomix and Ehiem Bio Mech, together with a TMC Vectron 200, V2 ozone (lowest setting every 3 hours) and a Hydor Slimskim Nano 135-35. I also have two Hydor Koralia 2200 circulation pumps. I have one Aqua Ray Reef Blue running from 10.30 until 22.00 and two x 2ft T5 marine whites running, soon to be replaced by three Aqua Ray LED lighting, one reef blue, one marine white and one Fiji blue. I've tried Easy-Life's Excital twice, but I can't get rid of it. I'm doing a 25-litre water change using RO water every week, and I siphon as much out as I can with every water change. I sure this stuff would survive a nuclear war!
Jason Harrison.

Dear Jason,
First of all, my friend, I know how you feel! Over the last decade I have established over 100 maintenance contracts, and believe you me, every single one of those tanks is an individual. No single aquarium acts the same as another; there are too many variables. However, I can look at the main contributing factors when a problem arises. Cyanobacteria is very difficult to sort out; there is a reason why this is one of the most successful microorganisms on earth. It is present in most aquariums but can be kept under control relatively easily. However, in cases like yours, when it takes over, the problem can become overwhelming. Briefly touching on your statement, 'I'm sure this stuff would survive a nuclear war' – it was one of the first things to come back after the Chernobyl disaster! When one of my maintenance staff mentions they have an aquarium with a persistent algae problem, I perform a site visit and ask the following questions:

1) How long is the light on for?
You have answered this for me already; 10.30 until 22.00 – this rings alarm bells for me. I always tell my clients: 'the more light, the more algae.' It is very rare that you see any of my aquariums with the lights on for more than 9 hours a day. In private home installations, where the lights don't need to be on for public display purposes, I incorporate a siesta period. The lights come on for 4 hours and then ramp down to 50% or sometimes 0% (off) for an hour, and then ramp back on. This is a technique used to confuse the algae. I would suggest that if you have a fish-only system, you would have next to no light while you were dealing with this problem. If you have a reef tank then you need to adjust the lights to the absolute minimum without having a detrimental effect on the corals. This is something that needs to be implemented over 6-8 weeks while you are trying to sort out the issue. When the algae calms down you need to seriously reassess how long the lights are on for.

Ben's colleague, Sparky Ian 'the Eel' Bailey, preparing the lighting on a new aquarium. Lighting can be the key to successful algae management.

> The more NPK present, the more the algae can grow. There are many products on the market that will soak up phosphate, so get on the forum and ask your fellow fishkeepers what they have tried and found to be successful



Here is an example of Cyano covering the sand bed.

2) Has the water been tested?
As part of my maintenance contract, I regularly test the water, and a diary is kept of every aquarium's individual water quality results. I can then look at the book and see if there's a spike in the NPK ratio.

- **Nitrogen**
- **Phosphorus (I look at phosphate)**
- **Potassium**

These are the main nutrients that algae feed on. Unfortunately, your water quality results would be more useful to me than an equipment list. For instance, the first thing to do when an algae problem arises is test for these parameters. The more NPK present, the more the algae can grow. There are many products on the market that will soak up phosphate, so get on the forum and ask your fellow fishkeepers what they have tried and found to be successful.

I think your problem can be sorted with some aquarium lifestyle changes, and I wish you all the best of luck.
Happy fishkeeping,
Ben Woodward.

Dear Marine Habitat, I am trying to better understand the feeding requirements of corals but am unsure about something relating to LPS corals. It seems common knowledge that hand feeding is beneficial and in some cases required, but does each head need hand feeding or would all heads benefit from feeding just one head? Much appreciated, Barry McCloud, Fife

Dear Barry,
Many thanks for the question. LPS corals have very small skeletons with large volumes of tissue growing on top, and they use water to inflate this tissue and support their shape. LPS species use this inflation method when the time comes to feed; they extend their polyps and they are ready to pick up any food that passes by. If you have a community tank you will perhaps notice this when you feed the fish. The corals will, of course, feed during this period if any food comes their way, providing the fish don't eat it first.

In reply to your question, the answer is yes, the LPS coral will benefit from accepting food from one head, although it is much more beneficial for the animal if more than one head is fed. As a rule, if feeding, say, a pellet diet, you should try to feed around 25% of the polyps (heads) once per week, and then rotate this on a weekly basis so all polyps are fed during a monthly cycle. By doing this you ensure that the animal has even growth and balance. This may involve target feeding, particularly for certain species with poor prey capture extension, such as Favia or Acans. Foods such as First Bite soft marine pellets in the 1mm size, or the dedicated LPS food kit, are ideal for this because they are very dense and therefore easier to direct into the animal's individual polyps using a syringe or similar target feeder.

Keep on top of your feeding regime and your corals will show good growth over time.

> you should try to feed around 25% of the polyps (heads) once per week, and then rotate this on a weekly basis so all polyps are fed during a monthly cycle

One thing you need to remember is that pellet foods or freeze-dried foods are generally high in protein (40-60%), and therefore if you wish to feed frozen or live foods of even the highest quality (10-15% protein by wet weight), you would need to feed around four to five times the volume to obtain the same food value for the animal. The advantage that a high-quality frozen or live diet has is that it is not denatured in any way, and the high levels of amino and fatty acids in certain types are very difficult, if not impossible, to replicate in a man-made diet. With this in mind, you could feed with frozen or live food on a more regular cycle, perhaps every other day, or alternate between pellets/frozen at different ratios, whichever works best for you.

I hope this information helps, and you have great success with your corals.

Nick Stevenson,
BCUK Aquatics Ltd.

ALERT SYSTEM

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- Filter Crashes NH3
- New Tank Syndrome
- Sudden pH swings
- Tank or Sump leaks
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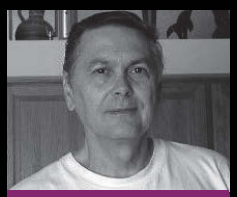


BOB GOEMANS

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

BOB's FAVOURITE STONY CORALS

Looking much like Tubastrea, and also in the family *Dendrophylliidae*, *Dendrophyllia cf. fistula* is another non-reef-building stony coral. It is most often found on deep vertical walls, and/or on cave entrances and walls where surrounding waters are high in nutrients.

Experienced marine expert **Bob Goemans** takes us through some of his favourite stony corals.

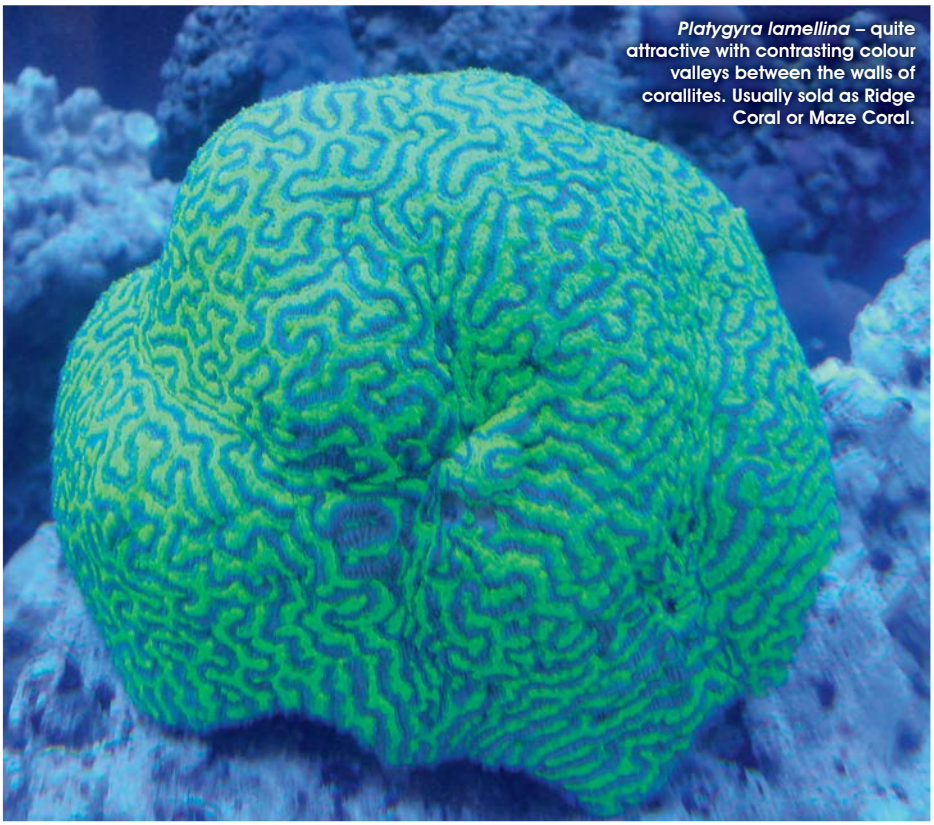
I've often seen much said about various invertebrates by some who have never actually maintained them long term, or even short term. Of course, all information concerning these animals is welcome and to be appreciated, but what interests me more is it coming from a person/writer who is speaking from actual long-term home aquarium experience with the discussed species, not what was briefly noticed in a LFS or read about on some online technical journal. With that said, I thought it might be a good idea to write an article dedicated to certain stony corals I've maintained for many years.

I've noticed over the past few decades that when marine hobbyists refer to colourful corals in their reef aquariums, they are usually talking only about those known as reef-building corals, or those technically known as Hermatypic corals; those that utilise photosynthesis, live in shallow waters, and get the majority of their nutrition from an alga called zooxanthellae living in their tissue. Yet not all colourful stony corals exist in shallow well-lit waters. Some – those called Ahermatypic – non-reef-building corals exist in deeper, sometimes cave areas, or under overhangs where light is little or non-existent.

Since it's quite possible in a well-planned reef system to include both, which I have accomplished in many past aquariums, I'll look at some of those used to render a balance between the two types, i.e. reef-building and non-reef-building. To do so, keep in mind that said type systems should have very good biological and chemical filtration equipment, as the non-reef-building corals generally require frequent direct feedings of highly nutritional foodstuffs, thereby creating an increased bioload not normally occurring in systems containing only corals that basically depend on light energy. Because of that, in these types of systems I've almost always used a canister filter; it's without question (in my opinion) the best form of equipment to accomplish chemical filtration. More recently, i.e. the last decade, I've used various brand nitrate and phosphate reducing products, and/or vinegar or vodka dosing applications to control/reduce said compounds that came about due to the input of additional foodstuffs.

Platygyra daedalea frags, which are among one of the easier stony corals to frag when in the encrusting form.

And yes, there are more than those described here, yet space allows only for a few to be written about. Therefore I've decided to stay with four reef-building and two non-reef-building corals in this article. Possibly, if those reading this want further discussions on more of the many stony species I've maintained over the past three to four decades, let the publishers know and I'll consider some more articles about other favourites, and possibly some that did not make good aquarium species!



Platygyra lamellina – quite attractive with contrasting colour valleys between the walls of corallites. Usually sold as Ridge Coral or Maze Coral.

PLATYGYRA LAMELLINA

I'll begin with the Hermatypic coral *Platygyra lamellina* in the family *Faviidae*; one that is occasionally seen in LFS, and one that is medium-priced and said to be easy to maintain. In the wild it is found in mound or encrusting forms in the Indo-West Pacific and Red Sea, including the western, northern, and eastern coasts of Australia, east to Tahiti and north to the Ryukyu Islands. In the wild it is quite common, yet not so in the trade. Most are found in reef environments, usually on reef flats or in some backwater areas. It's quite attractive, with contrasting coloured valleys between the walls of corallites. Shops usually have it labelled as Ridge Coral or Maze Coral. In fact, it and a sister species, *P. daedalea*, are among one of the corals that I've seen fragged quite frequently.

As for *P. lamellina*, those I've had experience with did not like to be touched, even slightly, as it produces copious amounts of slime/mucus. When that touches other corals in the aquarium, it harms them/causes them to close down or burns them, and they remain closed for hours until the mucus fully dissipates or is siphoned out. Some corals impacted by this mucus take days to fully recover, so if this species is desired, be prepared to siphon out any produced mucus when it enters your aquarium.

In the accompanying photo of a past aquarium (unfortunately one that had to be moved to a LFS because I was incurring severe back disc problems at the time), the two specimens of *P. lamellina* fared quite well. Yet the one that was mound shaped and placed in the upper rear right area of the aquarium experienced a growth rate that far exceeded the specimen on the bottom, and, in fact, became an encrusting coral. Since neither corals were fed, I attributed its amazing growth to it experiencing an improved water movement area because it was close to one of the aquarium's overflow areas; I thought more light impacted it in this high-up position.

Keep in mind that these are sometimes shallow backwater species and/or reef flat species, therefore, at least for one of these two specimens, more light and better water flow appeared to make quite a difference in the growth rate. Within about 12-24 months the upper specimen

actually encompassed a good portion of the upper right rear wall of the aquarium! Therefore, once placed in an appropriate location, i.e. moderate to bright light (e.g. 4-5 watts/gal) and receiving moderate water movement, be sure it's not too close to other corals in the aquarium, especially those that can't be moved, because it may overgrow them. Besides the slime situation if touched, it was quite active with the development of sweeper tentacles during night-time hours, especially if sensing nearby neighbours. And even though hand-feeding wasn't necessary, feeding tentacles were also displayed in evening hours; I never made any attempts at direct feeding because I thought it wasn't needed. I must say, the growth rate of one of these specimens was among the fastest I've ever seen with stony corals!

Another couple of favourites in the family Mussidae were those in the genera *Acanthastrea* and *Micromussa*. These are greatly experiencing the fragmentation (fragging/frags) method in today's marketplace. In fact, specimens in both genera are almost indistinguishable, yet those in the *Micromussa* genus have smaller corallites (the skeletal area containing the polyp) than those in the *Acanthastrea* genus. Technically speaking, *Micromussa* is a fairly new genus of coral, as the species was at one time all in the genus *Acanthastrea*. But as its species numbers increased, those with smaller corallites (8mm or less) were reclassified and placed in a new genus – *Micromussa*. In the trade they are simply called Micros, and those in the *Acanthastrea* genus are called Acans. From there, the names of differently coloured frags vary immensely, with their names only limited by one's imagination. They are highly sought after because their colours are quite stunning – as are their prices!

> I must say, the growth rate of one of these specimens was among the fastest I've ever seen with stony corals!

ACANTHASTREA

Acanthastrea specimens, even though widely distributed, are mostly found along the East African coastline, Madagascar, and the southern portion of the Arabian Peninsula. *Micromussa* specimens come from southern Japan, Hong Kong, and various other Indo-West Pacific regions, with most now coming from Australian waters. However, having spoken to some importers, most say that large mother colonies, i.e. those used commercially for fragging, are solely from Australian or Hong Kong waters. Actually, in the wild these are fairly common corals, and are found in shallow protected waters in their regions, with some attaining 1-2m in diameter. They are heavily tissued reef-building corals, with interconnected corallites of uneven heights having a thick fleshy mantle. Collectors in the past, have, in fact, removed only portions of large mother colonies for the trade so as not to flood the market with too many specimens. And as for Acans, it may have all started about a decade ago with one species, *Acanthastrea lordhowensis*, which is naturally found in an array of very pretty colour combinations.

In fact, most available in the trade are *A. lordhowensis* and/or *M. amakusensis* specimens, usually fragged. However, choice colonies of each are available but are very pricy, which was the case with those I chose for my aquarium. Both are located where they are impacted with moderate water movement and about 4 watts of light per gallon. Notice the green Acan specimen has a polyp splitting into two polyps, and it and the red Micro's growth has been excellent over the 2-3 years they have been in my aquarium. And yes, I do hand-feed various meaty-type foods to a few polyps on both specimens about once a week. Their feeding tentacles are almost

ABOVE Notice the polyp division in this extremely healthy specimen, which was no doubt brought about by hand-feeding various meaty foods directly to various polyps, as noted in this article.

BELOW *Acanthastrea lordhowensis* – pretty and well-developed frags for sale in a LFS.

visible every day; the normal daily feeding of other animals in the aquarium seems to cause them to extend. These occasional feedings seem to keep the specimens robust and quite healthy. Where the Red Micro (*M. Amakusensis*) is concerned, I usually only feed its outer edge polyps, which seems to keep the overall tissue more healthy looking from tip to tip. Actually, moderate water movement, medium light quality, and feeding as noted above, make these species quite easy to keep long term.

SCOLYMIA AUSTRALIS

Before I leave this family, there's one more I have to mention, and that's *Scolymia australis*, which is sometimes called the Australian Scoly; it comes from the Australia Great Barrier Reef and possibly along its more southern coastline. In the wild this solitary free-living

FEEDING TIME

Here is the Scolymia in its usual form.

Now the Scolymia senses food in the water column and sends out its stinging tentacles.

Platygyra lamellina encrusting the upper right rear wall of a past aquarium.

saucer-shaped photosynthetic stony coral often inhabits shallow forereefs, or slopes in protected highly clear waters. Its amazing combinations of fluorescent reds, orange and greens make it a must for many reefkeepers, however, it is quite pricy! The specimen in my aquarium had the same water movement and light as for those mentioned above, but I took more care in its feeding.

This specimen almost always (95% of the time) required coaxing/persuading to get its feeding tentacles displayed; there was no use in attempting the feeding unless they were displayed. Most of the time I had to rub freeze-dried krill between my fingers in the aquarium water to encourage it to put forth its feeding tentacles. That was always a time-consuming effort and usually occurred once every 3 days. I found that more frequent feeding was counterproductive and actually detrimental to the coral.

Once feeding tentacles were displayed, meaty foods such as pieces of fish or shrimp flesh and/or mysis were placed directly on the centre of the polyp, and would then be quickly engulfed. Occasionally, various pellet-like foods were used, as was live foods such as enriched live brine shrimp. But I must say that this species should not be overfed, especially with pellet foods, because it expels the soft excesses in an outward burst from the central mouth area. I've seen it do this twice; it's odd because it seems to spit out the excess, then look poorly for a day or two, and such behaviour does nothing to help maintain the surrounding water quality. A controlled varied diet put about 2.5cm of growth on the width of this specimen in its first 4 months in my aquarium! Again, overfeeding does cause a day or two decline in the specimen's overall condition, so be forewarned – feed in moderation. Let me leave you with some thoughts on its placement in your aquarium – it's found on flat substrate surfaces in the wild, not on ledges or overly active water-motion areas. Locate it in similar areas in your aquarium, i.e. on sandbed surfaces where it will be impacted with a gentle to moderate water flow, as strong flows harm its tissue. And note, even though not an aggressive species, be sure to provide enough space between it and its neighbours. Stings, even minor stings from somewhat aggressive corals, cause it to shrink greatly, and it won't take offered foods for many days, and will possibly waste away.

I'll move on to Ahermatypic – non-reef-building stony corals that exist in deeper, sometimes cave areas, or under overhangs where light is little or non-existent. I've almost always liked to combine both types of stony corals in some of my aquariums, to offer a more balanced view of the real reef.

Having now found some food, the Scolymia pulls the food inside and closes up.

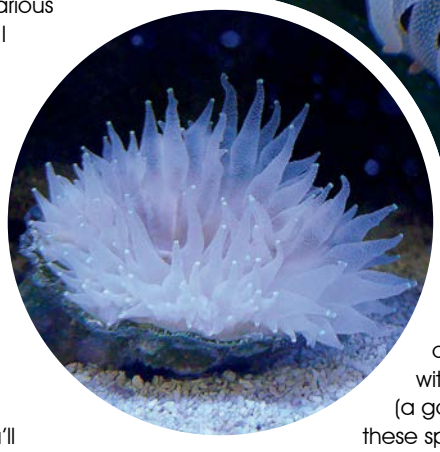
RHIZOTROCHUS TYPUS

What seems like about a decade ago, a deep water/cave-dwelling coral became available. It was one in the family *Flabellidae*, and was said to come from the Indo-Pacific and Red Sea; it was *Rhizotrochus typus*, sometimes called the Cup Coral, or simply a Rhizo. At the time there were only white specimens, yet now there are pink, yellow and green ones being offered in the trade. As to the specimen purchased, it was said to come from southern Japan; I've dived those waters, and if these are from there, they prefer somewhat cooler water temperatures than what most hobbyists normally maintain in their reef aquariums. I therefore thought it better to keep my aquarium temperature from rising much above 24°C. That didn't always happen,

but it still seemed to do well at about 27°C.

With it being a deep-water single polyp stony coral, it was located in a shady place in my aquarium where it was impacted with a gentle current, but where access was easy because it had to be fed directly by hand. I will say that this species is a big consumer of meaty foods! It required at least one feeding per day, and it liked whole freeze-dried krill that was pre-soaked with a liquid enrichment solution (such as Selcon by American Marine) and/or pieces of enriched fish or shrimp flesh. After experimenting with various foodstuffs for the first year, I noticed that if foods were not enriched, its tentacles lost their stickiness, and its interior orange colour dissipated. If it wasn't fed every day it seemed to want less and less food – this carnivorous animal must be a big consumer of plankton/live foods in the wild! It seems that when you go away on vacation, you'll need a trained housesitter to keep your Rhizo well fed! Otherwise, this coral presented no problems to its upkeep, yet daily feeding was somewhat negative, especially because of my busy schedule.

Rhizotrochus typus **appears to need daily feeding of meaty foods. If properly maintained it rewards its keeper with colourful polyp interiors and extremely sticky tentacles.**



LEFT Cave-dwelling coral *Rhizotrochus typus*, sometimes called the Cup Coral, or simply a Rhizo.

DENDROPHYLLIIDAE

To wrap up this article, another non-reef-building stony coral in the family *Dendrophylliidae*, which exists in the wild in similar conditions of the above, is *Dendrophyllia cf. fistula*. It's said to hail from northern Australia, Indonesia, and New Caledonia, and is most often found on deep vertical walls, and/or on cave entrances/walls where surrounding waters are high in nutrients. It has common names such as Dendro, Sun Coral, Orange Cup Coral, or Tubastrea, which is a mistake because it's not a Tubastrea species, although almost identical in appearance.

Because of that, it was necessary to send a photo of this specimen with its polyps closed (a good way to ID these species) to the British scientist Dr. Vincent Hargreaves, who is a close friend. He helped me to determine the exact species. It is thought to be named as stated, with the 'cf' in the name being an abbreviation of the Latin word 'confer', which means to compare or consult. This suggests a tentative name, comparing it to an already known correctly described species.

Anyway, these Dendros are far more expensive than Tubastrea specimens. They have only appeared in the trade with any frequency in the last several years, and it requires deep dives into dark areas to collect them. As with any deep-water specimens, they must be cared for appropriately or the investment will be lost quickly; proper placement and hand-feeding this coral is a must if it is to remain healthy. As with the other species, it should be placed in a shaded area where there is fairly good current, and where aquarist access to it is easy. It must be hand-fed at least every couple of days to remain healthy.

This specimen, which I was fortunate to purchase about 6 years ago, had seven polyps when placed in my aquarium, and was located on the bottom near the front of an entrance to a cave-like structure. It received no direct light from aquarium lamps, just direct daylight from the front aquarium panel. Long-handled stainless steel tweezers were used to feed each polyp small pieces of marine fish or shrimp flesh, or individual defrosted mysis shrimp. Occasionally, very small pellet-sized meaty-based foods were sprinkled onto open polyps to vary its diet. In the beginning it was necessary to feed daily to keep the polyp tentacles extended/visible. Within a month, feeding was reduced to once every 2 days. If the feeding time frame was exceeded, e.g. once every 3 or 4 days, some polyps remained closed and would not open until hours after the animal's other polyps were fed. Sometimes it would take several hours for all the polyps to open. Over a period of 6 months I found it best to feed every other day. Within 12 months the specimen grew 14 more polyps and all the tentacles became very sticky – a healthy sign that the animal was in tip-top shape. Again, when having these types of cave-dwelling/deep-water species, direct hand-feeding is a necessity. If there isn't sufficient time in your schedule to do so, I recommend not purchasing them!

My well-fed Dendro produced an amazing number of new polyps in quite a short time – actually, about 14 new polyps in 12 months!

If you have any questions about the above-discussed species, please contact me through the magazine publishers, or directly at: bob@saltcorner.com and/or visit my website: saltcorner.com where there is now posted a 300,000 word book containing over 1,000 colourful photos about marine aquarium husbandry for everyone to read for FREE! BC

YOUR ULTIMATE SPECIES GUIDE

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.

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.

This factual and convenient guide will feature a number of species in each issue. Each species will be treated to a full-page profile including facts and photos. This guide covers both tropical and temperate marine species.

THIS TIME...

Acan | Blue Chromis | Brittle Star | Snakelocks Anemone

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TROPICAL SPECIES

COMMON NAME/S:
Acan/ Pineapple Coral

SCIENTIFIC NAME/S:
Acanthastrea echinata, A. lordhowensis, A. bowerbanki

PHYLUM: *Cnidaria*

CLASS: *Anthozoa*

ORDER: *Scleractinia*

FAMILY: *Mussidae*

GENUS: *Acanthastrea*

RANGE: Indo-Pacific, Australia

Acanthastrea sp.

Written by John Clipperton

NATURAL ENVIRONMENT: Just one within the *Mussidae* family, the *Acanthastrea* genus of corals contains around 12-15 species. Although not particularly common, colonies may be observed in a variety of different shallow reef habitats, exhibiting either encrusting or massive growth forms. Some of the most commonly available and easy to identify species include *A. lordhowensis* and *A. echinata*. Identification to species level is generally difficult, and this is especially the case when the coral is alive because fleshy polyp tissues obscure skeletal features that are critical for identification. Corals in this genus are also very similar to many other Mussid and Faviid corals, and this makes identification even harder. Most have relatively large corallites that are between 8-15mm from edge to edge, and have large teeth or lobes around the rim.

CAPTIVE CARE: Acans are generally tolerant of quite diverse conditions in captivity, being able to adapt to moderately subdued lighting and reduced water flow conditions. They are voracious predators with a strong nocturnal feeding response, and often deploy stinging war tentacles against corals that are too close to them. As a result of this, it is usually possible to target-feed Acans in captivity, and frequent feeds consisting of suitable foods can increase growth rates. Finely minced meaty foods gently blown across the extended feeding tentacles of a colony are most likely to be consumed. Care should be taken when introducing a colony to a lighting scheme that differs greatly from its previous environment. Particularly, place the coral in a shaded area if the new lighting is more intense, and move the coral into bright light gradually over a few weeks. Despite this, they are said to be tolerant of diverse lighting conditions (providing it is intense enough to facilitate effective photosynthesis), including high K blue lighting schemes. Actually, captive propagation of this species is entirely possible, given a healthy colony, and can be achieved by simply splitting up the colony with a hammer and chisel. Perhaps fuelled by this, demand for intense multi-coloured Acan specimens has surged in recent years, and this means that these corals are highly sought after and usually command a high price (more colour usually equates to more pounds).

TROPICAL SPECIES

COMMON NAME/S:
Blue/Blue Reef Chromis

SCIENTIFIC NAME/S:
Chromis cyanea

ORDER: *Perciformes*

FAMILY: *Pomacentridae*

GENUS: *Chromis*

RANGE: Western Atlantic

Chromis cyanea

Written by John Clipperton

NATURAL ENVIRONMENT: A reef-associated species, the Blue Chromis usually occurs at water depths of around 10-20 metres. That said, it has been recorded as much as 60 metres deep and as little as 3 metres. It is a Western Atlantic species, occurring in the waters of Bermuda, Southern Florida, and the Caribbean Sea. In its natural environment, this species forms large aggregations above deep outer reefs where they feed on tiny floating zooplankton (primarily copepods) swept in by currents. They rarely stray too far from the reef face and dart back into cover when threatened.

CAPTIVE CARE: Like the rather more common-in-the-trade *C. viridis* (the Green Chromis), this species is best kept in groups in aquaria, and the larger the group, the better. Actually, many sources advocate keeping an odd number of individuals in order to diffuse persistent low-level bullying within the group, which frequently leads to the demise of the weakest individual. This is quite a common problem with the species in captivity, and often leads to the loss of individuals one by one. A group size of at least seven is advised; they grow to a maximum of 15cm, so a large tank with plenty of swimming room is clearly required for a group. Plenty of space should help to minimise instances of aggression by allowing subdominant individuals to retreat into cover. In the early stages of introduction, a relatively low level of lighting may encourage the group to settle and start to feed. For the best chance of long-term success, ensure excellent water quality, vigorous circulation, and strong aeration is provided, along with frequent offerings of small meaty floating foods. Flake foods should also be accepted quickly. Consider feeding at least three times a day as critical. Live foods can be used to help bring the fish into breeding condition. Also consider tank mates carefully, and avoid including any predatory or overtly aggressive species (fish or invertebrate) in with this species. It's worth noting that certain wrasse species often occur with shoals of Blue Chromis in the wild, and this could make for an interesting and visually stunning display in captivity. The presence of active 'dither' species like the Blue Reef Chromis can also help to make other shy fish species feel more at ease in a display system.

> A group size of at least seven is advised; they grow to a maximum of 15cm, so a large tank with plenty of swimming room is clearly required for a group

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TROPICAL SPECIES

COMMON NAME/S:
Brittle Star

SCIENTIFIC NAME/S:
Ophiarachna, Ophiocoma, Ophiotrix spp.

PHYLUM: *Echinodermata*

ORDER: *Ophiurida*

FAMILY: *Ophiotrichidae*

RANGE: Shallow water tropical species widespread across Indo-Pacific

Ophiotrichidae family

Written by John Clipperton

NATURAL ENVIRONMENT: Also known as *Ophiuroids*, Brittle or Serpent Stars are echinoderms closely related to starfish. Unlike their cousins, their arms are far thinner and more fragile, and exhibit hundreds of short spines. Also unlike starfish, the arms don't use tube feet for locomotion, and don't contain any organs either. This means the arms can be detached easily and regrown, a defensive strategy which enables the Brittle Star to evade predators. Actually, such a strategy has allowed Brittle Stars to become ubiquitous to many marine environments, and they can be found across the world oceans both in shallow water and at depth. There are literally thousands of species, and the whole taxonomy is complex and ever-changing. Some species are tiny, but some can reach up to around 3ft across! Shallow water ornamental species that are of interest to reefkeepers usually stay at a reasonable size and are found across the tropical Indo Pacific in fairly shallow water. Here they usually shelter within or under reef structures by day, emerging at night to feed on detritus. Some people distinguish Brittle Stars and Serpent Stars based on the presence, or lack of, spines on the arms, but for this profile they are all treated as Brittle Stars.

CAPTIVE CARE: Usually seen only as an odd arm sticking out of the rockwork during lighted hours, Brittle Stars nonetheless make interesting reef tank inhabitants that are rather hardier than the majority of starfish species. They are much faster moving too, and offer a useful addition to the clean-up crew, being able to get into tiny crevices and under rockwork. They feed on a range of foods, from detritus to meaty offerings. Once established in a system, they may become bolder and will often become active at feeding time. Although many hobbyists never target-feed their Brittle Star, this may be worthwhile, particularly with species that may otherwise exhibit predatory tendencies (such as *Ophiarachna incrassata*, the Green Brittle Star). This species has been known to stalk and consume small fishes. Ensure rockwork is secure so that your Brittle Star can't dislodge it, and take note that excellent water quality of natural seawater values is required. Brittle Stars, like other echinoderms, will not tolerate even traces of copper in the system, and don't react well to elevated levels of organic pollutants either. Given good conditions, they are tough creatures; actually, Micro Brittle Stars are a common hitchhiker that usually arrive on, or within, live rock, and which you may notice thriving and multiplying in the sand bed of an established aquarium. Larger species often on offer include the previously mentioned Green Brittle Star, Red Brittle Star, and the rather more unusual Gold Brittle Star.

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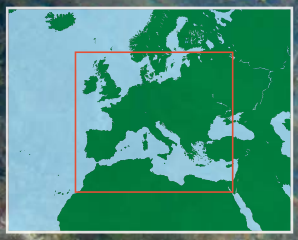
TEMPERATE SPECIES



COMMON NAME:
Snakelocks Anemone

SCIENTIFIC NAME:
Anemonia viridis

ORDER: *Actiniaria*

FAMILY: *Actiniidae*

GENUS: *Anemonia*

RANGE: Eastern Atlantic and Mediterranean. Found on south and west coasts of the British Isles, but largely absent from the east coast.

Anemonia viridis

Written by Gary Wallace; images by Mark Webster

NATURAL HABITAT: Locally abundant in rock pools and tolerant of a wide range of temperatures and salinity, this species is unmistakable with its 200 or so long wavy tentacles that cannot be retracted. The main colour morphs are a pinky-beige or a stunning brilliant green with bright purple tips. The variation in colour has been explained by the possibility that the duller colours are found in deeper waters; however, it has been my experience that populations are often very local, and beige specimens can also be found in very shallow and brightly lit waters, even in the Mediterranean. Highly photosynthetic with symbiotic algae within its tentacle tissue, this animal is easily found in shallow pools that are not prone to excessive drying out.

CAPTIVE CARE: Tough and tolerant, this anemone is an excellent species for temperate aquariums. Its green colour variant is very beautiful and will grow to an impressive size before undergoing reproductive splitting. A voracious predator, the tentacles are sticky to the touch, and can cause severe irritation to those who are prone to allergic reactions such as bee stings, etc. Some caution is advisable if there is any doubt. This powerful sting and stickiness allows this animal to grab and hang on to almost any creature that brushes against it's many long tentacles. It's not particularly reef safe, but as such an integral part of so many rock pools around our coast, it's hard not to include it. Small specimens hitchhike on seaweeds, rocks and shells, and upon growing will reproduce rapidly. Tompot Blennies are reported to feed on this animal, but I have never witnessed it myself. Snakelocks are highly mobile when the mood takes them. They are prone, especially when small, to detach themselves and embark upon a journey, allowing their tentacles to catch the current and drift away. This can cause problems in the aquarium if the roving juvenile is taken up by a pump impeller. The tentacles remain sticky even if detached from the body, and although the anemone seems disposed to survive this kind of accident, the loose tentacles are a hazard to other livestock. They can also move around via their squat column, and will often move away from Beadlets Anemones when attacked.

MONITOR YOUR TANK 24/7

In the last issue, we featured a full write-up of this awesome product… and now it's time to give some of them away. Bring your marine system into the 21st century with **Seneye Reef**.

So what exactly is Seneye? It is essentially a monitoring probe that is inserted into your tank and connected to a computer. It then takes readings on a regular basis and feeds the data back up into an online system (seneye.me), which in turn presents it to you in nice tables and graphs via a control panel. This means that the information is accessible from anywhere in the world. The system also has the option to send emails and text messages if particular parameters breach your chosen thresholds. It's a super-simple and effective piece of kit that gives you peace of mind. If something is starting to go wrong, it will tell you and you can take the appropriate action before it becomes a bigger problem.

Seneye Reef currently monitors a range of parameters, for example, temperature and pH, amongst other things. In addition it is fitted with a full light meter. What's even more exciting is that development work is under way to introduce even more parameters and functions in 2013.

SAVING FISH FROM

- Broken heaters & chillers
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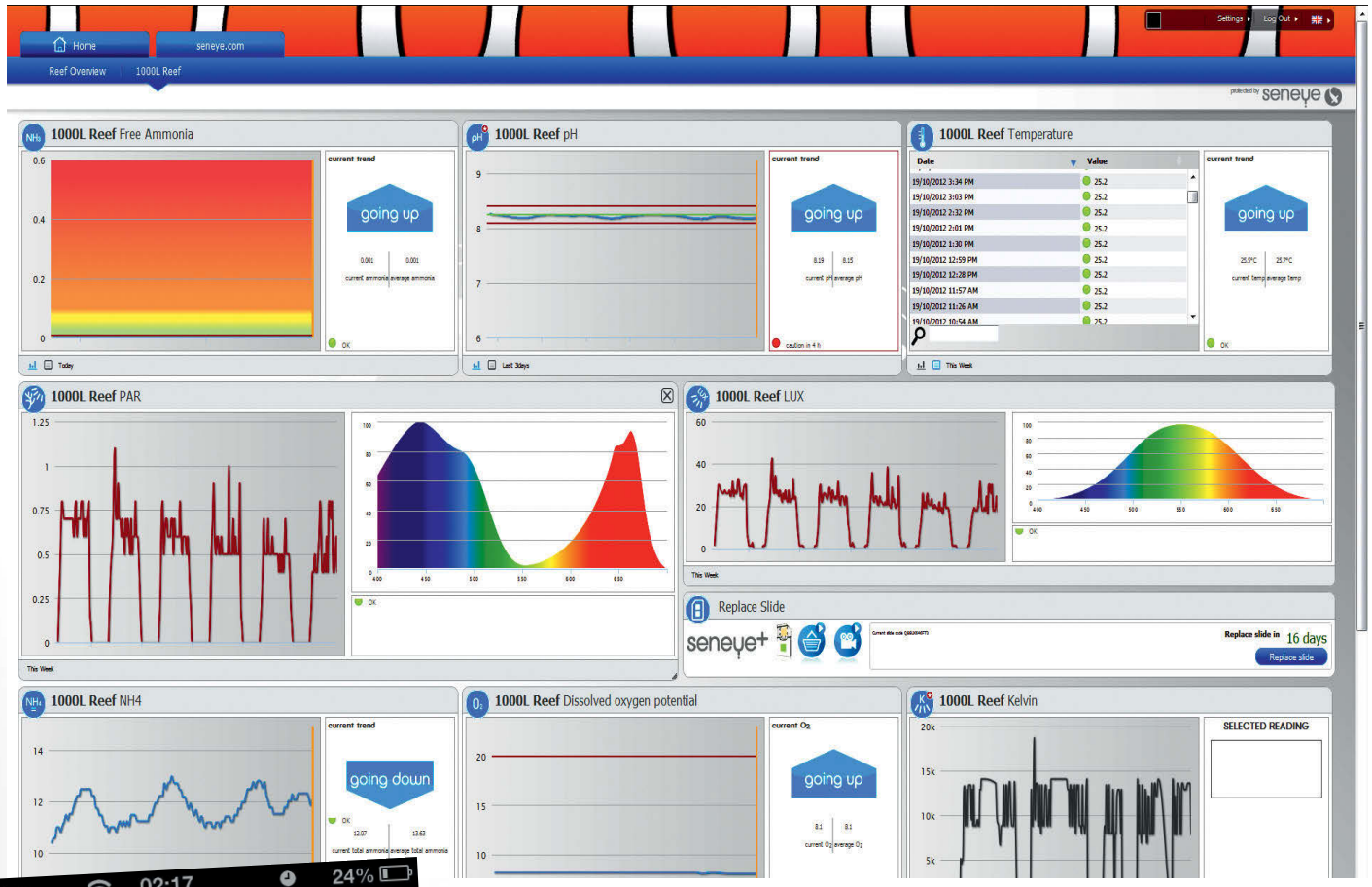
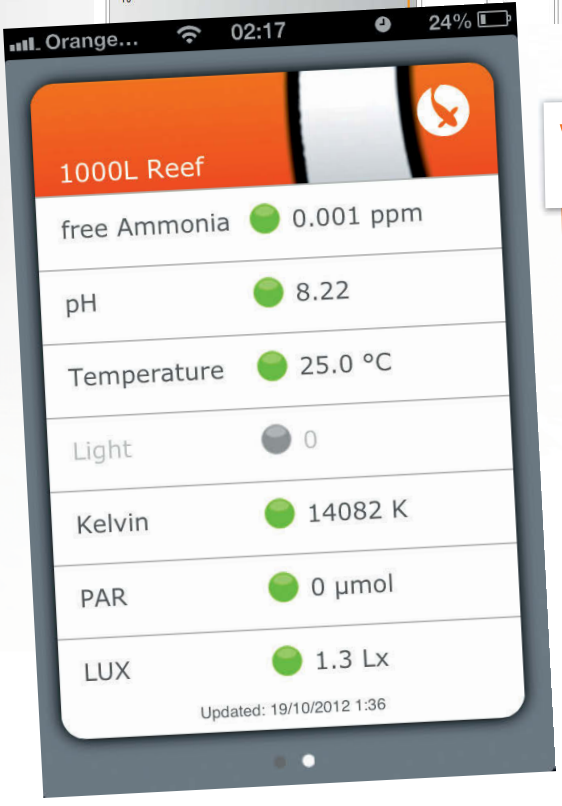
- New tank syndrome
- Sudden pH swings
- Tank or sump leaks
- Failing or incorrect lights





Here is a screen shot of the mobile app interface.

Seneye also produce other fishkeeping products that may be of interest.

WHAT'S UP FOR GRABS

SIX WINNERS WILL EACH RECEIVE A SENEYE REEF UNIT

TOTAL COMPETITION VALUE WORTH OVER £600!

Issue Ref: MH013

To win this fantastic prize, just answer this question;

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a) Heat loss or gain b) Underfeeding c) Filters crashing NH_3

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Please complete this entry form and post to:
Seneye Comp, Fish Junkies Ltd., PO BOX 4838, Sheffield S12 9DU, England.

Please photocopy this page to avoid spoiling the magazine.
Winners will be notified in writing.

If you do not wish to receive further information from Marine Habitat or its associates, please tick the box.
Marine Habitat ☐
Seneye and other associates ☐

Please be aware that address details of the winners will be provided to the sponsor of this competition to enable them to post out the prizes.

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.

PART 1 FRAG TANKS

This time **Jason Thresher** takes a break from the usual step-by-step fragging guides and looks at fragging systems.

This month I'm taking a break from coral propagation to discuss fragging systems. Once you have been bitten by the fragging bug you will almost certainly want to set up a frag tank. However, a project like this should not be rushed. Take your time and make sure you plan the build in its entirety. There are several things to consider, and with a little thought and preparation you will save time and money in the long run.

Budget: The cost of the project is the main consideration for most people. My first bit of advice would be to sit down with a sheet of paper and write down all the equipment you need. Once you have your list, price up the equipment so you have an idea of the cost. While the budget is important, I would recommend that you purchase the best equipment you can afford. Experience has taught me that inexpensive substandard equipment invariably fails first, and ends up costing more to replace in the long run. It is also important to remember to factor in running costs. As a general rule, the larger the tank, the more it costs to run.

Frag Tank Location: The location of the tank is also important. There are basically two types of frag tanks:

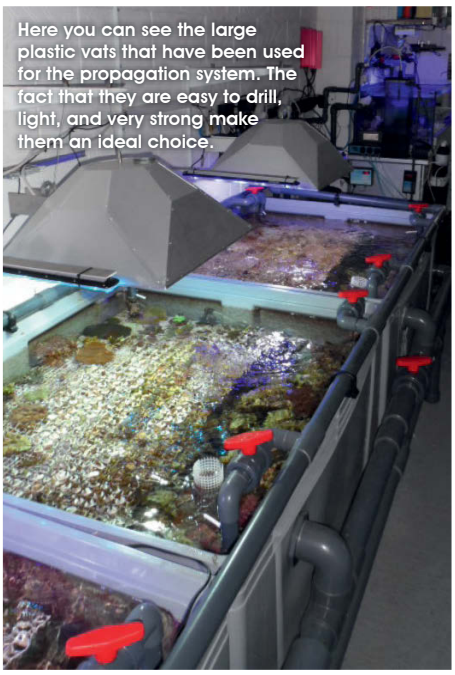
The pretty frag tank – this is a feature in the house and a hybrid of a display tank and a workhorse frag tank. It is aesthetically more pleasing than the workhorse, usually having a nice cabinet to sit on, gravel, and possibly a fish or two.

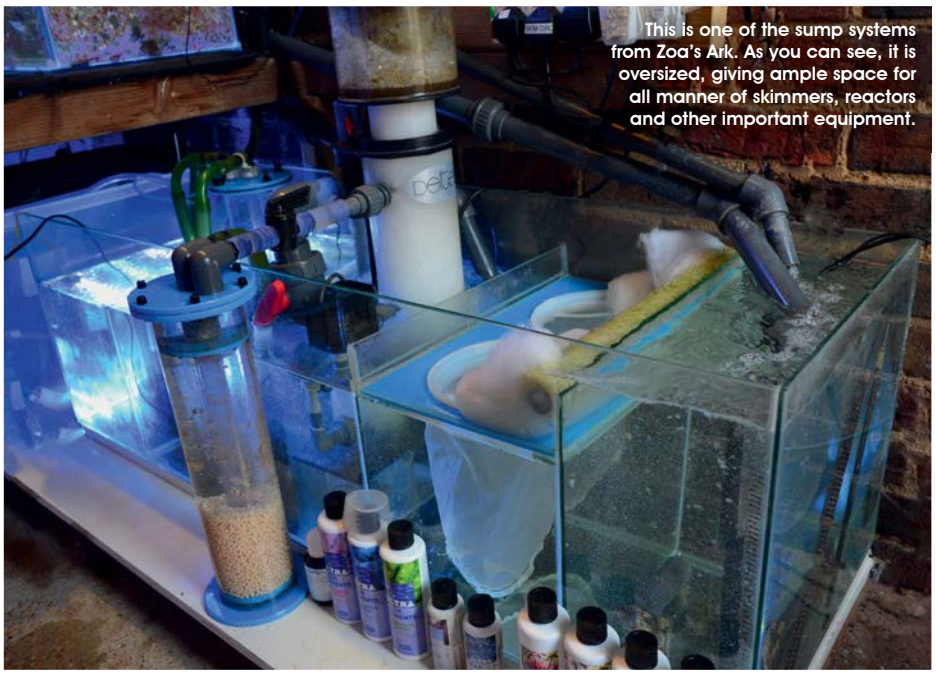
The workhorse frag tank – this tank is usually tucked away and the aesthetics aren't as much of a consideration. If you have the space available, this would be the best system to choose because it costs less and can be set up for minimal maintenance.

This is how the pros at The Living Reef do it! Here is one of the fantastic frag trays in their custom propagation system.

If you have the space, I would definitely recommend a sump, regardless of the system you choose. Sumps allow much more flexibility when it comes to adding equipment, and helps keep the tank healthy and the corals flourishing.

Tank Size: You don't want your frag tank to be too small. Keeping the parameters stable in a small frag tank (especially if you have SPS frags) is, at best, difficult. For me,


Here you can see the large plastic vats that have been used for the propagation system. The fact that they are easy to drill, light, and very strong make them an ideal choice.


This is one of the sump systems from Zoa's Ark. As you can see, it is oversized, giving ample space for all manner of skimmers, reactors and other important equipment.

the perfect frag tank is 60cm x 60cm x 30cm. It is large enough to house a very good selection of frags, but small enough to keep down running costs. If, however, you have the space and budget, go bigger!

Hard Corals or Soft Corals: While it is possible to keep hard and soft corals together in a frag tank, it is better to choose one and stick to it. Hard corals prefer pristine water conditions, and would either need regular water changes or dosing to keep the trace element levels up and water quality high. Softies, however, thrive better in nutrient-rich dirtier water. If you are starting out with your first frag tank, I would recommend you start with softies. They are easier to keep successfully and are much more forgiving should you make the occasional mistake, or miss a water change or two!

OK, so you've decided on the budget, tank location and size – so let's get started in building the perfect frag tank.

The workhorse frag tank is most often what people have, so I will cover this regarding the build. The same principle applies to the 'pretty frag tank' – except you would add the proverbial bells and whistles!

LET'S GET STARTED!

There are a few ways to keep costs down without cutting back on important equipment that would be critical in the successful running of the tank, and one is to build your own tank and stand. If you have decent DIY skills, you can literally save hundreds of pounds building your own setup. If this prospect is a little daunting, there are many excellent deals to be found if you shop around. When comparing prices, make sure you compare like for like; thicker glass is more expensive but is always worth the additional investment. Large food-grade containers are an excellent alternative to glass tanks. They are strong, inexpensive, and very easy to cut and drill. The downside is that you would only see the frags from above because the container sides are not clear.

LIGHTING

The three lighting choices are:

Metal Halides – Expensive to run and most bulbs need replacing at least once a year. They do, however, provide unparalleled growth, especially for hard corals.

T5 Tubes – Less expensive to run than the halides, but also need the tubes replaced regularly. This is a good all-round lighting choice, and with the various colours on the market, you can customise the lighting to suit your needs. If you choose the T5 option, try to purchase a unit with six tubes because this gives great flexibility for lighting customisation.

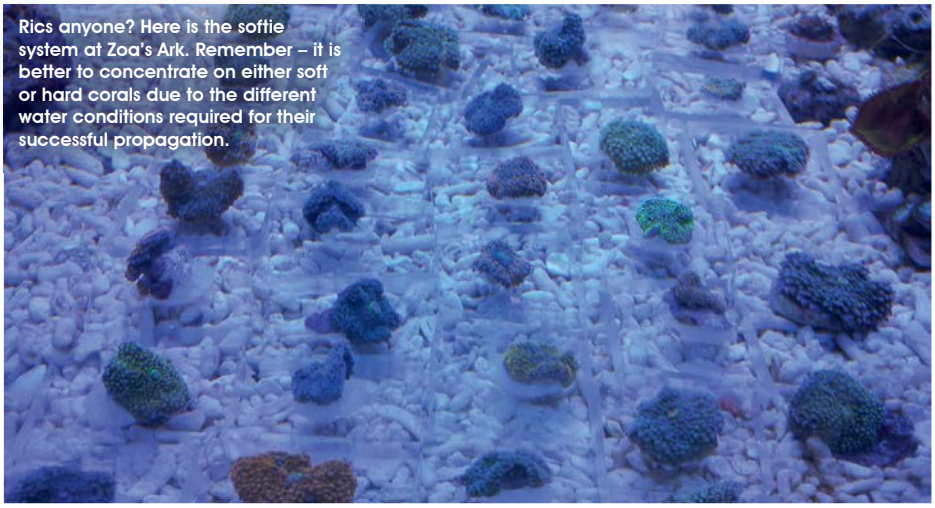
LEDs – Still a relatively new technology, and expensive, but improving all the time. The running costs are the lowest of all the options, and with most units having a 50,000 hour rating, the system will run for many years before needing replacing. Opinions vary on how effective LED lighting is for coral propagation.

TANK SUBSTRATE

Bare Bottom – Having the tank without any substrate is hugely advantageous. Firstly, there are less places for pests to hide, allowing you to easily find and ID anything that should not be in the tank. Secondly, you will be able to vastly increase the water flow without the worry of substrate clouding the water. Increased flow also keeps any detritus suspended, allowing it to be caught up in the filter system. Should any detritus be left in the tank, cleaning would literally be as easy as switching off the pumps, allowing it to settle and siphoning it out. Bare bottom tanks allow for the easiest possible tank maintenance.

Substrate – The only real advantage of substrate in a frag tank is for aesthetics. If the tank is on display, a thin layer of coarse substrate still allows relatively easy cleaning, while providing a more natural look in the tank.

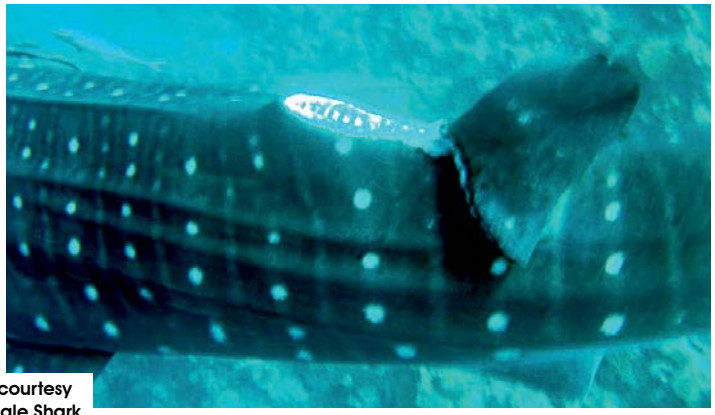
Well folks, that all for now. Be sure to join me for part two of this Frag Tank article in the next issue. JT


Rics anyone? Here is the softie system at Zoa's Ark. Remember – it is better to concentrate on either soft or hard corals due to the different water conditions required for their successful propagation.

WHALE SHARKS

MALDIVES WHALE SHARK RESEARCH PROGRAMME

Come on in, the water's fine... These are the words often heard from on board the research vessel of the Maldives Whale Shark Research Programme. So what's behind the long title? A short story of exploration, research and some really, really big fish!

Images courtesy of the Whale Shark Survey Team


In 2006 several young men from the UK took the opportunity to visit the beautiful and idyllic Maldives. The chain of atolls which run north to south along the Chagos-Laccadive ridge boast some of the world's most exquisite marine life. This library of marine inhabitants includes innumerable species of coral and fish, multitudes of jellyfish, turtles and octopus, unique manta ray cleaning stations, and the enigmatic whale shark, *Rhincodon typus*.

During this initial exploratory trip, it became evident that not only was there a lack of any formal research being carried out on whale sharks in the Maldives, but there was also a real potential for the establishment of a programme. Since these early days the programme has evolved from a modest organisation to a robust research establishment with a clear mission:

'To conduct whale shark research and foster community focused conservation initiatives throughout the Maldives and the Indian Ocean.'

Research is now carried out for 5 months of the year in the field, and is primarily sponsored by the Conrad Hilton resort, Rangali Island. The programme has sound relations with local community groups, such as schools, island councils and groups of fishermen, and conservation efforts go far beyond the shores of the atolls.

Information gathered so far has helped further the understanding of the whale shark's behaviour, demographics and oceanic movements. However, knowledge about the trans-oceanic movements of these animals is in the very early stages. This is in addition to any information about mating and birthing grounds because these creatures have managed to evade all prying eyes to date.

Although the whale shark is no longer hunted in the Maldives, for the water-repellent properties of the liver, as once was the case, and is protected by law, this gentle giant is still under threat. The ever-present fear of fins being taken for trophies or for sale to the Asian food market, for the chicken-flavoured shark fin soup, is never far away. Although whale sharks are not among the most targeted species, at least two of the sharks encountered by the research team have experienced either complete or partial finning efforts. Although the whale sharks are protected whilst swimming in Maldivian waters, this jurisdiction does not apply ocean-wide.

> Information gathered so far has helped further the understanding of the whale shark's behaviour, demographics and oceanic movements

The greater value of the whale shark, as a live animal rather than dead, is high on the Maldivian agenda. The Live-Aboard Association Maldives (LAM) and the Dive Association Maldives (DAM) host divers, snorkellers, swimmers and one-time adventurers into this underwater wonderland. Their local crews and guides have a wealth of knowledge, often coupled with accredited training schemes, and provide excellent information for those curious about the nature of these magnificent beasts. This, in turn, produces a sustainable livelihood which not only encourages the well-being of this animal, but also celebrates the whale shark as a national feature. The passion and enthusiasm that is integral for the continued success of the research programme comes not only from the permanent staff, but also from volunteers. The programme proudly welcomes individuals, such as Nick Bryan, to join the team for periods of up to 6 weeks. Those giving their time to the organisation reside with the team and spend between 3-4 days a week on the water (on board the research vessel). During this time the volunteers play a valuable role in the collection of data, both in and out of the water. In addition to the volunteers, the programme also welcomes students from around the world; schools and colleges, university undergraduates, MSc and PhD students. One example of this is the American School of Doha, who join the team each year for a week of coral reef ecology, fish and other species identification, sampling techniques and, of course, whale shark research. The students learn about the natural history of the Maldives and the biology of the whale sharks; they learn individual identification techniques and safe code of conduct.

So, if this hasn't enticed you enough, take a look at: www.maldiveswhalesharkresearch.org and if you have any questions, drop us a line.

Written by Rachel Bott - Maldives Whale Shark Research Team. Thanks also to Nick Bryan for helping to pull this article together.

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, Pinecone Fish, Twinspot Wrasse, Cleaner Wrasse, Yellow Tang, Addis Butterfly, Emperor Angel, Banggai Cardinalfish, Red Lionfish… plus numerous others!
other: All forms of shore life.

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

A hermit crab in a topshell re-establishing its balance after being knocked over in a shallow tidal pool.

BODY SCHEMA

Ever wondered how a hermit crab manoeuvres around a tank without too much difficulty? **John Dawes** explains the science behind how a hermit crab becomes one with its shell.

Hermit crabs, body schema, body image… and driving a car... have certain factors in common! This may sound unlikely, perhaps impossible, but if a team consisting of four Japanese and one UK scientists is correct, it is, indeed, the case.

Firstly, let's try to be clear about body schema and body image.

While there isn't universal agreement on what body schema is, neurologist Sir Henry Head defined it in 1911 as: 'a postural model of the body that actively organises and modifies the impressions produced by incoming impulses in such a way that the final sensation of (body) position, or of locality, rises into consciousness charged with a relation to something that has happened before.' Wow! Put another way: 'a body schema can be considered the collection of processes that registers the posture of one's body parts in space.'

As with body schema, there isn't universal agreement as to what body image is. The term was coined in 1935 by neurologist and psychoanalyst Paul Schilder, and is generally taken to refer to 'a person's perception of the aesthetics and sexual attractiveness of his or her own body.'

Now back to the crabs…

The five scientists set out to investigate the need for an animal to possess a flexible body image to be able 'to adapt to body changes and move effectively within a structured complex environment.' Hermit crabs are ideal subjects for such an investigation, because unlike most other animals, their body shape changes rapidly and dramatically every time they move from one gastropod shell to another. If they weren't able to handle these changes, i.e. if they didn't have a flexible body image or schema, they wouldn't be able to cope, and would presumably end up crashing into objects and possibly getting into awkward or impossible situations

This large hermit crab has attached anemones to its whelk shell home, visible between the fingers and thumb of the holder and along the bottom right.

A male *Gobius niger* can blend into its surroundings, and thus obtain protection from predators, while at the same time remaining hidden from unsuspecting prey.

Unlikely though it may seem, land hermit crabs (and, presumably, aquatic ones as well) have a highly developed sense of flexible body awareness.

Four hermit crabs (three in the centre and one at the extreme top right) in two very different types of shells (turritellid and periwinkle), each with its very specific equilibrium coefficients.

from which to extract themselves.

In a beautifully simple series of experiments, the researchers investigated the ability of the terrestrial Tawny Hermit Crab, Rug or Ruggie (*Coenobita rugosus*) to negotiate a corridor with partitions that provided alternate left and right corners, with variable distances between the partitions. In addition, by attaching a plastic plate to the shell, they were able to investigate the ability of the crabs to adjust to a new body shape (the shell ends up being regarded as a body extension by the crabs, just as a tennis player regards his/her racket the same). In other words, they tested the crabs' ability to adapt to a new body image (but without the 'sexual attractiveness' referred to in the definition given earlier).

I must admit that I hadn't ever given any thought to this concept. Yet it is one that's fundamental to the survival of hermit crabs, and not just coastal terrestrial species such as *C. rugosus*. See, for example, the contrasting shell shapes occupied by the hermit crabs, shown in the photos accompanying this article. It is self-evident that the equilibrium coefficient of the turritellid, or tower, of snail shells is very different to those of the rounder periwinkle and topshell, and the broader-spiralled whelk. Yet the crabs in question have to deal with such differences, and rapidly, if they are to be able to resume their normal lives promptly every time they change shells.

What the scientists found is that *C. rugosus* can adapt in as little as 10-20 seconds! At first, most crabs couldn't walk, but they adapted very rapidly by adjusting their leg positions and their posture inside the shell. When they had to negotiate the corners of the corridor with their original unmodified shells, the crabs rotated their bodies in order to avoid hitting the wall. When they had to do this with their shells modified by having a plastic plate stuck to them, they simply adjusted accordingly and increased the magnitude of the rotation. In other words, they were able to assimilate the plate extension as if it were part of their own body, becoming aware of the physical limits of their new 'body', as well as its new weight and balance point.

This, the authors claim, is like learning to drive a car, where the driver learns 'to assimilate his/her own specific position within that of the whole car. Even without a crash that potentially reveals the true dimensions, the driver gains knowledge of the length and width of the car. Full comprehension of the car body (whole body) occurs dynamically when steering the car between obstacles.'

Transferring this concept to hermit crabs in general, each change of shell, or even the attachment of sea anemones to an existing shell (a habit exhibited by some hermits), causes a shift in the overall 'body' characteristics, i.e. the crab's own body, plus that of its virtual body, represented by the shell. As mentioned earlier, *C. rugosus* can adapt in as little as 10-20 seconds. My guess is that fully aquatic species might be able to adapt even more rapidly, since their shells weigh less underwater than those of *C. rugosus* on land. I wonder if anyone is investigating this. If any readers know of such studies, please let us know. JD

FURTHER READING

- Rachel Sullivan, Crabs adapt to out of body experience. ABC Science, Wed. 29 Feb. 2012.
- Sonoda, K. Asakura, A., Minoura, M., Elwood, R.W. and Gunji, Y-P., Hermit crabs perceive the extent of their virtual bodies Biology Letters, 29 Feb. 2012. doi: 10.1098/rsbl. 2012. 0085

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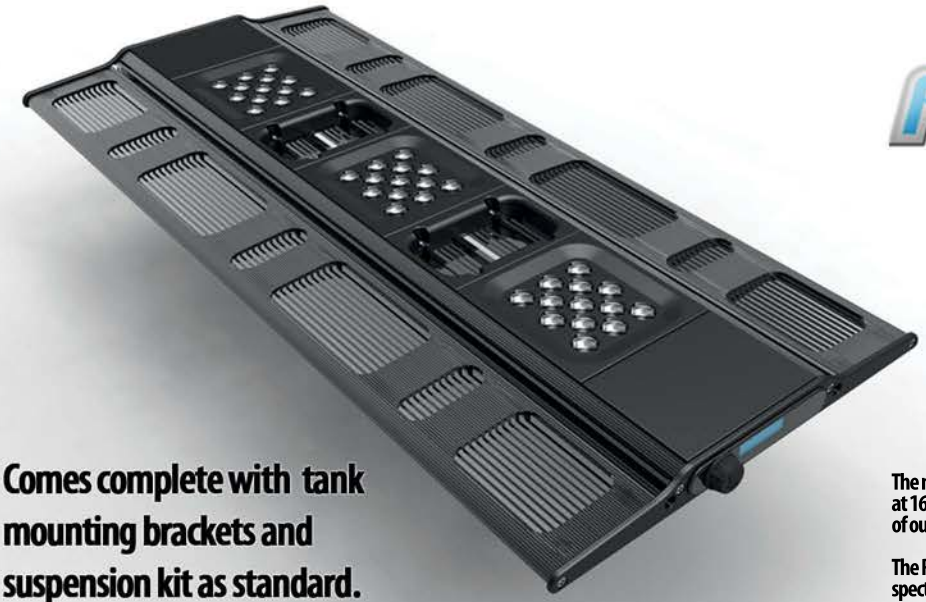

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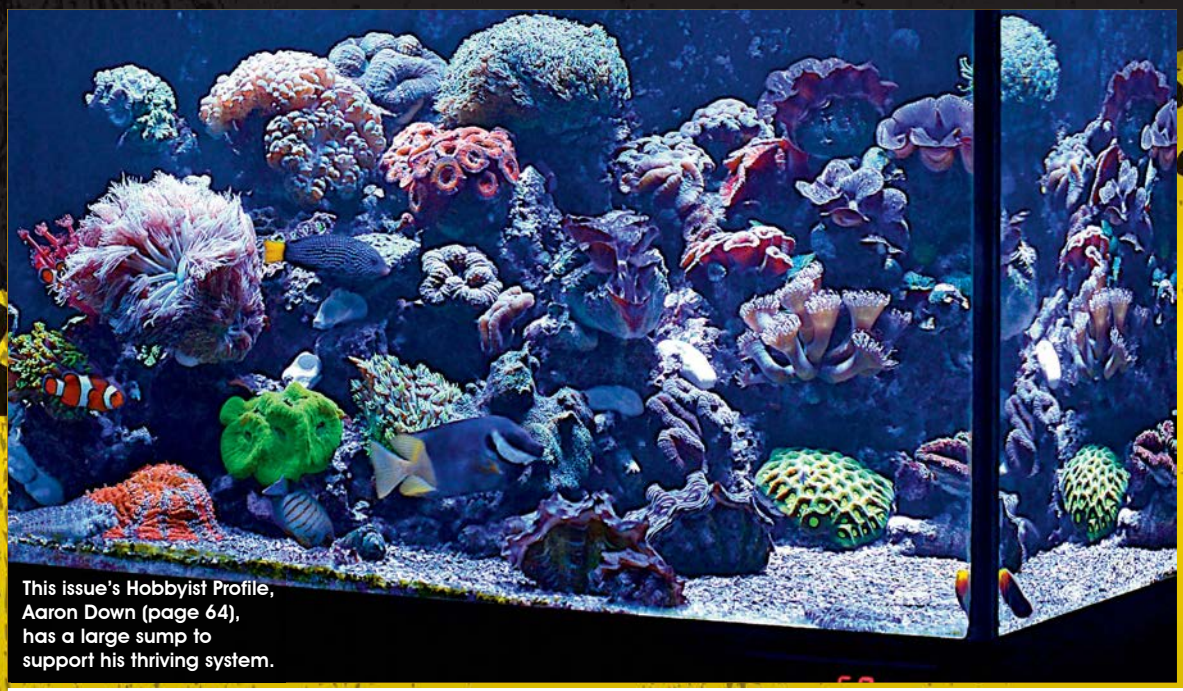
MYTH-BUSTER

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.



This issue's Hobbyist Profile, Aaron Down (page 64), has a large sump to support his thriving system.

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 discusses whether the use of a sump is an absolute necessity to keep a marine aquarium healthy.

It's a Friday night, your friends are over, the drinks are flowing, and before too long attention falls on your aquarium. After ogling your nemos, and remarking on the French accent of your cleaner shrimp, the next question we typically get from our non-fishy friends is, "Where's the heater?" Well, you see, we marine keepers are a savvy bunch, and in order to stop things like nasty heaters and internal filters impeding the appreciation of our beautiful inmates, we go to great lengths to ensure all our equipment is hidden away.

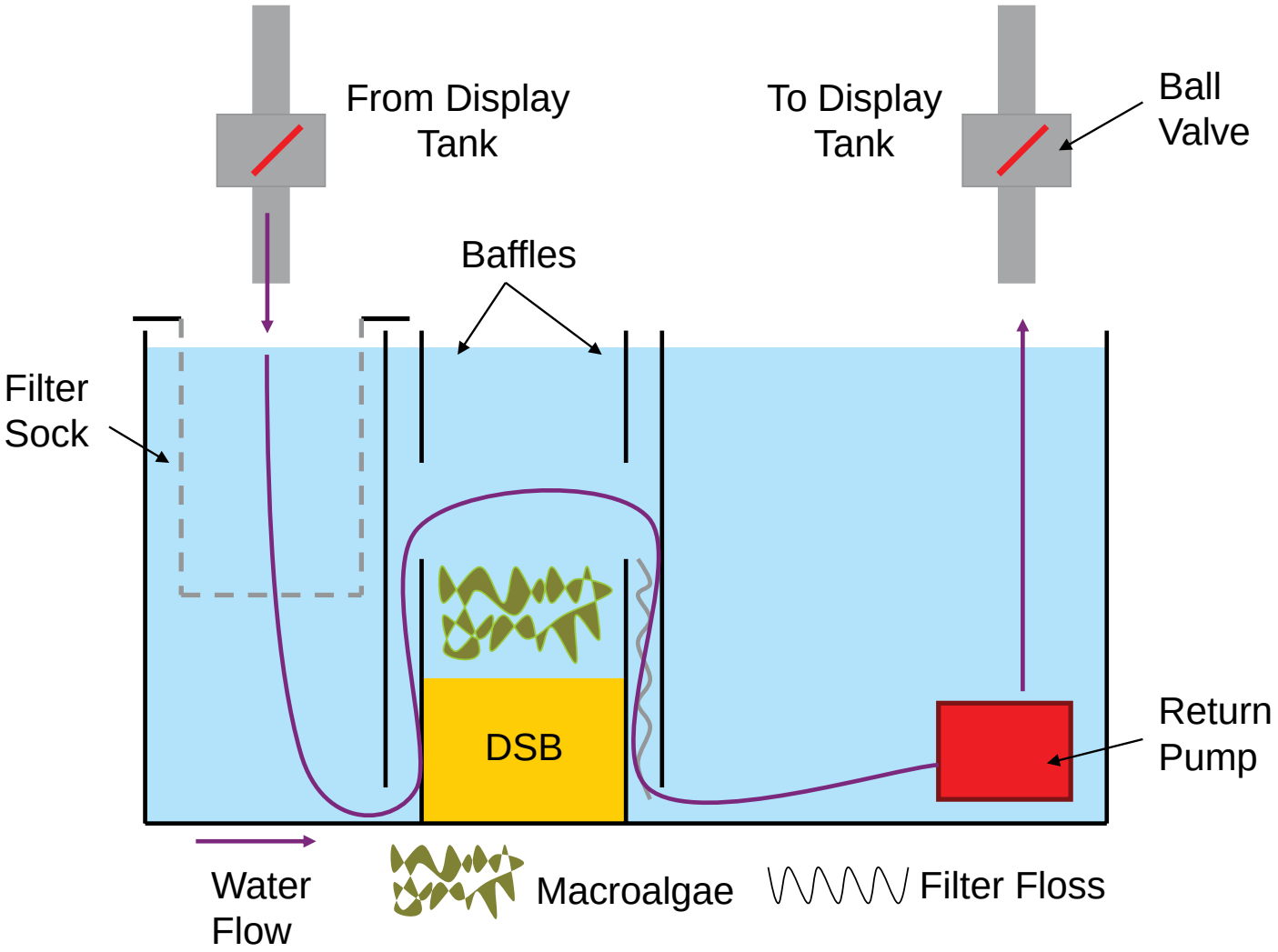
At this point the cabinet doors are flung open to reveal the hub of the marine aquarium – the sump. This is the point where your friends typically gasp at the complicated-looking apparatus lurking beneath the aquarium, and their considerations for emulating your superb reef display in their own homes are put on hold due to the apparent daunting subterranean running apparatus needed to keep it healthy. The conversation then usually strays to the inevitable questioning of the practicalities and structural stability of a tank full of water with a hole drilled in the bottom!

In this instalment I'm going to discuss the setup and working of sumps, and hopefully convince you that whilst sumps are a fantastic addition to a system, the myth that they are an essential is largely a misconception, and many marine aquariums have been successfully maintained without one.

> A sump is an auxiliary tank typically housed under the display aquarium

Firstly, what is a sump? A sump is an auxiliary tank typically housed under the display aquarium. There are a number of innovative ways to get water into and out of the sump; however, the most common way involves a hole drilled out of the bottom of the display tank. Water flows through this hole into the sump tank below, under gravity. To counter this, a pump, typically referred to as a return pump, lifts water back into the display aquarium. The flow of both the gravity feed into the sump and the pressurised water returning to the tank are regulated via at least one ball valve on each side. This allows the flow of water into and out of the sump to be matched. Water flowing into the sump faster than the return can raise it back to the display results in an overflowing sump. Contrary, water leaving the sump faster than it can fill results in a return pump running dry and an overflowing display tank. Therefore a couple of valves allow you to get the most out of a sump without the worry of overflowing either tank.

Usually, the hole in the bottom of the display tank through which water exits under gravity is hidden behind a weir. Weirs are made from glass or acrylic, and fence in the drain hole into the corner of the aquarium. The weir runs to the surface of the tank where



several slits are removed; this area is termed the weir comb. The benefits of this are threefold. Firstly, it stops fish or motile invertebrates being drawn into the sump through the drain hole, and secondly it ensures that should a power outage occur, causing the return pump to fail and therefore stop the return of water from the sump to the display tank, water can only drain into the sump up to the bottom of the weir comb, as opposed to draining right down to the tank bottom if the drain hole isn't walled off. Lastly, the weir comb creates a surface skimming action. It draws its water across the aquarium surface, ensuring that any build-up of surface mulm, which decreases the efficiency of valuable gas exchange in the system, is efficiently removed.

So what advantages does a sump have on a system?

A sump provides a sink for the various pieces of unsightly equipment associated with the successful running of a reef system. On a basic level, heaters, protein skimmers and reactors can all be incorporated into the sump of a system to keep them out of view. Additionally, dosing apparatus can and should be used in the sump area of a system, which potentially means that rather concentrated chemicals, such as kalkwasser, have the opportunity to get diluted in an ample volume of aquarium water before coming into contact with our delicate inhabitants.

> A sump provides a sink for the various pieces of unsightly equipment associated with the successful running of a reef system

At the most fundamental level a sump is simply a bare tank, however, most hobbyists typically include a series of baffles to compartmentalise their sumps, channelling water around the workings of the sump in a controlled manner. Additionally, baffles also give the opportunity for any bubbles which arise, either escaping from a protein skimmer, or generated by the system as a consequence of turbulent water entering the sump, to exit the system before entering the display aquarium.

Figure 1 (above) shows a very simple sump configuration, which is typical for most hobbyists. I've used this to illustrate the baffle concept, which forces water underneath a piece of glass and over another to ensure that all water in the system passes over the deep sand bed and macroalgae biological filtration compartment. Additionally, the sump incorporates

Sumps can also be a useful repository for suspicious looking hitchhikers, such as this rather meaty-looking crab!

Dave's (editor) view of his established sump which has now been running for around 6 months.

a degree of water polishing. As water enters the sump it is passed through a matrix to remove particulate matter; this can be a specific filter sock designed for the purpose, or a cheap and nasty leg cut from a pair of tights! Utilising a pre-sand bed particulate removal strategy such as this prevents the build-up of mulm in the sand bed compartment. Also, placing a piece of filter floss in the post sand bed baffle also ensures that any macroalgae which escapes from the bio-filtration compartment isn't drawn into the return chamber, with the potential to foul the impellor of the life-supporting return pump.

So, on to the myth; these sump tanks are usually quoted as being a prerequisite of a marine system, unless stated otherwise. Off the shelf systems come pre-drilled, with the assumption that the reefkeeper will need this extra tank to facilitate the proper running of a marine aquarium. However, this isn't the case. There are a number of alternatives to a sumped system in order to provide the filtration capacity to keep marine inmates healthy. In fact, it is still possible for equipment to remain hidden with a bit of foresight applied when setting up the aquarium.

Perhaps the neatest alternative involves a false back wall approach. In this design a piece of acrylic is placed a few inches away from the actual back pane of the aquarium. Similar to a weir, a comb can be cut out of one of the top corners of the false back and a pump placed in the opposite top corner, with the end of the pump placed through a cut removed from the false back pointing into the aquarium. This then draws water through the comb and back into the tank. If a series of baffles are placed in between the pump and the comb (before sealing on the false back!), in a similar manner to a sump, it channels the water through chambers and various different pieces of equipment before being returned to the aquarium.

> There are a number of alternatives to a sumped system in order to provide the filtration capacity to keep marine inmates healthy

Within these chambers can be hidden heaters, float switches for automatic top-ups, and feeds for external apparatus, such as chillers and reactors. Almost every protein skimmer manufacturer also produces a hang-on design, which can be clipped to the back of the aquarium, drawing and returning behind the false wall, again not spoiling the equipment-less look of the display aquarium. There are also a number of slim-line protein skimmers which fit neatly into a false back aquarium.

The other alternative to a sump is an external filter. External filter technology has improved unimaginably over the last decade. There are now filters which can be programmed to incorporate different chambers

Dave's (editor) algae helps keep the nutrients low, but also encourages life to inhabit the sump and thrive.

and media compartments via PCs, and they are sufficiently intelligent to never run at 100% output, allowing self-regulation to ensure that even in the event of the inlet strainers becoming blocked or restricted, they still run at a constant flow.

Whilst external filters provide for the biological filtration needs, the intake strainers and output spray bars are often unsightly. However, something that planted tank aquarists use for their external filters are glass uplift tubes and spray bars, which sort of disappear into the background of the aquarium, rather than the nasty green and black designs we're familiar with. I've never seen these used on a marine system, but see no reason why they shouldn't be a success.

The roots of this red mangrove provide excellent nutrient export and can easily be cultured in conjunction with macroalgaes in a sump or false back aquarium.

Without a sump, although things like reactors, protein skimmers and ultraviolet sterilizers can be placed under the aquarium, hiding the feed pumps can be challenging. In-line heaters can also be purchased relatively cheaply, which break either the feed or return from an external canister filter. However, matching the flow rate through the heater with the supply from the filter can be difficult, in order to ensure that the heater and water have sufficient contact time to sustain a stable temperature.

> In my experience, the main benefit of a sump, in addition to a hiding place for aquarium running apparatus, is the ease at which it can form a plantation for macroalgaes

In my experience, the main benefit of a sump, in addition to a hiding place for aquarium running apparatus, is the ease at which it can form a plantation for macroalgaes. These marine plants are the ultimate nutrient export machines, which ravage aquarium dissolved organics, making the environment in the display tank more unfavourable for unsightly problem algaes. Growing macroalgaes in lit compartments of false back aquaria is popular, and may even be achieved through overspill from the aquarium main lighting system. Macroalgaes are reasonably challenging to culture in external filters, due to the fact that the bodies of these are usually pretty opaque. However, with strong lighting there has been limited success with this style of propagation.

So, to summarise; despite the common myth that a sump is an essential component of a marine system, many successful saltwater aquariums have been maintained without one. They're a great hiding place for many of the unsightly pieces of apparatus required to keep our inmates healthy. However, alternatives do exist in the form of false back systems and external canister filters. NB

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Gear Guide

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2. Prodibio – BioDigest Standard (30 vials)
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> This food provides saltwater bottom feeders with the ingredients they desire, and also with brilliant natural colour enhancement and growth

5. BOOK: Corals – Author James W. Fatherree
RRP: £11.99 **MORE INFO:** www.tfhpublications.com

The Super Simple Guide To Corals is the book's full title. Written by well-known aquarist James W. Fatherree, this book is aimed at reefers who are just starting out in this wonderful and fascinating hobby. Although super-simple in design, the book contains a wealth of information. Subjects covered include natural history of corals, coral nutrition, coral weapons, reproduction, water quality, propagation and species guides. This is a paperback publication with 136 pages.

6. NEW TMC – AquaBeam 600 Ultima (single strip)
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T5 Aquarium Lighting Pendant

Price
RRP: From £189.99 (inc. bulbs & delivery)

Availability
iquatics.com/marinehabitat

Further info
iquatics.com/marinehabitat

AFFORDABLE QUALITY

Let's take a look at the AquaLumi Series 2, an all-new super-stylish high-output T5 light pendant by iQuatics.

iQuatics, known for their AquaLumi Series 1 and extensive range of bulbs and reflectors, have finally released the long awaited Series 2. With series 1, it was all about price. With Series 2, the emphasis changed slightly in order to product a high end product, but still at an affordable price. Back to the drawing board they went, and design began from the ground up – and it shows!

STYLE

The Series 2 has clearly been designed with visual appeal in mind, but without sacrificing on quality of light produced. It will quite easily sit as a centrepiece in your home; it has a sleek minimalistic design with all the required functions, with no unnecessary extras and gimmicks. The unit is manufactured from black anodised or silver powder-coated aluminum to protect against saltwater and corrosion. This product is available in either black or silver. For those familiar with Series 1, you may be interested to know that Series 2 is 50% wider increasing it from 27cm to 38cm wide. This has allowed an increase of overall output with a wider spread, but without increasing the power consumption. The Series 2 is available in various sizes ranging from 2ft (6x 24W T5) to 6ft (6x 80W T5).

TECHNICAL

It's a given that T8's are now pretty much extinct given the superior water penetration and improved efficiency of the T5s. The Series 2 supports six T5 fluorescents, and each has its own German-engineered reflective material to give the maximum reflection of light towards the tank. There is a single cable coming from the unit itself, which keeps it neat and tidy. At the other end of the cable it splits into two, which allows the user to have tubes two and five on at separate times, to bulbs one, three, four and six. Built-in fans and increased aluminum thickness provide both passive and active cooling for optimum efficiency with heat dissipation. Separate compartments between the electronics and the fluorescents allow for the twin fans to actively cool the electronics separately from the tubes, keeping the overall running temperate at the optimum 35 degrees.

FITTING

For ultimate convenience, this product is shipped with an adjustable slide mounting to securely attach the pendant to virtually any size aquarium (equal to or shorter than the length of the light unit), and also a suspension kit should you wish to hang it from the ceiling. The tank mounts are adjustable to up to 40mm longer than the pendant. One of the key features of this unit is the mounting brackets. They allow the unit to pivot with ease, providing convenient access to the tank for feeding or quick maintenance. This is particularly impressive given the heavy build of the unit, as straight forward plastic brackets wouldn't be sufficient but these have been manufactured from a combination of very strong plastic and fiberglass. By design, the unit cannot be fixed in the 'up' position. This is to purposely discourage hobbyists from attempting to change bulbs while the unit is fixed in place, which should not be attempted.

UNIQUE FEATURES

iQuatics appear to have really thought about the Series 2, which even led to a gap between the manufacturing of Series 1 and 2, but it was worth it to allow such careful planning. To highlight a number of the key unique features:

- Each bulb has an individual reflector
- As single cable leaves the unit
- The unit can be raised by pivoting fixing brackets
- Unit provides both passive and active cooling

CONCLUSION

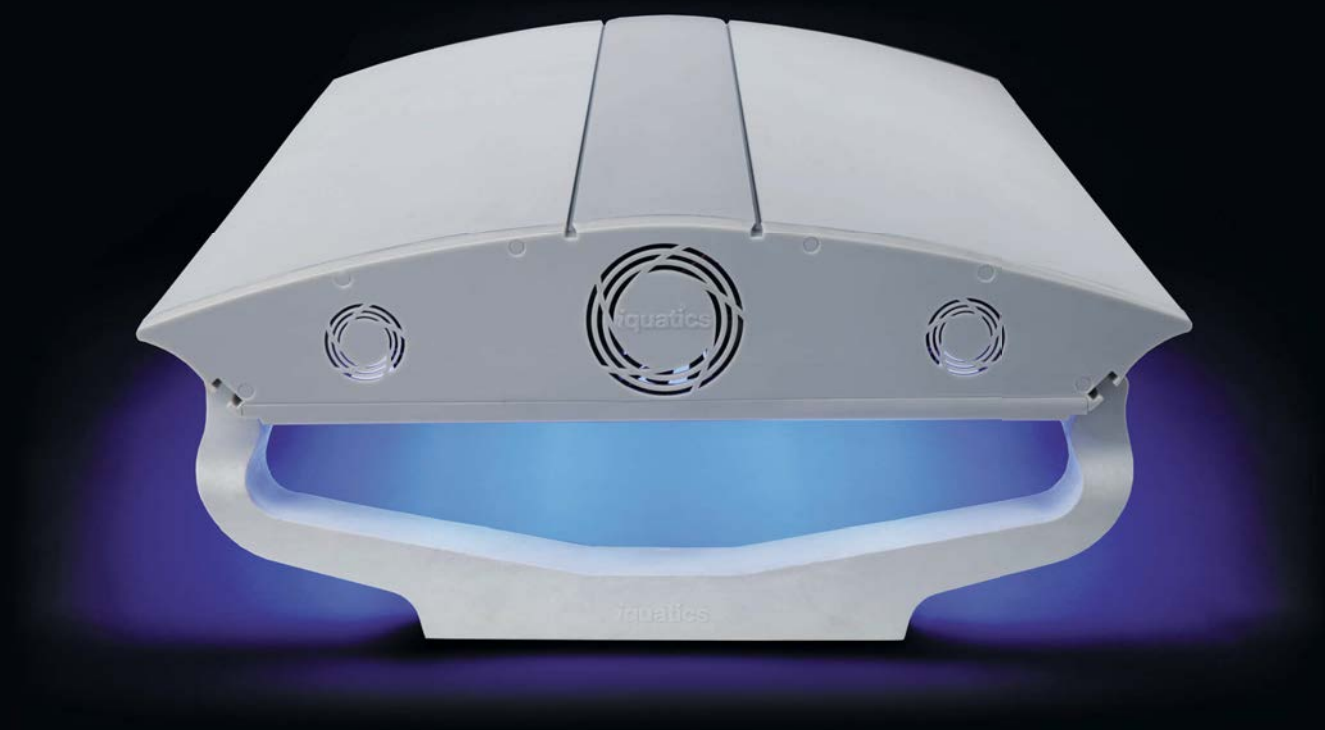
An exciting new T5 offering, well worthy of consideration. A high output T5 light source isn't a new concept, but it is tried and tested. It is proven to be successful in a marine aquatic setting and iQuatics have now given it a fresh new and very stylish housing fixture.

Written by Dave Pitt

iquatics

aqualumi

FROM ONLY **£189.99** INCLUDING T5 BULBS & DELIVERY



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www.iquatics.com/marinehabitat

Also available in black

AQUATICS LIVE 2012

For the second year running, the UK's largest show for fishkeepers returned, promising bigger and better things.

A fishkeeping show here in the UK – how could we not attend? The show was a 2-day event, and took place at the London Olympia on 10th and 11th November 2012.

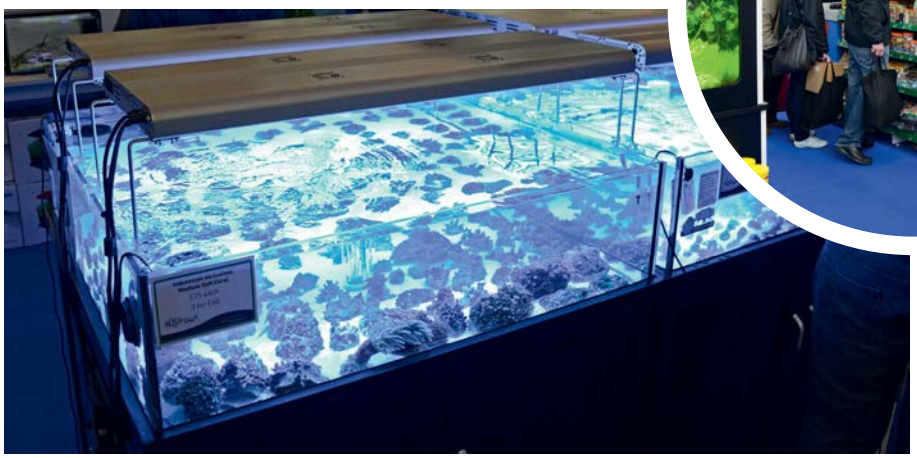
Three other members of the team and I had a 6.30 a.m. start and arrived at the Olympia at about 10.00 o'clock. We went as visitors this year because we really wanted get out there and mingle. For this event we offered a number of complimentary copies of the latest issue (Nov/Dec), and so for anyone reading this who discovered the magazine at the show, welcome! You obviously enjoyed your free copy and went on to purchase this issue, so thank you for your interest.

The event layout had changed from the previous year, and in my opinion, for the better. Rather than being split across two floors, it was situated in a larger single-level space. One observation made was that one of the large walls was filled with huge floor-to-ceiling windows. While this obviously allows loads of natural light in, I did feel that it toned down the atmosphere. Had this been a solid wall, creating a darker internal space, then the atmosphere and mood could have been dictated by organisers and exhibitors, with the use of artificial lighting systems.

The event was essentially made up of three aspects – exhibitors, activities and seminars – and I will comment on each in turn.

EXHIBITORS

The first thing to point out is that this was a fishkeeping show, and not specifically marine, so a large number of the exhibitors covered the tropical and cold-water elements. Some of the more recognised brands for marine hobbyists included the likes of Eheim, JBL, Tetra, TMC, and Giesemann. In addition, there were stands representing national chains, for example, Maidenhead Aquatics and Pets at Home. Then there were stands covering the conservation aspects of the hobby, such as Big Fish Campaign and Marine Conservation Society. Finally, for those interested in undergoing formal training and/or education on the subject of marine aquatics, Sparsholt College were represented. For reference, this college, which is located in Hampshire, offers marine courses ranging from a basic half-day marine fishkeeping course to a full-time FdSc Marine Ecology and Conservation course. From this, students can progress to a full BSc degree top-up in Marine Biology if they so wish.



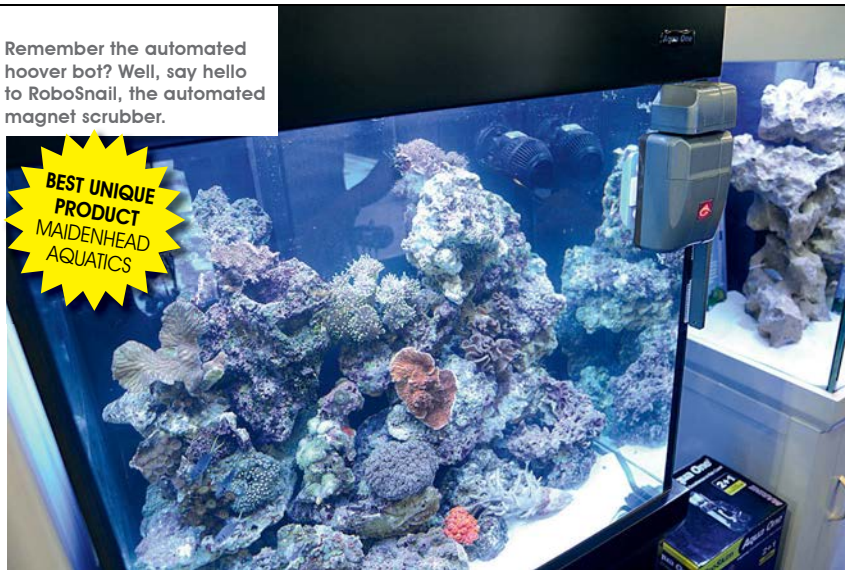
ACTIVITIES

A number of activities took place throughout the day, both for adults and kids. These included a Reef Building Workshop, Marine Wildlife Roadshow, and a Family Activity Zone offering face-painting, arts and crafts, and modelling with a definitively fishy feel!

SEMINARS

The day was packed with guest speakers, and those covering marine aquatics included Joe Yaiullo, Simon Garratt, and Cerven Curvball Cotter. Joe is the co-founder and curator of the Long Island Aquarium on Long Island in New York. As one of the world's leading experts in captive coral care, his 20,000-gallon reef tank holds one of the world's largest collection of corals found within a single aquarium. Joe is the guy the experts go to when they are stuck for answers.

Simon is one of the UK's most respected reefkeeping specialists. He's an avid photographer, international speaker, and builder of one of the most experimental tidal



Remember the automated hoover bot? Well, say hello to RoboSnail, the automated magnet scrubber.

reef biotope aquariums in the world. Simon lives and breathes the reef-aquarium hobby.

Cerven is the editor and founder of nanoreefblog.com and he discussed the role that nano reef aquariums play within the marine aquarium hobby, from simple inexpensive systems all the way through to high-end species-specific aquariums. Nano reef aquariums may be small, but the possibilities are endless.

Q&A SESSION

In addition to the individual guest speakers, there was an open question and answer session with a panel. It was great to see visitors participating, and a whole host of questions were raised on a range of topics.

WHAT WAS NEW?

Firstly, a Canadian brand Polyp Lab, which is new to the UK and is being distributed through Reef Eden International. The brand appears to offer a high-quality range of innovative reefkeeping products. One example from the range is REEF-ROIDS. This was originally engineered for feeding the Goniopora genus, but has since been very well received in the hobby as an excellent food source for all filter-feeding corals. Look out for these exciting products hitting the shelves.

Next up, AquaGenesis International are soon to begin distributing their brand new concept through Maidenhead Aquatics. Their revolutionary new gadget, called the RoboSnail, is the first and only fully automated aquarium glass cleaner in the world today. The intention is that it will clean the aquarium's surface once a day without user intervention. It is an electronic device which is programmed by the user. I have to say that in my personal opinion, while the concept is absolutely brilliant, I feel the demo unit being displayed at the show still needs some fine-tuning. It has obvious limitations, but this is nothing new for the first version of any product. It is certainly a step in the right direction; I'm sure there are many hobbyists out there who would relish the idea of never having to clean the aquarium glass by hand again. It's an exciting idea, and we wait with anticipation to see the final version that rolls off the production line and into the shops.

Again this year, the popular aquascaping contest was held, with contestants tinkering away.

CONCLUSION

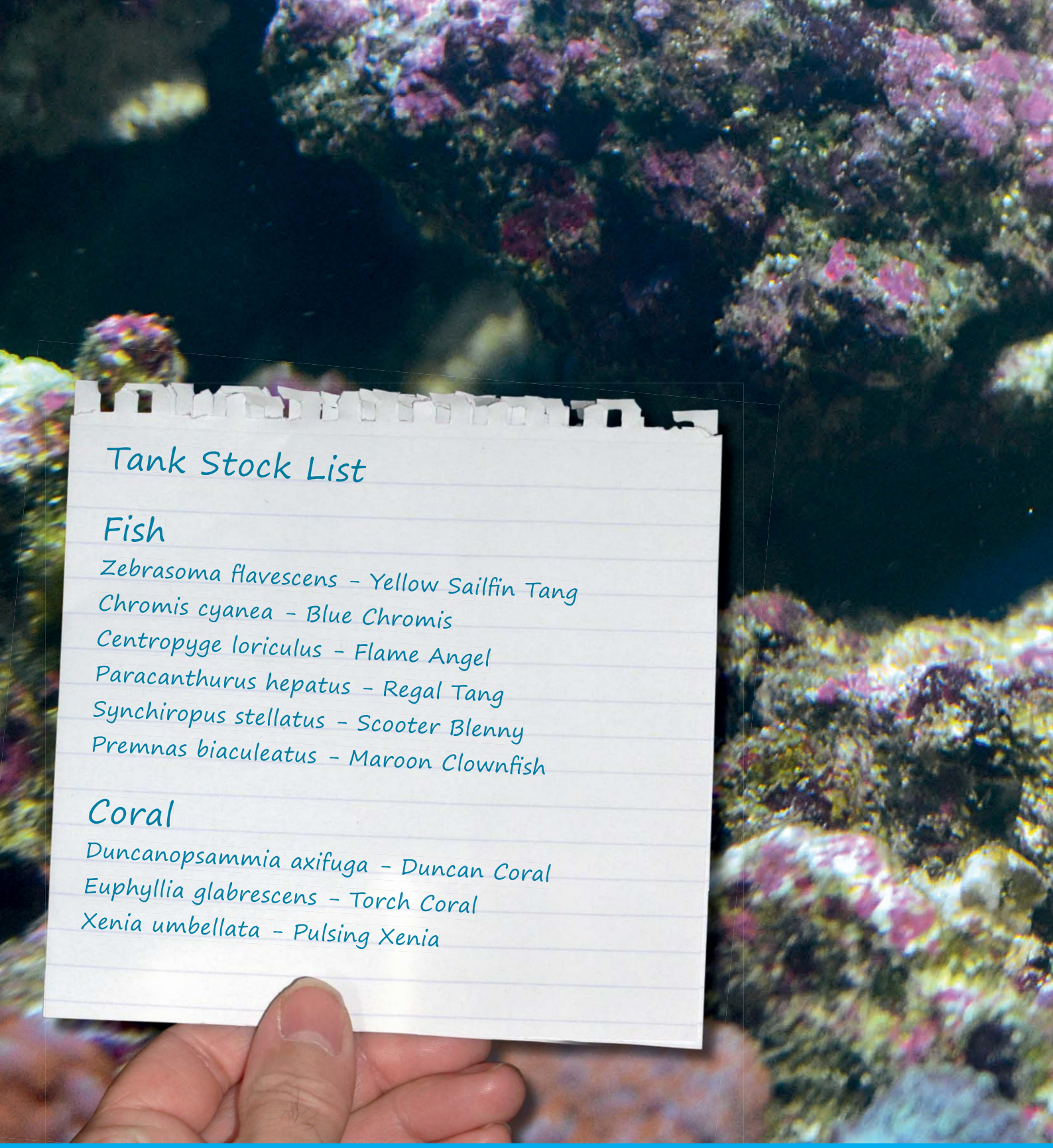
This show is still in its infancy, but is showing promise for the future. This year it had grown in size, improved its location, and attracted significantly more visitors than the previous year. It has to be said that London isn't on the doorstep for everyone, but it is worth a visit to catch a glimpse of the new products hitting the market, and also to have the opportunity of listening to world-renowned speakers.

I hope that the show continues to attract more exhibitors, more feature activities, more product launches, and obviously, more visitors.

Thanks to the team involved in the show, which includes Tom and Jill, who I know work very hard behind the scenes. DP

On the Reef Eden stand there was an impressive jellyfish display showing off the new Cubic jellyfish acrylic tank.

Simon Garratt of Reef Eden showing off the new Giesmann LED units and how they gave a good even distribution of light across the tank.



BEGINNER TIP

MAKE A LOG OF THE NAMES

Try to keep a list of all the animals that you acquire for your aquarium. List the common name and Latin name wherever possible; most livestock stockists will be able to provide this information for you when you make a purchase. Then when you are in a position to make a new addition to the aquarium, you can produce the list and ask an experienced member of staff for their opinion concerning the compatibility of potential new additions with your existing stock. Also, where possible, list intended future purchases to prevent any compatibility issues. Latin names can appear daunting at first, but they are unique to a particular species, whereas common names may vary, even from one stockist to another. For example, you may find the fish *Calloplesiops altivelis* sold as a Comet Grouper or Marine Betta.

BY TRISTAN LOUGHER

TOP OF THE ROCKS

TANK-BUSTERS

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.

In this issue **Tristan Lougher** considers an often overlooked part of the hobby... how big does the fish finally grow?

Selecting livestock for a marine aquarium should be an exciting and rewarding process, but above all it should be planned. The use of magazines, books and online resources as reference guides can help build a picture of how a particular species may behave in the short, medium and long terms with respect to other tank mates and, where applicable, sessile and non-sessile invertebrates. Creating an aquarium that is peaceful, beautiful and interesting to keep and watch, is the goal of almost every marine aquarist, and yet tempting animals can lure the unwary from their stocking plan and into potential problems further down the line. In this issue my Top 10 consists of species of fish that are likely to outgrow most aquaria if they are stocked without realising their true size potential.

CONSIDERATIONS

Whether a fish is too large for your individual aquarium depends on the size of the system and the number and size of other fish present. What is too large for a nano reef may be too small for a fish-only aquarium designed to house true angelfish or similar substantial fish species. The list I have compiled here does include some fish that grow too large for most, if not all aquaria, but one or two could easily be accommodated for all their natural lives in a 200-litre system. The snag is that many contemporary marine aquaria are significantly smaller than this. My choices reflect the species that are perennially acquired at small sizes – maybe only a centimetre or so in length in some cases, and which grow sufficiently quickly to cause issues.

> With foresight and planning, most issues concerning the final size of marine fish can be avoided

The problem facing most aquarists is the size at which many fish are offered for sale. Small fish are desirable because they are cheaper to ship, can appear cute, and have a potentially larger market. They can also adapt better than mature, adult fish and represent the best option for most aquarists. The problem is obvious – small fish 'fit' into practically any aquarium in the short term where little consideration is given to their long-term housing needs. Many aquarists are tempted to purchase fish that they know will outgrow their systems, stating they will return it to their local marine fish stockist when it becomes too large. In some cases this is without due consideration about how the fish is caught and transported, and the disruption it may cause to the rest of the aquarium inhabitants. In other instances, action may only be taken when it is noticed what impact an overly large fish has on the water quality of the system. Unfortunately, there are instances where action is not taken, or occurs too late, and the fish dies. With foresight and planning, most issues concerning the final size of marine fish can be avoided.

WILL IT REACH MAXIMUM SIZE?

It's the age-old question – will an aquarium limit the growth potential of a particular fish species? Certainly for some species it appears to, but this may have more to do with food intake, or lack of it, preventing certain fish reaching their maximum size potential rather than the physical dimensions of the aquarium. The bottom line is that assuming a particular fish species will not outgrow an aquarium is reckless and likely to lead to problems.

10

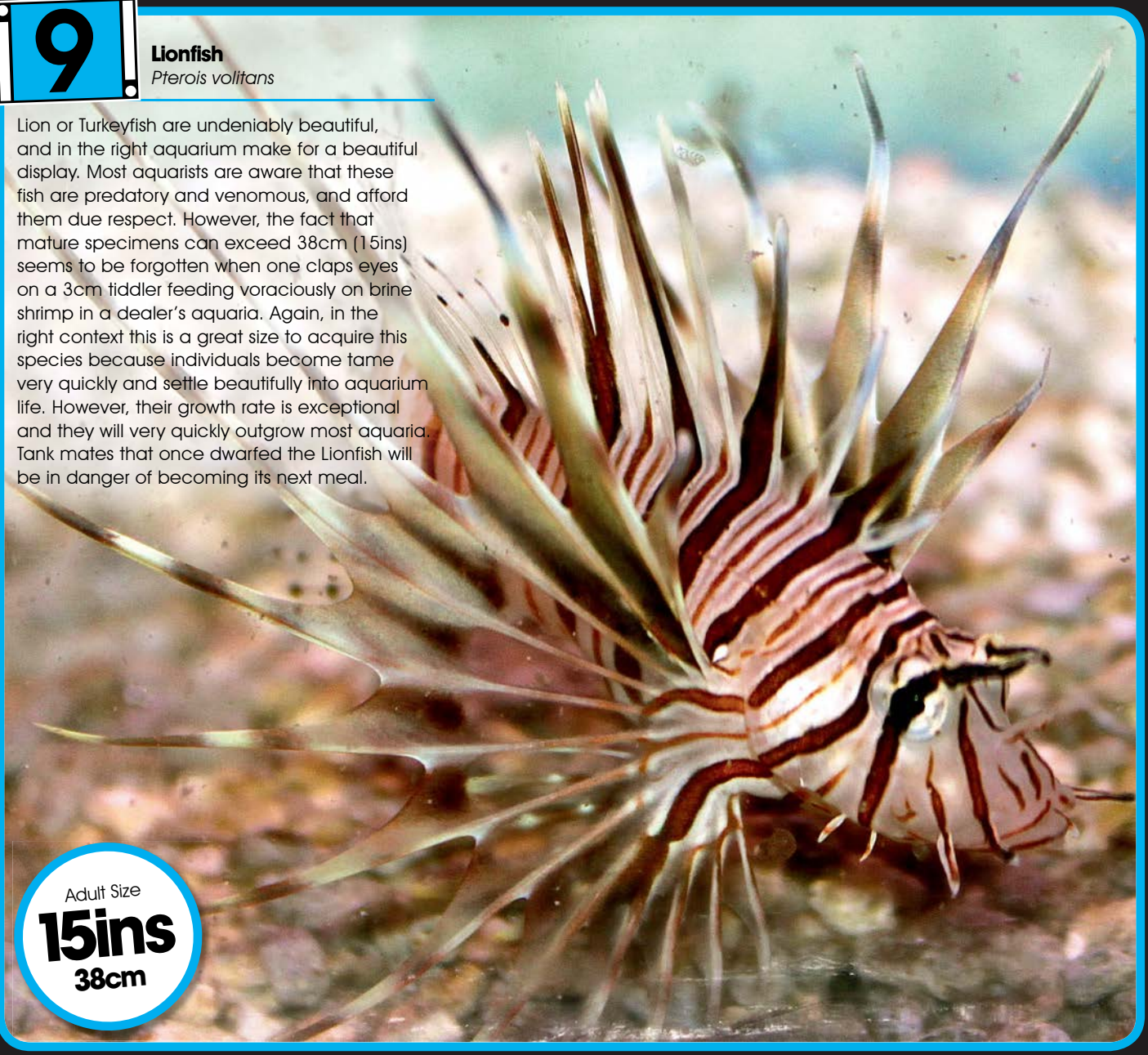
Banded Cat or Bamboo Shark
Chiloscyllium punctatum

This is a shark, so will always have its fans, but this fish is popular with aquarists because of how it is sold rather than what it actually is. Baby sharks are undeniably cute, and with its black and white bands this is one of the more attractively marked of the smaller dogfish-like shark species. What is the clincher for most buyers of this species is the fact that it is frequently offered for sale in an egg capsule known as a mermaid's purse. Taking roughly 4½-5 months (depending on aquarium water temperature) to hatch, and visible through the semi-transparent chitinous shell of the egg, aquarists can watch the embryo grow and develop, absorbing the yolk sac, over time. It's fascinating and highly interesting, and very easy to lose sight of the fact that this is a fish that grows to over a metre in length, is clumsy, and requires an aquarium in excess of 650 litres if it is to be housed in the long term.

9

Lionfish
Pterois volitans

Lion or Turkeyfish are undeniably beautiful, and in the right aquarium make for a beautiful display. Most aquarists are aware that these fish are predatory and venomous, and afford them due respect. However, the fact that mature specimens can exceed 38cm (15ins) seems to be forgotten when one claps eyes on a 3cm tiddler feeding voraciously on brine shrimp in a dealer's aquaria. Again, in the right context this is a great size to acquire this species because individuals become tame very quickly and settle beautifully into aquarium life. However, their growth rate is exceptional and they will very quickly outgrow most aquaria. Tank mates that once dwarfed the Lionfish will be in danger of becoming its next meal.



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8 Clown Sweetlips

Plectorhynchus chaetodonoides

Juvenile Clown Sweetlips are beautiful. They have wonderful patterning and a fascinating way of swimming in a graceful undulating fashion. They are also notoriously difficult to feed, and their novel swimming technique means they need to take on plenty of food to provide them with energy and resources to swim and grow. Should a well-feeding specimen be acquired and it settles, expect it to grow – and grow – and grow. And it changes quite significantly too. Mature Sweetlips are still rather beautiful fish but not necessarily the most attractive of reef fish available in the hobby.

> Should a well-feeding specimen be acquired and it settles, expect it to grow – and grow – and grow

courtesy of
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otomax.org.uk

7 Porcupine Pufferfish

Diodon holocanthus

The Porcupine Pufferfish ticks many of the boxes required to be classed as a tank-buster; it is available when small, and 3-5cm specimens are particularly tempting. It is cute – check out those eyes! It is interesting that when stressed it inflates itself with water, resulting in the body spines becoming erect and the body shape resembling a football (in an aquarium context this is something you really don't want to see). Although most specimens won't reach much more than 15cm in body length, they have the potential to exceed this, and even a 6ins Porcupine Pufferfish has an enormous appetite, which, if satisfied, puts a great strain on aquarium filters.

6 Batfish

Platax spp

There are three species of batfish that commonly make their way into the hobby. All are fascinating as juveniles, with the most popular two species mimicking something that other fish would find inedible. The Redface (*P. pinnatus*) is thought to mimic a noxious flatworm. The Orbiculate (*P. orbicularis*) mimics a dead leaf, and the Longfin (*P. tiera*) is just plain attractive with its long dorsal and ventral fins. So there are three commonly available juvenile batfish, and if good specimens are acquired and fed regularly, they will thrive in aquaria. These are true tank-busters, however, with the smallest species reaching 45cm (18ins) and the largest 2ft. Add into the mix that all three species appear very similar as adults, with little colour, and one might think twice before acquiring one.

Adult Size
24ins
60cm

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Guido & Philippe Poppe
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5 Black and Gold Chromis

Neoglyphidodon nigoris

Once upon a time the first fish into a marine aquarium were almost certainly damselfish. Frequently this led to problems, with individuals becoming territorial and beating up subsequent additions. However, the choice of damselfish species was fairly limited, and we tended to think that all would stay rather small. Small, as discussed already, is a relative term in the context of marine aquaria, which may range in size from less than 10 to many thousands of litres water volume. This damselfish, erroneously and somewhat misleadingly referred to by some as a species of chromis, appeals immediately because of its stunning blue-black and gold colouration. Available as small (2-3cm) juveniles, these fish quickly grow. Often a shoal is purchased, but a pecking order is established and the weaker individuals are often killed by a dominant male. They grow to around 15cm in total length, and are robust and often belligerent at that size, so will need equally solid tank mates. The other problem is the colour change, or rather colour loss, which occurs as this fish matures. The beautiful juvenile colouration becomes brown or grey, and it's difficult to believe that this is the actual fish purchased; it becomes big, dull and aggressive, and it's a hard lesson to learn.

The beautiful juvenile colouration becomes brown or grey, and it's difficult to believe that this is the actual fish purchased; it becomes big, dull and aggressive, and it's a hard lesson to learn.

Adult Size
5.5ins
13cm

4 Golden Trevally

Gnathodon speciosus

Adult Size
42ins
110cm

Many aquarists dream of an aquarium in which a shoal of fish can be maintained – a group of identical individuals that stick close together and dazzle as they move as one unit throughout the aquarium. Such shoals remain elusive, although we might occasionally glimpse such behaviour in an aquarium full of anemonefish or chromis. There is one species that displays this behaviour on a regular basis, and it's the beautiful metallic individuals of the Golden Trevally. When less than 5cm or so, these fish hide themselves amongst the stinging tentacles of jellyfish. Larger specimens hang around much larger pelagic fish, such as sharks, which has led to an alternative common name of Pilotfish (although these aren't the true pilotfish, *Naucrates ductor*). Fortunately, most Golden Trevallys are destined for public aquaria, but some do make their way into hobbyists' aquaria, where they must be fed plentiful food if they are to thrive, which is an issue in itself where strict nutrient control is required. However, this genuine tank-buster has the potential to reach nearly 4ft in length. Leave this one to the local public aquarium.

> When less than 5cm or so, these fish hide themselves amongst the stinging tentacles of jellyfish

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3 Yellow Boxfish

Ostracion cubicus

Adult Size
18ins
45cm

Keeping a saltwater aquarium isn't all about maintaining water parameters or knowing a lot about fish or corals. It's about discipline too. At the risk of making the hobby sound similar to an ancient martial art, those aspiring to be marine aquarists have to exercise self-control. Who doesn't find the sugar lump-sized juvenile Yellow Boxfish attractive? Almost impossibly cute, colourful, relatively inexpensive, and widely available, they are a popular aquarium fish. They aren't the easiest fish to care for in the long term, although specimens that survive to maturity can be very robust. Expect individuals to reach 30cm or more.

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2

Picasso Triggerfish
Rhinecanthus aculeatus

One of the most popular aquarium fish in the past, this species still has its fans amongst contemporary aquarists. The main reason for the decline in popularity is the prevalence of reef aquaria in the hobby, but given a suitably sized fish-only system, this triggerfish is an excellent fish to care for in the long term. At 30cm and with an inquisitive (some might say downright destructive) disposition, this fish needs a large aquarium – 500-litre system minimum – and that's for this fish and perhaps one or two other robust tank mates if filtered adequately. In common with so many tank-busting species, this fish can be purchased at very small sizes. I have seen individuals measuring little more than 10mm that are well-settled and feeding readily in wholesalers' aquaria. They are so very tempting to acquire, but when they reach 10cm, most aquarists will be already regretting the spontaneous purchase of this triggerfish.

> At 30cm and with an inquisitive disposition, this fish needs a large aquarium – 500-litre system minimum – and that's for this fish and perhaps one or two other robust tank mates if filtered adequately

Adult Size
12ins
30cm

1

Adult Size
12ins
30cm

Regal Surgeonfish
Paracanthurus hepatus

This may not be an obvious choice for number one spot in the Top 10, but to me this was the first fish on the list and difficult to place anywhere other than at the very top. The reason? Well, this is a beautiful and highly sought after species, and one that will thrive in systems sympathetic to its needs. The problem is that it can be purchased at sizes in the range of 12mm-30mm on a regular basis, and it proves just too tempting to resist. I have had many specimens that were caught from aquaria of 130 litres or less, when 300 litres is an absolute minimum for a 15cm specimen. Although it may not always reach its wild-size potential, it will outgrow 150 litres very quickly indeed.

CONCLUSION

Reading back through what I have written here, I am conscious that readers might think I don't like any of these species of fish. Nothing could be further from the truth, and the Top 10 actually includes a couple of my favourites. The problem with such species in an aquarium context is not of their own making. The term 'tank-buster' is a relative one. If your aquarium is large enough, you could house any of the above species. The problem I have with the fish listed here is that all too often they are stocked at small sizes into systems that will not cope with them in the long term. I fully appreciate that many aquarists intend to get larger systems in the future, and some become so attached to their fish that they upsize as many times as necessary to provide for their livestock. However, all too often a fish is purchased without any idea of its size potential, or the knowledge that its colour, shape or disposition will change significantly over time. Researching species is the best idea, and many of the popular aquarium fish books contain recommendations on minimum-sized aquaria for a given species. TL

DON'T FORGET

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

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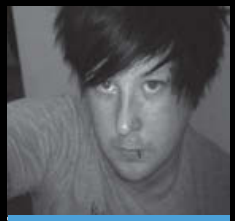
JUST SCAN!

Use your phone and scan this QR Code for quick access to all our Top of the Rocks

EXTENDED CONTENT numbers 11-20.

CLAM-TASTIC

In this issue, **Aaron Down** takes us through his fascinating reef story, and how he achieved his amazing display.



AARON DOWN

Age: 34.

Hometown: Nutley, East Sussex.

Occupation: Staff nurse (Mental Health).

Marine experience: 21 months.

Tank size: L3 x W3 x H2ft.

Tank start date: 29th December 2011.

Favourite fish: Copperband Butterfly.
coral: Goniopora.
invert/other: Tridacna Clams.

I have kept fish on and off for most of my life; my father had various tropical setups when I was a small child and I got the fish bug pretty early on. My first tank was a fancy goldfish setup when I was around 10. I then advanced to tropical fish, and soon after the bug really got a hold, and I had several tropical tanks through my teens and early-20s. In January 2011, I was toying with the idea of setting up a Discus tank as a new project, so went off to a local shop to look at livestock and aquariums. I returned with a small nano tank and 100 litres of salty water after wandering around the marine section, gazing at all the brightly coloured fish and corals. Whilst there, I had decided to have a crack at what I always perceived to be impossible.

My first marine tank was a Kent Bio Reef, which held a whopping 94 litres. This tank was set up and cycled and within a few weeks I had my first fish, a pair of clownfish, which are still with me to this very day. I started stocking with soft corals but was never happy with the small volume, and I decided that when I moved house I would upgrade to a bigger tank. The Classifieds were scoured and within a week I had bought a second-hand Betta Lifespace 680. The dimensions were very close to a 2ft cube and this tank came with a sump, but being so new to marines, I had no idea what the benefits were;

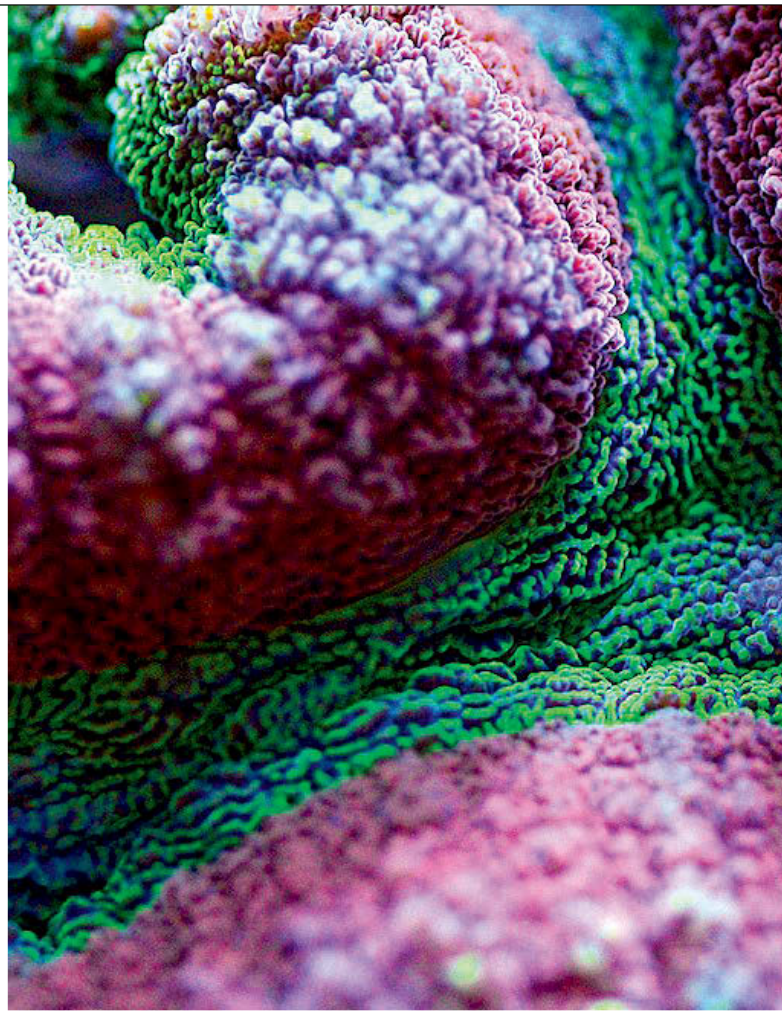
I only knew that all the people in the know wouldn't be without one.

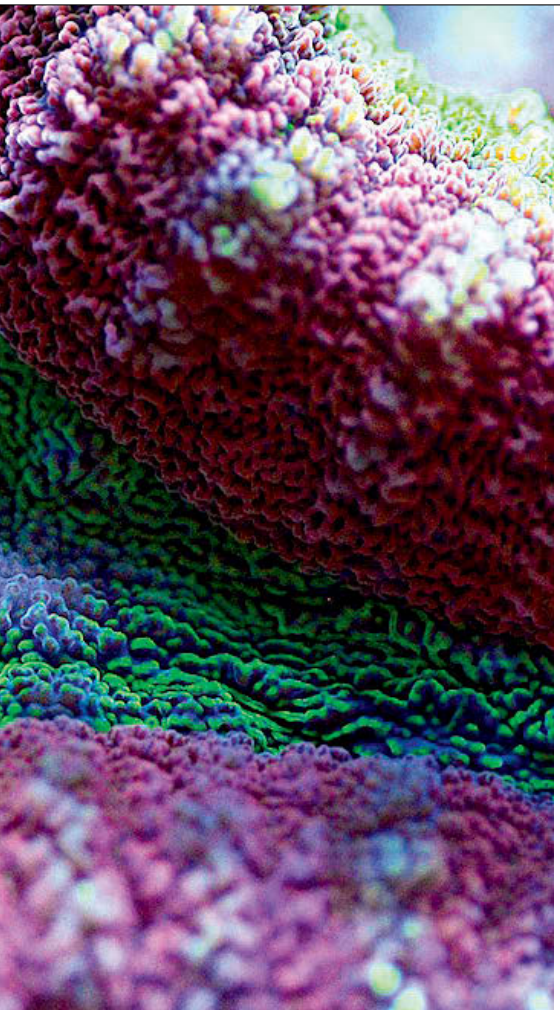
The tank was set up, cycled, and my stock was transferred over from the nano. Having a bigger sump meant I had more scope for equipment and it would remain hidden. I learned about UV, reactors, skimmers, and the overwhelming choice of lighting. I chose halide lighting because I really liked the shimmer it gave to the tank, and it seemed popular. My choice of corals moved towards LPS from soft corals; I liked the movement and bright colours. I really learned a great deal from this tank, and the addiction soon took a firm hold. My husbandry improved tremendously with this tank, and as my confidence grew, I ventured into mixing my own salt, as well as making my own RO water, rather than relying on shops.

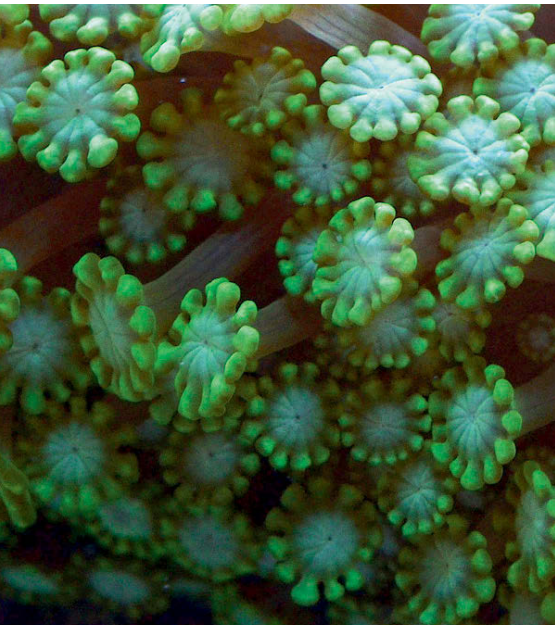
As my success with LPS corals grew, the tank filled up very quickly over the coming months. Disaster struck for me 10 days before Christmas 2011; I woke up to find water leaking down the front of the cabinet, and on inspection it was coming from the base. I had no choice but to compose myself and focus on emptying the tank and securing the safety of my livestock. It was a very disheartening experience, breaking up 9 months of hard work and effort. My fish were left with the LFS and the corals went to a local person. This led to the tank I have now, which was completely unplanned. I had to start over again.

> Disaster struck for me 10 days before Christmas 2011; I woke up to find water leaking down the front of the cabinet, and on inspection it was coming from the base

My current tank is a custom-build by Seabray, and I decided to stick with the cube dimensions of the last one, but on a slightly bigger scale. Because of my love for LPS corals, I decided to build on the success of my last tank; the stock that was being looked after was added. Also, a bigger tank meant I had more room for







equipment. I changed the lighting to T5 and ran an eight-tube ATI dimmable Sunpower. I had a few problems in the early stages; whitespot reared its head after a month, which I battled with ozone and UV. I lost a few fish but the ozone really helped me to get on top of the parasites. Since then I have run it continuously on an Orp controller and the tank runs at 400mv. The water clarity it gives is incredible, and I definitely feel it's worth using just for that alone.

In the early stages of the tank I suffered with byopsis. This pest algae drove me mad, and because very little eats it, it makes it more difficult to eradicate – it spread like wildfire. My first attack was to raise the magnesium to 1700PPM and keep it there for several weeks. This had no effect on it, so I then went down the route of carbon dosing, and by stripping the nutrients out of the water and manually removing, I managed to get on top of it and win the battle. Fortunately I haven't seen it since.

> I find these animals fascinating, and the colours and patterns available are incredible

The tank parameters are currently maintained through a three-channel Kamoer doser that maintains alkalinity, calcium and magnesium. For nutrient control I run Bio Pearls through a Gyractor, and these have done wonders for my nutrient levels, which I used to struggle with at times. They brought my nitrates down from 50PPM during the start-up phase to 5PPM in around 4 weeks, as well as significantly reducing phosphates.

I did briefly venture into SPS corals with this current tank, however, I was unsuccessful in keeping them happy, despite having stable parameters. At the time I was using a calcium reactor, and I suffered with stripping corals. This took the enjoyment out of the hobby for me; I found it stressful because I was spending more time worrying about new corals than enjoying the tank.

In the last 6 months I've developed a love for Tridacna Clams, and after buying just one they quickly grew on me and currently I have seven (four Maxima, one Crocea, one Derasa

AARON'S TANK SPECS

TANK: Seabray custom-build in black finish
DIMENSIONS: L3 x W3 x H2ft
LIGHTING: Two AI SOLs
WATER DISTURBANCE: Sicce Voyager 4, Eheim Compact 3000 and two MP10s
SKIMMER: Bubble Magus NAC7 and a TMC V2 400 that I use to dose ozone.

CAPACITY: Display 509L
CAPACITY WITH ROCK: 450L-ish
ROCK: 50kg
SUBSTRATE: TMC medium gravel
SUMP: 150L
SALT: Reef Crystals
ADDITIVES: None

LIVESTOCK
FISH:
Iridis Wrasse, pair of common clownfish, Randalls Goby, Algae Blenny, Scotts Fairy Wrasse, Black, Leopard Wrasse, pair of Christmas Wrasse, Fiji Foxface, Mimic Tang, Yellow Tail Tamarin Wrasse, Lubbock's Fairy Wrasse, M&F pair of Scooter Blennys

INVERTS: Seven Tridacna Clams, Tiger Pistol Shrimp, Boxing Shrimp, Fromia indica Starfish

CORALS:
SOFT: None
LPS: Coral stock consists completely of LPS. These include Goniopora, Lobophyllia, Acans, Favia and Euphyllia.

FEEDING REGIME: Due to work hours, the feeding regime varies. The fish get at least one cube of frozen food a day, sometimes two. Some days I feed flake as well as seaweed.

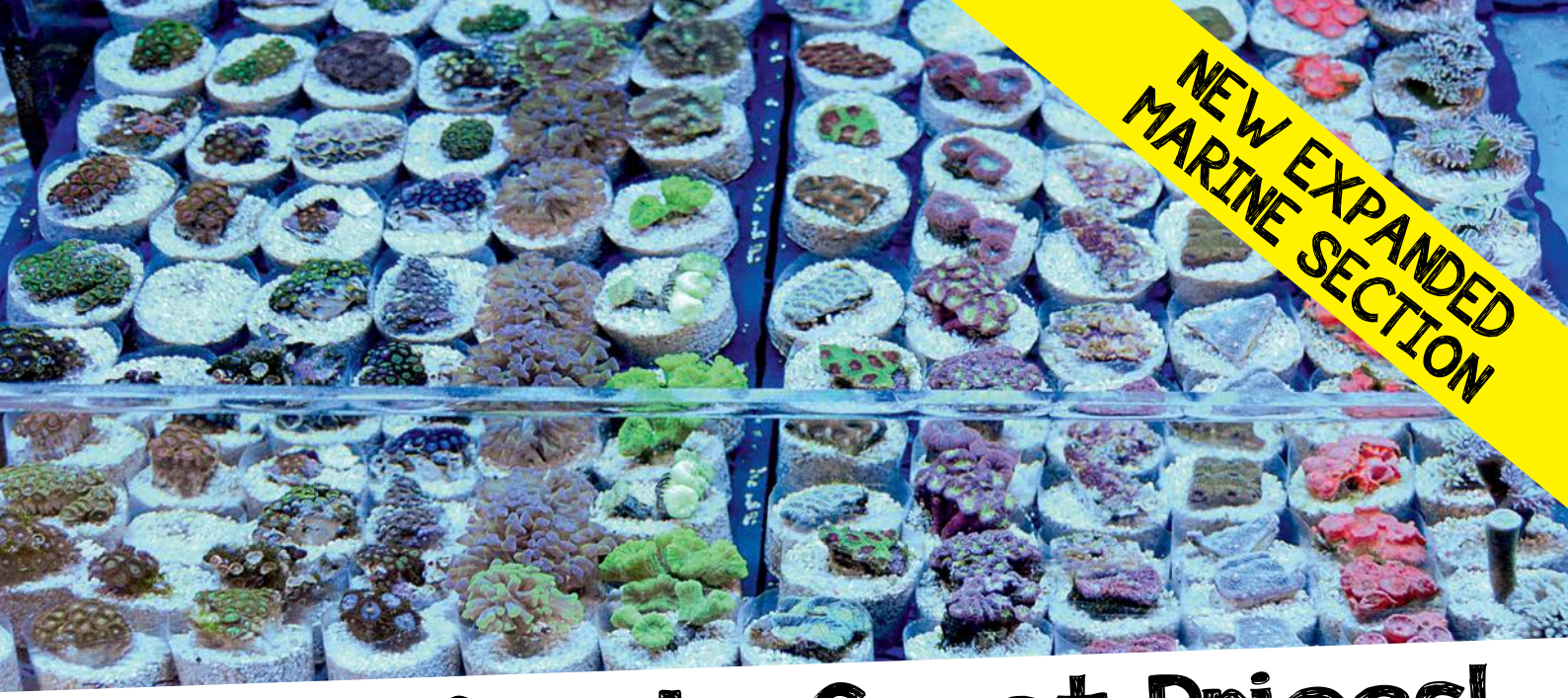
TANK STATS
SALINITY: 34PPT
CALCIUM: 450
DKH: 9.6
pH: 8
PHOSPHATE: 0.046
NITRATE: 5
MAGNESIUM: 1410

and one Squamosa). I find these animals fascinating, and the colours and patterns available are incredible, although I do find that having so many means they use a lot of calcium and alkalinity when they grow. My current fish stocking in the tank consists of mostly wrasses; I find them among the most active, colourful and interesting reef-safe fish available in the hobby. I particularly have a liking for the Macropharyngodon genus of wrasses; I think these are the most entertaining and stunning of the wrasse family. I plan to add several more wrasses to my tank, and on my stocking list are a Mystery and a Lineatus.

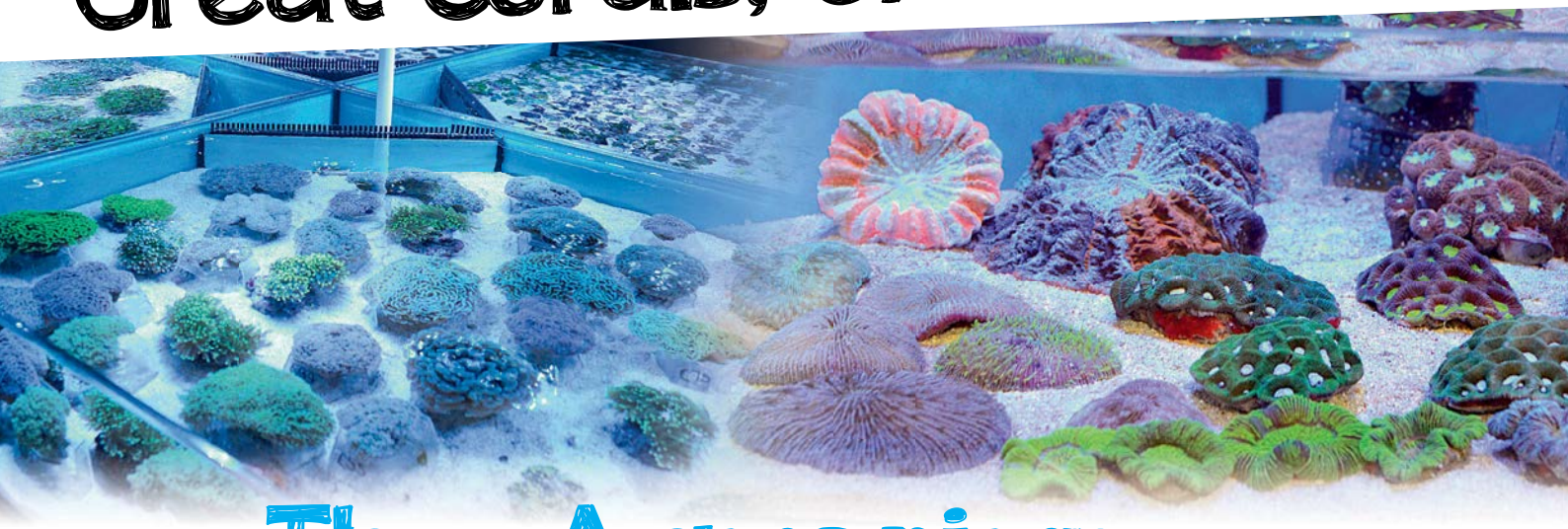
With regards to the husbandry and running of the tank, I try to do a 25-litre water change once a week, depending on work and other commitments. Some weeks it does get missed, but I try not to miss more than 2 consecutive weeks. Other than that, my maintenance involves emptying the skimmer every other day because I'm skimming wet due to the use of pearls. I top up the ATU twice a week, and every couple of weeks I mix up more salts and top up the dosing vessels. That's it regarding the maintenance; I like to keep things as simple as possible, and I don't add any additives to my tank, other than what is used through the doser to maintain the parameters.

> I particularly have a liking for the Macropharyngodon genus of wrasses; I think these are the most entertaining and stunning of the wrasse family

The most recent change to the tank is the lighting; I have moved over to LEDs. I replaced the ATI with two AI SOLs. The main reason for doing this is the spiralling running costs electricity-wise. The prices continually go up so I decided to make some savings where possible. I've been running these for a few months now and I don't miss T5s one bit. The corals look fantastic under the LEDs, and the shimmer they give aesthetically is very pleasing to the eye, something I missed when I changed from halide to T5 lighting when I started the tank. With regards to the long-term efficiency of the LEDs in supporting light-demanding animals such as my clams, it's still too early to say. They need a sufficient period of use and 2 months is too soon. However, I have no doubts after seeing Stuart Bertram's tank, which is SPS dominated. He has been running just AI SOLs for a considerable while, although for me, only time will tell. AD



Great Corals, Great Prices!



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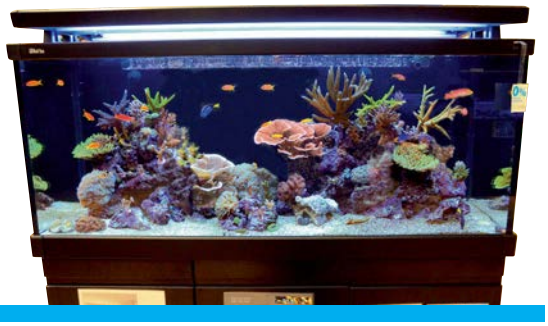

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PART 3
MARINE FISH ROOMS:
The Tours

MATT PEDERSEN

Age: In my 30s.

Hometown: Chicago, IL, USA (currently in Duluth, MN).

Full-time occupation: Interactive software developer.

Marine experience: 26 years.

Aquarium size: Multiple aquaria totalling 700 US gallons.

Favourite fish: Too many to mention.
coral: Hot Pink Birdsnest (*Seriatopora hystrix*).
other: Nudibranch (*Elysia diomedia*).

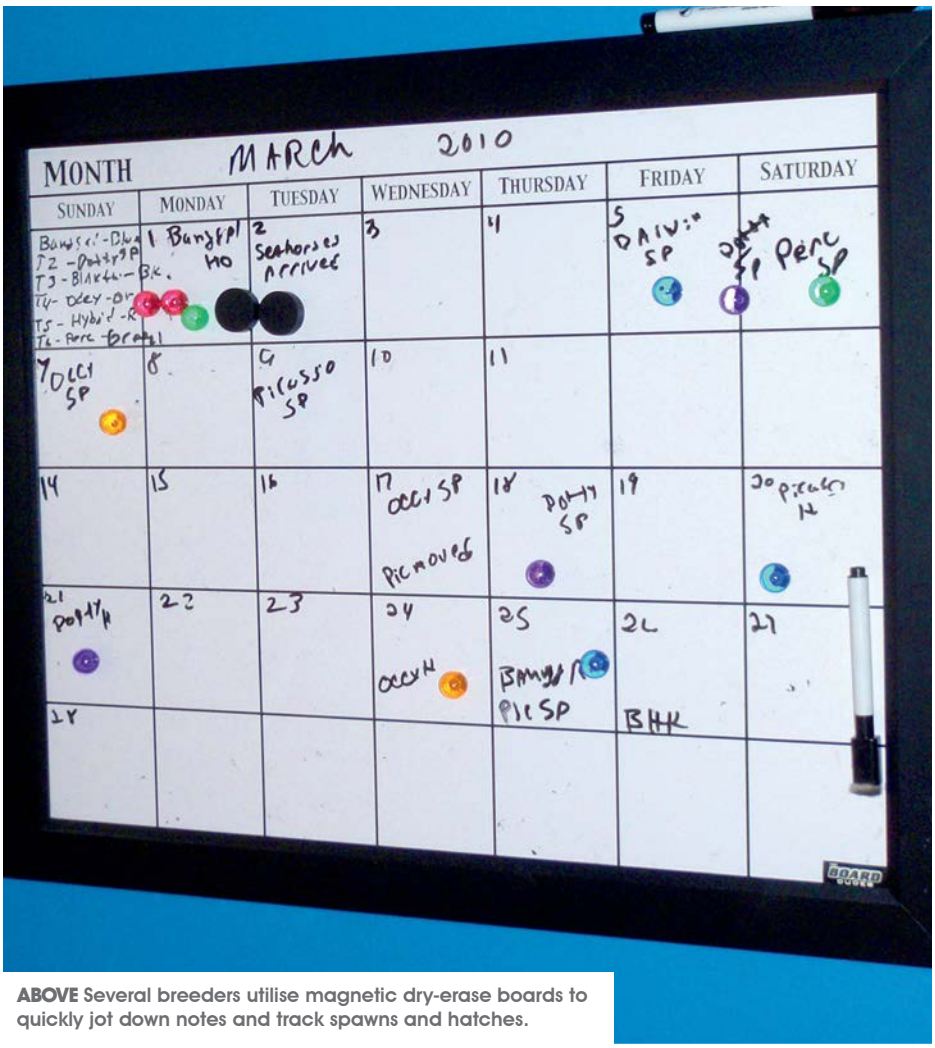
Specialist areas: Marine fish breeding.

In this final instalment, I'd like to ease up on the text and simply show you how it all comes together. At this point I've visited dozens of fish rooms, both freshwater and saltwater-oriented, and in every respect, no two were ever alike. If you're building your own fish room, the importance of visiting others cannot be underestimated – it gives you the opportunity to learn from others' mistakes, and will inspire you as well. Since a cross-country US tour of marine fish rooms is probably out of the question for most of you, this virtual tour will have to suffice as your introduction!

FISH ROOM OF TAL SWEET – FISHTAL PROPAGATIONS

I'm starting with Tal Sweet, who is the co-founder of the Marine Breeding Initiative (aka MBI – full disclosure, I am a council member myself). Tal runs Fishtal Propagations, his local captive-bred marine fish business, from a spare bedroom in his house. Tal's fish room is perhaps the best example because it is at a scale that is quite commonplace – it perhaps represents the first step beyond having a single pair of clownfish and a couple of tanks. The view of Tal's systems shown here is from 2011, and he has since expanded. The top shelf is connected to one of the sumps, and functions as a six-tank broodstock system. The middle shelf is connected to the other sump, and functions as a four-tank growout system. A separate run of four stand-alone tanks functions as a hatching/early larval-rearing setup.

Tal's primary focus is clownfish production, but he often cohabitates pairs of dottybacks and gobies with his clownfish pairs, allowing their tanks to serve multiple purposes. Tal's fish room won't produce thousands of fish every month, but it doesn't need to. Instead, Tal produces a manageable quantity of quality fish in a limited space. In 2011, Tal's functional tank space was less than 200 gallons, and if you discount the baker's rack for miscellaneous cultures and storage, he only took up one wall of the room. Not really that excessive when you consider the size of many reef tanks these days.



ABOVE Several breeders utilise magnetic dry-erase boards to quickly jot down notes and track spawns and hatches.

BELOW Tal Sweet, shown in his fish room in 2011, with the main system at left, and storage and food cultures behind him

FISH ROOM OF DAVID DURR – CLOWNFISH NORTHWEST

David Durr and I have this ongoing joke – I call him Mr Clean when it comes to his fish room. He chuckles, arguing that he only ever takes pictures of his fish room, or lets people visit, when it's clean. David's fish room is a great example of when you take your hobbyist-scale single-room business and ramp it up in a big way. Ultimately, David Durr sold his breeding business (Clownfish Northwest) when taking a big career step – let it be known that many breeders find it difficult to make a home-based fish-breeding business profitable as a full-time stand-alone entity. The ebbs and flows are too great to withstand without a second source of stable income. Note that every example fish room in this article, save the last, functioned as a business to take advantage of the cost savings and tax benefits associated with it being a business as opposed to a hobby. I've mentioned it many times – you're not going to keep the 1,000 clownfish you raise, you're going to have to find them new homes! If you are breeding fish, you are a business!

David's fish room was actually situated in a separate building on his property, allowing him to tailor the space to anticipate moisture and spills. David had room to expand vertically if he ever needed to, but he functioned well by having all his aquariums at a very workable height. David employed every nutrient reduction tool at his disposal, and also was very organised and routine in his maintenance of the room. Regardless of what David might tell you, this fish room was a clean and well-oiled machine.

ABOVE Platinum Percula Clownfish (*Amphiprion percula*), segregated from their siblings and ready for sale.

BELOW The unsorted offspring of two Picasso Clownfish; 25% wild-type, 50% Picasso, and 25% Platinum Percula.

ABOVE/BELOW David Durr's fish room, with one growout system centre, and broodstock aquariums running along the side wall at right. Below: The two main growout systems are modular duplications of each other.

FISH ROOM OF EDGAR DIAZ – ADDY-ZONE HATCHERIES

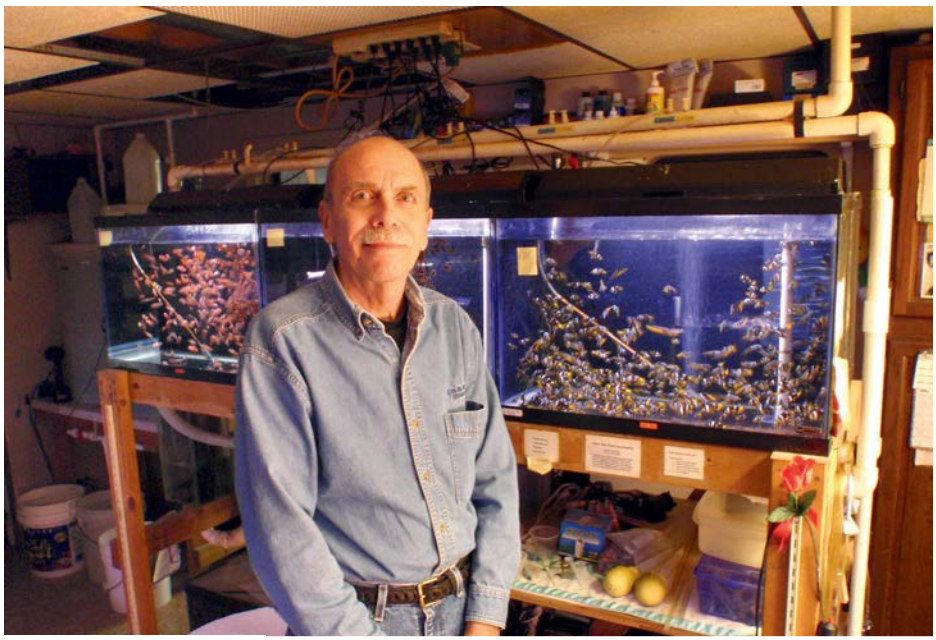
Edgar Diaz is a veteran fish breeder. Like many well-respected breeders who often stay under the radar, Edgar spent considerable time working at C-Quest Hatcheries in Puerto Rico underneath master breeder and pioneer Bill Addison. Edgar's time at C-Quest certainly helped his methodologies and sensibilities when it came to creating his own in-home breeding business, Addy-Zone Hatcheries. Edgar's systems are capable of producing thousands of clownfish each month, not to mention Edgar's other main focus, the dottybacks (*Pseudochromids*).

Edgar's larviculture and growout system, consisting of multiple rows of various black round tubs, was the most effective growout system I saw in all my tours. It was also perhaps one of the more appropriately-sized growout systems, producing oodles of quality fish. It's also worth pointing out that Edgar's system doesn't run on extremely expensive equipment. DIY biological filtration and home-made protein skimmers are every bit as effective and cut down expenses along the way. Edgar even employed the ultra-simple cinderblocks and wood stand construction method to support his aquariums; ambient room lighting gets the job done too. Egdar's fish room is super-simple and extremely effective. There's a lot to be learned from Edgar's fish room if you pay attention.

ABOVE Veteran breeder Edgar Diaz in his fish room with Jesus Diaz, the next generation of marine fish breeders.

ABOVE Juvenile Neon Dottybacks (*Pseudochromis aldabraensis*) in a 10-gallon tank, perhaps a month away from saleable size.
BELOW 100-gallon black round tubs make ideal growout containers for large quantities of clownfish.

BELOW A panoramic view of Edgar's basement fish room, where thousands of fish are produced on a regular basis. Note the simple design, and the thoughtful placement of electrical service at the ceiling.



FISH ROOM OF JOE LICHTENBERT – REEF PROPAGATIONS INC.

Joe Lichtenbert ran Reef Propagations Inc (RPI) out of his basement for 21 years. The basement was NOT that expansive, maybe only 300-400sq.ft. of space devoted to fish propagation. Despite this tiny footprint, RPI was a full-time business that provided a sizeable chunk of income for his family over the decades. Joe's fish room produced only one thing – clownfish, and 90% of those clownfish were probably *Amphiprion ocellaris*. Despite that high degree of focus, Joe's entire production was consumed by only two wholesalers and two local retailers. When you look at Joe's fish room, you are seeing decades of building and refining. Joe championed the notion of modularity – building one system, refining it, and then duplicating it only once, satisfied that you had it working properly. There was no shortage of ingenuity in Joe's fish room.

ABOVE Master breeder Joe Lichtenbert standing in front of three 20-gallon aquariums housing hundreds of juvenile Ocellaris, Maroon, and true Sebae Clownfish.

RIGHT Joe Lichtenbert's first pair of Tomato Clownfish (*Amphiprion frenatus*) was over 21 years old and still spawning regularly.

FAR RIGHT Joe's modular growout aquariums were exceptionally efficient.

BELOW Fish started their lives in a tank running off the system (left), and then were brought on the system (middle) for growout to market size

ABOVE Rod's famous pair of C-Quest Line Onyx Percula Clownfish (*Amphiprion percula*) produced fish for 14 years before the female passed on.

RIGHT Rod Buehler at home in his fish room.

BELOW Typical broodstock aquariums running as reef aquariums, with metal halide lighting, live rock, deep sand beds and anemones.

FISH ROOM OF ROD BUEHLER – ROD'S REEF

Rod Buehler is better known these days as the innovator behind Rod's Food, a line of frozen food blends that continues to grow in popularity throughout the US. Before Rod was the fish food legend, he operated a small retail aquarium shop in a rural area known as Rod's Reef, and he gained notoriety for his production of Rod's Onyx, a particular line of *Amphiprion percula Onyx* descended from the C-Quest line of Onyx Percula breeding. I was fortunate to visit this fish room before it was ultimately dismantled as the food business took up more and more of Rod's time. Rod's fish room was rather unique. His clownfish broodstock were kept in rather spacious broodstock aquariums, generally utilising deep sand beds, surge devices, live rock and live host anemones, even with full-blown metal halide lighting. This organic reef-type system contradicts most marine breeding setups, where broodstock is maintained in somewhat sparse conditions. While this approach can present problems when it comes to disease treatment, good quarantine practices for new broodstock should negate that risk, and the more natural aquariums were far more visually interesting than rows of barren tanks with only terracotta flowerpots and clownfish pairs. So the only real problem presented comes in the form of controlling organic waste for the benefit of the invertebrate life. Big skimmers, carbon dosing, and other forms of nutrient reduction could offset that concern. In a modern setup, utilising LED lighting, you might even be able to co-culture host anemones (specifically Bubble Tip Anemones, *Entacmaea quadricolor*) and other desirable invertebrates right alongside your broodstock.

ABOVE A panoramic view of the newest wing of the author's fish room; two columns of growout tanks on central filtration at left, followed by four stands of stand-alone broodstock aquariums. Note the PVC drain lines running along the base of the stands.

RIGHT A young F1 Lightning Maroon Clownfish growing up in the author's fish room.

BELOW LEFT Pedersen makes time for the sweeter side of aquarium keeping; future Atabapo Altum Angelfish broodstock (*Pterophyllum altum*) can be found tucked away in some freshwater aquariums.

BELOW RIGHT 16-gallon black round tubs are the vessels of choice for the author's larviculture system.

FISH ROOM OF MATT PEDERSEN

Ultimately, what you see in my fish room is the combination of dozens of fish rooms I've seen over the years. My systems are mainly marine, but with the expansion in 2012 I took the opportunity to shoehorn in a fair amount of freshwater capacity as well (you need to balance the salt intake!).

> The larviculture system, built in 2010, is probably the most ambitious/forward-thinking system in the room

The larviculture system, built in 2010, is probably the most ambitious/forward-thinking system in the room. Many of the freshwater aquariums run on nothing more than air-driven sponge filters, the very embodiment of simplicity. A PVC network with standpipes lines the perimeter of the fish room at the base of the fish tanks; this network leads to a floor drain which facilitates extremely easy water changes. I have yet to fully manage my water delivery, but the ultimate goal is a fish room where I have to carry no buckets for water changes – and I am close to this. As I've written before, the fish room is a perpetual DIY project. There is always another tweak or another improvement waiting to be accomplished. I will die with things left undone in my fish room!

INSTALLING THE POND

When you have a basement to play in, sometimes you get ambitious. Case in point, my 92-gallon reef tank upstairs would have filtration in the basement, but I thought it might be a good idea to place a massive reservoir of water in the basement to allow me to heavily stock the display tank upstairs. Rubbermaid Stock Tanks are commonly used here in the US as cheap reliable sumps and storage bins. The 300-gallon size (largest offered) cost me less than $300, and I drove it home on the roof of my car! Of course, I had measured a bit and presumed it would fit...

I anticipated bringing the pond in through my side door – it fit, but I quickly realised I couldn't turn it to get onto the stairs and down into the basement. I brought it through from the kitchen door on the main floor (my basement has two entrances), only to realise that part of the ceiling was too low to allow the pond down into the basement as well!

I had the idea that maybe I could bring it in from the kitchen and drop it straight down into the basement by removing the treads on the upper run of stairs. After doing some measuring, I realised I would have to remove more than just the treads.

Once the stairs were disassembled, I employed fellow breeder Mike Doty's assistance to once again bring the pond in through the ground floor of my house, and drop it from the kitchen floor into the basement.

> I had given up, and resigned myself to putting this brand new pond up for sale, when Mike noticed that the pond's lip was simply caught on part of a support beam

Of course, it wouldn't drop in, but maybe we could slide it in. The first attempt didn't go well! Desperately running out of options, we pulled the pond back up and flipped it, thinking maybe the narrower bottom of the pond would need to be at the bottom in order to allow it to slide in. Imagine my frustration when it got hung up yet again.

I had given up, and resigned myself to putting this brand new pond up for sale, when Mike noticed that the pond's lip was simply caught on part of a support beam. We moved it about 2ins off this hang-up, and the pond easily slid into the basement.

Today, the pond sits awaiting residents, while providing a massive water reservoir for the display aquarium above. Don't let setbacks in the fish room get to you – this is, after all, the ultimate DIY project! MP

Marine Habitat wants to hear your stories. Have you been successful at breeding marine fish? Do you have your very own fish room? If so, then please contact us because we would love to hear how you achieved success.

TOP TANKS

Brought to you by reef-face.co.uk

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

A SLICE OF NICE!

My name is Isaac and I am route admin on Reef Face, and this is my 7.7x2x2ft slice of coral reef. It has been running for 2 years now and is my second reef tank. The reason I chose such a large tank was to house my biggest passion, which is tangs, and as you know they need extra room. I am quite lazy when it comes to maintenance and the larger tank has less fluctuations; this is also helped by a 6ins deep sand bed in a refugium and a large aquamedic skimmer. However, I do make the occasional water change, which as you can imagine is very large.

TANK STATS

MAIN DISPLAY
W92 x H24 x D24ins
TOTAL WATER VOLUME: 1,000ltrs
SUMP: W36 x H15 x D12ins
LIGHTING Four pairs 54W ATI T5 Aquablue Speziale; two pairs 54W ATI T5 blue plus
FAVOURITE...
FISH: Longhorn Cowfish/Sohal Tang
CORAL: Frogspawn
OTHER: Red Bubble Tip Anemone

THE NOT SO GRIM REEF

My tank was started on 19th December 2010, so is nearly 2 years old. The main display tank size is 4x2x2ft with 450l. Six 54W ATI dimmable lights, Bubble Magus Calcium Reactor, Deltec MCE600 Skimmer, and one MP40 for flow. I don't run carbon or ozone, or even a phos reactor, just good old water changes. I think now that I'm close to full, so will be struggling to add to it, but as long as I can find room I will keep adding my favourite fish, which is the flame hawk. My favourite coral has to be the big Pink Hystrix. All in all, it's a simple tank that has run well so far.

TANK STATS

MAIN DISPLAY: W48 x H24 x D24ins
TOTAL WATER VOLUME: 480ltrs
LIGHTING: Four 54W ATI dimmable
FAVOURITE...
FISH: Flame Hawk Fish
CORAL: Acropora Nana
OTHER: Potters Wrasse

JUST A PURE REEF ADDICT

Hi, my name's Mark (aka reefaddict), and this is my Godiva Premier 2ft cube. It's been running since the middle of May 2011, when I was forced to downgrade from a 5x2x2 SPS reef tank. I run a chiller, which is outside and wired up to a TC10 temperature controller. 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.

TANK STATS

MAIN DISPLAY SIZE:
W24 x H24 x D24ins
MAIN DISPLAY VOLUME: 220L
SUMP SIZE: W20 x H15 x D18ins
SUMP VOLUME: 60L
LIGHTING:
Six 24W ATI Dimmable
FAVOURITE....
FISH: Peacock Leopard Wrasse
CORAL: Acans
OTHER: Red Bubble Tipped Anemone

Well done to the winner, who receives 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. Cockfields' 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.

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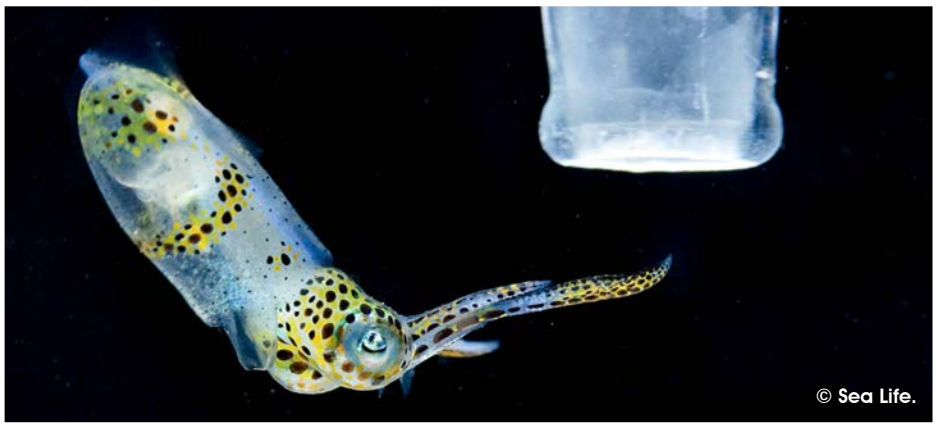
NEWS ROUND-UP

NEWS FROM AROUND THE WORLD THAT MATTERS TO YOU


© Sea Life.

BIGFINS FROM SMALL BEGINNINGS

Japanese Bigfin Reef Squid are being reared at a British aquarium for the first time.

Squid are the most difficult members of the cephalopod family to rear in captivity, but marine experts at the Sea Life displays development facility in Weymouth look set to succeed.

Aquarist Greg Casten hatched nearly 200 from eggs collected in the seas off Japan, and has managed to grow 35 of them from just a couple of millimetres 5 weeks ago, to around three 3cm.

"There is a long way to go and we will undoubtedly lose a few more yet," said Greg, "but with 35 having made it through the delicate first few weeks, the chances are good that we'll get some through to maturity."

Already having notched up rare breeding successes with mud octopuses and flamboyant cuttlefish, Greg's biggest challenge with the squid has been their tendency to eat each other.

"They flourish best in small groups, but are also notorious cannibals, so I have to monitor them carefully and separate any that fail to grow as quick as the rest," he said.

He has also had to source food – mainly plankton and tiny shrimps – in steadily increasing sizes to keep his tiny charges healthy and well-fed.

Adult bigfins – so called because their fins encircle their whole bodies – reach up to 33-cm, and are fished in vast quantities for the Asian food market.

They have the fastest recorded growth rate of any marine invertebrate, weighing as much as 600g (1.3lb) after just four months.

The Weymouth project, for which a special new breeding unit had to be built to enable very close control of lighting, and the quality, temperature and flow of water, is – like the squid – still in its infancy.

"Our goal is to complete the life cycle," said Greg, "to rear enough adults to produce more eggs, and then rear a second generation.

All this will be done behind the scenes in quarantine tanks, with water flow systems that prevent the squid touching the sides and potentially damaging their very delicate bodies.

The next stage will then be to develop suitable clear-acrylic tanks for them, which will ultimately enable us to display these amazing creatures in our global network of Sea Life aquariums."

That is a desirable goal because of the incredible light show that bigfin squid can put on almost from birth.

"Few creatures can rival them for inspiring wonder and fascination in the marine world, and that leads on naturally to concern for marine welfare and support for conservation efforts," Greg added.

> They flourish best in small groups, but are also notorious cannibals, so I have to monitor them carefully and separate any that fail to grow as quick as the rest

Like octopuses and cuttlefish, bigfin squid have millions of ink-sacs embedded in their skin and control the release of different colours from these to produce amazing shimmering colour patterns.

"It is even more dramatic in squid though," said Greg, "and bigfins are also thought to have reflective cells that mean they can turn green in green light, blue in blue, and so on, to render themselves almost invisible."

If Greg's nursery performs as he hopes it will, bigfin squid could be dazzling visitors to Sea Life's 40-plus aquariums around the world within 2 years.

Written by Mark Oakley, SEA LIFE.

CSIRO SENSOR DETECTS BOMBS ON SEA FLOOR

CSIRO has developed a sensor to detect undetonated explosives on the sea floor. It was developed as part of a project with the US government agency, the Strategic Environmental Research and Development Program (SERDP) and US-based research organisation Sky Research.

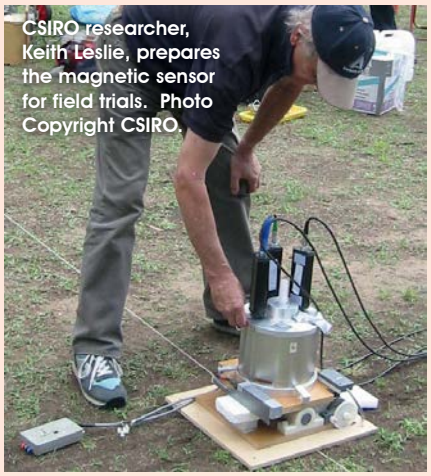
The method for finding undetonated underwater explosives is very similar to that used to detect underground mineral deposits. CSIRO electrical engineer Dr Keith Leslie stated, "Our highly sensitive sensor – the high temperature superconducting tensor gradiometer – delivers significantly more information about the target's magnetic field than conventional sensors used for this type of detection," he said. "It provides data on the location, characterisation and magnetic qualities of a target – whether it is a gold deposit or an explosive.

Our sensor has a critical advantage for small targets such as undetonated explosives," he added.

Over 10 million acres of coastal waters are contaminated by undetonated explosives, according to SERDP. Typically these small explosives rust and corrode at sea, making them even more dangerous.

Eventually the technology may renew exploration efforts at abandoned sites where drilling programmes were based on insufficient or inaccurate information. It also has the potential to help clear landmines.

For more information, please visit: www.csiro.au


CSIRO researcher, Keith Leslie, prepares the magnetic sensor for field trials. Photo Copyright CSIRO.

EXTREMELY RARE WHALES FOUND ALIVE

A couple of rare whales that marine experts thought might have become extinct have washed up on a beach in New Zealand.

The Spade-toothed Beaked Whale (*Mesoplodon traversii*) had previously only been identified from old bones – this is the first time they have been discovered whole. DNA analysis proved that the mother and calf were not the more common Gray's beaked whales

Experts are unsure as to why these whales haven't been sighted before. It could be that they live and die in the deep ocean waters surrounding New Zealand.

Sadly, the whales died soon after they were discovered.

CORAL-REPAIRING ROBOTS

A team headed by lead researcher Lea-Anne Henry, from Scotland's Heriot-watt University, is hoping to help rejuvenate the cold-water coral reefs in the Atlantic Ocean, just off the west coast of Scotland.

Coral reefs are very beautiful, but they are also very fragile, and easily damaged by human activities such as destructive fishing practices, as well as pollution and climate change. Natural regeneration takes many years, however, it is hoped that coral repair will be conducted more efficiently by the robots at depths that humans find difficult to work in.

The robots will be approximately 1m long, with image processing software, and tools to help reconnect broken coral fragments, this helping them to regrow. They will also exhibit swarming behaviour, working together to accomplish complex tasks, much like ants or bees.

For more information, please visit: http://www.hw.ac.uk/news-events/news/coral-reefs.htm

> it is hoped that coral repair will be conducted more efficiently by the robots at depths that humans find difficult to work in

Fragments of Hope Coral Nursery (Photo © Lisa Carne).

Deep-sea coral reef off western Scotland 'Changing Oceans Expedition.' (© JC073).

BONDI BEACH CLOSED BY RED ALGAE BLOOM

Sydney's Bondi Beach has been temporarily closed to swimmers due a rare occurrence called a red algae bloom. Nearby Clovelly Beach was also closed whilst authorities carried out tests. Swimmers were advised to keep away from the red algae *Noctiluca scintillans*, commonly known as Sea Sparkle, to prevent possible harmful reactions. High concentrations of their plankton food source are implicated in algae blooms, also known as 'red tides'. Whilst *N. scintillans* doesn't appear to be toxic, the plankton it eats contributes to high levels of ammonia accumulating and being excreted to the surrounding area, which can cause skin irritation.

Not all *N. scintillans* blooms are red; the colours depend partly on internal pigments. Swimmers have also reported being illuminated by a ghostly glow in the dark bloom, which sparkles with bioluminescence when disturbed. This has given *N. scintillans* popular names such as Sea Ghost and Fire of the Sea.

NEWS IN BRIEF

SUPPORTING OCEAN 2012

A network of Wildlife Trusts have recently signed up to support Ocean 2012. This alliance of non-government organisations aim to ensure that the 2012 reform of the EU Common Fisheries Policy stops overfishing, ends destructive fishing practices, and delivers fair and equitable use of healthy fish stocks.

For more information, please visit: http://ocean2012.eu

SUPPORTERS HELP STOP TURBINE THREAT TO ORCAS

Members of the Whale and Dolphin Conservation Society (WDCS) have helped stop the construction of tidal sea turbines in the waters just off Vancouver Island, Canada. A massive number of complaints were made by WDCS supporters and other members of the public, who publicly protested against the construction application. The turbines would have caused severe injury or death to any dolphin or whale that swam into one of these devices, including orcas from the WDCS Adaption Programme, as well as placing the orcas at risk from high levels of underwater noise.

MARINE PROTECTION IN SCOTLAND COULD BE WORTH £10 BILLION

The Scottish government will put forward proposals for a network of Marine Protected Areas (MPAs). The Whale and Dolphin Conservation Society (WDCS) have campaigned for whales and dolphins to be included in the protected species list in these areas; to date 30,000 people have signed their petition. A commissioned report from Scottish Environment Link, a group that includes WDCS, has suggested that the creation of these MPAs could be worth as much as £10 billion in economic benefits. The report has suggested that the MPAs could help boost fisheries and tourism, creating revenue and valuable jobs.

To sign the petition for whales and dolphins to be included in the MPAs, please visit: http://www.wdcs.org/protect/critical_habitat/mpascotland.php

THE SUPER SCOOPERS!

The Jawfishes

Scott Michael takes a look at one of the most comical-looking tank characters, a fascinating aquarium fish that provides aquarists with hours of enjoyment.

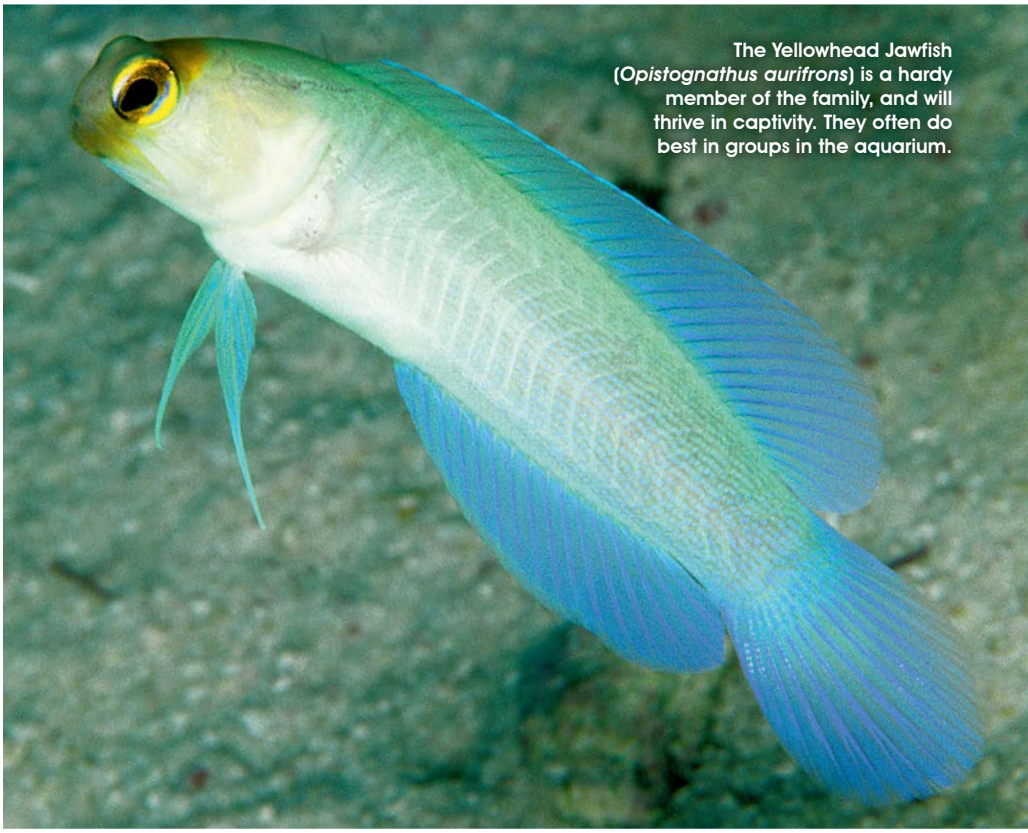
There are many species on or near the reef that exploit interesting habitats and exhibit fascinating behaviours in order to survive. The sand patches, flats and slopes that are adjacent to the coralline labyrinth are home to some fishes that either live in association with invertebrates that construct burrows in which to live, or build their own subterranean domiciles. One such group is members of the family *Opistognathidae* – known popularly as the jawfishes. These comical-looking fishes are a delight to observe; they dig burrows in the substrate and display at conspecifics or fishes that invade their territories. They also engage in a unique reproductive strategy, incubating their oversized eggs in their mouths. As far as marine aquarists are concerned, all the jawfishes are fascinating aquarium inhabitants that provide aquarists with hours of enjoyment, and all of them are relatively hardy if a few simple requirements are met. For this reason they are a favourite with aquarists who are looking for something a little different.

CLASSIFICATION AND BIOLOGY

The family *Opistognathidae* is comprised 85 described species in three genera, but many still await formal description. These fishes have elongated bodies, large blunt heads, big mouths, and they usually have large protruding eyes. The dorsal fin is long and continuous. The behemoth of the family is the Giant Jawfish (*Opistognathus rhomaleus*), which attains a maximum length of 51cm. Most of the jawfishes belong to the genus *Opistognathus*. The two other genera are *Lonchopisthus* and *Stalix*.

The jawfishes occur at depths of less than 0.3-375m. They are found on sand or sand/rubble flats and slopes near rocky and coral reefs. Many jawfishes occur in shallow back reefs or on outer reef slopes. They seem to have a preference for less turbulent areas (i.e. habitats that lack surge), which could destroy their burrows. However, there are some species that inhabit areas prone to strong currents. While many jawfishes occur in relatively shallow water, there are some species that are limited in distribution to greater depths. For example, in the tropical western Atlantic, the Yellowmouth Jawfish (*Opistognathus melachasme*) is found at a depth range of 146-275m.

One of the most interesting jawfish characteristics is their burrowing behaviour. All the jawfishes studied thus far dig burrows in mud, sand, or sand/rubble bottoms. They create an initial depression in the substrate by thrusting their tail into the substrate and rapidly undulating it. Then they turn, take substrate in their mouth, and spit it out of the depression. They continue this process of tail wagging and mouth scooping until they have created a burrow that they can retreat into if threatened. Even the smaller jawfish species have been known to dig burrows as deep as 50cm. At night, some of the jawfishes pull a shell or rubble over the entrance



The Yellowhead Jawfish (*Opistognathus aurifrons*) is a hardy member of the family, and will thrive in captivity. They often do best in groups in the aquarium.

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.

In all members of the jawfish family, the male orally incubates the eggs until they hatch. Here a male Yellowhead Jawfish (*Opistognathus aurifrons*) spits out and sucks the egg mass back into its mouth.

TABLE 1: A comparison of the social organisation of some western Atlantic jawfishes (modified from Hess, 1993).

Species	Density (fish per 100m square)	First nearest neighbour (m)	Second nearest neighbour (m)	Spatial pattern	Site fidelity
Yellowhead Jawfish (*O. aurifrons*)	29-56	0.46-0.52	1.11-1.59	Heterosexual pairs	High
Mottled Jawfish (*O. micrognathus*)	4.4-9.7	1.94-4.14	4.60-5.79	Heterosexual pairs to over dispersed	High
Banded Jawfish (*O. maxillosus*)	0.11-1.65	2.24-4.45	12.72-25.74	Heterosexual pairs	High
Dusky Jawfish (*O. whitehursti*)	6.5	1.34	2.39	Clumped	High

of their burrow to create a lid to seal it.

Jawfishes fall into one of two food habit categories. Some of the jawfishes feed on zooplankton; these species hover in the water column above the burrow and pick off individual planktons as they float past. The second group of jawfishes ambush larger prey (e.g. crustaceans and small fishes) that move by their burrows during the day. These species do not hang above the burrow, but usually reside just inside the entrance, with just the top of the head sticking out. Most are cryptically coloured, thus the head is very difficult to see when poised at the burrow entry. This makes them less detectable to potential prey and predators. At least one species of these ambushing jawfishes hunts motile invertebrates after dark.

Another interesting behavioural characteristic exhibited by the *Opistognathids* is that males orally incubate the eggs. After the eggs are laid by the female and fertilized, the male picks them up in his mouth. Although he holds them in the mouth most of the time, he may occasionally set them down in the burrow for short periods. As you might expect, food consumption rates fall considerably during the reproductive period. With the Yellowhead Jawfish (*Opistognathus aurifrons*), food consumption rates decrease by 86% when the male is incubating the eggs. In this species, and possibly others, males never feed when they have eggs in their mouth. The male spits the eggs out of his mouth and then quickly sucks them back in (this is sometimes referred to as churning behaviour). By doing this, he effectively aerates the eggs and helps rid the egg mass of waste products. It has been documented that those species that have smaller clutch sizes relative to the size of the mouth develop more rapidly than those that have a clutch that completely fills the mouth. In most cases, a male will have eggs that are all the same age, which indicates that they rarely take clutches from more than one female at a time. However, on rare occasions, a male may have eggs in two different stages of development. The mortality rate of clutches is apparently very low.

> The male spits the eggs out of his mouth and then quickly sucks them back in

CAPTIVE CARE

Members of the jawfish family can make comical, as well as fascinating aquarium inhabitants. Most are relatively easy to keep, as long as several key requirements are met. The more diminutive forms can be kept in tanks as small as 38 or 76 litres. In jawfishes, a higher tank is often preferred over a lower aquarium with an equivalent footprint. This is especially true for those species that hover in the water column above

While not common in the aquarium trade, the Swordtail Jawfish (*Lonchopisthus micrognathus*) is a handsome species that will do well in an aquarium where it is not bullied, and which has a deep sand bed.

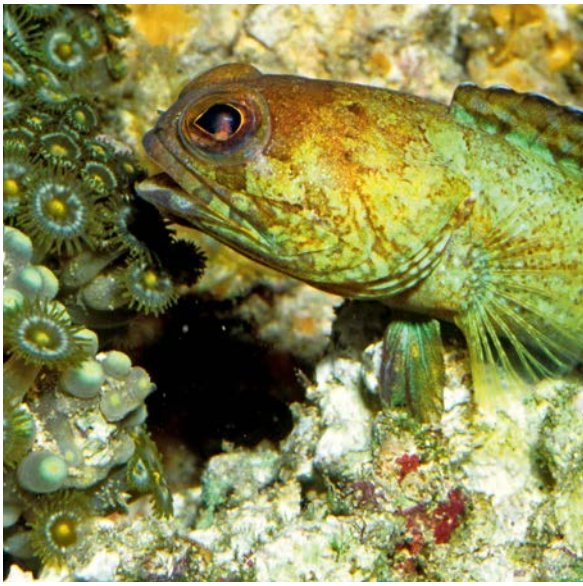
their hole. The larger species, which are rarer in the trade, require more substantial accommodations (e.g. 513 litres). All the jawfishes do great in reef aquariums as long as the husbandry conditions are met.

One of the keys to successful jawfish husbandry is to select the right kind and the right amount of bottom substrate. Because these fishes are industrious diggers, it is important to give them appropriate building supplies. In most species, this means a heterogeneous blend of coral sand, bits of rubble, shells, or bits of shells, etc. With this mix of materials they can create more stable burrows. It is also important that the layer of substrate is deep enough to allow them to create a usable burrow that they feel secure in. Of course, the depth depends on the maximum length of the species or individual in question. However, for most of the smaller aquarium species, at least 10cm (4ins) of substrate should suffice. It is also a good idea to put some flat pieces of live rock on the substrate. Jawfishes often dig under rocks, using them as a roof for their burrow chamber. Be aware that the larger species are prodigious diggers that can topple unstable rockwork. Therefore, if you can, put rockwork right on the bottom of the tank (e.g. the plenum, glass bottom) and surround it with the sand. In this way it will be more difficult for an industrious jawfish to dig under it and cause it to fall. If you keep more than one jawfish of a particular species in the same tank, they may steal building materials from one another.

> Because these fishes are industrious diggers, it is important to give them appropriate building supplies

In a jawfish aquarium, it also makes sense to have plenty of open sand bottom. If the live rock or faux corals extend from the back of the tank to the front, it gives the jawfish very little room to do its excavating. Some public aquariums place colonies of jawfish

Jawfishes use their mouths to dig burrows and relocate chunks of debris, which they use to reinforce the burrow entrances.



There is a group of more drab-coloured jawfishes from the tropical Western Atlantic that get larger and are a threat to small fishes and crustaceans. This is the Spotfin Jawfish (*Opistognathus robinsi*).

in a tank with a thick sand bed and no other décor – this makes for a fantastic display.

The leading cause of captive jawfish death is leaping from the aquarium; they seem to have an uncanny ability to find small holes in the aquarium cover from which to propel themselves! Most jawfishes perish within the first 24 hours of being placed in the aquarium because of this suicidal practice. If the lights go off in the aquarium before the jawfish has found a suitable place to shelter, it is likely to jump. This makes sense in light of their natural behaviour. Most of the jawfishes take refuge in their burrows at night, and may even seal the entrance. When placed in a tank and the lights are turned off before they have a chance to find a place to refuge, these excitable fishes are easily startled by any sudden movements. Even the sudden change in light levels, when the lights are extinguished, can catalyze a jumping spree. Therefore it is best to let them find some shelter under a piece of rock, or allow them to build a burrow before you turn off the lights (this may mean leaving the lights on for 24 hours). Even if a jawfish looks cozy in a temporary hiding place when the lights go out, many individuals come out of hiding and try to create a burrow during the night; these are also prone to jumping if startled. A small night light over the tank may help reduce the risk of jumping. Another time when jawfishes are likely to bail out of an aquarium is when they are being harassed by their tank mates.

The Variable Jawfish (*Opistognathus variabilis*) exhibits a number of colour varieties, including this greenish type and a golden form.

The best way to prevent suicidal jumping is to place some kind of cover over the tank. If you're worried that a glass cover may interfere with gas exchange at the water's surface, then use fibreglass mesh, egg crate, and your ingenuity to create a barrier to prevent jawfish jumping. PVC pipe can be used to create a frame to which monofilament line can be attached. The line is tied around opposite ends, about 1.5 to 2.5cm apart, to create a monofilament grid. Once again, be aware that they will leap from relatively small holes in the aquarium top, so make sure they are sealed accordingly.

Jawfishes should be provided with a varied carnivore diet. Frozen foods, such as prepared mixtures, mysid shrimps, vitamin-enriched brine shrimp, and sea foods (chopped to a suitable size for the species in question) are great staple foods for jawfishes. Many species also eat flake food. Some jawfishes only ingest food when it is moving through the water column or along the substrate. Once the food lands on the bottom, they may ignore it. For this reason, it is a good idea to have scavengers in a tank that contains only jawfishes. Shrimps, small hermit crabs, serpent stars, and benthic fishes that feed from the bottom will fill the scavenger role. (Remember, some of the larger jawfishes may eat crustaceans!)

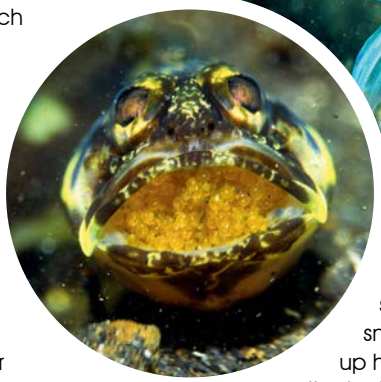
Fortunately, jawfishes are fairly disease-resistant, although there are reports of this species suffering from goiter problems. The Yellowhead Jawfish (*Opistognathus aurifrons*) regularly suffers from tail rot (the caudal fin turns red and begins to erode). This may be brought on by improper capture techniques, or from using large, sharp substrate in the jawfish aquarium. They have also been known to succumb to dinoflagellate and protozoan infections.

It is important to keep jawfishes (at least the smaller varieties) with more passive fish species. This is especially the case

The most spectacular member of the family, the Blue-spotted Jawfish (*Opistognathus rosenblatti*) is a species that will fight with members of its own kind, and thus is best kept on its own.

RIGHT The recently described Goldspecs Jawfish (*Opistognathus randalli*) is regularly imported from Indonesia.

BELOW INSET Jawfish in the genus Stalix are not often seen in the aquarium trade. The individual in this photo is a male of an undescribed species that is holding an egg mass.



if you are keeping them in a smaller tank. Aquarium bad boys (such as dottybacks), some of the pygmy angelfishes, larger sand perches, triggerfishes, etc. will pester jawfish, causing them to cower in the upper corners of the tank, or hide under décor all the time. Small groupers, dottybacks, grammas, and larger shrimp gobies may evict jawfishes from their burrows. When bullied, jawfishes refuse to feed and are more prone to leaping out of the aquarium (if possible). Eels, frogfishes, groupers, and snappers are jawfish predators, and thus should not be housed with them. Large Sleeper Gobies (*Valenciennea spp.*), which are also industrious diggers, have been known to inadvertently destroy jawfish burrows.

There is some variation when it comes to jawfish aggression. Some of the jawfishes do very well in colonies. These species will live in harmony, unless crowded to the point where there is not enough space for all individuals. In the latter case, the most subordinate (usually the smallest) individuals end up hiding in the corners of the tank. There are species that are very aggressive towards one another. For example, the Bluespotted Jawfish (*Opistognathus rosenblatti*) is a more aggressive species. Unless you can acquire a pair of these lovely fish, or have a tank with an incredible surface area (e.g. a standard 684 litres), you should only keep one per tank. Jawfishes are rarely aggressive toward heterospecifics (except possibly for other jawfish species), unless they try to enter their burrows. Even then, there are some species that allow other fishes to cohabit their burrows (see the Yellowhead Jawfish species account for more on this). They will display at intruders and push them from their homes with their open mouths. Some species also spit sand at interlopers!

Jawfishes will spawn in the aquarium; in fact, if a pair is acquired, both the Yellowhead (*O. aurifrons*) and Dusky Jawfish (*O. whitehursti*) do so with great regularity.

In conclusion, the jawfishes are some of the most interesting fishes available to home aquarists. Although not all of them are stunning in appearance, their behaviour goes a long way to making up for their lack of colourful hues. Another jawfish benefit is that they are relatively easy to keep – just make sure they don't jump out of their aquarium home, provide them with adequate digging materials, and keep them with fish that won't pick on them. SM

WORDSEARCH

£150 WORTH OF PRIZES! - 10 WINNERS!

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S	X	O	M	L	S	A	L	T	W	A	T	E	R	F
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FIND THE WORDS

~~Clownfish~~	GearGuide	**Save our reefs**
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Coral	Hobby	**Support LFS**

ABOUT THE PRIZE

Although this product is not technically tank-related, it's very cool all the same and will definitely spark conversation amongst friends when you pull it out of the cupboard. If they are fishy friends, they WILL want one! This product has been recently released for sale by Fish Junkies and can be purchased online from www.fjshop.co.uk.

WHAT YOU WIN

This time round, Marine Habitat magazine is offering wordsearch entrants the chance to win one of ten prizes, each consisting of a funky clownfish mug and matching egg cup.

To win this fantastic prize, photocopy and complete the page and post it to us:

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What did you like most about that issue?

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.

DUBROVNIK SEA AQUARIUM

Croatia, famous for its beers, culture and medieval cities, but how does its public aquariums fair up? **Iggy Tavares** talks about his little trip to the unusually captivating Durbrovnik Sea Aquarium.

A conference in May 2012 took me to the beautiful old city of Dubrovnik, often called the Pearl of the Adriatic. Old Dubrovnik on the Dalmatian coast in Croatia is surrounded by medieval walls and fortifications that were built between the 8th and the 16th century. The 2-kilometre walk on the top of the walls with its five bastions, three round towers, and 12 square towers offers some amazing vistas over the Adriatic Sea and the surrounding countryside. The Dubrovnik Sea Aquarium, situated in a corner in the Old Port area, within the walls of the medieval fortress, was founded in 1953, but is now part of the Institute for Marine and Coastal Research, University of Dubrovnik, which also runs a full marine research programme.

Today, Dubrovnik aquarium shows off the abundant and diverse fish and invertebrates of the Adriatic Sea in 29 aquariums or ponds of various sizes.

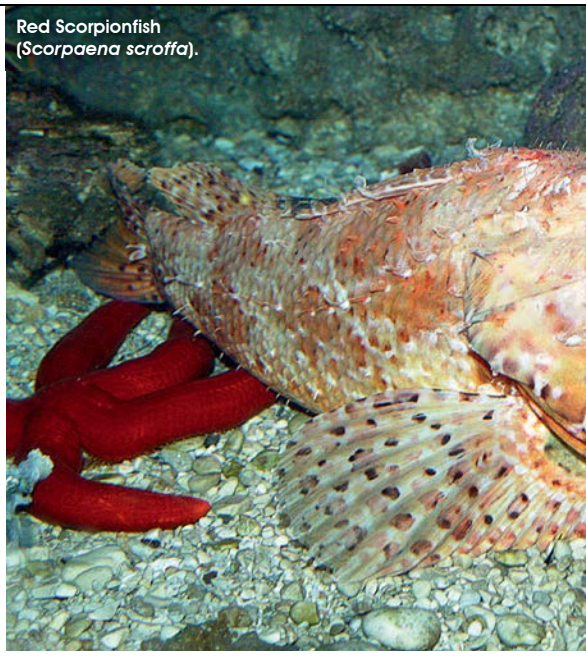
Dubrovnik Sea Aquarium entrance.

The medieval fortress, with very high ceilings, offers the aquarium cavernous accommodation and provides a tranquil atmosphere, which is in semi-darkness. The foyer to the Dubrovnik aquarium has three medium and two large aquariums built into the walls, and also, surprisingly, three ponds dug in the stone-paved floor.

During my visit, a shoal of large, rather active Amberjacks (*Seriola dumerili*) constantly circled around their pond (22.5 cubic metres), offering a different perspective of large fish, while a friendly Dusky Grouper (*Epinephelus marginatus*) was in the adjoining pond (6.5 cubic metres). The largest long pond (50 cubic metres) held a small, healthy looking, active Loggerhead Turtle (*Caretta caretta*), which was accidentally caught by a fisherman. It seemed to have settled down to life in captivity and was indifferent to the visitors.

I was captivated by several large intelligent-looking Grey Triggerfish (*Balistes carolinensis*) that were standing to attention and following my every move in the first medium-sized aquarium (770 litres) in the foyer. Triggers of this size are now apparently fairly rare in the Adriatic Sea, with smaller-sized specimens more likely to be encountered. The first large aquarium (6 cubic metres) is home to a pack of large unattractive black Conger Eels (Conger conger), some of which were free-swimming, while others packed themselves into long pipes, taking refuge during the day and coming out in the darkness of the night. The second large tank contained some free-swimming silver-coloured

Dubrovnik Sea Aquarium main hall right side.



Red Scorpionfish (*Scorpaena scroffa*).

Large friendly sea fish in ponds.

Common Dentex (*Dentex vulgaris*), which in the wild sometimes reach a metre in length and 14kg in weight, making them valuable food fish.

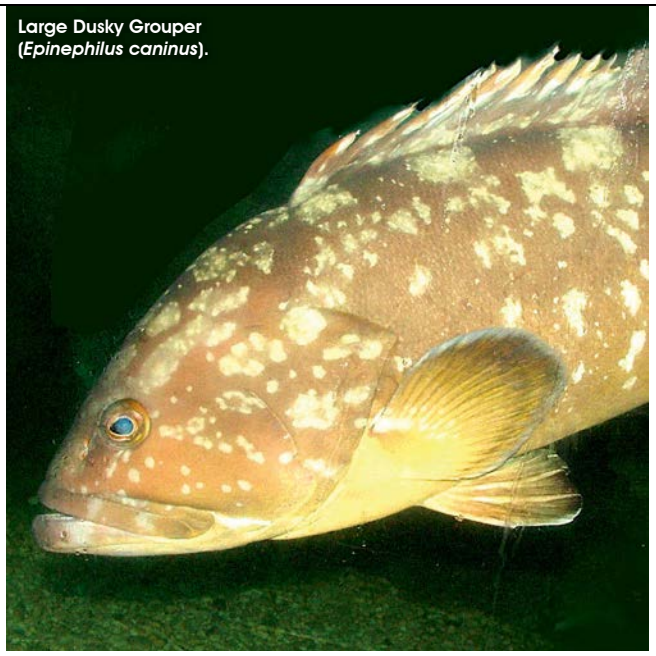
Along the left-hand side of the main hall is a bank of medium tanks (770 litres) embedded in the walls, all individually landscaped to suit the fish and invertebrates that they house. Quite a large Common Octopus (*Octopus vulgaris*) was resting in the corner almost out of sight, with just its tentacles pressed on the glass visible, but the inquisitive creature quickly came out to investigate me. One of my favourite tanks was planted with Posidonia Seagrass (*Posidonia oceanica*) and held several species of colourful wrasses in a crowded but very interesting setup. These include Green Wrasse (*Labrus turdus*), Brown Wrasse (*Labrus merula*) and Peacock Wrasse (*Symphodus tinca*), whose principal food in the wild includes sea-urchins, molluscs and crabs. There was quite a lot of action here, with the occasional jockeying for territory, making for an interesting spectacle. This tank also contained several small Saddled Bream (*Oblada melanura*) and two Banded Seabream (*Diplodus vulgaris*) that were more subdued in colour but not in activity.

> The first medium-sized tank contained a collection of strange-looking Locust Lobsters, which is a highly regarded delicacy in Europe, but is now rarely found because of over-fishing

The large tank in this bank contained a shoal of large slow-swimming grey-coloured Meagre (*Argyrosomus regius*) that are an important fishing resource, but the display was brought to life by several colourful Tub Gurnard (*Trigla lucerna*) with their large colourful pectoral fins. A couple of small stingrays, a common Eagle Ray (*Myliobatis aquila*) and Marbled Electric Ray (*Torpedo marmorata*), as well as a Cat Shark (*Scyliorhinus canicula*) added further interest and helped to brighten up this display.

On the right-hand side, at the entrance of the main hall, a small tank containing a few Seahorses (*Hippocampus hippocampus*) is worth a mention; the seahorse is the logo of the Dubrovnik Sea Aquarium. The first medium-sized tank (770 litres) contained a collection of strange-looking Locust Lobsters (*Scyllarides latus*), which is a highly regarded delicacy in Europe, but is now rarely found because of over-fishing. In another aquarium were Annular Seabream (*Diplodus annularis*) and golden-striped Salema (*Sarpa salpa*), which can trigger hallucinations in humans when eaten. Here a large number of Red Scorpionfish (*Scorpaena scroffa*), as well as Black Scorpionfish (*Scorpaena porcus*) were lying largely inactive at the front of the aquarium; they are largely nocturnal hunters.

The bank of seven well-spaced large aquariums (6 cubic metres) built into the wall hold a nice selection of large fish from the surrounding seas. A big group of handsome-looking 60cm-long Gilthead Seabream (*Sparus aurata*) were constantly on the move in the first large



Large Dusky Grouper (*Epinephilus caninus*).

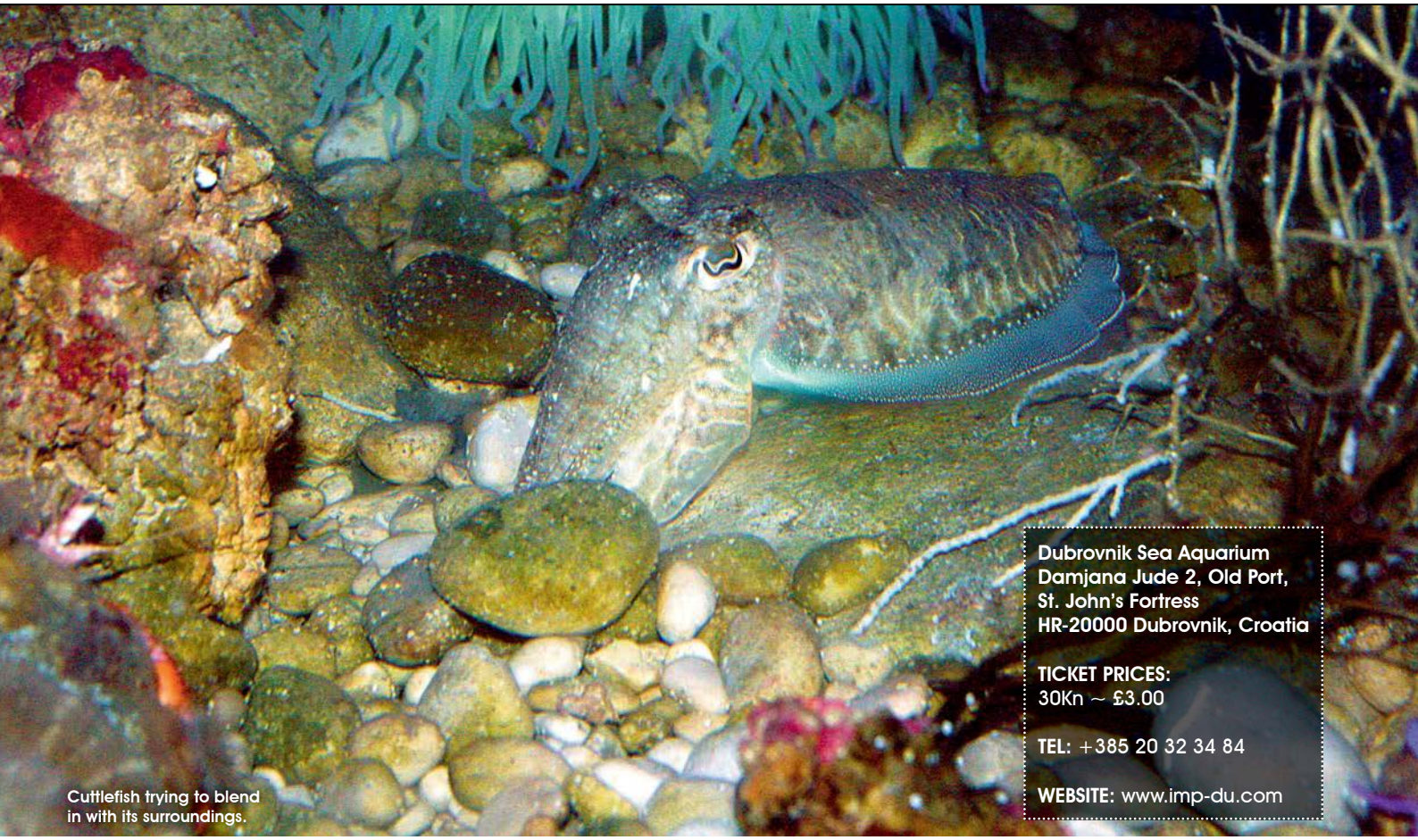
Large octopus keeping an eye on me.

Loggerhead turtle in large pond.

Mediterranean Locust Lobster (*Scyllarides latus*).

aquarium. Bream are on the menu of many Dubrovnik restaurants, but these were just 20-30cm in size. The European Eel (*Anguilla anguilla*) display had over a dozen metre-long thin black eels, some of which seemed to enjoy hanging in the water, while others were happy to just lie on the gravel. Grey Mullet (*Liza aurata*) also occupied the midwater of this display. In the next display, the half dozen or so more colourful Mediterranean Moray Eels (*Muraena helena*) behaved differently from the European eels, preferring to conceal their patterned bodies among the rocky caves with just their larger bulbous heads, gulping water, hanging out.

At the back of the hall, a shoal of Sharp Snout Seabream (*Diplodus puntazzo*) and Black Seabream (*Spondyliosoma cantharus*) occupied the next large aquarium, followed by a shoal of Sea Bass (*Dicentrarchus labrax*) in the adjoining aquarium, both species being netted for the table from the surrounding seas. Several impressively sized Dusky Grouper (*Epinephelus marginatus*) and the more colourful Goldblotch Grouper (*Epinephelus costae*), occupied the next tank, some of which sat in vertical positions watching the visitors before slowly swimming around. The last large tank, which had several colourful species of corals (*Paramuricea sp.*), was also home to some large Spiny Lobsters (*Palinurus elephas*), while in the waters above some fully-grown pink anthias swam around the middle waters. Smaller tanks at the aquarium hold a cuttlefish, which was trying to blend in with its surroundings, as well as several Mediterranean Damselfish (*Chromis chromis*), Brown Comber (*Serranus hepatus*) and small Ornate Wrasse



Cuttlefish trying to blend in with its surroundings.

Dubrovnik Sea Aquarium
Damjana Jude 2, Old Port,
St. John's Fortress
HR-20000 Dubrovnik, Croatia

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(*Talassoma pavo*), along with other fish that are commonly found in the water along the rocky shores around Dubrovnik.

BEHIND THE SCENES

The aquarium displays at Dubrovnik Aquarium are dimly lit, which helps to keep the sea creatures comfortable, but there is enough light to see the fish and other creatures in the tank. Additionally, wall plaques lit by small bulbs have an image of each fish in the aquariums, giving details of their maximum size, as well as the usual size encountered around the shores. Further information includes feeding habits and depths where the fish are encountered, allowing interested visitors to identify the species in each tank.

Small Ornate Wrasse (*Talassoma pavo*).

Brown Comber (*Serranus hepatus*).

The secret to Dubrovnik Aquarium's success in maintaining these large fish in a healthy active state is the use of large volumes of fresh seawater that circulates through each tank. Seawater from several hundred metres away from the sea wall is pumped into a gravitational tank (160 cubic metres) that feeds a bio-filter (200 x 200 x 100cm; 4 cubic metres) filled with crushed oyster shells mixed with large surface plastic bioballs. The purified seawater is then fed to each fish tank or pond. Some 400 cubic metres of seawater flows through the tanks in the aquarium each day, giving the equivalent of at least six-tank volume exchanges a day in all the tanks. Hence, waste products and nitrogenous metabolites are constantly being flushed out and are kept to a very minimum.

All the large fish and turtle are fed with sardines, anchovies, or similar small fish. In the winter, when temperatures are cooler and metabolism is lower, the turtle is only fed once a week, while the large fish are fed twice a week. In summer, the feeding is increased to three times a week. Smaller fish receive the same feeding regimes with smaller chopped-up pieces of fish. The temperature in the aquariums are very close to the ambient temperature of the outside seawater, with a slight lag due to the retaining tank, which is situated behind the several metres of stone walls. In the winter, the lowest temperature is around 13°C, but in summer this can rise to 25°C.

CONCLUSION

Dubrovnik Sea Aquarium is not glitzy like many of the modern public aquariums we now see in the UK and Europe. It is old school with comparatively small tanks, and relies on a continuous flow of fresh seawater pumped from the crystal-clear surrounding sea to keep all its inhabitants (including a loggerhead turtle) in good health. This aquarium is rather interesting, where many small and large specimens of the fishes of the Adriatic Sea can be seen, many of which are eaten by man. I thought that Dubrovnik Sea Aquarium, with its special cathedral-like setting, was well worthwhile visiting. **IT**

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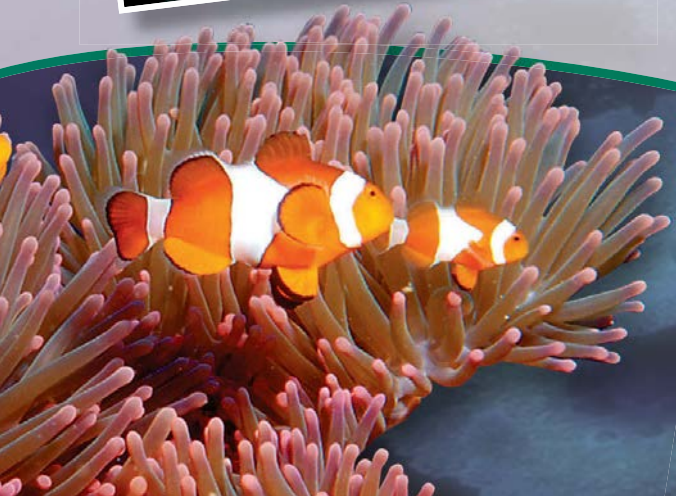

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