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THE BEST OF BRITISH

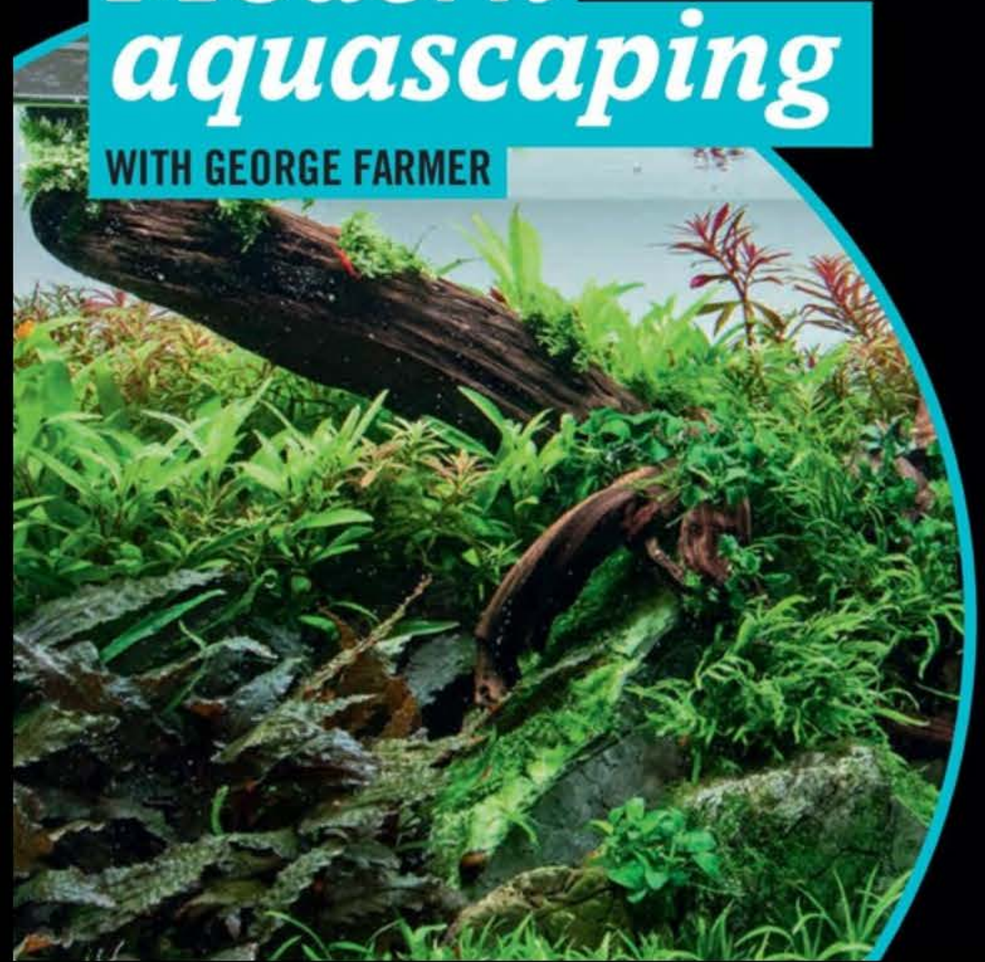
Photographer Jack Perks showcases our native fish

ALGAE

HOW TO KEEP IT UNDER CONTROL

Modern aquascaping

WITH GEORGE FARMER



RETURN OF THE BASKETMOUTHS

The resurgence of *Caquetaia*

DIGITAL EDITION

GEAR GROUP TEST

IN MARINE AQUARIA, one essential task is to remove protein-rich organic waste, which can break down into ammonia. Ammonia can harm aquatic life, but even when converted into nitrites and finally to the least dangerous nitrate, high levels can cause health or algae issues.

While marine fish are usually not more sensitive to nitrates than freshwater fish, corals struggle even at relatively low levels. In freshwater tanks you can keep nitrate in check with large water changes, but in marine tanks that's impractical.

The better approach is to remove organic wastes such as uric acid, peptides and protein compounds before these have any chance to break down into ammonia.

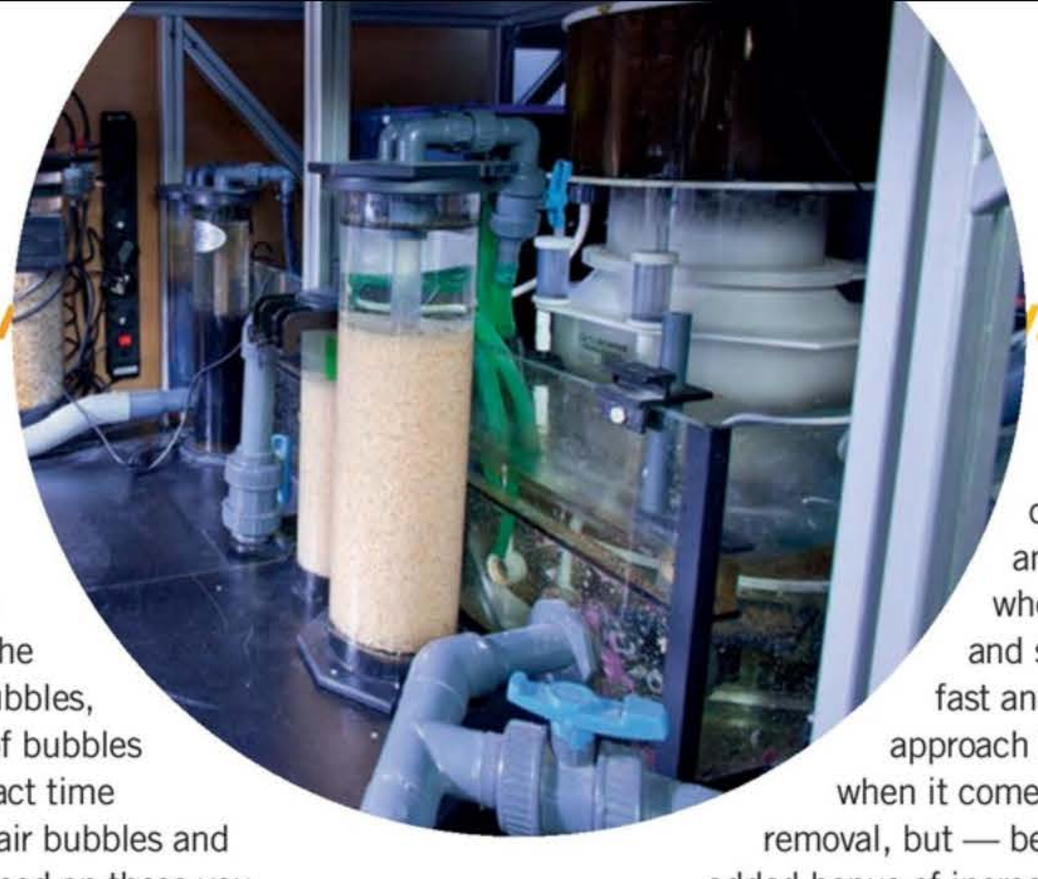
Protein skimmers use the phenomena that protein molecules will bind to small air bubbles in the water, creating a floating froth. If you walk at the seaside after strong winds you can this in nature: often a thick foam covers the water's edges.

There are many types of protein skimmers available, but they all work on the same principle of mixing air with the water.

This benefits water quality in two ways: the process promotes gas exchange, increasing the oxygen content in the water, and also exports organic waste.

In 'old-school' protein skimmers airpumps were used to provide the necessary air, but nowadays specially shaped rotors suck the air in through a venturi-system and mix it with the water.

There are also other versions of protein skimmers, using a water injection method (downdraft skimmers) or foam nozzles (Beckett skimmers), but they are either too large for home aquaria or too expensive to run.



Skimmer efficiency

Skimmer effectiveness depends on the size of the bubbles, the amount of bubbles and the contact time between the air bubbles and the water. Based on these you want a skimmer producing large quantities of very fine bubbles in a tall tower with a low waterflow rate. Go too slow, and you risk not turning over enough tank water to remove the proteins. Go too fast, and you risk reducing the contact time.

There is an ongoing debate among aquarists whether the slow and steady or the fast and furious approach is the better when it comes to protein removal, but — because of the added bonus of increased oxygenation — the majority tends to favour higher flow-through rates.

Aspirating skimmers allow you to alter these parameters according to your needs. These all feature a central pump, which in place of an impeller has a wheel covered by rows of special needles. It allows the pump to better mix air the air drawn in through a venturi inlet with water, and also to chop up the bubbles into smaller sized ones.

As a drawback it means that the pump moves less water around at a low head height. On the positive side, these types of protein skimmers very energy efficient. The water-air ratio can usually be adjusted by a flow controller.

On some models the air intake is also regulated separately, allowing fine tuning.

The air bubbles then pass through a bubble plate, which decreases turbulence and increases the contact time, leading to better quality skimmate.

The conical shape of the skimmer body concentrates the floating froth, which then flows over the edge of the cone and into to a collection cup. There is often a drain fitting at the cup, allowing you to drain and collect the froth in a separate larger storage reservoir.

In the case of dry skimming the skimmate is thick, dry and concentrated and the quantity is relatively low, allowing much less frequent cleaning. The wet method results in a large quantity of thin foam (or liquid) which can quickly fill up the collection cup.

The wet method is good for quickly removing organic materials but also wastes a significant amount of water. For everyday use the general recommendation is to set the skimmer up in a way that the foam just slowly trickles over to the cup.

Higher organic matter content would need an air-richer mixture in the reaction chamber. The amount of skimmate can also be affected by several things, including oily food, water treatment chemicals or even various additives, so you may need to adjust regularly.

Choosing the right skimmer

First of all, check how much space you have. In absence of a sump your choice is limited, but you still can use a hang-on type or an internal protein skimmer if your aquarium design allows. These are restricted in performance, but any protein skimmer is better than none.

To get the best from skimming you need a sump tank or — in case of some models — a large enough cupboard. Ensure that you have enough additional room to regularly access it for maintenance.

Next, calculate the specifications. This is slightly shaky ground, as there is no consensus on the 'right' sized protein skimmer.

Most reef aquarists concur that you should begin with the volume of the tank, including the sump. Then consider the bioload of the aquarium; whether lightly stocked or full of messy livestock.

Manufacturers often give tank-size recommendations on the packaging, stating the range of the aquariums their equipment is suitable for. The low end of the range usually corresponds to a heavy bioload, while the top end is for low bioload.

Some experts suggest getting a skimmer one or two sizes larger than the factory recommendations. Others disagree, arguing that a hugely oversized protein skimmer (designated for more than twice of the actual water volume) will actually work less reliably, as it will not find enough protein for continuous operation.

Both sides agree that an undersized skimmer is worse than an oversized one, so if your tank volume is near to the maximum size recommendation based on the given or expected bioload, you could be better off with a larger skimmer.

GEAR GROUP TEST

THE TEST

The real-life performance of protein skimmers is determined by true water flow, true air flow and contact time within the skimmer body.

The best way to measure effectiveness would be to compare the redox potential of using or not using the skimmer with a given livestock, but it would require several tanks with identical bioload, which could only be achieved in a scientific lab setting.

Therefore, this comparison is based on the feature I could relatively easily measure: the true air flow. Good protein skimmers should produce high volumes of very fine air bubbles. For heavily stocked aquariums you need around half of the water volume produced in air per every hour, meaning that for every 100 litres of water you need 40-50 litres of air.

The issue is that the rated air draw indicated on the packaging is often the maximum unrestricted airflow and the actual achievable values are much lower (as you could see in the table). If you add to this that you will only use around 15-30% of it for a maximum skimming performance (to maintain good water-air ratio) then it's useful to know how much air the skimmers could really produce.

To measure it I have used the sump-tank in my marine aquarium with 8 inches of water depth. The protein skimmers were turned on with a maximum air draw.

I blocked all openings on the skimming cup and attached a hose to the drainage port. This hose was attached to my home-made airflow measuring device I used for the airpump test a couple of year ago. It is basically a topless PET bottle with two marks on its side. The water volume between the two marks is exactly one litre.

This bottle was filled with water and lifted upside down until only a small part of the neck remained submerged. Then, while holding it with one hand I moved the end of the hose connected to the skimmer under the opening. When the decreasing water level — pushed out by the pumped in air — reached the top mark, I started the stopwatch and noted the time it took to replace the litre of water with air.

From this it was a simple calculation to get the air output in litres per hour. The measured outputs are in the table below.

THE LINE UP

FLUVAL

The Fluval Sea brothers – the SP1 and the SP2 Mini – were the smallest skimmers on test, but the minute size means good versatility. They don't look like a traditional skimmer, more resembling an internal filter, but could do a great job keeping protein under control.

If you happen to have a Fluval Evo Marine aquarium there is a dedicated chamber for these skimmers, but being relatively inconspicuous and offering various mounting options, the SP skimmers are perfect to use in a nano or moderate sized tank of up to 170 litres.

Despite the simple build, the Fluval SP Internal skimmers still allow you to adjust the airflow to achieve the skimmate quality you desire. My choice out of the two would be the SP1, which is very quiet and the mere 4W energy usage is negligible.

EHEIM

The EHEIM Skim Marine 300 is also a box-skimmer, albeit slightly larger. It can be used internally or in the sump tank, but this needs at least 28cm water depth. It creates nice small bubbles for efficient protein-bonding and the skimmate collection cup is very easy to clean. As the EHEIM skimmer has a magnetic mount, removing the whole unit for maintenance is quite simple. It's a perfect choice for medium sized marine aquariums (up to 300 litres) without a sump tank.

GEAR GROUP TEST

AQUA ONE

Those lucky enough to have a sump could also consider the AquaOne ReefSkim 300. It's a 'no-frills' skimmer providing only the basic services, but does a decent job. The relatively compact size means that you can fit it into the smallest sumps as well. Although the pump is a bit power-hungry it gives you a very good flow, so the skimmer would very easily cope with tanks even larger than 300 litres. If you have a limited budget but still need a reliable skimmer you should consider this.

A big thank you to the suppliers of the sample skimmers:

OCTO: evolutionaqua.com/regal-protein-skimmers
Rossmont: www.rossmont.com
AquaOne: www.aquaone.co.uk
Nyos: www.nyos.info/en
RedSea: www.redseafish.com
Fluval: www.hagen.com
EHEIM: www.eheim.de

ROSSMONT

The Rossmont Skimer SX2000 has the roundest body of the tested skimmers, but this 'fat lady' can really sing. The bulkiness is caused by the large reaction chamber, which is necessary, as this skimmer was designed to cope with up to 2000 litres tanks.

The powerful pump is placed outside of the skimmer body, making impeller cleaning an easy task.

This well-built kit comes with all the usual features of a high-end protein skimmer and will operate right out of the box as one of them, but to bring the maximum out of it I would suggest you get the optional Rossmont Waver Wifi controller. With this you can program your skimmer to follow your daily routine, harmonising its operation with your dosing pumps and feeding regime, as well as combining wet and dry skimming cycles.

RED SEA

If your budget is more limited, but you still need a high-quality skimmer its worth checking out the RedSea Reefer Skimmer RSK-300. This skimmer was clearly designed with usability in mind. The main features, such as the built-in neck cleaner, the precision geared skim-regulator, versatile pump positioning options and the quick release pump holder, are all there to make the user's life much easier.

The skimmer needs assembling, but if you have experience with IKEA furniture it's not too complicated. Once ready the skimmer feels solidly built and the reliable SICCE PSK pump delivers a good punch for a very little energy. At first glance the promised water and air flow values seem relatively low as compared to other brands but RedSea always present the actual, achievable flow rates instead of the maximum ones. In real life they are pretty much in par with — if not better than — the competitors.

OCTO

The OCTO Regal 150-S is equipped with all the extras you have ever wanted from a skimmer – and even more. The manufacturer has a long history of producing excellent skimmers and this experience is clearly shown in this equipment. Although being the space saving version (hence the "S") it still boasts a good-sized reaction chamber and an oversized collection cup.

Everything you would expect from a top-quality skimmer is there, including pinwheel impeller, plus ceramic shafts and bearing. Where the OCTO Regal 150-s is different from the others is that its VarioS pump runs on 24V DC.

With the included VarioS controller users can adjust the flow rate electronically (there is even a feed-mode), making the skimmer highly energy efficient and practical.

Although the price tag is relatively high it's a worthwhile investment – this skimmer will serve you well for many years to come.

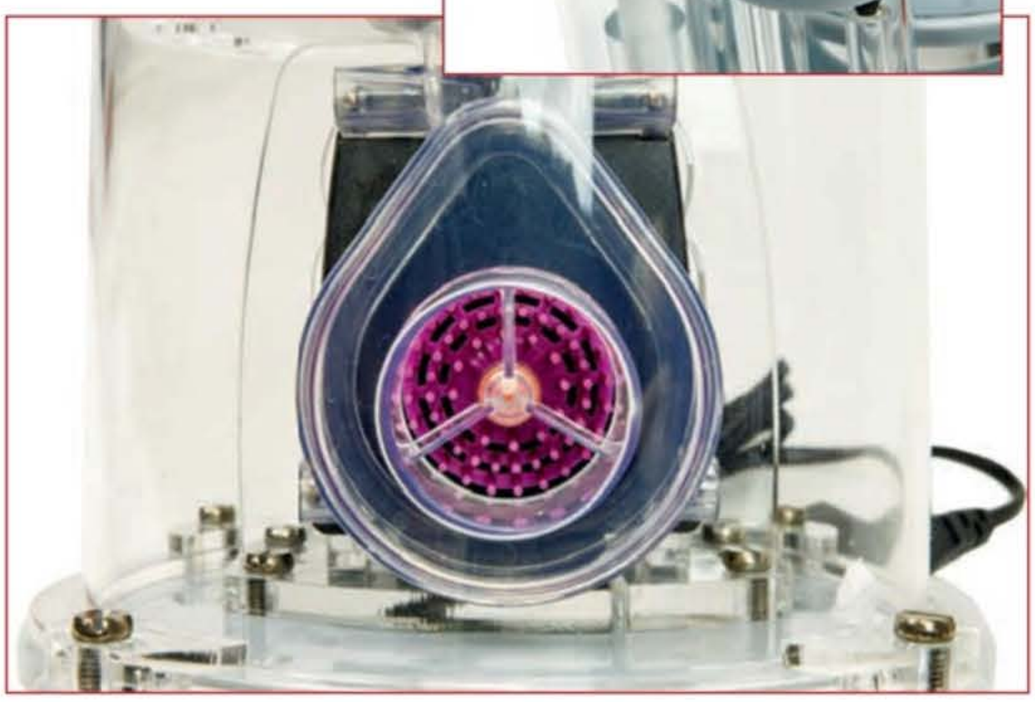
NYOS

Although the Nyos brand may sound unfamiliar to many, their products are well respected among reef-keepers.

The Nyos Quantum 160 shows nicely what all the fuss is about. This skimmer oozes quality and longevity: even the screws are made of titanium. The special design of the Hybrid wheel (combining advantages of the needle and the lattice wheels) creates very fine bubbles, while the added extra twister bubble plate extends the reaction time.

It's also a very smooth operator, allowing you to fine tune both the water and airflows.

Overall you will get lots for your money.



	RATED PUMP OUTPUT (QMAX – LPH)	RATED/MEASURED AIR OUTPUT (LPH)	WATTAGE	RECOMMENDED WATER LEVEL	RRP	TANK SIZE (L) A*/B*/C*
Fluval Sea PS1	n.d.	n.d.	4W	min 10"/25cm	£68.00	up to 170
Fluval Sea PS2 Mini	n.d.	n.d.	8W	min 8"/20cm	£46.69	up to 80
EHEIM Skim Marine 300	500	n.d.	7W	min 11"/28cm	£170.00	up to 300
AquaOne Reef Skim 300	800	n.d./310	25W	6-8"/15-20cm	£99.99	300/200/100
OCTO Regal 150-S	n.d.	900/650	25W	6-8"/15-20cm	£449.00	800/600/400
RedSea RSK-300	1000	500/560	12W	6-8"/15-20cm	£249.00	900/600/300
Nyos Quantum 160	n.d.	1500/740	18W	8"/20cm	£369.95	1000/600/250
Rossmont Skimer SX2000	3500	n.d./1480	34W	9"/23cm	£459.00	2000/1200/600
*a: Fish only, b: Low population, c: High population						

PFK