

This is a working document and mostly just copy and paste from some of my posts and not really a written essay. Sorry. I am jda on RC or r2r if anybody wants to discuss or PM me. Feel free to comment if you would like.

General thoughts about most internet posts about N and P:

Most posts telling people to get their N and P up are unhelpful and most typically do not know why they are posting them, other than they have heard this stuff before. The answers are complex, so read on, but it will take some time to understand what is happening, but it is worth it.

Low residual levels of N and P are a good thing if there is enough availability of things for the corals to use. The availability of these things is what people are after, but rarely gets posted about or offered as a solution.

In summary, although more reading is good, microalgae cannot easily use nitrate. While this is a generalization, it works for nearly all that we do. Microalgae can get nitrogen from ammonia/ammonium or from the host which can directly absorb things like bacteria (through the slime coat) and if they can use aminos (not really sure that all do and which ones are beneficial). Therefore, don't worry about nitrate, unless high, and feed more. With phosphate, there are many kinds and your test kit only tests for one of them... organic/inorganic/phosphate/phosphorus. Do you know that your corals need the same kind that you are testing for or even adding? Again, feed more and use the fish waste to get the right kind of phosphate/phosphorus to your creatures.

In the end, just understand that residual levels are fools gold and availability is what most people are after.

Thoughts on N and P residual levels vs availability:

These are not the same things and the difference is huge.

Residual - test kit levels on the back end

Available - stuff in the water column for a coral to use that is on its way in the N cycle

Everybody is going to need to understand the difference in availability and residual levels to make this thread work. First, you need to understand that coral would much

rather get nitrogen from ammonia or ammonium since processing NO_3 to get the N is costly, takes a lot of energy and is not efficient.

Availability is more important than residual levels - availability is usually what is in the water right now that has not yet made it all the way through the N cycle (plankton, ammonia/ammonium, etc.). Availability and higher residual levels are not mutually exclusive. However, if you are using a lot of media and chemicals, you can have very low availability and have higher residual levels still... this can be bad in some cases. You can also have very low residual levels and high availability - most tanks with lower residuals have this (zeovit, mine, etc.).

Everybody worries about residual levels since they have tests and stuff, but this is not where the prize is. Availability is what makes things run. ***Even people with higher residual levels are running off of availability even if they do not know it.*** I know that people like to post and talk about their N and P numbers, but this is like talking about horsepower only and not torque, gears, car weight, oxygen level, etc. when you are wondering if your car is fast... nearly worthless. Availability is harder to gauge and you have to pretty much just feed a ton and then also export a ton to where your residuals are not rising - basically, use your residuals to double check your availability.

Using chemipure, GFO, LC, organic carbon, reactors of all kinds is OK as long as the availability is there. This usually required a LOT of feeding and a lot of fish. When I say a lot, I mean the kind that few people have, especially in small tanks. The mistake that people make is that they think that the application of all of these things is universal and this could not be farther from the truth. Using them is not universal and suggesting that people remove them is not universal. However, the suggestion to remove them is usually more safe than adding them.

To wrap all of this up, if I posted that I was having X or Y trouble with my tank and then said that I had .1 residual nitrate and .01 residual phosphate, I would get no shortage of people telling me to raise my N and P and probably not one asking about availability. This is not helpful to most people and is too simple to do any good.

I had to rush earlier, but let me expand some more.

My tank has residual levels of about .1N and .01P... you need ICP to detect the nitrate and Hannah ultra low will be between 1-3 ppm. Nothing suffers in my tanks. Nothing.

People can find all kinds of things to complain about me, most of which are a bullseye, but not having thriving and growing stuff is not one of them.

I cringe when I see people post the parroted talk that people need to raise their N and P any time somebody has a problem. Could it help? Sure. Will it help? Who knows without more questions and stuff. It is not likely going to help unless they increase the availability - adding sodium nitrate and triphosphate will not likely do as much on the back end. ...so more import to start and more export if the import is overpowering the export.

There are also people who think that having higher N and P are what is moving the line forward, but this likely is not it either. The availability that keeps those levels high are what is doing the work - the man behind the curtain that goes unnoticed. These people would likely have much better results with lower residuals and the same availability - higher levels of N and P actually do slow down calcification and cellular processing even if they do not cause death and stuff still grows.

I also cringe when I see posts that media or chemicals are the devil. They certainly can be, but it is almost always the application. They can work fast and you have to be smart, but when used correctly, they can be an appropriate tool, but that tool needs availability on the front end to help the corals while it works on the back end. Nearly nobody should be using any chemicals on a new(er) tank - there is just no need since residual levels are not set yet and the biological processes in the tank are still settling in.

I get it. Availability is hard to understand and hard to measure. There are test kits for N and P and people can latch on to numbers. This is why you have to pay attention and be smart. Heck, BRS has not even made a video about it - notice my disdain for reefers who get all of their knowledge from BRS videos? However, BRS does make a comment in their ZeoVit video that says something like "people think that this tank with it's low N and P is devoid of nutrients, but there are more nutrients running through this tank than any other that we have ever had." They are right about that, even though I hate calling N and P nutrients - soapbox here. (see, I do watch their videos before I roll my eyes at a lot of them)

The people who have always said "feed the fish more" are likely completely right. There are people who have fed their fish more and seen the residuals get too high, so they cut back on the feedings when they need to up the export.

My advice is to feed your fish so that they are actively growing. A tang should grow an inch, or more, a year. Then, match your export to the import so that your residual levels are low, but detectable... like 1N and .05P would be near my top to keep any type of coral at any time but 5N and .10P might not freak me out too much if I did not have a bunch of sensitive acropora. Keep your carbonate and calcium near NSW to match. If your N and P are rising, then don't cut back on feeding if you have lots of coral, but up the export. Using chemicals is OK as long as you are not going down near zero and you are going SLOW - natural methods using sandbed for nitrate and chaeto/fuge for nitrate/phosphate are better since they can never really get to zero, but sometimes this is not possible and media/chemicals are needed. DO NOT use chemicals and media unless you have a well-known, documented problem (like for a while) and you know exactly what you are doing. For example, if I took my fuge offline for a few months to clean or replace, my P would climb a bit and I would use some GFO, but it would be small and only enough to balance the import.

I have my method on my re-build thread, but I use multiple skimmers, sand and chaeto in a fuge to keep my N and P down. I also change water, but not for this. There are many ways to up export. Don't be scared of upping export and driving your N and P down, just make sure that your availability is higher.

Lastly, if people feel like dosing, then dosing commercial ammonium is likely better than dosing nitrate. At least the ammonium is available to the corals in a manner that they prefer. Some might cringe and see ammonium as a poison, and it is at high levels. However, so is nitrate and people do not even think twice about this. I just prefer to feed the fish and let them produce the ammonia/ammonium, but I guess that not everybody can do this.

Here is the BRS video from about 1:20 where they explain the huge amounts of "nutrients" with low residual levels in their 160g tank:

<https://www.bulkreelfsupply.com/video/view/update-3-two-years-of-coral-growth-and-colonation-with-the-zeovit-system-52-weeks-of-reefing-brs160/>

Nitrate reduction with anoxic bacteria:

Live rock and sand will crush nitrate if you have developed areas of anoxic areas in the middle of the rock and deep into the sand. If you wonder where your nitrate goes, this is it. These bacteria do not have a ton of oxygen and turn NO_3 into nitrogen gas to just escape into the tank and out into your air.

It can take a while for dead rock and dry sand to be able to do this. ...maybe even two years if your rock is filled with terrestrial organic matter.

The sand/rock will develop bacteria to equilibrium that never brings the nitrate to zero and always saves a little bit to drive the equilibrium moving forward. This is good. This means that you have nitrate available, but not too much.

Phosphate absorption by aragonite:

Aragonite, calcite and dolomite will bind phosphate. The binds are exponential and the rock/sand will bind more when the water levels get higher. This can be a reservoir (bad) at high levels and a buffer (good) at lower levels. If you are dosing phosphate, you are likely just binding it up in your rocks and sand which will absorb most of it.

The phosphate bind is reversible unless the aragonite is in a live tissue structure and new layers are built over the top.

This experiment goes on and off the rails, but it shows that even a relative low water concentration with just a small amount of aragonite can hold a massive amount of phosphate. There are some nice links to other papers that show the same thing.

<https://www.reef2reef.com/threads/phosphate-absorption-rates-in-aragonite.352405/>

Dry/Dead rock usually has a lot of phosphate bound to it. This can be somewhat mitigated by some acid to remove the outer layers, but there will still be some inside. Expect this to unbind with the lower-concentration tank water.

Higher levels of N and P will inhibit calcification:

Will this matter to you? It depends on what you keep. Some corals will suffer at very slightly elevated levels and some might not mind if they are very high. When you see people tell you that the “corals” are fine in their tank at very high levels of both, you need to look and see which kind... not all “corals” can do this and the blanket statement of “corals” is not very helpful. There is a big difference between a very sensitive acropora and a typical discoma even though both are referred to as corals (true coral makes a skeleton and discoma are really colonial anemones, but people call them all coral which makes this hard).

There are links to Dr. Holmes-Farley's nitrate and phosphate articles (some which appear to not be available right now) that show the real science of this.

In any case, lower residual levels are usually better as long as your availability is good.

Why I hate the word “nutrients” for N and P

N and P technically are nutrients, but most people think of them the wrong way. Most people think of nutrients as fuel or energy. N and P are not food or fuel and having more than “enough” does nothing. This is not true with carbon based substances, which are truly like fuel and food. N and P are building blocks of life and while you certainly need some to make new tissue and to repair the old, if you have extra, they do not do anything.

The true fuel for corals comes from the light and any food that they can catch (not likely much outside of NPS corals). The N and P are building blocks. Too many building blocks are poison at higher levels - every piece of organic tissue will die with too much N and P around, but each one at different levels.

Think of the light as the bricklayers and the N and P as bricks and mortar. You need a slow influx of bricks and mortar for the Masons to use, but having too many just makes the worksite unmanageable and nobody can get anything done.

I would really like for people to refer to N and P as building blocks so that people can think of them in the right way.

Ways that High Levels of N and P can be Good

High levels of N and P can kill back (poison) dinos, cyano, macroalgae, but also some corals. Remember all building blocks are needed at appropriate levels and most are poisons at high levels. Having high levels of N might be good in a FOWLR to keep cyano and hair algae at bay, but these levels can also kill all but the most tolerant corals.

Macroalgae can also use nitrate directly, so having a detectable level in a algae tank can be good, but not too much or you will growth limit the macro. For me, I grow chaetomorpha and it grows like crazy at .1 (ICP needed to detect) N and 1-3 ppb of P

and will slow down for me once the N reaches 20 and P reaches .20, but YMMV - it still grows, but slower.