As the title suggests, this is intended as a short guide on what to do when you suspect dinoflagellates are trying to overtake your system. It is an attempt to boil down the protocols discussed across 11,000 posts in this "Are you Tired" thread along with thousands of other dino threads. I did not craft this protocol, nor have I conducted proper scientific tests to produce efficacy data. This is a simple distillation of many hundreds of observations. Nothing here is 100% effective nor terribly immediate, but if followed diligently, the odds are pretty good that you will reduce harm and get back to a more stable biome. There is one hobbyist I must shout out to as my mentor on this subject and that is @taricha. Whenever I have a question, I typically want his answer. There are many great contributors to the hobby on R2R and he is in my top 5.

We commonly find 5 different dinoflagellates in our captive systems. If your system has any vintage to it, some blend of these are already present. Like bacteria, you can't really avoid some blend of them entirely, nor should you try. They are a very natural microorganism that *typically leads a very marginal existence alongside other, more dominant competitors*. These competitors include diatoms, bacterial film, film algae, coralline algae, sponges, GHA, turf, corals, pods, etc. Some of these competitors are aesthetically pleasing while others are not, but they all have a role in managing surface space when the biome is healthy and stable. I could dump a bucket of dinos into my system today and my reef would not miss a beat. My competitive population is too established and healthy to cede surface to dinos. The point is, dinoflagellates are not super predators, rather they are marginal scavengers that only thrive once a reefer has starved, sterilized, poisoned, or otherwise weakened some of the natural (attractive or otherwise) surface competitors.

So let's get to it. Here is the outline for this article:

Section 1: Do I have dinoflagellates or something else?

Each of the 5 species has a slightly different look in the tank. They can also look very different and meld into any of the other competitors mentioned

above. They all form some kind of mucus. Some have long strands with bubbles while others do not. The mucus could be reddish, brown, gold, or in between. They can take over rock, sand, glass, plastics, even a refugium. They can be confused with diatoms, cyanobacteria, bacterial film and chrysophytes to name a common few. Good news: you don't need a microscope to find out if the gunk is dinoflagellates.

The coffee filter test:
a) Syphon out a good sample of the gunk along with some tank water.
b) Place in a container with a lid and shake very hard for 30 seconds or so. The gunk should be dissolved now.
c) Pour the solution through a coffee filter into a clear glass. The water should be largely clear now.
d) Place the jar under a light source for roughly an hour.
e) If the gunk coagulates back into a glob, well, welcome to the club nobody really wants to be in.

Section 2: What type of dinoflagellate do I have and why does it matter?

We can make some educated guesses without a microscope based on appearance and location, but I strongly encourage everyone to confirm which species is/are present. It is very common to have more than one species. Some are toxic while others are just a visual nuisance. Most respond well to UV treatment while one does not. They have different competitors too.

You can buy a student microscope for under $50 that will work just fine. 400X magnification is all you need, really. My son and I use it at least twice a month for all kinds of tank related stuff. Here is a link to one I bought but there are plenty of other suitable models. You will use your camera phone to take a video through the eyepiece. Experiment with zooming in with the camera for a bit more magnification. You might consider buying a phone cradle unless you have the hands of a surgeon. If you can find one with better reviews, buy that one. I recommend making a video because the swim pattern helps to determine the species almost as much as the shape

-- especially when the image quality isn't perfect. Nothing special about slide prep, just use a dropper to suck up gunk & water and drop it on the slide. You get 400X by using the 10X eyepiece and 40X barrel.

Once you have a video, you have options:
a) You can ID them yourself, thanks to the fine Dinoflagellate Identification guide put together by @taricha. Be sure to look at the videos he has linked so you can compare swim patterns.
b) You can post the video to the main "Are You Tired" thread. There are a handful of people that watch the thread regularly and are quite good at identifying dinos. In the event of a split decision, tag @taricha for confirmation.

Again, getting a proper ID on your dino(s) determines a few important things:
a) Do I need to (properly) implement UV equipment? Or is that a waste of time & serious money?
b) Do I need to do a blackout of the tank? Or not?
c) Do I need to be concerned with potentially serious toxins? Or not?
d) Should I order and dose some silicates? Or not?

Section 3: Treatment protocols common to ALL dinoflagellate species

- Ensure that the tank always has measurable residual amounts of nitrate and phosphate. Any nitrate test kit will do, but you need Hanna ULR for phosphate. Target roughly 10/.1. If you are 0 on phosphates, be prepared to dose harder than you can imagine. I dosed 2 liters of DIY before I could keep a residual reading. It binds to your rock and sand. Stock up on Hanna reagents!
- It is important to FIRST dose up PO4 to a stable level. Adding nitrate to a depleted tank will hammer your PO4 and stress/kill a lot of coral.

- Dose a nitrate and/or phosphate solution as necessary. Test almost daily -- at least initially -- if you are deficient.
- If your dinos are presently based in the sand, it is recommended that you dose silicates to restore competitive diatom populations. SpongeExcel is the most common source used. Detailed dosing instructions here.
- Avoid water changes unless it is an emergency. Dinos do seem to deplete certain traces. For me it was potassium, iron and Iodine. You will get a mini bloom with a water change. Also, it removes nutrients.
- Stop any amino acid dosing. Same goes for particulate coral foods. The dino mucus webs just grab it all anyway as their food source. It is also fine to feed the fish more. Fish waste is an ideal food source for competing microorganisms. Your tank needs more of those. However do not rely solely on increased feedings to restore NO3 and PO4. Dose!
- Basting off dinos is fine, but avoid "deep cleanings". We do these things to remove films and algae, but we need that population to recover. This is a common cause of relapse.
- If you are dosing 2-part or CaRx, watch your alkalinity. My consumption collapsed during (ostreopsis) outbreaks but rebounded shortly after.
- Higher pH is better than lower pH. I don't know the mechanics of why, but the pattern was unmistakable. I know it helps rebuild coralline. Open some windows when you can.
- If you have a UV lamp, it is a good idea to deploy it as described in Section 4 even if you don't (right now) see the presence of free swimming dinos. The dino species dominating your tank can shift over the course of days. Plus the UV performs other functions that are helpful in times of biome stress.
- Introduce live rock and/or live rubble. Can be ocean sourced or from another established system. If your tank was a dead rock start (and isn't a few years old already), your biome is missing bacteria by count or by genus or both as demonstrated here. While we do not understand how these deficits contribute to dinoflagellate

outbreaks, the outbreaks appear primarily with dead rock starts. Some potential live substrate choices are detailed in Section 5.

Yes, dinos can exist in a high nutrient system if the competition is somehow killed off -- most commonly when dosing chemicals to combat cyanobacteria. But 90% (anecdotally) of the time, a dino outbreak follows a period of competitor starvation or removal, so restoring nitrates and phosphates is job 1 for restoring competition.

Section 4: Treatment protocol for Ostreopsis, Prorocentrum, Small Cell Amphidinium & Coolia (The Swimmers!)

Tool #1: A properly sized, placed and paced UV install FOR FIGHTING DINOS looks like this:

- Ignore manufacturers recommended specs for sizing and flow! Their numbers are designed to sterilise/kill soft little parasites, bacteria and water borne algae. Those numbers are not designed to eliminate hard shelled protists sporting body armor.
- 1 watt per 3 gallons of tank volume
- Flow should turn over the tank 1-3 times per hour. The bigger the unit relative to tank size, the faster you can go and vice versa. As long as the bulb stays cool enough, you are not running too slow IMO.
- This should be plumbed directly from the display tank and returning back into the display. I used some PVC so that I could just slap it on the side of the tank, plug it in and go. Here is what that looks like. I know you are thinking it is ugly and unnecessary but it is effective, temporary and easy to add/delete.
- Ensure that the darn thing is running properly. The ballast is good and the bulb is less than 12 months old and hasn't been overheated.
- Baste as frequently as you can so that the dinos pass through the UV.
- To varying degrees, these species go swimming at night. Ostreopsis are the most adventurous of the four and I never needed to do a blackout to get them under control. The other three may require a blackout to get them moving into the water column. Try a two day blackout first to see if that is enough. Wrap the tank in cardboard or black trash bags. Turn off the fuge light if you have one going.

- Blacking out the tank *without* a proper UV in place is very unlikely to help. Yes, dinos are photosynthetic, but so is the needed competition. When the lights come back up you are back where you started.

Tool #2: The Poor Man/Woman's UV
If a UV isn't in the budget, or is stuck on a boat in Long Beach, or you just want to go after these guys a little harder, you can affix sheets of filter floss to the sides of the tank like this. Ostreopsis really prefer this surface when placed in a high flow/light area. Wherever your dinos seem to be hanging about is the right place to affix the floss. I used suction cups, zip ties to fasten the floss. Repeated basting of infested surfaces is encouraged. Rinse the floss each evening (before the lights go down) in fresh water and replace. It is oddly satisfying.

Tool #3: Removing toxins
All four of these have some level of toxin, with Ostreopsis and Proro having pretty high levels. It is a good idea to run carbon and refresh it more frequently than usual. PSA: IF ANYONE IN THE HOUSEHOLD HAS RESPIRATORY ISSUES LIKE ASTHMA, take some added caution. You want to shut off the skimmer to avoid aerosolizing and improve ventilation. Personally, I ate, drank, smoked and bathed in ostreos without any issue, but there have been reports of respiratory distress in the presence of ostreopsis.

Tool #4 Filtering
Our common dinos are rather small measuring 5-40 microns. The mucus can be trapped and contain many/most of the dinos as long as they choose to remain in the mucus. But as you will see on the microscope slide, they roam fairly freely from the mucus. Perhaps a 5 micron sock could be deployed to trap dinos once syphoned out. I don't have much conviction on efficacy, but if you have the energy it cannot hurt.

Section 5: Treatment protocol for Large Cell Amphidinium
If you are reading this section I have good news and bad news. Bad news: these are the most difficult species to remove. They cling to the sand and

do not swim around at night like the others will, eventually passing through the UV to be damaged or destroyed. The good news is that they are really quite harmless. They have very little toxicity; they just look a little worse than a good diatom population. Most steps people deploy to eradicate them (out of some desperation) are much more destabilizing than the LC amphids will ever be. If you really need that white sand back, be prepared to be patient. If you are looking for hundreds of LC Amphid war stories, our friend @Taricha started this thread some +1,660 posts ago.

Tool #1: Dosing silicates to restore diatom population
This is very harmless and is really the primary tool. The goal here is to feed a variety of diatoms in particular along with other sand dwelling microorganisms to the point where they outcompete the amphids. SpongeExcel is the off the shelf solution for this. I am not familiar with DIY options but I imagine they exist. The target range of SiO_2 is .5 to 1 ppm in the tank and holding it there long enough for the diatoms to repopulate. Make sure you are not running any GFO as it will bind up the silicate. Unfortunately, there don't seem to be many good testing options for silicates other than a $50 Hanna low range silica hi705. Continue to pull microscope samples from the sand bed to see if diatoms are increasing. Diatoms look like this (courtesy @taricha). If you prefer precise dosing instructions, there is this detailed post also courtesy of @taricha.

Tool #2: Adding in some microbial diversity via live rock, mud, sand or rubble from the ocean or another established captive reef
This is not a quick fix but is very helpful in recreating a more competitive, balanced and robust biome. Tampa Bay Saltwater, KP Aquatics, Gulf Live Rocks, IPSF.com are all decent sources. You may wish to quarantine for bit in some salt water while checking for any crabs, shrimp or dead seaweed that come with it.

Tool #3: Adding in some sand based CUC and improving the pod population
This is generally safe so long as there aren't other more toxic dino species mixed in. While not a total solution, several people reported good results

weighting down some chaeto on the sand bed. Chaeto houses pods, and is also believed to have some alleopathic against dinos.

Tool #4: Manual removal of Amphids, or the sandbed all together
I struggle with mentioning this one, but it always comes up as a question. Results are mixed and often temporary and I just don't believe they are worth the risks and disruption when the biome is already a bit noisy. But if you're becoming desperate, let's at least run through some considerations.

- Syphoning off the top layer and RODI rinsing it may be okay. You will kill some dinos that way, but their competition will also be killed.
- Removing, rinsing and replacing a complete section every now and then may be okay, but the same trade off exists.
- MOVING the entire sand bed to the (dark) sump has been done. It does help maintain your biological filtration which is good. Results are still out on that though.
- An old, relatively deep and previously unmanaged sandbed can contain some pockets of hydrogen sulfide which is toxic if released into the tank. Extremely rare.
- I will just point out that several reefers chose to leave the sandbed completely undisturbed and reported good results in conjunction with silicate dosing.

Tool #5: A properly sized UV
As stated at the outset, LC Amphid cling tight to the sand bed and do not migrate into the water at night where we can zap them in the UV. That said, there are other potential benefits to running a UV. They include:

- LC Amphids are the species most commonly found IN COMBINATION with other swimming species that will make it into the UV.
- UV oxidizes some trace elements that dinos need; e.g. Iron (Fe)
- UV also breaks down certain complex organic molecules that dinos crave along with dino related toxins

It is a pretty tame set of tools deployed (the first three at least). This species is just so hard to get at so really all we can do is work on building up a healthy and diverse set of competitive critters which takes some time.

Section 6: Avoiding relapse & What to expect next

Avoiding relapse is really pretty simple once the dinos begin to fade. Just keep doing what you've been doing, steadily. It can take some time for the competitive microorganisms, algae and bacteria to fully spool up and it doesn't always look attractive. Relish in it. It is a partial ugly phase you just have to get through.

- Avoid dosing amino acids for a long time. It is a dinoflagellate superfood.
- Maintain nutrient levels. This can be hard to do when you begin to see the old "villains" return. Diatoms and cyanobacteria outbreaks are nearly a given.
- Large Cell Amphidinium tanks SHOULD be seeing strong growth of diatoms on the sand. The color should be transitioning from a reddish color to a more rusty tan color. The glass should be getting a brown film.
- Syphon out the cyano and stay the course on nutrients. You don't have to maintain 10/.1 nitrate to phosphate anymore but residual nutrients must always be present.
- I find cyanobacteria blooms are transitional in our systems; they often appear when nutrient trends are shifting rich=>poor and vice versa. Keep nutrients steady & balanced and the cyano will be displaced.
- Keep testing for residual nutrients every couple of days until it gets boringly stable and predictable. Then test weekly.
- Next will come some green film and perhaps some GHA. If you let one or both nutrients bottom out now, that is just fodder for the dinos to return. It is just another ugly phase, not the end of the world.

- Now that you have some green stuff it is time to add some herbivores and CUC. Don't skimp here. Get working fish to work. Fish waste is the ideal food source for a healthy biome. Dosing nitrate and phosphate was a stopgap.
- Keep feeding the fish; upgrade your export if you have to (skim, refugium) but try to avoid GFO and NO CHEMICLEAN OR EQUIVALENT AT ALL.
- If the GHA builds up, try to stick with manual removal. Squirt it with a little H2O2 a couple times to soften it up and then pinch or scrub it off. Herbivores strongly prefer new growth and won't go after "old growth" GHA.
- If you are a Vibrant fan, hold off as long as you can and go super slow with it. Remember, it contains bacteria and a carbon source which will lower your nutrient levels.

The range of time it takes to fully resolve a dinoflagellate outbreak varies greatly. I have seen virtually overnight success following a blackout with a well implemented UV on ostreopsis and prorocentrum. On the flipside, I've seen LC and SC Amphidinium take many many months.

Section 7: FAQs

Q: Why not just use Dino-X?
A: If you keep SPS, I would strongly discourage the use of Dino-X. I am biased against reef additives that purport to be effective against a WIDE range of nuisances and don't list ingredients. If a product behaves like it contains an algaecide, it probably does. Dinoflagellates are free swimming protists and not a type of algae. If you read the 50 reviews on BRS, you will find plenty of 1-star reviews with SPS casualties.

Q: What about the Elegance Coral (Cruz) method?
A: It has been demonstrated to work, but for me it is just too harsh and destabilizing. A biome that is overrun with dinos is already in a somewhat fragile state. Deliberately setting off a bacterial bloom to kill off dinos seems unnecessarily violent, indiscriminate and risky. That said, if you find an

interest in the method, reach out to @Reef and Dive for some guidance with it. He can help you determine whether you should use the "full" method or the more "gentle" method. Stickheads take caution.

Q: What about the H2O2 method?
A: This too has been demonstrated to work and is certainly simple to apply. It is again a fairly indiscriminate oxidizing tool, but not terribly harsh. I don't understand the biological process behind it's effectiveness nor which species it should be applied to. But if it interests you, tag @vetteguy53081 and he can walk you through it.

Q: What is the worst that can happen if I just wait it out and keep doing as I have been?
A: This really depends on a lot of things. The more toxic species can take a toll in CUC and the rest of the smaller organisms. Remaining in a constant state of nutrient deprivation is kinda cruel but if you have algae, you have nutrient and you could wait it out. I'd suggest you at least implement the few steps in Section 3. Then take all the time you want. For newer tanks with LC Amphids, I actually recommend waiting it out over more intrusive efforts.

Q: I have what certainly looks a lot like dinos in the tank with bubbly slime. Are these dinos?
A: Good guess, but no. Those are chrysophytes or "golden algae". They are much smaller than dinos (this is 1200X) and sessile. Light dosing of Vibrant often clears these up. Track nutrients any time you are dosing Vibrant, carbon or bacteria in general.

Q: I have GHA and dinos. Where do I start?
A: Tough one that has several "it depends" caveats. Get an ID and if the species calls for UV get that going correctly and urgently. The system has nutrients, they are just bound up in the algae. Unless you are big on SPS, a slow and careful dose of Vibrant or AlgaeFix if you really feel the need.

Q: I have cyanobacteria and dinos. What do I do?

A: This is very common. We want the dinos to lose this competition to cyano. Cyano is ugly, we all hate it. but it is very transitional if you are keeping your nutrient parameters nominal. Follow the protocol and accept this competitor for a while. Yes it will stick to the parts of your coral that are already dead, but it isn't wasn't the proximate cause of that necrosis. Just keep exporting / syphoning the cyano. In time it will pass if you keep nutrients balanced.

Q: I have high or nominal nutrients and STILL got dinos. Huh?
A: Less common but it does happen. This is most often seen after dosing Chemiclean or equivalent to kill off cyanobacteria. Ironically, now you will have to pass through cyano again on your way out of dinos. I have also seen Prorocentrum show up (in the sand) when nutrients are present, but imbalanced with each other.

Q: I hate this. How did I get here?
A: I could not explain it better than @Reef and Dive did with some humor here. No need to do all of these, just a few will earn you all the dinos you could ask for.

Q: I am about to attach a new frag tank to my existing system. Any issues?
A: I am 0 for 3 in preventing dinos when adding a new tank to an existing system. But I will do better next time, promise. My suggestions:

- Run a little dirtier before you hook it up. You are about to dilute your nutrients with the new volume. Dose NO3 and PO4 accordingly.
- Remember, your existing system has some dinos already even if you cannot see them. They are just battling for a very marginal existence or even in cyst form. But all that new, sterile space is dino heaven. Keep the lights OFF for a good couple weeks. You won't get any film algae, but you should be building some bacterial film at least.
- I would slap a UV on there for a couple weeks if you can.
- Measure and keep residual nutrients in line with your old tank's nominal parameters.

- I once replaced a sump/refugium and got dinos in the refugium. Lights off for a while until a healthy bacterial slime can take hold first.