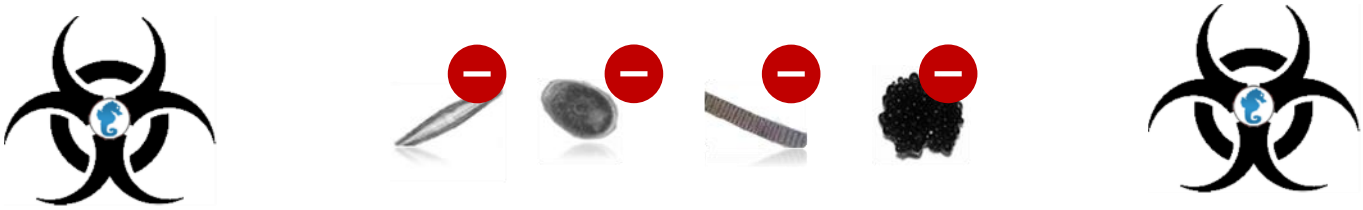
AquaCalculator Reef Aquarium Compendium – Part 3

Pests: Bacteria and algae

Pests are unfortunately a reality in many reef aquariums.



In this compendium you will learn everything you need to know,
to get rid of unwanted bacteria and algae.

(also available: Part-2 "animal pests")

We wish you good luck
(Martin Kuhn and the AquaCalculator team)

Last updated: 1.12 2024

Liability exclusion

The information and recommendations made in this compendium represent the author's state of knowledge at the time of the last update.

No guarantee can be given for the topicality and correctness of the contents! Any liability because of correct or incorrect application is rejected.

Symbolism

INFORMATION	Important note
WARNING	Things that are particularly often done/understood wrong
AVOID	You should NOT do that.
COMPLEX TOPIC	For advanced students - allow time to read through.

About us

We are a 3-person software development team and have been striving since 2005 to support reef aquarists worldwide in their hobby in the best possible way. We are enthusiastic MW aquarists ourselves, not dealers or manufacturers of aquarium products.

Our expenses are financed by income from our computer program **AquaCalculator** which is specially designed for marine aquarists.
The license fee is less than 10€ per year. You can then use AquaCalculator on as many of your own devices as you like. Each license is linked to one of three different operating systems, for each of which we create and maintain separate versions.

Over ten thousand aquarists worldwide are already using our program and have successfully improved the water values of their aquariums. Complicated calculations, e.g. for the dosage of salts or additional chemicals, are done for you by our software.
Water values, tank occupants and maintenance work can also be perfectly documented.

With every license you support and appreciate our development work!

Content

PART 1 - Identification

1.1 What to do if you suspect a plague?

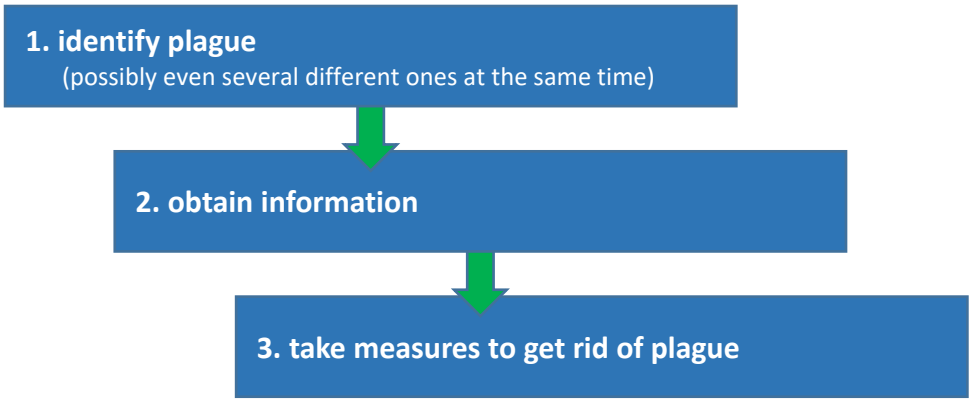
You are probably reading these lines because you have discovered a coating, algae or something disturbing in your tank. Possibly even animals/corals in your tank have died or are behaving conspicuously.

The logical consequence: You want to **get rid of** this problem **as quickly as possible** and with as little effort as possible.

This is 100% understandable. Unfortunately, in reef aquariiums it is often not quite so simple, because:

- Maybe your aquarium does not need any intervention, but just some rest
- Possibly an intervention is useful and perhaps even urgently necessary,
  as doing nothing would worsen the situation
- The methods of treatment are different, depending on which pest you have

Keep to the following procedure!



It is not recommended to do step 3 before step 1 or 2!
You also do not swallow antibiotics if you only have a small cold....

1.2 First identification by visual inspection

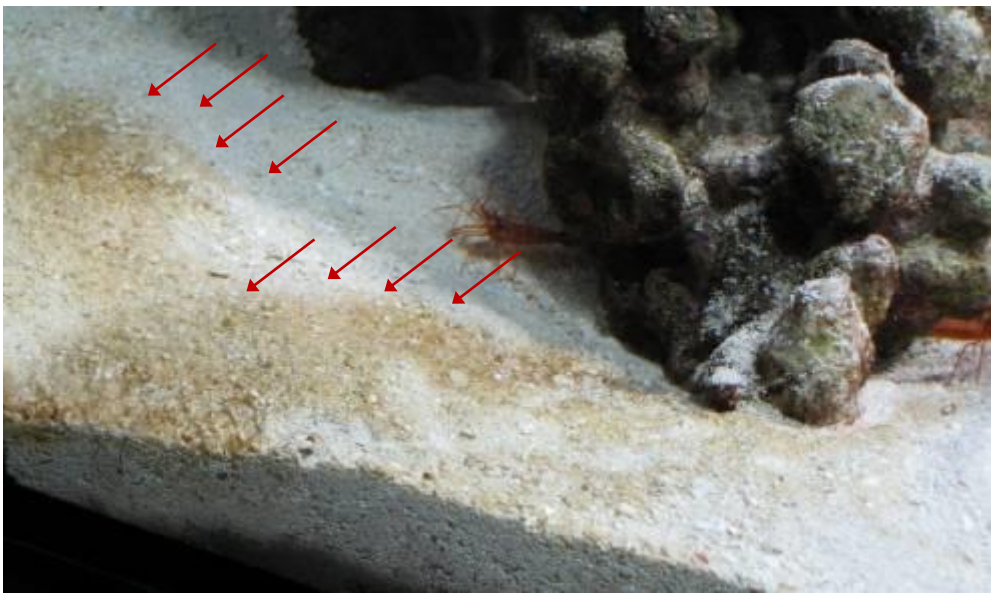
Some plagues caused by algae or bacteria can be sufficiently identified by visual inspection and description. For others, unfortunately, this is not possible.

... Filamentous algae

- Light to medium green
- Strong growth, sometimes up to 30 cm high
- Grows on sand, reef rock and even on aquarium glass
- Medium firm consistency
- Often slimy on the outside

Next to filamentous algae

... Diatoms



- Gray-brown
- Thin coatings (0.1 ... 2mm)
- Feels "sandy" when rubbed between fingers
  (shells of diatoms are made of hard silicon dioxide).
- Appear mainly on sand/ground, with stronger occurrence also on stones
- No oxygen bubbles on the coatings

Go to microscope images (recommended)

Go directly to diatoms

… Dinoflagellates

- Medium thick coverings (~0.5 … 5mm)
- Jelly-like, slimy, slightly sticky
- Orange/red-brown
  rarely also yellow/green or transparent
- On substrate (first) and also rock (later).
- Few oxygen bubbles in the coatings
- Coatings get more heavy over the day as of UV-light supporting growth
- When fanned with water, the coatings come off in shreds
  and also cloud the water
- Snails, starfish, sea urchins, etc. reduce movement or even die

Go to Microscope Images (Recommended)

Go directly to Dinoflagellates

... Golden algae

- Accumulations of gelatinous algae often with "plumes" standing upwards (No coatings)
- Mostly on rock, but also on the substrate
- Many oxygen filled bubbles
- Coloration green-brown, often transparent
- Difference morning/evening: number of vesicles
- Coatings do not come off when fanned with water

Go to Microscope Images (Recommended)

Go directly to gold layers

… Spherical algae / bubble algae


Valonia macrophysa

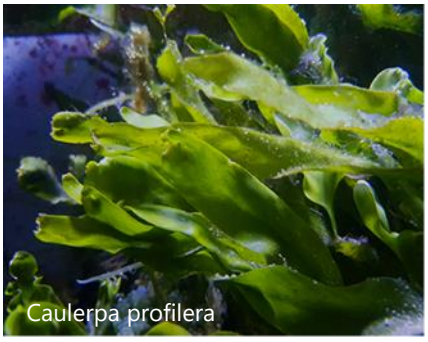

Ventricaria ventricosa

- Green, often transparent spheres
  2 types: small up to approx. 5mm / large up to 50 mm
- Small species forming aggregations on rock or in coral/gorgonian branches.
  Large species also sometimes simply lie around
- Slightly harder shell, which may burst under mechanical stress
- Bubbles are filled with liquid spores

Continue to spherical algae/bubble algae

... Macroalgae / Caulerpas


Caulerpa Racemosa


Caulerpa profilera

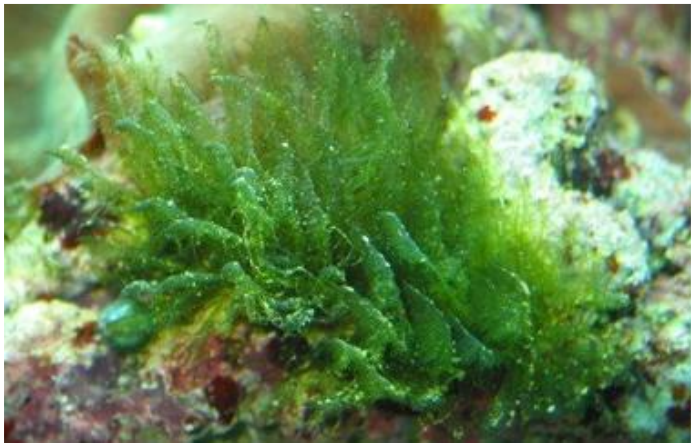

Caulerpa Taxifolia

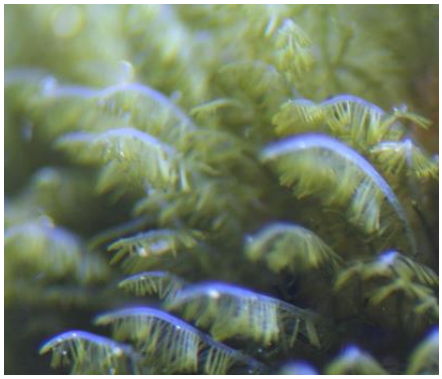
Appearance:

- Plant (no coating)
  Several different species with different growth forms
- Coloration bright to dark green
- All Caulerpas have roots with which they can anchor themselves (in rock, sand, mud)
- Either very fast growth (leaves and roots) OR
  dying algae becoming colorless but keeping the shape

Continue to Macro Algae / Caulerpa

... Bryopsis algae



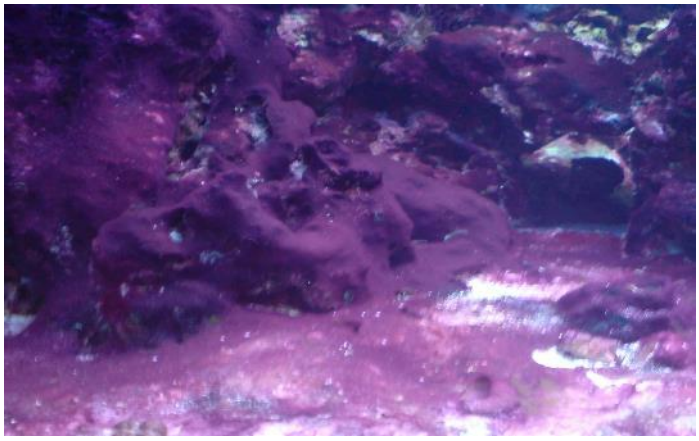


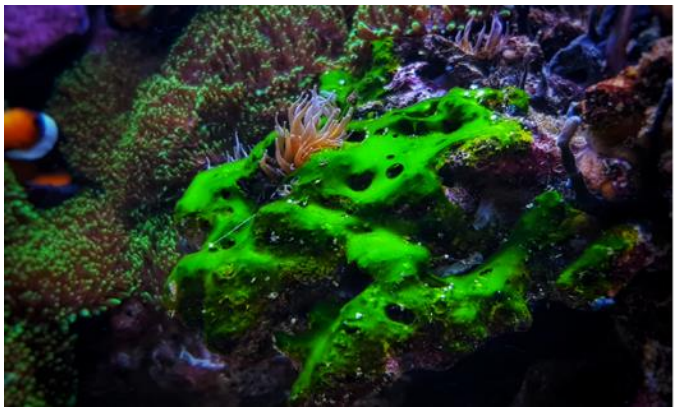
Appearance:

- Fast growing algae
  (no coating)
- There are several types / growth forms
- Often hairy consistency and relatively hard
- Feels a little rough (Detritus collected in the algae)
- Mostly settles on reef rocks
  Sometimes also on plastic parts in the tank (pipes, pump housings, ...)

Continue to Bryopsis

... Visual sample cyano-bacteria



Appearance:

- Thin to medium thick coatings (~0,1 ... 5mm)
  appearing literally everywhere in the tank (substrate, rocks, hard corals, glass panes, ...)
- Wine red/dark pink Color
  More rarely also bright green or black
- Matt/velvet appearance of the surface
- Gas bubbles sometimes visible, especially in the evening
- Coatings usually dissolve when fanned with water
  Some types have a thicker, syrupy consistency and can't be fanned off

Go to microscope images (Recommended)

Go directly to Cyano bacteria

1.3 Simple method to distinguish between bacteria | algae

The following simple method can show if you deal with bacteria (like cyanos) or algae.

- Remove some of the coating to be tested from your aquarium
- Soak the coating for a few minutes in pure alcohol (e.g. ethanol).
  → If the alcohol turns red or green (depending on the color of the coating)
  it is bacteria (e.g. cyano bacteria) and not algae.

The reliability of this method is not guaranteed

There are special forms in which this rapid test does not work (no staining despite clearly detected cyano deposits). If coloration occurs, however, the result is unambiguous.

1.4 Clear identification with microscope

A microscope is required to clearly identify the following algae / bacteria:
diatoms | dinoflagellates | gold algae | cyano-bacteria

This is how you do it

1. Take the sample to be tested from your aquarium using a pipette or syringe
   - An aqueous sample from an area with heavy deposits is ideal
   - Sample shouldn't contain solids/sand grains, as these interfere with microscopy

2. Prepare sample for microscopy
   - Drop sample onto slide with pipette-
   - Cover with coverslip (Caution: sharp edges)

3. Place the sample on your microscope and switch on the illumination

4. Set magnification + focus image

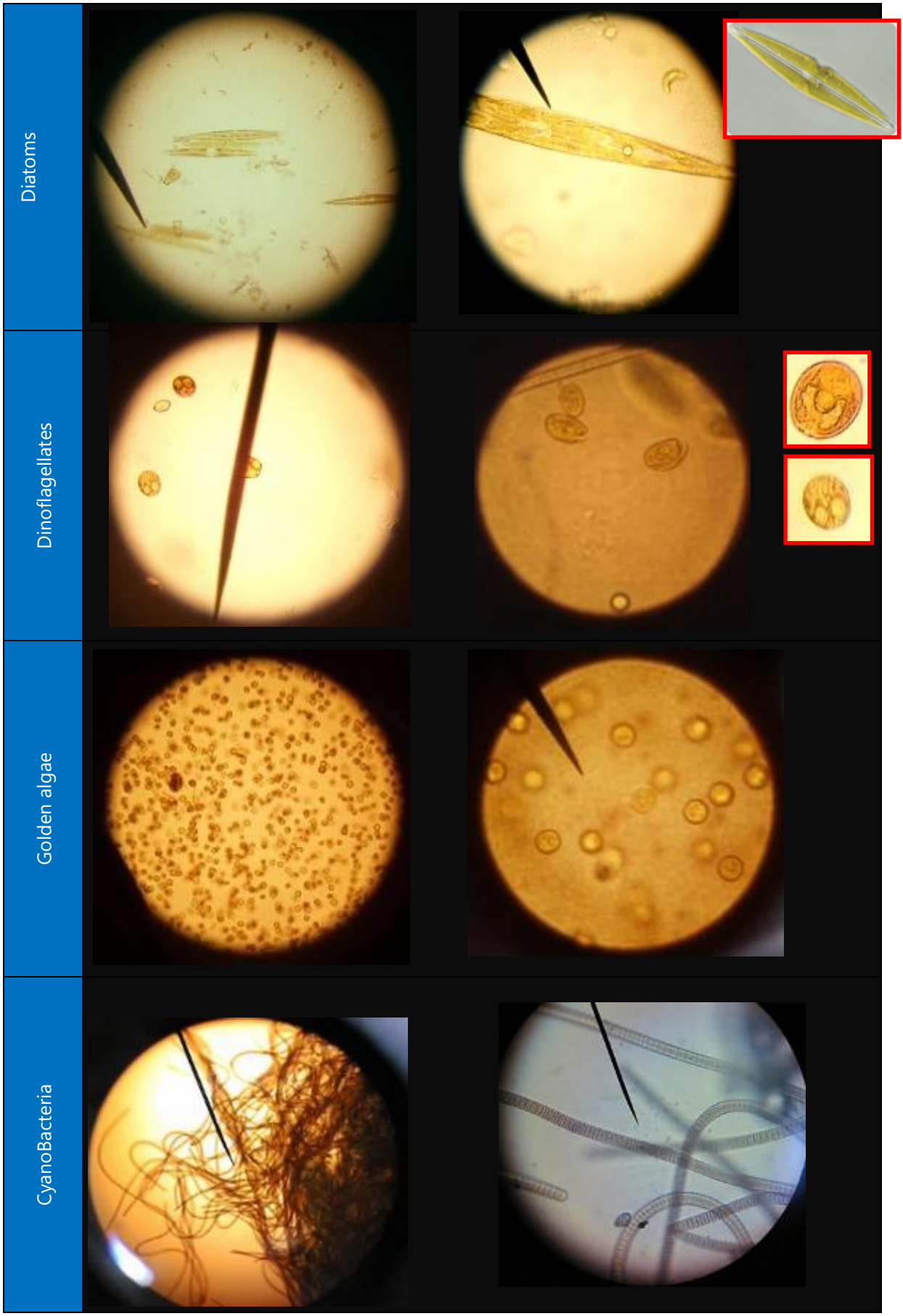
5. Examine sample, comparing with the images on the next page

Purchase recommendation: Microscope with digital camera and 1000x magnification or higher.

Description of the microscope images

Type	Description	Mobility
Diatoms	Trapezoidal, elongated	Little
Dinoflagellates	Oval, with scourge Striking orange/yellow coloration Several subspecies of dinoflagellates. However, in the end, it almost doesn't matter which exact species infected their system.	Movement similar to bumper cars the better the condition of the dinoflagellates the more mobile they are.
Golden algae	Spherical/circular, smaller than dinoflagellates	Little to none
Cyanos	long chains of single rectangles, because 1 cell	Minimum chain movement

1.5 Microscope images: Diatoms, dinoflagellates, golden algae, cyano-bacteria.



2.1 Filamentous algae

The starting point for filamentous algae growth is high nutrient concentrations in the tank water. If this is supported by other parameters, such as a light source with the wrong spectrum, a new stronger light source or supply of CO_2, they multiply strongly.

Filamentous algae occur when the nutrient input to the tank (at least temporarily)
is higher than the nutrient output/consumption from the tank.

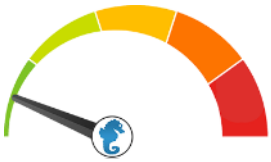
Whether the nutrient input is caused by dying material (e.g. when introducing new living stones) or e.g. due to excessive feeding is irrelevant.
Likewise, it does not matter "why" the nutrient discharge does not occur sufficiently. The important thing in control is that more nutrients are removed from the tank than are reintroduced.

In reef aquariums it is common for a nutrient peak to occur initially as there is almost always some dead material entering the tank. This results in a bloom of filamentous algae. However, this phase must be passed through in almost all aquariums at the beginning. If there are filamentous algae in the aquarium even after a longer time, it is usually due to the following causes:

- Continuous introduction of nutrients through poorly/not treated changing water
- Insufficiently dimensioned skimmer or other filter system
- There are Nitrate spinners in your aquarium circuit
  (bio balls, trickle filters, filter sponges that are cleaned too seldom)
- Dirty spots in the aquarium
- Death of animals might have caused released nutrients directly or indirectly

Thread algae are unsightly but relatively harmless. They clearly indicate that the nutrient cycle in the tank is not (yet) functioning, which can have many causes.
At the latest, if more demanding corals are to be kept, the tank should be free of filamentous algae to avoid overgrowth of the corals and thus damage by light deprivation.

Conclusion/Risk:



During the start-up phase of a tank, filamentous algae are normal.

However, if they occur in longer running aquariums,
there is a problem in the tank that should be eliminated.

... get rid of thread algae

Filamentous algae are usually only a temporary problem during the start-up phase of marine aquariums.

In running aquariums, they occur when the technology is incorrectly or severely undersized. There are various measures against filamentous algae that are easy to implement and work well. Generally the possibilities to get rid of filamentous algae are based on the following principles

- Add less nutrients to the tank (nitrate/N_3, phosphate/PO_4).
- Improve nutrient removal from the tank (nitrate/N_3, phosphate/PO_4).
- Remove algae manually
- Use algae predators
- Create food competition by other algae
- Kill filamentous algae (last way, usually not necessary)

List of measures for the removal of filamentous algae
(usually one or a combination of a few measures is enough to be successful)

- Ensure clean initial water (see water treatment)
  Carry out water change with clean initial water
- Reduce feed quantity, or feed feed with lower nutrient load
- Use of a good sized skimmer or
  use of another method to discharge nutrients such as use of caulerpas/macroalgae in the refugium, zeolite method, etc.
- Use of nitrifying bacteria
- Possibly adjust excessive dosage of trace elements
- Mechanical removal of filamentous algae
- Use of predators / snails (especially Turbo/Turban and Astraea snails)
  - Hermit crabs and other algae-eating crabs
  - Sea urchins (tip: *Mespila Globulus* is not too large and does not become rabid)
  - Sea hares
  - Algae blennies (e.g..e.g.: Salarias fasciatus)
  - Almost all doctor fish
  - Rabbitfish and foxfaces are strong algae eaters
  - Dredge gobies (especially suitable: A.Phalaena, A. Bynoensis, A.Rainfordi)
  - Establish some macroalgae in the refugium/technical tank (food competition).

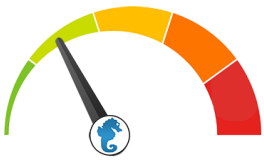
2.2 Diatoms

There are about 6000 different species of these single-celled organisms worldwide. They have a 2-part-, overlapping shell/shell of silica and can even move slowly. Reproduction is by cell division. Diatoms are the main component of the phytoplankton.

Diatoms proliferate when silicate is present in the water. They need this to build up their shell.

They occur during the start-up period in many marine aquariums but can also occur in running aquariums. This happens when the silicate concentration increases due to poor initial water and/or insufficient water treatment. Therefore, always aim for 0.0 mg/l silicate in marine aquariums.

Conclusion/Risk:



Diatoms are unsightly, but relatively harmless.
However, they can be the starting point for other plagues.

… Get rid of diatoms

- If the deposits are particularly heavy, you should vacuum/remove them.
  This will remove silicate that has already been built in from the tank.

- Further silicate in the tank can be **bound** and subsequently removed by using **silicate adsorbers.** By the way, phosphate adsorbers also bind silicates and can also be used.

- By far the most important measure: **Make sure that your source water is and remains silicate-free**. This is an absolute basic requirement for a well-maintained saltwater tank.

<u>This is how you keep your source water silicate free:</u>

For up to medium-sized aquariums, a **reverse osmosis system** with downstream **ultrapure water filter** is a cost-effective and clean solution in terms of water quality.
The reverse osmosis system already removes almost all undesirable elements from the source water, but not silicate (only about 10-20% is removed).
You require an ultrapure water filter to bind and then remove silicates completely from the otherwise already very clean water. This is done by forcing the water through a so-called mixed bed resin (consumable). You need to dispose and replace it regularly, depending on the amount of silicate in the source water. You will know when to do this latest when diatoms reappear in the tank after some time.

Note: In some areas the source water is completely silicate free, in others it is not or not always. Various waterworks, sometimes deliberately add silicates to the water to preserve the water pipes.
If you are sure that your water is silicate-free all year round, an ultrapure water filter might not be required. Your water supplier should be able to provide information on this.

For smaller aquariums, it may be advisable to purchase clean source water instead of making it yourself. Check with the aquarium dealer that it has been prepared using one of the appropriate water treatment methods described above or use distilled water.

2.3 Dinoflagellates

Dinoflagellates are a subgroup of algae. There are more than 1000 different species which show quite different behavior:

- Independent photosynthetic organisms floating around in the water as phytoplankton
- Symbiotic organisms such as zooxanthellae living in corals, anemones, mussels.
- Parasites attached to fish that can become small predators in their own growing up to 2 mm.

Basically, a small number of dinoflagellates is present in almost all marine aquariums. Dinoflagellates can also be introduced through corals, living stones, etc.

Dinoflagellate infections are frequent in still young aquariums.
The existing colonization area for bacteria has not yet been taken over by desired bacteria/algae, which is why they can spread unintentionally. The conditions prevailing in the aquarium determine whether dinoflagellates are suppressed by colonization with other algae or bacteria or whether there is even a strong increase.

Suboptimal design of water current as well as the lack of a suitable cleaning crew more often leads to the appearance of this annoying pest in marine aquariums.

Main problem: Under favorable conditions dinoflagellates can multiply rapidly. In case of strong occurrence, poisoning can occur. Some dinoflagellates produce nerve toxins that paralyze living organisms and can lead to suffocation. The animals poison themselves by ingesting this "phytoplankton" which is recognized/eaten as food.

Photosynthetic dinoflagellates adhering to surfaces are particularly troublesome. They form slimy, sticky layers which can cover substrate, reef construction, panes, etc. Unfortunately, these dinoflagellates also belong to toxic species.
Dinoflagellates are unfortunately very adaptable and therefore persistent, because they can feed organically and inorganically (so called heterotrophic assimilation). Only in the long run they cannot do without organic nutrients.

Possible effects

- Cloudiness of the aquarium water
- Damage by toxins up to life-threatening effects for tank inhabitants that ingest dinoflagellates as food. Particularly at risk: lower organisms such as snails, worms, starfish, sea urchins ...
- Coatings cover surfaces / corals and damage them by light deprivation
- Clogging of mechanical filters, overflow and skimmer

Conclusion/Risk:

Respond quickly and consistently when you recognize a dinoflagellate infection detected. Incipient infections usually spread.
Do not wait until this plague harms your animals!

Photo documentation of a rapidly spreading dinoflagellate infection.

0h:00min (turned flow pumps off)

After 5min

after 8min

after 11min

after 16min

after 18 min

after 20min

after 21min

… Get rid of dinoflagellates

Table: Overview of possible measures and their effect

Method	Effect	Description
Increase pH value	-	Increasing pH alone has limited effect and on some dinoflagellate species.
Reduction pH value	--	pH reduction alone has an effect on only a few dinoflagellates and even there only to a limited extent.
Reduction of CO_2 concentration due to increased pH value	o	Uptaking CO_2 is a must for purely photosynthetic organisms. If the pH is increased while the alkalinity remains the same, the CO_2 concentration decreases (a 0.3 higher pH leads to a 50% lower CO_2 concentration). Some aquarists report success with the method, others do not.
Manual removal by suction	-	Effect only temporary. Reduces the population but will not destroy them.
Reduction lighting duration	o	Effect is usually only temporary and does not lead to death. Also harms other tank inhabitants.
Reduction of nutrients a) Nitra (NO_3) b) Phosphate (PO_4)	 o +	The stronger the reduction and thus the lower the concentration, the more effective. Low PO_4 concentration is more effective than low NO_3 concentration.
Silicate content = 0 mg/l	+	Increased silicate concentration is a trigger for diatoms and is repeatedly mentioned as a possible trigger for dinoflagellate infections. Presumably this increases the risk of a dinoflagellate population.
Increased use of active carbon filtering or ozone	+	No effect on dinoflagellate population, but improves survival chances of the tank inhabitants since toxins are filtered out.
Create competition for colonization area by other bacteria	++	Displacement tactics! …elegant and has no negative side effects. Does not work for severe infections and often requires aquarium/technique optimizations.
Use cytotoxins	++ 	Destruction of other, desired, algae as well.

-- no effect - little effective o slight improvement + improvement ++ strong improvement

Method-1: Displacement by bacteria

The method presented below has been successfully applied by aquarist friends. Since it has virtually no negative side effects, I recommend "trying" it first before using more drastic methods.
Successful application should even lead to a stable running tank with reduced nutrient levels (nitrate, phosphate).

However, this has real chances of success only if the infection is not too advanced AND the infested aquarium has any potential for improvement at all according to the weaknesses described below.

Is your aquarium susceptible to infection? The following facts favor an infection:

- Are there areas in your aquarium (especially on the substrate but also on the reef structure) which are NOT properly flowed around?
  Are there possibly even places where detritus accumulates (gamma corners)?

- "Bottom cleaning crew" missing in your tank, rummaging through the sand and food residues/detritus coming to rest on it?

- Is the "Nitrogen cycle" really working reliably in your aquarium?
  (indication to not work are elevated nutrient values like NO_3 and PO_4)

Procedure

- Most important: Ensure that **all parts of the tank have a proper water flow**.
  This might require optimization of technology/flow pumps and also changes to your reef structure. (Recommendations: Compendium Water Parameters in reef aquariums chapter 1.1)

- Deploy a **floor cleaning crew**
  Especially well suited/diligent: Gobies of the genus Valenciennea (especially V.Sexguttata and V. Puellaris but also A. Phalaena).
  Note: Especially the first two are very shy. Take care especially in the first weeks for a safe protection against jumping out of your tank!
- **Animals browsing the substrate** itself:
  Well suited: Burrowing starfish, sand dollars and Babylonica snails.
  Important: Do not use in too young aquariums, as there might be not enough food in the sand and the animals could starve.
  When buying the animals, make sure that the tank size, other conditions and compatibility with existing tank stock are sufficient.

- Reduce light interval during treatment to a maximum of 6 hours/day (daylight interval).
  A not too intense blue light phase can be longer.
  - If the tank is illuminated by UV light by other means, it should be masked (eg with UV-impermeable film)
  - No water changes during treatment
  - No addition of trace elements during treatment
  - If possible, add few/no other nutrients to the tank.

- **Vacuum out infested areas & inoculate substrate with nitrifying bacteria**.

a) Dispose of the tank water removed by vacuuming (as it is contaminated) and refill with fresh salt water. Optimal time: In the evening shortly before switching off the lighting.
b) Prepare a low-dose bacterial solution from some aquarium water and a nitrifying bacterial culture (available from almost all well-known manufacturers). Mix the bacteria culture with a larger amount of tank water and let it rest for approx. 1h (the bacteria will already multiply a little).

c) Inoculate with a larger syringe.
Inject approx. 5 ml of the diluted bacteria solution approx. 5 mm deep into the substrate at as many places as possible, that were previously covered with dinoflagellates. Repeat the whole process in a grid of approx. 20mm for all previously infested areas of the substrate.
d) Let the skimmer run 24h/day to exclude possible bacterial bloom and associated oxygen undersupply!

- **Feed bacteria with bacteria nutrient solution or similar.**
In the following, regularly dose a bacteria nutrient solution or use vodka method or vinegar dosing. (Details: Compendium Water Parameters in reef aquariums , Chapter 6.5)

- Check nitrate/phosphate values with high quality test kits measuring/indicating accurately even in the range close to 0mg/l more frequently now. A reduction of previously elevated nitrate and phosphate concentrations is common and desired with this method.
However, **countermeasures** should be **taken if the reduction is too fast or to 0 values.**

  Reduction of nutrient values goes very fast?
  → Reduce the dosage of bacteria as well as the feeding (some coral species react sensitively to this actual improvement)

  Do the values get into the undetectable range?
  → Reduce the dosage of bacteria as well as bacteria feeding
  → Feed the fish more, e.g. with unwashed frozen food.
  → With SPS/LPS stock in the tank: Add amino acids to feed corals

- **Repeat suction,** inoculation **& feeding in a 1..2 day rhythm until coatings disappeared.**
This may take a few weeks, depending on the severity of the infestation.

Method-2: Dino X / phycoEx / etc

In case of persistent infections, use **Dino X**, **phycoEx** or similar algae cell poisons (Fauna Marin, Mrutzek Aquaristik, both approx. 25.-€ / 250ml).

Both products have similar ingredients and effectively fight not only dinoflagellates but also other types of algae. By the way, these products are antibiotic-free.

Although there are copies of these agents which are partly a little cheaper, I recommend the originals.

Consistently follow the **dosage instructions**

- In the evening, approx. 1h after switching off the lighting
  dose **5ml per 100 liters of** aquarium water (max. 6ml/100L) directly into the tank
- **Repeat** dosage **every 2nd day** until successful

- Reduce light interval during treatment to a maximum of 6 hours/day
  (applies to HQI as T5/T8, LED, blue light phase may be longer).
- If the tank is illuminated by other means (sunlight, ...)
  → Shielding e.g. by masking the panes with UV-impermeable foil.

- Adjust skimmer
  (Increased skimming due to death of dinoflagellates/other algae).

- No water changes during treatment
- No addition of trace elements during treatment

- If possible, add few/no other nutrients to the tank

- No OZON or activated carbon during the treatment (removes the chemicals!)
- Do not use PO_4/silicate adsorbers during treatment (removes the chemicals!)
- Switch off UV clarifier during treatment (weakens the effect!)

The average treatment time for a dinoflagellate infection is about 4 weeks.
However, it can be shorter or longer.

Do **not stop treatment too soon,** otherwise there is a high risk that the infection will spread again. Treatment of a resurgent infection is almost always more severe than that of an initial infection.

After the complete removal of all visible coatings, carry out at least two more doses.
Ideally, you should check the areas where stubborn coatings have been before again under the microscope. Do not stop dosing until no or no mobile dinoflagellates are visible. Observe closely and for several minutes.

Functionality
These products damage ALL types of algae (dinoflagellates, filamentous algae, spherical algae, calcareous algae/halimeda, macroalgae, bryopsis and also golden algae). They work fastest on unicellular algae such as dinoflagellates and golden algae.

As macroalgae are also damaged, special care must be taken when using refugia and algae/sludge filters, as the Caulerpas used belong to this species. In order to maintain the nutrient discharge (filtration) as good as possible or as long as possible, I would recommend the following procedure:

- Leave Caulerpa algae in the water circulation, but watch them closely If they turn pale/glassy → remove affected areas quickly
- if possible, reduce the amount of food to keep the nutrient input low (still pay attention to the well-being of your tank inhabitants, do not let them starve)
- Feed food with low levels of contaminants (bad: frozen food, especially if not rinsed, fine food for filter feeders and mussels).
- Check the nitrate value more frequently now. If it increases → intensify skimming

Side effects

Provided that the dosage instructions are followed, there should be no damage to fish or invertebrate stock. Even sensitive stony corals remain unaffected by the agent itself.
The following side effects are known:
- Slight decrease of the redox potential
- In case of prolonged use: damage to the general condition of sea urchins.

Various aquarists have reported a deterioration in the general condition of some animals, even death. Presumably the cause is the damage by toxins excreted by dinoflagellates.

- Damage to sea urchins, starfish, snails, mussels and other tank inhabitants that absorb the toxins through the tank water. Even more critical are the animals that eat the plaque (e.g. gobies). The more severe the infestation and the longer the animals are exposed to the toxins, the higher the risk. Therefore, starting the treatment early reduces the risk.
- Damage to light-dependent animals due to light deprivation (especially SPS).

I therefore recommend to remain all animals in the aquarium during the treatment.

After treatment....

The treatment represents a significant intervention in the aquarium biology.
Once completed, normal operation should be resumed.

- Remove the active substance from the tank again by **active carbon filtration**

In many aquariums, cyanobacteria appear briefly after treatment, but these should disappear again when the usual bacterial cultures have re-established.
Dosing of nitrifying bacteria after treatment is therefore advisable.

Method-3: Combination of several measures

If you want to avoid the use of toxins (Dino X/phycoEx), you can use the following method.

- Reduce nutrient levels to a range close to 0 mg/l (NO_3 ,PO_4).
- Do not add new nutrients, trace elements, amino acids
- No water changes
- Silicate concentration in the tank = 0 mg/l
- Raise pH and keep at 8.4 and 8.5 → Add lime water
  (for dosage see Compendium Water Parameters in reef aquariums chapters 5.3 and 7.4)
  If there is no improvement after a few days → raise pH to 8.6.
  (pH 8.6 is max to avoid unnecessary stress for animals)
- Maintain alkalinity or keep it at a high level (but ≤ 12°dkH).
- Reduction of the lighting duration (HQI, T5, T8) to a maximum of 6h/day
  (lighting duration of not too intense blue light can be longer)
- Vacuuming of the coatings to reduce the population density and reduce toxicity
- Measurement of the water parameters is absolutely necessary with this method.
  Use high quality tests to assume correct readings.
- Recommendation: Leave all animals in the tank.
- Do not stop treatment prematurely

Continue for at least another 4 days after the deposits have completely disappeared. Places where coatings were previously present should ideally be checked again under the microscope.
Stop dosing only when no or no more mobile dinoflagellates are detected. Observe closely and for a few minutes.

2.4 Golden algae

Golden algae are gelatinous interconnected cells. They can multiply rapidly. In general, they are not dissimilar to dinoflagellates, although with less potential risks, as they aren't toxic.

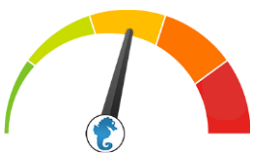
Mostly they occur in still young aquariums, where there is still free bacterial colonization surface. Food supply as well as possible occurrence of other (more dominant?) algae species decide whether golden algae can spread. The conditions prevailing in the aquarium decide whether they are suppressed by food competition with other algae species or colonization with other bacteria, or whether this unwanted species creates space for itself.

Almost the exclusive reason for the appearance of this pest in marine aquariums is suboptimal design of the current (current dead spots) as well as the lack of a suitable cleaning crew.

Possible effects

- Coatings containing air bubbles
- Can cover surfaces/corals and partially damage them by light deprivation
- Clogging of mechanical filters, overflows and skimmers

Conclusion/Risk:



Gold algae are unsightly and annoying

In the case of intense or long-lasting deposits you should initiate countermeasures

... getting rid of gold algae

Treatment of golden algae is similar to that of dinoflagellates.

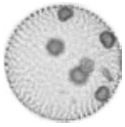
Since golden algae are not toxic and the infection is usually less severe than with dinoflagellates, I recommend first trying the displacement method or even the alternative method, and only if unsuccessful apply a Dino X/phyCo-Ex treatment.

When using the alternative method, the somewhat complicated raising of the pH value can be dispensed with. The dosage of bacterial cultures that take over the colonization area (in front of the golden algae) that has been released also has a supporting effect.

In the case of lighter infections, the use of special bacterial mixtures that have a particularly high "displacing effect" is also an alternative. These include e.g.:

- RED X (Fauna Marin)
- Coral Snow / Cyano Clean (coral culture)

2.5. Spherical algae/bubble algae



Spherical algae are usually introduced into aquariums accidentally, typically as appendages of stony corals. They can be found in most reef aquariums.

They like to settle in ramifications of stony corals, rock crevices or other places in the aquarium from which they are not washed away by the current. Once established, they usually spread out .

Attention: If the harder outer shell of the spherical alga breaks, it will release its spores. Further spherical algae can develop from the spores.

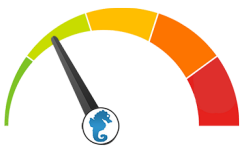
Spherical algae compete for food with other algae. If, on the other hand, no food is available, the number of spherical algae is also reduced.
However, spherical algae can also become a nuisance.

Possible effects

Spherical algae are a type of weed.

Settling on stony coral branches shades them from light in places and also easily hinders coral growth. Death of single polyps or whole regions of a coral are the possible consequences.

Conclusion/Risk:



Spherical algae are not particularly critical. But you should not deliberately introduce them into your tank.

Before inserting new stony corals you should check them for spherical algae and remove them before adding them to your tank.

... keeping spherical algae under control

As already mentioned, in many reef aquariums there are also some spherical algae. It is not necessary, and also difficult to eradicate them completely.
In addition, with the introduction of each new coral, there is a risk of reintroducing spherical algae.

A good strategy is to keep them under control by removing them.

Tips for removing ball algae

- Use a sufficiently rigid object to "pry" off the balls.
  Well suited for this purpose are toothpicks or shish kebab skewers
- Regular/frequent removal of the algae reduces spreading
- Often entire clusters/nests of spherical algae can be removed at once
- Avoid piercing / crushing spherical algae,
  as this causes spores to emerge which form new spherical algae.
- If possible, remove infested objects (e.g. stony corals, pump housings, ...) from the tank during treatment. This minimizes the risk of outbreaking spores.
  Rinse treated corals afterwards with fresh tank water (salt water!) to avoid introducing spores that may have unleashed.
- Pump housings, etc. can be treated with fresh water, or carefully with concentrated hydrochloric acid.
- In places where treatment is only possible in the tank
  → Remove already removed spherical algae from the aquarium immediately. (Collect, suck off or catch with a skimmer). Switching off the flow pumps during removal prevents flushing away.
- In the case of spherical algae nests in filigree stony corals, the tissue of the coral is often damaged or no longer present. Removing dead coral branches by snipping/breaking off before treatment often facilitates removal in other areas of the coral.
- Discard the object used to remove the spherical algae (spherical algae spores!).

Conditions for ball algae deteriorate

As with other types of algae, spherical algae proliferate especially when nutrient levels (nitrate/No_3, phosphate/PO_4) are excessive.
If these are at a low level, then spherical algae also multiply less.
Creating good flow conditions throughout the tank makes it harder for spherical algae to colonize.
Reduction of lighting intensity or duration seems to have little effect on spherical algae. Quite often they are even found in places with almost 0 lighting, such as inside flow pump housings.

Predators

1. Chelmon Rostratus (Pintail fish)
2. Siganus unimaculatus, Siganus vulpinus, Siganus stellatus (foxfishes, rabbitfishes)
3. Elysia crispata (Cauliflower bag-tongue snail)

Consider required tank size as well as husbandry conditions and compatibility with other tank occupants before purchase!

... Get rid of spherical algae

In the case of stubborn infestation, the following method, suggested by Konrad Schätz, is another option. According to previous information, it can even be used on stony corals in the immediate vicinity of the ball algae.

Treatment with sodium hydroxide porridge

1. Dissolve 10 to 20 beads of sodium hydroxide granule beads in 10 ml of aquarium water to create a viscous pulp. (Use safety goggles!)
   (Sodium hydroxide = "caustic soda" with >99% concentration, available in every online shop)
2. Draw up sodium hydroxide porridge with a syringe with a thick needle.
3. Turn off the flow pumps for a short time.
   (If an oxygen deficiency occurs, e.g. fish gasping for air or behaving strangely -> turn the flow pumps back on immediately -> stop treatment)
4. Apply the sodium hydroxide porridge to the ball algae in such a way that it remains on top of them. Exposure time approx. 30 minutes. Spherical algae will change color from light green to white.
5. Switch the flow pumps back on.
6. The ball algae dissolve on their own within the next 48 hours. The jelly drifting away has no negative effects on corals. Fish spit out eaten porridge calmly.

Repeat the application after a few days until all spherical algae have died.

2.6 Macroalgae / Caulerpa

Caulerpa are also called macroalgae because individual leaves/spheres consist of many nuclei of a macro-cell.

Caulerpa In marine aquariums also have advantages

+ In refugia or mud filter aquariums, they bind phosphates.
  You can remove them from the tank/circuit by simply plucking them out/removing them. The more nutrients in the tank, the stronger the growth of algae.

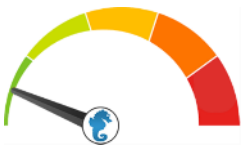
+ Caulerpas form a natural habitat in species aquariums.
  (E.g.: Seahorse tank).

However, inexperienced MW aquarists deliberately introduce Caulerpa into the main tank because of its appearance ("...*finally a plant in my aquarium*..."). However, the growth of this algae sometimes becomes so massive that it can already be described as a small plague.

Caulerpas in reef aquariums also have disadvantages

– Strong growth can shade invertebrates from light and thus harm stony corals
– If eaten by fish, bounded nutrients and/or pollutants are taken up
– Caulerpas becoming glassy release bound nutrients/pollutants into the aquarium water

Conclusion/Risk:



You should avoid introducing caulerpas/macroalgae into the main tank, as they will probably spread.

Using them in refugia or mud filters is useful.
However, prevent fragments from entering the main tank.

... getting rid of macroalgae / Caulerpa

Removal tips

- Grasp the algae as close to the root as possible and carefully pull them out. There is no danger of Caulerpas spores escaping and spreading the algae. Caulerpas spread by continuing to grow from all existing branches, as well as by reattaching torn off/bitten off sections
- Remove Caulerpa pieces/branches from the tank immediately. Shutting off the flow pumps during removal will prevent removed pieces of algae from washing away.
- If the algae are rooted in the sand: dig through the sand with your finger or another object to expose the root and then remove it completely
- If the algae are grown in the reef rock, it may not be possible to pull out the roots. As a result, they will keep growing back from there.
  One way to get rid of such a spot without removing the whole stone from the tank and disposing of it is to break the affected spot out of the stone (with soft porous reef rock even possible in the tank with a screwdriver) or chisel it off with hammer & chisel outside the tank.
- Preventing the spread by creating unfavorable conditions for the algae is hardly possible. Neither low nutrient values (nitrate/NO_3, phosphate/PO_4) nor low light really bother them. Dying Caulerpas can be recognized by the fact that they become glassy/transparent.

Some animals like eating caulerpa/macroalgae

- All types of doctor fish
- Percnon gibbesi (algae-eating crab)
- Tiger snails, flat spindle snails

Remove larger accumulations of Caulerpas manually beforehand, as the animals eat the nutrients/pollutants absorbed by the algae. Even if not directly harmful, these subsequently re-enter the tank circulation (excretions/detritus).

Consider required tank size as well as husbandry conditions and compatibility with other tank occupants before purchase.

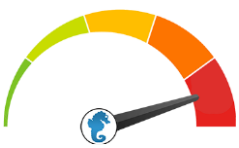
DinoX/phycoEx is also effective against Caulerpas / macroalgae.
However, the side effects of this chemical do not compare to the benefits.
The destruction of Caulerpas also takes a long time (about 4 weeks).
I do not recommend its use here.

2.7 Bryopsis algae

Some forms of algae are introduced into aquariums with live stones or even deliberately.
With Bryopsis you should avoid this at all costs. They are difficult to remove and grow back even with small fragments torn off/drifting around in the most impossible places in the tank, among other things preferentially on reef rocks.
Fish eating other algae, unfortunately do not like Bryopsis algae.
Bryopis are difficult to impress by nutrient-poor conditions, that are harmful for many other algae.
Bryopsis grow even in low light conditions. They are hard to impress by the use of alternative algae, such as macroalgae, as food competitors.

In addition to the unattractive appearance, these the algae multiply strongly, and can overgrow almost everything and thus harm invertebrates by shading.

Conclusion/Risk: Bryopsis should be banished as soon as possible from your aquarium, as they develop practically always to a plague!



... getting rid of this algae

... there is a lot that does not help!

Pulling out the Bryopsis algae only helps for a short time, but not in the long run, because parts of the Bryopsis algae remain on/in the substrate and grow back. Immediately remove uprooted Bryopsis pieces from the tank. Turning off the flow pumps during removal will prevent removed pieces of algae from being washed away.

Cultivation of macroalgae (Caulerpas) limits the infestation but does not usually eliminate it. Bryopsis compete with Caulerpas for food in the long run, which is why they die.

Increasing the magnesium content to the unnaturally high value of 1600 mg/L with the agent "Kent Tech-M" used to be an option, but no longer works (in a formulation change, a relevant active ingredient was probably removed or used in a less concentrated form).

for the removal of Bryopsis algae.

- Remove infested stones from the tank as soon as possible.
  Throwing away expensive stones as well as possibly newly positioning them in your the reef structure should not be an obstacle, as the risk of spreading to other areas is high.

- In the case that only individual areas of larger stones, are affected, these can be removed by breaking off or chipping off part of the stone (screwdriver, hammer & chisel, ...) in order to save parts of the stone. Proceeding thoroughly is a prerequisite. It is better to remove a few centimeters more than too little.
  If you are unsure, better remove affected stones from the aquarium.

Additional introduction of predators increases the probability of success.
However, it is repeatedly reported that the animals in some aquariums do not touch these algae. Presumably, this is related to differences from animal to animal as well as the low palatability of various Bryopsis species.
Following animals might eat Bryopsis to some extent, but will not be able to eradicate an infestation:

1. Percnon gibbesi (algae-eating crab)
2. Lumpfish
3. Heteropenaeus longimanus (swimming shrimp)
4. Siganus vulpinus (foxface/rabbitfish)
5. Some surgeonfish
6. Elysia crispata (Cauliflower bag-tongue snail)
   Attention: Animal is a food specialist for algae.
   If the appropriate food is missing, the animal will starve.

Required tank size as well as keeping conditions and compatibility to other tank occupants, are to be considered before purchase absolutely!

... Fluconazole application

A new method for Bryopsis removal was found in 2017. It works with a high probability of success.

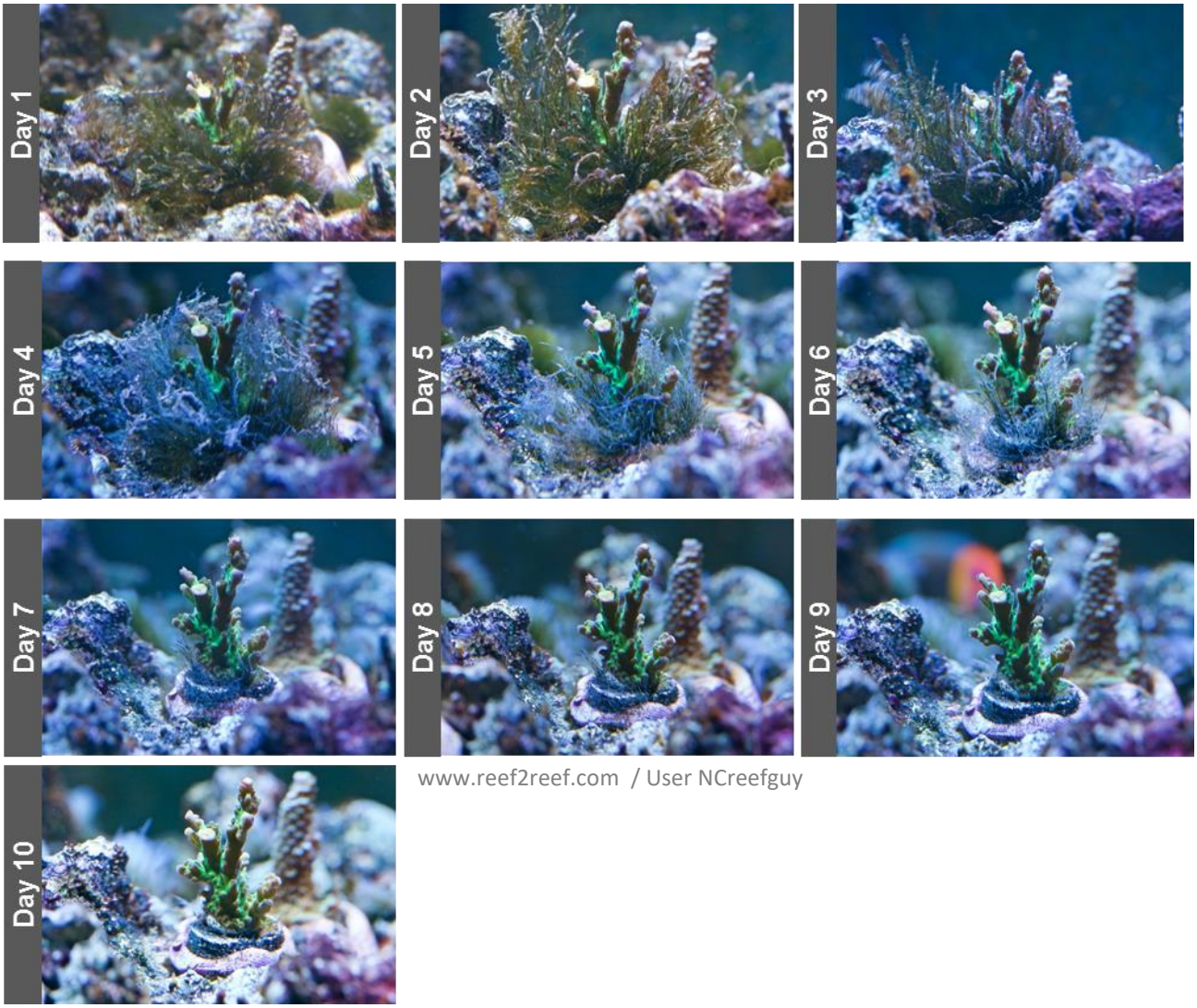
Green filamentous algae are also removed by this method.

Although, to my knowledge, no side effects have been reported, side/late effects cannot be ruled out.

The drug Fluconazole is applied. Fluconazole is an antifungal used for infections of the mouth/throat, lungs, intestines, esophagus, genitals, and blood.

Find out about a source of supply on the Internet or from your doctor.

Mode of action: Fluconazole blocks the enzymatic pathway for the production of ergosterol. This is important for maintaining the cell wall integrity of plants (similar to cholesterol in animal cells).



www.reef2reef.com / User NCreefguy

Application

1. Obtain medication containing fluconazole (e.g. tablets of 150 or 200 mg fluconazole each).

2. Preparation:
   a) Remove algae from algae filters/refugia.
   (They would die as a result of the treatment and should not pollute the tank.
   Do not reintroduce any algae that was removed after treatment/ Danger of re-infection)
   b) Carry out water change
   - treatment time approx. 14 days
   - due to dying usually an algae nutrient increase takes place
   - Suspend filtering with carbon as well as UV filter (would remove the medicine)
   c) Remove skimmer pot, but let skimmer run
   - Oxygen input necessary
   - but medicine should not be removed by skimming

3. Do not change the following things (if used continue to run):
   a) Supply with Ca/Alk,Mg (balling, lime reactor, lime water, ...)
   b) Continue to dose any trace elements
   c) Phosphate/silicate filter can/should continue to run
   (supports the discharge of PO4 by dying algae)
   d) Illuminate your aquarium as before without any changes
   e) Continue dosing Ozone (if you dose)

4. Single dosage of **500mg Fluconazole per 100 liters of** actual water volume *1)
   - Remove tablet shell with box cutter or similar /Use only capsule contents
   - Dissolve drug in some water/ mix as well as possible.
   (it will not dissolve completely, it doesn't matter, amount of water doesn't matter either)
   - add mixture to the tank at a place with strong flow, optimal way at night

   *1) Volume of tank+technical tank+piping minus sand, stones and corals.

5. **Treatment duration: approx. 14 days**
   Treat until all algae are SURELY dead

6. Remove the medication at the end of the treatment
   a) Put the skimmer pot back on
   b) Filter with activated carbon / restart UV filter that may have been switched off
   c) Carry out a generous water change (20%)

2.8 Cyano bacteria

Cyanos, even though they look like a red carpet of algae, are not algae but bacteria. They are unicellular organisms and connect through mucus walls to form a chain-like bacterial association. You will find them more often in areas with intensive lighting, as they produce oxygen through photosynthesis.

Cyanos are present in practically every tank. However, the population is usually so small that it is not disturbing. However, cyanos can spread rapidly if conditions are optimal for them.

Population is expanding under following conditions::

- Insufficient flow, or poorly flowed areas in the tank.
- Detritus/dirt in the bottom ground / presence of mud stains
- Changes to the aquarium biology. Mostly when new layers of sand or new colonization space are introduced, as well as after the use of chemicals such as Dino X
- Use of lightning with unsuitable light spectrum (yellow-, red-heavy) or worn-out light spectrum

The risk of cyanosis is higher in aquariums with a not yet run-in biology than in aquariums that have been running stably for a long time. However, with every intervention there is also the risk of catching cyanos. The bigger the intervention, the higher the risk.

Sometimes they occur even in well running and nutrient-poor aquariums, with optimal flow and light conditions. These cyanos are called "pure water form".

Effects

Cyanos are unsightly, but at least have no toxic effect on other tank occupants. It is problematic if the coatings shade invertebrates and thus harm them.

Conclusion/Risk:

Do not panic at the appearance of cyano-bacteria!
In many cases they "*come and go*" again.

Eliminate weak points in the tank / flow / tank biology.

Most of the time you have to be patient until you get rid of this pest.

... get rid of cyanos

Unfortunately, getting rid of cyanobacteria in marine aquariums is not a matter of overnight and requires some effort. However, the probability of getting rid of these, unfortunately frequently occurring, pests is good.

The following is the starting point for all further measures.

Cyanobacteria cannot multiply if the necessary colonization area for them is already occupied by other, desired bacteria.

Cyanos are sensitive to changes in the environment.

Prevent or get rid of cyanos in a natural way

It is best to take the following **preventive measures** into account when planning/occupying the tank and prevent cyano plagues from occurring in the first place.

1. Use of a high proportion of fresh and good quality live rock

2. Introduce desired bacterial strains into the tank, especially if there is only a small amount of live rock present

3. Provide good water flow and cleaning of the bottom
   - align current pumps in such a way that in the soil range everywhere light current is
   - employment of excavator gobies with sufficient aquarium size
     (V.Sexguttata, V.Puellaris, A,Phalaena, ..)

4. Avoid excessive nutrient levels (NO_3, PO_4)

In order to **get rid of deposits** already present in the tank, the following measures are possible/sensible for removal:

1. Regularly vacuum off cyano deposits using a thin hose and then dispose of them.
   Replace missing salt water with fresh water.

2. Pick up accumulations floating on the surface with fine mesh and/or cellulose cloths and dispose of them.

3. Cyano coatings in well flowing technical aquariums can be filtered out by briefly inserting filter wadding and whirling up the coatings. Dispose of afterwards. Mat filters are also well suited

4. Remove stubborn accumulations or buildup of coral with soft brush (toothbrush) and vacuum

5. Most A.Phalaena gobies eat cyano-bacteria

6. Replace outdated lamps (rule of thumb: replace after approx. 1 year)

7. Last but not least: Keep calm & be patient because
   it simply takes time for the necessary tank biology to set in.

It is even more efficient to combine this with the injection of the low-dose bacterial solution described in the displacement method.

Various aquarists also report improvement by changing the type of salt. I think this is more by chance, or by the last "missing drop" that restores the necessary tank biology/environment.

Cyanos also frequently occur when changing the substrate. When changing sand or substrate, it is advisable to proceed gradually. This will reduce the risk of extended cyano population.

Example:
Suck out the old substrate in the tank on the left *1) and replace with new after
1 week: Suck out the substrate in the center of the tank *1) and replace with new
after 2 weeks: Suck out the substrate in the right side of the tank *1) and replace with new one

*1) completely vacuum up to the bottom, dispose of the substrate, try to keep the amount of sludge in the tank as small as possible (thick hose). This way, existing bacteria cultures in the substrate are not eliminated overnight, which clearly benefits the biology of the tank.

Predators
- A.Phalaena (dredge goby)
- Batillaria sp. (cerithium snail)

... Natural control with phytoplankton Synechococcus

Phytoplankton Synechococcus is a floating cyano-bacteria that is deliberately cultivated. It "feeds" quasi identically to the unwanted cyanos, and is thus in direct food competition. The cyanos are thus deprived of their livelihood and the habitat freed up can be occupied by other, desirable bacteria.

Dosage: 50-80 ml Synechococcus per 100 liters daily
add to the tank for about 3 -5 weeks
turn off the current for 1 hour after each addition

Use Synechococcus cultures from controlled breeding with suitable high quality fertilizer, reduces the risk that they are contaminated with heavy metals or toxins.

The cyano coatings start to clear after approx. 2-3 weeks.
End of treatment after approx. 4-5 weeks (no more visible coatings).

Undesirable side effects are not known. No residues remain.
Residues are taken as food up by corals and other tank inhabitants.

Treatment with antibiotics

It is known that cyanobacteria can be combated with certain antibiotics. The problem is, however, that desired bacterial strains can also be fought and massive after-effects cannot be ruled out.
Antibiotics can also, even if unknowingly introduced (e.g. by exchanging corals, fish, etc...) lead to resistance with undesirable effects.

Treatment by antibiotics, or agents which contain antibiotics should only be the last option! These include, among others:

- Treatment with chloramphenicol, mycosidol, or similar broad-spectrum antibiotic.
- Treatment with ChemiClean (low-cost broad-spectrum antibiotic erythromycin)

... Purchasable means for the reduction of cyanos

RED X (Fauna Marin, 25€.-/ 250ml)
Special bacteria mixture that "displaces" cyanos particularly well
Use harmless. Medium success rate.

Dosage for 6 days, 10ml per day on 100 l waterEffect
occurs after another 5 days.

CyanoClean (Korallenzucht.de, 14,50€.-/ 10ml)
Special bacteria mixture which "displaces" cyanos particularly well
. Medium success rate

Dosage of 2 drops (0,1ml) per day on 100 l waterTreatment duration
depending on infestation

Coral Snow / **Coral Snow Plus** (Korallenzucht.de, 18.50€ or 20,50€ / 100 ml)
Dosage of 1 ml per day on 100 l water, treatment time ~10 days.
The rate of aquarists who were able to reduce/get rid of cyanosis is relatively high, however, this agent did not work reliably for all.

In addition, AntiRed (Aqua Medic) and **Algan** (Price) are offered. The
effectiveness of these two drugs on cyanos is rather controversial, but there are some aquarists who claim to have gotten rid of cyanos through this.

Imprint

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Sources & personal data

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Randy Holmes-Farley	http://reefkeeping.com Problem Dinoflagellates and pH / What Your Grandmother Never Told You About Lime
Tim "NCreefguy"	Bryopsis Cure: My Battle with Bryopsis Using Fluconazole

Threads/opinions of various forum posts: meerwasserforum.info | reef2reef.com | reefcentral.com

THANK YOU FOR YOUR ATTENTION!