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REEF CARE PROGRAM

# Algae Management

*Testing and Supplementing*

 Red Sea



## Red Sea's Reef Care Program - Recipes®

The complete Reef Care program is the result of years of research into the physiological demands of SPS, LPS & Soft Corals in the reef aquarium. Reef Care Recipes® translates the many years of practical experience with Red Sea's Reef Care Program on tens of thousands of diverse reef tanks worldwide into a simple to implement regimen of water management activities specifically for the most common types of hobby reef aquariums.

Water management refers to all of the water related activities such as water changes, testing and supplementing that needs to be done on a regular basis to ensure the success of your reef aquarium. This is not just limited to maintaining the ideal balance of the seawater but also deals with controlling nuisance algae and coral nutrition for their long term health and vitality.

In addition to the Algae Management program, which is fully described below, the complete Reef Care program also includes the following:

**Foundation™** – Provides biologically balanced levels of the foundation elements (calcium, carbonates and magnesium) that ensure the optimal water conditions for a sustainable, vibrant coral reef.

**Trace-Colors™** – Provides the essential minor and trace elements that are part of the coral skeleton and soft tissue and are specifically important for SPS corals to display their natural pigments.

**Reef Energy®** – Provides the carbohydrates, vitamins and amino and fatty acids that fuel all metabolic processes of corals.

For optimal results you should implement the complete program.

## **Nitrate NO<sub>3</sub>/Phosphate PO<sub>4</sub> control**

Micro-biological reduction of algae nutrients (nitrates & phosphates) occur naturally in all anoxic areas of the aquarium (inside live rocks, porous filter media and substrates). This bacterial activity is limited by the availability of suitable carbon sources and mineral co-factors and under normal conditions is unable to reduce all of the algae nutrients generated on a regular basis. Supporting the natural processes by regular dosing of a suitable carbon source and mineral co-factors provides an easy and reliable method of incremental control of the algae nutrient levels to safely control both the presence of nuisance algae and the population of the symbiotic Zooxanthellae.

## **Coral's Symbiotic Zooxanthellae Algae**

Understanding the role played by the symbiotic Zooxanthellae algae and their relationship with the coral is essential for successful implementation of the algae management program.

In nature corals host Zooxanthellae inside their soft tissue. The corals derive approx 85% of their energy from the Zooxanthellae and produce the remaining 15% in their soft tissue by metabolizing coral nutrients (Carbohydrates, Amino and Fatty acids) that are available in the surrounding water. This energy fuels all of the corals' metabolic processes such as protein production and coral skeleton growth.

The Zooxanthellae use the strong sunlight on the tropical reef as their primary energy source and pass on up to 95% of their photosynthesis products (Carbohydrates, Amino and Fatty acids) to their coral host, utilizing the balance for their own metabolic processes. The coral host provides the Zooxanthellae with nutrients, nitrogenous compounds, phosphates and CO<sub>2</sub>. It is this symbiotic relationship, involving the recycling of nutrients, that is the key to the ecological success.

Another aspect of this symbiosis relates to photo-protection from strong radiation. In nature, the Zooxanthellae protect the corals from intense UV radiation by absorbing the light energy and shading the delicate inner layers of the coral soft tissues.

In nature the Zooxanthellae population density is controlled by the algae nutrients (nitrate and phosphate) excreted by the coral, however in an artificial reef aquarium the amount of algae nutrients accumulate rapidly and if left uncontrolled will induce an over-density of the Zooxanthellae populations.

The high nutrient induced over-density of the Zooxanthellae population disturbs the natural balance causing competition between the Zooxanthellae and the coral for the available resources such that without additional nutrition the coral may become undernourished. Furthermore the increase in Zooxanthellae population causes the corals to become darker with a deep brown tint that obscures the natural vivid pigments of the coral. Higher Zooxanthellae population densities within the acceptable range will however provide the coral with the energy required for accelerated coral growth.

Reducing the algae nutrients in the water will reduce the Zooxanthellae population to the level that can only be supported by the algae nutrients supplied directly by the coral. Under these conditions the coral will receive less energy from the Zooxanthellae and will have less protection from the UV radiation. In this situation, if suitable coral nutrients (Carbohydrates, Amino acids and Vitamins) are readily available in the water, the soft tissue of the coral can increase its internal production of energy and assuming the necessary trace elements are available in the water, the coral will increase its natural UV protection by enhancing pigmentation of the soft tissue which is seen as enhanced coloration.

**Optimal levels of Nitrate and Phosphate according to type of aquarium**

Aquarium Type	NO <sub>3</sub> (mg/l)	PO <sub>4</sub> (mg/l)	Recommended Test Kit
Mixed Reef	2	0.1	Marine Test kits
SPS Dominant	0.25 - 0.5	0.01 - 0.02	Reef Pro / Algae kits
SPS Frag tank	1-2	0.08 - 0.12	Reef Pro / Algae Kits
ULNS	0	0	Reef Pro / Algae Kits
Marine Fish	<10	<1	Marine Test Kits

## **NO<sub>3</sub>:PO<sub>4</sub>-X**

NO<sub>3</sub>:PO<sub>4</sub>-X is a unique complex of a number of different carbon molecules and other organic-bonded elements that enable a controlled biological reduction of algae nutrients (nitrate and phosphate) by naturally occurring nutrient reducing bacteria that exist in all aquariums. Nitrate will be reduced to nitrogen gas that will be released to the atmosphere while the phosphate will be used and absorbed by the bacteria and eventually removed from the system by the protein skimmer.

The fine control of the nitrate and phosphate levels provided by monitored dosing of NO<sub>3</sub>:PO<sub>4</sub>-X guarantees the gradual changes and accurate maintenance of the nutrient levels preventing destruction of the Zooxanthellae population that can cause UV shock and starvation of the corals.

Unlike some other low-nutrient regimes, correct use of NO<sub>3</sub>:PO<sub>4</sub>-X will maintain all of the micro fauna that are beneficial for the reef.

NO<sub>3</sub>:PO<sub>4</sub>-X is recommended as a complete carbon source for use with carbon based de-nitrators.

Do not use NO<sub>3</sub>:PO<sub>4</sub>-X in conjunction with sulphur based de-nitrators or phosphate and nitrate removers as the different methods for nitrate and phosphate reduction will cause interference.

## **The Algae Management Test Kits**

Nitrate Pro test kit is an advanced colorimetric comparator test, measuring the level of nitrate to an exceptionally high resolution of 0.125 ppm.

Phosphate Pro test kit is an advanced colorimetric comparator test, measuring the level of phosphate to an exceptionally high resolution of 0.005 ppm.

## **General instructions for testing NO<sub>3</sub> & PO<sub>4</sub> and dosing NO<sub>3</sub>:PO<sub>4</sub>-X**

1. Only use NO<sub>3</sub>:PO<sub>4</sub>-X according to the enclosed instructions.
2. Test only with high resolution test kits (recommended accuracy: PO<sub>4</sub>-0.02ppm/ NO<sub>3</sub>-0.25ppm) such as Red Sea's Nitrate & Phosphate colorimetric comparator Pro Kits.
3. The NO<sub>3</sub>:PO<sub>4</sub>-X dosing chart (on back of product) is based on treating 100 liters / 25 gallons of water. Estimate your total volume of water (aquarium & sump less volume of live rocks etc) to calculate the correct dosage for your system.
4. NO<sub>3</sub>:PO<sub>4</sub>-X should be added to the sump. If you do not have a sump, add NO<sub>3</sub>:PO<sub>4</sub>-X slowly to an area with high water flow to prevent direct contact with the corals.
5. Efficient protein skimming is essential to provide the necessary oxygenation of the aquarium and to remove bacterial flocks from the water.
6. NO<sub>3</sub>:PO<sub>4</sub>-X must be added consistently on a daily basis to prevent starvation and destruction of the nitrate and phosphate reducing bacteria. If you miss one or more days of using NO<sub>3</sub>:PO<sub>4</sub>-X do not add the amount that you have missed and resume the dosing at the current daily dose.
7. For optimal results it is recommended to use NO<sub>3</sub>:PO<sub>4</sub>-X with a dosing pump. Make sure that the container and tubing are suitable (e.g. acrylic containers are not suitable for NO<sub>3</sub>:PO<sub>4</sub>-X) and that the container is kept almost closed to limit evaporation.



## **NO<sub>3</sub>:PO<sub>4</sub>-X - Directions for use**

### **Controlled nitrate and phosphate reduction**

In biological nitrate and phosphate reduction there is direct relationship between the reduction of nitrate and phosphate, the reduction rate of nitrate being higher than that for phosphate. The dosing of NO<sub>3</sub>:PO<sub>4</sub>-X is therefore regulated by measured levels of nitrate however in lower nutrient systems is important also to monitor the levels of phosphate.

### **Mixed Reefs, Marine fish and Frag tanks**

Before starting to use NO<sub>3</sub>:PO<sub>4</sub>-X measure and record the level of Nitrate in the aquarium

Start with the recommended daily dosage, test the nitrate every week and adjust the dosage until the nitrate level is stable between 1 and 2.5 ppm.

Measured Level (ppm)	Daily Dosage ml/ 100 L (25 gal)
NO <sub>3</sub> above 10	3
NO <sub>3</sub> above 2.5 but less than 10	2
NO <sub>3</sub> above 1 but less than 2.5	1

In the event that the nitrate level drops below 1ppm cut the daily dose by 50%. Test nitrate 2 times per week and adjust the dosage accordingly until it stabilizes between 1 and 2.5 ppm.

### SPS Dominant and ULNS

Before starting to use  $\text{NO}_3:\text{PO}_4\text{-X}$  measure and record the level of Nitrate and Phosphate in the aquarium

Start with the recommended daily dosage, test the nitrate every week and adjust the dosage until the nitrate level has been reduced to approximately 1ppm.

Continue daily dosing as recommended, test both nitrate and phosphate at least 2 times per week to make sure that nitrate and phosphate levels do not drop below the desired levels of  $\text{NO}_3 = 0.25$ ;  $\text{PO}_4 = 0.02$

Once the desired levels have been reached continue dosing daily and monitoring both nitrate and phosphate weekly.

Measured Level (ppm)	Daily Dosage ml/ 100 L (25 gal)
$\text{NO}_3$ above 10	3
$\text{NO}_3$ above 1 but less than 10	2
$\text{NO}_3$ above 0.25 but less than 1 ; $\text{PO}_4$ above 0.04	2
$\text{NO}_3$ above 0.25 but less than 1 ; $\text{PO}_4$ above 0.02 but less than 0.04	1

In the event that the nitrate level drops below 0.25ppm or the phosphate drops below 0.02 immediately cut the daily dose by 50%. Test nitrate and phosphate 2 times per week and adjust the dosage accordingly until they stabilize at the desired levels.

## Important notes for using the Algae Management Colorimetric Comparator Test Kits

- Before testing clean the glass vials and the large syringe by rinsing it with the water to be tested.
- After testing rinse all syringes and vials with RO or distilled water before storing. If vials are left unwashed a residue can form that will affect the results of future tests. Use a slightly acidic solution such as vinegar to remove the residue.
- In order to ensure an accurate drop size **always hold reagent bottle vertically** above the test vial, and gently squeeze out each drop
- Close all reagents tightly immediately after use.
- The test reagents are stable up to the date stated on each bottle when stored closed between 15 – 25 °C.
- Store the reagents and color card in the plastic box to prevent damage from prolonged exposure to light.

**N-NO<sub>3</sub>**: Table below gives the values for N-NO<sub>3</sub> the Nitrogen content of Nitrate

Low Range (ppm)	NO <sub>3</sub>	0.25	0.50	0.75	1.00	2.00	4.00
	N-NO <sub>3</sub>	0.007	0.013	0.027	0.053	0.120	0.91
High Range (ppm)	NO <sub>3</sub>	4.00	8.00	12.00	16.00	32.00	64.00
	N-NO <sub>3</sub>	0.91	1.82	2.73	3.64	7.27	14.55

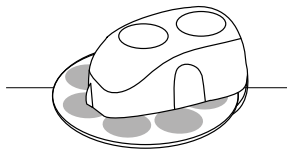
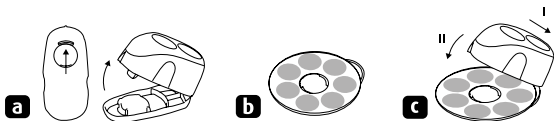
**P-PO<sub>4</sub>**: Table below gives the values for P-PO<sub>4</sub> the Phosphorus content of Phosphate

Low Range (mg/L)	PO <sub>4</sub>	0.01	0.02	0.04	0.08	0.12	0.16
	P-PO <sub>4</sub>	0.003	0.007	0.013	0.026	0.039	0.052
High Range (mg/L)	PO <sub>4</sub>	0.17	0.34	0.68	1.36	2.04	2.72
	P-PO <sub>4</sub>	0.06	0.11	0.22	0.44	0.67	0.89

## Assembling the Colorimetric comparator

- Press the catch in the recess of the base outwards and raise the body of the comparator from the base.
- Place the color disc onto the base so that the white surface on the base is in the center of the disc.
- Replace the body of the comparator by hinging it to the base at the back and pushing the catch through the center of the disc. The color disc should rotate freely in the comparator.

**NOTE:** In order to maintain the high accuracy of Red Sea's colorimetric comparator Pro Tests they are supplied with special optically clear glass vials that have a slightly smaller diameter than the regular glass vials supplied with all other kits. To prevent mistakes the regular glass vials do not fit in the comparator.



## Directions for Nitrate Pro Test Kit

1. Using the syringe provided, place exactly 16 ml of the water to be tested into both of the glass vials.
2. Insert one of the vials (control vial) into the outer hole of the comparator.
3. Add 5 drops of Nitrate Pro reagent A to the second vial (Reaction vial) Close the vial with the cap and shake for 15 seconds.
4. Add a leveled measuring spoon of Nitrate Pro Reagent B, close the vial with the cap and shake vigorously for 60 seconds.
5. Add a leveled measuring spoon of Nitrate Pro Reagent C, close the vial with the cap and shake vigorously for 15 seconds.
6. Wait 9 minutes for the color in the reaction vial to stabilize at the end point.
7. Remove the cap from the reaction vial and shake the vial gently to release tiny air bubbles and reagent particles that settled on the bottom. insert the vial into the center hole of the comparator.
8. When the end point of the test reaction has been reached look into both vials from above and rotate the color disc until the closest color match possible is achieved between the vials. Note: Turbidity or severe coloration of the water sample (high organic load) may distort the colors.
9. The nitrate level corresponding to the color selected is printed on the color disc as indicated by the pointer on the side of the comparator body. If necessary, estimate an intermediate value.
10. The color in the reaction vial will remain stable for 5 minutes. Do not relate to the color in the reaction vial after this time.

**High Range:** For levels of nitrate above 4ppm dilute 1ml of the water to be tested with 15ml of RO water.

## Directions for Phosphate Pro Test Kit

1. Using the syringe provided, place exactly 17 ml of the water to be tested into both of the glass vials.
2. Insert one of the vials (control vial) into the outer hole of the comparator.
3. Add 13 drops of Phosphate Pro Reagent A to the other vial (reaction vial), close the vial with the cap and shake for a few seconds.
4. Add 4 drops of Phosphate Pro Reagent B using the pipette, close the vial with the cap and shake for a few seconds.
5. Remove the cap from the reaction vial and insert the vial into the center hole of the comparator.
6. Wait 15 minutes for the color in the reaction vial to stabilize.

**NOTE: If the water sample has cooled to below 20°C wait for 20 minutes.**

7. When the end point of the test reaction has been reached look into both vials from above and rotate the color disc until the closest color match possible is achieved between the vials. Note: Turbidity or severe coloration of the water sample may distort the colors.
8. The phosphate level corresponding to the color selected is printed on the color disc as indicated by the pointer on the side of the comparator body. If necessary, estimate an intermediate value.
9. The color in the reaction vial will remain stable for 5 minutes. Do not relate to the color in the reaction vial after this time.

**High Range:** For levels of phosphate above 1 ppm dilute 1ml of the water to be tested with 16ml of RO water. Multiply the test result by 17.



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