



Breaking the spell on
CARBONATE CONSUMPTION
and its REPLACEMENT
in reef aquariums



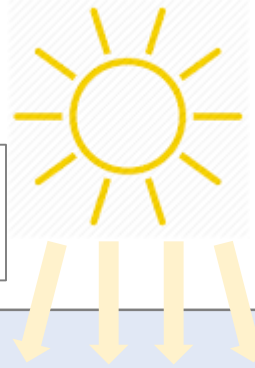
Martin Kuhn

www.aquacalculator.com

To achieve healthy conditions for stony corals and other animals in your reef aquarium you need to match these conditions

1 Saltwater

- Salinity of 34 - 35,5 [psu] (ideal 34,8 [psu])
- Temperature 24-26 [°C]



2 UV-Light

- Strong enough but not too intense
- Correct UV spectrum

3 Water flow

- To avoid sedimentation of detritus and transportation of plankton to polyps
- All around but not too intense

4 Free of poisons

- Avoid heavy metals in your water (copper, mercury, ...)

5 Nutrient Levels

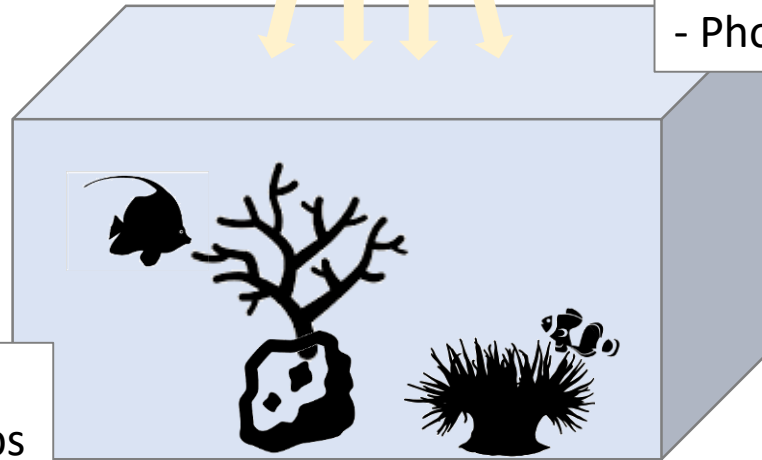
- Kept at a low and constant level but NOT 0 !
- Nitrates 2-10 [mg/l]
- Phosphate 0,01-0,10 [mg/l]

6 Major elements

- Alkalinity 6 .. 8 [°dKH]
- Calcium 400 – 450 [mg/l]
- Magnesium 1280 – 1350 [mg/l]

7 Trace elements

- Required but not as important to have at perfect levels as major elements (Potassium, Strontium, Iodine, etc)



Let us regard the major elements...

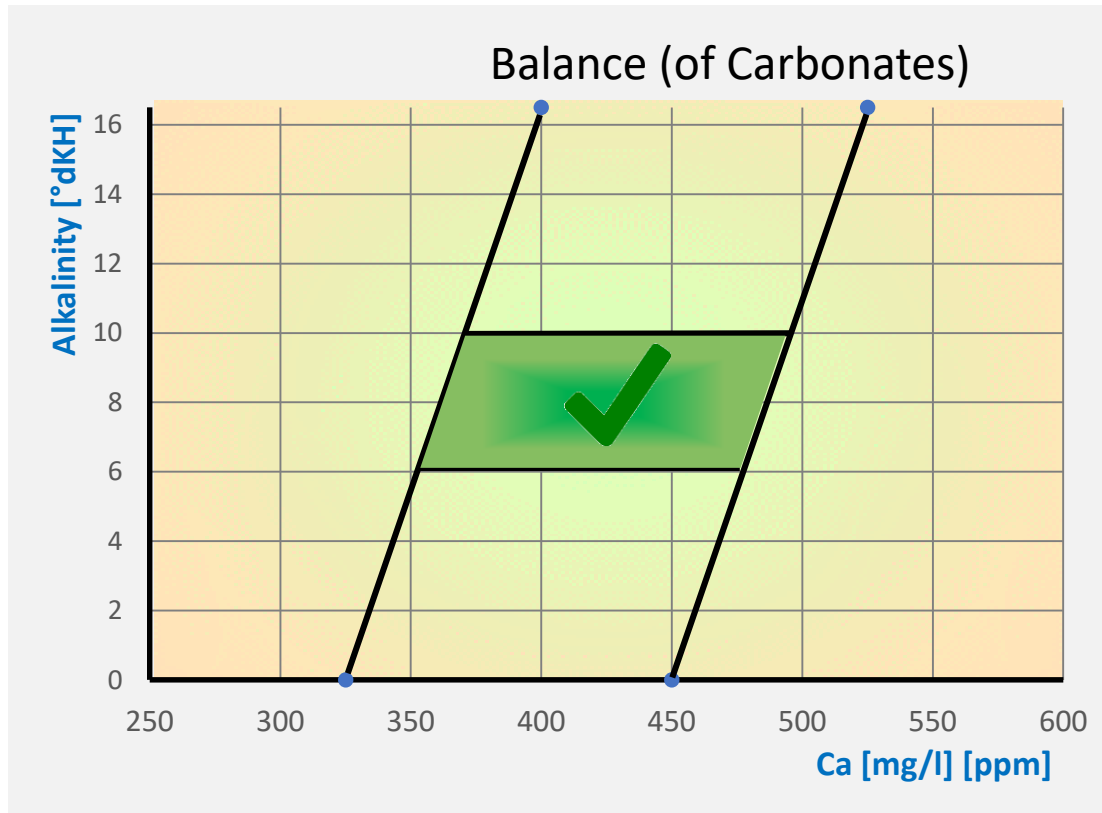
6 Major elements

- Alkalinity 6 .. 8 [°dKH]
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- Magnesium 1280 – 1350 [mg/l]

... how to get and maintain them at perfect levels



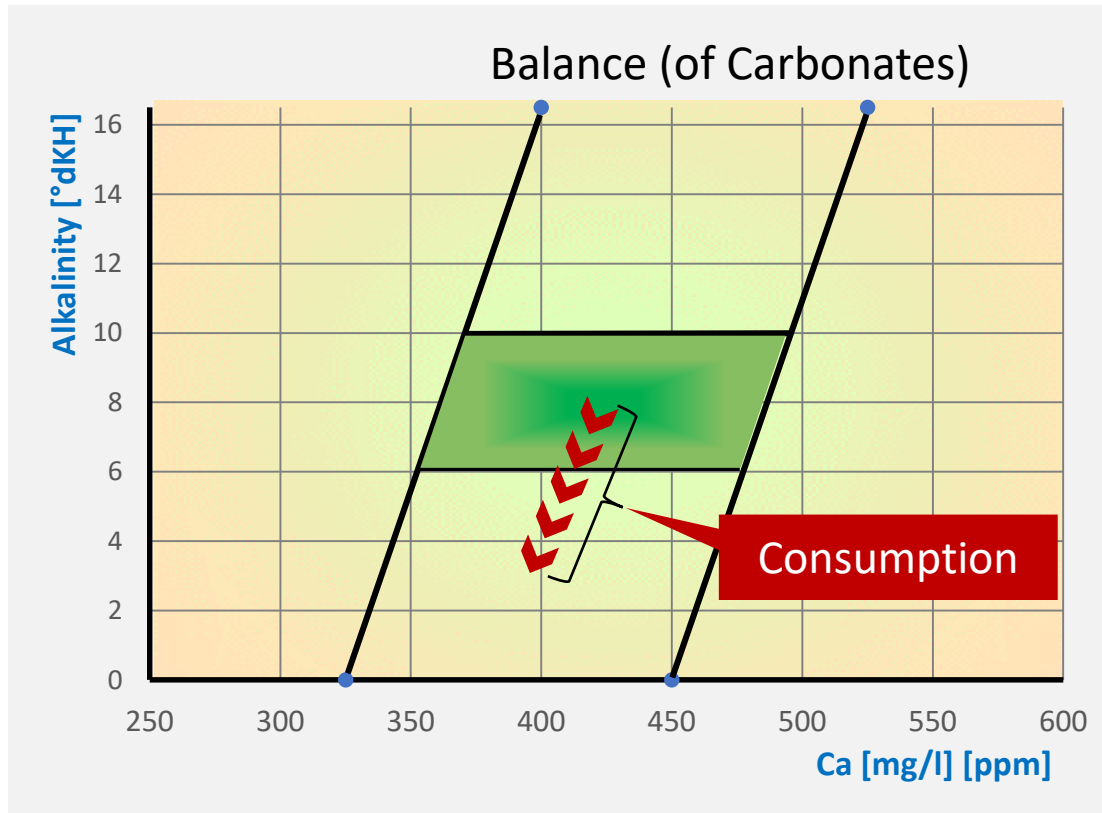
Carbonates are a major factor for SPS and other coral growth



- Important parameter for SPS and also other corals is the **Carbonate concentration** of your water
- You need to measure 2 parameters:
- **Alkalinity** in [°dKH]
 - **Ca** in [mg/l] or [ppm]
- Once **Ca AND Alkalinity** are in a sweet spot (green range in diagram) SPS and also other corals have optimum conditions. We can call this **BALANCE** of Carbonates



Growing corals “Consume”

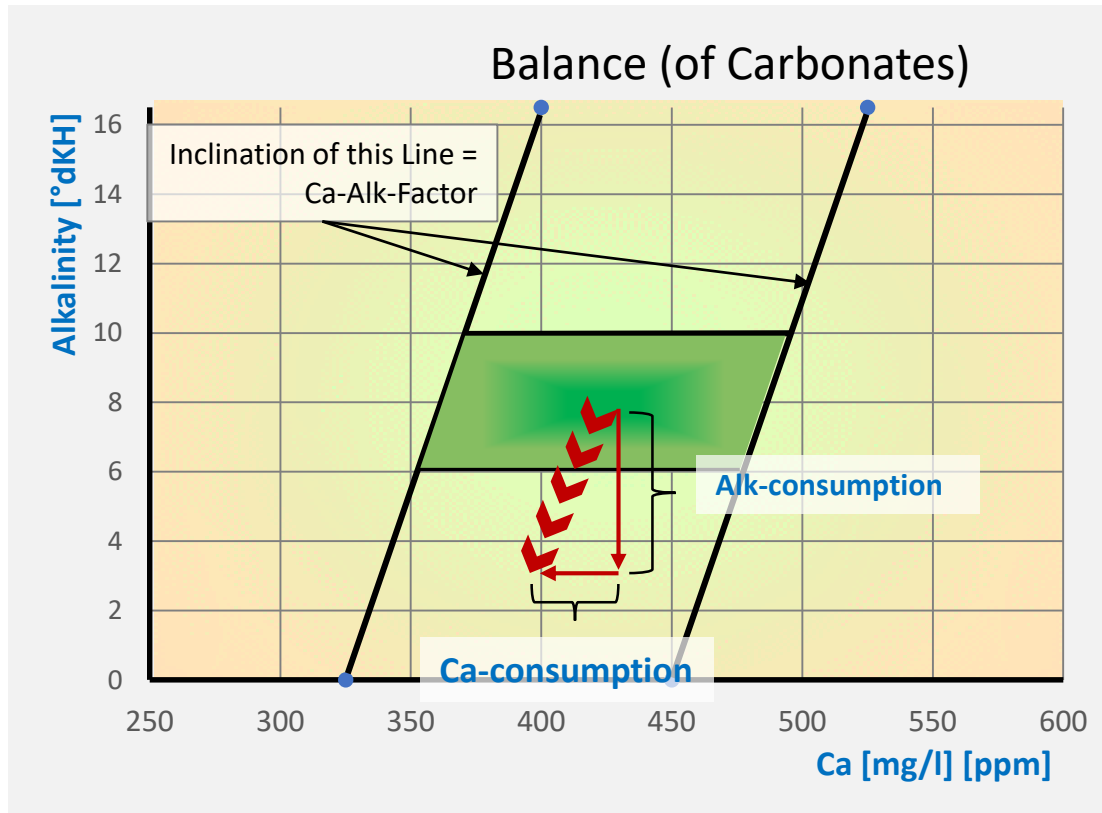


- Growing corals are just amazing!
For their metabolism SPS and other stony corals **consume** a reasonable amount of major elements and also trace elements from within the water.
(Also other animals can consume these elements eg coralline algae)
- Different to reefs in nature where the amount of water around is infinite, we have a strongly limited water volume in our tanks
 - In nature consumption is continuously balanced out by the immense amount of surrounding water
 - In our tanks the amount of Carbonates gets steadily reduced
→ Ca and Alk values (Carbonates) DECREASE

Let's call this the **CONSUMPTION OF YOUR TANK**



Consumption of Ca and Alk goes hand in hand



- Your tanks' consumption varies, depending on:
 - how many corals you have and how demanding they are
 - how well they are growing
 - constant levels of your water parameters
 - Consumption is split into Ca and Alk consumption
Usually the consumption of Ca goes hand in hand with the consumption of Alk!

Per 1,0 [°dKH] consumption of Alk we get a bit more than 7 ppm consumption of Ca [ppm] (7,134 ppm to be more exact)
- Let's call this the **Ca-Alk Factor**
Once consumption is balanced the Ca-Alk Factor = **7.134**

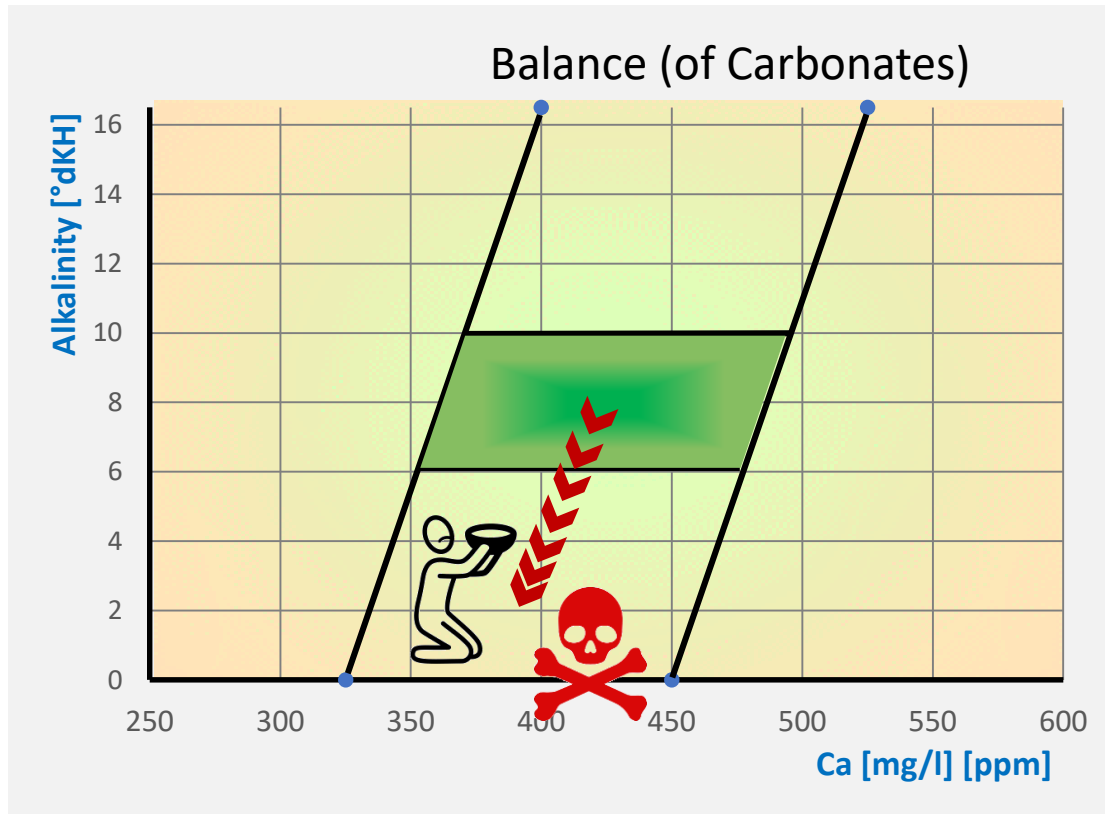
The formula for BALANCED CONSUMPTION is

$$\text{Ca-consumption [ppm]} = \text{Alk-consumption [°dKH]} \times 7,134$$

$$\text{Alk-consumption [°dKH]} = \text{Ca-consumption [ppm]} / 7,134$$



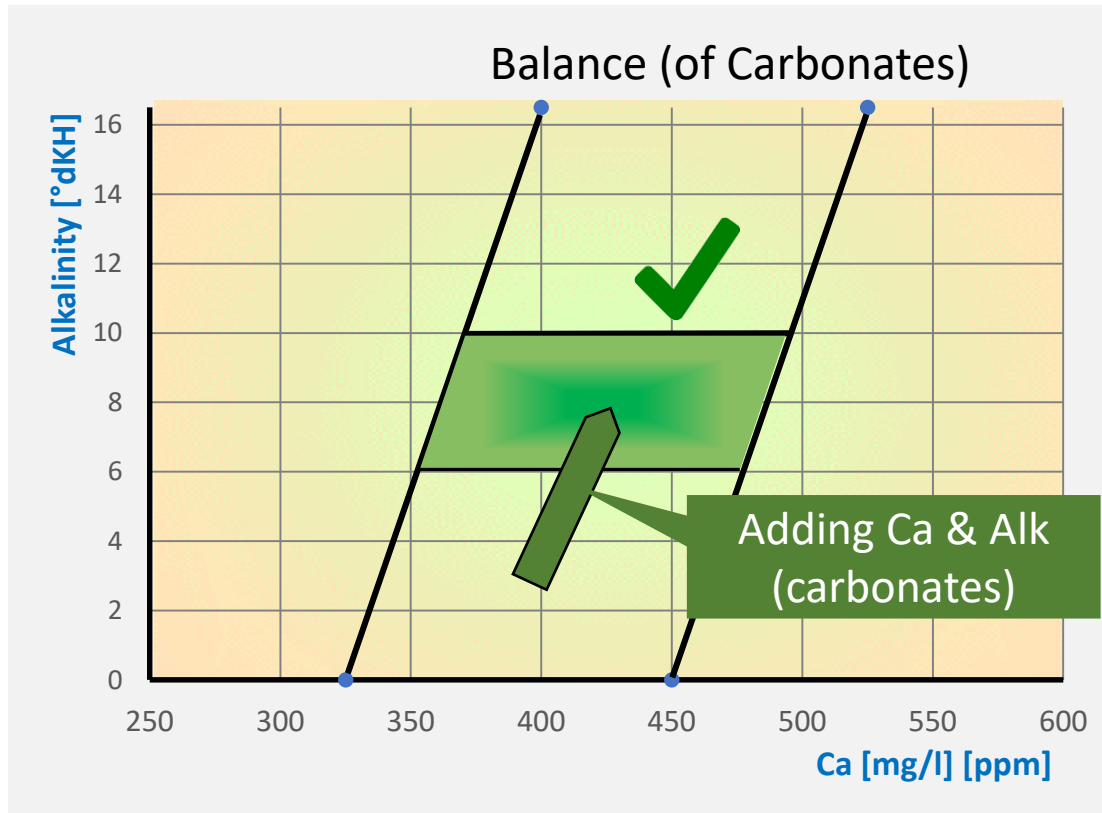
Action is required to keep your corals healthy and alive!



- If you don't do anything, values get lower and lower each hour, each day
- Once values reach a certain level, coral growth stops and they suffer
- If levels keep declining corals will even start dying from starvation
- As a result of no more consumption (starving or dead corals) Ca and Alk values do not go further down until 0, but remain at a certain level



Counteracting of consumption is required



- **Your reef aquarium requires your action in order to “refill” the quantities your tank/corals consumed!**
- There are several ways to do this, like
 - Water-changes with salt mixes rich in Ca/Alk
 - Running a Calcium Reactor
 - Dosing of Limewater, eg. together with an ATO
 - 2/3 part dosing

At the end all of these methods can do the job, with more or less cost and maintenance effort from your side

- Dosing the **correct amounts** of Ca and Alk, using the same **Ca-Alk Factor** as before, will get your ideal tanks' levels back
- You have to **repeat this each day!**
- Changing consumption of your tank (as a result of more corals) requires adapting your dosing!

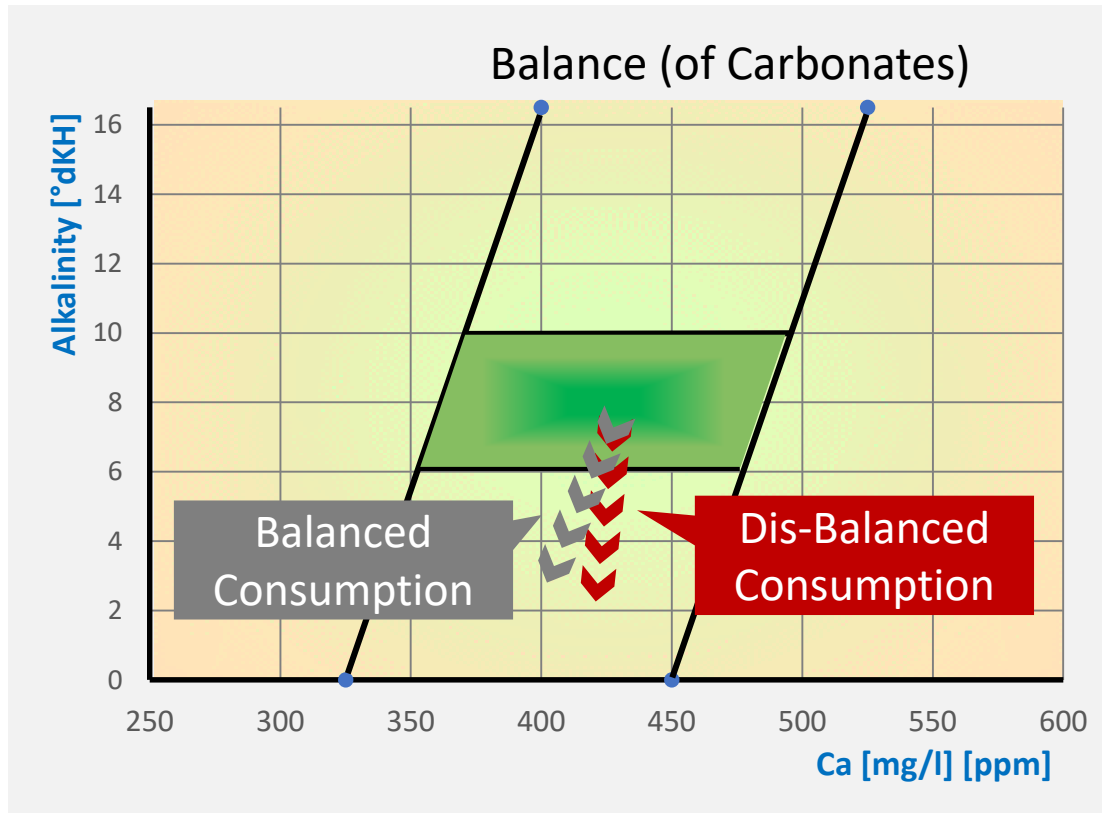




So far, so good! BUT....



Dis-balanced Consumption occurs in lots of our tanks!

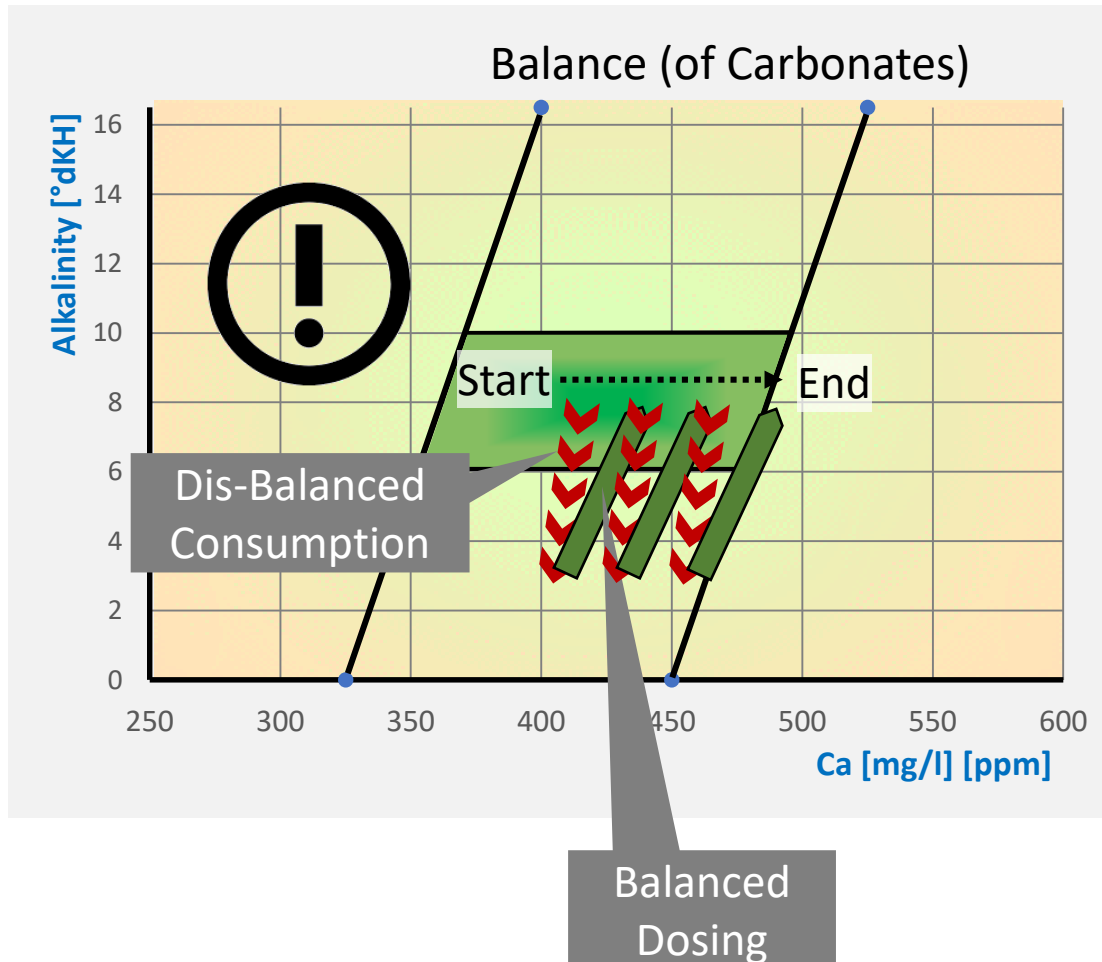


- Lots of reef aquariums, for different reasons, do NOT Consume Ca and Alk in a balanced ratio!
- The Ca-Alk Factor is NOT the usual 7.134 but different
 - In a majority of tanks the Ca-Alk Factor is smaller (tank consumes less Ca than Alk *₁)
 - In rare cases Ca-Alk Factor is higher. (tank consumes more Ca than Alk *₁)

*1) to make things easier to understand



Dis-balanced Consumption + Balanced dosing of Ca + Alk is an issue !

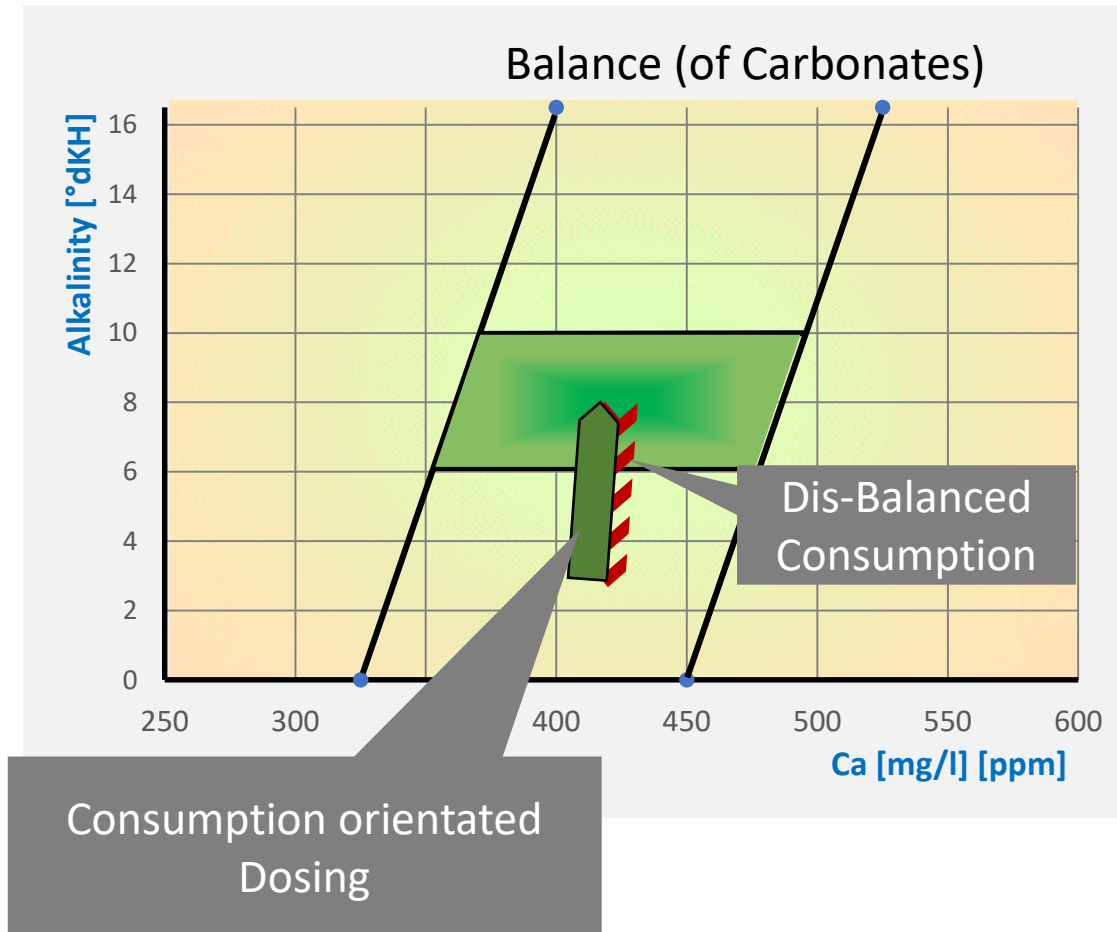


- Example shows a tank with **Dis-balanced consumption** over a 3 day period with (Ca-Alk Factor $\ll 7.134$, less Ca than Alk consumed)

+ a **Balanced dosing** of Ca / Alk (eg by water changes , limewater, 2-part dosing)
- In the example you focused on the required consumption of Alk only
→ as a result, your **Ca value climbs unwanted high** and can cause issues
- Another option is to focus on the Ca consumption
→ as a result, your **Alk value will get too low** causing even more severe issues






Consumption orientated dosing of Ca + Alk required for tanks with Dis-balanced consumption



- If your consumption is disbalanced, your Ca and Alk dosing should be also !
Let's call this **consumption orientated dosing**
- Consumption orientated dosing is
 - a) ... easily feasible with 2/3 part dosing.
Of course you have to adapt your doses according to your Ca/Alk consumption
 - b) ... NOT possible with
 - Calcium reactors
 - Limewater(as both of them are always Ca/Alk balanced)
 - c) ... manageable with water changes using selected salt mixtures, matching your tanks' Ca/Alk consumption (Most expensive)



Which method of dosing should I use to manage my tank's Carbonate consumption?It's up to you and your tank's requirements !

Method used	Balanced Dosing		Consumption orientated dosing	
	Feasible with certain limitations	Expensive for high consumption	feasible with lots of limitations	Expensive for high consumption
Water Changes				
Limewater 	Feasible	Only for average consumption (limited to amount of evaporated water per day)	-	-
 Calcium Reactor	Feasible	For low to high consumption	-	-
 Dosing (2/3 part)	Feasible	For low to high consumption	Feasible	For low to high consumption

2/3 part Dosing is the most flexible method, suitable also for SPS tanks with high consumption rates



Comparison of some dosing products related to Carbonate consumption

Table: Required doses for typical products for a balanced dosing for **100L watervolume and Ca +7,1 [mg/l] / Alk +1,0 [°dKH]**

Product / Recipe	Liquid solution for Ca [ml]	Liquid solution for Alk [ml]	Dose Ca vs Alk
Tropic Marin Original Balling	36 ml	36 ml	1:1
Randy Holmes Farley's 2-part #1	20 ml	19 ml	~1:1
Randy Holmes Farley's 2-part #1	40 ml	38 ml	~1:1
Bulk Reef Supply	19 ml	19 ml	1:1
ESV Bionic	11,8 ml	12,8 ml	~1:1
Fauna Marin Balling Light	6,5 ml	28 ml	~1:4
Aqua Forest Ca/KH-Plus	7,1 ml	20 ml	~1:3
Aqua Forest 1+ 2+	40 ml	38 ml	~1:1
Red Sea Reef Foundation	3,6 ml	32 ml	~1:9

Differences of the recipes (beyond price Level)

- Premixed solutions are in general more expensive as ones mixed from dry salts + RODI water
- The amount of stock solution you require to match your consumption
- The dose required to match Ca vs Alk is not always 1:1 (...is this a requirement ?)
- Effect on tank's ph-value (Buffered Y/N?)
- Some recipes can adapt also Mg, others don't
- Some recipes can adapt also consumption of Trace Elements, other's don't
- Purity of materials used ... Remember: You don't want to poison your animals!

