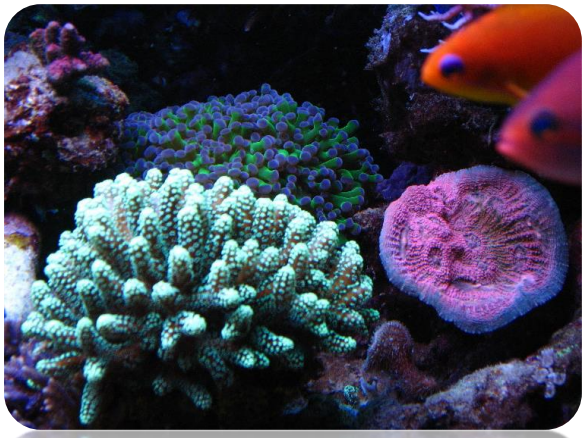
Mastering the Balling method with AquaCalculator for MS-Windows



The *Balling* method is the best way to steer the consumption of Calcium, Magnesium and Alkalinity, which is absolutely essential for growth of stony corals. The major advantage lies in its capability to steer and maintain these three water parameters in your tank separately and very accurately according your tank's needs. Also trace elements (Potassium, Strontium etc) or mixtures can be added to according your tanks demand.

Although several working steps are needed to adjust everything exactly to your tank's demands, experienced Balling users say it is very easy to maintain. That is correct… if only there was an understandable and complete explanation for it!
With this step-by-step instruction, together with the Aqua-Calculator, you will be able to master the Balling method without any chemical background or calculation effort.

FAQ last updated: November 14th 2019

Table of content

Symbols

Information / ***Hint***

Warning: text passages being extra important or things frequently misunderstood

Ban: Things to be avoided

Text passages explaining complex behavior in detail * Plan some time for reading

Recommendations given are according actual state of knowledge of the Author.
There is no guarantee for correctness.
Liability in case of correct or incorrect use will be dismissed.

Introduction

***Why should I learn about the Balling method*?**

Sea water in nature has a very special composition of several mass and trace elements. Animals within our tanks are demanding for an at least likewise water composition to enable a stress-free life. Using high quality artificial salt mixtures, we can adjust optimum conditions in our tanks. Several animals, especially small polyp stony corals (SPS), consume bigger amounts of these elements for growth and healthiness.
Carbonates are consumed most by far and are measurable by two aquarist test methods: Calcium (in mg/l or ppm) and Alkalinity (in either [° dH] or [mEq/L]).
Also consumed, but on a much lower level, is Magnesium.

If we did not balance this consumption, several animals (eepecially stony corals) would stop growing or even degenerate.

Is it really worth doing all the maintenance and measuring needed for the Balling method?
If you do not plan to cultivate sensitive corals like SPS, this method is not definitely needed; you can also balance levels for Ca/Mg/Alkalinity by frequent water changes.
Anyhow, tanks aiming for a good growth rate of stony corals must have a separate Ca and Alkalinity supply. Balancing this just by water changes might be a lot of work and very expensive.

Besides using the Balling method, you can also do that by using Calcium reactors or by kalkwater. But the Balling method has big advantages that the other methods do not:

- Ca, Mg and Alkalinity can be balanced independently from each other
- several aquarists report that coral growth improves

There are also several special products and mixtures available for balancing Ca, Mg and Alkalinity, resulting in the same results as using the Balling method. Normally these products are quite expensive and have to be dosed by hand. For smaller tanks, however, they might be a good solution.

The Balling method is the best-known way to balance your tank's consumption of Ca, Mg and Alkalinity and thus taking care for well-looking and growing stony corals.

The name of the Balling method is due to *Hans-Werner Balling*, who published it several years ago. His idea was to add a so-called "NaCl-free" salt mixture to make the tank's water more nature-like. Hans-Werner is a very experienced and advanced aquarist and biologist, working several years for the well-known company Tropic-Marin.

H.W. Balling (Dez.2009)

Balling ≠ Balling!

You will find tons of information about the Balling method on the internet, books, or even aquarist stores. Only some of them recommend the initial recipe suggested by Hans-Werner Balling but using the name "Balling". Recipes as well as dosing suggestions for liquid solutions differ a lot. Also, some of them do not add "NaCl-free salt". Thus, you might as well ask: "*Which one is correct?*"

The answer: *You can use one or the other*, *because it is very flexible.*

Two oft he most commonly used Systems are

- **Fauna Marin – Balling Light System**
  - Pharmaceutical grade dry salts, delivered pre-portioned.
    Aquarist just has to mix with a certain amount of RO-DI water
    (Salt-Mixtures with chemical advantages like Buffering
    are used for Alkalinity and Magnesium)
  - Fauna Marin Trace Elements, developped to fit to the recipe,
    are mixed into the liquid solutions
  - Good and detailed instructions incl. a free CouponCode for
    AquaCalculator for Windows included in Balling Light Starterset.

C. Schumacher (2015)

- **Randy Holmes Farley's DoIt-yourself**
  - 2 different Recipees for tanks with either high or low pH
  - Cheap as based on commercially materials like eg "Dow Flakes".
  - Also offered from BulkReefSupply
    (biggest Online supplier for reefer products).
  - No Trace elements included into recipe

The following step-by-step instruction explains an **often-used variant** of the Balling method, very detailed and easy to understand with the following boundary conditions:

- Adjustment of Ca, Mg and Alkalinity with the Fauna Marin products "Balling Light".
- Adjusting to following water parameters (which are my favourite ones):

Ca:	420	mg/l
Mg:	1250	mg/l
Alkalinity:	8	°dKH

  (of course you can also adjust to alternate values)

- Calcium and Alkalinity (Carbonates) to be adjusted separately and usage orientated.
  (differing from original Balling method, which uses a fixed ratio for Ca/Alkalinity)

- Dosing station with three+ channels available

- All calculations by the software tool *AquaCalculator*

- Examples shown are for the following AquaCalculator settings
  - Units will be calculated in SI Units (not fractional units)
  - Alkalinity measured in [°dH] (not [mEq]])
  - salinity is measured with a refractometer in [psu] (not density, spec. density or conductivity)

  You, of course, should use the measuring system and measured values of your own tank!

Aqua Calculator for MS-Windows is available for download on my homepage.
Use of necessary functions requires upgrading to “Premium version” (9.99 € / 11,49 US$).

* Download from following Link and install

* AquaCalculator is already installed on your computer?
  Update to the recent version:

  Settings → *Miscellaneous* → *Auto Update*

System requirements for AquaCalculator: Microsoft Windows 10, 8, 7, Vista or XP
With some limits in graphical display, Aqua Calculator works also on “Windows Emulators“
on other operating systems (Linux, Apple-OSX…)

You should know about your tank’s exact salinity first,
to then accurately measure and adjust Ca, Alk and Mg.
Salinity in your tank should be ~ 34,8 psu.

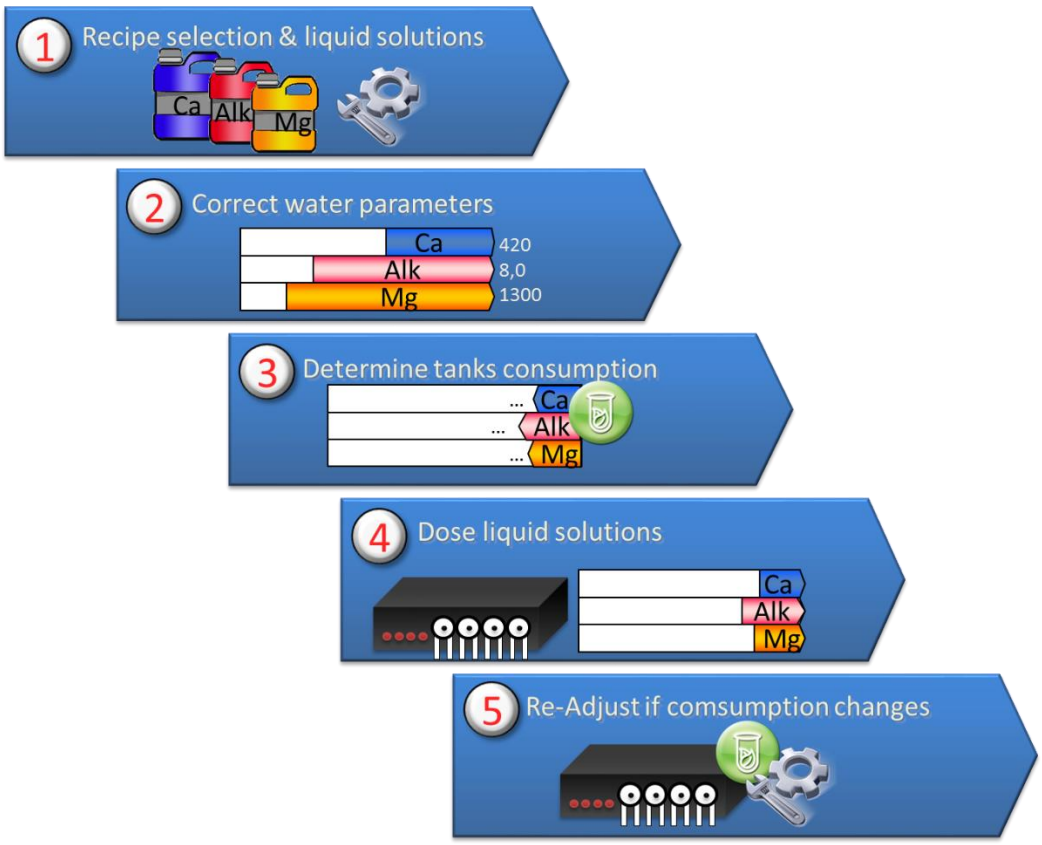
Correctly measured water parameters is extremely important. Be absolutely sure that you know how to measure and use only correct results. If starting with incorrect measured values, you risk harming your animals or not being able to balance Ca, Alk and Mg correctly. In any case, I recommend checking each test kit with a reference solution about its correctness, before taking the measured values for granted.

You are missing materials or tools needed for the 2/3 part Balling method?

* Check the shopping list at the end of this FAQ

Balling method at a glance

Following graphics show the five necessary working steps:



① Situation: We first have to decide on a "Balling recipe". To be able to dose well, we need so called liquid solutions mixed from Balling salts + water.
Compositions of the stock solutions are determined and solutions are mixed together.

② Situation: In your tank initially not all water parameters might be in the optimal range.
Ca, Mg and alkalinity are brought to optimal values by adding Balling salts or stock solutions. This may take several days. After each addition, the values are measured. This phase ends when all 3 values are within the optimum range

③ Situation: The concentrations of Ca, Mg and alkalinity will fall again by the renewed consumption. That can not be avoided (consumption of your tank).
For some days no more Balling salts are added.
Parameters are measured regularly.
Characterized the consumption of your tank is determined in this phase.

④ Situation: The appropriate amount of liquid solutions must be dosed to your tank. the most convenient way is by dosing with a multi channel pump.
Required amounts of liquid solutions are determined and dosed daily.

⑤ Situation: If the consumption in the tank remains the same, dosing is fine.
This is the desired state! Ca, Mg and alkalinity should still be checked regularly, where consumption is subject to change by increasing or stagnant growth.
Required amount of liquid solutions will be changed in case of changing consumption.

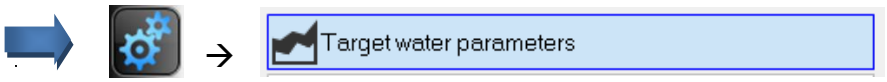
1. Recipe selection & liquid solution

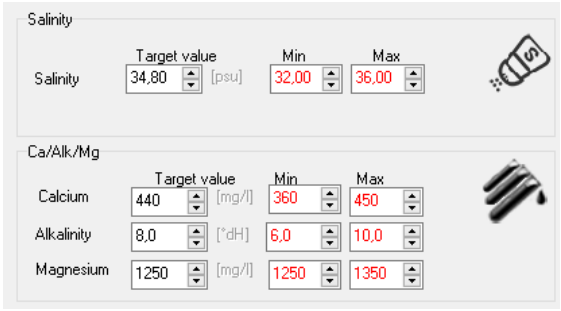
1.1 Program settings

First we adjust our targeted water parameters and the Balling-products to be used.

- Calcium: **440** [mg/liter]
- Alkalinity: **8** [° dKH]
- Magnesium: **1250** [mg/liter]

Parameter are dependent from your tanks salinity.
So we adjust salinity also, in case beeing different from (34,8 psu).





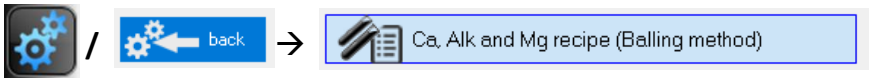
Hint: You are measunring salinity by aerometer or conductivity sensor and thus are wondering about your settings? Target values then should be

Density @25°C *1)	1,0232	[g/cm³]
spec. Gravity / rel.density @25°C *1)	1,0262	[-]
Conductivity @25°C *1)	52,80	[ms/cm]

In case you are not absoluty sure which unit your device is displaying, please refer to my Waterparameter-FAQ chapters 1.6 … 1.9

*1) means: This value is for a measuring temperature of exactly 25°C. These 3 measuring are, different to salinity in [psu], „stronlgy dependent from the temperature“. Different temperatures, different results!.
(lower water temperature → higher measued values and vice versa)

Select the „recipe to be used “



Aqua-Calculator is a very flexible tool and has several options.
To follow the example, we select **Fauna Marin – Balling Light**

1.2 Containers for liquid solutions

We could do our dosing by directly adding the (dry) Balling salts. This will work without any doubt. But it is not very convenient weighing the amount of the three Balling salts for each day. It is also not very convenient to dose the Balling salts per hand each day for a longer period of time. Also, there needs to be a pause between dosing the Balling salts for raising Ca and Alkalinity each day.

So we should do different and mix so-called “liquid solutions” from the respective Balling salts and RO water. As the next step we will automate dosing the liquid solutions by a dosing pump and thus using the following advantages:

- Weighing of the Balling salts can be done for several weeks in one working step.
- Liquid solutions are much easier to dose than pulverulent Balling salts.

1.3 Important information for mixing liquid solutions

(To avoid existing confusion)

- ✓ It is not “THE Balling liquid solutions” – but there are different ones possible.

- ✓ In the end, it is only important to “dose the correct amount of Balling salts” each day. How much water you used to solve the salts is basically irrelevant.
  But it is extremly important to “know about the concentration of the liquid solutions used”. Not knowing this means also not knowing which amount (eg millilitre) you have to dose to for a “defined raise in Ca, Alk, Mg”.

- ✓ The water volume of your tank is just as crucial for the dosage. The bigger your tank, the greater the consumption.

- ✓ It would be nice to mix each liquid solution in a way that you solute *as much salt as possible*, because it would last for a long time.
  But the amount of Balling salts is limited to a certain saturation limit (max. saturation), which restricts the amount of salt than can be used. If you exceed this limit, you will get precipitations in your liquid solution, meaning that you might dose less Balling salts than you want.
  Maximum saturation of the different Balling salts is strictly different from each other.

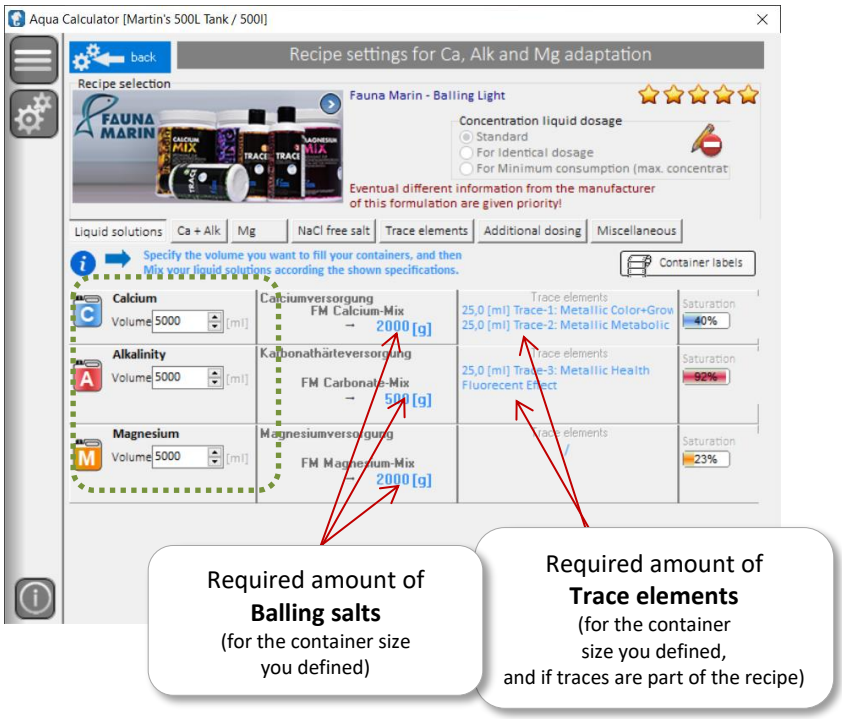
Example:	$CaCl_2 * 2H_2O$	986 Gram mixed to 1 liter.
	NaCl-free salt	only 20 - 25 Gram mixed to 1 liter

- ✓ To prepare the liquid solutions RO water or distilled water or water from an ion exchanger is recommended.
  In the case of using tap water, there is the risk of introducing impurities (nutrients, copper, silicate or especially when the container "A" also precipitates).

- ✓ Don‘t mix together liquid solutions in order to ease dosing or use less dosing pumps!
  In addition to the inability to have targeted individual parameters this would exceed saturation limits. Also Above, there are incompatibilities of the individual stock solutions among themselves (mainly NaHCO3 and CaCl2 * 2H2O)

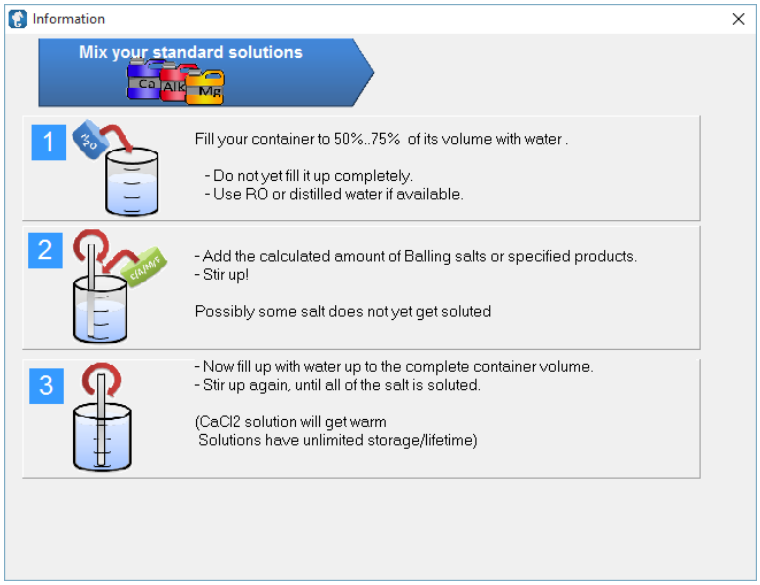
Let us prepare our liquid solutions….

Define the sizes of the containers you want to use (see green frame)



Click 

 Make sure you understood these instructions before preparing 



Get yourself containers with an as large as possible opening, because they make filling with salts easier!
Containers need a closing cap in order not to evaporate.
Best choice: „Wide neck vessels“.

- Salts are added to the water, never the other way round

  Correct: pour in water first, then mix in salt

- Only using the described three-step method gets you the correct volume of your liquid solution and thus also correct concentration

  Correct: Fill up calculated amount of Balling salts with water to reach the targeted container filling volume.

  Wrong: Add the calculated amount of Balling salts to the amount of water that matches your container filling volume.

- Some Balling salts warm up the water after mixing in (eg. $CaCl_2*2H_2O$).
  Higher concentrated liquid solutions = Higher temperature.

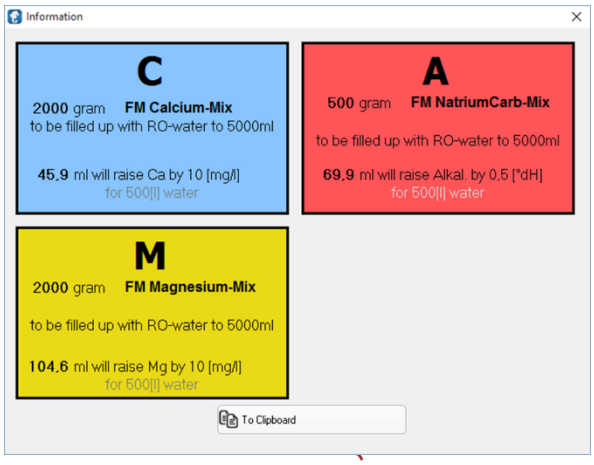
- You are not able to solute the calculated amount of Balling salt?
  a) Eventually you used "not enough RO water" or "too much Balling salt".
  * Check your weight and/or water volume in a measurement device.
  b) Use another Balling salt than being asked
  (eg: waterfree Calciumchloride or Calciumoxide isntead of $CaCl_2$ * $2H_2O$).

- Sediments in liquid solution containers
  * are normally uncritical. Remove if mixing the next liquid solution.

Label your liquid solutions containers, to exclude mix-ups

Click 

and there <to *clipboard*>



Open any application that can print „images".
(Word, PowerPoint, WordPad, etc) and insert this image (<CTRL>+<V>).
Print and stick to your liquid solutions containers.

2. Correction of water parameters

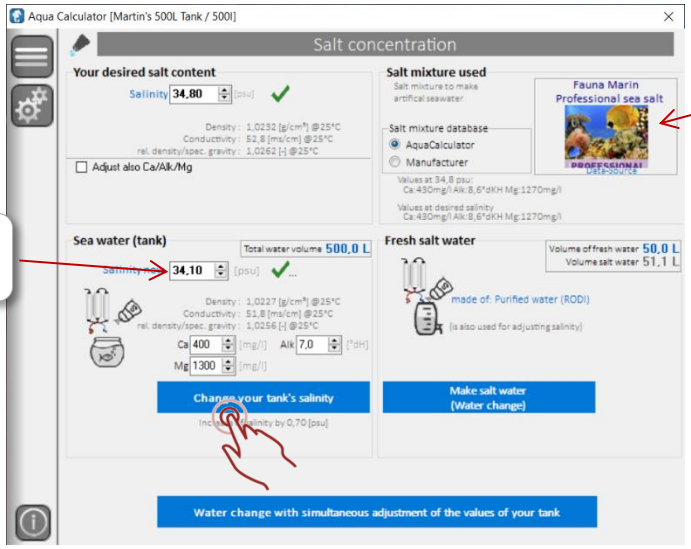
2.1 Adjust salt concentration

We check salinity first as this also affects Ca, Alk and Mg levels.
In case it is not perfect …. Let's adapt it first.

Switch to Mainmenue  and select  **Adjust salt concentration**

Measure your tanks actual **salt concentration (salinity)** and input this value
Specify the **sea salt mixture** you are using

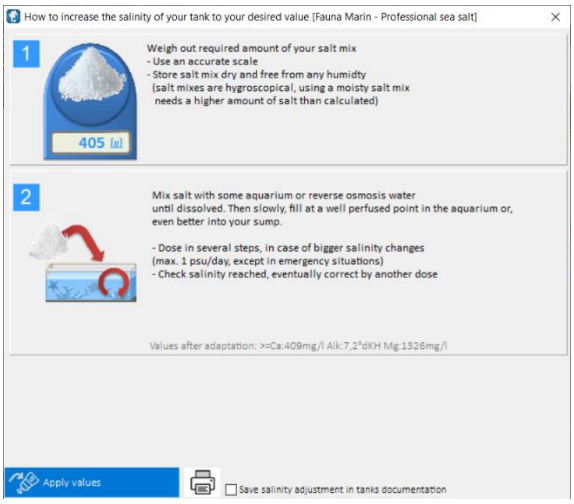
Click **Change your tank's salinity**



Your tanks actual **salt concentration**

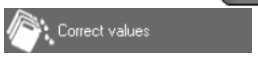
Sea salt mixture used

AquaCalculator tells you what you have to do, in order to adjust your salinity.
This can be "adding salt" (as in the example), "replacing some salt water with fresh water" or also "do nothing". Depending on your tanks actual salinity.



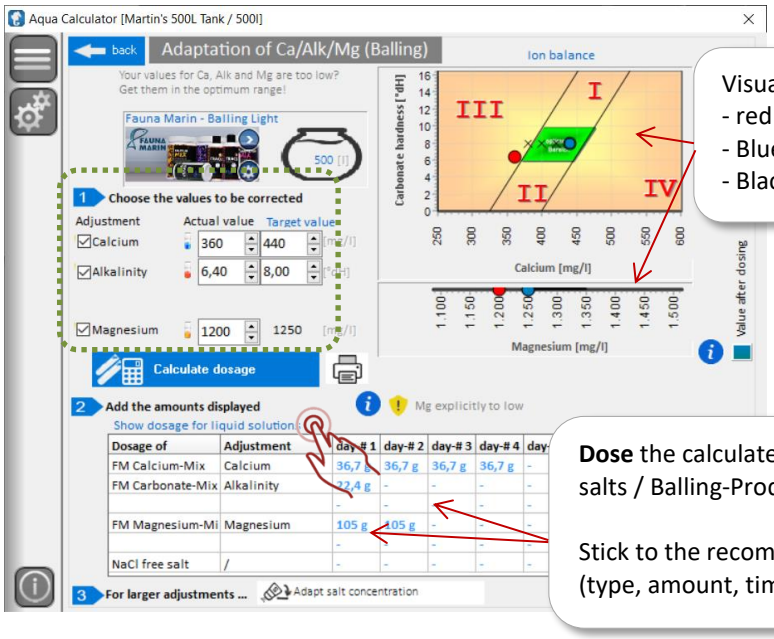
2.2 Adjust Calcium, Alkalinity and Magnesium

Measure your Ca, Alk and Mg values

Switch to MainMenue  and select  Adaptation of **Ca/Alk/Mg (Balling)** there 

Enter the Ca, Alk, Mg values measured (actual value, green)

Click 



Visualization of your dosage
- red dotd: Conzentration before dosage
- Blue dots: Conzentration after dosage
- Black crosses: Values after x-days

Dose the calculated amounts of Balling salts / Balling-Products

Stick to the recommended way of dosing (type, amount, time for dosing)!

Hint: Depending on how serious the deviation from the target value is, it might be the case that you don't reach your targetted values within 1 week.
In this case: Dose one week, then measure again and calculate/dose for the next week again etc

Die you already prepare your liquid solutions?
→ Click the link „**Show dosage for liquid solutions**" to display the required volumina

	Adjustment	day-# 1	day-# 2	day-# 3	day-# 4	day-# 5	day-# 6	day-# 7	Total
C	Calcium	92 [ml]	92 [ml]	92 [ml]	92 [ml]				367 [ml]
A	Alkalinity	224 [ml]							224 [ml]
M	Magnesium	261 [ml]	261 [ml]						523 [ml]
	/								

We need three different so-called *Balling salts*. They can either be generic available ones, or from Premium suppliers like in the example from Fauna Marin.

With each salt, you can raise the concentration of exactly one, either Ca, Alk or Mg !

$CaCl_2 * 2H_2O$	(*CalciumChloride-DiHydrat*)	→ raises Ca-concentration
$NaHCO_3$	(*NatriumHydrogencarbonate*)	→ raises Alkalinity
$MgCl_2 * 6\ H_2O$	(*MagnesiumChloride- Hexahydrat*)	→ raises Mg-concentration

Hint: There are 2 more Balling salts being used in only some of the recipees

Na_2CO_3	(*NatriumCarbonate*)	→ raises Alkalinity
$MgSO_4 *\ 7\ H_2O$	(*MagnesiumSulfate Hexahydrat*)	→ raises Mg-concentration

In the example we used Fauna Marin Ballingsalts and thus have to use exactly this ones in order to get the correct dosing calculated.

You need exactly the salts specified, not any others.
Balling salts can be purchased quite cheap at your aquarium store.
Buying them in drug stores might be more expensive.
I do not recommend buying extra cheap material, because of the risk of impurities.

You will need the identical salts also to mix liquid solutions from it to obtain your Ca, Alk, Mg concentration over weeks and months, thus it might be a good idea to purchase not too small an amount.

You can just raise, but not lower, concentrations by adding Balling salts.
Anyhow, there are two options to decrease concentration:

a) Wait until concentration comes down by itself (usage within your tank) or
b) Do a water change with a salt mixture which is lower concentrated for a particular macro element.

This is what you have to take care of:

- Use an accurate set of scales for weighing the required amount of Balling salts (this is of special importance for smaller tanks).

- You can add Balling salts to your tank's water without soluting them beforehand. If you like you can also put them in RO water and then add them.

- Balling salts should be added at a position with good current flow, best would be in the sump. Under no circumstances should you do so with direct/concentrated contact to any of your corals/animals.

- The different Balling salts for raising Ca (CaCl2) and Alkalinity (NaHCO3) must not be added at one time, but with minimum of 15 minute's difference.
  Doing this any differently might result in precipitation and not raising values to the appropriate level.

2.3) Control water parameters at the end of the adaptation

➡ Dose Balling salts as long as AquaCalculator told you.

➡ Measure concentration of Ca, Mg and Alkalinity again.

Targeted concentration reached (Ca 420 mg/l, Mg 1250 mg/l, Alkalinity 8 °dH)?

Yes: Very good, continue with chapter two

No: Check if you did everything ok and used the correct amount of Balling salts.

If one or more of the concentrations are too low, this might be because your tank has already a pretty nice consumption of Ca, Alk, Mg and thus also of the needed Balling salts.

* Continue dosing until optimum concentration is reached.
* If only one concentration is affected → raise only this value.

Eventually you even have to increase the dose per day because the usage of your tank is higher than what you dose for raising concentration.

Ca, Alkalinity or Mg cannot be adjusted in any way?
Maybe that is because one of the following reasons:

- Your water test kits show an incorrect result or you made a mistake using them (see instructions for use of test kits).

- Concentration of Magnesium is still too low to add Balling salts for Ca and Alkalinity. It has to be >1200mg/l once you start dosing the other Balling salts.

- One of the concentrations is too high and does not get lower just by waiting. Is there any ceramics or non-reef type material in your tank which might emit Ca/Alk/Mg?

3. Determining your tank's consumption

3.1 Meeting your tank's consumption.

Our target is to adjust the dosage of Balling salts exactly so that it will match your tank's every-day consumption.

- Stop dosing Balling salts as well as dosing other elements that might raise Ca, Mg or Alkalinity.
- Do not do any water changes now.
- Measure concentrations of Ca, Mg and Alkalinity daily and always at the same time.

In this working step, we will check ***how long your tank will need to reduce a certain amount of Ca/Alk/Mg*** by its specific consumption.
AquaCalculator can not do this for you. But it can make it easier and more understandable.

Select  then  **Major-/Trace elements (Ca,Alk, Mg …)**

there 

The values entered here are used LATER to calculate the required quantities of your Balling stock solutions.
Since you probably do not know them yet, you click on the text link "**Click here to determine your consumption**"

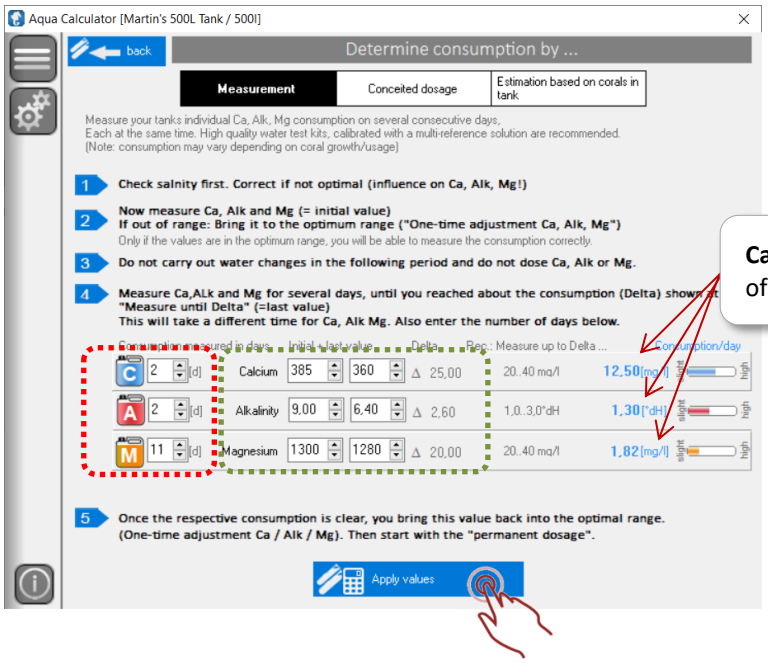
I recommend to continue measuring as long as:

- Ca dropped by 20 .. 40 mg/l
- Alkalinity dropped by 1°dKH .. 3°dKH
- Mg dropped by min. by 20 .. 40 mg/l

What you need is

- your ***measured values*** (especially your first and last value) as well as the
- ***time needed*** in days to reach this specific consumption.

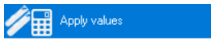
This takes a different amount of time for each of the three measured values (Ca, Alk, Mg), because consumption is usually different. Normally KH drops fastest, Mg slowest.
If you see that one value is going down very slowly, there is no need to measure it every day.



Calculated comsumption
of your tank, for each day

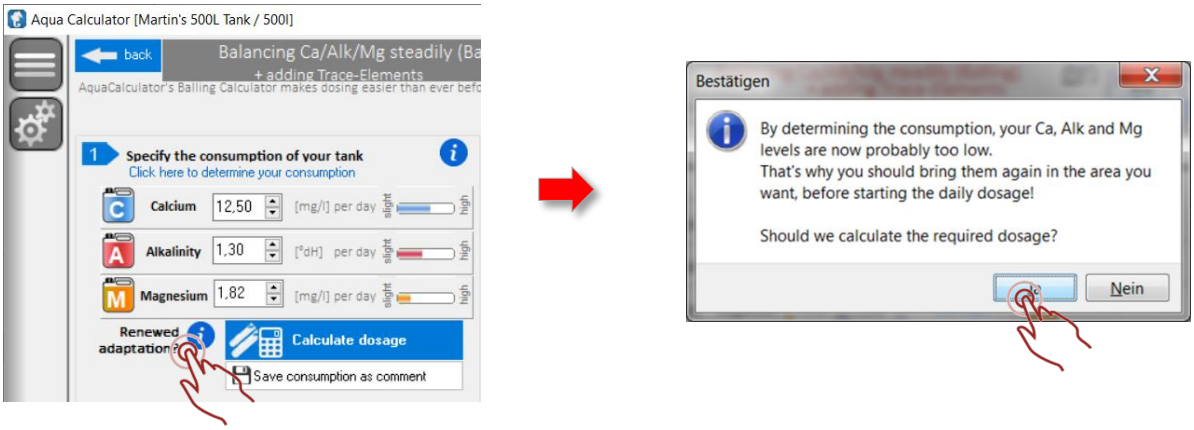
➡ Enter **initial** and **last values** for Ca, Alkalinity and Mg (green)
➡ Enter **Time required** per each measurement

Aqua Calculator calculates the DAILY cosumption of your tank

➡ Click 

3.2 Adapt Ca, Alk and Mg once again

After determining your tank's consumption, water values are again in a non-optimal range. Thus, we have to adapt them once again!



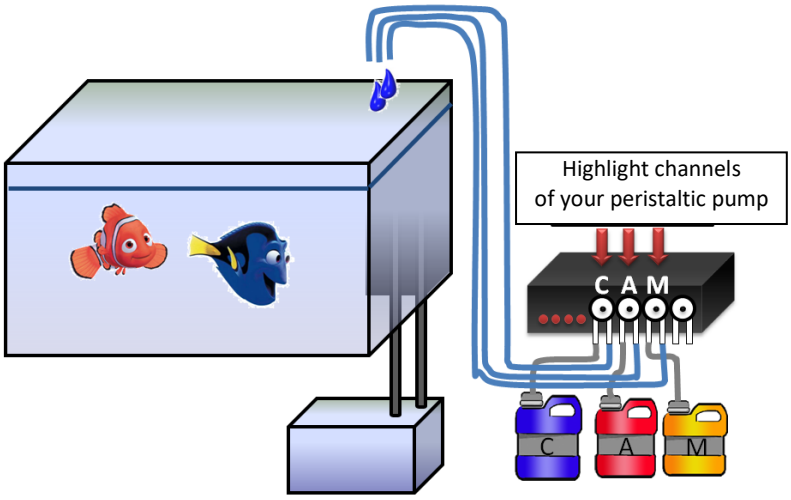
This corresponds to a repetition of the steps in Section 2.2!
Ca, Alk, Mg should be at optimum concentrations **again**,
before you start with the STEADILY ADAPTATION of Ca, Alk, Mg

4. Dosing liquid solutions

4.1 Installing peristaltic pump

Look for the best place to establish your peristaltic pump as well as the containers for the liquid solutions. To avoid problems in case of defects or leakage, you should install as following:

- ✓ Containers with liquid solutions should be below the water level of the tank where they will be dosed. (Avoid unwanted leakage of liquid solution)
- ✓ Hoses coming from peristaltic pump should "drop into" the tank's water and not "reach into" the tank. (Avoid unwanted leakage of tank's water)



- Highlight the channels of your peristaltic pump with letters C, A, M, (F)
- Install all hoses tightly. (Also check them regularly for possible clogging)
- Add cap/covers to your containers to avoid evaporation.
  Drill holes through cap/cover. This is where your hoses will run through.
  Hint: Closed containers should not be as tight that pumping of liquid solutions create a vacuum.
- Adjust your dosing pump's channels according to AquaCalculator's dosing recommendations. See manufacturer's instructions of use for this working step.

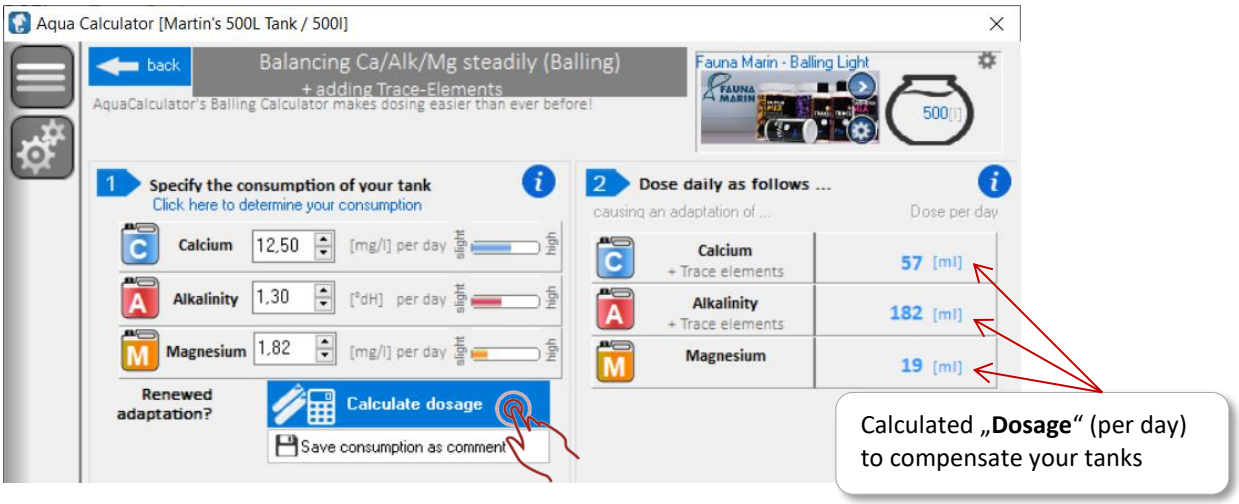
Tips: Best time for dosing is in the morning before the tank's lighting switches on. At this time ph value is lowest, thus having the lowest risk of precipitation. Adjust pump to dose different liquid solutions with a difference of 15 to 30 minutes. If your dosing pump also can split the days doses over several portions, this is even better for your animals.

Once container content is (nearly) used up, dispose of the rest first and then fill up from scratch.

4.2 Permanent compensation Ca, Alk and Mg consumption

Click 

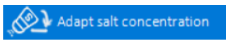
Adjust your peristaltic pumps to dose the calculated amounts
(or dose liquid solutions manually)



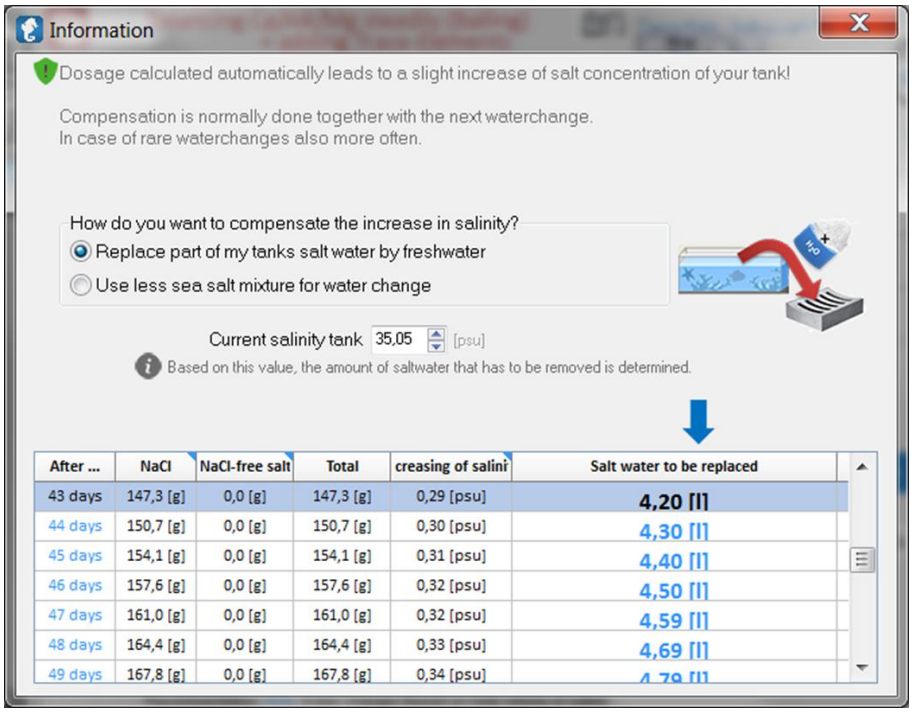
4.3 Compensating salinity increase

By dosing of Balling salts, at the same time, an addition of NaCl (sodium chloride) is carried out. This inevitably leads to an increase in your tanks salinity.

If not compensated over a longer period of time,
your salinity will eventually become too high!

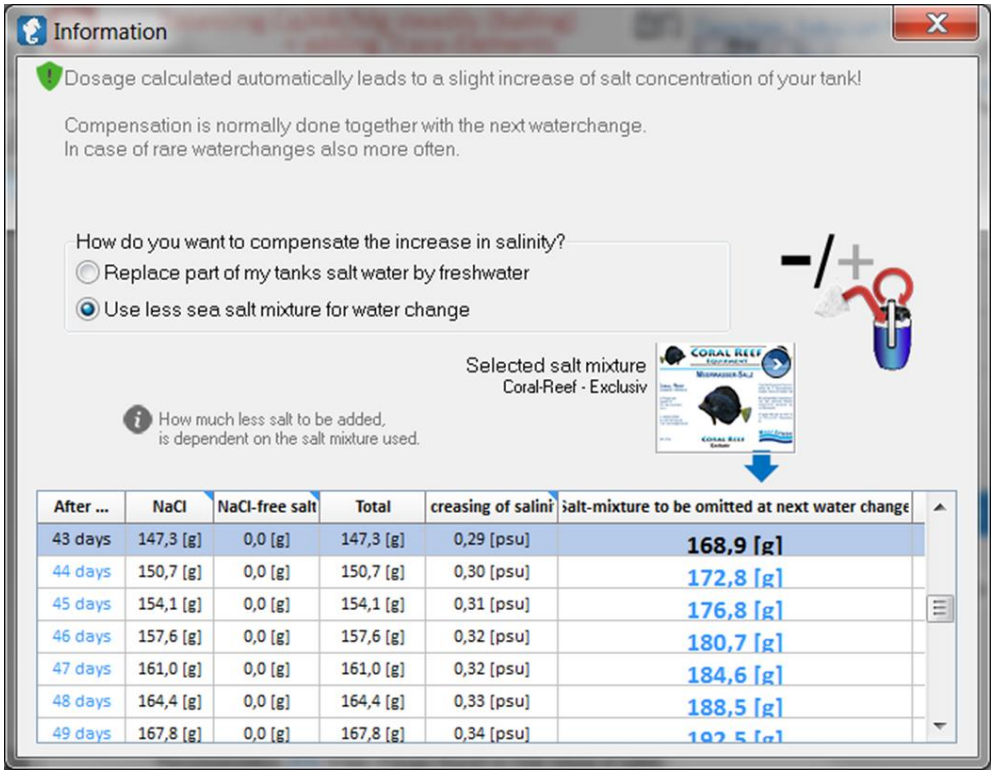
Click 

AquaCalculator, depending on the number of days of dosage, then tells you
"how much **salt water you have to replace with fresh water**"
(In order to compensate salinity increase)



You want to save some work and a water changeis already planned?

Click „**Use less sea salt mixture for waterchange**“



After ...	NaCl	NaCl-free salt	Total	creasing of salini	alt-mixture to be omitted at next water change
43 days	147,3 [g]	0,0 [g]	147,3 [g]	0,29 [psu]	**168,9 [g]**
44 days	150,7 [g]	0,0 [g]	150,7 [g]	0,30 [psu]	172,8 [g]
45 days	154,1 [g]	0,0 [g]	154,1 [g]	0,31 [psu]	176,8 [g]
46 days	157,6 [g]	0,0 [g]	157,6 [g]	0,32 [psu]	180,7 [g]
47 days	161,0 [g]	0,0 [g]	161,0 [g]	0,32 [psu]	184,6 [g]
48 days	164,4 [g]	0,0 [g]	164,4 [g]	0,33 [psu]	188,5 [g]
49 days	167,8 [g]	0,0 [g]	167,8 [g]	0,34 [psu]	192,5 [g]

At your next water change, again depending on the number of days you dosed, you renounce this amount of sea salt mixture when mixing your salt water.

(Important: You need to choose the salt type you'll use when changing the water, because various salt mixtures have a different fertility)

5. Readjustment in case of changing consumption

Your tank's Ca, Alk, Mg should now be stable for a longer period of time, but your tank's consumption can change again in case of:

- Adding new corals or other livestock

- Your tank changes consumption by other reasons
  Hint: Pretty often, especially in tanks with lots of SPS, you will see better growth of your corals, thus your consumption will raise.

Measure Ca, Alkalinity and Mg on a regular basis. If values are constant and no new corals are added, you can have longer intervals between your measurements.

In case you see a drop (or increase) of one of the values you should react by adding the correct Balling salts.

You know how to do everything right now, but just a quick recap:

- Parameters Ca, Alkalinity and Mg can and should be adjusted separately from each other.

- **Raising** of the values is done by **adding** the appropriate Balling salts.

  Reducing of the values can be done either by **waiting**, or **water changes** with a salt mixture having a low concentration of the elements you want to reduce.

- Once values are adjusted from optimum, first **readjust the amount of dosage** at your **dosing pump**. (Separate for each channel/liquid solution).

  If **consumption has dropped** → **Reduce** amount per day
  If **consumption has raised** → **Raise** amount per day

  Hint: We already have liquid solutions available and can use them to raise values instead of weighing in and using the dry salts. Use a syringe with an attached thin hose to get a certain amount of liquid solution from its container. The container label tells you how much you need.

  Raise the values of your tank – but again not too fast. Rule of thumb is not more than:

Calcium	**20**	**[mg/l]**
Alkalinity	**2**	**[°dH]**
Magnesium	**30**	**[mg/l]**

  per day

  Also: $CaCl_2$ and $NaHCO_3$ have to be dosed with a minimum 15-minute's break to avoid precipitations.

6. Frequently asked questions (FAQ)

6.1 What is “Ionic balance” and what do I have to regard?

We are using industrial-available chemicals to raise the parameters Ca, Alkalinity and Magnesium, which we call Baling salts. Besides the desired elements (Ca, Mg, Carbonate) they also contain unwanted elements (Na, Cl, SO_4,...).

In my view, buzz wording “ionic balance” is placed by some manufacturers intentionally, to thereby promote their own products better!

Within our tanks these elements react as chemical compounds. Besides the desired effect of raising Calcium (Ca), Magnesium (Mg) and Alkalinity (Carbonate), the unwanted elements will remain in our tanks.

Most interesting are these Balling salts:

- $CaCl_2 * 2H_2O$
- $NaHCO_3$
- $MgCl_2 * 6H_2O$

- Ca, carbonates and Mg are “consumed” by corals
- Some additional “water” (H_2O) is added to the tank
- Na and Cl will remain (marked red above)
  * NaCl is “sodium chloride” also known as “table salt” * is added to the salt water

- Only a part of natural salt-water salt (70%) is NaCl. There are 30% of “other salts” in sea water
- Adding different amounts of the three different Balling salts can formulate stoichiometric “not totally balanced“ chemical compounds (some formulas might be not fully balanced).

These effects are described as “ionic balance”

AquaCalculator is automatically calculating the added amount of NaCl by Balling salts dosed, in a stoichiometric exact way.

One possible way to act according a better ionic balance to also dose a so called “NaCl-free salt mixture”.

If dosed, the amount of arising NaCl is extended to the 70/30% mix, which is also in natural sea water. NaCl-free salt is a mixture from the other ingredients (besides NaCl) of natural sea water and is only available in aquatic stores. Price per Kilo is $20US, which is quite expensive. Anyhow, you need just small amounts of this salt mixture.

Another way is the separate metering by additional trace elements (eg by Fauna Marin Trace Element mixtures)

Compensating ion balance by trace elements: Pros and Cons

- Most aquarists refrain from targeted addition of trace elements. Instead, regular water changes are made, which also add consumed trace elements.

- Especially at high dosages of liquid solutions and good conditions for stony corals a separate trace element dosage is a good choice.

Decide for one of the possible paths:

- Compensation of ion balance through trace elements integrated into a stock solution
- Compensation of ion balance by separately dosed trace elements
- Compensation of ion balance by adding NaCl free salt (mixture)
- Ignoring ion balance (but doing regular water changes)

6.2 Should I dose trace elements with my Balling salts/liquid solutions?

Most owners of SPS tanks rely on trace elements to get maximum coral growth and colour.

Also, trace element solutions are made out of several elements available in natural sea water (besides Ca, Mg and carbonates). Most manufacturers have two or three different trace element complexes that have to be dosed together.
It is strictly recommended to dose according to manufacturers suggestions, because exact concentrations are normally not given out.

What I can recommend most is trace elements added directly to the Balling liquid solutions. Thus, you need not dose them separately (but together with the liquid solutions C, A, M) and, even more importantly, they are automatically dosed in the correct amount in relation to Ca, Mg and Alk consumption. This also reduces the risk of overdosing trace elements.

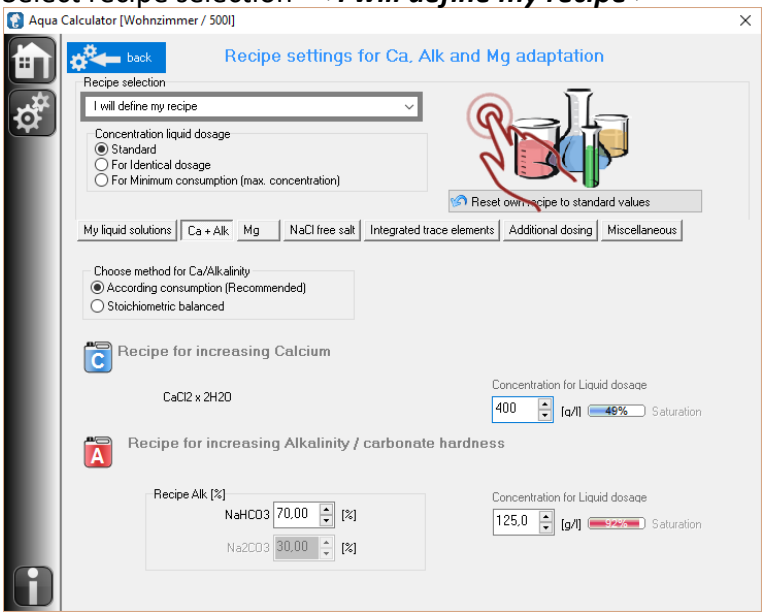
6.3 Which Balling salts should I use?

First of all you might think this is only a price question, but “cheap” Balling salts are often less straight – meaning that they include more “unwanted/other” elements.
Using lots of impure salts over a longer time period might act like a time bomb (eg by adding heavy metals or sulfur steadily to your tank). I suggest relying on Balling salts from manufacturers that guarantee you very good purity and quality only.

There are also “special Balling-salt-mixtures” which are a mix of different salts, partially with added additional organic material. Possible advantages might be better pH-buffering or others. The best known of these products are Fauna Marin’s “Balling Light Balling salts”, but also special balling products from Tropic Marin and RedSea.

6.4 I want to use a recipe which is not included in AquaCalculator. Can I use it anyhow with this software?

Select recipe selection < ***I will define my recipe*** >



Now all recipe settings can be set manually. i.e.:

1.) All settings for Balling recipe itself

- Calcium vs alkalinity dosing
  a) Consumption depending (recommended), or
  b) always in a fixed ratio (HW Balling's idea to come up with identical amounts added)
- Dose one/two salts for raising Alkalinity, or even a mix of both salts
- Dose one/two salts for raising Mg, or even a mix of both salts
- Dose NaCl free salt (to get a mixture very similar reellem seawater)?
-

2.) Adjustments to the liquid solutions
What amount of the respective Balling salts should be given in one liter of liquid solution, separated by the 4 stock solution tanks (= concentration)

3.) Settings for trace elements to be used within liquid solutions (up to 3 different possible)
4.) Settings for trace elements to be dosed separately

6.5 One of my parameters (eg: Magnesia) is stable over weeks. Should I dose respective Ballingsalt anyhow?

No, omit the corresponding Balling salt, or its liquid solution in this case.

This is quite often the case for Magneisa or if regular water changes are carried out with a well-abge voted sea salt mixture.

Shopping list

Description	Designation, comment, where can I buy this?	average price
Measurement unit to measure salinity	Recommendation: - Big areometer and temperature measurement or - Refractometer (use psu display only.) Aquarist stores and aquarist online shops	Starting with 30€
Water measurement test kits: - Calcium - Alkalinity - Magnesium	Use only high-quality test kits and only test kits that are designed for measuring salt water Aquarist stores and aquarist online shops	together 40€
"Standard solutions" to calibrate your test kits for Ca, Alk and Mg	Aquarist stores and aquarist online shops	together 20€
Balling salt Ca, Alk and Mg	You can use special Balling salt mixes like eg Fauna Marin's Balling Light salts or you can use generic Balling salts Buy from Aquarist stores, aquarist online shops, as drugstores and pharmacies might be more expensive	5€..10€/kg
NaCl-free salt mixture (Trace element mixzure)	Optional ! Available products: Tropic Marin *Pro Special Mineral*, Fauna Marin *Mineralsalz,* Aqua Terrashop *Cheap Mineralsalz,* Grotech *Mineral Pro,* Preis *Mineralsalz* Available in Aquarist stores and aquarist online shops	15€/kg
Trace elements	Optional !	?
Scales for weighing in Balling salts	Especially for smaller tanks you need an accurate set of scales available in lots of online/shops	30€
3 to 4 containers	- size depending on consumption - big opening, closed by cap - should be food-safe quality	1-10€ each
Funnel to bottle Balling salts into containers	Pipe diameter as big as possible to fit in your containers openings	5€
3 to 4 syringes - for manually dosing liquid solutions - Attach tube to exhaust from containers	Recommeded size 50ml Available in pharmacies, drugstores	5€
Dosing pump (peristaltic pumps)	Recommended models - Grotech TEC III NG (3 channels, expandable to 11) - GHL Dosing unit 3 pumps - GHL Dosing unit 4 pumps - Aqua Medic Reef doser triple (3 channels) - Aqua Medic Reef doser Quadro (4 channels) - IKS Vario 4Pro (4 channels, needs also IKS Computer) Available in Aquarist stores and online shops	 360€ 250€ 300€ 260€ 330€ 300€

Contact / Imprint

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Hans-Werner Balling	Article: *Die Balling Methode – Eine nicht mehr ganz neue Methode der Calciumhydrogencarbonat Zufuhr für Riffaquarien* from professional journal „*Koralle*“