ULTIMATE SECRETS TO SALTWATER AQUARIUM FISH & CORALS
Introduction to Selecting and Planning a Saltwater Aquarium

A note about being a saltwater aquarium owner:

The cost of setting up a saltwater aquarium and being a responsible owner:

Before you start setting up your tank:

Planning your saltwater aquarium correctly:

Aquarium types: Fish-Only Systems

Aquarium types: Fish-only With Live Rock Systems

Aquarium types: Reef Systems

How to Choose an Aquarium Size and Where to Put It

How to Choose Fish for Your Aquarium

Stocking Your Tank With Marine Life

What Commonly Goes WRONG When It Comes To Stocking

Making a Livestock Stocking Plan

Stocking Your Tank The First Time

Stocking Invertebrates

Marine Life Stocking Tips and Tricks

An Introduction to Choosing Marine Fish That are Compatible With Your Aquarium and With Each Other

Deciding What Goes In The Tank

Putting Fish Into Your Tank

How To Choose The Right Happy, Healthy Fish Specimen For Your Tank

This is how you choose the right specimen for your saltwater aquarium:

…At The Fish Store:

Selecting Marine Invertebrates

The Look of your Saltwater Aquarium:

Necessary Equipment: For Healthy Saltwater Aquariums

The other vital aquarium components are:

Vital Components 1: Filtration

1. Mechanical filtration:

2. Physical filtration:

3. Chemical filtration:

4. Biological Filtration:

What Makes An Effective Bio Filter?

The Best Product is Nature!

Choosing your Filter

Power/Canister style filters:

Undergravel filters:
Fluidised bed filters................................................................. 55
Wet / Dry (Trickle) Filters: ...................................................... 55
The Role of Filtration in Your Tank ................................................. 56
Lighting Your Saltwater Aquarium .............................................. 58
Lighting Fish-only and FOWLR tanks ........................................... 59
Lighting a reef tank .................................................................. 61
Reef Tank Lighting Overview ...................................................... 62
My Opinions on Reef Lighting Selection ....................................... 63
Keeping Corals Happy Under Lighting ......................................... 64
How To Choose Your Lighting Wisely! ........................................ 65
Placement of Photosynthetic Marine Life Under Lights .................. 66
Heating/Chilling Your Saltwater Aquarium .................................... 66
Substrate For Your Saltwater Aquarium ........................................ 67

Setting Up a Saltwater Aquarium The Right Way. ......................... 68
Setting Up: Tank Design and Layout ............................................ 68
The Aquascape ........................................................................ 69
Saltwater Aquarium Decorating Options ....................................... 70
Preparing the Water & Filling the Tank ......................................... 71
Putting Your Saltwater Aquarium Together ................................... 72
Biological Cycling of Your Saltwater Aquarium ............................. 74
Initiating the biological cycling of your aquarium; the easy way! .... 75
What Happens In a Cycling Tank? ............................................... 76
What Phase of The Cycling Process is Your Tank in? ..................... 77
Stocking Your Tank After Cycling ............................................... 78
Looking After Your Beneficial Bacteria ........................................ 79
Maintaining Your Saltwater Aquarium .......................................... 79

Daily Maintenance .................................................................... 80
Weekly Maintenance ................................................................... 80
Monthly tasks ............................................................................ 82
Other Maintenance ..................................................................... 82
Saltwater Aquarium Maintenance A to Z ...................................... 83
1. Partial water changes: ............................................................. 84
2. Cleaning filters and equipment: ............................................... 85
3. Visual inspection of you marine aquarium: .............................. 85
4. Algae control: ................................................................. 86
5. Water Quality Testing: .......................................................... 87
Creating a Perfect Environment................................................................. 93
1. Ensuring Good Quality Water: ................................................................. 93
Why is Water Quality so Important to Saltwater Aquariums? ....................93
Poor Water Quality Can be Fatal............................................................... 94
The Keys to Good Water Quality ............................................................. 95
Testing Water Quality ............................................................................. 96
How pH works in your tank and how to adjust it ..................................... 99
Ammonia/Ammonium, Nitrite and Nitrate: ..............................................100
Water Hardness: ..................................................................................... 101
Carbonate Hardness (dKH): ................................................................. 102
Salinity/Specific Gravity: ................................................................. 103
Phosphates: ......................................................................................... 104
Calcium: ............................................................................................. 105
Here are 2 easy to use water testing charts to help you: ......................... 107
Heating and Cooling Your Saltwater Aquarium ...................................... 109
Get a Good Heater! .............................................................................. 109
Chillers................................................................................................. 110
The Nitrogen Cycle In Detail ................................................................... 111
Getting rid of nitrates ........................................................................... 113
Nurturing Your Beneficial Bacteria ......................................................... 114
Biological Filtration in a Nut Shell ......................................................... 114
Protein Skimming = Mechanical Filtration ............................................. 115
What Exactly Do Protein Skimmers Do? ................................................ 115
How Does Protein Skimming Work? ...................................................... 116
What Skimmer Should You Get? ............................................................. 116
So, What Makes a Good Skimmer? ......................................................... 117
Counter- current and co-current skimmers ............................................. 118
Venturi-style skimmers ........................................................................ 118
Needle Wheel Skimmers ....................................................................... 118
ETS’s & Down-Draft Skimming .............................................................. 119
Cone Skimmers .................................................................................... 119
Beneficial Micro-Organisms in Rocks and Sand ..................................... 120
Setting Up a Live Base For Bacteria ....................................................... 121
Compatibility in Your Saltwater Aquarium ............................................ 123
Common Incompatibility Causes: .................................................................124
Dealing With Territorial Behaviour: ..........................................................126

16 Popular Saltwater Aquarium Species Fact Sheets .................................. 128

Caring For Corals and Invertebrates .......................................................... 132
Phytoplankton ................................................................................................ 133
Zooplankton .................................................................................................. 134
Feeding Plankton in your Aquarium ............................................................. 135
Caring For Corals .......................................................................................... 136
Purchasing Corals ......................................................................................... 137
Now, Let’s Get to The Guts of Coral Keeping: ........................................... 138
The Preferred Water Environment for Coral and Invertebrates .............. 142
How to Choose Healthy Coral Specimens That Are Right For Your Tank .. 142
Questions to ask the Pet Shop about Invertebrates and Fish: ................. 144
Where Does Your Marine Life Come From and Why You Should Care? ... 145
What Do Bad Collection Practices Mean For You? .................................. 146
Unnecessary Loss of Life From Underhanded Tactics ............................ 147
1. Sodium cyanide capture ........................................................................ 147
2. Collection and retail of species unsuitable for home aquariums ........ 149
3. Bad handling, husbandry and shipping practices: .............................. 150
Where to Place Corals and Invertebrates In The Tank ............................ 151
How to Correctly Acclimate Corals and Invertebrates ............................ 152
The Floating Method ............................................................................... 152
The Drip Method ....................................................................................... 153
Common Coral Problems and Solutions ................................................. 154
Stress is the Cause of Most Problems! ...................................................... 155
Coral Bleaching ....................................................................................... 157
Common Invertebrate Ailments and Diseases ........................................ 159
Coral Diseases ......................................................................................... 160
Coral and other invertebrate treatments ................................................. 161
Compatibility Among Coral and Invertebrates ....................................... 162

Marine Fish Diseases and General Health ............................................... 164
Providing a Healthy Diet ........................................................................... 164
Frozen Food Options ................................................................................. 165
Freeze-Dried Food Options ..................................................................... 165
Dried Food Options .................................................................................. 166
Liquid Food Options ................................................................. 167
How To Provide Your Fish a Healthy Diet ...................................... 167
Where Do Your Fish Feed and Why it Matters? .............................. 171
Feeding the Occasional Treat ..................................................... 172
Ensure a Varied Diet ............................................................... 173
Infectious Marine Fish Diseases ................................................ 173
Points to Note Before You do Battle With Saltwater Aquarium Disease 174
Common Saltwater Aquarium Fish Diseases and How to Battle Them: 175
Disease: Amyloodinium Ocellatum ............................................. 175
Disease: Bacterial Infections ...................................................... 180
Disease: Brooklynella Hostilis ................................................... 180
Disease: Cryptocaryon Irritans ................................................... 184
A Note About Copper Treatments .............................................. 187
A Note About “Other” Ich Treatments: ....................................... 188
Common Behavioural Signs of Disease ....................................... 189
Common Physical Signs of Disease ............................................ 189
Preventative Measures: Quarantine ........................................... 191
The Importance of a Quarantine Tank and Quarantining .................. 192
Why Quarantine? ...................................................................... 193
A Quarantine Tank Will Serve Multiple Purposes: .......................... 194
This is How You will Set Up Your Quarantine Tank: ....................... 197
Here’s my Super-Simple Quarantine Procedure: ............................. 197
How do You Quarantine Corals and Other invertebrates? ................ 198
Quarantining Sick Marine Life ................................................... 199
A Proper Medicine Cabinet for Aquarium Owners ......................... 200
Antibiotics: ............................................................................ 200
Immunity and Stress ............................................................... 202
Stress in Marine Life ................................................................ 202

Tank and Fish Troubleshooting .................................................... 205
The 10 Most Common Saltwater Aquarium Mistakes Ever Made .... 205
1. Buying marine life without knowing enough about the specimen .... 205
2. Taking things too fast ......................................................... 206
3. Marine life incompatibility .................................................... 207
4. Marine aquarium overload causing “New Tank Syndrome” or system crash .. 208
5. Lack of tank maintenance ..................................................... 209
6. Using poor quality water ..................................................... 210

7. *Unwittingly purchasing sick marine creatures* ........................................ 211
8. *Diagnosing disease incorrectly* .................................................................. 211
9. *Poor water circulation and filtration* ......................................................... 212
10. *Too much medication* .............................................................................. 213

Common Tank Problems and How to Remedy ................................................ 213
Invertebrate Problems and How to Solve Them ............................................. 216
Diet Related Problems .................................................................................... 217
Environmental Causes of Disease .................................................................. 219

Pest Algae Problems ....................................................................................... 220
Common Pest Algae Species in Saltwater Aquariums .................................... 221
1. Blue-Green algae (Cyanobacteria): .......................................................... 221
2. Hair Algae (Derbesia): ................................................................................ 222
3. Bryopsis: ...................................................................................................... 222
4. Bubble Algae: .............................................................................................. 223
5. Diatoms: ........................................................................................................ 224

Marine Fish That Eat Algae ............................................................................. 225

How to Win the Battle Against Pest Algae ...................................................... 227

*Pest Algae quick fix solutions:* ..................................................................... 228

*Underlying cause 1: Too much phosphate* .................................................... 229
*Underlying cause 2: Too much nitrate* ........................................................... 230
*Underlying cause 3: Too little water movement and too much CO2* .......... 231
*Underlying cause 4: Old lighting or too much natural light* ...................... 231

Preventing Problems Within Your Aquarium .............................................. 232

Recommended Resources Section .................................................................. 233
A note about being a saltwater aquarium owner:

Once you have decided to take that first step into bringing the undersea world into your home the overwhelming majority of people, (like me!) never look back. It truly is a captivating, entrancing addition to any home, and you will really enjoy the company and antics of the colourful inhabitants inside.

Owning a saltwater aquarium filled with mesmerising, brightly coloured marine life is quickly becoming one of the hottest hobbies in the world today. It’s easy to see why: everyone is always so impressed when they see a saltwater aquarium set-up in someone’s home, all who visit are totally hypnotised by these amazing creatures as they play and chase each other around the tank. Marine aquariums have been scientifically proven to greatly reduce stress levels and their otherworldly inhabitants entertain and entrance for hours on end.

Thanks to modern technology and decades of research and development owning a marine aquarium has never been easier or cheaper. However it is not for everyone, for starters it’s not the cheapest hobby around and it requires regular input from you; unless you use the services of maintenance and set-up companies. You really need to know what you are doing plus nurture and care for your aquarium to reap the rewards of years of entertainment and joy. Just like owning any other pet a commitment is required from you.

Marine life have specific requirements in terms of diet, habitat and water quality, you will need to be aware of these and set things up just so. Not only this you will need to know which marine species gets along with which and who eats what. Aquariums need to be maintained regularly and you will need to consider a whole lot of factors
before you bring one into your home; available space, time and budget are just a few. Are YOU ready for a marine aquarium?

Do you have what it takes to keep marine life?

The cost of setting up a saltwater aquarium and being a responsible owner:

The complete and honest truth is that setting up, maintaining and running a saltwater aquarium is not cheap and if you are looking to get by in this hobby by choosing low price over good quality at every chance you should stop now…

As marine life lovers our allegiance has to go to marine life first, taking these stunning marine creatures out of their natural environment puts a massive responsibility on us as their caretakers to ensure that they fair better under our care than in the wild.

The truth is our oceans are dying and increasing masses of coral reef are bleaching out and I really believe that this hobby will eventually become the cornerstone in preserving the biodiversity of our planets tropical reef environments for generations
to come by using captive breeding technology (learning how to breed marine life in an aquarium) to replenish natural marine organism populations.

I take my caretaker responsibility very seriously as a scientist and nature lover; I have often been told I am too hard on aquarists who won't pay a bit more for quality equipment and for that I make no apologies. You should be too!

To be the best aquarist you can be you really need quality equipment… your equipment is the **life support system** of your marine pets!

*If you think about it paying for quality has a number of advantages:*

1. Your marine life will have a much better chance of survival if your equipment and food are quality, this is the best advantage you can give them and you will see them thrive, which means you have succeeded.

2. Quality stuff lasts longer than cheap stuff that only does half the job and will inevitably breakdown in the near future (in most cases).

3. Your initial set up cost will be more when buying quality products - but is that worse than watching your marine life die because you wanted to save a few bucks? You will usually find that the costs of replacing your dodgy equipment and dead livestock are so much greater than buying right in the first place.

4. You get what you pay for: *cheap stuff is seldom quality and quality is seldom cheap.*

5. By purchasing quality equipment the first time it greatly reduces the need to upgrade when you change your set up or add more marine life to your tank, which will save you money in the long run.

I totally believe that if you invest in better equipment it will not only prevent the unnecessary death of your marine life because your equipment does the job it needs
to do, but save you money in the long run in the form of replaced and upgraded equipment and replacement pets. But most probably the greatest advantage is that it will make your life less frustrating and prevent the very real pain of losing your precious marine pets, which don’t take long to die in many cases of vital equipment failure.

Please consider checking out a trusted fish store in your area or reputable online retailers who won’t sell you cheap rubbish. A good retailer will choose every product they stock based on its quality, durability and reputation.

**Before you start setting up your tank:**

When you decide to set up a new aquarium, whether you already have a fresh water tank that you want to convert to saltwater, or you’re upgrading from a fish-only aquarium to one that includes reef organisms, it’s important that you **plan ahead** before you start dumping your fish and water into the aquarium!

With saltwater aquariums, there is more to the set up and planning than you might think, and a little research of the various system design and equipment options there are before you start can save you a lot of headaches later on. **You need to decide exactly what you want before you begin.**

A huge mistake that I see time and time again is **people setting up their marine aquariums with a lack of fore-thought and planning before they jump in headfirst.** Once the aquarium is set up and running it becomes that much harder to change things around when you don’t like them or you want to do something else. You should to come up with a **detailed written plan** about what you want to achieve for your aquarium, before you start putting fish and water in there. If you don’t do this it is much easier to make mistakes you will regret later.
Planning your saltwater aquarium correctly

So many people make fatal mistakes with their marine life simply because they didn’t plan ahead and know exactly what they were going to do and what was required for their set-up - don’t let this happen to you!

When I say plan, I mean sit down and write it all down on paper/computer. This way everything will be set in stone and you can follow your optimised plan to the letter which will prevent any impulse buys and help you to avoid decisions you may regret in the future.

So, first of all you need to decide exactly what you want in your aquarium tank (this is the theme); for example a fish only community tank or a mini reef featuring soft corals from the Red sea, whatever floats your boat! Write it down, do some research to see how easy/hard this is going to be for you, how much it will cost and what you need to achieve the look you want to see if it is feasible considering your available time and budget.
Next, fully decide what type of set up you would like; fish only tank, fish only with live rock (FOWLR) or a full-blown reef set up. After this you need to decide how much time you have (for maintenance/feeding/observing) and what budget you have got to work with, remember to factor in the ongoing costs of saltwater, electricity and food.

The easiest and best way to decide on the set up and look you are after is to look at what other people have got, view as many set ups as you can until you find one that really resonates with you. Ask the owner exactly what equipment they have, what skimmer, what substrates, what lights, any hints they can give will greatly help your planning and make it easier to emulate their tank.

After you have worked this out you need to decide what size tank you will need (my hint is to buy the biggest you can afford, this gives you more room for error and more options with stocking marine life), remember to take into consideration where it will go because you wont be able to move it easily when its full!

Other factors you will need to consider are:

- Available space around the tank for equipment.

- How much weight the surface you are planning to put your aquarium on can handle.

- Proximity to natural light (this will heat your aquarium excessively and cause algal blooms).

- How much marine life you want (the bioload).

- How much space your marine pets will need to be happy.
All this leads us on to the next vital part of planning, you will need to sit down and work out EXACTLY what species you want for your aquarium. Start with a few of your must-have specimens.

This will involve a lot of research to find out:

- what they eat
- what conditions they need to thrive
- how hard they are to care for
- what other species they are compatible with

You need to ensure what you have selected will lead to a harmonious marine aquarium (which needs to be your aim for a trouble-free tank).

Once you have thoroughly researched and decided upon a few key species you are well on your way. Make sure you give your aquarium plan room to evolve in the future and not fill the tank up in one hit, purchasing good quality equipment rated slightly above what you currently have will ensure your aquarium can easily cope with the biomass of future additions.

The next step is to decide what equipment you will run, the big two here are lighting set ups and filtration. There are no short cuts here, you will need to do research to see what conditions your chosen species require and purchase accordingly from a quality retailer.

As I have said previously, my advice here is to not try to buy the cheapest products you can; spend a bit more and buy quality as this will definitely pay you back in the long run and keep your tank running optimally. It will also save you money spent on costly upgrades and replacing failing poor quality equipment, get online and see what people are saying about that product you are thinking about.

I can’t stress how important research is at this early stage, try and find out as much info as you can from many different sources about the set up you want (it is out of the scope of this ebook to provide info on every single option and marine species),
and any potential problems you may come across. Also remember to find out what the species you want to keep require in order to thrive, and what other species they are not compatible with.

Next up after doing all the research make yourself a **shopping list** of things you will need (in order of importance), make sure that this fits the budget you have, if not put it off until you save some more cash or make some changes!

The look you want really relies on the **aquascape**, the best idea to plan your aquascaping is to draw the look you want for your aquarium on paper in as much detail as you can, then when you come to setting it up you wont make any mistakes you may regret. Once again do some surfing on the net until you find a set-up that you like the look of.

Once you have your plan set in stone and you have purchased all the equipment you need, start the construction of your dream saltwater aquarium. Do everything slowly and carefully, any shortcuts you take here may come back to bite you later on!

Remember not to under-estimate the importance of the basic elements of any good marine aquarium; **filtration, lighting, heating/chilling**, a **protein skimmer** (a must-have unless you’re creating a fish only tank then its optional) and **pumping water** around the tank. Never take shortcuts with these essential elements or you may pay the price later with your marine life getting sick or dying (are you getting sick of hearing me say that yet?).

After its all set up following your plan, double check the plan to ensure its all correct, if it’s all good then it’s time for the water. Then after the system is equilibrated the marine life can be added into their new well thought-out habitat and your new creation!
Moorish Idol; beautiful but hard to feed!

Let’s look at the major types of aquarium set-ups...

**Aquarium types: Fish-Only Systems**

Most fish-only systems are just called plain old “saltwater aquariums” by the majority of people. They contain fish, but sometimes may also have algae, detritus eating crustaceans and snails. In a fish-only aquarium, you wouldn't have live corals or many other sessile (non-moving) invertebrates. Many fish-only systems contain decorative rocks, synthetic coral, artificial plants and seashells.
Fish-only set-ups are the **cheapest** saltwater aquariums to set up, as you don’t strictly need fancy lighting rigs, live rock and other coral sustaining equipment such as protein skimmers, dosers, RO filters and trace elements. Fish-only aquariums are also the **easiest** to keep, as fish are less fussy about their water quality than delicate marine invertebrates like corals.

Fish only set-ups require regular water monitoring and more partial water changes to keep the water clear than other set-ups because active fish produce the greatest amount of accumulating nitrates and other biological waste products, which need to be diluted out to keep the fish healthy and the water from becoming too cloudy and smelly. The presence of Live rock will help convert nitrates to harmless nitrogen gas which means less work for you.

You will need to periodically monitor the pH, *ammonia*, *nitrite* and *nitrate* levels (ammonia and nitrite should be zero in a cycled tank). These readings will give you a good handle on the water quality inside your tank and thus the health of your fish. It will also give you an idea of how regularly you should be performing water changes to get rid of these waste molecules.

**There are 3 main subtypes for your fish only aquarium:**

1. **A community based aquarium** inhabited by peaceful fish species that get along well together for example small groups of small herbivorous species.

2. The next subtype is for **semi-aggressive species** that should be kept one of each species per tank. In this set up you will have fewer fish, as these fish tend to be larger usually predatory fish.

3. Finally you could have a **biotope fish-only tank**, which has groups of fish focused around a few main individuals from a specific geographical location such as a Fiji island lagoon for example or a specific environment such as New Zealand kelp forest.
Fish only tanks can be very lively!

Aquarium types: Fish-only With Live Rock Systems

There are only a handful of differences between the fish-only set up and the fish-only with live rock system aquarium; both are based on fish being the main feature. The fish-only with live rock system does not include usually include more than 1 or 2 corals, but often has a few invertebrates.

Instead of using solely decorative rocks, live rock harvested from real reefs is added into the tank to make the tank look much more natural (marine plants, algae and other organisms encrust the outside and live within the live rock) plus you also have the added benefit of the beneficial bacteria, macro-algae (non-pest algae species) and tiny detritus-feeding organisms that inhabit live rock that help your tank filter waste naturally.
Live rock also provides a huge number of habitats for marine creatures and makes them feel at home, there are also food morsels present so fish will always be browsing the rock like in nature. The only fish that are kept in these systems are those that won’t be destructive to the organisms that grow on the rocks (except for algae eaters, which you want to include to help keep the algae pruned) as these organisms help clean your tank and filter your water.

Live rock (which you will learn about in more detail later) is actually made of the calcium carbonate skeletons of corals that have died long ago, and other calcareous organisms. Its name “live rock” is referring to the organisms that grow on and in the rocks rather than the rocks themselves.

Live rock and live sand (sand containing beneficial live organisms) will actually act as your biological filter in this set up, either by itself if you have enough for all your filtration needs, or with a commercial filter if you don’t and thus greatly aids water quality and increases stability. There are a variety of interesting hitchhikers (some you don’t want such as mantis shrimp, Aptasia; tiny anemones and coral eating fireworms that will need to be inspected for and removed before your live rock goes in the tank) that will help with cleaning duties and gradually reveal themselves and add to the interest and colour of your aquarium.

Live rock may well be the most expensive part of your FOWLR tank as you should aim for 1 or 2 pounds per 1 gallon of water, but it is highly beneficial and looks cool!

FOWLR set ups usually are really good to keep a few invertebrate species in as the live rock provides a fantastic eco system and structural base for them. You can just sit back and watch your tiny ecosystem come to life with new creatures revealing themselves almost every day and beneficial encrusting algae slowly spreading around the tank.

The beauty of a FOWLR set up is that is can be easily converted to a reef aquarium later on by upgrading lights and adding a few other bits of equipment. The real
advantage of using Live rock and Live sand is the extra filtration (reduces maintenance) and eco-system species you add to your tank.

Aquarium types: Reef Systems

The most prestigious, expensive and challenging saltwater aquarium set-up is the reef aquarium, which concentrates on corals not fish (there are usually only one or 2 token small fish). Reef tanks usually focus on reef building coral species (hard corals) building calcium carbonate skeletons on a live rock base to grow a real life coral reef in your house!

This type of set-up uses invertebrates such as soft corals and LPS (large polyped stony coral) and reef building SPS (small polyped stony coral) hard corals as well as anemones and other stationary or moving marine invertebrates. Reef tanks often have an otherworldly, alien look, which many people find cool.

There are sometimes included a few “reef-safe” fish species as well, specially chosen to add interest and movement, control algae and not disturb the corals. Their numbers are kept down though because their waste products (i.e. fish poo) add nitrate and phosphates to the water both of which are not tolerated well by corals. Nitrates need to be below 10.0 ppm and phosphates below 1.0 ppm for optimal coral health.

Reef systems are meant to duplicate a small part of the ocean within the confines of the tank; this requires high intensity, full spectrum light so corals can photosynthesise (which means: energy generated by symbiotic algal cells in coral tissues called zooanthellae) and grow. Corals are fussier than fish when it comes to water quality and water movement, they like a lot of both; this means that you will have to be very diligent in providing for their needs.

The reef tank is the most advanced set up but also the most visually stunning. Corals and some invertebrates can be challenging to keep as they have different and
specific lighting, water quality and water movement requirements. The fancy lighting set up and high quality water supply (reverse osmosis (RO) or deionised (DI) or RODI is best) are the expensive parts. Certain corals and other invertebrates can also be quite pricey and hard to keep happy, so you really need to know what you are doing.

You will need to have plenty of live rock for biological filtration and will need to add supplements to the water for the corals such as Calcium, Strontium and Iodide to keep the corals happy over the long term.

A fair amount of experience is recommended for owning a reef tank, because you will need to keep the water parameters perfect and stable for corals and invertebrates, which means a lot more regular water quality testing. You will also need to know exactly what lighting requirements, food, preferred position in the tank and water movement levels your chosen corals and invertebrates require in order to have them thrive.

My advice is for beginners to start out keeping a fish only or FOWLR set-up and then after you have mastered this for a good period of time upgrade to a reef when you are ready.
How to Choose an Aquarium Size and Where to Put It

There are several things to consider when you are determining what size aquarium to get. First of all, you'll need to figure out where you will put your tank and how much space you have, bearing in mind that it should be kept away from:

- Excessive noise.
- Vibration (to keep stress to a minimum).
- Natural light (causes algae blooms and heats the water).
- Windows (either cool or heat the water, so are not good for keeping the temperature stable).

A saltwater aquarium is best used as a focal point in the room it is placed.
Whatever you use to hold your aquarium (the stand or support) must be able to support the weight of the filled aquarium, so you need to be sure the stand (and the floor!) you use is sturdy enough to support the size aquarium you choose. Place it correctly the first time because moving a tank full of water and marine life is NOT easy.

The major factor in the size of the aquarium you select, however, is the type of fish you plan to put in it and the number of fish you hope to keep in your tank. Certain fish require a minimum area to swim and live to be optimally healthy, like Tangs and Angels. Big, active fish require more space than smaller, lazier fish. All fish require more room than invertebrates.

Your budget will also obviously play a role in the size of aquarium you choose; as the larger the tank the higher the price tag.

My advice is to always buy the biggest tank you can afford, this gives you more stocking options later and the bigger the volume of water, the bigger the buffering capacity of the water so the longer it takes for shifts in water parameters (like drops in pH) to cause damage which is especially helpful for beginners still learning the ropes. Don’t worry too much, this just means you get more room for error with a bigger aquarium.

How to Choose Fish for Your Aquarium

This is probably the most fun part of setting up a saltwater aquarium: selecting your marine fish!

Choosing marine life for your saltwater aquarium is really fun, however it is easy to make mistakes you will regret by choosing something that is:

- Too hard to care for.
- Sick.
Carries disease.
Not compatible with the rest of your marine aquarium inhabitants.

This next section will help you to avoid making these common mistakes...

Stocking Your Tank With Marine Life

Stocking your saltwater aquarium (which means adding specimens) is one of the most exciting events for the marine hobbyist. Introducing new additions to your colourful marine aquarium to watch and wonder over is awesome fun. For everything to go to plan and your new pets to thrive means that you will need to take things very seriously here in regards to compatibility, stocking levels and choosing healthy specimens.

What Commonly Goes WRONG When It Comes To Stocking

Incorrect stocking of marine aquariums is a very common mistake; this usually arises from people moving too fast, picking unhealthy specimens and not doing enough research on their desired pets leading to marine life compatibility issues. This can lead to stress in your aquarium (mostly the new inhabitants) and even death.

Stocking a marine aquarium is the biggest variable to success in the set up process, if you do it wrong it can make the whole exercise a disaster, but if you do this right and take your time marine aquarium ownership will be smooth sailing for you. Any thoughtless purchases at this point can bring compatibility issues later which can be very hard to solve without getting rid of some of your pets.

Stocking a saltwater aquarium must be taken very seriously, the key here is to have patience and move very slowly, you should write a “fish stocking” plan (with the
compatible species and the order and timing you should add them) and adhere to it adding one or two fish every month (starting with the most hardy but least aggressive ones) or so to give the biological filtration a chance to catch up with the increasing bioload resulting from the fish biological waste.

A clownfish is a hardier fish that may be added early on.

Making a Livestock Stocking Plan

The best place to start with stocking is to make a saltwater aquarium plan, if you keep to your plan, things are less likely to go wrong. You really need to know what it is you want in terms of marine life. Start with one or two “must have” species that will be the focal point of your aquarium. This is especially a good idea for small to medium aquariums, with larger aquariums you would go for a type of fish (or coral) you want such as Tangs, Butterflyfish or Angels. Once you decide on your favourite fish, find out their exact requirements and set up the aquarium and choose other marine life centred around your tank “stars”. This keeps stocking very simple and as long as no one fish or invetebrate will compete closely with your favourites for a specific food type that is not readily available you are onto a winning strategy.
Stocking Your Tank The First Time

When stocking your tank for the first time, you will first decide how many fish you can have (called a stocking level) this is primarily based on your tank size – and this also depends on the type of set-up you want to have (for example a reef tank contains corals, which are sensitive to nitrates and phosphates; so can safely contain less fish) the third factor that determines how many fish you can safely have is the size and activity levels of the fish. The forth and final factor is the biological filtration; this is the bacterial life support system that processes the toxic waste of the fish into less harmful products, so you need to have enough filtration to cope with your number of fish/invertebrates present.

A good beginner’s rule of thumb that gives you some margin for error is as follows:

- **Fish only marine aquarium** – 8 inches (20cm) of total fish length (nose to base of tail, not counting tail fin rays) per 22 gallons (100L) of water.

- **Fish only aquarium with live rock** – 6 inches (15cm) per 22 gallons (100L) of water.

- **Reef aquarium** – no more than 4 inches (10cm) per 22 gallons (100L) this is because of the very low tolerances of corals and other invertebrates for slow nitrate build up in the water.

The above estimates allows for room for error, but I warn you if these limits are exceeded by much the bioload will put too much strain on your biological filtration system and all it will take is one lost, dead fish or a bunch of uneaten food over a few days to cause the system to completely crash.

**When in doubt always under-stock**, this allows room for error and also takes into consideration your growing marine life.
Stocking Invertebrates
Adding invertebrates to the mixture can make things slightly trickier; if you have a fish only with live rock (FOWLR) set up try to use hardier invertebrate species (such as those commonly associated with live rock) that can tolerate a bit more nitrate in the water. This will make your life easier trying to cater to Invertebrate water quality needs.

Marine Life Stocking Tips and Tricks

1. As I have mentioned before the key to stocking compatible species is diligent research of your chosen species in regard to:
   - behaviour/temperament
   - Diet
   - fully-grown size
   - preferred water conditions (light and water circulation)
   - growth rates
   But ultimately fish have very individual personalities like us people, so it can be common for individuals of the same species to behave slightly differently.

2. Another factor that affects stocking is the size of your tank and how much rockwork there is, generally the bigger the tank is and the more likely that fish can get out of the line of each others site for a while the better they will get on.

3. A good way to ensure new additions settle in well is to rearrange the aquarium (and the residents established territories) when someone new is added, also keeping a light on at night seems to take the focus off the newcomer and can greatly help with any bullying.

4. Keeping fish well fed will keep them happy too; a hungry fish is a grumpy fish.
5. When adding new fish to an established aquarium a great strategy is to put about 500mL of display aquarium water into the quarantine tank and visa versa so the newbies and the established fish can become familiar with the scent of each other before they meet.

6. Another good idea is to put the quarantine tank next to the display tank so the fish can see each other.

7. When stocking your aquarium for the first time, start with the more hardy, less aggressive fish first. This will give your aquarium water valuable time to stabilise after cycling before more sensitive species are introduced and will also help keep more aggressive, territorial species under control if they are not the first additions.

8. Take the addition of fish very slowly waiting a month or so before adding one or two more, this gives the biological filtration system time to adjust to increasing waste levels.

9. The final aspect of stocking to get right is choosing healthy specimens, this can be very easy to do with careful visual inspections of the fish you intend to buy, checking every part of the fish for parasites, disease or other damage. Make sure the aquarium it is housed in is healthy and clean also. Pay attention to the fish’s behaviour to make sure it is acting normally. The golden rule here is to watch it eat (more than once if you can) make sure it has a good appetite, is alert and competitive with the other fish for food.

10. The final thing you want to avoid is a brand new fish into the store; give it a week or so to see how it adjusts to captive life and copes with the stress of being removed from the reef environment. It is worth a mention again that where possible purchase captive reared marine life, as they are much hardier, disease resistant, better eaters and happier than their wild-caught relatives. Captive bred species also reduces pressure on species harvested from reef ecosystems, which should be very important to any marine life lover.
So the keys to successful marine life stocking are research, planning and lots of patience. Carefully planned out and executed saltwater aquarium stocking will provide years of happiness for marine life and marine aquarists alike. A thoughtless purchase not adhering to your compatible fish plan will usually come back to bite you.

Many damselfish such as this humbug damsel, can be bullies, especially when put in first.

An Introduction to Choosing Marine Fish That are Compatible With Your Aquarium and With Each Other

Saltwater fish species may have special needs, including water temperature requirements, dietary requirements, specific chemical parameters, or specific tolerances (or intolerances) for other fish in the tank. It's important that you study the basics of any species of fish you want to include to make sure your fish community can live together in harmony; this is compatibility.

To get it right you will need to research the compatibility of the fish you want in regard to:
✔ Behaviour/temperament
✔ Diet
✔ Size the fish grows to
✔ Preferred water conditions (light and water circulation)

Basically, the question you are asking is can the different species you want co-exist together and do they like similar water conditions? Ultimately fish have very individual personalities like us people, so it can be common for individuals of the same species to behave slightly differently - but don’t worry too much about this as you cant do much about individuals that fall outside the general guidelines for a species.

The other 2 important factors I have mentioned that affects compatibility is the size of your tank and how much rockwork there is.

I will go into saltwater compatibility in more detail in Chapter 2.

Deciding What Goes In The Tank

A really good idea in deciding what marine fish and invertebrates you really want is to make a saltwater aquarium plan before setting up your tank if you haven’t already (see page 9). Here you would list all the marine life you are interested in then research each in terms of the following considerations:

1. Care required and how easy they are to care for – can you care for them easily or willingly?

2. Size at purchase and at maturity – do you have enough room for them?

3. Diet: food and feeding – can you provide for them easily or willingly?
4. **Behaviour** (shy fish can’t be put with boisterous ones easily) – will your pets get along ok?

5. **Set-up/water conditions required** (additives, water movement, light levels) – can you easily provide what they need?

6. **Compatibility with other marine life** (will they get along?)

7. **Degree of aggression/territoriality** (if high will cause other species stress)

8. **Can they be kept in pairs or groups?** – If not, don’t even try.

Now, you would group all species you like - that still make sense to purchase for your tank after researching according to the above 8 criteria, all together, based on such things as **set-up required** (fish only, FOWLR or reef aquarium), **compatibility** (i.e. compatible or not), and **type of community**.

The idea is to see what species fits into your plan and come up with a harmonious but interesting and vibrant community that will get along and have similar or manageable requirements. Obviously each species can go into more than one group. Now you choose which group would be best and coolest for you. And this is what you will go with!
Moray Eels don’t usually play nicely with others.

Doing this planning **before** you set up your aquarium will give you a **holistic approach** allowing you to set up and use equipment centred on **exactly** what you want to keep, which will help to keep costs down for you by enabling you to purchase only what you absolutely need.

*Here are some other marine life selection points to consider:* 

- Obviously fish that require coldwater temperatures can’t be placed with fish that requires warm water temperatures and visa versa.

- Timid species (unless they have plenty of hiding places) will be stressed out by boisterous species.

- Territorial fish like Clownfish should not be kept in more than a pair and often different species of a fish type (family) should not be combined.

- Some fish are aggressive/predatory and will eat other smaller less-aggressive fish species if they can fit in their mouth!
• The more different your fish are in terms of size, shape, diet and colouring the more likely they will get along!

• Some fish should not be kept in groups or pairs because of aggression.

• Certain fish species require more room to swim about than others like Tangs and Angelfish, which are very active fish that like to swim around a lot and should not be kept in a small, cramped aquarium.

• It is important to note that all marine life is aggressive to a degree because fish and invertebrates must be competitive in their natural environments, so you are looking out for overly aggressive and bullying species to avoid (such as Damselfish, also many Triggerfish).

Putting Fish Into Your Tank

If you are just starting out you would choose one or two of the species in your group that are most hardy (such as Clownfish or Gobies, but not most Damselfish because they are more often than not bully fish) and start by adding them first; after the tank has finished cycling and you have zero readings for nitrites and ammonia, because hardy fish can tolerate imperfect water conditions better. I repeat, add hardy fish first!

This will give your aquarium water valuable time to stabilise after cycling before more sensitive species are introduced and will also help keep more aggressive, territorial species under control if they are not the first additions to the tank.

Take the addition of fish very slowly waiting a month or so before adding one or two more, this gives the biological filtration system time to adjust to increasing waste levels (beneficial bacterial populations increase), test for ammonia and nitrite (should be zero) to ensure the bio filter has caught up.
Adding invertebrates to the mixture can make things slightly trickier; if you have a fish only with live rock (FOWLR) set up try to use hardier invertebrate species (such as those commonly associated with live rock; crabs, shrimp etc even soft corals) that **can tolerate a bit more nitrate and phosphate** in the water to begin with and more sensitive species later after water quality has stabilised over a week or more. This will make your life easier trying to cater to Invertebrate water quality needs.

The water needs to be **very stable** over a period of a few months before you try to add SPS (small polyped stony corals) especially, or LPS (large polyped stony corals) corals or photosynthetic anemones to set up a reef tank.

*Water needs to be very stable over a long time before you add SPS corals like this Acropora.*

### How To Choose The *Right* Happy, Healthy Fish Specimen For Your Tank

Now you have chosen what species you want you now need to choose your specimen. Where possible ALWAYS choose **captive bred** species (i.e. not wild caught from the reef):

- These species are ecologically sustainable.
- Will be in better health.
- Are much more hardy.
- More tolerant to adverse water conditions.
- Very unlikely to carry disease.
- Are much more likely to eat whatever you give them.

Most importantly if you purchase captive bred species you can be 100% sure that you are not inadvertently funding illegal, reef destroying and cruel capture methods somewhere in the world.

If you can’t purchase the particular species you want as captive bred, then you will need to find a **reputable fish stockist**. They must be professional, have a good reputation and most importantly have all their marine life collected from sustainable sources. Ask them where they got their fish and if you think it’s not legitimate do **not** buy from them.

It really is crucial to choose only happy, healthy marine life for your tank, because if you don’t learn how to do this the consequences could be massive. For example; expensive vet bills, the heart break of losing your precious pets, the chance of spreading infection to your current tank inhabitants, lost money and time; these things can be easily avoided.

*Captive bred clownfish, like these ones from alphacorals.com can be excellent choices!*

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This is how you choose the right specimen for your saltwater aquarium:

1. **Research:** what you want online, or through books. Find out their exact requirements (i.e. diet, habitat, water conditions, compatibility etc) and decide whether this fits in with your current set up and existing pets (as mentioned above). A new species must be compatible with everything you currently have.

2. **Select a good retailer:** Choose a reputable marine fish, they must be professional, have a good reputation; look for testimonials and most importantly have all their marine life collected from sustainable sources or farmed (captive bred), for the sake of preserving our oceans ask them where they got their fish and if its not legitimate don’t buy from them.

...At The Fish Store:

3. **Observe your fish:** Go to the tank that contains your ideal candidate, and study it: A healthy fish will be interactively swimming around its tank mates and be curious about its surroundings and you!

4. Start by looking at the size; it needs to be **not too small or scrawny and not too big** as these sizes are less likely to adapt to your aquarium conditions and are more likely to be in worse shape after capture and shipping. Large specimens are also less likely to adapt to the change of diet and be more entrenched in their behaviour. Watch how they behave, swim and breathe looking for anything abnormal. A healthy fish is active, alert and looks healthy with vibrant colours.

5. Study its eyes; **both should be bright and clear and not sunken or bulging out.** Study the body for evidence of **physical damage** and **external parasites**, Ich
and velvet will show up as white spots or dust especially at eyes, mouth and where the fins join the body. Remember, your ideal fish should be alert, active and look healthy with vibrant colours. Shallow breathing, inactivity, looking dazed and confused and sunken/too small looking eyes are a good indicator of cyanide capture; avoid this fish as it may die as a result of this inhumane and illegal capture method.

6. Feeding time: Next, ask the store people to feed the fish (or if this has recently been done, come back at feeding time). A key indicator to a fish’s health is how well it is eating; you will definitely want to observe this (a couple of times preferably). The fish should eat actively and should be alert and competitive with the other fish in getting food. It should eat heartily and have a good appetite.

7. Avoid new arrivals: Another tip is to never purchase a fish that is brand new to the store, give it a few weeks of being in the captive environment to ensure it adjusts well, is not stressed and has not been damaged during collection. This amount of time will also reveal whether or not the fish has a disease. What you can do is ask the store to put it on hold, put down a deposit if you must and wait around a week or so to ensure that it remains in good condition.

8. Guarantee? Once you have researched, observed and chosen your fish ask the store owner if they offer a guarantee on the fish (always pays to ask). And most importantly of all; when you get the fish home ensure you acclimate it correctly and then quarantine (more information about these in later chapters) it before placing it in your display tank, this will halt spread of disease from the new fish into the main tank and gradually acclimatize the fish to your specific aquarium conditions.

Selecting Marine Invertebrates

Selecting healthy marine invertebrates is much more difficult but generally if it looks appealing and healthy is usually is.

*Here are some general rules of thumb for specific invertebrates:*

**Sea Urchins** should not be shedding spines one or two broken off around the aquarium is fine but anymore than this is a bad sign.

**Sea fans and sea whips** should be damage free and preferably attached to a bit of live rock. Polyps that are fully extended are a sign of good health.

**Sea Anemones** unbelievably can be dyed for visual impact, avoid these unusually coloured specimens. Their basal discs, columns and all tentacles should be intact and healthy looking. Beware of constantly retracted individuals. Collapsed anemones will most likely have bubbles of air trapped inside them from improper handling. Also ensure the anemone is erect and expanded.

**Molluscs** will have no shell damage and a fully extended mantle and be exploring the tank.

**Corals** should be undamaged (not too many bits broken off) and of uniform colouration and not bleached looking. There should be no obvious area of tissue absence, necrotic lesions or overly black or white regions. Avoid specimens with hair algal growth. Ideally you will observe the polyps to be expanded and soft fleshy areas will be turgid.

**Sponges** should always be submersed in water or else they can easily die, make sure your supplier knows this before buying from them.

**Sea stars** should not be showing lesions or have a patched appearance, they should be looking healthy and normal.
If you take your time to look for happy, healthy marine pets and can recognise the tell-tale signs of stress and disease then you should be able to avoid the cost and emotion of sick and dying marine life in your saltwater aquarium.

Choosing a healthy coral is vital to your success. Look for expanded polyps!

The Look of your Saltwater Aquarium

Aquariums come in all shapes and sizes. The first question you need to ask is acrylic or glass, you should have already decided on the size. The major disadvantage of acrylic is getting scratched, however you can cheaply buy scratch repair kits if this does happen. The advantages over glass are strength, lightness, better insulation and clarity to view your marine life.

Glass aquariums are generally slightly easier to work with in terms of positioning lights and getting things in and out, but frankly glass is almost a thing of the past because of the aforementioned advantages of acrylic aquariums.

There are tanks that are created to be placed into the corner of a room; as well as aquariums that are built right into walls, allowing you to view through the aquarium from one room to the next. Standard aquariums in rectangle shapes can sit on
wooden or metal stands, or other sturdy surfaces and become a beautiful fixture in any room.

Some furniture is also being designed to hold aquariums - including coffee table aquariums and end table aquariums. You can even get kitchen benches and entire walls as saltwater aquariums now. These make wonderful conversation pieces and add interest to any décor.

When you've selected your aquarium, clean it thoroughly with fresh water and a sponge or cloth.

If you would like to add a background to your tank, you can purchase a pre-designed background that will fit the size of your tank. Backgrounds are somewhat like a poster that adds dimension to your tank; and can be purchased with reef designs or other under-water themes. They help you hide the mechanics of your tank. Some are applied to the outside of the aquarium and others are placed on the inside glass of the aquarium.

If you are creating a background from the inside of your aquarium, be sure that it's made from materials that are designed for fish tanks so that it cannot harm the aquarium life in any way.

Take time and care deciding the look of your aquarium before you buy, your aquarium will be with you for many years and is very difficult to change once it is all set up and full of marine life.
You want a good looking tank.

Necessary Equipment: For Healthy Saltwater Aquariums

When you come to the point of purchasing equipment for your saltwater aquarium it is really easy to get overwhelmed with all the available options, brands and all the contradicting advice you will hear or read about what is the “right way” to set up your marine aquarium.

In truth there are many different approaches that work and it ultimately comes down to the level of cost and complexity you personally want. There are now many expensive add-ons like tank controllers and automatic dosers that will cost you a lot but also help take care of and monitor your tank for you, but if you do more work you can spend less money by using less technology.
At the start all this different equipment and technology may seem quite complex, and it can put a lot of first timers off due to information overload!

But persevere because after you have figured out the fundamentals and what everything actually does (where I can really help you out at my www.SaltwaterAquariumAdviceVIPClub.com and also at my regularly updated blog www.SaltwaterAquariumAdviceBlog.com) you realise that there is a lot you really don’t need to know, its like buying a car; ultimately they all do the same thing to varying degrees of efficiency but there are hundreds of different makes and models out there to choose between, don’t sweat it and start basic!

**Standard equipment will vary a bit** with the kind of set up you are going for, for example a full reef aquarium needs better lighting and a way of adding and testing for calcium in the water that a fish only set up does not require.

Additionally size of the set up plays a part too, a smaller aquarium will require equipment that is also designed for small aquariums, which will cost less, but smaller set-ups generally have fewer options because of the physical size constraints.

Let’s start with the most obvious necessity: making electricity and water mix safely! You need electricity to run your aquarium, including the lights, filters, heaters, and pumps, but how do you get around the dangers of mixing electricity and water?

A **Ground Fault Circuit Interrupter** is an inexpensive method that will protect both you and your aquarium equipment and should be at the top of your “must have” list. You NEED your equipment wired through a Ground-Fault Circuit Interrupter (GFCI or GFI) that can stop electricity in a milli-second. This is the easiest safety precaution you can take with you saltwater aquarium and is an absolute MUST!
The other vital aquarium components are:

1. **Filtration** (most importantly biological and physical filtration components).
2. **Lighting**
3. **Heating/Chilling** (you only need chilling if you live in a hot climate or have a delicate reef system with powerful lights)
4. **Substrate**

*Each of these components are explained in detail below including the underlying principles of how they work and why they are important for your saltwater aquarium:*

**Vital Components 1: Filtration**

Filtration is probably the **most critical element** to a healthy saltwater aquarium. Essentially it is the **process of removing dissolved and undissolved organic waste** (from excrement, food, scales, algae, detritus, dead organisms) from the...
water, which if left to breakdown will cause the level of toxic compounds to build up to concentrations that can easily kill marine life.

So good filtration equals good water quality and a stable, healthy aquarium environment. Do not take short cuts or cheap options here.

**THE Most Important Form of Filtration = Biological**

Saltwater aquariums primarily need to have a **biological filtration** system in place. This basically gives your saltwater aquarium a place for beneficial bacteria to grow.

Biological filtration is the process of bacteria cycling (consuming) nitrogenous biological waste, namely excrement, decaying food and organic detritus and turning it into less harmful chemical compounds. This is very important because water quality can easily degrade to toxic levels that can kill all life if left untreated.

In the ocean the shear volume of water instantly dilutes these waste products, additionally, there are hundreds of different marine organisms that feed off one form or another; nothing is wasted down to the last molecule.

In your aquarium there is a very different story because of the **small volume of water in a closed system** and there is lack of diverse organisms found in the ocean to completely break it all down: _this means we need to employ filtration devices to help do natures job for us._

The area of filtration can be a very complicated and confusing one to the uninitiated, there are quite a few different types of filtration and let me tell you not all of them are necessary in your saltwater aquarium. And for every different type of filtration there are a huge number of options....
The most important thing we can do for our tank is provide good bio filtration.

Let's look at the different types of filtration:

1. Mechanical filtration:
Removes undissolved organic matter such as debris and uneaten food particles from the water using mechanical filters that **sieve the water**; this aids biological filtration by removing a lot of the waste at the source before it is broken down. Suspended solids affect your water clarity and if you can get to them before they dissolve and breakdown into ammonia all the better.

As well as biological filtration and physical filtration (protein skimming) all marine systems should have some form of mechanical filtration. Luckily these days a lot of biological filters have a mechanical component built in often as a **prefilter**. Be wary of mechanical filtration in a reef aquarium as this can **remove the corals food** (plankton, detritus), so turning it off while feeding is a good idea. Also in an aquarium with live rock mechanical filtration is less necessary as the life contained in the live rock processes suspended waste effectively too.
Mechanical filtration media can be any number of different unreactive materials such as sponge or wool and will need to be cleaned out or replaced every few weeks or so as this is dirty waters’ first obstacle in the filtration process.

2. Physical filtration:
Also known as Protein skimming is by far the most vital component to effective water cleaning, this method of filtration is so effective at clearing and oxygenating the water it is considered an absolute MUST for any marine aquarium and is secondary in importance only to biological filtration. It serves to get rid of dissolved organic waste before it is mineralised into ammonia (highly toxic to marine life), thus greatly reducing the load on biological filters which reduces the strain on the system and helps keep nitrates down.

Protein skimming works by using fine bubbles to attract protein molecules usually from the aquarium water surface (as this area is where most waste accumulates) in a chamber which removes the dissolved organic waste from the water column and makes a foam of concentrated, smelly brown liquid which is channelled into some kind of collection cup to be discarded.

Most people are amazed how much gunk comes out of their aquarium water in this fashion. You cannot over skim a marine aquarium in my experience.
The "natural" or Berlin style filtration system uses only a large volume, high output protein skimmer, mechanical filter and live rock (and/or live sand) as the foundation of its filtration requirements. Often there is also a wet/dry filter (without the wet/dry chamber) with prefilter and sump containing the protein skimmer as well.

3. Chemical filtration:
The main component of chemical filtration is activated carbon or charcoal (which naturally absorbs and deactivates chemicals) and this, if required, should be placed in-line after mechanical and biological filtration has taken place so the chemical media is not fouled up with gunk.

This has most common application in reef aquariums where water quality is of higher importance. Chemical filtration removes unwanted metabolites, colouring and chemicals from the water as a last stage treatment option.

Chemical filtration is not absolutely necessary if you are cautious about what goes into the water but does have its use in high water quality generation especially in reefs. For most applications the activated carbon simply sits in a nylon bag in the filter housing through which the water is passed, the activated carbon/charcoal
“scrubs” up phenols and heavy metal contaminants. If you plan to use carbon 200-250g per 100 litres of tank water is a good amount to begin with. Carbon will intermittently need to be changed after 3 to 6 months as its ability to absorb chemicals will markedly decrease after time.

Chemical filtration media.

Another important aspect of chemical filtration is phosphate removal as this compound can get into the water in a number of ways (overfeeding, detritus, phosphate containing additives) and will essentially over fertilise the water, usually resulting in unwanted, out of control algae outbreaks. Phosphate reactors with special media can effectively reduce phosphates, which is especially important in reef aquarium environments where corals don’t tolerate phosphates well.

4. Biological Filtration:
By far the most crucial type of filtering to any saltwater aquarium, this is a service performed by marine bacteria feeding on dissolved nitrogenous waste and is part of the nitrogen cycle. Waste is excreted from marine life in the form of protein, which is quickly mineralised into ammonia/ammonium (NH3 or NH4); ammonia also comes from the breakdown of food particles and decaying organisms.
This ammonia is highly toxic to marine life, but luckily nature has a solution for us in the form of a marine bacterium (*Nitrosomonas*) who use this substance as their energy source and aerobically (in the presence of oxygen) convert it to nitrite (NO2).

Nitrite is less toxic but still nasty, yet another bacterium (*Nitrobacter*) then comes along and converts nitrite to the less harmful nitrate (NO3). This process is known as nitrification and you will need test kits to keep tabs on these levels in your saltwater aquarium.

The final phase of this biological cycling is denitrification where anaerobic bacteria in oxygen free environments convert the nitrate into harmless nitrogen gas bubbles. These anaerobic zones can be found in the interior of live rock and live sand; you can also purchase commercial denitrification filters that harbour these special bacteria. The challenge of denitrification in a marine aquarium is to keep up with the nitrate levels being generated as nitrification occurs at a much faster rate than denitrification so nitrate levels can slowly rise over time, this is why we dilute them out with regular partial water changes.

*Ammonia/Ammonium, Nitrite and Nitrate testing kits. Regular testing is neccessary.*
What Makes An Effective Bio Filter?

An effective biological filter will have plenty of **surface area** for the bacteria to grow (filter media includes balls, sponges, fibres, floss, beads and many others) and will be supplied a constant source of well-oxygenated water and obviously ammonia to use for food. These beneficial bacteria will eventually colonise any surface and will grow as a “biofilm”. You must be careful to nurture this bacterial growth as damaging the bacteria can cause your aquarium to crash because waste is no longer broken down efficiently.

The Best Product is Nature!
The best biological filters are natures ones: **live rock** and **live sand**, these natural substrates are harvested from tropical waters and are jam packed with beneficial bacteria and tiny marine organisms that will literally come to life in your aquarium.

This not only gives your tank a natural look but gives marine fish a place to hide and is packed with not only beneficial micro organisms but interesting algae and entire tiny invertebrate eco-systems. The rock harbours both aerobic and anaerobic zones which will see biological waste not only broken down to nitrate but converted to harmless nitrogen gas; the **complete marine nitrogen cycle**. Live rock is weight by weight the most expensive item for saltwater aquariums but is well worth the investment.

**Live Sand** is another popular medium used in saltwater aquariums as a natural biological filtration source it does the same job as live rock due to the bacteria and other tiny marine organisms present but comes in the form of a substrate, which goes in a bed on the base of your tank. It can also be used for other purposes. Some people put sand in their tanks as a shallow or deep sand bed substrate, use it in combination with live rock, or set up a raised-off-the-bottom, few-inches-thick Jaubert style natural nitrate reduction (NNR) filter (also called a **plenum**) with their
sand. This “deep sand bed” set up has anaerobic zones (which shallow beds don’t), which process the nitrates from the water.

Choosing your Filter
Many commercial filters on the market today incorporate 3 types of filtration (bio, mechanical and physical but not chemical) into one filter device such as **Wet-Dry/Trickle filters**, which usually go in sumps if you choose one of the devices be sure there will be sufficient surface area for adequate biological filtration for your aquarium size/bioload or use live rock as well.

![Image of a filter system](https://www.saltwateraquariumadvice.com)

1 Example of an "all in one" filter system. It includes physical (protein skimmer), mechanical, chemical and biological filtration.

When considering filtration you will need to decide whether or not you will have a **sump** or a **refugium**, which are physical chambers **separate** from the display tank (often beneath the aquarium that pump water from the aquarium and back to it).

The advantages of sumps are **increased area for water treatment/water dilution**; you can add various filtration components to it, have easy access for maintenance and hide equipment that otherwise would be around the tank itself.
A refugium is a modified sump, which has a chamber where you can keep filtering marine life or even grow food species.

A good quality biological filter is a must, my personal favourites are Wet/Dry filters because they thoroughly aerate the water and are very effective at converting ammonium to nitrite then nitrate through a huge surface area for bacteria. Most also have a pre-filter that acts as an effective mechanical filter and good ones have enough space to put other filter media or even marine life. When used in conjunction with a denitrification system (which would be regular partial water changes, live rock or a commercial denitrification filter), these wet/dry filters have been bullet proof in my experience.

Physical filtration is key in maintaining excellent water quality, the best way to tackle this as we have seen is with a Protein Skimmer, which uses fine bubbles to attract and remove dissolved organic waste from the water column as a concentrated, smelly brown liquid. A good quality protein skimmer is an absolute must in all but the most basic marine aquarium set ups.

Aeration and water movement are very important factors for a saltwater aquarium especially if you intend to keep corals and other invertebrates. Basically its hard to have too much of these two factors. Good filtration equipment will serve both purposes well, but I really advice the use of a couple of powerheads to provide multidirectional water flow this is healthy for marine life and stirs up detritus which could cause water quality problems.
Powerheads: very good for water movement.

**Denitrification** or **Natural Nitrate Reduction filtration**, (NNR), is even better than regular biological filtration by itself, because it goes **one step further** and converts the nitrate (which normally gradually accumulates until you remove it by water change) into harmless nitrogen gas which bubbles off the water's surface. For all but the simplest tanks I would invest in some sort of denitrification component, especially if you keep corals.

Bear in mind some filtration set-ups reduce nitrate levels naturally: for example the use of **live rock** (which when teamed with a protein skimmer is termed the “Berlin” system), some **large fluidised bed filters**, live sand with Jaubert filters (**plenum**), or a combination of live rock and **live sand**. The faster the water moves over the bacteria, the more efficient it is at reducing nitrates in the aquarium.

**Including the natural methods of Live rock and Live sand there are several other options for biological filtration methods, including:**

- Power/Canister Style Filters
- Undergravel Filters
- Fluidised bed filters
- Live Rock / Berlin Systems
- Live Sand / Jaubert Systems
· Wet / Dry Trickle Filters

Let’s look at some of these bio-filters in more detail:

**Power/Canister style filters:**

Power filters are excellent options for smaller and fish-only aquariums, they come in many forms such as inside, outside, “hang on back” and canister. Power filters pump water from the aquarium, filter it in a box using a sponge type filter then pump clean water back.

They often come with mechanical filtration built in and have space for chemical filtration media. They are excellent multi-purpose filters and are easy to maintain, require the least amount of care, adapt quickly to increasing bioloads and they also aid water circulation.

![Hang-on-back power filter](image)

**Undergravel filters:**

Are very commonly used and are now considered outdated and should be limited to fish-only tank set-ups as they can create a lot of nitrates which would damage your reef. Some people believe you absolutely must have an underground filter while others think they are no longer needed due to other, better filtration methods. The undergravel filters sit under the gravel you have in your aquarium, and pull the water
down (or pushes it up) through the gravel and traps particles in a plate-type filter as the water passes through it. It's similar to the filters found at the bottom of in-ground pools. This is “old school” technology!

**Fluidised bed filters:**
These are a relatively new technology that sees the biological filtration take place in a sleek tower unit separate to the aquarium where water is pumped up the chamber suspending the media (sand or similar) inside which is coated with beneficial bacteria providing excellent circulation and an unmatched surface area for efficient biological filtration, if these units are large enough they can contain an anaerobic zone for denitrification. Fluidised bed filters are especially good for large and heavily stocked aquariums. They cope well with rapidly increasing bioloads and are very efficient and self-cleaning.

![A fluidised bed filter](www.saltwateraquariumadvice.com)

**Wet / Dry (Trickle) Filters:**
These filters are popular for people because they are extremely efficient at converting dissolved organic waste into nitrates as well as aerating the water. Because they are so efficient you need to stay on top of nitrates levels with water changes or enlist the help of a NNR/denitrification system.

Wet/Dry (trickle) filters (a.k.a. reef filters): are my top choice for medium to large or heavy bioload aquariums as they are easily the most capable filters at providing good water quality and provide a high level of oxygenation. Therefore they are a
definite best choice for reef set-ups and biologically filter the water seriously fast and can often provide biological, mechanical, physical and chemical filtration all in one package.

These filters are usually reservoirs beneath the aquarium and are mostly in 2 parts, the wet/dry chamber and a sump area which can contain a number of water treatment options such as live sand, protein skimmers, denitrification filters, phosphate removers, dosers. The principle is to maximise the air-water interface by “trickling” the water over unsubmerged filter medium (dry area) which highly oxygenates it, the water is then directed to a wet area where it is additionally treated chemically and/or physically. Often these filters mechanically filter (sometimes using a prefilter) the water as it is entering the system too.

The wet/dry (trickle) filter is very efficient and results in outstanding clean, oxygenated water being pumped back into the aquarium.

A wet/dry trickle filter designed to act as a sump.

The Role of Filtration in Your Tank

As you can see filtration plays a very important role in our marine aquariums removing undissolved and dissolved organic waste and is the key component in good water quality. Good biological, mechanical, physical and (sometimes) chemical filtration will serve to create the pristine water environment marine life needs to truly thrive.
You'll want to select the filtration system based on your tank size and bioload and set-up; whether you are going to have a fish-only tank or a reef tank which will need more filtration to keep the corals happy. Also you do need to select your filtration system based on the level of maintenance you are able to provide your aquarium, as some require more cleaning and changing of media than others.

Filter media, how often does it need to be replaced or changed? Are you happy with that?
Lighting Your Saltwater Aquarium

The process of lighting a saltwater aquarium serves two purposes:

1. The first is to allow us to **view the marine life** and also to showcase and **highlight the amazing colours** that lie within.

2. The second function is to **mimic natural sunlight** as closely as possible; to give our marine life some sort of **day/night rhythm** and **provide food** for the **photosynthesising** organisms such as corals, marine plants, coralline algae, anemones, phytoplankton and other invertebrates which use light as their energy source through photosynthesis. Ultimately this means they turn light and carbon dioxide into food (carbon), oxygen and water. **The light requirement for this process is between 350- 750nm (wavelength) and is partly UVA.**

The type of lighting you choose for your aquarium will depend on whether you have a fish-only set up or a reef tank. It's not that the lighting used in a reef tank won't work in a fish-only tank, but you would probably find it to be much too bright and “too much!” and maybe produce too much heat.

To adequately light your marine aquarium the only 3 parameters you must consider are **quality, quantity and duration of light:**

1. **Duration of light:** Regular **12-16 hour** lighting periods are optimal for good marine life health, a great idea is to use timers and have the actinic bulbs only on for 1-2 hours each end to simulate dawn and dusk.

2. **Quality of light:** The best lighting system will be a combination of **actinic** (blue light) and daylight bulbs.
As a general rule of thumb the bulbs needed to sustain photosynthetic light should have a **colour temperature** of around 6500°K - 12000°K (Kelvins) for general reef applications. Colour temperature increases with depth so much deeper water species require higher colour temperatures, these species are very specialist!

3. **Quantity of light**: You should also aim for **3 (soft corals) to 5 (hard corals)** watts of light per gallon of saltwater as another general rule, this will help you decide how many bulbs at what wattage you will need.

**Lighting Fish-only and FOWLR tanks**

**Fish-only Tank Lighting**

If you do not intend to keep corals life for you is simpler! The most simplistic lighting requirements can be used for fish only aquariums where all you want to do is be able to view your fish and give them a day/night cycle. Fluorescent lights of normal/standard output (NO) are all that is required here; full spectrum bulbs produce a more natural looking light and actinic (blue) lights bring out colourful pigments nicely.
Basic Fish Only Tanks
A very basic fish-only aquarium will consist of the tank, filter, heater and lighting. You can even go with the pre-made plastic tank covers that come with a single or double fluorescent tube light. These are by far the easiest to install and maintain. You buy it, put it on the top of your tank and flick the switch on. The bulbs are may be geared more for freshwater goldfish instead of saltwater varieties, but there are very little differences between the lighting except for a colour enhancement, they wont affect the health of your fish.

Most fish will be enhanced greatly by certain types of lighting that the typical (basic) hood lighting system won’t bring out in the fish. If you replace the standard bulb in the hood lights with a different variety (full spectrum and actinic bulbs), you can greatly enhance the colour of your fish. You can get pretty cool bulbs that make the colours on your fish fluoresce, which looks awesome.

FOWLR Lighting
A FOWLR requires a bit more lighting forethought than a fish only tank because of photosynthesising organisms on the live rock and possibly the introduction of a few extra invertebrates.
Fish only with Live rock aquariums typically include the photosynthesising red coralline algae encrusting the live rock and a handful of select invertebrates, depending on how many and which type of corals and/or photosynthetic anemones you have you may want to go up to high output fluorescents (greater luminosity than normal output fluoros) such as a T5 set up. T5 lights have become extremely popular in the past few years. If combined with electronic ballast they run cooler, longer and more energy efficiently than other lighting set ups, they also penetrate the water better than many other types of thicker bulbs.

If you have not much more photosynthetic life than just live rock in your FOWLR simple actinic blue normal output fluorescents will suffice to keep the photosynthetic creatures and algae happy and thus increase water quality too. If you want to keep a variety of corals or marine plants you will need to get reef ready lighting.

![T5 lighting rig with actinic blue bulbs and daylight bulbs.](https://www.saltwateraquariumadvice.com)

**Lighting a reef tank**

Now, if you have a reef aquarium or have a few corals or marine plants the lighting story is *much different*, as these organisms produce their food from light. So you will need to get a lighting package that basically mimics the suns rays (as in nature). Here the quality, spectrum and duration of your saltwater aquariums light really will
mean the difference between life and death for your marine creatures and their photosynthetic symbionts (the algae called zooanthellae that live in coral tissue).

**Optimal Reef Tank Lighting**

This is a delicate arrangement that is dictated by the type of reef aquarium you plan to keep and what creatures you plan to keep in it.

**Photosynthesising marine life falls into 3 different categories:**

1. Low light species such as many **soft corals**.
2. Moderate light species such as **large polyped stony corals** (LPS).
3. High light loving including many **small polyped stony corals** (SPS) and **Tridacnid clams**.

**Reef Tank Lighting Overview**

Reef tanks require much more intensive knowledge of lighting and can be an intimidating area. **Wattage**, the **colour rendition index** and **Kelvin** are all considerations for reef tanks.

Ultimately our reef aquarium lighting set-up depends on how much money you have and what variety of corals you want to keep.

There also tends to be many pros and cons of every suggested lighting set up for a reef aquarium. The specific lighting you need for a reef tank will vary depending on the reef life you plan to keep - and you may need to find a specialized resource to help you select the appropriate lighting for a reef aquarium. Lighting is dependant on the animals you intend to keep.

As you may have guessed by now a reef aquarium requires the most intensive lighting set up and to a **reef appropriate lighting is as important for good health as filtration**.

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My Opinions on Reef Lighting Selection

Often times lighting will be one of the most expensive components in a reef aquarium. I recommend **HO fluorescents** (such as T5’s) over **VHO (very high output) fluorescents** for deeper, larger aquariums or more sensitive species, with a combination of actinic blue and daylight bulbs.

A reef tank require full spectrum bulbs that mimic the suns rays.

Many aquarists use **metal halide** lights but because of their expense, excessive heat output, high UV radiation (use shields here), high electricity usage and limited lighting penetration over good fluorescents I don’t really see the real advantage of the additional costs (and potential fire-hazard) involved.

Now you can get reef-ready **LED lighting** that is relatively new on the market and has low power usage, heat and long bulb life. People have been getting great results from this lighting in their reefs. This would be **my top pick** if you budget can afford this reef lighting option.

**Retrofit systems** and other fluorescent lamp housings should have the light **bulbs no more than 3 inches above the water surface**. Reflectors should be used to direct all light to the water, many bulbs now have reflectors built in, these are very efficient.
Keeping Corals Happy Under Lighting

Soft corals require the least amount of light. Hard corals require more intense lighting, as do taller aquariums. Don’t forget my general rule of thumb is 3 watts per gallon for soft corals and 5 watts per gallon for hard corals.

For every reef set-up you should have blue actinic bulbs and “full spectrum” daylight bulbs with a Kelvin (K) rating of at least 5,500 to 12,000 for normal reef applications and up to 20,000 for the most demanding of deep-water hard corals, colour temperature increases with increasing depth the particular species is found at – deep water invertebrates are for experts only!

Kelvin (K) is a way of measuring the units of colour temperature. (Colour temperature is a term used to measure the similarity to day sunlight.)

As I said previously generally the bulbs needed to sustain photosynthetic life should have a colour temperature of around 6500°K - 12000°K for general reef applications. **Actinic lights are necessary when using frequencies below 10,000 K** to provide all lighting components, so will be necessary for almost all reef aquarium owners. Actinic lamps provide necessary blue light and act as boosters for daylight lamps between 5,500K and 10,000K.

So if you intend to keep corals and other photosynthetic organisms, you will need HO (high output) or VHO (very high output) fluorescent lights such as T5’s or power compacts, with a combination of actinic (blue light) and “daylight” bulbs (remember with a colour temperature of 6500°K up to about 12000°K for regular reef applications) or metal halide lights or reef capable LED’s.

Metal halide lights are commonly used for stony corals but produce greater amounts of heat, often requiring the use of a **water chiller** and so cost a lot more (and also use a lot more power). Metal halides originally were thought to be the ultimate lighting system for corals. However they produce that much heat and UV radiation facilitating the requirement for chillers and UV shields. These days with modern technology there are cheaper options that produce similar lighting with a lot less heat.
(such as T5 HO fluoros, VHO (very high output) fluorescent lights (such as power compacts) and LED lighting suitable for hard corals). Metal halide lamps will add 7-8 degrees F to room temperature and water in your aquarium so this is fairly significant.

I have already said I really recommend LED lights if you can afford them, which produce the intensity of metal halides but have a fraction of the heat output. This saving in electricity costs, long life of the bulbs plus the convenience of cooler lighting will pay itself back over time.

**How To Choose Your Lighting Wisely!**

When choosing a lighting set up, other than knowing what marine life you plan to keep, you should always take into consideration the initial cost of the lighting fixture, the ongoing operating costs (electricity), bulb replacement costs, frequency of replacement, whether or not you would need a chiller for the aquarium and the ease and eventual need for any upgrading. Some systems maybe cheaper initially but may require more frequent bulb changes or chilling systems because of heat generated making them more expensive in the long run.
Placement of Photosynthetic Marine Life Under Lights

The trick here is to try and get compatible species that thrive under similar light conditions or get very creative at placing high light species higher up towards the lights and moderate light species lower in the aquarium this way you won't saturate some species with too much light (damaging) or cause some species to not receive enough lighting for good growth. Species that are not getting as much light as they should be can to some degree be compensated with supplementary feeding such as plankton.

Heating/Chilling Your Saltwater Aquarium

(Chapter 2 goes into more detail on saltwater aquarium heating and chilling) To adequately heat your tank all year, you will need at least one aquarium heater to keep your aquarium at optimal temperature at all times (2 smaller heaters means if one fails or gets stuck on your tank should still be fine until you discover it), if you live in a hot home/climate or have a metal halide light system you may need a chiller to keep the water below 80°F (26.66°C).
A chiller is also a good idea if your water temperature fluctuates a lot within the day because marine life (especially corals) really don’t like this, marine life is only good at coping with very gradual changes over time, too rapid temperature changes cause stress which can lead to disease. A chiller will work in sync with the heat emitted by the lighting to keep the water a stable temperature. A good pair of thermometers will give you a handle on what the temperature is doing; this should be checked daily.

Substrate For Your Saltwater Aquarium

Also based on your aquarium plan you should know if you want substrate or not. Personally I don’t use it as this makes it way easier to remove any detritus and the space eventually gets covered with attractive, natural looking coralline algae and other awesome encrusted marine life. By far the most beneficial substrate is Live Sand substrate which is inhabited by beneficial microorganisms and tiny crustaceans which will greatly enhance water quality and plays a similar role to live rock.

To add substrate or not? Mostly comes down to personal choice.
**Book 2:**

**Setting Up a Saltwater Aquarium The Right Way.**

Now that you have finished planning your saltwater aquarium and know what vital equipment you need (if you haven't planned everything go back to Chapter 1 and go through the process I outlined!), you now have done all the decision-making stuff and now its time for the fun action part!

First, it's finally time to buy all that stuff you need, making sure you adhere to your plan 100%. If you adhere to your plan, then everything goes to plan, this is important to your ongoing success. If you have a legitimate reason to change your plan then do so making sure you write it down and have explored all the implications and ramifications of this.

It’s important to note at this stage to **TAKE IT SLOW.** It’s not a race, do things slowly and carefully and do not take any shortcuts here. A *well-executed set up is vital to your long-term marine life keeping success.*

**Setting Up: Tank Design and Layout**

Coming up with a good tank design and layout or “aquascape” is like **interior decorating** for your fish tank, but you will want to take into consideration what is going to be living in the tank when deciding how to aquascape it.

As mentioned briefly previously, there are pre-designed backgrounds that can be added to your tank to add interest, depth and help you hide the mechanical functions of the tank, if you like this sort of thing.
Alternatively, you could paint the outside of the aquarium, along the back piece of glass/acrylic. Use a solid colour, like ocean blue, black, or green. Appliance spray paint sticks to glass quite well. The advantage of painting the outside of the tank is that you don't have to worry about water getting in between your background piece and the glass - which tends to happen and can create a challenge for cleaning as the salt water will leave a salt creep residue between the glass and the background if not cleaned properly. You can also buy aquariums that already have a solid color on the back. This is entirely your choice.

The Aquascape

When thinking about the aquascape of your aquarium, consider whether any of the fish you plan to keep require hiding spaces. Dottybacks are fish that need to find places to “hide” to feel secure in their environment - and there are numerous fish that have unique needs that should be considered when designing your tank layout, this is why you should plan your tank carefully from the beginning. It is possible to use live rock and aragonite rock (many types of rock shouldn’t be used because of leaching minerals into the water) to construct caves, grottos, valleys whatever habitats your fish would like to make them feel at home.

If you are keeping reef in your tank, you’ll need to have an understanding of which corals need more intense light and which corals need less light. Generally stony corals like more light and soft corals less, but each individual species does have it’s own slightly different requirements. You’ll use live rock/rock to position the light-lovers closer to your light source while keeping the others more towards the bottom of the tank.

When designing your aquarium, keep in mind you will need to maintain the aquarium around what you put in. For instance, if you put live rocks and corals too close to the glass, you may find it difficult to scrape algae off the surface of the glass without disrupting your aquascape. If you add multiple water plants in one corner, it may
make it impossible to vacuum off the gravel. These are all important considerations when you set up your tank: it needs to both look nice and be functional.

Dottybacks, like this False Gramma Royal, love hiding places.

Saltwater Aquarium Decorating Options

“Fake” Coral, sometimes called “dead” coral, you may think looks great when you first put it in your aquarium, but it really is hard to keep clean (and is so 1970’s). You'll probably wish you didn't buy these decorations within a few tank-cleanings because they don't look as nice after a short period of time in the water. Also they are not really natural looking.

Live Coral on the other hand is one of the most natural ways to decorate your aquarium, live corals are of course a living animal so they are more difficult to maintain than dead coral, but they do clean themselves!

Live Rock looks natural AND serves a great biological purpose to your saltwater aquarium. It's also ideal because of how much fun it is! You can literally use aquarium silicon sealant to shape rocks into a design of your choosing. Live rock can be drilled and then piped together with PVC pipes or bits of dowling,
allowing you to create columns and archways out of the rock if they are attached to each other in this method it is possible to dismantle them again.

This art is referred to as “rockscapeing”. Just be sure you keep these rocks directly on the bottom of the tank rather than on top of sand as you may have stability problems and any sand burrowing species may get injured or trapped if the rocks are sitting on the sand.

**Preparing the Water & Filling the Tank**

Creating a saltwater aquarium isn't quite as easy as dumping some table salt into the water inside your aquarium but it needn't be overly complicated, either!

The products available on the market for saltwater aquariums these days make it possible for even beginning aquarium enthusiasts to have and maintain a healthy saltwater aquarium relatively easily.

Once you have:
- Written a detailed plan of the type of fish and/or reef you are keeping.
- Purchased the appropriate sized aquarium.
- Prepared the tank by cleaning it with freshwater and a cloth.
- Decided what kind of aquascaping you are going to add.

**You can then, finally, start putting it all together.**
Putting Your Saltwater Aquarium Together

Before you put anything inside the tank, you'll need to figure out where you're going to keep the aquarium. Remember that it will be nearly impossible to lift and move once you pour the water in because of its weight, so it's a good idea to position your tank wherever you are going to be keeping it at this point.

Grab your aquarium and set up the stand (if you have one) in your decided location, make sure it is level. The aquarium needs to be thoroughly cleaned with freshwater, now is the time to do any plumbing customisations, add a background and add your sump (if you want one). Ensure the aquarium is placed on the stand level then attach all your equipment where you want it to be.

If you intend to use substrate, wash it in purified freshwater first, then put it in your tank and place a clean bowl on the bottom of the tank and pour purified freshwater into the bowl filling up the tank. The idea here is that the flow via the bowl won't disrupt your substrate too much. You should be using water that has been filter purified; or distilled water that you've purchased to minimize any harmful effects that tap water might cause to your marine life. After the tank is filled to your desired level you can turn on all the equipment for a "wet run" to make sure everything is functioning correctly for a day or so. Now is also the time to check for any leaks and see how everything works together.
Making a tank into an ecosystem means moving slowly!

After a day or so of making sure all equipment is functioning correctly turn it all off and remove about half the water because its time for aquascaping as we mentioned earlier. If you haven’t already done so in your saltwater aquarium plan It’s a good idea to draw a couple of options on paper and decide on the best one, remember to keep in mind what marine life you will have and what sort of habitats like caves and grottoes they will like to frequent.

Arrange all your decoration as you have decided, as I touched on earlier a great way to put everything together is to peg bits of aquarium suitable rock or live rock together by drilling holes and gluing in a piece of dowel in a rock then attaching it to the other rock without glue, this way you can easily disassemble your structure if you need to. It is a good idea to trial this on a table to see if your reef creation is balanced before it goes in your aquarium. By doing this you can easily make an amazing looking reef formation and provide a variety of hangouts for your marine life.

After your aquascaping is complete my strong recommendation is to initiate the cycling of your aquarium using Live Rock (although there are other ways to do this). Before this however you will restart the heaters, pumps/powerheads, protein skimmer, filtration devices.
Now you will then add your aquarium salt, a good dechlorinated salt mix that you've purchased from a pet supply store or online. This creates your synthetic seawater, you need to be continually mixing and measuring it to ensure the correct specific gravity (ideally 1.023) pH (ideally 8.3) and temperature (ideally 77-80°F which is 25-27°C).

You'll need to test the water with pH and salinity (specific gravity) test kits. Instructions are on the aquarium salt bags. The water will take a number of days to stabilise to appropriate levels and temperature. After this time you can do any adjustments you need to.

**Biological Cycling of Your Saltwater Aquarium**

*So how do we correctly cycle a marine aquarium?* To start with you need be familiar with all the cycling terms: break in cycle, start up cycle, nitrification, biological cycle; it’s all talking about the same biological process; converting toxic waste into more harmless plant food by beneficial bacteria.

The most important time to do this is when you are first setting up your aquarium, it usually takes around 2 weeks or longer depending on how fast the bacteria colonise your aquarium at each stage of the cycle during this process you will need to test your water using a test kit for ammonia, nitrite and nitrate and log your readings.

Whatever chemical has the highest concentration will tell you at what phase the aquarium is in; it will go from ammonium spike to nitrite spike to undetectable levels of ammonium/nitrite and detectable nitrate (use test kits to find out). The entire cycling process will take anywhere from 3-100 days depending on what type of biological filtration you are using: live rock or a commercial filter, cured or uncured live rock.

The only way to tell which phase the aquarium is in is to detect zero nitrite over time and to observe various parameters such as pH start to stabilise.
I do not recommend you put any fish in until the cycling is complete, as they will get stressed and can die. The best way to initiate the cycle is with live rock which will contain the beneficial bacteria and decaying organic matter to provide the ammonium source and kick off the cycle.

**Initiating the biological cycling of your aquarium; the easy way!**

Live rock is quite possibly the most beneficial substance in the world to a marine aquarist (and a smelly fishy rock to everyone else!). Live rock is porous rock taken from the rubble zones of ocean reefs; it contains many tiny invertebrates and microorganisms essential to biological cycling - which by now you know means converting animal waste ammonium into nitrite, then much less toxic nitrate which is either absorbed by plants or removed by partial water changes or denitrification filters.

The outstanding advantage of live rock is that it harbours anaerobic zones where denitrifying bacteria grow; these awesome little guys convert the nitrate into harmless nitrogen gas thus completing the nitrogen cycle.

To begin with your new saltwater is *essentially sterile* and we need to *encourage beneficial bacterial growth* on the surfaces of your aquarium to make it viable for marine life.

**Here’s how we do that:**

The biological cycling process is kicked off by ammonia, which will be *released into the aquarium by decaying life on the live rock* (if it is unseeded or uncured), if your live rock is cured (seeded) you may need to add a *commercial ammonia solution* to kick off the reaction, this ammonium source will encourage the growth of specific bacteria which will use it as an energy source and convert it into nitrite which is less toxic to life. The increasing concentration of this new compound will initiate another sort of bacterial population to multiply which convert nitrite to nitrate. This 3-step
process is known as nitrification and is the series of reactions behind biological filtration.

Many people used to kick of cycling by adding a Damselfish which sometimes died. There are much less cruel ways...

What Happens In a Cycling Tank?
So, in the first few days ammonium levels will rise rapidly as the any dead life on the life rock decays and the bacteria present multiply and begin to convert it, this is the most stressful phase for marine life. Once the bacterial colony has established, the ammonium level will peak and begin to decline to zero as the bacteria convert it to nitrite.

Now nitrite levels will rise which again is stressful to fish (but no so much), the second stage bacterial colonies will multiply and begin to start converting nitrite to nitrate, nitrite can take a good week or so to reach its peak, then it will start to drop and nitrate becomes detectable.

Now the 1st and 2nd stage bacteria have reached the correct density to keep up with the ammonia released into the water, and now the tank is fully cycled and you can
begin to slowly stock up your marine aquarium after the water is stable and settled for a week or so.

**What Phase of The Cycling Process is Your Tank in?**

In case you have forgotten, you will use your ammonium, nitrite and nitrate test kits to establish which phase the aquarium is in; it will go from **ammonium spike** to **nitrite spike** to **undetectable levels of ammonium/nitrite and detectable nitrate**. The entire cycling process will take anywhere **from 3 to 100 days** depending on what type of biological filtration you are using: live rock or commercial filter, cured or uncured live rock. The only way to tell is to detect zero nitrite over time and to observe various parameters such as pH start to stabilise.

*Do not rush this; putting in livestock now could easily throw the system out of equilibrium!*

Throughout the entire process my recommendation is to **keep the protein skimmer on** to remove all the detritus and dissolved organics from the water. You water will look pretty dirty throughout this process, you can just **siphon out excess settled detritus** and let the protein skimmer and bacterial populations do their thing. You also may see algae start to grow; this indicates nitrate levels are building; you should get rid of the algae before it builds up to crazy levels.

The **final phase** is to initiate denitrification; get rid of the building nitrate by using a **commercial filter**, conducting **partial water changes** with or without the assistance of **live rock**.

You will want to bring nitrate levels down to around **20ppm** and tweak any temperature or water quality levels and let the water settle and clear before you GRADUALLY add your livestock.
Stocking Your Tank After Cycling

When stocking your tank after cycling you need to **add marine life very gradually** so the **different bacterial populations have a chance to adjust to the increasing bioload**. Start by adding the hardiest species first, wait for the system to adjust and test to be sure. A mistake here could easily cause the whole system to crash. And finally to avoid excess nitrates is the reason why you should conduct a **twice-monthly 20% water change** as part of a regular maintenance routine.

Adding your first few marine species is the fun part! Add one or two species from your plan into the aquarium; take it very slow to allow the bacteria to adjust to the increased bioload. After a week or so test the water levels and if you get a zero reading for ammonia and nitrite add one or two more. Then start **gradually building on your correctly set up and cycled dream marine aquarium!**

*Start with a hardy species like this Clownfish*

When first lighting your tank, try to follow natural rhythms for day/night cycles to keep your fish healthy and happy, simply by turning the lights on during the day and off at night. An easier way is to have your lights connected to a **timer** so this happens
automatically for you. Have your hood and lighting system ready to cover your aquarium once you add your fish. If you don't cover your fish tank, your fish will jump out so keep the cover on!

Looking After Your Beneficial Bacteria

Having a correctly functioning nitrogen cycle in your aquarium requires regular water testing and ensuring that the bacterial populations in your biological filter are not physically damaged or removed (such as any process that removes too much from the filter media) or chemically damaged (adding something to the water that will kill them off).

Maintaining Your Saltwater Aquarium

A saltwater aquarium requires ongoing maintenance to ensure the health of the marine life inside it, and keep it looking as nice as the day you set it up. If you are going to become a saltwater aquarium owner, you'll need to commit to a regular maintenance routine, just as you would commit to other home chores that must get done.

There are daily procedures that all aquarium owners should complete, but there isn't really a set structure for the other weekly, bi-weekly or monthly maintenance tasks. Each tank is unique and has it's own needs, but you will start to understand the needs of your tank as time goes on.

To get you started, however, here is a general guideline you can follow for maintaining your saltwater aquarium:
Daily Maintenance

✓ **Check the powerheads, pumps, lights and filters** and other electrical equipment pieces to be sure they are all working properly.

✓ **Check the temperature of the water.** The perfect way to catch a malfunctioning heater before it hurts your pets.

✓ **Check your marine life.** Are they all there? Watch the fish swim around- any noticeable changes in behaviour or appearance? Do your invertebrates look good? Is everything normal? The best time to do this is feeding time.

✓ **Check your protein skimmer** and empty out the skimmer cup of collected skimmate and rinse with water. Ensure bubbles are being produces as is a nice foamy skimmate.

✓ **Does the water appear clean and without odour?** If the water smells foul or looks cloudy, use testing kits to check ammonia, nitrite and nitrate levels to make sure everything is ok.

Weekly Maintenance

✓ **Check water filtering media** (sponge, cartridge, pads, floss, etc- based on what filtering system you are using) to see if it needs cleaning or replacing, a weekly check and monthly clean is fine. Be careful not to remove or damage beneficial bacteria from surfaces.

✓ **Partial water changes:** Are the BEST thing you can do to replace trace elements used up by marine life, increase buffering capacity of water and get rid of harmful nitrates and phosphates. This is the most important maintenance task **bar none. You should actually aim for 10% every week.**
✓ **Top up any evaporated water** with fresh water, this actually increases the specific gravity as the salt doesn't evaporate: not good for sensitive marine life.

✓ **Water quality testing**: just a quick pH, Ammonia/Ammonium, Nitrite and Nitrate test. Record the results to be able to see general trends. If nitrate is building or pH is slipping increase frequency of partial water changes or add denitrification filter or increase buffering capacity of the water.

✓ **Clean tank**: clean viewing panels on both sides, wipe off and remove salt build up (salt creep) on the cover and tank light bulbs. Only use aquarium safe cleaning products.

✓ **Gentle stir up** a small area of the gravel or sand each week to help prevent excess detritus or organic material from building up. If you don't have substrate vacuum tank bottom with a siphon to remove detritus. A saltwater aquarium clean up crew can help you with this.

*A gravel cleaner set is a good idea.*
Monthly tasks

✓ Adding any supplements: Mostly important for reef aquarium applications. Things like calcium, iron, iodine and strontium are very important for healthy reef growth and are quickly depleted from the water.

✓ Through checking of heating units: heater malfunction is a common killer believe it or not. Malfunctioning heaters can also cause electrical fires so check them well to be on the safe side.

Other Maintenance

The frequency that these items need to be done will vary depending on your own tank and how it's set up.

✓ Remove algae from the walls of the tank, rocks, gravel or sand.

✓ Replace chemical filtration materials as needed.

✓ Check leftover food levels: do not over-feed your fish- if you notice uneaten food building up at the bottom of the tank, cut back on how much you are feeding them.

✓ Check the lights: all bulbs have a limited lifespan (usually around 6 months to 1 year) after which time lighting set ups gradually lose their intensity, so much so that they will no longer be beneficial to your photosynthesising organisms. Record installation dates and read manufacturers replacement recommendations.
✓ Keep an eye on plumbing: This is an often-overlooked area and plumbing degradation can cause the contents of your aquarium to end up on the floor! Check for rot, salt creep and degradation on tubing, fixtures and joins.

Small tanks REALLY need you to have a good handle on maintenance.

Saltwater Aquarium Maintenance A to Z

Good saltwater aquarium maintenance is the key to a happy thriving aquarium once you have set it up properly and stocked it intelligently.

Ensuring a good regular maintenance schedule will help to ensure that your marine aquarium is always looking at its best, it also will help to ensure your equipment lasts as long as possible and your marine life is optimally healthy. So I strongly advise people to be disciplined about this and do your maintenance regularly, the time you will spend doing this will pay itself back in terms of minimal replacement equipment and the costs and heartbreak of replacing marine life.

Here’s more detail on the tasks you will need to do:
1. **Partial water changes:**

This is very important as toxic biological waste builds up in your tank all the time changing the water quality, if there are enough nitrates and phosphates present your marine life will die. The only way to prevent this waste build up and replace vital trace elements is to physically change the water. The most common technique is to replace 30-40% of the aquarium water every month, now I personally recommend you replace 20% every fortnight (or 10% per week); this is because if you replace 40% at once pH shock can harm your marine life, also fish are very sensitive to changes in salinity and temperature, so this will help reduce the shock of 1 major change. The water you are replacing must always be the same temperature, pH and salinity etc.

When changing the water a good idea is to use a powerhead to “rinse” all debris from rocks, corals and other items, then vacuum this out (as well as food debris) from the bottom of the tank using a gravel cleaner or siphon. This should be done as you siphon the water out into a bucket and discard it. The idea here is to stir up the detritus and suck it all out!

Water change equipment like this Python tool will make the whole process easier.

Ensure you replace the water with good quality water (i.e. dechlorinated, well mixed and the same temperature, salinity, specific gravity and pH as the rest of the tank) that you have prepared beforehand in clean containers.

**Don’t forget to unplug your heater** before you conduct a water change as a dry heating unit can get very hot and may shatter when exposed to cold water. Many
heaters these days turn off automatically when removed from the water, which is very handy!

2. **Cleaning filters and equipment:**

When you are conducting your water change a good idea is to clean out the filters and protein skimmers, getting rid of any debris and gunk you find, this will also let you get a handle on when any pads need to be replaced. Also check the filter media such as activated carbon and top up or replace as necessary. You should do this monthly.

Clean any pumps and powerheads too, this ensures optimal flow in your marine aquarium. These devices are very important in maintaining water quality and therefore keep your marine life alive, ensuring everything is in good working order is very important.

Cleaning the tank and equipment safely requires that you don’t use any chemical that could kill you marine life (easier to do than you might think), buy a special aquarium cleaning product or make up a solution of a small amount of vinegar and water. This will keep you tank looking pristine.

3. **Visual inspection of your marine aquarium:**

This is the most simple but most important part of your maintenance routine, it should be done daily at feeding time and is your opportunity to observe your marine inhabitants to ensure they are all are eating properly, and are disease symptom, parasite and damage free. It also gives you a chance to do a roll call to ensure all your pets are present. If you spot anything wrong the key is to act fast to ensure the problem doesn’t get worse or disease spread to others. Observe behaviour too, to make sure everything is normal. This is a good opportunity to catch an illness and do something about it before it is too late!
4. Algae control:

Algae should be **minimised and not completely eliminated** as it does play a beneficial role in the marine aquarium ecosystem by filtering out nutrients (phosphate, nitrate) from the water and providing additional oxygen (although marine plants can do this).

However algae can often get out of hand and start taking over your saltwater tank this is usually done by **pest algae species** or “micro-algae” such as red slime (cyanobacteria), hair algae or bubble algae. Not to be confused with beneficial marine plants which are usually termed “macro-algae” species, meaning big, for example coralline algae, Caulerpa and Halimedia species.

Algae control should be part of your regular maintenance routine. Excessive amounts of **nutrients** (primarily nitrates, phosphates and silicates) and excess or **incorrect spectrum light** (especially old bulbs or sunlight) causes pest algal breakouts. Manual removal of algae from tank walls and rocks can be very effective, but the underlying cause of an algae outbreak is probably excessive nutrients in the water from such things as overfeeding, not doing regular or big enough water changes, using unfiltered water, adding a product to the water containing excessive nutrients (read the labels!) or decomposing waste; usually uneaten food or a dead pet coming from somewhere. You can also stock fish such as **Tangs, Algae Blennies** and/or invertebrates such as **Turbo & Astrea snails, Sea Urchins** that like to eat algae to help keep it under control.
5. Water Quality Testing:

(Later on in this chapter we go into more detail on water quality and testing.) Ideally all parameters should be measured completely every 1-2 weeks, things like temperature and pH should be checked a few times a week at least (temperature is very quick and can be checked daily using a good thermometer). Purchasing pH test kits is inexpensive and regular testing will prevent problems.

Other things you should test for are ammonia (should be 0 ppm), nitrates and nitrites (should be very low and consistent), oxygen and salinity.

If you adhere to a good, well documented maintenance schedule it will not only keep your saltwater aquarium looking its best but ensure optimal health of your marine life and help to prevent any costly problems and fatalities. I also recommend you keep a maintenance checklist and write down any observations and record readings over time to help you understand your tank better and also to help you track the source of any potential problems.
Fish like this Purple Tang will help you get rid of pest algae.

How Do You Change The Water In A Saltwater Aquarium?

First - it's important to note that it's never a good idea to change most of the water in the fish tank at any one time! This is because it removes the bacteria, which are necessary to keep the water from becoming toxic, also because the new water (if more than 30%) can cause shock in your marine life if the parameters are not within 98% of the old water’s. Most people recommend changing 10-15% of the saltwater aquarium water every two weeks, but I say go for 10% per week or 20% every fortnight. This will ensure your water is always in top condition.

For around $60, you could have plenty of prepared saltwater on hand - for whenever you need to change your water quickly, or for your regular water changes.

What You’ll Need:

<p>| An unused 30-55 gallon plastic trash container (get a size equal to or slightly larger than your aquarium) |</p>
<table>
<thead>
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<th>10 feet of flexible, vinyl tubing</th>
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<tr>
<td>Floating thermometer</td>
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<tr>
<td>Multipurpose aquarium powerhead/water pump</td>
</tr>
<tr>
<td>Submersible aquarium heater</td>
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<tr>
<td>Refractometer (to measure specific gravity)</td>
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</tbody>
</table>
What You’ll Do:

1. Using purified fresh water (you can purchase distilled water, or get a reverse osmosis or deionisation purification unit), rinse out your plastic trash container. Do not use any soap or detergent of any kind. Place it next to your aquarium. Fill it with the amount of purified water you will need to replace the water in your aquarium that you plan to.

2. Test the water temperature within your aquarium, and the specific gravity, and record this information on a piece of paper.

3. Place the thermometer into your plastic mixing container. Place the powerhead and heater at the bottom of the container to help the salt dissolve into the water more quickly.

4. Measure out the total amount of quality salt mix (no phosphates should be in it) you need for your tank (follow instructions on bag) and then divide it into three equal amounts. Pour a third of the salt into the mixing container and stir until it is completely dissolved before adding another third of the salt and so on. Check the water temperature after each addition of salt. When the entire amount of salt has been completely dissolved, you can test the specific gravity of the water adjust as you need to by adding more salt (increase) or more fresh water (decrease) until it is the same as your display tank.

5. You will run the powerhead in your bucket for several hours to completely aerate the saltwater. It's a good idea to have prepared the saltwater 24 hours before using it, but in emergencies, you could attach air stones to an air pump, or protein skimmer in order to ensure you achieve the proper levels of oxygen. After you've mixed, properly tested and oxygenated the saltwater, it's ready to use! You can keep a lid over the water to prevent anything from contaminating the water until you're ready to use it.

6. You will siphon out as much debris from your aquarium as possible as you get rid of the old water.
7. Turn off all electrical equipment. Carefully remove 10-15% of the water from your tank. You can do this with measuring cups, so you know how much water you've removed.

8. Check the filters to see if they need changing and make sure the glass and pumps are free from algae and other forms of waste.

9. Begin adding your newly prepared and tested saltwater, and replace the percentage of water you removed. If you're using the suggested pump equipment, you can attach the flexible tubing and the powerhead will add the water for you through the hose!

**Target Gravity & Temperature Ranges:**

The idea is to match your prepared saltwater in your bucket as closely as possible to the temperature and specific gravity measurements of the water in your aquarium. The target levels should be:

Temperature:  
- 72-80 degrees Farenheit for fish only systems;  
- 75-78 degrees F for reef systems

Gravity:  
- 1.020 – 1.024 for fish only systems;  
- 1.023 – 1.025 for reef systems

**Marine Tank Janitors: Saltwater Aquarium Clean-up Crew**

It’s true that keeping your marine aquarium clean can sometimes be a chore, but it is a small price to pay for having a pristine display tank that looks awesome and wows everyone that walks in the room. But, there is an easier way; enlisting the help of a few particular species of invertebrates, plants and fish to do the job for you!
Marine tank janitors are a selection of **beneficial marine organisms** that basically feed on **algae**, **detritus** and any **uneaten food** left in the aquarium, additionally **marine plants mop up nitrates and phosphate** (biological waste products of excretion) in the water.

This assortment of helpful invertebrates, fish and plant life are literally the janitors or clean up crew of a marine aquarium. If you own a reef tank having these guys around is a **must** do as long as they get along with your corals and invertebrates, if you have a fish only set up just do a bit of research first and make sure none of your fish species will feast on your clean up crew (always research fish, coral and invertebrate species compatibility before adding in new tank inhabitants).

So your clean up crew will generally be made up of a combination of **crabs**, **snails**, **shrimp**, **sea cucumbers**, **Starfish**, **marine plants** and sand sifting **Gobies** and **Blennies**. A number of these species are more suitable for beginners such as Cleaner shrimp, crabs, Gobies and starfish.

If you have a sandy substrate, sand sifting species such as the Gobies (for example; 2 spot Goby, Sleeper Goby, Watchman Goby) and sea cucumbers such as the black or Tiger tail will do an excellent job of ploughing through the sand looking for detritus. This is very beneficial to keep your tank looking clean and the nitrate/nitrite levels down and efficiently aerates the sand.

*Ward's Sleeper Goby (Valenciennea wardii) will sift your sand.*
Species that will keep the rocks and glass free of algae and detritus are herbivorous fish species such as Blennies and Tangs, Hermit crabs such as dwarf and electric species and snails such as the hugely popular Astrea and Turbo snail. Snails and hermit crabs are quite small so will not rearrange the aquarium or require much care, however Tangs can grow quite large and need additional feeding so make sure you have enough space.

Hermit crabs such as the blue legged and red legged species are perfect for algae control because they are small so do not cause too much of a disturbance in the tank and can fit into tiny gaps for better algae predation. In terms of true crabs, the Emerald Green Crab is the best selection for a reef aquarium because they are so reef safe and so good at controlling algae.

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**Book 3:**

**Creating a Perfect Environment**

1. **Ensuring Good Quality Water:**

Fish are very dependent upon their environment and sessile invertebrates even more so. A slight change in temperature can shock marine life and cause them to become ill or die; as can changes in the ph, ammonia, nitrite levels, or specific gravity (salt content) measurements.

**Why is Water Quality so Important to Saltwater Aquariums?**

All marine creatures have evolved in the ocean, which is a very stable environment with massive water buffering capacity because of its large size (which means
constantly stable temperature, pH, specific gravity, oxygen, nitrate and other chemicals).

This is unlike freshwater species whose environment can often be affected dramatically by events like landslides, snowmelt, drought and flooding causing massive changes in water conditions. This lack of chemical and physical change in seawater means marine fish and invertebrates do not possess the physiological ability to adapt to different water conditions that freshwater species possess.

**Poor Water Quality Can be Fatal**

In my experience poor water quality is the *number one reason things go wrong* with marine life in peoples' saltwater aquariums. It is the *leading cause of death* resulting from the stress and shock of chemical and physical fluctuations in the water.

For us as marine aquarists this means to ensure our marine pets not only survive but thrive, we need to provide optimal water quality at all times. This is especially true for reef aquariums where corals have a much more specific set of requirements than marine fish.

Keeping a healthy saltwater aquarium requires that you keep up with the daily/weekly/monthly/occasional water quality testing and routine maintenance of the tank in general (see book 2). If you fail to do these simple steps correctly or frequently enough, your fish and invertebrates will probably not survive for the long term...
The Keys to Good Water Quality

1. The first main consideration in top quality water is a really good purified water source. As I have mentioned before water from the tap should never be used as it contains high levels of phosphate, nitrate and heavy metals among other chemicals you do not want in your aquarium. The best way to obtain purified water is to purchase a reverse osmosis or deionisation or RO/DI (combined unit) water filter for tap water; this investment will soon pay itself back to you, and they are getting cheaper all the time. Alternatively you can purchase prefiltered/distilled water or pre-prepared saltwater, which is a more expensive option in the long term.

2. Next up would be a high quality salt mix if you are using filtered freshwater, this should closely replicate the chemical composition of natural seawater (NSW) and will add in all the vital minerals and trace elements your marine life need for health. Be careful that your salt mix doesn’t contain unwanted additives like phosphates etc, check the ingredients.

Now that we have the nuts and bolts of a good quality saltwater source figured out the next major parameter required for high quality saltwater aquarium water are a high level of oxygenation and strong water movement.

3. Oxygenation can come from a good protein skimmer, but also airstones, water pumps and powerheads; anything that moves water around rapidly or puts bubbles into it. All marine life breath oxygen as do we humans so this is important especially
as saltwater absorbs 250 times less oxygen than freshwater so we want a high water turnover at the surface of the tank where oxygen can be absorbed.

4. **Strong, multidirectional water movement** as I have mentioned before is especially important for corals and other sessile invertebrates; to bring them their plankton food and nutrients, clean them of detritus and oxygenate them. You can never really have too much water movement in a marine aquarium; it stirs up detritus and prevents anoxic (oxygen free) zones forming where organic debris could start decaying anaerobically releasing deadly toxins into the water. A series of powerheads pointed at each other will do the job (one in each corner is great); you can even put them on timers to emulate ebb and flow. You can also get **advanced programmable propeller pumps** to simulate different reef water movements and waves.

![Powerheads are your friends!](image)

**Testing Water Quality**

Regular testing of your water parameters will be required to ensure your aquarium and marine life are in optimal health at all times.

Testing your water may seem like a chore but things change in your saltwater aquarium water over time and you need to stay on top of what is going on because
Poor water quality is the number one killer of marine life around the world. After you get into a routine of testing it becomes that much easier, especially when you know how often you need to test the various parameters.

Testing also acts as an early warning system for the environment your marine life live in; it will tell you if there is a problem somewhere and give you time to act before it gets worse. This is especially true for smaller aquariums where things can change very rapidly because of the small volume of water present to buffer any changes.

Regular water testing can easily save the life of all your pets if a test result shows a parameter at dangerous levels, you will be able to act immediately which is why it is vital to not rely on the pet store or aquarium guy to do this for you, if you have to rely on someone else it may be too late. This may save you a little bit of time but it’s just not worth the risk.

Things are much simpler for marine aquarists these days than they used to be and every vital element and parameter can be easily and quickly tested for using test kits and testing equipment which will tell you exactly what is going on in your aquarium. I have said this before, but it needs repeating: you should also log all your results in an aquarium journal to keep track of changes over time this will teach you how your aquarium is functioning so it becomes predictable and you can anticipate any changes.

**Temperature**: The ideal water temperature for a saltwater aquarium is 77-80°F (25-27°C) this should be achieved using 2 heaters depending on your aquarium size, 2 heaters means that the damage to your tank will be minimal if a heaters sticks on or fails.

If you live in a warm house/climate or have metal halide lights you may need to purchase a water chiller too, especially if you have a reef aquarium. A chiller is particularly useful if your temperatures are fluctuating more than 4 degrees (F) over less than 12 hours, this will stress out your marine life.
A chiller: good for hot climates and temperature fluctuations.

To accurately keep the temperature in the range 77-80°F (25-27°C) you will need an accurate thermometer. Even better is a good quality temperature controller unit hooked up to your heater that will keep temperature fluctuations to a minimum and lead to less stressed marine life. These units can be linked to both heater and chiller to provide a VERY stable climate.

**pH (alkalinity):** Testing the pH level of the water requires a testing kit. They're available from most aquarium retailers or online stores, for around $10-15. You'll want to test the water every few days, and after any additions to the tank - including water changes or new tank decorations. *The ideal pH level for a saltwater aquarium should be 8.3.*

In a fish only set up the pH can range from 7.6 to 8.4 without causing harm to the fish. In a reef tank the invertebrates are more sensitive requiring a pH range of 8.0 to 8.4.
How pH works in your tank and how to adjust it

In a saltwater aquarium set up the pH is normally likely to go down overall (become more acidic) mostly as result of organic acids produced by biological waste from ordinary respiration of your pets. Usually the waters buffering system can retard this pH drop to a degree but it does begin to wear out after a while and the buffering chemicals such as calcium, carbonate, and bicarbonate need replenishing. This is where the term “alkalinity” comes in; it is the waters buffering ability to stay alkaline in the presence of these acids.

The best way to stabilise pH is with regular partial water changes, which replenishes the aquariums buffering capacity, and also adds back vital trace elements that get used up by marine life.

*If the pH is too low you can add a pH reduction product. If its too high you can add a pH increaser product or baking soda, you just have to be careful as the basic baking soda can burn marine life before it gets diluted.*

![A pH probe is much quicker to use than strips.](image-url)
Ammonia/Ammonium, Nitrite and Nitrate:

These substances are all Nitrogenous compounds (composed of the element Nitrogen) formed from the breakdown of biological waste and organic matter. All should be scrubbed up by effective biological filtration and be kept to an absolute minimum. Test kits are readily available for each compound. Ammonia and Nitrite are particularly toxic to marine life and should only be present during biological cycling in a new aquarium, ideally you will have a zero reading for these.

1. Ammonia: Having too much of a build up of ammonia within the tank will harm your fish, literally it will burn their delicate skins. An established aquarium should have 0 parts per million (ppm) ammonia level - which is determined with a test kit.

Ammonia is a natural by-product of animal metabolism, and also comes from decomposition of plant and animal wastes which breakdown directly into ammonia; but it is toxic to fish. Ammonia is especially dangerous when transporting fish in small volumes of water, because soon after the fish excrete ammonia is formed from the waste, you would need an ammonia deactivator for a situation like this.

Use an ammonia testing kit weekly to make sure the levels are remaining constant, and if they start to rise, it could signify a problem with your filter not being clean, or too infrequent of water changes. A weekly test is only necessary if your tank is not established yet, if it is you only really need to test for ammonia if something is going wrong.

2. Nitrates & Nitrites: Nitrite comes from the breakdown of ammonia and should also be present only in tanks that have not yet completed the biological cycling process. So unless your tank is cycling nitrite readings should be zero - this needs be as close to none as possible as nitrites are toxic to fish, nitrite is in turn converted by bacteria into nitrate.
Nitrate is the end product of biological filtration, and comes from the decomposition of nitrites. There are separate testing kits that allow you to check the level of nitrates and nitrites within the aquarium.

Fish only aquariums should have less than 50ppm (~20mg/litre) of nitrates. Reef and FOWLR (fish only with live rock) aquariums should have less than 20ppm (~3mg/litre) nitrates. If your test results reveal increasing levels of nitrates, you need to change your filter more often, or replace it if it's not functioning properly. Nitrates can be removed from the water by conducting regular partial water changes (as can ammonia and nitrites – BUT their rapidly increasing presence in an established tank indicates something is wrong, for example a hidden decomposing fish).

These days testing kits for nitrogenous waste are easy to use and fast.

Water Hardness:

The hardness of water influences the regulatory functions of fish, plants and micro-organisms within the aquarium. Water hardness differs depending on where you live. If you are using distilled, purified water, instead of tap water, the hardness of the water you use should be constant. When you purchase your purified water, see if you can find it with water hardness above fifty but under two hundred parts per million as this is the water hardness level in which fish thrive.
Carbonate Hardness (dKH):

This is the measure of alkalinity or buffering capacity of saltwater, which is essentially the **pH stabiliser** (and is different from water hardness!). Ideally you will have **9-12dKH** this will provide good buffering against pH fluctuations. This can best tested for with carbonate hardness test kits. Carbonate hardness is mainly a concern for reef tank owners as corals are very sensitive to pH changes.

You can increase your water's buffering capacity with a carbonate hardness buffer.

**Calcium Reactors** are high tech pieces of equipment that offer a fantastic solution to the problems of **pH fluctuations, carbonate hardness** and **calcium dosing** (especially important for reef building corals) all in one unit. Aquarium water, CO2 gas and calcium carbonate are combined in a reaction chamber to produce injections of calcium bicarbonate that provides the calcium vital for invertebrates’ growth, adequately buffer aquarium water and corrects pH. **Calcium reactors are strongly recommended for reef aquariums as corals use a lot of calcium and are more sensitive to pH fluctuations.**
Got a reef tank with lots of hard corals? You should get a calcium reactor.

**Salinity/Specific Gravity:**

Specific gravity is *a weight ratio of one litre of a substance (saltwater in this case) compared to one litre of pure water* and is temperature dependant. It is essentially a way to measure the salt content in your aquarium and to make sure it is as close as possible to seawater. This is an important parameter of good quality aquarium water.

A salinity level of “0” is equivalent to a freshwater aquarium. **Ideally the level for a marine tank should be 1.023.** A high level of salinity may require attention, as it is possible there is not enough oxygen being absorbed by the water.

**Hydrometers** are used to measure specific gravity. Conductivity however is a more accurate measure. The conductivity of your aquarium water should be 50.1 ms/cm @ 25°C this can be measured using conductivity probe.
Hydrometer: necessary to measure salinity/specific gravity.

Specific gravity will change with the event of evaporation, which leaves behind salt and increases specific gravity and salinity that will harm marine life; this is why we need to measure it regularly. If it's too low add more salt mix, too high add more purified water.

It's important to note that marine life from the Red Sea which has a higher salt content than the rest of the world's oceans need their specific gravity at 1.024-1.025 to be optimally healthy.

- All the major water quality and water chemistry components have now been covered for fish only aquariums if you have a FOWLR aquarium with a few corals and other invertebrates or a reef aquarium you must also consider the following parameters:

**Phosphates:**

Phosphate levels must be kept to a minimum, even though phosphate is a major nutrient for corals. Ideal phosphate levels should be less than 0.05ppm (or 0.01 mg/litre).
Phosphate can be introduced to the aquarium in many forms (unfiltered water, overfeeding, non-phosphate free salt mixes or medias) and excess leads to algae blooms that are particularly undesirable in reef aquariums where it grows on the corals and can suffocate them. So you should test new aquarium products for phosphate by putting them in water for an hour then testing that water. Phosphates are additionally not very well tolerated by corals.

Phosphate test kits are cheap and easy to use. Phosphate removal media is a very good way to get rid of excess phosphate from your system. Regular water changes help with keeping on top of phosphate levels.

![PhosBan is a very good phosphate removal media.](image)

**Calcium:**

This element is a very important compound in reef aquariums as hard corals, molluscs, soft corals and crustaceans use a lot of this compound to build their skeletons. Calcium is used up from the water fast in an established aquarium; as much as 15mg/litre per day! Reef building SPS corals use the most calcium.

Calcium levels are ideally 420mg/litre, which is the same as NSW. Test kits can be used to give a handle on this vital element calcium can be dosed into your aquarium using a calcium reactor and not simply by adding coral sand to your aquarium as
many people incorrectly think. Depletion of calcium also reduces the buffering capacity of marine aquarium water too.

Other important elements for thriving invertebrates in reef aquariums are iodine and iron, which are both beneficial for fish too. Commercial additives and test kits are easily available. The ideal levels for each are 0.5 mg/litre for iodine and 0.05 mg/litre for iron. Both are used up from the water by marine life so will need to be tested for regularly.

Stony reef building corals also need strontium, ideally at 8 mg/litre for building up their skeletons. Strontium is quickly depleted from the water so will need to be added regularly.

Reef additives, important, but use sparingly.
Here are 2 easy to use water testing charts to help you:

1. Testing parameters and frequencies recommended for a Fish only marine aquarium set up:

<table>
<thead>
<tr>
<th>Parameter:</th>
<th>Method:</th>
<th>Frequency:</th>
<th>Acceptable range:</th>
<th>Ideal level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Thermometer</td>
<td>Daily</td>
<td>77-80°F (25-27°C)</td>
<td>26°C</td>
</tr>
<tr>
<td>pH</td>
<td>pH probe</td>
<td>4-5 times a week</td>
<td>7.6-8.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Test kit</td>
<td>Daily if cycling, every 2 weeks if not</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Nitrite</td>
<td>Test kit</td>
<td>Daily if cycling, every 2 weeks if not</td>
<td>None - 0.01ppm</td>
<td>None</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Test kit</td>
<td>Weekly</td>
<td>10-50 ppm</td>
<td>None</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Hydrometer (or conductivity probe)</td>
<td>Weekly</td>
<td>1.020-1.024 (45.3-51.5 ms/cm @25°C)</td>
<td>1.023 (50.1ms/cm @25°C)</td>
</tr>
<tr>
<td>Carbonate Hardness (optional)</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>7-12 dKH</td>
<td>9 dKH</td>
</tr>
</tbody>
</table>

2. A FOWLR set up with a handful of invertebrates + corals and a reef aquarium have a few extra parameters added on for the coral and other invertebrates to grow optimally:

<table>
<thead>
<tr>
<th>Parameter:</th>
<th>Method:</th>
<th>Frequency:</th>
<th>Acceptable range:</th>
<th>Ideal level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Thermometer</td>
<td>Daily</td>
<td>77-80°F (25-27°C)</td>
<td>26°C</td>
</tr>
<tr>
<td>pH</td>
<td>pH probe</td>
<td>4-5 times a week</td>
<td>8.0 -8.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Test kit</td>
<td>Daily if cycling, every 2 weeks if not</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Nitrite</td>
<td>Test kit</td>
<td>Daily if cycling, every 2 weeks if not</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Test kit</td>
<td>Weekly</td>
<td>less than 20 ppm</td>
<td>None</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Hydrometer (or conductivity probe)</td>
<td>Weekly</td>
<td>1.022-1.026 (48.7-53.3 ms/cm @25°C)</td>
<td>1.023 (50.1ms/cm @25°C)</td>
</tr>
<tr>
<td>Carbonate Hardness</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>9-12 dKH</td>
<td>9 dKH</td>
</tr>
<tr>
<td>Phosphate</td>
<td>Test kit</td>
<td>Weekly (preventitive)</td>
<td>0- 0.04 ppm</td>
<td>0.01 ppm</td>
</tr>
<tr>
<td>Calcium</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>380- 450 ppm</td>
<td>420 ppm</td>
</tr>
<tr>
<td>Iodine</td>
<td>Test kit</td>
<td>Experts only</td>
<td>0.4- 2 ppm</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>Strontium</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>5- 15 ppm</td>
<td>8 ppm</td>
</tr>
<tr>
<td>Iron</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>0.03- 0.05 ppm</td>
<td>0.05 ppm</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Test kit</td>
<td>Twice monthly</td>
<td>1250- 1350 ppm</td>
<td>1280 ppm</td>
</tr>
</tbody>
</table>
Corals require more chemical tweaking of your tank than do fish.
Heating and Cooling Your Saltwater Aquarium

Saltwater aquariums are almost always stocked with tropical marine life (you can also have cold water marine set ups, but these are relatively uncommon), which by definition is marine fish and invertebrates that come from tropical regions of the world where water temperatures are a constant, balmy 77-80°F (25-27°C). This marine life can only tolerate small and gradual changes in water temperature. This universal characteristic of our favourite marine pets makes temperature (heating and cooling) a vitally important aspect in any marine aquarium. The importance of heating is often under-estimated by new marine aquarists, which can lead to heating disasters, the easiest way to wipe out your entire tank results from heater malfunctions, such as a single big heater being “stuck on” or not heating at all. A heater being stuck on and causing all the inhabitants to perish is the source of many a sad email to me.

Get a Good Heater!

The best thing you can do to prevent heating disasters is to buy a quality heater. Cheap, poorly made heaters (for example many Chinese brands) can and do often get stuck on or fail to heat; they can also be a fire risk in your home.

You need to look at your heater(s) as a life support system for your marine life; choosing the cheap and cheerful option can often cost so much more in the long run.

A good heater is fully submersible as opposed to hang on. This is because if the water level drops the hang on model can overheat and burn out. Another important feature of a quality heater is being made of shatterproof material and is also corrosion resistant. New titanium heaters are an excellent investment in my opinion, these heaters are accurate, conduct heat brilliantly and mostly have a built in temperature sensor which shuts off the unit if it comes into contact with the air which would otherwise cause the heater to overheat and break.

Temperature Controller Units

A temperature controller unit is advisable to use with heating and cooling units, this does all the leg work for you and keeps fluctuations to a minimum, which is very
good news for marine life. I also advise a thermometer with an audible alarm (or one that messages your smart phone!) as an extra measure.

**Heater Tips**
As I have hinted at earlier on another good practise is to go for 2 smaller heaters as opposed to one big one; this will make it harder for one to overheat the tank before you realise (if it gets stuck on which does happen) and if one stops heating the tank temperature wont drop severely so shouldn’t cause massive damage to your marine life. This means the tank will only cool down or heat up half as fast and that gives you **twice as much time to save your marine life!**

Remember to handle all heaters with care and set-up as per manufacturers instructions, turn units off when exposing to air or performing maintenance and keep them clean, especially so you can see the indicator light is on. Always plug them into a Ground fault circuit interrupter (GFI).

![A good heater: titanium with a temp. control unit.](image)

**Chillers**
If you live in a hot climate, prefer your home a little warmer or have an intense lighting set-up (such as metal halide fluorescent lights for a reef aquarium; which are the hottest lights) chances are you will need an aquarium chiller, which will keep your marine aquarium water below a particular set temperature. This is especially
important when you keep corals because the lighting requirements they have create a lot of heat generation from the bulbs, often times this can cause a water temperature increase of around 7°F! These lighting set ups can often mean you won't need your heater turned on, however it is advisable to have one as a back up. Once again as the correct temperature is so important it is my advice to purchase a quality chiller unit.

When both a chiller and a heater are hooked up to a temperature controller this is ideal to keep the temperature in your saltwater aquarium constant no matter what else maybe happening and you marine life will love you for it.

Temperature controller unit can power your heater and chiller.

The Nitrogen Cycle In Detail

The Nitrogen cycle is one of the most crucial biological pathways that takes place in your saltwater aquarium. It is carried out by microscopic marine bacteria found in all seawater and occurs naturally in the ocean, understanding it is our key to successful marine aquarium keeping.

This cycle is the cornerstone of biological filtration and is crucial to initiate correctly when you first set up your aquarium, as we have seen this is called “cycling”.
Back in the 70’s when this hobby first started to emerge, the nitrogen cycle was not very well understood, which resulted in fish, corals and invertebrates having a very short life in captivity due to high mortality. Once people came to terms with understanding the *microbiological processes* happening in their marine ecosystem marine aquarium keeping became much more mainstream as marine life survival rates became much higher.

The nitrogen cycle is initiated by biological waste products of your marine life (i.e. excretion) and decaying organic matter:

1. Waste is excreted from marine life in the form of protein, which is quickly mineralised into ammonia/ammonium (NH3 or NH4); ammonia also comes from the breakdown of food particles and decaying organisms. This ammonia is highly toxic to marine life and will also lower the pH of your tank if present in high enough quantities. In oceans - which are huge, the buffering capacity of the water is so great ammonia cannot get a chance to build up, but in an aquarium (a small closed system) this is much more of a problem. Ammonia burns gills of marine fish.

2. But, luckily nature has a solution for us in the form of a marine bacterium (*Nitrosomonas*) who use this substance as their energy source and aerobically convert it to nitrite (NO2). Nitrite is less toxic than ammonia but still nasty.

3. Yet another bacterium (*Nitrobacter*) then comes along and converts nitrite to nitrate (NO3). Nitrate is again less toxic than nitrite and readily absorbed by plants that use it for growth, this build up of nitrates is a common cause for excessive algal growth. Then to complete the cycle the plants decay or are eaten by fish and the whole cycle begins again.

Nitrate is also harmful to marine life in high concentrations; as little as 20ppm will harm corals (however corals require *trace* levels of nitrate to grow well) and fish will become uncomfortable when levels reach 50ppm. **It is these 2 types of bacteria that make up our biological filters by growing on live rock, sponges or other types of filter media.**
4. Remember, the final phase of the nitrogen cycle is called **denitrification** this is an anaerobic (oxygen free) reaction whereby anaerobic bacteria covert the nitrate into harmless nitrogen gas that bubble to the surface of the water and enters the atmosphere completing the nitrogen cycle.

**Getting rid of nitrates**

Another way to get rid of climbing levels of nitrates other than by using live rock (which is the easiest way) is by doing regular partial water changes (I recommend 10% per week), growing marine plants which use nitrate for growth or by using a denitrifying filter.

While cycling your aquarium Ammonia and Nitrite levels tend to peak and then drop to undetectable levels as they are converted to the next compound in the pathway, but unless the nitrate is removed manually or you have enough live rock to cope with this it will soon build up to harmful levels.

Now you can see how the nitrogen cycle plays a crucial role in the marine aquarium and is the cause of one of the major disasters that can befall a new aquarium; when it is not cycled correctly and the marine life dies because of the water toxicity.
Nurturing Your Beneficial Bacteria

Having a correctly functioning nitrogen cycle in your aquarium requires regular water testing and ensuring that the bacterial populations in your biological filter are not physically damaged or removed (such as any process that removes too much from the filter media) or chemically damaged (adding something to the water that will kill them off), this is critical for your tank to survive.

Biological Filtration in a Nut Shell

A biological filter in a saltwater aquarium is simply the place where bacteria are able to grow. The biological filtration system includes all surfaces within the aquarium that come into contact with the water. The movement of the water that passes over the bacteria affects the efficiency of the biological filtration system; the faster the water moves- the better. Bacteria are literally stripped from the filter surface.
Protein Skimming = Mechanical Filtration

After biological filtration the next most important aspect in maintaining the good water quality you need (especially for corals) has to be physical filtration done by protein skimmers (a.k.a. foam fractionators).

These waste products are anything organic from uneaten food to fish excrement, detritus, decaying marine organisms. As I have explained it all breaks down into the same substances by the work of microscopic bacteria.

Skimmers get rid of dissolved organic wastes in the form of protein and amino acids before they breakdown and are converted to the toxic compounds ammonia and ammonium.

What Exactly Do Protein Skimmers Do?

The protein skimming process removes undesirable dissolved nitrogenous waste at the source and greatly reduces the load on biological filtration microbes. This means fewer nitrates are being produced in the system and the water is more stable a very good thing!

Other than protein, skimmers also remove fats and fatty acids, carbohydrates and trace elements such as copper and important iodine (which will need to be topped up in reef aquariums). Contrary to popular belief skimmers do not remove plankton because they are simply too big.

So not only this removal of noxious substances, but protein skimmers also serve to oxygenate the water, reduce algae growth, increase water clarity and increase its reduction/oxidisation potential all of which are also highly beneficial for our marine life.
How Does Protein Skimming Work?

The organic waste material we don’t want likes to accumulate at the water’s surface as protein is attracted to air and away from water (hydrophobic) and protein skimmers use this phenomenon in that dissolved organic molecules are also attracted to air bubbles which they stick to and then rise to the surface of the skimmers reactor chamber to be trapped and separated from the rest of the aquarium water. This residual foam should reduce into about a cup a day of smelly brown liquid, which you most definitely will be glad has left your aquarium water!

It deserves a mention right here and now that you cannot skim an aquarium too much, protein skimmers should run constantly and if your aquarium is quite big you should have two, these things really are worth their weight in gold.

The process of protein skimming also occurs in the ocean with the natural wave action over reef environments creating sea foam that deposits proteinaceous waste on the shore.

What Skimmer Should You Get?

I strongly recommend any marine aquarium owner to purchase a good quality high capacity skimmer; the best you can afford. This is an investment in the health and well being of your marine fish and invertebrates. These wonderful devices are an absolute must for every saltwater aquarium there is nothing better that improves water quality.

Protein skimmers can be inside aquarium, hang-on back or in sump models. Hang on and in sump options are the best in my opinion. Water fed from the very surface of the saltwater aquarium is more desirable as this is where most dissolved waste will accumulate.

In sump models should be able to catch all water from the aquarium, ideally from a surface overflow box first before any other water processing takes place (such as
mechanical filtration) to be most effective. They should sit in a contained area with a constant water level (reduces stress on skimmer parts) in a sump within a sump so to speak; this keeps the unskimmed water from flowing to other areas of the sump allowing the most effective water filtration route possible.

So, What Makes a Good Skimmer?

The flow rate/turnover of the skimmer pump (gallons per hour) should be around 5 times the tank volume as a general rule; we want a high volume of water processed.

Also the finer the bubbles produced the better, as efficiency is all about surface area and small bubbles have more surface area in the reaction chamber than big ones (because there are much more of them!) so more waste is removed.

A longer contact time between water and bubbles increases efficiency as well, so a larger skimmer works better than a smaller item. We also want a lot of consistently small bubbles with the right water to air ratio for maximum water removal efficiency.

When you first set up a skimmer you may need to tweak the air/water volumes to produce the best efficiency possible for your system, do this by keeping one constant and adjusting the other, you will be able to tell this by the appearance of your skimmate which should be dark brown; aim for a cup per day.

Different Types of Protein Skimmers:

Here is a brief explanation on some of the different types of protein skimmers just so you can understand the main differences between them.
Counter-current and co-current skimmers

Counter-current skimmers are more efficient than co-current (water and bubbles flowing in the same direction: the earliest skimmer models) skimmers because with counter-current models there is a longer reaction time between bubbles and water because the water has to flow down through the upward stream of bubbles then back up, which means more waste is removed because of increased contact or “dwell” time.

The earliest and most simple skimmer types; co-current, air driven skimmers also use lime wood air diffusers (which decay and block up with time so need to be replaced) to produce bubbles.

Venturi-style skimmers

Years later an inventor by the name of Mazzei developed a “Mazzei Valve”. All skimmers that use the Mazzei Valve are called Venturi-Style Skimmers. They use air-injection created within the valve, so the Venturi valve was invented to draw in air from the output side of the water pump then injects both the water and air as a high pressure whooshing, foaming mass into the reaction chamber which also increases air-water contact time, efficiency and output. This model type does away the need for an airstone or air diffuser and gives better efficiency for less cost as co-current air driven, however there are quite a few ineffective models on the market to beware of.

Needle Wheel Skimmers

An alternative to the Venturi design is the aspirating skimmer, which pulls in air and water together from the water pump intake side then “chops” it up using an impellor such as the “needle wheel” design to create much finer bubbles to be injected into the reaction chamber, again increasing efficiency and contact time. These types of protein skimmers are typically very efficient, consistent performers and take up relatively little space compared to the other types, the best models are not cheap but
require little maintenance and perform fantastically, especially the “needle-wheel” models.

**ETS’s & Down-Draft Skimming**

Another relatively new protein skimmer innovation is the **downdraft skimmer** or **ETS** (environmental tower skimmer). This type of skimmer uses a long tube that connects to the sump down which water is forced by a large pump down over bio-balls which diffuse the water violently and turn it into a foam where it enters the sump and is collected after a long dwell time. By the time the water makes the journey from the top of the tube to the bottom, the water has become a sea of foam. A collection cup is placed at the top of the tube, and the protein-rich froth that was created rises up and “deposits” the junk stripped out of the water. These skimmers are big, expensive to purchase and operate and are especially good for larger aquariums since they can process large volumes of water.

**Cone Skimmers**

One of the newest protein skimmer forms to emerge is the cone skimmer; this conical body shape allows for a more effective accumulation of protein-rich foam with reduced turbulence and massive efficiency benefits.
Protein Skimmer Summary

A protein skimmer is a very valuable addition to your marine aquarium; buy the best you can afford and clean it out regularly (the reaction chamber neck, collection vessel and air injecting unit especially). A high efficiency, large capacity skimmer that is easy to clean and adjust is a good skimmer. The best protein skimmers are reliable and require little maintenance and adjustment they should serve your marine life well for years to come.

Beneficial Micro-Organisms in Rocks and Sand

Basically for you to recreate a small slice of the ocean in your home, you need a myriad of micro-organisms that are a crucial to the ocean eco-system. This is the reason why early saltwater aquariums (like in the 70’s dude!) ended up having all the marine life dying; especially corals, which people began to think could simply not survive in captivity.

And right there is where live rock and live sand come in, you see live rock is taken from rubble zones of ocean reefs it is very porous and in these pores live micro-
organisms and tiny invertebrates that break down the waste products created by the
nitrogen-cycle in the ocean. So essentially to breakdown the waste products (from
excretion) in your aquarium it only makes sense that you require the assistance of
such organisms. So live rock and sand is fundamentally the biological filtration agent
of the oceans.

Before you go hurling chunks of live rock and handfuls of sand into your aquarium,
this stuff needs to be cured before it comes into contact with your marine life or else
the early stage decomposition that it will undergo can harm your marine life and
throw out your water quality by adding ammonia and debris. Curing initiates the
nitrogen cycle and takes about 5 weeks to do it properly, you want to initiate the
nitrogen cycle so the micro-organisms break down the waste products of your
marine life which if left unchecked will build up to toxic levels. During this curing
process you will want to change the water about once a week, replacing 25% at a
time. A good rule of thumb is to use 1.5 pounds of rock for every gallon of water.
Remember to check with the seller of the live rock to see whether the curing
has already been done, if you have to do it yourself it may seem like a lot of effort
but it is well worth it. Your marine aquarium will be a much more healthy and efficient
eco-system with a lot less toxic nitrates in the water. Also now you know how to cure
live rock, if you live in a tropical beach environment you can go and harvest your own
live rock from reef rubble zones and save a ton of money!

Setting Up a Live Base For Bacteria

All saltwater aquariums need beneficial micro-organisms to remain a healthy
environment. Most people will build the foundation of their aquarium by lining the
bottom of the tank with a calcium-rich, aragonite marine substrate. This is basically
the little stones you see on the bottom of fish tanks.

The substrate, once seeded will eventually be loaded with beneficial bacteria that
reduces the cycling time of your aquarium, and helps maintain the ideal water
chemistry and pH levels. It basically provides additional surface area for the bacteria
to adhere to; approximately 20,000 square inches per cubic inch, which serves your biological filtration system.

On top of the substrate, you can add two or three inches of live sand (this is the seeding). As I have said live sand also provides beneficial bacteria and micro-organisms and it has been harvested from the sea bed. Live sand may play a very important role in denitrification (removal of waste nitrate from your aquarium) if it is in a deep enough layer (probably more than 6 inches deep) so that no oxygen gets to the base few inches.

Aragonite substrate, if you do want substrate use this and live sand!

On top of this foundation layer, you can add your live rock. As we know the rocks hold many beneficial bacteria, micro-organisms, interesting hitchhikers and encrusting animals and plants. Remember it also serves to give your smaller fish and aquarium life a place to hide, which the need to be optimally happy. Live rock massively increases biological filtration within the tank, and simply looks appealing and creates a more natural environment for your marine life. There is no downside, except the cost!
Live rock actually comes in many different varieties, shapes, and colors. The amount of live rock to be an efficient filter in your tank should be around 1.5 pounds of rock per gallon of water in your tank.

Compatibility in Your Saltwater Aquarium

If you are to be successful at keeping marine life in your saltwater aquarium you will need to understand the concept of species compatibility. I introduced the concept of compatibility in book 1, but it is so important I will now go into it in more detail here.

This is one of the major areas that newbies to the hobby fail to address adequately and so cause massive stress, injury and even death to your marine life.

There are a whole lot of different species in the tropical reef environment and all of them play different roles in their ecosystem from predators to prey, herbivores to carnivores. Not only this, species must be able to compete with other species for food and space.

We want a harmonious marine aquarium and therefore we must carefully match our chosen species together to ensure that the tank environment remains peaceful in regards to territoriality and aggression.

Invertebrates are much simpler than fish when it comes to compatibility the only real rule is to keep stony (especially LPS corals) and soft corals far enough away from each other so as not to start a stinging tentacle war when they encroach on each others space this can be very savage and even fatal. Because most invertebrates don’t move around very much they usually get along fine with other invertebrates unless one preys on another in nature. The real trick with them is to match them well to reef-safe species of fish and other motile (moving) invertebrates such as crabs.
To a certain extent a particular marine fish species eating habits can dictate its behaviour, but there is much more to compatibility than this. The only way to anticipate how one species will react to another is to research it thoroughly and there are many good resources around. As we have seen like species can go with like (for example algae eating species), but often times you cannot add more than one or two of the same species as territorial instincts come into play which will result in fighting. A good way to avoid this type of behaviour is to have enough space for fish to get away from each other and a few different areas fish can use as their home base.

There are 2 golden rules of marine fish compatibility:

- A small fish that can fit into a larger fishes mouth may end up being an expensive treat!
- The less related and similar looking (size, shape, colouring, pattern, even diet) fish are the more likely that they will get along well.

Common Incompatibility Causes:

Compatibility issues usually fall into the following categories:

1. **The predator-prey relationship**: Basically you will need to ensure if you keep any large, carnivorous predator species for example Groupers, Lionfish, that you do not also have small potential prey species that it may eat in its natural environment especially if it fits in the carnivores mouth. Keep it with other like aggressive species, larger species or don’t get one at all. Watch your motile (moving) invertebrates too!

2. **Opportunity feeders**: these are species that will snack on anything if given the chance like Triggerfish, so it is not advisable to keep them with invertebrates or other small species. Also there are quite a few types of fish that enjoy the occasional coral polyp snack that should be avoided in a reef set-up.
Triggerfish commonly can "taste" a chunk of other fish and even you!

3. **Fish protecting their mates:** When you have a mating pair and you introduce another individual of the same species there will often be aggression from the same sexed fish of the pair towards the newcomer. Avoid this scenario as often they can fight to the death.

4. **Fish protecting their young:** This one is also rather obvious, fish that are spawning will be very protective of their young; warding off all fish around their nesting area. This aggressive behaviour can be countered with housing for the nesting species and plenty of space.

5. **Territorial behaviour:** This is the *most common* form of incompatibility a marine aquarist will have to face. When you put a few different fish into a new aquarium at once this is **optimal** because fish (all being new) will have not already established a territory or home range. **The problem lies in when you add a new aquarium inhabitant into an established aquarium community;** it may well end up being harassed regardless of what species it is by the more territorial of its tank mates which essentially have a natural instinct to protect their territory that they have already established. Damselfish are well known for their territoriality. The best thing you can do is swap water over and put the fish side by side as I have already mentioned in book 1.
Territorial behaviour is made worse if the new addition is a member of an existing species (or close relation) in your aquarium. This behaviour decreases the less similar the new marine fish is to existing sizes, shapes and colours of fish already in your aquarium!

The general rule here is to only have one example of the same species in your aquarium if you want more its best to introduce them at the same time so they do not get victimised by the more established of their species. You could also try getting the opposite sex fish and have a pair, which works for lots of fish species.

**Dealing With Territorial Behaviour:**

There are a few ways territorial behaviour (the most common reason for bullying) can be remedied and you can save that fish being harassed but you will need to get adventurous:

1. You can place the new addition inside a physical barrier (such as transparent plastic with holes) placed in the aquarium for a couple of weeks and remove this after all fish concerned have gotten used to each other.

2. As I said above you can even do this using separate tanks placed close to each other for the quarantine period of 2 weeks, mixing a good 500ml of each other’s water in every few days so they can get used to the “smell” of all concerned.

3. Another option is to remove all established fish from the aquarium then rearrange all the aquascaping before placing them back in with your new addition at the same time, I have seen good success with this method.

As you can see compatibility can be a huge issue but if you do your homework correctly it shouldn’t be a problem, but there are always exceptions. If worst comes
to worst you can always try asking your fish supplier if you can return your incompatible fish and swap it for a more compatible fish.

Please understand that all marine fish are very different and it is outside the scope of this ebook to be able to recommend which of the hundreds of fish species can go with which, you will need to do your own specific research, either online or with a marine species compatibility book (one with tables is helpful!).

Dont put a Moray Eel in with tiny fish!
**16 Popular Saltwater Aquarium Species Fact Sheets**

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Percula Clownfish</th>
<th>Golden Seahorse</th>
<th>Lionfish</th>
<th>Blue Tang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name:</td>
<td>Amphiprion percula</td>
<td>Hippocampus Kuda</td>
<td>Pterois volitans</td>
<td>Paracanthurus hepatus</td>
</tr>
<tr>
<td>Photo:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet:</td>
<td>flakes, pellets, some live meat</td>
<td>Trained to eat frozen Mysis (and other shrimp varieties)</td>
<td>Live meat, smaller fish, shrimp, crabs.</td>
<td>Herbivore</td>
</tr>
<tr>
<td>Feeding Frequency:</td>
<td>Daily</td>
<td>Two or three times daily.</td>
<td>At least once per day; can also feed smaller amounts more frequently.</td>
<td>Three times per week</td>
</tr>
<tr>
<td>Size &amp; Markings:</td>
<td>Clownfish are typically orange in color, with white stripes and black markings and adults may grow to be about 4 inches in length.</td>
<td>About 12 inches long, golden in color.</td>
<td>14 inches long, has venomous spine. Stripes help them blend into surroundings.</td>
<td>Up to 12” in aquarium, blue with black and yellow markings.</td>
</tr>
<tr>
<td>Compatibility:</td>
<td>Tank raised clownfish, raised without anemones, are not as aggressive. Can be housed with other clownfish or other fish species without difficulty.</td>
<td>Seahorses can be housed with non-aggressive fish and corals that don't require intense lighting.</td>
<td>Lionfish are extremely lethal and will attack and eat just about anything they can fit in their mouths— Compatible with reef and most non-aggressive fish. May become aggressive to other blue tangs.</td>
<td></td>
</tr>
<tr>
<td>Activity:</td>
<td>Associate people with food; and actually appear happy to see you</td>
<td>Quite sedentary!</td>
<td>Hide in caves during the day, hunt at night.</td>
<td>Likes to hide at times, enjoys having space to swim around.</td>
</tr>
<tr>
<td>Geographic Origin:</td>
<td>Pacific and Indo Pacific Regions</td>
<td>Tropical Indo-Pacific or Caribbean.</td>
<td>Pacific Ocean</td>
<td>Fiji, Indo-Pacific, Solomon Islands</td>
</tr>
<tr>
<td>Common Name:</td>
<td>Spotted Cardinal Fish</td>
<td>Neon Blue Goby</td>
<td>BiColor Angelfish</td>
<td>Yellowtail Damselfish</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Scientific Name:</td>
<td>Sphaeramia nematoptera</td>
<td>Elacatinus oceanops</td>
<td>Centropyge bicolor</td>
<td>Chrysiptera parasema</td>
</tr>
<tr>
<td>Photo:</td>
<td><img src="image1" alt="Spotted Cardinal Fish" /></td>
<td><img src="image2" alt="Neon Blue Goby" /></td>
<td><img src="image3" alt="BiColor Angelfish" /></td>
<td><img src="image4" alt="Yellowtail Damselfish" /></td>
</tr>
<tr>
<td>Diet:</td>
<td>Carnivore, well balanced diet of meaty foods such as feeder shrimp, flake foods, pellet foods, marine flesh, bloodworms, and depending on its size, live feeder fish.</td>
<td>Carnivore, live and frozen brine shrimp, frozen mysis shrimp, table shrimp, and frozen food preparations for carnivores</td>
<td>Omnivore. <em>Spirulina</em>, marine algae, high-quality angelfish preparations, and mysis or frozen shrimp.</td>
<td>Omnivore. Will ignore invertebrates in the aquarium and feed on zooplankton and algae. Meaty items such as mysis shrimp and vitamin-enriched shrimp</td>
</tr>
<tr>
<td>Feeding Frequency:</td>
<td>Daily</td>
<td>Daily</td>
<td>Daily</td>
<td>Daily</td>
</tr>
<tr>
<td>Size &amp; Markings:</td>
<td>Up to 3”. Greenish-yellow face. Midsection is silver with bold black scalar margins and the posterior section of the body is silver with orange polka-dots.</td>
<td>Up to 2” in length. Dark blue with a striking horizontal light-blue stripe on each side beginning above the eyes and running the entire length of the body.</td>
<td>Up to 4.5” in length. Has yellow on the anterior half of its body and a deep blue on the posterior half.</td>
<td>Up to 3”. Brightly blue colored with a yellow tail.</td>
</tr>
<tr>
<td>Compatibility:</td>
<td>In a group, they develop a hierarchy without aggression. Lives peacefully with most other peaceful fish.</td>
<td>Great in reef tanks; will fight its own species unless they are a mated pair.</td>
<td>The fish are semi-aggressive. Are not good with reef as they nip at it.</td>
<td>Semi-aggressive.</td>
</tr>
<tr>
<td>Activity:</td>
<td>Swims around very slowly, in a methodical manner.</td>
<td>Hardy fish that helps control diseases; will spawn in the tank and leave eggs in corners and crevices.</td>
<td>Very difficult to breed in an aquarium. Needs places to hide.</td>
<td>Likes many hiding places and peaceful tank mates.</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------</td>
<td>----------------------------------</td>
<td>-------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Common Name:</td>
<td><strong>Bicolor Pseudochromis</strong></td>
<td><strong>Black &amp; White Butterfly Fish</strong></td>
<td><strong>Orbiculate Batfish</strong></td>
<td><strong>Green Mandarin</strong></td>
</tr>
<tr>
<td>Scientific Name:</td>
<td>Pseudochromis paccagnella</td>
<td>Heniochus acuminatus</td>
<td>Platax orbicularis</td>
<td>Synchiropus splendidus</td>
</tr>
<tr>
<td>Photo:</td>
<td><img src="link" alt="Bicolor Pseudochromis" /></td>
<td><img src="link" alt="Black &amp; White Butterfly Fish" /></td>
<td><img src="link" alt="Orbiculate Batfish" /></td>
<td><img src="link" alt="Green Mandarin" /></td>
</tr>
<tr>
<td>Diet:</td>
<td>Carnivore. Meaty foods including brine shrimp and prepared frozen foods.</td>
<td>Omnivore. Small meaty foods and herbivore preparations</td>
<td>Omnivore. Shrimp, scallops, vitamin-enriched brine shrimp, and frozen herbivore preparations</td>
<td>Small crustaceans</td>
</tr>
<tr>
<td>Size &amp; Markings:</td>
<td>Up to 3&quot;, has bright yellow and bright purple colors.</td>
<td>Up to 10&quot; Has elongated white dorsal filament. Base color is white with two wide black stripes. The soft dorsal and caudal fins are yellow, and there are black marks above the eyes.</td>
<td>Up to 22&quot;. Round body of reddish brown and large round fins.</td>
<td>Up to 5&quot;. A maze of blue and orange over a green background fish. Vivid yellow spots over head.</td>
</tr>
<tr>
<td>Compatibility:</td>
<td>Not intimated by other fish, will defend territory. Semi-aggressive. Reef compatible.</td>
<td>Can live with other peaceful fish or with own species if introduced at same time.</td>
<td>Not compatible with reef. Can live with most other peaceful fish.</td>
<td>Compatible with reef and most other fish except for conspecifics</td>
</tr>
<tr>
<td>Activity:</td>
<td>Good hunters and agile swimmers.</td>
<td>Prefers swimming in areas of live rock.</td>
<td>Swims often, needs large area to swim in.</td>
<td>Will often spawn successfully in an aquarium.</td>
</tr>
<tr>
<td>Geographic Origin:</td>
<td>Indo-Pacific</td>
<td>Fiji, Hawaii, South Asia, Tahiti</td>
<td>Indo-Pacific, South Asia, Tahiti</td>
<td>Indo-Pacific</td>
</tr>
<tr>
<td>Common Name:</td>
<td>Clown Goby Yellow</td>
<td>Sand Sifting Sea Star</td>
<td>Bartlett’s Anthias</td>
<td>Arothron Dog-Face Puffer</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Scientific Name:</td>
<td>Gobiodon okinawae</td>
<td>Astropecten polycanthus</td>
<td>Psuedoanthias bartlettorum</td>
<td>Arothron nigropunctatus</td>
</tr>
<tr>
<td>Photo:</td>
<td><img src="image1.jpg" alt="Clown Goby Yellow" /></td>
<td><img src="image2.jpg" alt="Sand Sifting Sea Star" /></td>
<td><img src="image3.jpg" alt="Bartlett’s Anthias" /></td>
<td><img src="image4.jpg" alt="Arothron Dog-Face Puffer" /></td>
</tr>
<tr>
<td>Diet:</td>
<td>Carnivore- brine shrimp, frozen mysis shrimp, table shrimp, and frozen food preparations for carnivores.</td>
<td>Omnivore. can be fed small pieces of shrimp, fish, urchins, bivalves, or other small starfish.</td>
<td>Zooplankton feeders. Mysis shrimp, vitamin-enriched brine shrimp, frozen preparations and other meaty items for zooplankton feeders.</td>
<td>Carnivore- meaty foods including; squid, krill, clams, and hard shelled shrimp.</td>
</tr>
<tr>
<td>Feeding Frequency:</td>
<td>Daily</td>
<td>Daily</td>
<td>Several times daily.</td>
<td>Daily</td>
</tr>
<tr>
<td>Size &amp; Markings:</td>
<td>Up to 1.5”. Bright yellow in color.</td>
<td>Up to 1” in an aquarium. Beige to brown body with lateral spines (teeth) extending upward along each side of its five arms</td>
<td>Up to 3.5”. males have a more intense coloration with violet body and yellow on back..Females lavender with yellow back and caudal fin.</td>
<td>Up to 13”. Changes appearance during different stages of life. Face resembles a dog.</td>
</tr>
<tr>
<td>Compatibility:</td>
<td>Rarely aggressive towards other fish, but will fight with its own kind in small tanks.</td>
<td>Compatible with reef. Not compatible with puffers. Needs several inches of sand.</td>
<td>Compatible with some fish- is semi-aggressive. Best in tank of own species.</td>
<td>Can tolerate other puffers if they are less aggressive than itself.</td>
</tr>
</tbody>
</table>
It used to be extremely difficult to raise the more delicate invertebrates and corals in an aquarium. With advancements in the marine hobby though; primarily improved nutrition, it is now much easier to keep invertebrates and corals healthy in your aquarium.

In the ocean, most corals and sessile invertebrates photosynthesise but also eat plankton as a major source of nutrition (usually at night). There are numerous varieties of plankton, but when trying to create an ocean-like environment within your aquarium for corals and invertebrates, you'll want to be sure to include phytoplankton and/or zooplankton as they are the most important species for corals and invertebrates. Different corals feed on different types of plankton/copepods/amphipods.

Invertebrates as you probably know are animals without backbones. The animal kingdom overall is divided into 34 phyla, and 33 of them include invertebrates. The majority of marine invertebrates are classified in one of the following groups based on their characteristics:

- Porifera (Sponges)
- Cnidaria (Corals and Anemones)
- Platyhelminthes (Flatworms)
- Nematoda (Worms)
- Annelida (segmented worms)
- Mollusca (Molluscs)
- Arthropoda (Arthropods)
- Echinodermata (spiny skins e.g. sea urchins)

Invertebrates are classified based on having one of three different types of body symmetry. They may be asymmetrical, have radial symmetry, or bilateral symmetry. They also can have one of three different types of body cavities in which the organs
reside, including acoelom (no cavity), psuedocoelom (false cavity) or coelom (fluid filled body cavity). Many invertebrates are found within the ocean and are most likely the first animals on earth. In fact, they are the ancestors of the world’s current animals.

Invertebrates mostly have simple body plans and are able to obtain their food and oxygen directly from the environment.

Some of the most simple marine invertebrates (zooplankton) are food for our captive marine invertebrates.

**Phytoplankton**

These are plant-based organisms such as free floating plants and algae and are extremely tiny, this is the preferred food by filter-feeding invertebrates and corals that have feathery like appendages or gills such as soft corals, zooanthids and gorgonians. Phytoplankton can be purchased both in liquid and powder forms, a variety of types are best for the nutrition of your invertebrates. Some marine organisms absolutely require it for growth, including:

- Feather duster worms
- Scallops
- Clams
- Gorgonians with small polyps
Phytoplankton, very easy to feed your marine pets.

Zooplankton

As the name suggests, zooplankton represents the animal portion of the plankton species, these organisms can propel themselves through the water, there is great variation in the size of organisms in this group but they are much larger than phytoplankton and are eaten by invertebrates and corals with larger polyps (that don’t resemble feathers), including:

- Soft Corals
- Zooanthids
- Mushroom corals
- SPS (small polyped stony) corals
- LPS (large polyped stony) corals
- Large polyped gorgonians
- Anemones
- Shrimp
- Crab
- Lobsters

Zooplankton is available in both liquid and frozen forms, some liquid forms are complete zooplankton diets for zooplankton eaters. Frozen forms are finely chopped
Mussels, Mysis Shrimp, Baby Brine Shrimp, Daphnia, Brine Shrimp, and Ocean Plankton.

**Feeding Plankton in your Aquarium**

When feeding invertebrates and corals plankton within your aquarium, you'll want to turn your protein skimmer off first and remove mechanical filtration that might trap the food. You should attempt to mimic the natural plankton cycle as much as possible, and **feed phytoplankton during daylight and zooplankton at night.**

![Mixed plankton, yummy for your corals!](image)

You can **target feed** specific invertebrates in your tank using a turkey baster, or proper coral feeder filled with a solution of their food. Squirt a small amount of the basters' content onto the invertebrate then **give them a minute** to catch all the particles before repeating.

There are dosing systems that allow you to use prepared food that offers a way to avoid overfeeding and keep your protein skimmer running. It's important that the feeder prevents the exchange of water from the aquarium into the feeder.
You need to remember it is difficult to generalize the food requirements for specific groups (LPS, SPS or soft) of corals as there are always a few species in each group, which have a more selective and specific diet.

Mysis Shrimp, Brine Shrimp, Copepods and Amphipods (collectively known as ‘pods to the home aquarist!) will also be devoured by many corals. Copepods and Amphipods are actually quite easy to purchase or cultivate in refugiums. You can raise your own Brine Shrimp as Brine Shrimp eggs can be cheaply hatched and raised in a simple DIY Brine Shrimp Hatchery.

Caring For Corals

Keeping corals in your saltwater aquarium can be a very rewarding experience. Corals really do add an extra dimension to the marine aquarium, making it look a lot more like a genuine slice of the ocean reef and add authenticity and colour to your tank.

Some corals are very difficult to keep because of their requirements (for example most SPS corals) and some are pretty easy (like most soft corals), so once again my advice is to do your research and find one that suits your experience level, current marine pets and existing aquarium set-up (i.e. in regards to lighting, water movement, space etc).

When researching corals it can sometimes be challenging to find enough information on the species you are interested in, so here’s a helpful tip; researching the corals’ family name can yield quite a few clues on caring for the particular species you are interested in.
Purchasing Corals

You also need to be aware that corals are pretty delicate and can be expensive to purchase (which apart from ocean conservation reasons is why you should learn to propagate your own) especially if they are wild harvested. These days most corals are propagated in saltwater aquariums and are grown from frags, the advantage of growing corals from frags is that because they have been cultured in a saltwater tank they are likely to be more hardy and less stressed in your tank.

Beginners, take heart it may seem like a massive expense to get your aquarium set up with corals, but remember when they are established you can easily recoup your costs by “fragging” your corals and swapping or even selling them to other enthusiasts or pet stores.
Now, Let’s Get to The Guts of Coral Keeping:

1. **Water Parameters**: These need to be optimal to ensure the health of your corals, so basically this means levels like this:
   - ✓ Specific gravity at 1.023 - 1.025
   - ✓ Temperature in the range of 76 - 82 °F
   - ✓ Alkalinity about 2.1 to 2.5 meq/L
   - ✓ Calcium 400 - 450 ppm
   - ✓ Magnesium 1200 - 1400 ppm
   - ✓ Ammonia, nitrite, nitrate and phosphate at 0 ppm

Keeping corals in such a pristine environment usually means you will need to carry out more regular partial water changes than you would if you have a fish only set up, **my recommendation is still changing 10% per week or 20% per fortnight**.

Also if you are planning on keeping a lot of corals you probably will need to add a **calcium supplement** to the water for the corals growth requirements and possibly a growth supplement that contains the trace elements they need for strong growth such as **strontium, iron, magnesium** and **iodine**. Although good quality salt mixtures should contain these trace elements and it is **preferable to use these** because many supplements contain unwanted additives like phosphates which will do more harm than good in your water. I recommend using a good salt mixture and doing away with “magic reef additives in a bottle”.

Look for a salt mixture with the trace elements you need for your reef.

2. **Lighting:** As I’m sure you know by now the majority of corals have symbiotic zooanthellae living in their tissues providing photosynthetic energy. This group of corals are called **hermatypic** and require a decent amount of light to thrive. Corals without zooanthellae (**ahermatypic**) require a lot less light and a lot more feeding (these species are more uncommon in saltwater aquariums).

So in conclusion your light set up is dictated by what corals you want to keep, for example **stony corals**, **zoanthids** and **Corallimorphs** need **high intensity** lighting (usually metal halide or T5-HO) and most soft corals including the beloved mushroom corals do fine with **lower lighting** as we have discussed in book 2.

Remember that to set up for your corals the lighting component will be the most expensive part (purchasing lights and ongoing power costs) so do your research well.

3. **Water flow:** This needs to be high for coral, the reason for this is that the current:
   - Brings corals their plankton food
   - Washes away any mucus produced as the corals way of protecting themselves
• Rinses away any sediment and detritus that can eventually cause infection (if not removed).

So corals should always be placed in areas of high water flow in your aquarium, if the water flow is not sufficient they could easily die. **High turnover is required; usually 20-30 time per hour** will be fine as a flow rate. Get creative with your powerheads; you want overall turbulence instead of uni directional flow having powerheads in opposite corners facing each other is an easy way to achieve this.

4. **Compatibility:** One of the most important factors to take into consideration with selecting corals is how compatible they will be with the existing inhabitants of your aquarium, for example parrot fish eat coral so you wouldn’t want one of these around your corals, a fair few other fish occasionally graze on coral so research carefully.

Another factor to take into consideration when selecting 2 or more differing species of corals is aggression, when corals are **placed too close together** they can become aggressive (especially LPS corals) and **deploy tentacles with stinging cells** (nematocysts) to literally destroy the nearby rival coral, whereas **soft corals** may initiate **chemical warfare** releasing toxic metabolites into the water column. So ensure the corals are not too close together and research their compatibility with each other generally, **corals should always be placed at least 6 inches apart**.

A general rule of thumb is keeping one species or very similar species can be less of a headache. Also rival corals can release chemical compounds into the water (soft corals especially) which is another reason why regular partial water changes and chemical filtration media are important, if you have corals that do this using **activated carbon** in your sump will help to mop up any chemical warfare toxins.
5. Placement and Attachment: So, after you have done all your research, got your tank ready and purchased your new corals the next step is attaching them inside the aquarium.

Different corals prefer different areas inside the aquarium depending on light intensity and water movement, so take your species’ requirements into consideration before attaching them.

Attachment for stony corals is as easy as attaching them to rock with superglue! Take the rock out of the tank, let it dry and simply glue the frag to it, let it sit for a few minutes then replace in the tank. Soft corals can be a bit more challenging; the frags can be stuffed into holes of a rock, they can also be attached by rubber band, wedge them between rocks or even piece them and hold in place with a toothpick!
The Preferred Water Environment for Coral and Invertebrates

Corals and invertebrates have very specific and usually fussy requirements for the water they live in (coral requirements are mentioned above). The exact specifics will depend on which corals or invertebrates you are adding to your aquarium, but the majority require a water temperature between 72 and 78°F (22.2°C – 25.5°C), moderate to strong moving water, specific gravity between 1.023 and 1.025, and a pH between 8.1 and 8.4.

Corals are Sensitive to Change

One thing to keep in mind is that corals and invertebrates are extremely sensitive to changes in the water environment, so you will need to acclimate them to your aquarium very slowly, and then maintain consistency in order for them to remain healthy. Fluctuations in water temperature or water chemistry will cause stress and stress is the leading cause of death for corals and other invertebrates in captivity.

How to Choose Healthy Coral Specimens That Are Right For Your Tank

When you are visiting an aquarium retailer, there are some clear signs as to whether or not the marine life is likely to be cared for properly:

- ✓ When you look at the tanks themselves, are they clean?
- ✓ Is the water clear and do the invertebrates/corals seem to be active/brightly coloured/healthy?
- ✓ Do the corals have expanded polyps and are they free of slime?

If so, chances are the retailer is caring for the aquariums and marine life appropriately. If the water is dirty or the fish appear to be unhealthy, you will probably want to take your business someplace else to ensure you increase your chances of getting healthy specimens to take home.
If any of the following occurs to marine fish in a retailer’s aquarium store, you should look someplace else to purchase your fish because these are signs of illness, which probably means the corals aren’t much better (but it’s harder to spot poor health symptoms in corals):

✓ Fish have white, green or black spots on them
✓ Tiny worms in wounds of fish
✓ Frequent rubbing against the tank or objects in the tank
✓ Fins are torn or ripped
✓ Eyes appear to have a slimy coat over them
✓ Cotton-like fungus around fish mouth
✓ Bloated bellies
✓ Scales appear to be falling off
✓ Grey, gold or white dust on fish body
✓ Eyes protrude from head
✓ Fish seem to be gasping for air at the surface of tank

If the fish are healthy chances are the corals will be too.

In order to choose corals and invertebrates that are right for your tank, you need to know what water temperature your tank water is kept at, the specific gravity and the pH level. Make sure you bring this information with you when shopping for
new specimens, and take care to select corals and invertebrates that can survive within the current environment of your aquarium.

In addition, you will want to make sure the invertebrates and corals you select are not going to be toxic to the other fish and marine life living in your aquarium. There are a few varieties of invertebrates and corals, including “Sea Apples”, which are very colourful but extremely toxic to most fish and marine life. They are pretty but perhaps not a good idea.

Other factors to take into consideration are the fully-grown size of your invertebrates/corals (if you can find this out) and how adaptable they will be to your set-up.

**Coloration and behaviour** are also important selection criteria for marine invertebrates as well as fish; you should be aware that some fish species are only colourful at the juvenile phase and become drab when they mature (most Angelfish change their colours and patterning dramatically between juvenile and full grown). A good fish choice should have impressive colouration or exhibit interesting behaviour that is a delight to observe. Corals will not change colour like this but you do have to ensure the form and colouration will please you for the long run. Corals do not generally exhibit behaviour (like motile invertebrates), except for having expanded polyps and pulsing Xenisa pulsing!

**Questions to ask the Pet Shop about Invertebrates and Fish:**

- Is the fish/invertebrate tank reared (fragged) or gathered from the wild? Tank reared probably means less chance of disease, more hardy, more likely to take most foods, less stressed.

- If from the ocean was it sustainably gathered? Only buy sustainably gathered marine creatures, as reef and ocean conservation should be very important to any marine aquarist countries to beware of are Indonesia and the Philippines
(where 50% of our marine life comes from anyway) look for certification with conservation and/or sustainable harvest agencies.

- If from the wild, what area is the specimen from, this will help you to diagnose any potential diseases and give you more insight into the characteristics of your pet.

- Is there a guarantee on the life of the fish? It’s always better if there is. Get them to put their money where their mouth is!

- Ask to see the fish get fed (twice is best), so you can see whether they are eating or not. You can also ask to see a coral get fed.

- Is the fish juvenile or adult? This will let you know what part of the life cycle the fish is in, i.e. some fish are only colourful when juvenile so you may want to avoid those species.

Remember, it is up to you to do all the research on the species you want to ensure they will be compatible for you and your tank, don’t trust what the local fish store tells you. If you are informed before you buy you are less likely to make a decision you may regret later.

**Where Does Your Marine Life Come From and Why You Should Care?**

Now is a good time to talk about purchasing ecologically RIGHT marine life, as any good home aquarist should care about the conservation of the world’s reefs, the health of their potential purchases and know how to vote for good businesses with their wallets.

The bottom line is that we all should know where our marine life is coming from and whether or not it was collected humanely and sustainably.
The reason for this is that the collection and handling practices used on the species we buy has a real effect on their health and longevity in the home aquarium, not to mention the negative effects unsustainable collection has on our oceans coral reefs…

Most people have no idea where their marine life comes from (actually about 50% come from the Philippines or Indonesia) and may not even be aware that there are still some cowboys out there who collect marine creatures, handle and ship them in a cruel fashion to make a quick buck from the end consumer…you! **Don’t forget that up to a whopping 80% of all wild caught species die somewhere between reef and your display tank!**

**What Do Bad Collection Practices Mean For You?**

The reason you should care is because these species are often unsuitable for the home aquarium and/or they are collected unsustainably thereby depleting natural stocks and putting entire reef eco-systems at risk (which can easily collapse if enough key species are lost). But not only that, the species collected often arrive at the local fish store in such bad shape that they will die in the next few weeks, which means unsuspecting consumers lose, many of these unsuspecting consumers are first timers and give up the hobby completely because of this bad experience, which is very sad…

Did you know a whopping 98% of all marine life in the trade is collected from the wild (compared with just 30% of freshwater species) from a very stable environment in regards to physical and chemical conditions (temperature, pH, alkalinity, salinity etc). This equates to the real world statistic that up to 80% of saltwater species die before they reach their final destination: the home aquarium.
It’s a long hard road from here to your place.

Unnecessary Loss of Life From Underhanded Tactics

The reason there is so much loss of life is stress. The health of aquarium species (especially fish) is directly related to collection, handling, holding and shipping/packaging practices in the chain of distribution, from collector to fish store customer.

So what exactly are the practises that we as hobbyists need to be aware of and avoid to protect the future of our planets reefs and the health of captive marine life?

1. Sodium cyanide capture:

This is still a very large problem in the Philippines and Indonesia. Cyanide is a very toxic substance (ever hear of cyanide gas being used in wars?) that comes in tablets which are crushed into squirt bottles of seawater, divers then squirt this over coral
reefs and collect the stunned fish who are unable to swim quickly, the theory is that “most” fish can recover from this chemical. Some fish escape into the coral heads before the drug takes effect; the divers respond by smashing up the coral until they find their fish!

The poison also indiscriminately kills corals and smaller marine species and lingering toxicity will often kill captured fish weeks later and is strongly associated with "sudden death syndrome".

Treated fish can often (but not always) be spotted in your local fish store: they often have too bright colours and will seem “dazed” in the tank and unresponsive, completely in their own world. Angelfish are the fish family most often caught in this fashion. So watch for “dazed and confused” Angels in the pet store having a private party in the corner of the tank!

The Philippines are starting to enforce the ban of this nasty chemical that is also very toxic to the divers that use it (through accidental exposure and poor equipment), but a high premium for live fish, weak enforcement and widespread corruption means it has been slow to take hold. The International Marine Life Alliance (IMA) has opened cyanide detection labs across the Philippines, which randomly test fish for export. The IMA has also trained many local fishermen to use fine mesh nets on the reef instead. Both these steps have seen cyanide capture reduce in the Philippines, but its use has instead risen in Indonesia.

Sadly cyanide capture has now spread to pristine reefs from the central Pacific to East Africa.
If your Majestic Angelfish has too bright colours and appears "dazed and confused" it could well be cyanide caught.

What can you do about this?

Make sure you only purchase fish from a retailer who guarantees the fish are not captured with cyanide! Be especially suspicious of fish from Indonesia or the Philippines.

2. Collection and retail of species unsuitable for home aquariums:

Species such as Damselfish, Parrotfish, Moray Eel, Cleaner Wrasse, Seahorse, Scorpionfish, Stonefish and many others have a very poor survival rate when they are taken out of their natural environments (despite what you may be told). Also check out this link to my Saltwater Aquarium Advice blog to see what marine invertebrates and corals you shouldn’t buy.
Retailers that sell these species and encourage new tank keepers to try their hand at a species such as this not only cause grief with tank owners who lose money and time but also to the reefs themselves.

**What can you do about this?**

The truth is quite a few fish stores know that these species should not be sold to beginners or should not be sold at all, yet they still sell them, I consider this rather despicable. These stores give the industry a bad name and I encourage you to avoid them and tell others to do so as well.

3. **Bad handling, husbandry and shipping practices:**

Many marine collectors, brokers and exporters poorly handle and house the fish through lack of knowledge, funds or share laziness; this is especially true in South East Asia. It really is the rule that the more hands that handle the fish in the chain of distribution the higher the mortality rates! Every step involves a transfer of liquid environment and so a stressful acclimation process.

* A good handling procedure involves specimens being bagged separately with oxygen being used and plenty of space or systems for dilution of toxic wastes. *Shipping containers should be protective and strong as well as capable of maintaining water temperature effectively.*

Many holding tanks in the industry are too small and are overcrowded with unsuitable species put together that should be kept separate and less than optimal water quality. This all serves to create stress and as we all know stress lowers the immune system and makes the animal more susceptible to disease and death.

**What can you do about this?**
Do some research on your preferred marine life retailer, where do their fish come from? How are they handled? Do they have a certification from any marine life organization? Can they guarantee the life of the fish you purchase?

If your retailer gets their stock from sustainable sources, they will go to great pains to tell you this in my experience!

Always purchase captive raised marine life and coral frags where possible!

Where to Place Corals and Invertebrates In The Tank

Corals prefer different areas of aquariums, mostly due to the closeness to the light source and volume of water flow. Here are some examples:

- **Acropora**: mostly prefers intense lighting, so should be placed as close to your light source as possible. Also likes high flow water with a changing current.

- **Zoanthids**: are hardy and can handle a variety of different conditions within your aquarium. You can put them anywhere and they'll do fine.

- **Ricordea** Florida and many other soft corals: prefer low light conditions and low/medium water flow, but could survive in higher light if you had to put them closer to the light source.

Invertebrates typically require the **drip-method process** (next page) for acclimating them safely to their new environment, so be sure to give them adequate time to get used to the water before you place them into the tank. You can place invertebrates along the side of your aquarium, and many will stick to the glass (snails, starfish, etc). Other invertebrates can be placed at the bottom of the tank after they have been fully acclimated.
How to Correctly Acclimate Corals and Invertebrates

A good acclimation practice for both corals/invertebrates and marine fish will ensure your survival rates are much higher than without using these methods correctly. Proper acclimation is a very good way to ensure you give your new marine creatures the best possible start to their lives in captivity.

The most stressful time your pets will have to endure (other than when they were caught) is the introduction to a new aquarium. You do this right and you will save yourself a lot of money and grief.

There are two main ways to acclimate corals and invertebrates to your water; the floating method and the drip method. You never want to come home from the fish store and just dump your new purchases into the tank. The shock will cause severe trauma, illness- and may even kill them. A surprising number of people do this! These methods also apply to marine fish.

The Floating Method

1. Dim the lights in the room you’re going to be opening the shipping box in. Sudden exposure to bright lights will shock the corals and/or invertebrates.
2. Turn the lights off in the aquarium.
3. Place the sealed bag with your new purchase in the aquarium and allow it to float for fifteen minutes. Do not open the bag at this time. The water temperature will slowly adjust to the temperature that is inside the aquarium, and the bag itself will maintain a high level of dissolved oxygen.
4. After 15 minutes have passed, cut a small opening in the bag under the metal clip. Roll the edge of the bag down so that an air pocket is created within the top of the bag, and keep the bag floating on the surface of the water. If you are acclimating heavy pieces of live coral, place the bag with the coral in a plastic container.
5. Add a ½ cup of aquarium water to the shipping bag and allow it to sit for four minutes.

6. Add another ½ cup of aquarium water to the bag and wait four minutes. Repeat every four minutes until the bag is full.

7. Lift the bag from the aquarium and discard about half of the water into a bucket (never discard the water directly into the aquarium).

8. Float the bag in the aquarium again and add ½ cup of aquarium water into the bag every four minutes until full.

9. Use a net to remove the marine life and release into the tank.

10. Remove and discard shipping bag and shipping water.

The Drip Method

For more sensitive corals and invertebrates, including sea stars and shrimp the drip method should be used to acclimate the animals into the aquarium. You’ll need a three or five gallon bucket that is used only for aquarium use; and if you are acclimating fish at the same time as corals, use separate buckets for each.

1. Start with the first 3 steps of the floating method to acclimate the water temperature within the shipping bag.

2. Slowly pour the contents of the shipping bag into the bucket, but make sure that invertebrates are not exposed to the air. You may have to tilt the bucket on its side to make sure the animals remain fully submerged.

3. Use airline tubing to set up a drip line from the aquarium into the bucket. You can tie a few loose knots in the airline tubing to regulate the flow of water; or use a non-metal airline control valve.

4. Suck on the end of the airline tubing that will be in the bucket with your new purchase to begin a siphon. When water flows out through the tubing adjust the drip with a knot or control valve. You want the water to come out at a rate of about 2 to 4 drops per second.
5. When the water volume in the bucket doubles, get rid of half of the water and begin the drip process again until the water volume doubles one more time. It will take about one hour.

6. At this stage, you can place the specimens into the aquarium. Again, make sure they remain fully submerged in water. You can move the entire bag from the bucket to the aquarium, place the bag fully underwater and release the specimens before removing the shipping bag from the aquarium.

You can buy really good drip acclimation sets like this one.

If in doubt always use the drip method. An excellent acclimation procedure like this will ensure your marine life is stressed as little as possible. Don’t forget to quarantine all new arrivals for 2 weeks before putting them into your display tank! This way no disease or parasite should ever make it into your display tank.

Common Coral Problems and Solutions

Corals can be quite challenging to keep at times, sometimes things go wrong and you have no idea why.

Often non-moving invertebrates do not display obvious symptoms like fish do (luckily!) which are specific to a particular problem. This lack of an obvious link between symptom and cause can make correcting the problem difficult. When things go wrong many just retract their polyps, wilt and gradually turn to slime.
Its no secret that non-moving or sessile (which actually means attached to the substrate) saltwater aquarium invertebrates are notorious for being difficult to diagnose if things go wrong, this is especially true for photosynthetic anemones and corals.

**Stress is the Cause of Most Problems!**

Up to around 80% of invertebrate symptoms are simply a result of stress - usually caused by poor or fluctuating water quality or incorrect lighting, this is the case most of the time. However there are some pretty nasty coral pests, predators and diseases out there that you need to be aware of the majority of these will not often show up in an aquarium where the new corals have been *acclimated correctly and then have been quarantined for 30 days before placing them into the display tank.*

So, stress is the number one killer of corals and other invertebrates. So, what are the major forms of stress (in order of likelihood that these are affecting your invertebrate):

1. **Poor/fluctuating water quality** (most commonly temperature and pH, phosphates, nitrates induced stress).
2. **Incorrect or inappropriate lighting** (bulbs too old, too new, too close or too far away).
3. **Not enough water movement** (you can never have enough of this in my opinion).
4. **Incompatible tank mates** (caused by predation, chemical turf wars, other physical damage).
5. **Starvation** (feeding with supplements really helps sessile invertebrates out and massively reduces the likelihood of starvation).
6. **Physical damage** (caused by collection, handling, pests, parasites, predation).

*Stress causes these major symptoms in corals and other sessile invertebrates:*
1. **Tissue recession** (or degeneration).
2. **Slowing or stopping of growth**.
3. **Coral Alleopathy** (chemical warfare between invertebrates).
4. **Lack of polyp expansion** in corals, collapsing of anemones.
5. **Bleaching** of tissue in corals/photosynthetic anemones.

All these symptoms can be fully recovered from if the stressor is identified (start by testing the water quality!) then kept to a minimum. Recovery will be sped up if the affected invertebrate is well fed.

*This coral is bleaching out.*

**So to diagnose your invertebrates’ problem start by:**

- Checking your water parameters at least **4 times over a 48-hour period** to rule out incorrect chemistry and fluctuations over time.
- Then **check your lighting** in terms of bulb age and appropriate distances to marine life (check the specific coral species literature for this).
- Whether or not you have **enough water movement**.
- Are you **supplementary feeding**? This can really help your invertebrate life thrive.
- Finally **check for incompatibility** in your tank and who could be causing any physical damage (if there is any)…
Coral Bleaching

A common problem with corals is bleaching/fading; this is when there is a mass expulsion of zooanthellae (symbiotic algal cells contained in coral polyp tissues that provide food converted from sunlight for the corals in return for safe housing and nutrients) because of stress. This phenomenon is also occurring in the oceans of the world today because of temperature stress caused by global warming.

In your marine tank there is a whole lot of potential causes of this stress-related illness. The first place to start would be to check all the potential causes of stress (above) one by one and rule them out, until the cause can be established. In other words good old detective work!

As stress is the number one killer of corals (and disease symptoms are often actually caused by stress as opposed to disease causing organisms) all ailments should be worked through (not just bleaching!) in this fashion before you ring the vet or medicate.

So you will need to check these things:

1. Temperature stress (usually the most common cause often caused by fluctuations which a chiller and temperature controller can fix).

2. Physical stress; this can be damage caused by collection/handling and also predation by fishes/invertebrates.

3. Chemical stress; all water parameters need to be checked here, also think about what has been added to the water recently. The most common water parameters that cause bleaching in corals are alkalinity (pH), excessive nitrates and phosphates.
4. **Lighting stress**: perhaps the bulbs are too new or old (most common), if they have just been replaced try moving them up a few inches, if they are old they may need to be replaced due to losing intensity with age.

5. **Water movement**: poor water movement will deprive a coral of its non-photosynthetic food source (plankton) and also cause detritus that settles on the coral to stay put, this will start to decay and *possibly become a source of infection and algal growth* (a powerhead or turkey baster can remove this). Corals need high water movement to truly thrive.

6. **Parasites and predation**: this could be snails, fish, flatworms, bristleworms, coral spiders and everything else that enjoys a coral snack. Often many invertebrate parasites are active at night, so get your hands on a red light or torch to check for them while they are up to no good.

**The good news is that corals can recover over time if stress is kept to a minimum and they are well fed.**

![Image of coral]

*Generally speaking: the harder the coral, the more easily stressed it is.*
### Common Invertebrate Ailments and Diseases:

<table>
<thead>
<tr>
<th>Main sign of ailment/disease</th>
<th>Other signs</th>
<th>Species affected</th>
<th>Possible diagnosis</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mantle irritations and damage</td>
<td></td>
<td>Giant Clams</td>
<td>Parasitic snails in the family <em>Pyramidellidae</em>. Pyramid snails.</td>
<td>Addition of Neon Wrasse; feeds on snails and are colourful and harmless to other species.</td>
</tr>
<tr>
<td>Moulting problems</td>
<td>Lethargy</td>
<td>Crustaceans</td>
<td>Iodine levels are too low</td>
<td>Add commercial supplement to water</td>
</tr>
<tr>
<td>Crushed or broken parts of invertebrate</td>
<td>Death</td>
<td>All corals and other invertebrates (especially hard skeleton species)</td>
<td>Physical damage caused by mishandling (shipping or collection), or becoming dislodged from placement site (e.g. by powerhead, fish)</td>
<td>Not much can be done, except ensuring optimal health and well fed and lit. Care and common sense can reduce incidences.</td>
</tr>
<tr>
<td>Damaged soft tissue/polyps</td>
<td>Excess mucus production in corals. Small dark worms spotted.</td>
<td>Mostly corals, sometimes other soft tissue invertebrates.</td>
<td>Animal predation due to non-compatible species in tank. <em>Convolutriloba Flatworm</em> infestation (.25 of an inch long, reddish brown in colour, 3 pronged tail)</td>
<td>Observe tank to find offending animals and remove. This could include species introduced with live rock/sand. If flatworms: freshwater dip afflicted specimen or add small Butterfly fish.</td>
</tr>
<tr>
<td>Softening of exoskeleton</td>
<td>Malformed shells, fatality</td>
<td>Crustaceans, molluscs and hard corals</td>
<td>Calcium levels are too low</td>
<td>Add commercial supplement to water, also check pH is correct</td>
</tr>
<tr>
<td>Obvious increasing algal growth on coral/hard invertebrates</td>
<td>Disease</td>
<td>Corals and other hard sessile Invertebrates</td>
<td>Algal colonisation on damaged or weakened species</td>
<td>Add algae eating fish/snails. Reduce light (if not absolutely necessary for corals)</td>
</tr>
<tr>
<td>Specimen cannot right itself e.g. collapsed anemone</td>
<td>Specimen is upside down for long period</td>
<td>Echinoderms, Anemones.</td>
<td>Bubbles of air trapped within body caused by being removed from water</td>
<td>Carefully attempt to work out bubble with fingers in tank.</td>
</tr>
<tr>
<td>Sediment accumulation on coral/sessile Invertebrate. Could be sand or food detritus. (can cause bacterial infections)</td>
<td>Excess mucus production, algal growth, bacterial infection</td>
<td>All species of sessile Invertebrate</td>
<td>Damage caused by poor water flow not removing sediment, substrate sifting species.</td>
<td>Place specimen higher up in tank, remove substrate-sifting species, and manually remove sediment with powerhead/syringe.</td>
</tr>
<tr>
<td>Species appearing lethargic and generally unhealthy</td>
<td>Not feeding, death</td>
<td>All invertebrates</td>
<td>Cytotoxicity caused by copper (i.e. parasite treatment)</td>
<td>Replace all water in tank immediately, remove afflicted to quarantine</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Black region on coral underneath which tissue is being eaten. Progresses as black band over coral. Rotting area on anemones</td>
<td>All corals, except alcyonarians and fungids. Anemones</td>
<td>Anemones: bacterial infection. Coral; <strong>Black Band Disease (BBD)</strong> caused by cyanobacteria</td>
<td>Antibiotic paste painted onto specimen (e.g. neomycin sulphate), coral: 2-3 days of darkness, fragging ahead of infection</td>
<td></td>
</tr>
<tr>
<td>Soft tissue deteriation/shrinking and changing colour</td>
<td>Lack of growth</td>
<td>Corals, zooanthellae containing clams and anemones</td>
<td>Too little light or incorrect spectrum bulbs used</td>
<td>Fit bulbs with correct spectrum and wattage, move specimen closer to light source</td>
</tr>
<tr>
<td>Progressive area of obvious tissue absence; a white band moving slowly across coral</td>
<td>Tissue peeling off in small globes leaving bare skeleton</td>
<td>All corals</td>
<td><strong>White Band Disease (WBD)</strong></td>
<td>Antiseptic bath (Lugols solution) can help, fragging ahead of band followed by optimal water and lighting conditions</td>
</tr>
<tr>
<td>Coral tissues appearing white or abnormally light in colour</td>
<td>Death</td>
<td>All corals</td>
<td>Bleaching: (mass expulsion of zooanthellae) usually because of physical, chemical, lighting, salinity, diet, poor water movement stresses</td>
<td>Eliminate stress: major cause is temperature, so adjust if necessary. Check all causative stress factors. Coral can recover over time if stress is minimal and they are well fed</td>
</tr>
<tr>
<td>Rapid tissue sloughing from the base up leaving white skeleton</td>
<td>Death</td>
<td>Corals, most commonly Acroporid species and pocilloporid corals</td>
<td><strong>Rapid Tissue Necrosis (RTN)</strong> usually fatal and highly contagious resulting from non pathogenic stress</td>
<td>No treatment as death is sudden. Can be prevented by quarantining new corals after slow acclimation. Lugols dips, chloramphenicol and fragging can be effective</td>
</tr>
</tbody>
</table>

**Coral Diseases**

Surprisingly, relatively little is known about coral disease, but as I have emphasized to you stress is the number one killer of aquarium corals. In fact bleaching, infection, polyp recession and rapid tissue necrosis are all likely caused by physical stress, environmental stress and nutritional deficiency.
Pathogens may not be the cause of these ailments (they just cause the symptoms you can see). Any disease treatments should be always be undertaken in a quarantine tank so as not to spread infection or cause harm to the aquarium ecosystem with treatments.

**Coral and other invertebrate treatments**

**Chloramphenicol**: This anti-biotic agent can be harmful to humans and other marine organisms but is widely thought to be highly effective against Rapid Tissue Necrosis. 20mg/L seawater can be used in the quarantine tank with the infected coral/invertebrate submersed for 24 hours.

**Freshwater dips**: 1-3 minute dips can get rid of some parasites such as flatworms and cyanobacteria. The water should be chlorine treated (so chlorine is removed) and be the same temperature and pH as the aquarium water. Note; some corals do not like this treatment.

**Antibiotic powders, solutions and dips**: these are primarily used for bacterial infections; for example a paste applied to a coral with BBD (black band disease) is very effective. Most common antibiotics are kanamycin and neomycin sulphate because of low levels of toxicity to other aquarium inhabitants. One of the most highly regarded methods of antibiotic usage is soaking food in antibiotic and feeding directly to infected invertebrate, this is a safe method as little antibiotic will remain in the tank itself.
**Surgery**: That’s right you can easily perform surgery on your ailing invertebrates! This is done by cutting out or off infected tissue with a clean, sterile implement ensuring you remove all infected areas by cutting into healthy tissue. This method is especially good for corals and echinoderms as they regenerate relatively quickly.

**Lugols’ solution dips**: This compound is iodine in potassium iodide. It can be very effective at removing parasites and pathogenic micro-organisms especially in corals. 1 drop of solution per 20-40 gallon of aquarium water is added to the tank over affected coral. Some corals and invertebrates however have a strong reaction to this.

**Compatibility Among Coral and Invertebrates**

Just like with fish, you have to take into consideration which corals and invertebrates are compatible in the same aquarium before you start buying them. In addition to basic considerations like the water temperature, specific gravity and pH levels; certain corals cannot occupy the same tank as certain fish, and the same goes for invertebrates.
**Coral Compatibility**

Coral can mostly be kept with all types of coral in various amounts within the aquarium, but try to avoid placing different species so they are touching or too close as one may attack the other or release toxins into the water, at least 6 inches of space is required between them.

**Many fish are compatible with coral, including:**


**Fish to avoid are:**

some species of Angelfishes, Boxfish, some species of Butterflyfishes, Comb-tooth Blenny, Filefish, Parrotfish, Porcupinefish, Pufferfish, Triggerfish.

**Other Invertebrate Compatibility**

Invertebrates can also be kept in groups of any number. **They are compatible with fewer types of fish than coral** (because more fish snack on invertebrates than corals), but still a decent enough number to give your aquarium variety.

**Compatible fish with invertebrates include:**

Fish are like any other living creature, in that they are susceptible to disease and illness especially when stressed. As an aquarium owner, there are a number of things you can do to help keep your marine life healthy and free from disease.

Providing a Healthy Diet

Every species of fish has its own dietary requirements, which you should learn prior to putting a fish into your aquarium. There are no boxes of fish food available that are a one-size-fits-all approach to feeding the life in your aquarium!

It wouldn't be healthy for a human to eat the same food day after day, and fish also need a varied diet in order to get the necessary nutrition for a healthy life. Improper and incomplete diets often result in vitamin and nutrient deficiencies, which cause a weakened immune system, improper growth or even death.

A balanced diet is a must for happy, healthy and optimally colourful fish. You can even feed your fish some human food, for example giving the herbivores fresh lettuce or peas can be a cheap way of providing a healthy varied diet.

Providing all the necessary nutrients for your fish will ensure they are more content in their aquarium environment, but not only this their colouration will be more striking, they will grow bigger and live longer while being more resistant to disease and stress.

As I have mentioned before: hungry fish are grumpy fish; so providing the right foods in the right quantities (enough to keep them looking in good condition which will probably be less than you think) will reduce squabbles and bullying behaviour, which cause stress.
Dont be like some beginners and just feed flakes!

**Frozen Food Options**

Frozen food for marine life range from “meaty foods” like shrimp and squid, to vegetable portions, such as seaweed and spirulina.

Depending on the type of fish you are feeding, frozen foods can be the staple diet, or can be used to add variety and supplement the staple diet as a delicacy. Nutritional value is retained in frozen foods, as well as the natural shape and appearance of the foods which helps your fish instinctively feed on this food source.

Frozen foods can be purchased in convenient cubes and are actually as nutritionally beneficial as fresh foods and much more cost effective. Frozen foods are better fed to your marine life by thawing and breaking them up in a container of aquarium water and slowly pouring in so all is eaten. Remove juices from meaty frozen foods that have thawed as this is a major way of introducing phosphates.

**Freeze-Dried Food Options**

Freeze-dried food also retains its natural nutrition, appearance and texture of the live food, but is processed in a freeze-dried system that allows for easy feeding and
storage. You can also use freeze-dried varieties to give liquid vitamin supplements, by adding a few drops into the food as needed. Freeze-dried food is typically for a “treat” food for your fish, but in some cases may be used as part of the staple diet.

**Dried Food Options**

Dried foods are designed to make up the majority of your marine life’s staple diets. The food is flakey and softens in the water without disintegrating. When you sprinkle the food in the top of the aquarium, it makes it's way slowly down through the water - and what isn't eaten by most fish will then fall to the bottom of the tank, where other fish varieties prefer to eat.

Prepared foods such as flakes and pellets can be very nutritionally complete contrary to popular belief as well as being extremely convenient. The only issue is correct storage to ensure the food is in top condition at all times. Avoid repackaging food and buying in massive bulk, the food needs to be a quality product packaged correctly (shaker containers are good) and stored as per instructions. If food goes off or gets contaminated it can actually kill your fish, don’t take risks here.

In addition to the most common flake variety, dried food is also available in pellets and granules; with sinking or floating varieties, and even specifically formulated for carnivore fish or herbivore fish.
Freeze dried sea veggies, delicious and nutritionally complete!

**Liquid Food Options**

*For smaller fish, filter feeders, corals, and younger fish,* sometimes a liquid food source is necessary. The food is typically a liquid suspension of tiny food particles or plankton - and is **small enough that the tiniest marine life can eat it.** Liquid food varieties are extremely concentrated, which makes overfeeding a concern. It is best to use droppers or pipettes to target feed the liquid food source to the animals that need it.

**How To Provide Your Fish a Healthy Diet**

What is the best way to feed your fish and ensure they have a healthy balanced diet? One of the easiest ways to ensure your marine life is optimally healthy is to **ensure a balanced, varied diet.** So, how exactly do we go about this?

The first step is to find out whether your fish are **herbivores** (eat plants only such as Tangs), **omnivores** (plants and meat, such as Damselfish) or **carnivores** (meat only, like a Lionfish). This will teach you what sorts of foods they will eat.
When it comes to marine fish diets there are 4 main categories that aquarium species fall into:

1. **Herbivores**: This means a vegetarian diet, which in the ocean is algae and marine plants. **These fish are grazers, swimming around picking at things all day.** Aquarium Herbivores are Surgeonfish, Tangs and some types of blennies. Herbivore invertebrates are some types of Sea Urchins, crabs and hermit crabs but most of these are carnivores or omnivores. For those vegetarian species try throwing in some lettuce and dried algae (such as Kombu and sushi Nori) from the supermarket along with their commercial foods. Also growing algae in the aquarium from the live rock is an awesome easy feeding idea and gives the fish an element of their natural habitats.

![Goldrim Tang](image)

*Tangs are probably the most famous herbivores, like this Goldrim Tang.*

2. **Omnivores**: This group of marine fish eat marine plants as well as meat in the form of invertebrates, crustaceans and even coral polyps. **Omnivores are not predators so do not exhibit the characteristic predatory behaviour.** Omnivorous fish include: Angelfishes (some species feed exclusively on corals or sponges
though), Anthias, Batfishes, Boxfishes, Blennies, Butterflyfishes, (some species feed exclusively on corals or sponges) Cowfishes, Clownfish, Damsels, Dottybacks, Filefishes, Goatfishes, Hogfish, Moorish idols, Sweetlips and Wrasses. Because of the variety of food items these fish eat they are relatively easy to feed.

![Image of Harlequin Filefish]

_Tiny little hard to feed omnivore: the Harlequin Filefish._

3. **Carnivores**: These fish are exclusively meat eating **predators or scavengers**. Predators hunt or lie in wait for their food and will often eat any smaller fish that will fit in their mouth so don’t tempt them with little tank mates. Scavengers will take whatever they can get such as leftovers and detritus. Carnivorous fish that are predators (most are scavengers too) include: Anglers, Cardinals, Dottybacks, Eels, Frogfish, Grammas, Groupers, Hawkfish, Hamlets, Lionfishes, Pipefishes, Porcupines, Puffers, Seabasses, Scorpionfishes, Sharks, Snappers, Soiderfishes, Squirrelfishes and Triggerfishes. Most anemones are carnivores too.
4. Filter feeders and sand sifters: Filter feeders are invertebrates that filter out tiny plankton and food particles suspended in the water using modified feeding appendages. This includes corals, sponges, some crabs, tubeworms and tunicates. Other species are sand sifters like some Gobies, Mandarinfishes, Dragonets, Sea Cucumbers, marine worms and Starfish. These marine species displace sand on the bottom of the aquarium looking for copepods and amphipods that live in the substrate.
Where Do Your Fish Feed and Why it Matters?

The second step is to find where in the water column your fish typically feed (i.e. top, middle or bottom feeders) and other specific feeding behaviours like sand sifting and algae nibbling off rocks. This way you can cater to each type of fishes specific requirements, which will keep them happy and ensure that they get their fair share of food.

So you need to familiarize yourself with your fish’s natural diet and feeding habits:

1. Fish that are **top feeders** will need food that floats on the surface, such as flakes.

2. **Middle feeders** will need slowly sinking food like sticks and pellets, where they can catch the food as it falls through the water, these foods tend to sink and spread in middle waters.

3. **Bottom feeders** need more dense food options that sink all the way down such as tablets and wafers.

4. Finally **filter feeders** like coral and some invertebrates can get all their nutrition from liquid diets, squirted toward them.

It is also important to **feed your fish the same time everyday**; this gives them consistency in their lives; a healthy routine and can make for some quite interesting antics when they see you coming!

It is also **vitally important NOT to overfeed your fish**, a general rule of thumb is feed only what they can eat in a minute or so making sure that each different type of eater is catered to in terms of type of food and where you place the food for them.

Uneaten food will breakdown into unwanted ammonia in the water which is toxic to the rest of your marine life and puts additional stress on your filters and protein skimmers, **it is advised to remove this uneaten food yourself with a net or siphon.**
Ultimately you want no uneaten food it is far better to underfeed so go for feeding less more often. Remember that in the wild marine life would go through periods of almost no food at all.

Overfeeding is one of the key causes of crashes in biological filtration that will cause massive damage to all livestock. Overfeeding is much more harmful than underfeeding, if fish are eating less than you feed then provide less, and if they are still looking hungry provide a little bit more, be flexible and adjust your feeding quantities over time and in sync with your fish’s requirements.

**I recommend feeding your fish twice a day**, once in the morning and once at night, as I mentioned previously it is better if you stick to a schedule, your fish will be happier this way. Herbivores graze and eat little bits continuously and carnivores usually consume bigger quantities less often, so twice a day is a good middle ground for all fish types.

**Feeding the Occasional Treat**

If you want to provide your fish a special treat by feeding live food (such as brine shrimp) ensure that you rinse under freshwater to avoid parasites and disease entering your aquarium. Live foods are good for your fish but can be a massive effort and expense for you (unless you culture them yourself). Live foods also can make your marine life more aggressive as natural instincts from the wild come back into play.

A lot of aquarists claim live food is the much more healthy, natural option but the reality is your pets will still get the same nutrient injection from frozen foods of the same type. However fresh foods can be a good option for new or very fussy marine fish.
Ensure a Varied Diet

The final diet related tip for a happy healthy fish is a varied diet, like us fish have basic nutritional requirements that need to be met for optimal condition, such as protein, carbohydrates, vitamins and minerals. So try to mix up food types: frozen, dried, fresh, live to give your marine life a balanced diet (as mentioned above). For example feed herbivores occasional lettuce leaves and peas along with spirulina and seaweed flakes. Carnivores enjoy live, fresh and dried foods, such as bloodworms, brine shrimp and even store bought marinara mix!

In general a diverse diet results in healthy, lively, stress and disease resistant fish. The correct healthy feeding regimen is the easiest way to ensure optimal health.

"Feed me different foods" says the Threadfin Butterflyfish!

Infectious Marine Fish Diseases

There are some diseases and illnesses that marine life can contract that can spread to the other fish in your tank. It is important to recognize the signs of infectious diseases and take care of it right away to avoid losing all of your fish to the disease.
The 3 most common diseases (and the 3 biggest killers) are – in order of how much captive marine life deaths they are responsible for:

1. Marine Ich caused by the parasite *Cryptocaryon irritans*
2. Marine Velvet caused by the parasite *Amyloodinium ocellatum*
3. Clownfish Disease caused by the parasite *Brooklynella hostilis*

Points to Note Before You do Battle With Saltwater Aquarium Disease

- Before you medicate your fish **you need to be SURE what the disease is** as you may only get one chance to get it right and incorrect medication can and does kill fish and invertebrates.

- As I mentioned above you also need to figure out **why** your fish have the disease to nip the cause in the bud! The most common causes are transport stress and incorrect acclimation procedures and “new tank syndrome” if your aquarium has just been set up which means it hasn’t been cycled long enough and this is causing chemical stress.

- **You need a quarantine tank**! Think; (a) quiet, stress free place for new arrivals to acclimate and (b) perfect environment to separate and medicate sick marine life effectively. Two awesome reasons to get one!

- Consider **“cleaner” species** such as Gobies (especially the Neon) and Shrimp (Skunk cleaner shrimp are excellent), these guys will happily pick off parasites from your fish and are natural biological control agents.

- To effectively medicate **read the label first** (obvious I know, but so many people don’t) and ensure medication will have no bad side effects on you other pets (another reason a quarantine tank is a good idea!) especially corals and the like. Finally remove any chemical filtration such as carbon to
effectively douse your sick friend with the medicine without the media pulling it out of the water.

Common Saltwater Aquarium Fish Diseases and How to Battle Them:

**Disease: Amyloodinium Ocellatum**

**Common Names:** Marine Velvet, Oodinium, Amyloodiniosis, Gold dust disease, Coral fish disease.

Amyloodinium ocellatum is one of the fastest-acting saltwater fish diseases, and also one of the deadliest. If one of your fish has this disease, it is very likely that all of the fish sharing the aquarium will be infected with it to some extent. It is a Dinoflagellate (an algae like single celled organism placed halfway between plants and an animal's) parasite called Amyloodinium ocellatum (formally known as Oodinium ocellatum).

Unlike marine Ich (the number 1 saltwater tank killer, read below!) **there is unlikely to be latent (existing in the background but not infesting fish) populations existing in the aquarium that flare up when fish are under stress.**

Usually the Amyloodinium is brought in on something being introduced wet to the aquarium (invertebrates can carry this disease too) and reproduces rapidly, **which again brings to light the absolute need for freshwater dips and quarantine procedures before adding something from the wild or another aquarium into our own.** This organism is very common in the wild and is commonly found on the skin of wild caught specimens. When marine velvet is present you will know all about it!

Most aquarium cases of this disease, if left untreated result in rapid infestation, reproduction and damage to fish’s gills causing death, eventually by oxygen
starvation. Sadly this disease can kill as early as a single day of noticing the early warning symptoms. **It attacks the gills first.**

The lifecycle of *Amyloodinium* is similar to *Cryptocaryon irritans* (read below) the 2 are often confused.

**Visible Symptoms:**

- Rubbing at things in the tank.
- Coating of tiny white particles on skin (looks like white, grey or gold dust) = severe symptoms.
- Hyperactivity.
- Twitching.
- Shuddering.
- Rapid and shallow breathing.
- Reduced appetite.
- Faded coloring.
- Gasping and staying near surface or in areas of highest water movement.

**Treatments:**

*Preventing this particularly nasty parasite from ever entering your aquarium in the first place is much, much easier than trying to stop it once it has a hold on your fish.* So correct acclimation procedures, including freshwater dips for 3-5 minutes (of everything!) and quarantine for about 4 weeks is going to save your marine life from all the above mentioned nastiness.

The key to effectively treating this disease is rapid diagnosis and appropriate treatment. Every minute counts with velvet! **Ensuring excellent water quality and nutrition throughout the treatment will aid the fish’s immune systems and speed up recovery.**
Marine velvet is NOT responsive to Hyposalinity treatments like with marine Ich (the 2 diseases are commonly confused but caused by very different parasites) but can be killed in their free-swimming stage with UV sterilisers.

Some marine fish if exposed to small numbers of parasites can actually become immune to infestation when Dinospore numbers are low enough not to cause mortality and upon infection the trophonts simply fall off. But don’t try to wait for natural immunity to happen, this is a swift progressing disease and if left untreated it will kill your fish!

**So what are the effective treatments for marine velvet?**

1. **Copper treatments:** Copper is really the ONLY effective treatment here. The treatment is the same for Marine Ich: you will need to ensure the copper levels in the water remain at the effective level (0.15-0.25 mg/l) for at least 14 days. That will mean testing for the appropriate copper solution (chelated or not) at least daily to ensure it is in the effective range and adjust accordingly following the instructions. Levels lower than this will not be effective and levels much higher than this will start to become toxic to your fish.

As I have mentioned before copper is extremely toxic to all invertebrates and the best option is to remove all fish (because the disease is highly contagious) to a QT (quarantine tank) after a 3-5 minute freshwater dip and treat there, removing any chemical filtration media. **After treatment has been done you will want to remove all traces of copper using chemical media (such as activated carbon) and water changes.**

The main tank should be left to run “fallow” and be run fish free for a month (with or without invertebrates) where the parasite will go through its lifecycle then die out because of a lack of host fish.
A product like Cupramine is GOLD when you have an Ich or Velvet outbreak.

2. Freshwater dips: Although not a treatment in themselves a 3-5 minute freshwater dip will provide relief for your infected fish by destroying at least some of the parasites. This should be done prior to removing to said QT and copper treating. It should also be done every time you want to introduce a new pet into your aquarium before the quarantine period. Freshwater dips should always be done with filtered water that has been adjusted to the same pH as in the water the fish is coming from.

3. Chloroquinine diphosphate: There is a single effective alternative to copper solution treatments which is also an anti-malarial drug! However it has all the same downfalls as copper being it is toxic to invertebrates (not to fish though) also it is more expensive than copper and harder to find. The active dose of Chloroquinine diphosphate is 5-10mg/L for 10 days.

4. Other treatments: Despite what you may read or hear the above treatments are the only EFFECTIVE treatments currently on the market, as with other diseases there are many “miracle” Amyloodinium specific “reef safe” products around that work with seemingly random limited success. This disease is so rapid to kill that you should take no chances with something that only MIGHT work. Something
should be said for UV sterilisers though which are able to kill free swimming Dinospores but cannot eradicate the parasites from the fishes bodies or in their encysting stage so are not a cure in themselves.

The bottom line here is that this disease is particularly lethal, contagious and very quick to overcome marine fish as it attacks their respiratory system first. You will need to act rapidly and decisively and be able to identify the early warning signs. As I have said the best way to treat is to remove all fish to a quarantine tank, treat them there and let the display tank sit for at least a month while the little nasties carry out their lifecycle without hosts and die out, alternatively you can treat the display tank with bleach then rinse it out a number of times.

The single best way to avoid this disease is to prevent it from entering your aquarium in the first place!

Marine Velvet infection. Photo credit www.reef-face.co.uk
**Disease: Bacterial Infections**

Bacterial infections in marine life are **typically a result of having poor water quality**, although can be the result of injury or parasite infestation. Usually only one or two fish in your aquarium will be infected initially.

**Visible Symptoms:**

- Water in aquarium appears cloudy (when looking end to end)
- Red spots and/or lines appear on the body of fish
- Fish eyes seem cloudy
- White patches on skin
- Lesions or ulcers may appear
- Loss of appetite
- Fish may seem to hide
- May have swollen bellies
- Increased breathing

**Treatments:**

Typically, identifying the cause of the stress (poor water quality) and correcting it will correct the problem if noticed early on. Otherwise, a variety of antibiotics can be used to treat the affected fish. Fish will return to health quickly once the cause of stress is removed and a good diet is provided.

**Disease: Brooklynella Hostilis**

*Common Names: Clownfish Disease, Brooklynellosis.*

*Brooklynella Hostilis* is a parasite infection that is commonly seen in Clownfish, but other species can also suffer from it. You will notice symptoms on one or two fish initially; but it will spread rapidly if you don't take care of it. *Brooklynella Hostilis* will kill fish in just a couple days if uncared for.
Clownfish disease or Brooklynellosis is the third of the “Ich” type diseases caused by 3 different external parasites, this group of 3 diseases exhibit similar symptoms to the untrained eye and so are commonly confused by uneducated aquarists. My aim is to ensure you don’t make this mistake yourself and lose lives by incorrectly diagnosing and treating your marine fish.

Clownfish disease is caused by a ciliated protozoan known as *Brooklynella hostilis*, which grow up to a few millimetres in size. A ciliated protozoan is surrounded by hairs (cilia) that it uses to move around.

Brooklynellosis wreaks a lot less havoc in marine aquariums than Marine Ich and Marine velvet but is so commonly associated with that most popular marine aquarium inhabitant Clownfish, that it has been named after them. This disease is very common in wild caught Clownfish, which get very stressed especially when being removed from their Anemone hosts up to half of them don’t make it to home aquariums. It also occurs when captive reared Clownfish come into contact with wild caught ones and also when Clownfish undergo trauma in an aquarium environment. This disease most commonly is seen in wild caught Clownfish or captive bred examples exposed to wild caught ones and is usually brought to your aquarium in this fashion. If these factors are ruled out this organism is not that commonly seen.

This disease isn’t just seen on Clownfish though, Angelfish, Tangs, Wrasses and even Sea Horses commonly fall victim to this parasite.

This parasite reproduces more quickly than both Amyloodinium and Cryptocaryon and if left untreated can kill a very short time. The main symptom is excessive production of mucus as a defence response to try and shed the attached parasite. As this disease advances a thick whitish mucus coating spreads out from the head and white rash-like lesions on the fishes skin will follow.

**Visible Symptoms:**
✓ Excessive mucus production centred around the gill area – characteristic symptom
✓ Loss of colouration around the head – early warning sign
✓ Open mouth gasping near the surface – early warning sign
✓ Rapid breathing (because the gills are being attacked first) – early warning sign
✓ Rubbing against things
✓ String-like material (mucus) sloughing off the fish
✓ Hyperactivity in beginning stages of disease
✓ Lethargic in later stages of disease
✓ White skin lesions in later stages of disease
✓ Hiding in the tank
✓ Loss of appetite

**Treatments:**

Prevention is the best way to stop this disease before it can even occur (are you seeing a pattern yet?) preventing is much, much easier than doing battle with it once it has a foot hold. **So, correct acclimation procedures, including freshwater dips for 3-5 minutes (of everything!) and quarantine for about 4 weeks** is the call of the day.

The big difference with this parasite compared to Ich and velvet is that copper is NOT an effective treatment here.

**Secondary infections:** You have to be aware of secondary bacterial infections that can often occur when your fishes immune system is being compromised by a *Brooklynella* infection, this can easily occur around the skin lesions. I recommend you should consider using an antibiotic such as **Erythromycin** and even add some **methylene blue** to the treatment water.

1. **Formalin treatments:** Formalin/formaldehyde is the ONLY effective treatment here. You will need to be very careful, work in well-ventilated areas, follow the
instructions and wear gloves, as **this chemical is toxic** and a potential carcinogen. Formalin usually comes as a 37% solution, which you will use as a dip or a bath (pH adjusted fresh or saltwater, but less than 80°F).

You will need to remove your fish to a **quarantine tank** (Formalin dip before adding to QT), as Formalin will damage beneficial bacteria, corals, invertebrates and live rock in your display tank. As Formalin depletes oxygen levels you should use an airstone in your Formalin bath vessel.

The best way to treat is a Formalin bath using a 37% Formalin product; one or 2 teaspoons should provide the active dose, which will be 100 – 200 ppm (again, follow the instructions). Scaleless and more sensitive species such as Tangs and Butterflyfish should have a half dose.

You can either add Formalin to your QT which will damage all the above or can conduct a series of Formalin baths which is my recommendation.

The bath should be given in a clean few gallon container containing an airstone. You will want to place the fishes in here for at least 15 minutes to half an hour at a time. If the fish gets highly stressed remove it and try again the following day. This bath procedure should usually be repeated for 5 days (with new baths being made up each day). It is a good idea to have another clean vessel of water to rinse the fish from medication and parasites in for a few minutes after its dip before being placed back into the QT to recover. Conduct very regular partial water changes of the QT over the treatment period to remove any free-swimming parasites and residual medication.

2. **Freshwater dips:** Although **not a treatment** in themselves a 3-5 minute freshwater dip will provide relief for your infected fish by destroying at least some of the parasites. This should be done prior to removing to said QT and formalin treating. It should also be done every time you want to introduce a new pet into your aquarium before the quarantine period. Freshwater dips should always be done with filtered water that has been adjusted to the same pH as in the water the fish is coming from.
Successful identification of *Brooklynnella* is paramount to treating this disease in time. **As the other 2 Ich type diseases are treated by copper, which is ineffective against Brookynella** a mistake here could be very costly to your marine life. Once again, non-formalin/formaldehyde commercial treatments can widely vary in their effectiveness, in my humble opinion it is not wise to gamble with your marine life.

*Disease: Cryptocaryon Irritans*

*Common Names:* White Spot Disease, Saltwater Ich, Marine Ich (or Ick), Marine whitespot, Cryptocaryonasis.

*Cryptocaryon irritans* is caused by a ciliated Protozoan parasite. It is one of the more common diseases that captive saltwater fish experience **it is the number 1 disease of captive marine life!** This little nasty rarely occurs in the wild and is a lot less fatal than in closed aquarium conditions. In a captive system it can wreak havoc because aquariums are so suited to its reproduction and there are plentiful hosts around. **Infestations are usually brought about by environmental stresses like temperature and exposure to excessive ammonia, nitrite and nitrate.**

**Understanding the Cryptocaryon irritans lifecycle**
The protozoan parasites start out as **trophonts** feeding, embedded on the skin of the fish underneath and protected by the mucous layer.

They then drop off (**protomont** stage), fall to the bottom and crawl around for a few hours before attaching to the substrate and transforming into cysts (now called **tomonts**) where they multiply into many daughter parasites (called **tomites**) after 3-30 days they then hatch from the cyst and are free swimming **theoronts** who must attach onto a fish host within 24 hours or die. **This is the stage at which Ich is most effectively target by chemical treatments.**

*This complicated lifecycle is the reason why full treatment must span the entire lifecycle of a month or so. Many people think they have cured Ich only to find it back in a few weeks because of this.*

Infestations are usually brought about by **environmental stresses** like temperature and exposure to excessive ammonia, nitrite and nitrate. **Tangs; along with Pufferfish and Boxfish are especially prone to Cryptocaryon Irritans infestation.** If you learn to recognize and treat at the onset of this parasite, it will not be a major concern. Cryptocaryon Irritans progresses slower than Amyloodinium. The disease starts with a telltale white, **salt-size** spots on the fish- and **can be treated before the disease gets out of control.**

**Visible Symptoms:**
- Salt sized white spots (1mm) appearing on the fins first and all over the body in advanced cases.
- The infected fish will “flash” which means scratching and rubbing against objects
- Frayed fins
- Twitching
- Hyperactivity at early stages
- Increased breathing in later stages
- Increased mucus production
- Faded coloration
Fish eyes are cloudy looking
Fish may appear to hide
Not eating leading to rapid weight loss

**Treatments:**

As per the other major diseases the best treatment is prevention, again this means correct and gradual acclimation, quarantine for a month, freshwater dips on all new arrivals (kills off parasites), keeping good water quality – this book will help you to achieve all of these. **If you do you can reduce the occurrence of disease in your tank by up to 90%!**

*I really recommend removing all the fish to a quarantine tank for treatment, the Ich will naturally die out in the display tank after a month or so with no fish hosts.*

If you identify a Marine Ich outbreak you should crank up the water temperature to around 85°F (29.4°C) if your marine life can tolerate it to speed up the lifecycle (and treatment) of Crypto.

1. **Hyposalinity:** In my opinion this is **the safest of effective Ich treatments** and it involves reducing the salt content (and thus specific gravity) of the water to 16ppt (1.010 specific gravity at normal water temperature) for around 2 weeks. This should in theory cause the Ich theoronts to “pop” with osmotic pressure (they deserve it!). This procedure is best done in a QT (quarantine tank) as it can kill invertebrates (including those populating live rock) and some more sensitive fish (such as sharks and Rays) don’t like it.

   You will have to gradually bring the specific gravity back up after the treatment over a few days so as not to stress your fish; aim for 0.001-0.002 specific gravity points per day until they get back to their normal 1.023.

2. **Copper Solution Treatment:** First of all, a word of caution copper is **highly effective against Ich** in the free swimming stage but very toxic to all invertebrates so do this procedure in a quarantine tank or remove any invertebrates from your
main tank first! This treatment although harmful to some marine life will be 100% effective!

**A Note About Copper Treatments**

Excessive copper concentrations are harmful to fish; fish without scales are a lot more susceptible than scaled fish to copper (like Blennies and Pufferfish). The dose must be spot on because too little copper won’t work and too much will suppress their immune systems and could even kill your fish. Remember to turn off or remove your chemical filtration before treatment. Also materials containing calcium carbonate like dead corals and coral sand will actually absorb the copper making it useless!

You want to aim for **0.15 - 0.2 mg/l copper treatment**, but always follow the manufacturers instructions dosing at night is best because this is when the theorists will hatch looking for a new host. I personally recommend Seachem Cupramine.

You should monitor the copper levels every day to ensure they are within the effective treatment range and adjust as necessary. Copper solutions come either chelated (attached to another molecule to last longer in water) or not (more effective but disperses faster) so you will need a test kit for chelated copper or not depending on what you are using.

You will want to treat as per instructions, for about 7-10 days, and remember to change the water sufficiently over time for undetectable copper levels before returning fish to the main tank or before reintroducing any invertebrates. Again it is way better to copper treat in a QT!

**3. Regular Water Changes:** This is the simplest place to start for minor infestations and where sensitive species are present that may not tolerate harsher treatments such as copper. If you don’t have a heavy infestation this would be my treatment of choice, as it is very safe for all fish and invertebrates. The idea is to remove all your fish into a QT and perform 50% water changes every day for 2 weeks and do a total clean of the aquarium each time. This should physically remove mobile parasites.
from the aquarium in various phases of their lifecycle. You will need to ensure the water parameters are carefully matched up to cause the minimum amount of stress. After 2 weeks keep them hanging around for another 3 weeks to regain strength before putting them back into the display tank.

**A Note About “Other” Ich Treatments:**

There are plenty of other treatments that are out there, a few work quite well like using Formalin (quite a toxic carcinogen) but are best left to very experienced aquarists because they can be quite dangerous to handle (you need to wear gloves and aerate the room etc). There are also various “reef safe” products which go in and out of favour all the time but are generally believed to be mostly ineffectual by the experts and also treatments from the kitchen such as garlic, ginger and pepper, these I would be tempted to leave alone if you have an Ich outbreak you want to use something that works for sure! Yes, they may work but with Ich you really want to use tried and true methods above that have worked for me and people I know.

*Marine Ich: the number 1 saltwater aquarium killer.*
Common Behavioural Signs of Disease

Often when a fish is behaving abnormally, it can be because it has something wrong with it. Here are a few telltale behaviours not mentioned above and what they could mean for your fish:

*Sudden quick movements:* This could point to new tank syndrome or sudden onset water poisoning, especially if the fish has balance issues and its gills are moving rapidly. Water quality should be checked immediately.

*Sudden death:* This is likely to be Pancreatic necrosis virus if the fish is lethargic, losing weight and accumulating fluid in its abdomen. Unfortunately there is no treatment for this virus.

*Fish rubbing up against things and generally appearing irritated:* most likely to be skin flukes, especially if the skin is red and inflamed looking. Treatment options are freshwater dips (five minutes for five days) or a commercial eco-parasite product.

*Fish appears inactive, weak and its physical condition is deteriorating:* could be blood borne protozoan parasites. A commercial preparation such as Methylene blue added to the water is highly effective.

*Respiratory issues causing distress:* when this is coupled with the fish itching its gill areas and general lethargy the most likely issue is gill flukes. Treatment options include freshwater dips (as above) and ectoparasitic commercial treatments.

Common Physical Signs of Disease

Additional to any unusual fish behaviour, there may be recognisable physical abnormalities indicative of particular diseases and ailments:
**Ulcers and haemorrhaging**: usually coupled with abnormal swimming, this is likely to be caused by a bacterial infection. The fish should be immediately moved to a quarantine tank and be treated with antibiotics.

**Depressions in fishes head muscles and lateral lines (Tangs and Angelfish)**: Will be Head-and-lateral-line disease most likely caused by a deficiency in vitamin A, but could also be protozoan/viral infection. Try vitamin A supplement then if no effect treat against protozoa and virus.

**Tiny black spots over skin**: may also be causing respiratory distress, is most likely caused by protozoa (generally Turbellaria) parasites. Freshwater dips can be highly effective.

**Losing weight with bulging abdomen**: highly likely to be tapeworm especially if the fish is no longer growing in size. Commercial treatments are readily available. Note: Fish losing weight with curvature of the spine is a symptom of fish TB for which there is no easy cure, this disease is highly contagious.

**Tumour-like bulges on flanks of fish**: neoplasia; surgery is required to remedy.

**Abnormal bumpy tumour-like growths on skin and fins**: usually caused by Lymphocystis. Ozone and UV treatment may resolve, but usually heals by itself.

**Marks on the skin of Tangs and Surgeonfish that resemble fingerprints**: Tang fingerprint disease. There is currently no treatment for this virus.
Preventing disease and good water quality and diet are the secrets to healthy fish.

Preventative Measures: Quarantine

It is easier to prevent illness and disease in fish than it is to determine what is causing illness in your tank. One of the most important preventative measures you can take to ensure the long-term health within your aquarium is to Quarantine fish before adding them to your tank.

Whenever you make a purchase of a new animal for your aquarium, you should keep it quarantined for a minimum of three weeks (and 4 if you can be patient) before you place them with your other fish in the display tank.

You just need to have a small, “bare bones” isolation tank; which has a heater, thermometer, sponge filter with air pump and PVC pipe to give the fish hiding places. You can use a small 10 gallon tank or even a plastic barrel - but just keep in mind you may need a larger size for certain fish varieties.
You can also use the isolation tank when you need to treat your fish for illnesses and diseases - unless the fish cannot be moved for any reason. Removing sick fish for treatment in an isolation tank will minimize the risks of other fish contracting the infectious disease, as well.

**The Importance of a Quarantine Tank and Quarantining**

For those that don’t know quarantine tank (QT) is a small, basically set up (bare bones) stand-alone aquarium completely independent of your display aquarium. Its primary purpose is to “quarantine” all newly acquired marine pets to ensure they do not carry disease into your display tank potentially infecting your established pets.

Quarantining fish and invertebrates is a very important part of keeping a successful marine aquarium full of happy, healthy marine life.

There are two main reasons to quarantine:

- ✓ When introducing a new fish or invertebrate to your display tank (to acclimate it to a life of captivity)
- ✓ To avoid the spread of disease when you notice you have an ill marine creature.

Quarantine tanks don’t have to be fancy (and are better if they are not) but they are invaluable when it comes to looking after your marine life properly and avoiding potentially fatal spread of disease. They will easily pay for themselves in terms of trouble avoided.
A little 15 gallon like this will be perfect for a QT.

The simple act of putting all newly acquired marine specimens into quarantine for a month (after acclimation) before putting them into your display tank will prevent disease outbreaks, stress and shock to the tune of approximately a 90% reduction in mortality across the board. That is massive; imagine what that could do for your stress and sorrow levels not to mention your bank balance with disease and deaths wrecking havoc in your not-exactly-cheap aquarium.

Think of it as the most effective way to limit your loses bar none. Public aquariums and fish breeders ALL quarantine livestock!

**Why Quarantine?**

When you first purchase a new fish it will often come home highly stressed out, and can be unable to compete with other fish for food and/or be harassed by other fish if put directly into the display tank, this can easily lead to death. Not only this; store brought fish can also harbour disease even if symptoms are not obvious yet.
Just a few weeks ago when your new fish was swimming around the coral reef minding its business the balance between parasites/disease was on much more equal footing than in an aquarium setting. Let me explain; most parasitic infections in the wild are pretty minor, the parasite just wants to reproduce and there are many many fish and a huge area of the reef which means that for the parasite/infectious organism to ensure its continued survival there will be low infection rates on any one fish.

But when the fish is captured it becomes very stressed - its’ body virtually shutting down functions like the immune system to devote energy to a potential escape (fight or flight response), not only this but the stresses of transport and sub-optimal water quality begin to kick in further weakening its immune system. Then you add it to a small closed system (your aquarium) which doesn’t naturally dilute out infectious organisms and parasites like the ocean and this set of circumstances stack the odds massively in the favour of parasites and disease.

This is where quarantine becomes vitally important. So putting your new pet into quarantine for at least a month (to totally rule out any infection) will ensure it is fit and healthy enough to thrive in your display tank and will limit the spread of any existing disease to your existing fish. Additionally a period of quarantine will allow you to try a whole range of foods out on the fish and see what it will eat and to give it one on one care to ensure it is optimally fit and healthy enough to thrive in the display tank.

A Quarantine Tank Will Serve Multiple Purposes:

1. A peaceful haven to rest up, de-stress then strengthen marine pets that were swimming around on a coral reef a few days before and are seriously weakened, dazed and confused after their gruelling transport to your place. This is ideal before they face the rigours and potential aggressive behaviour of other fish in your display aquarium. You can also use this time to learn their particular habits and behaviours and make sure they are eating properly.
2. The perfect isolated environment to check for any disease symptoms over the time period you would see them presented. After this time (a month) if there was any disease you would definitely have seen it so can safely say your pet is disease free and its ready to meet the rest of your pets.

3. A quiet place to observe your marine pet away from the stresses and competition of your main aquarium if you suspect disease, damage, bullying etc.

4. An excellent place to effectively medicate sick, diseased individuals so that disease cannot spread further in your display tank and the medication cannot harm your other marine life (for example many medications are toxic to invertebrates, corals, biological filter bacteria and live rock).

5. A place to put marine life if something goes wrong in your display tank, your QT will be nearby on standby.

6. You can even use it as an extra aquarium, breeding brine shrimp, propagating corals, snails for food or cleaning the display tank.

So what do you need to set up a quarantine tank?

Here is a list of the very basic requirements of your quarantine tank. You will need a bare bottom tank with adequate heating, aeration and filtration consisting of:

1. A small covered glass or acrylic aquarium of about 10-40 gallons depending on the number and also size of the fish to be quarantined and the number of fish your display tank contains.

2. A simple outside filter such as a hang-on canister filter or wet/dry filter that will give you combined mechanical and biological filtration in one. It is a really good idea to “seed” your new filter from water containing bacteria from your main aquarium.

3. A basic heater and thermometer appropriate for the aquarium size.
4. Some PVC piping cut at different lengths for fish to hide in.

5. Very simple fluorescent lighting to illuminate the tank (or if you intend to quarantine corals find a fluoro light around the same intensity as they are getting in the main tank).

6. No substrate, rocks or anything else that could possibly absorb treatment medication.

That’s it! It is also a good idea to get a net and a siphon that you use only for the quarantine tank. You will also need to purchase the appropriate test kits for any copper etc you will use for treatment.

*This Percula Clownfish says "If you love me you will quarantine me!".*
This is How You will Set Up Your Quarantine Tank:

The best way to set up your QT is simply to use water from your existing display tank (if it is healthy), this way you wont need to go through the entire cycling process. You can seed the filter material by placing it in the sump of your display aquarium for a few days, this way you can always ensure your filter is good to go on a moments notice. Ensure your heater and filter are plugged in and test you water parameters (which should be on par with your display aquarium). Simply maintain as per your display aquarium and use that water for top ups and regular partial water changes, too easy!

Here’s my Super-Simple Quarantine Procedure:

*When you get your new fish home, start with my acclimation procedure as per Chapter 4, then a freshwater dip for 3-5 minutes, which will kill, off a lot of the nasty skin parasites. Then simply place in the quarantine tank, turn off the lights, don’t feed for 24 hours and observe every day keep a careful eye out for any infection.*

With your QT conduct maintenance and regular partial water changes as you would your display tank. And strive to siphon up any debris and uneaten food quickly. Keep the fish in the aquarium for at least 30 days (the duration of marine Ich and Marine velvets’ lifecycles). If at any time during this 30-day period you add another specimen to the QT you need to hold the original specimen for another 30 days (nothing should go into the display tank without being quarantined for at least 30 days).

If you spot any sign of disease or parasitism diagnose quickly and treat in your perfect treatment centre feeling good about the fact that the disease is not spreading rampant through your display tank! After all signs of the disease are gone you will need to hold for an additional 30 days to make sure everything really is fine
This procedure is so easy and will make such an unbelievable difference to your chance of success with your new marine pet!

If you are using your QT to medicate don’t forget to use water changes and chemical filtration at the end to get rid of every trace of chemical (if harmful) until it is undetectable using the test kit. Then drain and clean all parts of the system thoroughly before using again. Remembering that the medication may have killed off your filters beneficial bacteria, in this case sterilise then place in the sump of your display tank to seed again.

How do You Quarantine Corals and Other invertebrates?

The introduction of corals into your aquarium can easily result in adding flatworms, box snails, planarians and even worse to your aquarium. The procedure for their quarantine is very similar to marine fishes with a couple of differences:

1. Corals need to be spaced out from each other so as to avoid any chemical or physical warfare as much as possible. Especially species in possession of sweater tentacles (mostly LPS corals) that will sting their neighbours.

2. Avoid freshwater dips with invertebrates as they are more sensitive than fish and they may not recover from the osmotic shock.

3. Chemical filtration will be necessary to mop up any metabolites and toxins released in to the water. This is best achieved by simply placing a pouch of media such as activated carbon into the filter box in contact with the incoming water stream.

4. Debris such as mucus, uneaten food and parasites should be siphoned out regularly from the bare base of the tank, which allows you to see them easily.
5. To help remove metabolites and toxins from the water and replenish vital elements you will need to do **more regular partial water changes**. I change 5% at a time, twice a week. If appropriate just use water from your display tank to keep things easy.

6. As I mentioned above you simply need to try and match the lighting intensity you use in your display tank with simple fluorescent lights, any lack of lighting can be made up for by simply feeding them more while in quarantine.

7. Parasites can actually be lured out of their coral hiding places by putting a bit of seafood meat near to the corals.

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**Quarantining Sick Marine Life**

*When you notice some disease symptoms on organisms in your display tank you should immediately remove them to the quarantine tank, then medicate.* This will hopefully stop the spread of disease and allow you to medicate in a stress free environment where the medication cannot harm any marine invertebrates.

The most common marine aquarium disease is marine Ich (caused by *Cryptocaryon* protozoans) the life cycle of the disease causing organism is 2 to 3 weeks, so quarantining for at least a month weeks will allow you to be very sure the disease has gone before re-introduction back to the display tank. The quarantine tank allows you to treat the disease immediately in a stress-free environment. Another tip is to get a small quarantine tank (I recommend a tank about 20 gallons, 10 gallons is too small and 40 is getting too big) so you will have to use less medication to treat your infected fish.

Hopefully by now you will have realised the massive importance of quarantine and how having you own QT is massively useful, beneficial and not that expensive or difficult.
A Proper Medicine Cabinet for Aquarium Owners

In order to be well prepared, aquarists should have certain items on hand to handle the more common fish diseases. As mentioned above, having a quarantine tank ready to go is probably one of the most important items on the list: it can save you time and save the lives of your fish.

You should also have extra saltwater that is already conditioned for your aquarium available as well. You may need it to help clear up low quality water, and since it takes time to condition seawater, it's always a good idea to have it mixed and ready to go.

All saltwater aquarists should have test kits for ammonia, pH, copper, and specific gravity – among other testing kits and tools. Having an assortment of fish antibiotics on hand can make treating the common ailments easier, but you can always obtain these items when they are needed.

**Antibiotics:**

There are a number of fish antibiotics available, and the one you choose to use will depend on what you are treating...be sure to get this right!

*Minocycline:* effective for many bacterial infections when used in a double dose every day for five to seven days. Internal infections are treated well with this antibiotic because it is absorbed well into fish systems. The disadvantage is this antibiotic will turn the water in your tank brown, and while it may not be as effective as Neomycin or Nitrofurazone (see below), it seems to be less destructive than Neomycin on biological filtration. You can increase the effectiveness of this medication by changing the water in the tank each day before adding another dose.
**Nitrofurazone**: can be used for both internal and external infections. You use this antibiotic in a one-time dose of 30 to 40 mg per gallon, and it treats for three to five days. Dim the aquarium lights when using this medication as light can deactivate the medication.

**Neomycin**: considered the most powerful of the antibiotics listed here, it's not quite as useful for internal infections. It is the preferred treatment for external conditions, including fin rot. You cannot use Neomycin in combination with copper; but it can be used with either Minocycline or Nitrofurazone. You use Neomycin with a one-time dose of 250 mg per gallon, and the treatment will last three to five days. You will definitely want to remove your biological filter when using Neomycin, because this antibiotic will kill the bacteria needed for the biological filtration (particularly nitrite converting ones). Neomycin is a poor choice within a crowded aquarium.

**Nifurpirinol**: this antibiotic was developed specifically for the aquarium industry. It's often packaged with the name “furanace” or “furanase”. You will want to follow the directions on the package for a four-day treatment.

One thing to keep in mind is that the package directions for antibiotics often recommend low doses that may not have the desired response. If the fish aren't responding to the antibiotic therapy within three days, or they appear to be getting worse, you will want to change the water in your tank and try another antibiotic or a stronger dose.
Sensitive marine invertebrates make medicating the display tank difficult - all sick fish should be removed to quarantine.

**Immuny and Stress**

Fish that survive saltwater ich can actually develop a degree of immunity for about six months, although this doesn't happen in all fish. The immunity occurs when fish maintain the presence of the parasite, but without evidence of pathological lesions. It's not pure immunity or protection, though, and some fish may also have a low level infection that can cause later outbreaks because the parasite is not completely eliminated. If a fish is under stress, the immunity can be diminished which will result in a renewed outbreak by enabling the parasite population to increase.

**Stress in Marine Life**

Stress in fish is any condition that causes physical or mental discomfort. Stress increases heart rate, blood pressure, blood sugar and cortisol (steroid) levels in fish just as it does in humans. Stress contributes to the majority of deaths in aquarium fish.
When a fish is under stress, they have a lowered immune response and that allows parasites, bacteria and fungi to infect the fish and then cause disease and/or death.

Causes of stress in marine fish include:

✓ Elevated ammonia levels
✓ Elevated nitrite/nitrate levels
✓ Water temperature fluctuations
✓ Improper pH levels
✓ Decreased oxygen level
✓ Not having a place to hide
✓ Too small of a tank
✓ Improper levels of salinity
✓ Being harassed by other fish
✓ Too many fish in the tank
✓ Poor nutrition
✓ Shipping of fish

Eliminate Stress in Fish

Just as it is not possible to eliminate all stress experienced by humans, it is not possible to eliminate all potential fish stressors - but they can be reduced significantly:

When adding new fish to your aquarium:

✓ Be sure to give them proper time to get acclimated
✓ Use the quarantine tank
✓ Make sure they are being fed properly with a balanced, varied diet.
✓ Don't allow people to tap on the glass of your aquarium, as this is a common cause of stress.
✓ Avoid too much vibration around the tank for example from heavy bass.
✓ Try to provide suitable habitats and give them plenty of rockwork to get away from other fish and forage in.
✔ Avoid netting the fish frequently as it causes stress.
✔ Ensure you always select compatible species.
✔ Keep a good eye on chemical and physical parameters as fluctuations and improper conditions cause a LOT of stress.

*By providing a suitable tank environment, most stress will be reduced which will greatly reduce the amount of diseases your fish are exposed to.*
Even the most careful of aquarium owners can come up against tank or fish problems. This chapter is dedicated to helping you troubleshoot common issues and help provide you with effective solutions.

**The 10 Most Common Saltwater Aquarium Mistakes Ever Made**

This is a list of the 10 most common mistakes people make with their saltwater aquarium to help you to avoid them. The methods to avoid these mistakes you would have learned about already just by reading this book, but I will go over the methods again just to remind you!

There is a mistake-making epidemic in the hobby today and it stems from people falling in love with the idea of having an awesome marine aquarium and rushing in head-first without doing their due diligence.

**Here are the top 10 most common mistakes:**

1. **Buying marine life without knowing enough about the specimen**

   This is probably one of the most preventable mistakes you can make. So many people get upset when their newest pet gets sick or worse then you find out its because they had no idea how to care for and feed it, and sometimes they don’t even know what it is!

   Don’t be lured in by the pretty colours or the nice shapes of marine life at the pet shop, any purchase you make should be fully researched FIRST! And don’t just rely
on the person at the pet shop, do your own research and ensure you know what the exact requirements are for keeping your new pet in optimal health.

You need to know as much as you can about any living purchase you want to make. Research what it is; if the fish store can't tell you the vital info then move on to the next store! Know what it eats, what habitat it prefers, how to care for it, how hard it will be to keep with your level of experience and how compatible it will be with your other marine life.

To avoid disasters with your marine life every purchase needs to be well researched and thought out. Think of the bigger picture (your aquarium eco-system) rather than individual purchases that catch your eye. You also need to ensure (as I've said time and time again) it will be compatible with your marine aquarium set up and the current marine pets you have.

Do you know what this is? If no then don't buy it!

2. Taking things too fast

This is probably the number one mistake that causes new systems to crash and marine life to perish. When setting up your marine aquarium it is so vital to go slow, to prevent overloading the system especially when it comes to biological filtration.
It is very tempting to add marine life when the water is in the tank but you must be patient and give the appropriate bacterial populations time to build up to levels that can cope with the biological waste that will come from your marine life.

**A tank must be properly cycled before you put any life inside,** do the appropriate tests to ensure the water parameters (ammonia, nitrites and nitrates especially) are 100% correct. Patience is required for just about everything you do with a saltwater aquarium, it is a living ecosystem that can only adjust gradually to new inputs, so go slow!

Additionally, you really need to take the time to study up on marine aquarium keeping first (**starting with reading this entire book!**), before you begin and take all things slowly and carefully. Every step must be carefully planned out and executed.

### 3. Marine life incompatibility

Another very common mistake; the bottom line here is that you must thoroughly research every species you put into your aquarium to make sure it will get along with everything else you plan to keep in there. If not it may cause stress, injury or even death to affected specimens. If you have gotten anything from this book it has to be this!

The first consideration is not to put predatory species in with something they might like to eat; this is an expensive way to feed! Also if you plan on keeping corals and other invertebrates you will need **reef-safe fish** that will not eat coral.

Some species are very toxic or territorial as well which may not be agreeable to the rest of your inhabitants. Yet other species like some Tangs cannot be keep in groups, as they will constantly fight.
You will need to research potential pets eating habits, behaviour and personality to make sure that they will fit in well into a harmonious happy aquarium. Choosing compatible species will save you a lot of trouble. The ocean eco-system is ruled by a complex series of marine life interactions; therefore you can’t predict what will happen, you MUST do your research before you buy.

4. Marine aquarium overload causing “New Tank Syndrome” or system crash

This is when you put too much marine life or live rock/sand into your aquarium at once; the system cannot handle it and the delicate balance is thrown out and new tank syndrome often results.

This commonly occurs in a tank that has been recently cycled or has not quite completed the cycling process. It occurs by putting in too much livestock at once throwing out the delicate biological balance where your beneficial bacteria can no longer keep up with the organic waste levels and toxic ammonium and nitrite levels build up. It can happen in established aquariums too. The bioload is too much for biological filtration.

Once again the key is to go slow and not overload your tank. You must also be careful to preserve the bacterial populations and not accidentally physically remove them by messing with the filter media too much or damage them with some sort of fish medication for example. The solution? Slow down and gradually add more stock so the system can cope much more efficiently naturally AND know what the bioload limits should be for your tank size and set-up.
How many of these big guys (Indian Sailfin Tang) can you have in your tank? You should know.

5. Lack of tank maintenance

If you let the marine aquarium chores get on top of you, you could easily throw out your water quality and cause a massive system crash that can easily be fatal. This is a LAZY hobbyist's mistake!

To ensure your aquarium remains a pristine environment for your marine life you **MUST be disciplined and conduct maintenance at regular intervals** (see book 1). If you do this you should seldom have *poor water quality, high nitrate, excessive algae or contamination* issues. You need to be strict with yourself on this; it is a key area for preventing problems with your marine aquarium. A little work now will save a lot of problems in the future.

Your maintenance schedule should consist of daily, weekly and monthly tasks, log them in a journal and do them religiously. If you break tasks up in this fashion they are less likely to get on top of you. Also learn to love your maintenance; everything
you do here is helping your marine life flourish. If you can’t learn to love it outsource it!

6. Using poor quality water

A lot of people use tap water or other un-purified water to make up saltwater for the aquarium, Tap water contains varying levels of heavy metals, phosphates and other chemicals that marine life especially corals just will not tolerate. This can lead to water quality issues, which can sometimes be pretty dramatic (like all your corals dying!).

I recommend you purchase quality distilled or RO (reverse osmosis) water, or some form of pre-purified seawater. Failing that another option is to use water RO/DI (reverse osmosis/deionisation: either RO or DI or both together in one unit) purification filter, however make sure it is a quality product. Using good quality water is a wise investment that will greatly help prevent water problems.

Get an RO filter...makes good drinking water too!
7. Unwittingly purchasing sick marine creatures

Choosing a sick individual could easily result in its death with the shock of moving into a new aquarium, not only that but you could spread disease to your existing marine life.

The key to not making this mistake is to observe the fish for a while (see books 1 and 4), studying their behaviour and the fish themselves carefully. You should learn what common tell tales signs of disease and illness to look for (book 5). Another major indicator of sickness is when the fish get fed, if it's not eating normally then do not buy it, if it doesn't display a healthy appetite and isn't competitive in getting food DON'T buy it, even if you feel sorry for it.

You will also want to observe the marine specimens body for physical damage and parasites. Ensure it isn't exhibiting odd behaviour and that the eyes are bright and clear. It's colouration should be vivid and not faded looking! Discovering whether a fish is healthy or not is very easy to do and will save you a load of trouble. For corals and other invertebrates it can be a lot more tricky, look for bold, not faded colours, extended polyps, no lesions and erect/turgid stature.

8. Diagnosing disease incorrectly

You need to learn to recognise the signs of common diseases and parasite infections accurately (see book 5), then you will not go through the tedium of treating one disease while your marine life gets sicker from another. If you are not sure what the disease is and you medicate incorrectly chances are you could be too late and you sick pet will die. You will need to get up to speed on marine life disease and symptoms; the Internet is also a good resource for this.

For example saltwater ich is commonly mistaken for marine velvet or Clownfish disease (and vice versa) these have similar (but different) symptoms but are caused by 3 different parasites that require very different treatments. 2 organisms have the
same treatment and one is different, this means you have a 33.3% chance of getting it wrong by guessing! But there are easy ways of finding out which organism is responsible which will allow you to act before it’s too late. Once again you need to do your research.

Just because your Clownfish has white spots doesn’t make it Clownfish disease...

9. Poor water circulation and filtration

These two factors are a must for any healthy saltwater aquarium. Ultimately it is hard to have too much of either filtration or water circulation.

Poor biological filtration will quickly result in the demise of your marine life due to water toxicity, you must ensure that your filtration is adequate for the bioload produced and is a good quality product(s). Mechanical/physical filtration is also important to keep gunk out of the water; a good protein skimmer will do this job. Good filtration results in good water quality that will never build up to levels toxic to marine life.

Water circulation is vital to stir up detritus, feed/clean sessile invertebrates, increase dissolved oxygen (DO) levels and reduce pest algal build up. It has
also been proven that fish in high water movement environments are happier and healthier. Ensure you have at least 2 powerheads creating multidirectional water flow.

There are a wide range of choices in purchasing these two essential life support systems, especially filtration; where not getting the right filter set up for your particular waste levels can lead to problems. Circulation can be easily improved by adding additional powerheads or a surge device.

10. Too much medication

It’s very common for me to hear reports about aquarists submitting sick animals to ludicrous amounts of the wrong medication in panic. This is the wrong thing to do, you need to identify the disease correctly then select medication that targets this disease specifically (but this said you can get really good broad spectrum solutions) and medicate according to the instructions.

Preferably this would happen in a quarantine tank to isolate the disease in a stress free environment for the patient. A Quarantine tank will also prevent the ill effect of medication damaging your other marine life, for example medicines containing copper are very toxic to corals.

These are the world’s top 10 saltwater aquariums mistakes, so now you should never make any of them right?

Common Tank Problems and How to Remedy

Poor Water Quality: is the most common problem in aquariums. It is the main cause of disease and death within marine life, and is easily remedied.
The best way to keep the water quality of your aquarium at its most optimum level is to do **regular water changes** (10% per week is optimal). In between changes, you can also use special water conditioners as a quick fix, but use them *sparingly*. These products will fix the symptoms but not the underlying cause. **Water conditioners** exist to remedy the following situations:

- *Reduce overall cycle time*
- *Instantly remove contaminants to make water safe for fish*
- *Remedy dangerous ammonia spikes*
- *Clear cloudy water*

**Invertebrates surviving the copper treatment method:** Saltwater Ich is best treated with copper. If you have a tank that contains both fish and invertebrates together, you cannot use copper, as it is lethal to invertebrates. Medicate in a quarantine tank or move all your invertebrates to another tank if you believe the fish are too weak to survive moving. **You will need to flush the tank out many times to remove all traces of copper.** It will also pay to get some chemical filtration media that can absorb copper.

**What to do if your marine aquarium gets too hot:**

In summer time and in hot climates a lot of heat stress can be put on your aquarium. Too hot is above 80°F (26.6’ Celcius), above which damage to marine life will occur.

This is a pretty bad situation, as a scientist I know only too well that excessive heat causes *proteins to denature* in organisms (which are made of protein). So essentially once your marine life gets too hot it can be fatal.

**So now that we have established too much heat is a bad thing, what can you do about it?**

1. Draw curtains and blinds in the room the aquarium is in (if you don’t have them get some), also open windows/turn on air-conditioning.
2. If the lights aren’t necessary (no corals or marine plants) try turning them off as these produce heat, or reverse the cycle so the lights come on at night when it’s cooler.

3. You can also vent air across the surface of the water with a small fan etc. Just be careful here and make sure the fan is firmly attached and cannot fall in the water.

4. The most important thing to mention is getting a good quality, reliable thermometer, and checking it regularly to get a feeling for the normal temperature fluctuations in your marine tank. If you catch a problem early you can prevent it before it’s too late.

5. Purchase a **chiller** unit; this is especially important if you keep corals, which hate temperature fluctuations. This unit will kick in when the temperature rises to specific point and turn off once it has cooled the water to its programmed set point. Coupling a heater, chiller and temperature control unit will always ensure your aquarium temperature is within a specific range not matter what is happening outside the tank.

*Easily the best long term solution for excess heat problems is just to splash out on a chiller.*
Invertebrate Problems and How to Solve Them

Problems with corals, anemones, shrimp, and other invertebrates, are difficult to detect and treat.

Most invertebrate problems come from:

- Poor water quality
- Aggression between animals
- Inadequate water motion
- Poor lighting levels
- Issues in how the invertebrates are handled in the supply chain before you purchase.

Lack of polyp expansion in corals: this problem is usually caused by not having enough water motion, poor lighting and/or poor water quality. A healthy, happy coral will always have expanded polyps. Sometimes corals naturally retract their polyps as part of their normal life cycle for a few days (usually to shed mucus), this should be a phase lasting less than a week if this is the cause.

Coral bleaching: (expulsion of zooxanthellae) is typically a result of water temperature stress or lighting problems. (see book 4 for more information).

Tissue recession in corals: while the causes are debated, it is thought that it may be caused from physical damage, temperature stress or insufficient water changes, or chemical warfare. Sometimes this is a result of disease in which case you will be able to see white or black (necrotic tissue) areas usually accompanied by a lot of slime.

Limbs lost by crustaceans: crabs and shrimps show problems by loosing limbs when shedding. They also may appear very lethargic. Causes are typically related to poor water quality, imbalances in the chemical makeup of the water, and dietary issues.
Diet Related Problems

Preventing dietary problems is possible by ensuring your marine life get a well-balanced diet. Check with the aquarium retailer or get a book about the various species and the types of foods they require for a nutritionally complete diet.

That being said, what sort of symptoms might indicate diet improvements are necessary?

Poor growth: if your fish are not growing properly, it can be a strong indication that they require an improved diet or could also mean the water quality is not good enough.

Depressed behaviour: Fish that are stressed, living in undesirable water conditions or have a poor diet may exhibit depressed behaviours usually involving repetitive behaviours.

Eye problems: fish that become blind are often a result of nutritional deficiencies if physical damage is not to blame.
Death: fish that are extremely deprived of adequate nutrition will die. They will have hollow sunken bellies and dull faded colours if nutrition is responsible.

Dietary deficiencies can be caused by:

- Foods that are not properly stored
- Not giving your fish foods that are an adequate substitute for their natural diet
- Not giving a well-balanced diet
- By under or over feeding.
- Fish foods that are kept beyond their expiration dates lose nutritional content, unless frozen.

You can refrigerate flake and freeze-dried food to extend their life. Always buy in smaller quantities so food remains fresh.

Some fish require several, small feedings each day because they have rapid metabolisms. Some fish, including most predators, shouldn't be fed every day, as overeating will cause them to accumulate too much fat. There are some species, like tangs, which require constant food to “graze” on. It’s extremely important that you understand the dietary requirements of each of the fish species you have in your tank.

You can also soak the fish food in a good vitamin supplement on a regular basis, to ensure that they are getting adequate nutrition.
To get the best colouration out of your Firefish provide them good nutrition.

Environmental Causes of Disease

About 95% of the causes of fish illness and disease are environmental, and are not caused by an outside organism. Conversely most of the pathogenic diseases remain dormant, unless the fish are weakened by environmental factors, then stress will lower their immune systems and the fish become susceptible to whatever background levels of pathogens/parasites resides in the water.

If you notice problems with your fish, you can probably assume it is related to environmental factors. An aquarium is attempting to recreate the ocean in a closed ecosystem and it's extremely vulnerable to changes, imbalances and overload. Often, simply changing the water will clear up many problems that are environmental – even if a check of the water shows it is of good quality.

*The first step of any disease symptom should always be a check of the water quality at least twice over 48 hours; that is the environmental factors.*
Pest Algae Problems

There are many different types of pest algae, and numerous reasons why an aquarium may have problems with algae growing on the tank, substrate and rock surfaces.

Algae is a healthy part of all marine environments and should be a part of yours too as it provides excellent filtration and oxygenation, mostly you should just need to give it a trim and scrape some off the glass or rockwork every now and again in order to view your marine life unobstructed. When its growth is out of control, then you have a real problem!

Both beginners and experienced aquarists alike all have to deal with unwanted algae outbreaks from time to time. Explosive, out of control algal growth in your aquarium indicates an underlying problem.

High phosphates, nitrates, excess nutrients and silicates may be the cause, but there are other reasons as well.

Beware Microalgae...
So, its micro-algae species that causes the huge majority of pest algae problems in marine aquariums. They cause issues by covering every object in the tank (and the glass) including corals and other invertebrates which can suffocate them, cause infection and block out their light causing damage and even death. Some algae are even toxic if eaten.

Pest algae outbreaks also suck out massive amounts of oxygen from the water at night, clog up filters, destroy water quality with their decaying biomass and generally look nasty preventing us from seeing our lovely fish and corals!
Common Pest Algae Species in Saltwater Aquariums

1. Blue-Green algae (Cyanobacteria):

Blue-green slime algae is responsible for a lot of saltwater aquarium mayhem, these single-celled organisms are more related to bacteria than algae. In colour this algae ranges from red all the way through to bluish-black and can be seen as slime, hair-like threads or a smear of evil looking film. Blue-green algae covers everything in its path and is very tolerant of water parameters but does best in high phosphate, well-lit environments.

Blue-green slime algae can be any thing from blue to red to purple to black to green!

It is mostly encountered when aquariums are going through their start-up cycling and also when there is not enough aeration and water movement and too much dissolved organic waste.

It is easy to remove from the aquarium but difficult to control, growing back quickly. Unlike other pest algae species there are very few marine organisms that will feed on this; perhaps a hermit crab or two if you are lucky.

Specific control of slime algae is through thorough cleaning, chemical treatments and reducing light levels.
2. Hair Algae (Derbesia):

Also known as filamentous green algae and officially as Derbesia species. This is one of the most annoying algae’s and is very common in saltwater aquariums. Its growth as im sure you can guess resembles clumps of feathery hair that are green.

![Hair Algae Image]

This stuff can soon cover everything if left unchecked; luckily it is in the convenient form to be pulled out and plenty of things like to eat it. Like all algae’s it thrives in conditions of too much nitrates and phosphates and not enough water movement. Hair algae are very common on tropical coral reefs, mostly growing over dead corals, see for yourself next time you are snorkelling.

3. Bryopsis:

Bryopsis is a green macro-algae (usually macro-algae are not pests in saltwater aquariums) and also goes by the lovely name of Sea Fern, but this stuff is anything but lovely in your aquarium. It grows very fast and its green-brown feathery mass can take over your aquarium in a couple of days! Bryopsis is often introduced on live rock and is commonly mistaken for Hair algae or Caulerpa.

This algae contains toxic defence compounds and will not be eaten by much at all except a few Bryopsis only eating sea slugs that sadly will die when it is finally gone! Not only that when you try to pull it out, it fragments, reattaches and spreads.
The only real way to get rid of this nasty stuff is to elevate the magnesium content of the water. Luckily there is a fantastic product called Kent Marine Tech M that works a treat!

Unlike the name Sea Fern is not pleasant!

4. Bubble Algae:

Bubble algae (Valonia and Ventricaria species) are common hitchhikers on live rock and resemble a growth of green bubbles in your saltwater aquarium (obvious I know) that would be fine in your tank if they didn’t grow so damn fast. They have little nutrient or light requirements too (can grow in near dark), so reducing these 2 factors will do little to get rid of them.
Don’t pop the bubbles!

The best way to get rid of bubble algae is good old manual removal making sure you don’t pop the spore containing bubbles to avoid more growing up in their place. They are also a popular favourite food of most species of the reef safe **Emerald crab** and **Indian Ocean Sail-fin Tang**.

5. Diatoms:

Diatoms are also known as brown algae, gold algae or “grass of the sea”. This is another pest algae that is not actually an algae at all! Diatoms are single celled phytoplankton encased in a silica shell, they grow as a **brown/green/gold film** on the aquarium glass and will happily grow over corals, killing them quickly.
Diatoms: happy to kill corals.

These plankton are very common and will often be the first species to colonise surfaces in a marine aquarium. Typically Diatoms usually appear just after or during the initial aquarium cycling phase and when live rock is introduced. As they grow on aquarium panels they can be easily scraped off with a sponge, being careful to rinse the sponge after each wipe and vacuum out the scrapings if a hungry Tang doesn’t get to them first.

Diatom growth predominantly arises in the presence of silicic acid or silicates; these could be introduced to aquarium water from unfiltered tap water, the wrong type of substrate (Aragonite is best), or your poor quality salt brand having too much silica.

In keeping with other algae’s; phosphates, lighting, nitrates, dissolved organics and water movement all contribute to growth.

Marine Fish That Eat Algae

Some fish eat algae, but it grows back much faster than the fish can eat it and keep it under control, in most cases. Having a few species that eat algae (most
notably Tangs) can't do anything but help, though! Fish that are most likely to pick at various types of algae and seagrasses include:

- Angelfish
- Batfish
- Blennies
- Butterflyfish
- Clownfish
- Damselfish
- Dragonnets
- Filefish
- Gobies
- Parrotfish
- Puffers
- Rabbitfish
- Seachubs
- Surgeonfish & Tangs
- Triggerfish
- Emerald crabs, sea urchins and certain snails also effectively remove algae.

Algae usually thrive in a fish only tank as there is little competition and lots of nutrients, in a tank like this marine plants can use up a lot of the nutrients algae feed on effectively out-competing them (marine plants are macro-algae species not the pest algae species which are predominantly micro-algae).

One way to help control the amount of algae in your tank is to reduce the level of light in the tank. Be careful as some corals require a certain amount of light- but if your aquarium can do without the lights on for an hour or two, you'd be surprised by how much that can reduce the growth of algae within the aquarium.

Another way is to completely eliminate phosphate, by conducting water changes, eliminating phosphate-containing products, using a phosphate reactor or by adding marine plants. The paragraph below will go into these strategies in more details and give you some other hints to banish algae for good.
How to Win the Battle Against Pest Algae

*How to stop pest algae thriving in your saltwater aquarium:*

Except for the specifics I mentioned for each pest algae above, any excessive algal growth is almost always caused by the same factors: too much nutrients in the water (mostly nitrates and phosphates), lighting and poor water movement are major contributing factors.

Pest algae can be a real nightmare to get rid of, if you have an outbreak there are a number of steps you can take to get rid of it that work, either by themselves or in conjunction with each other these are the quick fix solutions below.
**Pest Algae quick fix solutions:**

Note: these quick-fix solutions don’t fix the underlying problem, so most likely the algae will come back.

**An algae-grazing aquarium crew:** An assortment of these helpful aquarium tank mates should be able to keep that algae under control: Sea urchins, Turbo and Astrea snails, some Tangs especially sail-fin Tangs, some Blennies especially the aptly name Lawnmower Blenny and crabs such as Emerald crabs. Do your research first and make sure they are suitable for your tank and existing pets.

**Algaecides:** There are a number of good algae destroying products on the market such as Kent marine tech M for Bryopsis outbreaks. Some can damage biological filters as they are antibiotics, herbicides and the like so once again research carefully.

**Scrapers and magnet cleaners:** Good old manual labour goes a long way and of course is the most direct measure to deal with your problem. Many products are available for this purpose.

_A fine example of a pest algae quick-fix solution!_
Reducing light: If you have a fish only tank, then you can have blackout periods of a few days to kill off the algae. Obviously if you have any photosynthetic species including live rock this will not be a good idea.

UV Sterilisers: These are actually very good at destroying floating particles of algae (single celled micro-algae’s which are mostly our pest species), they are devices which radiate the water passing through them with Ultraviolet (UV) light killing organisms like algae, bacteria, parasites. Powerheads do the job of pumping water through the UV steriliser.

These quick fix solutions all work fine however I would advice you to look deeper, there is an underlying cause of your outbreak and if you want to get to the bottom of it, instead of praying the algae doesn't come back again, (just like the saying “treat the cause not the symptoms”) rule out the following underlying problems one by one, wait for results for each, this is showing you what is working and what isn’t, enabling you to ensure it doesn’t happen again long term!

Underlying cause 1: Too much phosphate

Phosphate (PO4) is probably the most important element in the growth of plants (including algae). To find out whether this is your problem you will need a phosphate test kit (phosphate should be undetectable in a healthy tank) and to pay closer attention to what is going into your water. Phosphate can come from:

1. Overfeeding (fish foods contain phosphate), of particular importance here is the juice from frozen foods, defrost and get rid of it. You can test foods by mixing them up in a little water and reading after 20 or so minutes.

2. Tap water can contain phosphates, RO filtered water (link to RO filters) will get rid of phosphate, nitrate and other nutrients, heavy metals and so on

3. Aquarium additives can contain phosphates.
4. **Activated carbon**, some brands have phosphates, put some in water and test it!

5. **Long-term use of Kalkwasser** precipitates phosphates out of the water making them insoluble and so unavailable for algae. But in localised areas of the tank the pH can drop from built up debris, which actually releases the insoluble phosphate settled on the rocks in that area into the water! **So rockwork should be wiped down from time to time.**

**Underlying cause 2: Too much nitrate**

Nitrates are the other major chemical element algae thrive on. Nitrate (NO₃) is the resulting compound from dissolved organic waste and accumulates in the water all the time unless removed. Get a test kit (link to nitrate test kit) and check this out.

**Ways to reduce nitrate are:**

1. **More regular partial water changes** go for a higher volume per week like 10% water replacement. You should be topping up evaporated water with pure water not tap water.

2. **Use RO** or some other form of purified water.

3. **Vacuum your gravel more often** and make sure you get rid of settled detritus. A good glass and rockwork wiping now and again helps as well.

4. **Get a protein skimmer**, these remove dissolved organics at the source (before they get converted to nitrate) they are VERY good at keeping the water pristine.

5. **Clean out or replace your filter media regularly**, organic debris can easily build up in here adding to the nitrate levels in the water.

6. **Only feed as much food as your fish will eat in a few minutes**, less is more!

7. **Purchase a nitrate reducing system** or some more live rock (I can never have too much of this stuff!), which has anaerobic zones, which will convert nitrate into harmless Nitrogen gas.
8. **Get some macro-algae species**, also called sea plants, they look cool, oxygenate the water and will effectively out compete the pest algae for light and nutrients. They can either be kept in the display tank or in a lit refugium. You can’t go wrong here!

**Underlying cause 3: Too little water movement and too much CO2**

Too little water movement makes “dead” zones perfect for algal growth that like stagnant waters, if there isn’t enough water movement CO2 will probably be high and saturated oxygen levels will be down also.

You don’t want so much water sloshing around that fish can’t swim properly but good, vigorous multi-directional water movement helps stir up detritus (so it is picked up by the filter or skimmer), feeds corals their food, oxygenates the water (thus reducing CO2) and makes conditions generally unfavourable for pest algae. All this is achieved by a couple of simple powerheads strategically placed pointing at each other.

**Underlying cause 4: Old lighting or too much natural light**

You should always change your bulbs as per the manufacturers instructions; either once a year or every 6 months. **As bulbs age their colour spectrum changes and produces more and more light that algae like!** Algae like less intense light over shorter time frames.

**Natural light** is obviously what causes algae to grow in nature, so you want as little as possible hitting your aquarium. **Algae also like heat** so if your aquarium is hotter than it should be this will favour algal growth.
So, algae are actually beneficial to the saltwater aquarium environment when it can be groomed and trimmed and trusted to not over run the tank. When you get an algal bloom it can be fixed immediately using the quick-fix strategies in the pages above however this outbreak is always caused by an underlying problem so if you don’t want to periodically be trying to reclaim your aquarium from these plants I recommend you get to the bottom of it using the information directly above!

Preventing Problems Within Your Aquarium

As mentioned in more than one book of this volume, many of the problems that may occur within your saltwater aquarium can be prevented with some precautionary measures, including:

- Proper tank maintenance.
- Good diet and nutrition for your marine life.
- Limiting the number of fish you keep in the aquarium.
- Testing the water to ensure it's of good quality.

**Tank Maintenance:** having an aquarium requires that you are prepared to maintain it! This involves checking that the equipment is all operating properly; the tank is adequately cleaned frequently. (See Maintaining the Aquarium in book 1 for time schedule sample.)

**Good Diet & Nutrition:** as with all living creatures, marine life requires a good diet with adequate nutrition to live a healthy and long life. It is up to you, as the aquarium owner, to ensure that all of the species you maintain in your aquarium have an adequate food supply with the nutritional elements each need to survive. (See more about Proper Food and Nutrition on page 165)

**Testing the Water:** throughout this ebook, the importance of having quality saltwater for your aquarium has been stressed. It's a fact that the majority of issues and
fish diseases are a result of poor water quality. Changing the water frequently, having a backup supply of tested and prepared saltwater, and performing regular tests of the aquarium water will help you keep the water quality good for your marine life. Good water quality will help prevent a number of other problems that can occur within your aquarium ecosystem, so this should be a top priority for you. (book 2 will provide you with the information for creating and maintaining high water quality for your aquarium, starting on page 92).

Thanks for reading!

Andrej Brummer, Bsc (Bachelor of Science)

Recommended Resources Section

Additional saltwater aquarium information:

http://www.SaltwaterAquariumAdviceBlog.com
Have a look through my hundreds of articles about all things saltwater aquarium on my blog, to find an article on a specific topic, use the search bar to the right.

http://www.SaltwaterAquariumAdviceVIPClub.com
For those who want to fast track their way to saltwater aquarium mastery, I have created an outstanding new program.
My **VIP club membership** gives you personal access to me to help you and is jam-packed with **Premium Content:**

Weekly E-classes direct to your inbox packed with exclusive insider knowledge and seriously helpful marine aquarium articles with all the details of all my unique marine secrets, techniques and steps from years of scientific theory, experience and research. Why not take your tank to the next level and master this awesome hobby!

http://www.chucksaddiction.com

An excellent online resource by someone who knows what they are talking about with detailed articles and loads of photos. Good quality information from a reliable source.

http://wetwebmedia.com/marine/index.htm

A very well written, authoritative and detailed site with excellent specific information on many different marine species highly useful for research on new species to put into your tank.

**Livestock sourcing:**

http://www.liveaquaria.com/

A very professional outfit and probably the most reliable place to order livestock online, these guys also offer a 14 and 30 day guarantee on livestock and have great shipping practices. They also have good information about the particular marine species they are selling.