**Brooklynella hostilis and Uronema marinum**

**Introduction**

*Brooklynella hostilis* and the less common, and often misidentified, *Uronema marinum* are both ciliate parasites that infect the skin of many species of marine fish. *Brooklynella hostilis* is often referred to as causing clown fish disease and it is true that clown fish are very susceptible to this pathogen. However, this parasite is opportunistic and will infect a wide range of fish species.

In both *Brooklynella hostilis* and *Uronema marinum* infections, acute symptoms can appear very rapidly and fish can go from being very health to near death in a few hours. Typically, reef keepers go to bed with their tank looking well and wake up to find the fish in crisis showing acute symptoms.

Both of these parasites have a direct life cycle: they live on the fish, feeding and the population growing very rapidly, then drop off into the water column (where they can live quite happily for some time) and then go on to infect another fish.

**Symptoms and diagnosis.**

Fish with either *Brooklynella hostilis* or *Uronema marinum* lose colour very rapidly, appearing pale and “washed out”. Often there is thickening of the skin’s mucus; so much so that the fish appears to have a rough white coating (figures 1, 2 & 3). This thickening of the mucus layer may become so severe in some species and individuals that mucus strands trail behind the animal as it swims. The fins of infected fish become slightly opaque and appear to be brittle with the edges fraying as small bits of the fin margin break away when it swims (figures 1 & 3). Often the scales are loosened in the infected area and may come away from the fish when it is caught in a net. The major difference in the gross pathology between *Brooklynella hostilis* and *Uronema marinum* is that the lesions associated with *Uronema marinum* have a more defined margin between the thickened mucus and normal skin that is often red and inflamed. However, the symptoms and treatments are so similar that accurate diagnosis is not required for successful treatment.

Towards the end stages of these infections the fish often develop rapid breathing, stop feeding and become listless, hanging near the surface or sitting on the bottom of the aquarium. If the fish are examined carefully during the end stages they often look thin and the skin appears to be stretched tightly over the muscle blocks. This is because the fish has lost water through the lesions caused by the parasite as it feeds on the skin, and the animals have become acutely dehydrated. Death usually occurs due to dehydration or osmoregulatory failure combined with gill damage. *Uronema marinum* can, in rare cases, causes an internal infection where it invades
through the skin and forms abscesses in the liver, muscles and other organs where it can cause a long term chronic infection.

It is quite difficult to misdiagnose these infections; the most frequent disease that it can be mistaken for is marine velvet (*Amyloodinium ocellatum*). However, fish with marine velvet do not develop such a severe mucus layer nor do the fins become brittle. Also marine velvet tends to be a sort of pale gold colour (a bit like the colour of ground white pepper) unlike the white lesions of *Brookynella hostilis* and *Uronema marinum*. A more detailed description of marine velvet can be found at [http://www.ultimatereef.com/articles/marinevelvet/](http://www.ultimatereef.com/articles/marinevelvet/).

**Prevention and Treatments**

As said earlier these pathogens develop very rapidly and one of the most important things to do is to act fast. Fortunately rapid relief of the symptoms (although not a full cure) can be obtained by the use of a freshwater bath (see treatment section) and this strategy can be used to buy you some time as you decide on the most appropriate way to manage this disease.

**Prevention**

It is said prevention is better than a cure and this is very true of these parasites. By far the most effective way to keep these parasites from infecting your fish is to avoid introducing them into your display system in the first place. So having no susceptible animals in a system or applying successful treatments during quarantine means that the parasites can be successfully eradicated from a display or quarantine system.

How do we avoid introducing the parasites in the first place? Well, the following list may seem obvious but should always be followed:

1. **Buy from an LFS with a good reputation that you trust**
2. **Quarantine your fish AND invertebrates**
3. **Practice good bio-security between tanks, live feeds, visits to the LFS or helping with a friend’s system**
4. **Use of dietary immunostimulants**
5. **Ozone and UV**

Let us consider each one in more detail:

1. **Buy from an LFS with a good reputation that you trust**

That statement may seem obvious, but many a wipe-out has occurred from someone buying a “sympathy” fish, which is doing badly at a poor LFS, and adding it to their valuable display system without quarantine. As a rule of thumb you should get to know your LFS: ask about their health management regime (if they are OATA members they have access to OATA’s excellent
document on bio-security and fish heath, which they would be wise to follow). They should be happy to tell you if they quarantine fish before sale, how long they do this for and if they use copper as a routine treatment in their fish systems (in this case copper is a poor treatment for these parasites). The rule should be “if in doubt over a fish’s health then leave it where it is”. Only if you are sure that there is little risk to it and your fish from your quarantine system should you buy it. But in reality, with a good LFS it has a good chance of recovery; with a bad LFS vote with your feet and hope they close down due to a lack of trade from discerning reef keepers.

2. Quarantine your fish AND invertebrates

This is the most common way that parasites get into a system. Fish with a low level of infection, or water from an invertebrate system that has infected fish in it, are the major sources of bringing this parasite into a reef tank. Quarantine was designed for ships and refers to a period of 40 days and nights (very biblical). Usually this is sufficient for most mammalian diseases to appear and action to be taken. However, as fish are cold blooded, 40 days may not be long enough.

Why quarantine my invertebrates? You can introduce free living parasites with the water or on living rock or a coral’s skeleton, so a reef tank really needs two quarantine tanks - one for fish, where copper can be used, and one for invertebrates. In the invertebrate tank time is really the only guarantee of eradicating the parasite so we would recommend a quarantine period of 8 to 10 weeks. Alternatively, you can use a sentinel fish in the invertebrate quarantine tank, which can then be treated in the fish quarantine tank should the need arise. Quarantining invertebrates also prevents the introduction of coral-eating nudibranchs or Zoanthid-eating pycnogonids, which can be a huge advantage to a good reef tank where the invertebrates are as spectacular as the fish.

What should be in my quarantine tank? Ideally the tank should be as large as possible, have a simple filter (sponge filters are particularly good in this role), have minimal décor (bare bottom, no living rock etc) - hiding places can be provided by plastic piping. For a fish system lighting should be subdued and it should have its own set of equipment (nets etc) which never goes near the main tank. Most importantly you must know the volume of water very accurately to allow for the correct dose of medications to be administered.

3. Practice good bio-security between tanks, the use of live feeds, visits to the LFS or helping with a friend’s system

Bio-security is the terminology that describes methods for preventing the spread of an organism from one system to another. Everyone, hopefully, washes their hands after going to the loo. Well, reef keepers should do that before going into their tank. However, there is a lot more to it than that;
each tank should have its own nets, pipe-work, syphons etc. and they shouldn’t be swapped between tanks without disinfection. One of the best disinfectants I have used for fish tank equipment is Milton’s fluid; to use it just follow the instructions and soak all your equipment in it after use and wash thoroughly before drying. So our advice would be always wash and disinfect hands and equipment before using it in your tank. This is true if you are an angler, have loaned kit to a friend or have simply been helping them out and tinkering with their tank.

4. Use of dietary immunostimulants

One of the biggest recent advances in marine reef keeping is the use and development of superb dry diets and the use of immunomodulating dry diets and sprays for enriching frozen foods. Unlike garlic and other crude terrestrial plant matter, where there is no evidence in the scientific literature that there is a benefit to fish, there is a huge amount of scientific evidence out there that immunostimulants help reduce the infection rate with fish pathogens (not just white spot). It is excellent to see that some manufacturers have decided to run with this and produce a range of excellent products aimed at the reef keeper. Immunostimulants work by up-regulating the non-specific defence mechanisms of an animal, thus preventing a pathogen establishing an infection or allowing an already infected animal to be in a position to rid itself of the pathogen more rapidly. However, they can’t be fed all the time otherwise the animals become tolerant to their effect, and most commercial regimes recommend two weeks on one type of immunostimulant followed by two weeks on a second immunostimulant then 4 weeks on the standard diet before returning to the immunostimulant diet.

5. Ozone and UV

Both ozone and UV can be very useful tools in the fight against this parasite. UV kills the parasite by damaging its genetic material while Ozone disrupts cell membranes. Both methods require pumping of water out of the aquarium through either a UV lamp system or into a protein skimmer that has ozone injected into it. Used correctly and at sufficiently high enough doses both ozone and UV are very effective in removing the free living parasite from the water column and hence reducing the infective pressure during an infection or preventing an infection establishing itself.

Treatments

Environmental treatments

A) Freshwater dips

In freshwater the parasite drops off the skin of the fish very rapidly. However, if the fish are simply returned to the tank where the outbreak occurred then they will just become re-infected. For this treatment to be
effective (like all the dip treatments discussed in this article) the fish should be kept in a quarantine tank and the main display tank kept fish free for 8 to 12 weeks. Once in the quarantine tank the treatment should be repeated on days 1, 2, 3, 5, 7 & 11 followed by 4 to 6 weeks of observation in a quarantine tank.

As these parasites breach the skin as they feed on the fish the skin's integument is broken and the fish's osmoregulatory potential is hugely reduced. This is exacerbated in freshwater so remember that a heavily infected fish could easily become physiologically stressed with this treatment method.

One of the most important things about a freshwater dip is that it will buy you some time to start another treatment or to set up a quarantine tank as even a very badly infected fish can lose most of its parasite in a few minutes and improve quite dramatically.

To carry out a freshwater dip:

1. Take some freshwater (RO is best) and heat it up to the same temperature as the tank: I find the best thing is to float a plastic ice cream tub full of freshwater in the tank until the temperature equalises.
2. Adjust the pH of the freshwater to match the tank using a commercial pH buffer.
3. Catch the fish and pop it into the freshwater bath, watch the fish carefully and be prepared to remove it if it becomes very distressed. Normally 3 minutes in a freshwater bath will dislodge most parasites; this can be extended to five minutes. I would not leave the fish any longer than five minutes in a freshwater bath.
4. Catch the fish and put it back into the tank. Do not pour the freshwater back in the tank as this may introduce the parasites back into the display tank.

NB A freshwater dip is a pretty stressful process and is not advisable for very delicate or very ill fish.

b) Hyposalinity

Hyposalinity is often quoted as a good and safe way for treating *Brooklynella hostilis* and *Uronema marinum*. Unfortunately there are no scientific papers backing this statement up and in the authors’ experience hyposalinity, like copper, is hugely overrated in the management of these parasite. So if you DON'T want to cure your outbreak of *Brooklynella* then by all means use hyposalinity therapy.

1. Chemical treatments
a) Copper

For this parasite, this isn’t the drug of choice. There are a few reports where copper has been used successfully to treat these parasites, but many more reports where it has been ineffective. In my experience copper is not effective for treating these parasites. However, in a quarantine tank situation copper may help after a freshwater or formalin bath treatment in reducing the parasite load.

b) Formalin

Cheap, cheerful and effective: sounds perfect, so what’s the catch? Well it’s toxic, carcinogenic and an irritant. It is, however, one of the best treatments for *Brooklynella hostilis* and *Uronema marinum*. It can be purchased readily from your chemist and some off-the-shelf cures contain it or a related chemical (paraformaldehyde or gluteraldehyde) so a read of the labels or data sheets of some products is essential if you want to use it.

The best way to use this chemical for *Brooklynella hostilis* and *Uronema marinum* is as a formalin dip followed by a long term formalin bath (see environmental treatments).

To use it as a short dip in seawater, make up a bath in seawater at 200 to 250ppm for 1 hour. The dip component of this treatment regime should be carried out on days 1, 2, 3, 5, 7 & 11 after each dip the fish should be returned to a quarantine tank to which formalin has been added (see below).

For the long term long term bath component of this treatment, add 25ppm of formalin to your quarantine tank (it’s toxic to some invertebrates and algae, including most coralline algae species, so cannot be used in a reef situation after 10 days.

Remember liquid formalin (which is how you will get it from the chemists) is 37 to 40% formaldehyde and you want 25ppm so you need to add 0.0625ml formalin per litre rather than 0.02ml to get the correct dose.

NB formalin dips are a very stressful process and are not advised for very delicate or very ill fish.

As this chemical is very toxic I would recommend that appropriate protective clothing is worn such as gloves and safety glasses and use it in a well ventilated place.

c) Acreflavin
In my opinion, Acriflavin is one of the most under-used treatments available to marine fish keepers. It has a broad range of effect, being effective against protozoans, bacterial infections and external fungal diseases. It is as “reef safe” as any other “reef safe” treatment and is easily obtained. It can be bought in several formulations from the LFS but make sure it isn’t combined with malachite green or methylene blue which have toxicity issues in marine systems.

It is effective at a concentration of 6 ppm against many ciliates (Paperna, 1984) and this dose should be added to the aquarium on days 1, 2, 3, 5, 7, & 11. Your skimmer should be turned off and any activated charcoal removed. It dyes the water a greenish yellow colour which will change the light spectrum reaching your corals (if you decide to use it in a reef tank - personally I believe all medications are best kept out of a reef aquarium and used in a quarantine tank) and this colour is a bit of a pig to get rid of, but after treatment turning your skimmer back on and adding activated charcoal helps remove the coloration (as do water changes).

Prescription Medicines

Flagyl (metronidazole) is by far the most effective drug available against these diseases. Indeed it is the only effective treatment for fish that are internally infected with *Uronema marinum*, but it has to be administered in the diet. To treat with Flagyl (metronidazole), add 34mg/l (34mg/kg bodyweight is required if treating the internal disease) of the drug to the aquarium water to be treated. A single dose should be effective, but it can be repeated daily, if required, as the drug is well tolerated by most fish. It is a very reef safe drug having little impact on invertebrates **BUT** it will kill of all protozoans and anaerobic bacteria in the treated tank, so, like all medications that are used in a reef tank, it will have some undesired effects on the ecological stability of the tank.

Some general comments on using treatments in a reef tank

The following words of warning should be heeded before chemical treatment of a reef tank is attempted. (Source: Simon Garratt, posted on UltimateReef)

"Modern reef keeping methods have now moved way beyond the days when LR was considered a simple source of bacteria, and filtration. In modern systems the ‘critter’ population regularly feature as a major player in the functioning of the tank. As such, any treatment should consider the impact it will have on the tanks ecosystem. ‘Reef safe' chemicals have often only been tested with the most commonly kept 'show' inverts. Many have not been tested nor claim to be safe with the multitude of background life that 'modern' reef keeping deems as beneficial, and form a substantial part of a modern reef eco-system, especially those containing sand beds etc. The use of 'chemicals' designed to kill parasites can have disastrous consequences in more diverse systems as they will kill off these beneficial animals as well as
the parasite. As a rule of thumb keep chemicals out of the reef tank and carry out any treatments in a specialised quarantine tank. Whilst it’s perfectly acceptable and correct to deem the survival of the fish as a priority, it shouldn’t be at the detriment of the rest of the system, and certainly not to the degree it jeopardises the systems stability.”

Conclusions

If you suspect *Brooklynela hostilis* or *Uronema marinum* then immediate action is require as these diseases progress so fast any delay can lead to losses. However, if prompt action is taken these are relatively easy parasitic infections to treat and you should be able to avoid losses. I cannot recommend enough the importance of quarantine in preventing this disease entering you reef tank.
Figure 1
Clown fish with acute Brookynellosis. Image © Dow Photography (http://dowphotography.smugmug.com/) used with permission.
Figure 2
Clown fish with acute Brooklynellosis
(Source http://home2.pacific.net.ph/~sweetyummy42/brookynella.html)
Figure 3
Twin spot goby with acute Brooklynellosis note the slightly opaque, ragged and brittle fins. Image © Campbell Barr used with permission.

Figure 4 *Brooklynella hostilis* in a skin scrape, counterstained with eosin to improve contrast.
(Source http://home2.pacific.net.ph/~sweetyummy42/brookynella.html)
Figure 5 *Uronema marinum* in a skin scrape (source http://protist.i.hosei.ac.jp/pdb/images/Ciliophora/Uronema/sp_2.jpg)