Red Band Syndrome in Marine Fishes: Potentially Caused by the Protozoan; *Uronema* sp.

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Introduction:

This moderately common disease of certain species of marine fish is so often misdiagnosed that most aquarists apply incorrect treatment methods when attempting a cure. Symptoms include the rapid development of a red mark forming in the hypodermis (fat and muscle) region of the fish, often following rows of scales so that the lesion is typically elongate, and angled downward as it progresses front to back along the flank of the fish. Within a day or two of the development of the primary lesion, the fish will become lethargic, stop feeding and its respiration rate will increase. Scales above the lesion can be easily dislodged due to the massive trauma to the underlying tissue. Death follows rapidly; with few fish surviving beyond three days after the primary lesion develops.

Almost universally, aquarists who do not have access to a microscope will identify this disease as a "secondary bacterial infection resulting from some injury". In fact, "capture damage" is often cited as the original cause due to the often-linear nature of the lesion – looking so much like a bruise from being hit with a net frame for example. The rapid onset of the lesion (often many days after capture), and the fact that it develops internally and then erupts externally all point to another cause.

Uronema is an elongate oval ciliated motile protozoan up to 40 um in length, which can become an opportunistic pathogen in marine aquariums. Because it is so generic-looking, identification in the field is always provisional. Most professional aquarists actually mean "*Uronema*-like" when they say "*Uronema*".

Necropsy findings:

Examining material from the lesion of an infected fish under a microscope will show massive tissue necrosis and huge numbers of motile ciliate protozoans, most likely *Uronema* sp. It turns out that *Uronema* is capable of developing intercellularly, that is, deep within the muscle and organ tissue of the fish. It isn't until it reaches a severe level that the lesions erupt to the surface of the fish's skin. Some bacteria, (in particular, *Vibrio* sp.) have also been isolated from these lesions, but the primary cause of mortality seems to be the *Uronema* protozoan. While *Vibrio* is capable of causing lesions on its own, these seem to form beginning at the surface of the fish's skin, penetrating deeper into the fish's tissue as opposed to working from the inside out as with *Uronema*. Additionally, *Vibrio* lesions usually have a distinct edge around them, sometimes of a lighter color, that is always lacking in *Uronema* lesions.

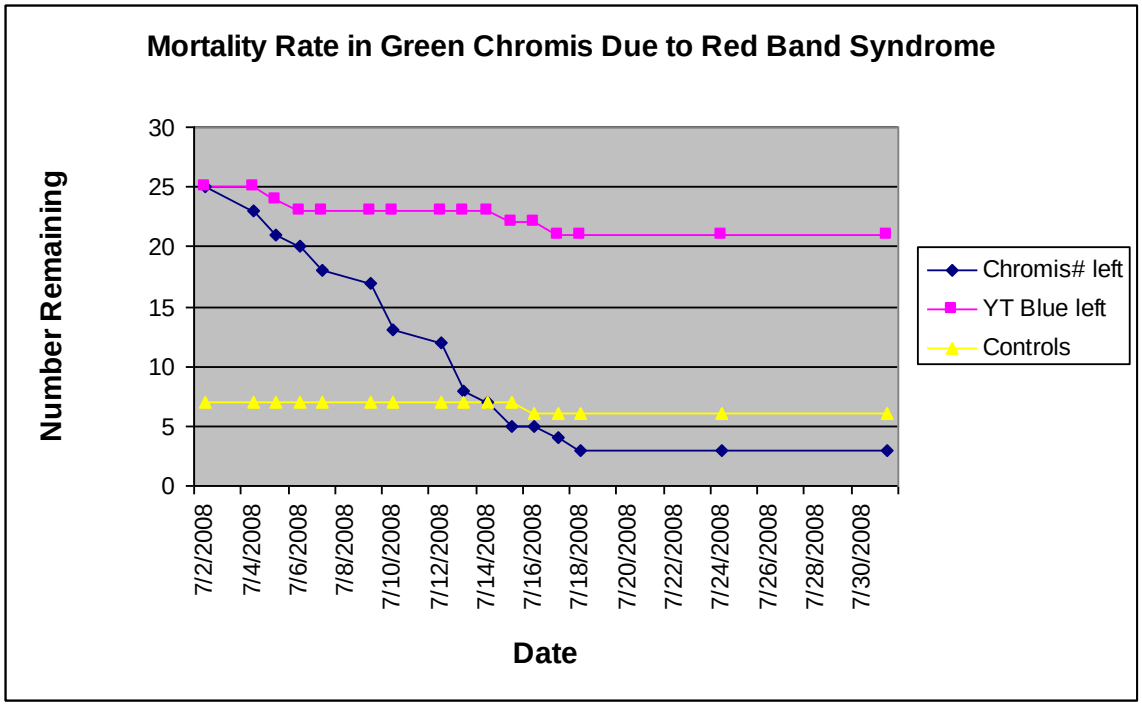
The author has seen this syndrome in only six families of fishes (in roughly descending order of frequency): Pomacentridae (damselfish, specifically of the genus *Chromis*), Serranidae (subfamily Anthiinae the Anthias), Syngnathidae (seahorses and seadragons) Labridae, (the wrasses) Chaetodontidae, (the butterflyfish) and occasionally, in Pomacanthidae, the angelfish. There are no doubt other species of fish that can be

infected. Most of the fish involved tend to have large, loosely attached cycloid scales, and it may be that other species are also affected, but because of different scale structure, have different symptoms. For example, weedy seadragons, (*Phyllopteryx* taeniolatus) develop small external white circular lesions and rapid breathing as the primary symptoms of internal *Uronema* infections.

Fish with larger, loosely attached scales are more prone to developing red band syndrome.

Case study:

Because red band syndrome is so commonly misdiagnosed by home aquarists, there are few accurate accounts of the disease progression in large groups of fish. Home aquarists buying just a few fish at one time do not always see the magnitude of the problem; their fish dies, but they do not realize that many of the fish in the same group sold to other hobbyists may have also died.



The table tracks the longevity of 25 green chromis (*Chromis viridis*) and 25 yellowtail blue damsels (*Chrysiptera parasema*) for 30 days after their acquisition from a major importer. The six control fish were in the same system and were post-quarantine captives (> 90 days). None of the four blue damsels that died showed signs of *Uronema* infection, their deaths were attributed to tankmate aggression. The one control fish that died during this time, a bicolor parrotfish (*Cetoscarus bicolor*) had been a long term captive but succumbed to *Uronema* evidently brought into the system with the Chromis. The Chromis experienced an 88% mortality rate within 16 days, and all were positive for *Uronema*. During this time, an organically chelated copper medication was used as a quarantine method (primarily to control another ciliate, *Cryptocaryon irritans*). Not shown on this graph was that during the ensuing 30 days, no additional fish of any of the three groups died. This implies that the disease was self-limiting and that there were no other acute husbandry problems underlying the initial high mortality rate in the green chromis.

Beware using hyposalinity treatments on certain species of fish such as this Bartlett's anthias, as they may develop red band syndrome as a result.

Relationship to Hyposalinity: There is a suspiciously high occurrence of *Uronema* outbreaks seen in fish being kept under hyposalinity (low salinity) to control another protozoan parasite, *Cryptocaryon irritans* (saltwater ich). It seems that *Uronema* either prefers low salinity water, or such treatments lower the fish's resistance to the protozoan. It may also be that many hyposalinity treatments are commonly administered in bare quarantine tanks, with warmer water and having higher than normal organic loading – a perfect habitat for *Uronema*. Either way – a higher than expected proportion of hyposalinity treatments involving susceptible species of fish develop problems with red band syndrome. In fact, hypersalinity, (increased salinity) is an effective treatment used by some aquarists to control chronic *Uronema* infections in seadragons and seahorses.

Cryptocaryon is a much more common disease, potentially affecting many more species of fish. Therefore, it might not be prudent to simply forgo using hyposalinity treatment as a quarantine method, but caution must be given when exposing wrasses, anthias or green chromis to hyposalinity treatments, as this will all too often result in fatal *Uronema* infections in those species.

A Green chromis, (*Chromis viridis*) that succumbed to red band syndrome after 10 days in quarantine. Notice the angled red band lesion and wide opened mouth; all common symptoms of this syndrome.

Disease Control: A variety of treatments have been suggested for *Uronema* infections, but full control is rarely seen following most of these treatments. Part of the issue seems to be that *Uronema* is ubiquitous, (naturally occurring in marine aquariums) and re-infection is commonplace. Bath treatments may fail because the medication used does not target the intercellular protozoans, only those living externally on the skin of the fish. Copper treatments may reduce the numbers of these ciliates, but good control is not seen until ionic copper levels reach 0.23 ppm, and this too close to the lethal limit for many species of fish. Formalin baths of various concentration and duration have been proposed, but this treatment is also mostly effective against external protozoans. Formalin treatments are administered on a sliding scale of concentration versus duration. Most fish can tolerate continual exposure to formalin at 25 ppm. On the other hand, formalin concentrations of 166 ppm may only be tolerated for one hour. It seems that the best control of *Uronema* may be found by dosing formalin at 75 ppm for three hours, and then changing enough of the aquarium's water to reduce the formalin level to the well-tolerated 25 ppm level (by changing 66% of the aquarium's water). Remember to take into account the length of time to perform the water change into the three-hour treatment time (for example, if it takes one hour to drain and fill the tank, you would need to begin that task beginning after the second hour of the treatment).

With some fish diseases, a proposed cure may actually be more damaging than the illness itself. In human medicine, this is called the iatrogenic effect, where the proposed cure causes its own serious problems, To avoid this, aquarists must always be aware of the Latin term; "Primum non nocere" or "First, do no harm". Oddly enough, this is sometimes ignored when freshwater baths and hyposalinity treatments are touted as cures for this problem. Since *Uronema* flourishes in brackish water, these treatments are ill-

advised. It is probable that most of these low salinity recommendations are based on the improper extrapolation from treatments for *Cryptocaryon* infections, but the two protozoans require very different control methods.

Because *Uronema* is not an obligate parasite, and is capable of feeding on bacteria, uneaten food, etc., it may help to maintain a cleaner aquarium – especially in bare-bottom quarantine systems. Any debris should be siphoned out of these tanks on a daily basis.

A series of qualitative in-vitro tests were conducted to test the efficacy of Chloroquine phosphate (a human anti-malarial drug) as a treatment against *Uronema*. These very basic tests seemed to show that this drug is effective at killing *Uronema* when used as a bath. In one instance, the body of a parrotfish fish that had succumbed to a *Uronema* infection was cut in half. One section of the fish was placed in tank water, the second section was placed in tank water dosed with Chloroquine at 40ppm (a higher than normal dose). After six hours, the number of *Uronema* in the treated sample had been markedly reduced, while the numbers in the untreated sample had actually increased. In another test, the bodies of two deceased green chromis were exposed to Chloroquine at 35 ppm. A marked reduction of the numbers of the ciliate was seen within three hours, and only one surviving Uronema was seen on the body of one of the fish after eight hours. A third green chromis that died from a *Uronema* infection was placed in water treated with Chloroquine at 30 ppm for 24 hours. Less than 1% of the Uronema survived. Using deceased fish for these bio-assays is problematic in that there is difficulty obtaining specimens "as-needed" and tests longer than 24 hours cannot be performed as the fish flesh begins to putrefy.

Chloroquine has been used to control protozoan diseases of fish for many years. Older aquarists may recall a product from the late 1970's known as "Marex" that was simply a small amount of chloroquine powder in a plastic tube. Public aquariums routinely use chloroquine, and can even measure the concentration of the drug in their exhibit water using ultraviolet spectrophotometers (Adams & Capen 2008). The use of chloroquine is not without its risks. There are some anecdotal reports that this drug may impair the nitrifying bacteria in aquariums, causing a subsequent rise in ammonia and nitrite concentrations of the water. This seems to be more of an issue with newer aquariums – well established systems usually do not see this problem.

Most suggested treatments with chloroquine call for a concentration of 10 to 20 ppm as a continuous bath in a quarantine aquarium. Activated carbon must be removed from the filters, and ultraviolet sterilizers should probably be turned off as there have been reports that ultraviolet rays will decompose chloroquine. The ammonia level must be monitored closely, and partial water changes or other methods employed to keep it below 0.50 ppm at all times during the course of the treatment. In 2020, misuse of chloroquine as a "treatment" for the Covid virus caused it to be removed from the open market. Currently, the only way to obtain this material is through a prescription from a veterinarian, and that is rarely given.

Conclusion:

Uronema is much more easily prevented than it is cured. Once the protozoan becomes systemic within the fish's tissues, it is rarely curable. The best means for prevention seems to be to quarantine all new fish for at least 30 days, maintain a proper

salinity, remove uneaten food promptly, do not overstock the tank and be prepared to act swiftly and decisively if your fish become afflicted with this malady.

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