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Surviving a Disease Outbreak in Koi Hobbyist-Level Aquaculture

By **Dr. Erik Johnson**, Veterinarian and Fish Health Specialist, <http://www.koivet.com>

Identifying Disease

Koi behavior (Usually the earliest cue)

- ? ? Appetite - Koi in optimal conditions are ravenous 24/7
- ? ? Activity - Koi do not naturally lay around. The minimum energy expenditure in health is the "cruising" behavior and the peak is represented in the "chase and dash"
- ? ? Isolation - No normal Koi will isolate unless it is under two to three inches in which case it may be normal predator evasion by margination.
- ? ? Swimming comportation (See <http://www.koivet.com/symptoms.htm> for full details)

Physical symptoms

- ? ? Muroid, ulcerative or other qualitative changes in skin, fin, body condition, gill
- Exclusion of environmental conditions which might mimic pathogenic disease

Interpretive thought process

Enumerate or itemize contributing **environmental** factors

- ? ? Has it been a cold winter? When is the last time they ate some food? Are they crowded? Is the water very warm? Are the fish stressed by an adjacent threatening factor?

Enumerate or itemize contributing **host condition** and husbandry factors

- ? ? Are the fish recently shipped or stressed? (Prognosis dims) Have the fish been on a varied and adequate diet?

Diagnostic process

Minimum Database (Do not proceed without the following numerical values or you are an idiot.)

- ? ? Ammonia, Nitrite, Nitrate
- ? ? pH and Total Alkalinity
- ? ? Skin and gill biopsy

Additional information for Database

- ? ? Heavy metals, Water hardness, insecticides, stray voltages, fecal examination

Integration of the interpretive and diagnostic thought process

You have to realize, after interpreting the contributing factors, and making a diagnosis, that the two factors are separate but when they intertwine, the prognosis for the fish dims considerably. For example, if the fish are recently shipped and they break with bacterial skin or gill disease shortly after receipt in the cold water of October, and your biopsy shows Costia, you are in serious trouble. There are numerous variables you have to control. It's not just a case of pouring in medicines.

Strategizing your therapy

- ? ? **Consequences** - All treatments represent a departure from nature's equilibrium. This is not desirable and requires adaptation on the part of the fish, in the short term this represents a stress, if the treatments are overlapped and extended, they represent chronic stress and will precipitate a collapse of the immune system. Then, nothing will work on the fish, they will flip and die in the Hospital tank. **[People kill fish with over-treatment when they operate without the above, minimum data base of information!!!]**
- ? ? **Objectives**- Have reasonable goals for the fish. A reasonable objective would include the following four factors, at which time the fish can and probably should be returned to the main facilities wherein a natural equilibrium exists.
 1. Return of appetite
 2. Clearance of surface pathogens as determined by microscopy,
 3. Evidence of preliminary healing of skin wounds,
 4. Return to normal "friskiness"

- ? ? **Recommendations** - Correction and optimization of the environmental factors is very important BEFORE treatment is instituted. Do not overcrowd the hospital tank, nor should you have one fish in there, alone! Looking at a list of environmental factors that influence the treatment choices, treat the most deleterious pathogen first. Often, your first treatment will clear the entire panel of pathogens, an example is Potassium permanganate or perhaps Formalin. If a bacterial infection is super-imposed on another parasitic issue, you should curb the parasitic issue first, and the bacterial issue after the fish have adapted to whatever therapy you have instituted for the parasitic issue. Once diagnosed, the sooner you start injections for the bacterial issues, the better the fish will do.

Generalities Concerning the Proper Hospital Tank

- ? ? "Larger is better" with regard to tank size (Ideal 300 gallons+) and will increase your success rate. ("No wonder my fish died, it was fourteen inches in a thirty gallon aquarium!") If you cannot provide a large, roomy hospital tank, you are completely screwed.
- ? ? Natural sunlight filtered by foliage will increase your success rate.
- ? ? A coating of algae on the tank walls will increase your success.
- ? ? Feeding freeze-dried krill will increase your success rate.
- ? ? Temperatures in the mid-seventies °F are optimal and will increase your success rate. Warmer is not qualitatively 'better'. It decreases oxygen availability and this can matter to fish with gill parasites or lesions.
- ? ? Minimize turbidities with flocculents such as Enviro-Reps Rapid Klear® or Aquarium Pharmaceuticals' Accu-Clear®. Aerate well during and after use.
- ? ? If the water "stinks" or appears foamy or cloudy, it's a warning that your DOC (Dissolved Organic Content) is dangerously high and a negative outcome can be expected unless you do a 90+% water change with plain old dechlorinator.
- ? ? Covering a hospital tank is smart, but not if it obscures natural sunlight or inhibits algae growth. Ideally, float a Styrofoam-box-lid on the surface, the fish will hide under it. Then, bird-net the tank.
- ? ? Keep the hospital tanks clear of anything the fish will "beat themselves" on. Avoid sharp edges or other appliances that could abrade the fishes' skin or snouts.

Aftermath of a bacterial disease outbreak

I will remind you that a bacterial infection represents an interpretive **and** a diagnostic process. If you are approaching the case correctly, you will have obviously diagnosed the environmental factors that may mimic pathogenic disease and you will have determined the pathogen. The interpretive process will also reveal contributing factors, which are present historically, and they bring home an important point:

- ? ? The reason that bacterial infections seem to spread from fish to fish is because of "latency". This means that ALL the fish are exposed to the bacterial invader when it's introduced, usually on the haptens of a fluke, and ALL the fish suffered together through the long winter, the bad water, the recent shipping, etc. When the first fish breaks with "overt" visible disease, you begin to diagnose and treat that fish. [Now remember they were all inoculated and they all suffered the same environmental contributors!] A couple days later, another fish shows up with disease. It has been brewing, you see. Indeed, if you've properly interpreted and diagnosed the disorder, it should appear obvious that it's inevitable that almost all (except the most immunologically strong) of the fish will show overt symptoms sooner or later.

The aftermath of a bacterial infection outbreak is usually a frustrated owner who treats each fish as it breaks with clinical (visible) symptoms and becomes convinced that the disease is still spreading from fish to fish when in actuality it is present from the beginning of the outbreak but shows up at varying times based on the fishes' genetic constitution. GoSanke, Goshiki, Hi and Ki Utsuris and other highly bred fish tend to break first, with the Chagoi, Sorogoi or other "closer-to-carp" specimens breaking last, if at all!

It probably seems aggressive, but it is not unwise or unsuccessful to treat all the fish at once at the outset of an obviously morbid bacterial disease outbreak. Here's a guideline.

1. Diagnose and interpret the condition
2. Correct and optimize environment factors
3. Treat surface pathogens and lesions
4. **Inject all fish once at the outset.**
 - ? ? Do not re-inject the clinically normal fish (Yes, resistance issues, duhhh.)
 - ? ? Re-inject fish with minimal infections only once. Realize that further handling may contribute to the cumulative effects of stress
 - ? ? Re-inject sick fish every 36-48 hours for a total of three injections or until healing starts. If four to five injections are done and recovery is not underway, the infection is misdiagnosed or all the environmental contributors have not been identified.

Aftermath of a Parasitic Disease Outbreak.

Parasitic infections have the following common aftermath

- ? ? Bacterial secondary infections of skin or gill.
- ? ? **Environmental deterioration after a water-borne treatment has annihilated the beneficial heterotrophic bacteria.** [Seemingly inevitable among hobbyists]
- ? ? Residual or sequestered pathogens which can repopulate the collection.

Steps to avoid the above aftermath

- ? ? Observe for, and treat expediently for bacterial infections. The gills should be examined on any fish that isolates during or after a parasitic disease treatment.
- ? ? Check water quality daily and take precautions to spare heterotrophic bacteria in your biological filtration system via bypass or removal of media.
- ? ? Make sure to perform, or have-performed, a skin and gill biopsy at the time you are pronouncing the collection "clean and cured". It's not a bad idea to get a "heads-up" biopsy in the Fall so you don't put fish to bed with unwanted bedbugs.