

## Virginia Tech report on South Fork Shenandoah fish deaths

Dr. Stephen Smith, DVM, PhD  
Professor of Aquatic Medicine/Fish Health  
May 13, 2005

This summarizes the diagnostic laboratory findings identified from the three species of fish (long-eared sunfish, smallmouth bass, and white sucker) you sent us last week for evaluation. All fish arrived alive and were humanely euthanized for examination.

### VT05-906 (long-eared sunfish)

External examination showed that almost all of these fish presented with localized skin and fin lesions of varying severity. Some of the lesions were superficial, while others were deep ulcerations into the dermal tissues of the skin and fin. Skin biopsies of these areas revealed that most of these lesions had a mixture of parasitic protozoans (*Trichodina* sp, *Epistylis* sp.), several monogenean flatworms, some bacterial and fungal elements. Gill biopsies also had low numbers of the parasitic protozoans (*Trichodina* sp, *Epistylis* sp.) and a few monogenean. Most of these potential pathogens were found in low numbers on the skin and gills, but did not appear to be in numbers sufficient to cause lesions by themselves.

On internal examination, the fish (8 females and 6 males) all appeared to be fairly normal and in various stages of sexual reproduction. All appeared to have been eating well, and most had food material in their stomach and intestinal tracts. Almost all of the internal organs looked fairly normal, and there was an adequate amount of body fat present in the abdominal cavity of most fish.

Histopathology of the fish showed a mild to moderate amount of local to generalized hyperplasia (thickening of the epithelium) of the gill tissue, a few encysted (encapsulated) digenetic trematode (flatworm) larvae in various organs (liver, kidney, heart, and mesenteric tissues), a few small intestinal and cecal nematodes (roundworms and in one fish a mild pericarditis (inflammation of the outer surface of the heart). The remainder of the tissues appeared within normal limits. Bacterial samples of these fish did not produce any culture growth of significance.

### VT05-907 (smallmouth bass)

External examination showed that most of these fish also had skin and fin lesions of varying severity. While some of the lesions were superficial, most were deep ulcerations into the dermal tissues of the skin. Skin biopsies of these areas revealed that most of these lesions had both bacterial and fungal elements present. Gill biopsies demonstrated a few *Trichodina* sp., *Epistylis* sp., and monogeneans. Again, most of these pathogens of the skin and gills were found in very low numbers.

On internal examination, all of these fish (5 females and 3 males) appeared to be normal and in various stages of sexual reproduction. Most appeared to have been eating well, and most had food material in their intestinal tracts. Almost all of the internal organs grossly looked fairly normal, and there appeared to be an adequate amount of body fat present in the abdominal cavity of these fish.

Histopathology of the fish showed a mild to moderate amount of generalized gill hyperplasia, with a few localized areas of severe hyperplasia of the gill tissue. The spleen and mesenteric tissues of one fish had a few small granulomas (walled off areas of tissue necrosis) and a few localized areas of tissue inflammation. There were a small number of encysted digenetic trematode larvae in several organs (liver and kidney), and a small number of larval nematodes in the wall of the intestine. In addition, there were several adult nematodes and one adult cestode (tapeworm) in the lumen of the intestine of one fish. The remainder of the tissues of these fish appeared within normal limits. Bacterial samples of these fish did not produce any bacterial growth.

#### VT05-908 (white sucker)

External examination showed that three of the five submitted fish (2 females, 3 males) presented with small, circular skin and fin lesions of varying severity. Most of the fin and gill lesions appeared as small, raised, white bumps, while some of the skin lesions appeared as ulcerations of raised, white bumps. Skin biopsies of these lesions on both the skin, fin and gill revealed these were cysts caused by an unidentified protozoan (myxosporidean) parasite. It appeared that once the skin cysts ruptured, they became secondarily infected with bacteria from the water. Gill biopsies showed an increased amount of mucus on the gill tissue and a small numbers of *Epistylis* sp. organisms.

Internal examination demonstrated that the fish (x females and x males) were in excellent condition, with an abundant amount of body fat present in the abdominal cavity. All of the fish appeared sexually mature.

Histopathology of the fish showed a moderate amount of generalized gill hyperplasia, a few encysted digenetic trematode larvae in the heart, and confirmed the identification of the myxosporidean parasite in the skin. The remainder of the tissues appeared within normal limits. Bacterial samples of these fish did not produce any culture growth of significance.

#### Summary

In summary, none of the lesions or identified pathogens account for the observed mortality you have been experiencing in the Shenandoah River. In addition, if a common pathogen was causing this mortality, one would expect the particular pathogen to be observed consistently in all three species of fish which was not the case. Most of the observed pathogens are either considered relatively non-pathogenic in low numbers (i.e. protozoan parasites, monogeneans, encysted digenetic trematode larvae) or incidental findings that may have contributed but not directly caused the mortality in these fish. For instance, only one fish out of the sampled group was systemically (internally) infected with a potential bacterial pathogen. Therefore, as we have previously discussed, the most likely scenario for the observed fish mortality is secondary bacterial and fungal skin infections due to immune suppression of the fish as a result of fluctuating water and environmental temperatures. This situation is probably made worse by the high organic and bacterial loads of the river system at this time of year. As a result, when the integrity of the skin is compromised by an ulcerative lesion as seen in these fish, the fish lose their ability to osmoregulate and ultimately die due to ion/mineral imbalance.