

# Enteric Septicemia of Catfish

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Enteric Septicemia of Catfish (ESC) has become one of the two most significant diseases of economic significance in the catfish industry. ESC is a highly fatal systemic infection caused by the bacterium *Edwardsiella ictaluri*. The disease was first identified and the causative agent determined at Auburn University in 1976. Since these early beginnings, ESC's movement into the commercial catfish industry more than 30 years ago, it has spread throughout the industry and is now present and a strong economically significant pathogen in most fish stocks and culture ponds.

*E. ictaluri* is a type of bacteria that is comparatively host specific for channel catfish. ESC outbreaks usually occur within a temperature range of 22°-28° C. This thermal range is also optimal growth and virulence of *E. ictaluri*. Typically, this thermal range is associated with pond temperatures in spring and fall. As water temperature rises above 30° C or drops below 20° C the bacteria becomes inefficient and becomes dormant or dies. The bacterium is generally not able to cause disease outbreaks in catfish until the environmental temperatures are again favorable.

Husbandry and environmental stress play significant roles in determining the clinical and economic impact of *E. ictaluri* infections. Nevertheless, this organism is considered a primary pathogen and is capable of causing substantial losses even on well-managed farms.

Researchers at various institutions have demonstrated that ESC bacteria can survive for three months in moist pond mud at 25° C. As a result of this study, it was proposed that pond muds are one source of re-infection in culture ponds during the fall. In this same study, *E. ictaluri* was shown to survive less than five days in mud held at 5° C. Pond muds do not appear to be a source of infection in the spring. Other studies have shown that ESC bacteria can be isolated from brain tissue when the bacteria is inactive due to low water temperature (<20° C). Springtime disease outbreaks are thought to be initiated by carrier fish which have maintained *E. ictaluri* in their bodies over the winter.

## Cause of ESC

Enteric septicemia of catfish can occur when a susceptible host (channel catfish) encounters a virulent pathogen (*Edwardsiella ictaluri*) under the right environmental conditions. Although ESC may occur in healthy fish in non-stressful environmental conditions, stress factors such as handling, close confinement, improper diet, low water chlorides, poor water quality, and water temperature fluctuations all lead to increased susceptibility to infection. The introduction of ESC-infected fish into a pond containing healthy fish, or stocking healthy fingerlings into a pond containing older catfish that are carrying *E. ictaluri*, can result in the perpetuation and spread of ESC. Fish that survive an outbreak can carry the bacterium in the brain, kidney and liver for extended periods (up to 200 days). These survivors develop specific immunity that protects them from subsequent infection and disease

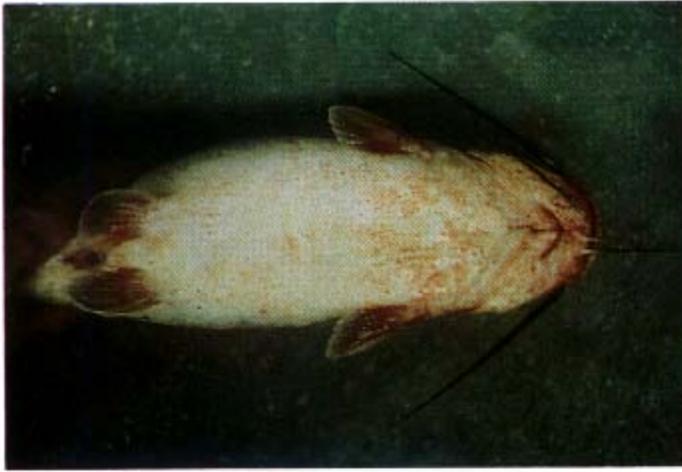
ESC affects all ages of channel catfish. The size segment of fish hardest hit by ESC seems to be overwintered fingerlings going into their second growing season. Natural immunities have been shown to develop with exposure to the bacteria which corresponds with increased age of fish. Older fish are generally more resistant to ESC infection than younger fish.

Fish commonly get their first clinical infection with ESC when they are fingerlings. Once a fish is infected, it may either: **1)** become clinically ill and die; **2)** become clinically ill, recover and develop protective immunity; **3)** become clinically ill, recover and develop protective immunity but become a carrier and 4) become sub-clinically ill (the catfish farmer cannot detect the infection) and develop protective immunity

All of these scenarios may occur in different fish within the same pond. Antibiotic therapy can prevent death and production losses due to ESC. When antibiotic therapy is initiated after fish in a pond have become clinically ill, fish will either: **1)** die if they do not ingest enough antibiotic or if the disease has progressed too far; **2)** recover and develop protective immunity; **3)** recover and develop protective immunity but become a carrier ; 4) remain healthy and develop protective immunity.

## Clinical Signs

*E. ictaluri* causes a number of devastating changes in channel catfish. There are a number of clinical signs associated with ESC, but it should be noted these signs are by no means restricted to ESC infections alone. Other disease problems do share some of these clinical signs. Channel catfish infected with *E. ictaluri* in the same pond may exhibit a number of different signs of the disease.



**ESC rash**

Photo by A. J. Mitchell, Fishery Biologist,  
Fish Farming Experimental Laboratory, Stuttgart.



*Figure 1. Red and white ulcers on the skin of a charrel catfish with ESC. (Photo courtesy of Joe Newton)*

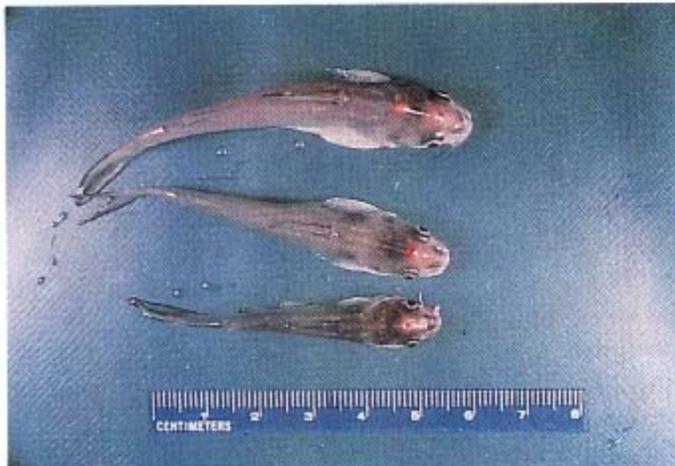


**ESC showing white circular spots**

Photo by A. J. Mitchell, Fishery Biologist,  
Fish Farming Experimental Laboratory, Stuttgart.



*Figure 2. Petechial hemorrhaging caused by ESC on the ventral surface of a charrel catfish. (Photo by John Hawke)*



**ESC "hole-in-the-head"**

Photo by A. J. Mitchell, Fishery Biologist,  
Fish Farming Experimental Laboratory, Stuttgart.



*Figure 3. This red and white lesion at the cranial foramen of a charrel catfish fingerling is a sign of ESC of catfish. (Photo courtesy of Al Casas)*

## Physical Signs

- Small (2-3 mm diameter), circular, red spots over the entire body.
- Rash-like areas on body.
- Bloody areas on base of fins.
- White circular spots (2-3 mm diameter).
- Raised reddish area on top of head.
- Ulcerated areas on top of the head (hole-in-the-head).
- Protruding eyes.
- Bloated fluid filled belly (yellowish or bloody).
- Internal organs and tissue hemorrhages.
- White pustules in the liver.

## Behavioral Signs

- Reduction of feeding intensity.
- Erratic swimming, swirling, and jumping.
- Hanging head up, tail down in the pond.

## Prevention

Prevention of ESC is difficult because of its widespread distribution throughout the catfish industry. Various management practices, however, can reduce the incidence and impact of ESC. These include reducing stress, using proper nutrition and feeding practices, and administering drugs and chemicals correctly.

**Stress** – The most common advice given for the prevention of bacterial disease in fish is to avoid stress. This is a difficult goal to accomplish because commercial aquaculture is stressful by nature. Stocking density may be the most important factor, with higher stocking densities increasing the efficiency of disease transmission and spread throughout a population. Although reduction of stress is helpful for prevention of disease, it is not always effective because *E. ictaluri* can cause disease even in the absence of apparent stress.

## Treatment

All suspected cases of ESC should be confirmed by a disease specialist before treatments are initiated. The use of chemical treatments, such as copper sulfate to control algal blooms and parasites, should be avoided during the ESC temperature window. The increased stress due to degraded water quality and the possible immunosuppressive effect of copper sulfate can result in severe outbreaks of acute ESC with high mortality rates.

Antibiotics sensitivity should be determined to ensure the effectiveness of the prescribed treatment. ESC infections can sometimes be controlled or managed by offering feed containing the following antibiotics:

Terramycin (oxytetracycline), Romet (sulfadimethoxine-ormetoprim) or Aquaflor (florfenicol) as antibiotic feeds. A few strains of *E. ictaluri* have been identified that are resistant to both Romet and Terramycin. Antibiotics used to treat ESC should be based on drug sensitivity tests, feeding intensity of the fish, associated secondary infections (in most cases of ESC other disease organisms such as protozoan parasites and other species of bacteria are present and must be considered) and economic considerations.

**Terramycin** should be fed for 10-14 days and then followed by a 21-day withdrawal period before slaughter.

**Romet feeds** should be fed for five days followed by a three-day withdrawal period before slaughter.

**Treatment with Aquaflor** incorporated into floating catfish feed and administered daily for 10 consecutive days. A withdrawal period of 12 days has been established by Food and Drug Administration for Aquaflor-treated channel catfish.

One commonly used approach to managing the effects of ESC is to interrupt feeding or to feed in a very restricted way. This is done during the time the temperatures are most conducive to mortality from ESC. Often this is in late summer or early fall when fish appetite is very robust and growth is rapid. This has a strong economic impact on profitability of grow-out ponds.

Catfish infected with ESC usually slow or stop feeding in cooler weather as the infection progresses. Fast and accurate diagnosis is extremely important since the only way to treat the infection is through oral antibiotic therapy. Typically, the farmer has to wait until his fish become sick and, by this time, the whole pond is likely infected but at the same time building immunity. When feeding an antibiotic feed, it is best to administer the feed two to three times a day to ensure weaker fish have a chance to feed.

Fish can become immunosuppressed due to a variety of conditions and can re-break upon exposure to ESC in the pond or from carrier fish. This can occur whether fish have immunity from vaccination, natural exposure or from a previous outbreak that was treated with antibiotics. Fish immunity can be compromised due to nitrite toxicity, chemical over-treatment, oxygen depletion or another disease. In addition, large numbers of ESC organisms can overwhelm protective immunity.

## **Conclusions and Future Outlook**

Clinical disease from ESC is costly due to mortality and reduced weight gain. Saline water such as that found in western Alabama can help in reducing outbreak impact relative to non-saline waters.

Antibiotics can prevent losses during initial ESC outbreaks while at the same time allowing the fish to develop protective immunity.

Protective immunity, however, regardless of the fish's history, can be overwhelmed due to immunosuppression or a high pathogen load in the pond, resulting in re-breaks. In these cases, proper antibiotic treatment can again minimize losses.

The development of ESC vaccines is a promising area. Recent studies have shown that vaccines reduce the incidence of ESC related mortality but do not completely eradicate the problem.

Genetically improved stocks which are resistant to ESC are of strong interest to researchers. Hybrid catfish show considerable promise in resistance to ESC.

## **Additional Reading**

Hawke, J. P., R.M. Durburrow, R.L. Thune and A. C. Camus. 1998. ESC- Enteric Septicemia of Catfish. SRAC Publication No. 477.

