Fuzzy Winter Sunfish

Influence of Management Decisions on Fungus Outbreaks

Definition

- *Saprolegnia* (winter fungus, winter mortality and winterkill syndrome)
- Typically thought as a “secondary” invader.
- Referred to as a “cold water” fungus as it flourishes in colder water (below 59 F), but it lives well in a wide range of water temperatures extending from 37 F to 91 F.
- Mortality usually increases as temperatures rise in early spring.

What spreads this disease?

- Overcrowding – stress and too many organics in too little water
- Handling – stress and removal of the mucous coat on the fish
- Epidermal integrity – open wounds that provide direct access to tissue
- Parasites and pathogens – parasites cause wounds that allow pathogens (like bacteria) to enter the tissue thus giving sap a change to take hold and stress

What spreads this disease?

- Pollution – stress and reduced water quality
- Spawning – stress and physical damage
- Water quality – stress and reduced physiological conditions
- Water temperature changes – stress.

Diagnosis

- Diagnosis is based on typical gross clinical signs where the skin, gills and other surfaces of an infected fish or eggs become covered with white, cottony tufts of fungal growth.

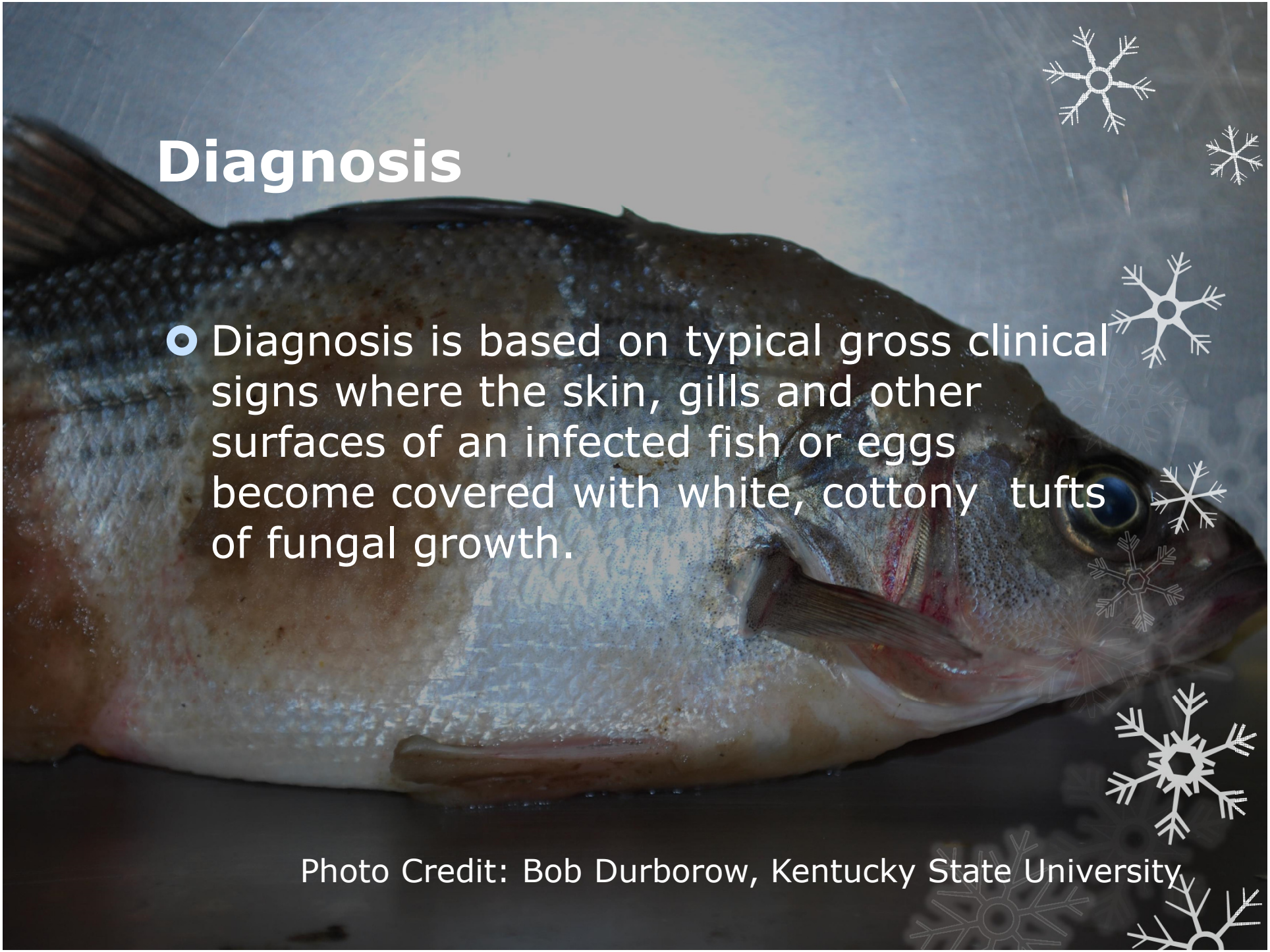


Photo Credit: Bob Durborow, Kentucky State University

Clinical Signs

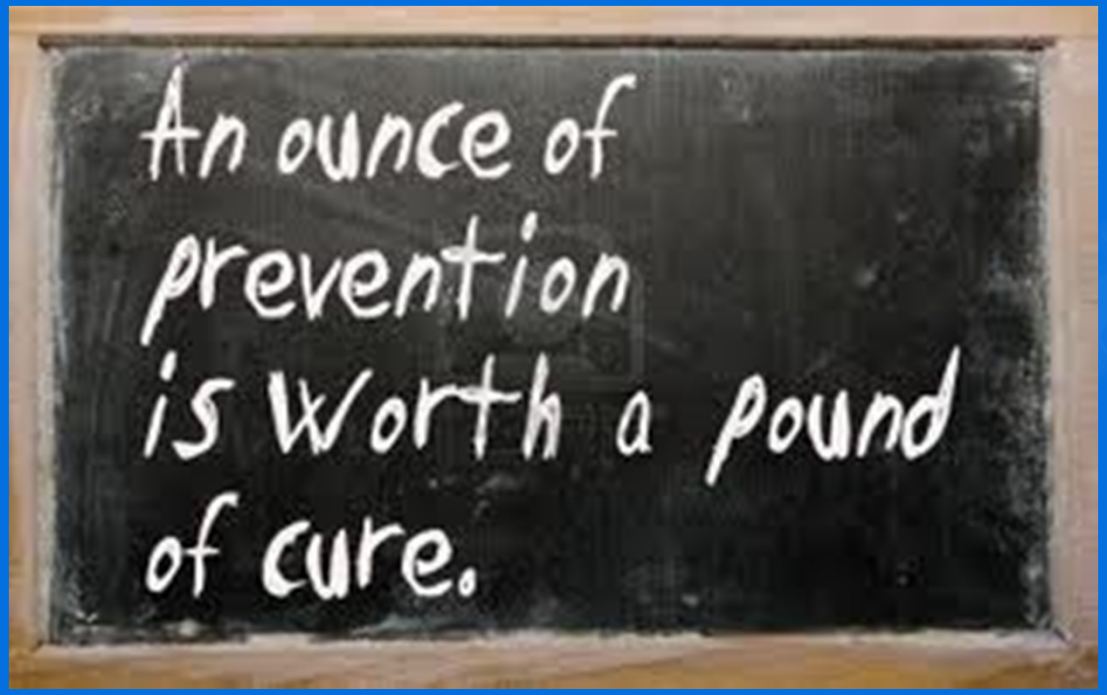
- Gray-white lesions on skin
- Lesions start small and circular: spread can damage internal organs
- ALL fish susceptible!!

Source

- Can live on dead or live matter, affect only fish which have been compromised in some way:
  - suppression of immune system (unfavorable temps)
  - injury to skin (trauma)

Susceptible Fish

- Primary risk factor is thought to be the inability of the fish to adapt to rapidly fluctuating water temperatures during the winter months.
  - Impair the fish's immune system, cause a loss of mucus from the skin, and temporarily suppress mucus production in the dermal layers of the skin.
  - Mucus (contains antimicrobial components) provides a physical barrier that prevents fungal spores from contacting and infecting the skin of the fish.



Prevention

Broodstock

- Broodstock should be handled in cool water, which is conveniently available during stocking season (late winter to early spring).
- Fish should be handled as little as possible, sedated when practical, and transported in well oxygenated tanks.
- Thermal shock should be avoided at all costs.

Environmental Conditions

- Winterkill
  - Highly eutrophic, shallow lakes and ponds in the northern prairie region to have over 50 per cent of their volume in ice during severe winters.
  - Low oxygen levels possible in ponds covered with cloudy ice and snow
  - Management
    - Clear ponds surface of snow
      - Photosynthesis in the waters under the ice actually maintains high levels, even supersaturation, of dissolved oxygen.
    - Use of airlift pumps or aerators to form a refuge for fish

Fish Harvest

Fish Harvest

- Harvest after 2 days without food
- Do not handle fish in less than 60°F
- Harvest fish using un-tarred seines and soft-mesh nets
- Do not overload dip nets or loading baskets.
- Fish should be handled rapidly, and delicate, scaled species should be kept in water whenever possible.

Fish Harvest

- Avoid the warmest times of the day and direct, bright sunlight.
- Minimize the time out of water on windy days when the drying effect is greatest.
- Avoid injuries (broken or damaged fins and scale loss), which provide sites for opportunistic infections. Adverse effects from stress are additive and cumulative.
- Always avoid temperature shock.
- Any sudden temperature difference of more than 10° F can harm fish, particularly smaller ones. Cold winter air and wind chill factors can cause temperature shock when fish are moved in nets.

Fish Loading

- Load fish carefully into transport units.
- Delicate fish should be given mild sedation while in the holding vat. Increase the oxygen supply while fish are being loaded.
- Check dissolved oxygen (DO) in hauling unit to assure adequate concentrations
- To lower water temperature about 10° F use ice at 1/2 pound per gallon. Avoid using ice made from chlorinated drinking water, as some species are extremely sensitive to chlorine. Lowering the temperature during transport quiets fish, lowers their rate of metabolism and increases the oxygen saturation level.

Loading Rates

- Largemouth Bass (trips < 30 h)

Fish Size (Inches)	Loading Rate (lbs/g)
5	1.5
4	1.0
3	0.66
2	0.5
1	0.33

Source: SRAC #393

Loading Rates

- Bluegill (65-80F and up to 16 h)

Fish Size (inches)	Loading Rate (lbs/g)
4	1.00
3	0.66
2	0.5
1	0.33

Source: SRAC #393

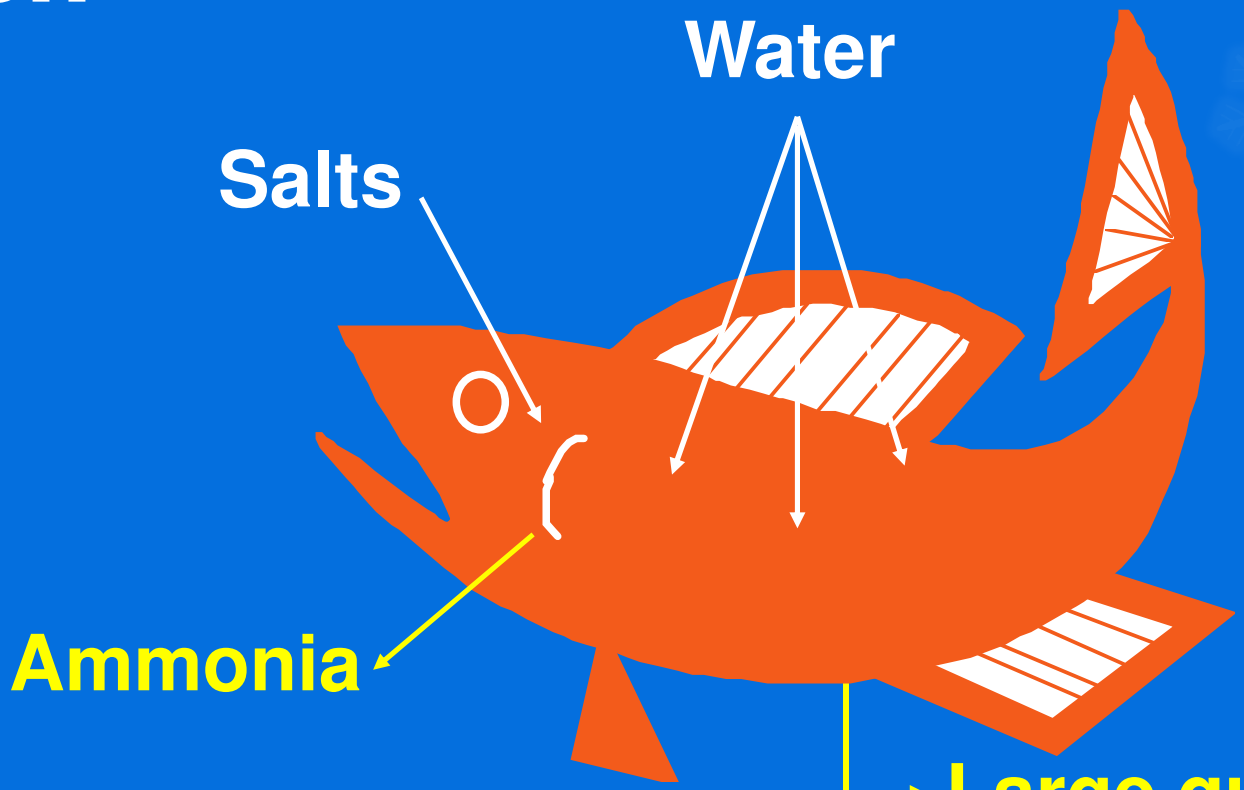
Fish Transport Water Quality

- Hardness and alkalinity levels
  - 50 to 100 ppm are preferable.
  - Sodium bicarbonate and calcium chloride will increase alkalinity and hardness, respectively, are safe to use and have no restrictions.
- Anti-foaming agents are used to combat the formation of scum or foam on the water surface.
  - Foam buildup interferes with observing fish and may inhibit some gas exchange.

Fish Transport Water Quality

- Maintain pH at 7-7.5
- Watch D.O levels
  - Low and high
    - Gas bubble disease

Water Balance in Freshwater Fish



Use of Salt

- Common table salt without iodine
- The concentration of salts in the blood of most fish is 1 to 1.2 percent.
- Adding salt to the transport water reduces the mineral difference between the water and fish blood which lessens the effects caused by this osmotic imbalance.

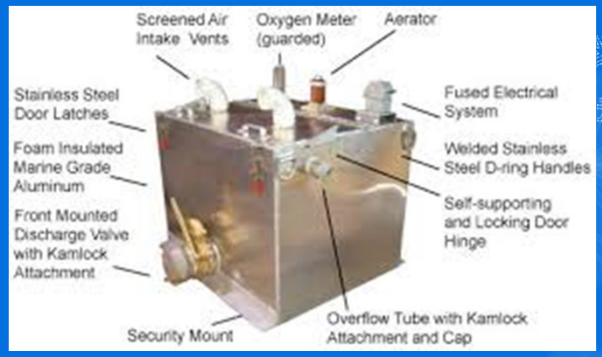
Use of Salt

- Salt is added to make solutions of .05 to 1 percent (500 to 10,000 ppm), depending on the species of fish.
  - Equivalent to 0.4 to 8 pounds of salt per 100 gallons of water. Use the lower rates on freshwater fish.
  - Use 0.5% for sunfish

Hauling Boxes

- Insulated tanks
  - Temperature control
- Proper aeration equipment
  - Use of dissolved oxygen instead of surface aerators for oxygen when possible
  - CO2 removal through aeration

VS



Fish Anesthetics

- Reduces metabolic activity.
- Less oxygen consumption and less carbon dioxide and ammonia buildup.
- Also, energy is conserved which is available for maintaining ion balance.
- Fish can be over-anesthetized and die.
- Larger individuals generally require greater concentration than smaller fish but are anesthetized faster.

Fish Anesthetics

- Finquel™ and Tricaine-S™
  - Not registered for use on food fish in the U. S
    - 21-day withdrawal prior to fish consumption
  - 15-330 ppm for 6-48 hours transport
  - ~75 ppm for sunfish

Finquel™ and Tricaine-S™

- Higher doses or longer exposure times required at cold temperatures
- Lowers the pH of water
  - To prevent problems, the stock solution can be buffered with sodium bicarbonate (baking soda) to achieve a pH of 7.
- One of the major drawbacks of MS-222 is that even when fish are deeply anesthetized, handling still increases levels of plasma cortisol concentrations, an indicator of stress.
- Recovery is usually rapid and equilibrium can be expected to return after only a few minutes.
- A recovery time longer than 10 minutes suggests that too much anesthetic is being used or that the exposure time is too long.

Unloading Fish

- Advisable to mix receiving water with hauling water before releasing fish into a pond. This tempering is recommended if the pH difference is 1 or more units or the temperature difference is more than 10° F.
- Temper fish at least 20 minutes for each 10 F difference
- Small fish most susceptible
- For short trips, the hauling temperature should be similar to that of the water at the destination. For trips longer than 8 to 12 hours, tempering can begin several hours before arrival.

Treatments for Fungus

Possible Solutions

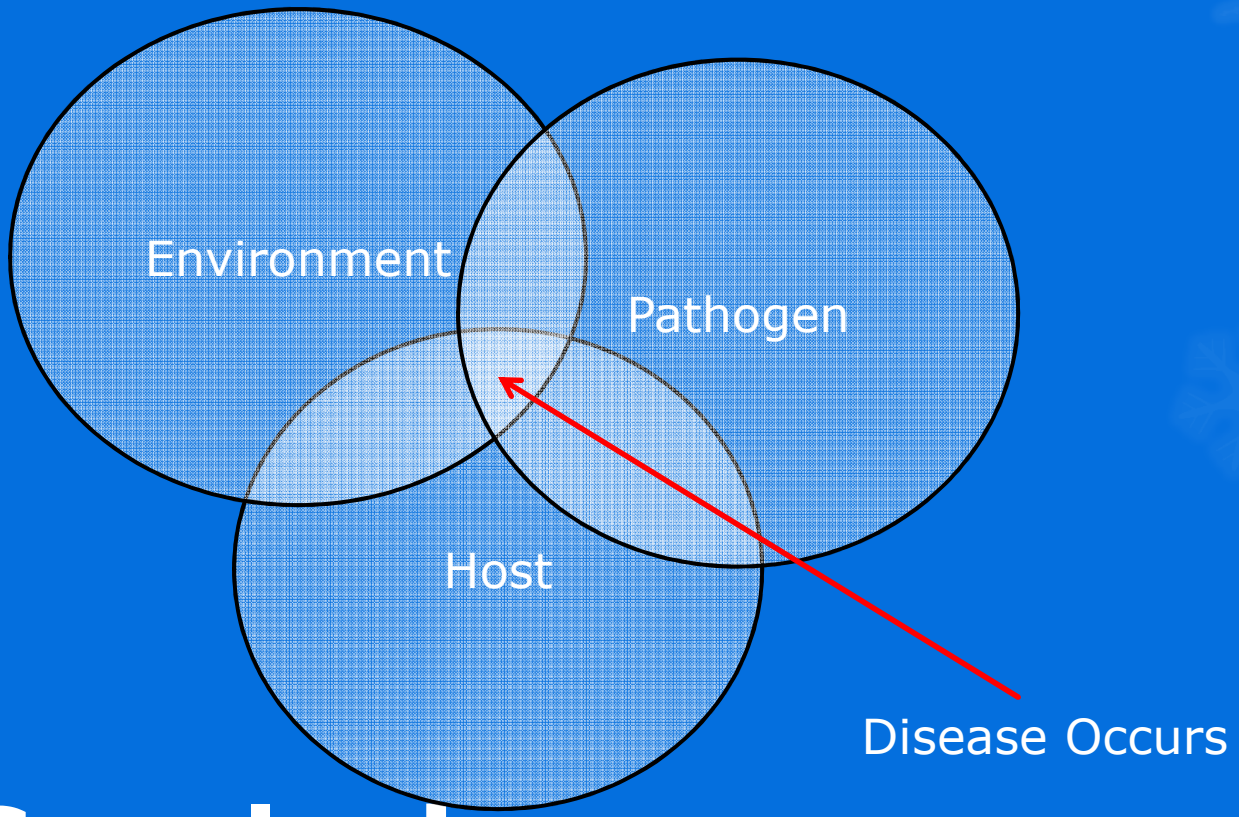
- Reduce densities earlier in the fall to have lower densities over winter
- Continual winter aeration
- Treatment with copper sulfate
- Addition of vitamin C to the diet in the fall?
- Probiotics?
- Indoor culture

Treatment and Prevention

- Use of prophylactic chemical treatments
  - Laboratory trials
    - Formalin (25 ppm)
    - Copper sulfate (rate depends on water alkalinity)
    - Diquat (0.125 ppm)
    - Higher rates needed in ponds than in lab trials

Useful References

- The Role of Stress in Fish Disease
  - SRAC Publication No. 474
    https://srac.tamu.edu/index.cfm/getFactSheet/whichfactsheet/121/
- Saprolegniasis (Winter Fungus) and Branchiomycosis of Commercially Cultured Channel Catfish
  https://srac.tamu.edu/index.cfm/getFactSheet/whichfactsheet/170/
- Diseases of Warmwater Fish and Trout Diseases
  - DVD available for $30 from robert.durborow@kysu.edu



Conclusions

Drugs in Aquaculture

Drugs in Aquaculture

Drug Use

http://www.fws.gov/fisheries/aadap/drugs.htm

Drugs in Aquaculture

Drug Use

Winter Fungus drugs:

Formalin, Malachite Green, Hydrogen Peroxide

Copper sulfate, Salt, Potassium Permanganate

Drugs in Aquaculture

Drug Use

Approved Drugs

Extra Label Drug Use

Investigative New Animal Drug (INAD)

Low Regulatory Priority (LRP) Drugs

Special Category

Generally Regarded as Safe (GRAS) Drugs

Forbidden Drugs DFA Deferred Decision Veterinary

Feed Directive Drugs (Medicated feeds)

Drugs in Aquaculture

Drug Use

- Approved Drugs - Immersion
  - Formalin (only for fungus on eggs!)
    - Formalin-F™ - NADA 137-687
    - Formacide-B - ANADA 200-414
    - Paracide-F® - NADA 140-831
    - Parasite-S® - NADA 140-989
  - Hydrogen peroxide (only for fungus on eggs!)
    - 35% PEROX-AID® - NADA 141-255

Drugs in Aquaculture

Drug Use

- NO FDA APPROVED Drugs – for fish saprolignia

Formalin (only for fungus on eggs!)

Options:

Extra label use by veterinary prescription

INAD 9013 External fungus

Hydrogen peroxide (only for fungus on eggs!)

Options:

Extra label use by veterinary prescription

INAD NOT AVAILABLE for saprolignia

Drugs in Aquaculture

Drug Use

Potassium permanganate – Not Approved

SPECIAL REGULATORY

Options:

INAD 9246

Copper Sulfate – Not Approved

SPECIAL REGULATORY

Options:

INAD 9101

DO NOT USE below Total Alkalinity of 50. Calculate by TA/100=ppm $CuSO_4$ < 2.5 mg/L total

Drugs in Aquaculture

Diquat

INAD NOT AVAILABLE for fish saprolignia.

Malachite Green

FOREBIDDEN!!!!

Salt

Low Regulatory Priority

Drugs in Aquaculture

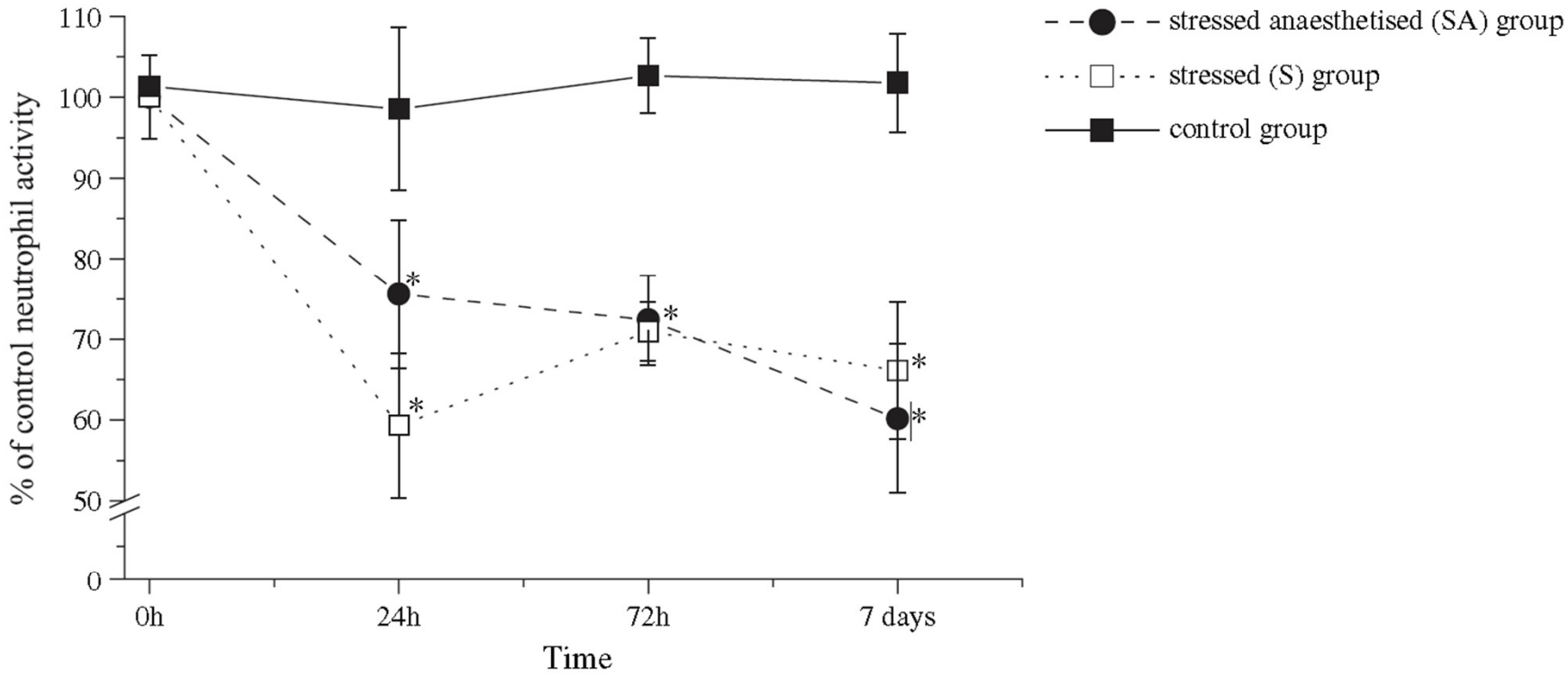


Fig. 5. The reduction of neutrophil activity in adult fathead minnows exposed to handling and crowding stress with (SA) or without (S) 75 mg mL^{-1} of MS-222 for 20 min. At 24 h, 72 h and 7 days post exposure significant decrease in activity was observed in neutrophils from the SA and S groups (*$P<0.05$). There was no significant difference between the SA and S groups. Data are presented as the mean $\pm$ SEM ($n=6$).

Drugs in Aquaculture

Drug Use Guidance

Approved Drugs
http://www.fws.gov/fisheries/aadap/approved.htm

Extra Label Drug Use
http://www.fws.gov/fisheries/aadap/extra label_drug_use.html

Low Regulatory Priority (LRP) Drugs
http://www.fws.gov/fisheries/aadap/lrps.htm

Generally Regarded as Safe (GRAS) Drugs
http://www.fws.gov/fisheries/aadap/gras.htm

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Veterinary Feed Directive Drugs
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