

Botulism in rearing ponds

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Clostridium botulinum

Gram positive, rod-shaped, spore-forming, anaerobic bacterium

C. botulinum is widespread in soil, marine and freshwater sediments and in the GI tract of man, other animals, and fish

Neurotoxin that causes the condition known as Botulism

Seven types of botulinum neurotoxin – Types A through G

Clostridium botulinum

- ▶ Spores are likely to become established in the mud and bottom-living invertebrates of ponds
- ▶ Spores are difficult to kill and can remain in sediments long after fish have been released (decades)
 - ▶ Heat-resistant, thrive in anaerobic environments
 - ▶ Toxin can be killed by boiling > 85C for 5 + minutes
- ▶ Bacteria will not grow in acidic conditions thus combinations of low temperature, salt, and low pH (<4.6) can be used to prevent bacterial growth and toxin formation

Botulism cycle

- ▶ Fish die, spores germinate in dead body, toxin produced
- ▶ Toxin is then ingested by predators that scavenge the dead
- ▶ Spores may also be ingested from environment by animals (fish, bird, mammal) or by toxin-unaffected organism (algae, plant, invertebrate) that then become vectors when they die
- ▶ Toxin-unaffected organisms can concentrate toxins and when ingested will kill the predator

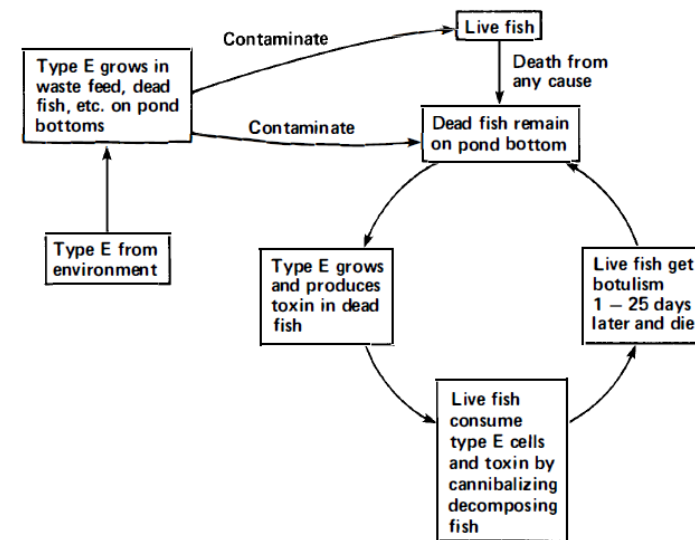
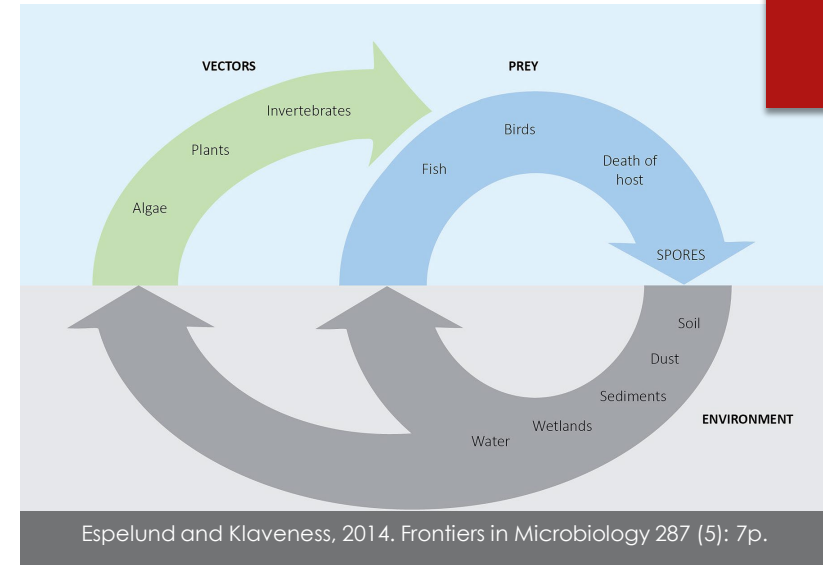


Fig. 4. Botulism cycle in fish-rearing ponds.

Botulism Outbreaks

- ▶ Favorable Conditions:
 - ▶ Anaerobic environment (decomposing plants, animals, algae)
 - ▶ Organic matter in sediment
 - ▶ Water pH between 7.5 and 9
 - ▶ Water temperature > 68°F
 - ▶ Spores in soil/sediment
 - ▶ Can be mobilized by surface waters in heavy rains (e.g. freshet)



Botulism – Clinical signs

- ▶ Erratic swimming bursts
- ▶ Loss of equilibrium – unable to maintain normal body position in water column
- ▶ Head up, tail down sink to bottom (fin paralysis)
- ▶ Resting on bottom of pond
- ▶ Decreasing reactivity to stimuli
- ▶ Large-scale death (escalating)
- ▶ Fresh mortalities may have viscous amber-colored fecal material in distal intestine suggestive of constipation
- ▶ Other wildlife dying



Botulism – Diagnosis

- ▶ Consistent clinical signs
- ▶ Exclusion of other potential diagnoses
- ▶ Mouse bioassay – detects biologically active toxin
 - ▶ Mouse bioassay was performed on frozen GI tracts of affected fish at USDA National Veterinary Services Laboratory in Ames, Iowa.
 - ▶ Time consuming and expensive
 - ▶ Sensitivity is low and false negatives are common

Botulism – Treatment

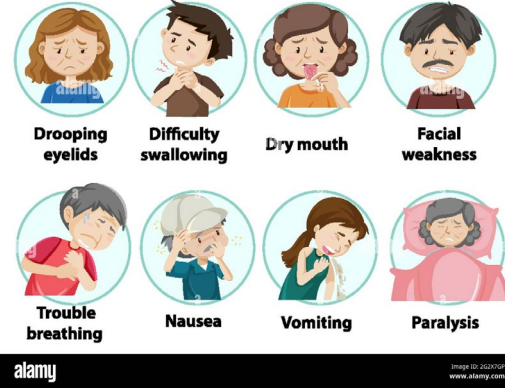
- ▶ Remove mortalities
- ▶ Increase flow to flush out toxins and dead fish
 - ▶ Removing dam boards can help
- ▶ Medicated feed can be used to kill gut flora and prevent toxin release when fish dies
 - ▶ Only works if fish eat the feed and there are no other sources for bacteria
 - ▶ Temporary stop-gap while performing other treatments
- ▶ Remove fish from pond



Botulism – Other Considerations

- ▶ Zoonotic pathogen
 - ▶ Can infect humans and other wildlife
- ▶ CDC reportable pathogen

BOTULISM – SYMPTOMS



Clean-up

- ▶ Remove surface mud, mortalities, invertebrates and any detritus
- ▶ Dry out
- ▶ Till & Lime
- ▶ Line ponds

