

CHAPTER 12

Dundee State Fish Hatchery *Prymnesium parvum* Management Plan

DENNIS G. SMITH

Abstract

This management plan was prepared as a guide to control the toxic alga *Prymnesium parvum* and its ichthyotoxin and eliminate, or at least minimized, its adverse impact on fish production. The plan includes monitoring presence and abundance of *P. parvum* and concentration of un-ionized ammonia nitrogen, and application of effective chemical treatments. Ammonium sulfate is applied at concentrations to raise the un-ionized ammonia nitrogen concentrations to 0.2-0.4 mg/L when water temperatures are 15°C or higher, and copper sulfate (or Cutrine-Plus) is applied at 0.2-0.4 mg Cu²⁺/L when water temperatures are up to 15°C. The selected target concentrations of un-ionized ammonia nitrogen and copper depend on the tolerance of the fish that would be exposed to the treatments.

Introduction

The Dundee State Fish Hatchery is located in Archer County, Texas below Lake Diversion which supplies water to the hatchery. The hatchery has 97 ponds: 73 are plastic-lined totaling 24 ha (59.5 acres) and 24 are earthen ponds totaling 9.3 ha (23 acres) of surface water. Other culture units include four outdoor raceways and indoor 12, 1.8-m fiberglass round tanks, 90-jar egg incubation system and 4-trough (970-L) rearing system. All indoor culture systems can be operated as flow-through or closed systems. The spawning and rearing building which houses the indoor culture units also is equipped with an ozone generator and UV system for treating lake water containing *Prymnesium parvum* cells or toxins.

Fish species cultured at this facility include striped bass *Morone saxatilis*, palmetto bass (striped bass ♀ × *M. chrysops* ♂), channel catfish *Ictalurus punctatus*, black basses *Micropterus* spp., koi carp *Cyprinus carpio*, rainbow trout *Oncorhynchus mykiss*, walleye *Stizostedion vitreum* and saugeye (female walleye × male *S. canadense*).

In 2001 fishes on the hatchery suffered substantial mortality from *P. parvum* ichthyotoxicity. Losses included 5.1 million striped bass and palmetto bass, 1,500 black basses, and thousands of channel catfish, rainbow trout and koi carp. Through the efforts of hatchery staff and the Hatcheries Golden Alga Task Force, strategies have been developed to control *P. parvum*. These strategies form the basis of the *P. parvum* management plan described herein. This plan continues to evolve and modifications are made to it as more effective or efficient solutions to the *P. parvum* toxicity problem are discovered.

***Prymnesium parvum* Management Plan**

Pond Management

- Fill ponds well in advance of fish stockings to allow water temperatures to rise so treatment with ammonium sulfate, if needed, can be effective.
- Avoid flushing ponds too rapidly and decreasing temperature if ponds must be flushed. If possible avoid pond flushing.
- Treat ponds at least two days prior to anticipated stockings to allow treatments to work and toxins to decompose.
- Perform bioassays and check for cells any time *P. parvum* toxicity is suspected and on the days before fish stockings.
- Maintain a minimum of 0.18 mg/L un-ionized ammonia nitrogen (UIA-N) or 2 mg Cu²⁺/L in ponds depending on treatment option.

Prophylactic Treatments of P. parvum in Ponds

- Measure pond water temperature and pH
- If pond water temperatures are consistently above 28°C
 - *P. parvum* may be absent or present in very low numbers and ichthyotoxicity is unlikely. Treatment should be unnecessary.
 - Monitor ponds for presence of the alga and signs of toxicity at least once per week.
- If pond water temperature is 28°C
 - Check for presence of *P. parvum* cells twice per week.
 - If cells are present measure ammonia, temperature, and pH.
 - Calculate concentration of UIA-N.
 - Apply ammonium sulfate to raise UIA-N to 0.3 mg/L if UIA-N is less than 0.18 mg/L.
- If pond temperatures are below 28°C, consult an ammonia ionization table (Piper et al. 1992) or hatchery ammonia spreadsheet to determine proportion of total ammonia in the un-ionized form.
 - If the proportion of total ammonia in the un-ionized form is less than 5%
 - Apply Cutrine-Plus® or copper sulfate to raise copper concentration to 0.25 mg/L.
 - Measure copper concentration once per week.
 - Maintain copper concentration above 0.2 mg/L.
 - Check for presence of *P. parvum* cells once per week for monitoring purposes.
 - If the proportion of total ammonia in the un-ionized form exceeds 5%
 - Measure ammonia, temperature, and pH once per week (twice per week for sensitive species such as striped or palmetto bass).
 - Calculate concentration of UIA-N.
 - Apply ammonium sulfate to raise UIA-N to 0.3 mg/L if UIA-N is less than 0.18 mg/L.
 - Check for presence of *P. parvum* cells once per week for monitoring purposes.

- If the proportion of total ammonia in the un-ionized form is low (5-15%) and pH is expected to increase above 8.5
 - Reduce target ammonium sulfate treatment to achieve UIA-N of 0.25 mg/L. This treatment level is high enough to control *P. parvum* but requires less ammonium sulfate and lower total ammonia. Thus, should pH rise the UIA-N generated may not be toxic to the fish. Treatments at this lower UIA-N rate may require more frequent applications.

Indoor Culture Units

- Use UV- and ozone-treated lake water (treated water) for all culture activities in the spawning and rearing building if lake water contains *P. parvum* or its toxin. High dosage UV (180 to 200 mJ/cm²) and ozone treatment is required to eliminate *P. parvum* toxicity if toxins are present in the supply water.
 - Check treated water for presence of *P. parvum* or toxin to be sure the system is working.

Treatment of Ichthyotoxicity

- Treat ponds or other culture units with potassium permanganate at the demand rate or up to 2 mg/L above the demand rate for temporary relief if fish show signs of ichthyotoxicity.

Fish Harvest

- Check incoming lake water for toxicity and presence of *P. parvum* one day before fish harvest.
- If *P. parvum* or toxin is absent in lake water
 - Harvest fish using routine hatchery procedures.
- If *P. parvum* or toxin is present in lake water but water not toxic.
 - Do partial pond draining the day before harvest.
 - Harvest fish as scheduled within 2 hours using lake water.
 - Treat pond water with potassium permanganate if fish exhibit signs of ichthyotoxicity.
- If lake water is toxic
 - Suspend fish harvest until the condition improves.
 - If fish must be harvested, use non-toxic water from adjacent ponds or treated water and potassium permanganate treatment if fish show signs of ichthyotoxicity.

Fish Hauling Units

- Fill fish hauling units with treated water.
- Rinse fish to be transported off the hatchery with treated water before loading to avoid introducing *P. parvum* into hauling tanks and ultimately into stocked lakes.
- After fish loading check hauling unit water for *P. parvum*.
 - If *P. parvum* is absent deliver fish according to hatchery guidelines.
 - If *P. parvum* is present drain out some water, refill with treated water, and recheck for *P. parvum*. Repeat until no *P. parvum* is found.

Management of *Prymnesium parvum* at Texas State Fish Hatcheries

- Upon return to the hatchery, disinfect hauling units with 10% chlorine bleach.
- Use lake water free of *P. parvum* cells or toxins, or treated water to transfer fish between hatchery culture units.

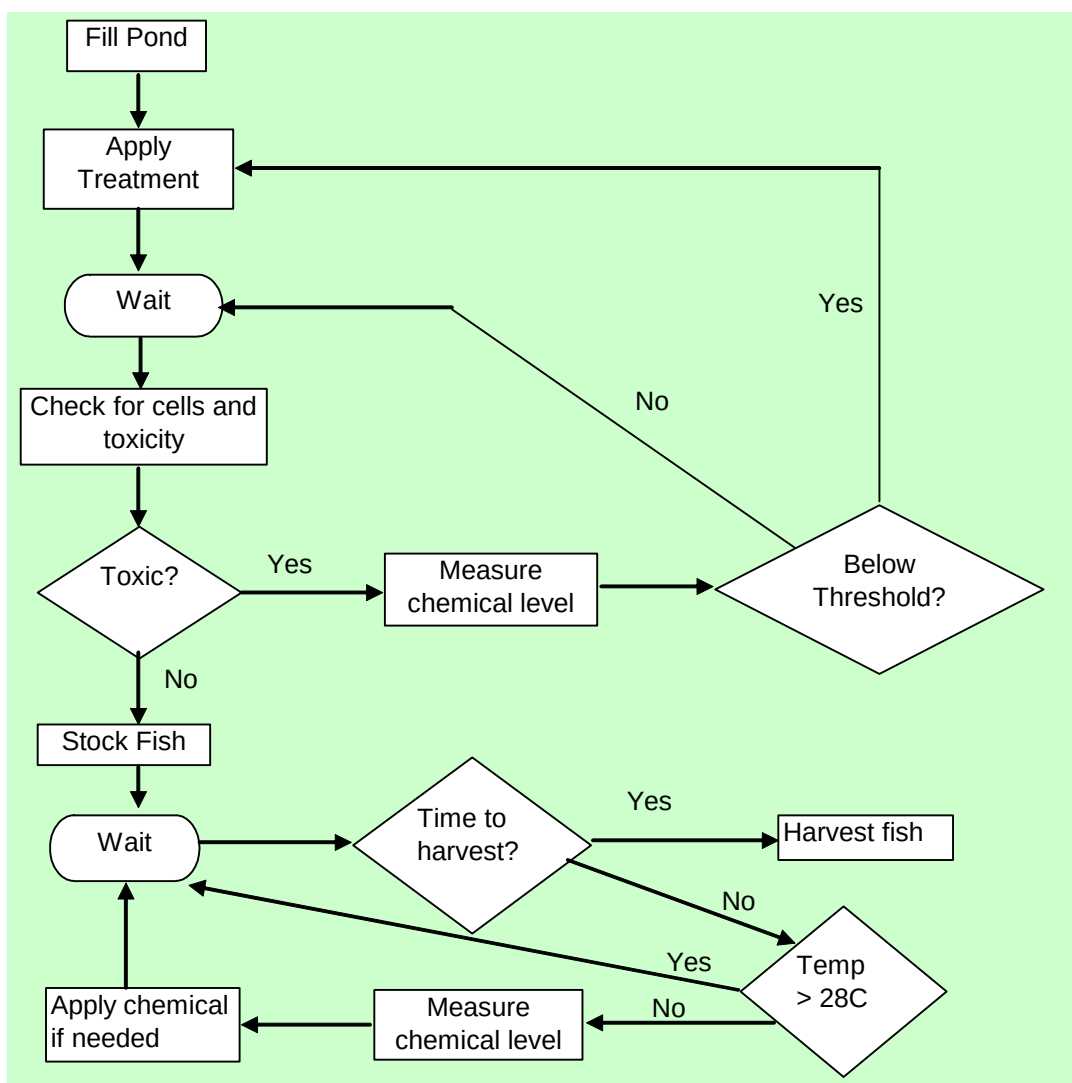


FIGURE 1.—A schematic diagram of the Dundee State Fish Hatchery pond management plan.