Importance of water quality in aquaculture

Matthew A. Smith
Aquaculture Boot Camp
07/14/2018
WQ can be overwhelming

Interpretation of Water Analysis Reports for Fish Culture
Nathan Stone, Jay L. Shelton, Brian E. Haggard, and Hugh K. Thomforde

Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds
William A. Wurts and Robert M. Durborow

Ammonia in Fish Ponds
Robert M. Durborow, David M. Crosby and Martin J. Metcalfe

Nitrite in Fish Ponds
Robert M. Durborow, David M. Crosby and Martin J. Metcalfe

Recirculating Aquaculture Tank Production Systems: Aquaponics—Integrating Fish and Plant Culture
James E. Rakocy, Michael P. Masser and Thomas M. Losordo

Handbook for Aquaculture Water Quality
Claude E. Boyd, Craig S. Tucker
How do you eat an elephant?
Why even eat an “elephant”; learn?

- Not because it’s fun, but because it **directly affects profitability** and offers the farmer a **piece of mind**
- “I’m not sure why they are sick and/or dying” is an easier “strategy” than monitoring regularly
- However, farming is a business and it’s up to each business to decide what level of commitment to have
- Time = $$$ of course

[Image: Elephant diagram]

https://www.atl.org.uk/latest/blog/how-do-you-eat-elephant-one-bite-at-a-time
What are your goals?

- Your goals are going to tell you how much time and energy to invest in water quality
- Full-time venture?
  - Likely higher # fish and plants
  - More worried about survival/stress
  - Higher (appropriate) feeding rates
  - An investment
  - More recording of parameters!
  - Plenty of stress on the farmer
Stress

- headache
- rapid breathing
- weakened immune system
- high blood sugar
- high blood pressure
- increased depression
- insomnia
- heartburn
- risk of heart attack
- pounding heart
Stress in humans | **Acute** vs. **Chronic**

**Acute Stress**
- New Challenge
- Athletic Competition
- Presentation at Work
- Lifting Heavy Weights
- Intermittent Fasting
- Running Sprints

**Chronic Stress**
- Drive to Work
- Annoying Boss
- Bad Work Schedule
- A Difficult Spouse
- Poor Sleep Habits
- Negative Friends
Stress in humans | Acute vs. Chronic

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Fish are often lost because of a combination of acute and chronic stress related to water quality.
Imagine your hobbyist timeline…

- You feed them every single day and even have friends to come over and watch them feed in the tanks.
- They grow and grow and by the spring of 2019 you have a buyer for July 2019.
- Another 100 degree heat index hits and your tank water is very hot, meaning dissolved oxygen saturation is low.
- You feed and leave; fish don’t eat; ammonia elevates.
- Low survival means you no longer have fish to sell for a profit.
- Same can happen on a larger scale…
Oxygen example

- 16 days, blue line (bottom line) is morning oxygen temps and orange line is afternoon temps
- June 2018 weather for example
- How would we know without testing?

**Probable cause of the drop??**
Ease of monitoring

- Water quality monitoring is becoming easier and easier to do...
- Meaning excuses should be less and less! – takes a lot less time
- Many meters are becoming easier to calibrate and use
- Many titration methods have better/cleaner instructions
- YouTube videos
Realities of checking water quality on farms in Ohio... and beyond

• Few farmers utilize meters or kits and regularly test/record water quality data
• Tested and/or recorded parameters usually stops at DO
• Those who haul fish are significantly more likely to at least carry a DO meter
• Memory of the farmer usually tested to know “status quo” of the systems
• Meters/kits do not mean anything if they are not accurate
• Does it pay to routinely check and monitor WQ?

The Ohio State University
College of Food, Agricultural, and Environmental Sciences
Final thoughts

• “My fish are eating and look fine”
• There are reasons for these presentations
• Come see me – practicing WQ testing/recording
• The truth
  • Most won’t test/record, at least not until already in trouble
Readings

**Fact Sheets** ▶ Water Quality (460-471; 4600-4699)

- SRAC 0460: Control of Clay Turbidity in Ponds
- SRAC 0461: Water Quantity and Quality Requirements for Channel Catfish Hatcheries
- SRAC 0462: Nitrite in Fish Ponds
- SRAC 0463: Ammonia in Fish Ponds
- SRAC 0464: Interactions of pH, Carbon Dioxide, Alkalinity and Hardness in Fish Ponds
- SRAC 0466: Algae Blooms in Commercial Fish Production Ponds
- SRAC 0467: Cost of Alternative Effluent Treatments for Catfish Production
- SRAC 0468: Carbon Dioxide in Fish Ponds
- SRAC 0469: Fertilization of Fish Fry Ponds
- SRAC 0470: Characterization and Management of Effluents from Aquaculture Ponds in the Southeastern United States
- SRAC 0471: Fertilization of Fish Ponds
- SRAC 4600: Toxicities of Agricultural Pesticides to Selected Aquatic Organisms
- SRAC 4601: Measuring Dissolved Oxygen Concentration in Aquaculture
- SRAC 4602: Pond Mixing
- SRAC 4603: Managing Ammonia in Fish Ponds
- SRAC 4604: Managing High PH in Freshwater Ponds
- SRAC 4605: Algal Toxins in Pond Aquaculture
- SRAC 4606: Interpretation of Water Analysis Reports for Fish Culture

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**Aquaponic System Design Parameters:**

**Basic System Water Chemistry**

Wilson Lennard PhD