Hemloch Aquaculture

ABC Aquaculture/Aquaponics

November 8, 2025

10:00 – 10:40 am

1864 Shyville Road, Piketon, OH 45661

Outline

- Background of you & Kirk
- When & How you got into aquaculture
- Vision (Sustainability – maintaining your lake)
- What have you learned?
    - Species
        - Redear sunfish 2023-2024
        - Bluegill 2023-2024
        - Largemouth bass 2024-2025
        - Redear sunfish 2025-2026
        - Largemouth bass 2025-2026

- System: Floating In-pond Raceway (IPRS)
  - Not optimal design
  - Issues with waste
  - Issues harvesting
  - Etc.

- What have you implemented
  - Water quality monitoring
  - Feed management (feeders)
  - Security (birds/mammals, etc)

- Logistics
  - Fish feed (availability)
  - Stocking (fingerlings)
  - Harvesting (live fish)

Collaboration

- Ohio Aquaculture Association
- OSU Extension
  - Production set up (sampling, monitoring, feeding, etc.).
    - Reports submitted to the 2024 ePLUS Reports –POTENTIAL FOR TAX BENEFITS

  - IPRS – allows to collect & take out fish sludge/slurry & solids by using the trash pump.

  - But there are dissolved nutrients that still may affect the ecosystem, that is why we have partnered with OSU Extension & the FABE (Food, Agricultural & Biological Engineering) through the Capstone projects
    - 2024-2025 – Team 3 students – monitoring WQ & designing potential system
    - 2025-2026 – Team 4 students – evaluating a pilot model

- **2024 ePLUS Reports.**

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Production of Largemouth Bass in a floating in-pond raceway system

OBJECTIVE

This project is Evaluate production of Largemouth bass (LMB) as food-fish in a floating in-pond raceway system (IPRS) in a spring-fed pond rather large, traditional earthen ponds.

eFields Collaborating Farm
OSU Extension
Miami County

STUDY INFORMATION

Stocking Dates	05/02,08,21/2024
Harvest Date(s)	TBD
Species	Largemouth bass (*Micropterus salmoides*)
Stocking density	3.6 kg/m3
Management	Feed: 10,839 lb (until November 30, 2024)
System	In-pond Raceway System (IPRS)
Study type	Observation
Size of IPRS	214 m3 (56,500 gallons)

STUDY DESIGN

A total of 10,058 feed-trained largemouth bass LMB fingerlings with an individual average weight of 76.2±19.8 g (CV=26.0%) were stocked early in May 2024, in one floating in-pond raceway system (IPRS). The IPRS is in a spring-fed pond derived from a reclaimed limestone quarry in Miami County.

Water quality parameters including water temperature, water pH, and dissolved oxygen; and feed consumption have been taking daily. Other water quality parameters such as ammonia, nitrite, hardness, alkalinity, and chloride have been measured monthly.

Fish weight and lengths have been taken regularly to evaluate growth response in the culture system. The floating IPRS draws water from deep in the pond using airlift pumps to circulate in the culture unit. Removal of solid waste produced by organisms has been done on a weekly basis

Floating in pond raceway system, placed in a large spring-fed pond derived from a reclaimed limestone quarry.

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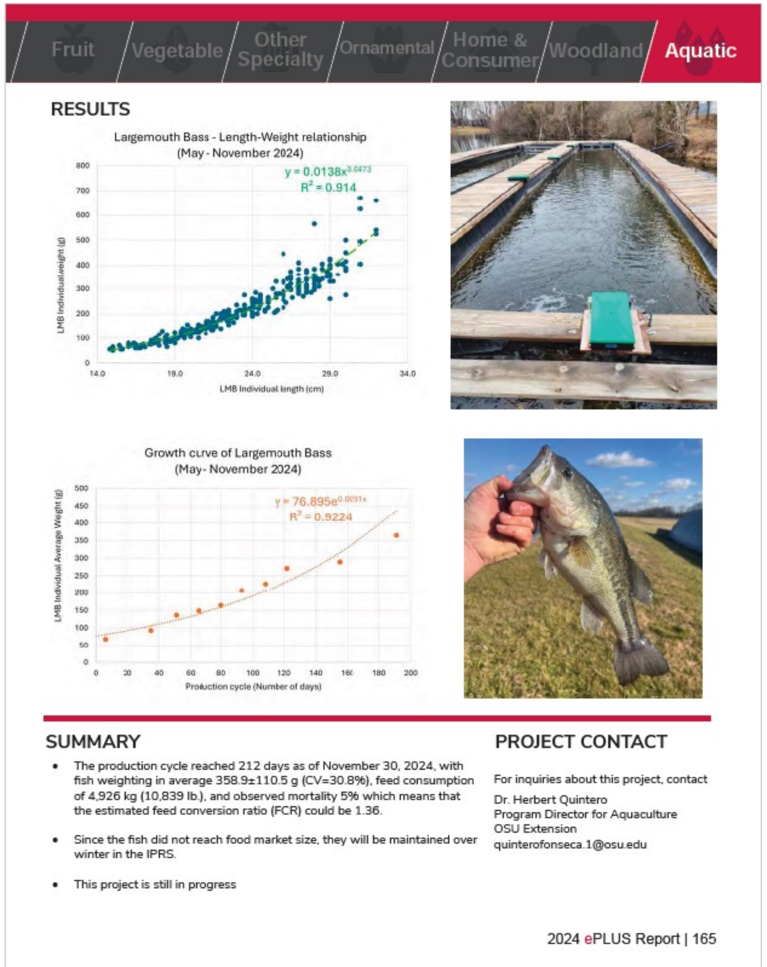

Fruit / Vegetable / Other Specialty / Ornamental / Home & Consumer / Woodland / Aquatic

RESULTS

SUMMARY

- The production cycle reached 212 days as of November 30, 2024, with fish weighting in average 358.9±110.5 g (CV=30.8%), feed consumption of 4,926 kg (10,839 lb.), and observed mortality 5% which means that the estimated feed conversion ratio (FCR) could be 1.36.
- Since the fish did not reach food market size, they will be maintained over winter in the IPRS.
- This project is still in progress

PROJECT CONTACT

For inquiries about this project, contact

Dr. Herbert Quintero
Program Director for Aquaculture
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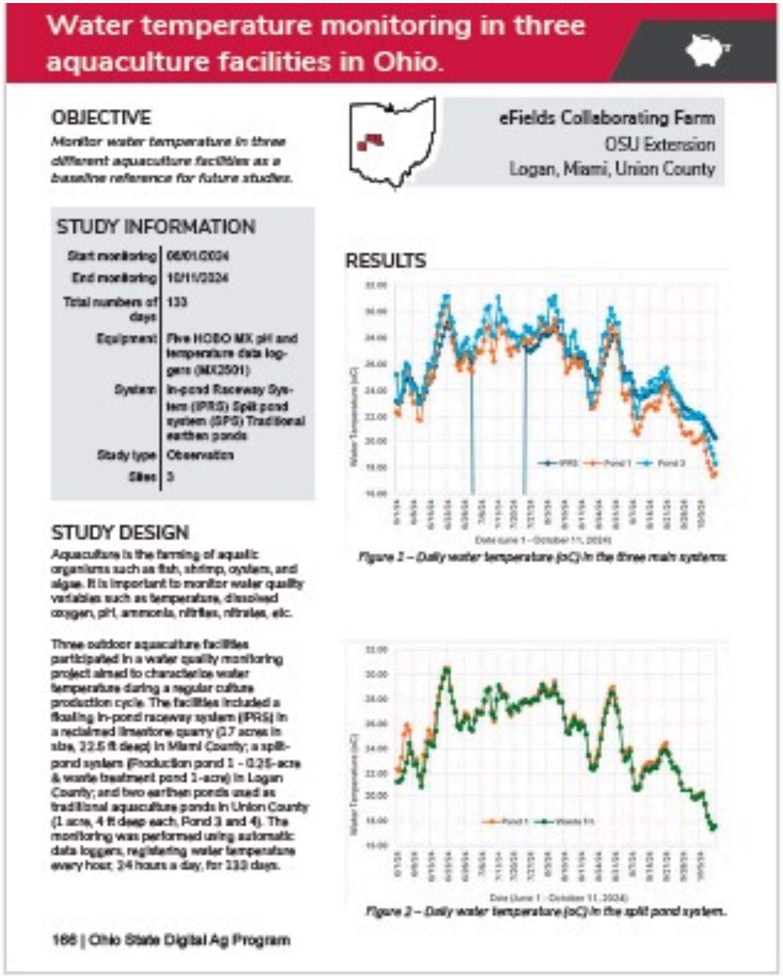

Water temperature monitoring in three aquaculture facilities in Ohio.

OBJECTIVE

Monitor water temperature in three different aquaculture facilities as a baseline reference for future studies.

eFields Collaborating Farm
OSU Extension
Logan, Miami, Union County

STUDY INFORMATION

Start monitoring	06/01/2024
End monitoring	10/11/2024
Total numbers of days	133
Equipment	Five HOBO MX pH and temperature data loggers (MX2501)
System	In-pond Raceway System (IPRS) Split pond system (SPS) Traditional earthen ponds
Study type	Observation
Sites	3

STUDY DESIGN

Aquaculture is the farming of aquatic organisms such as fish, shrimp, oysters, and algae. It is important to monitor water quality variables such as temperature, dissolved oxygen, pH, ammonia, nitrites, nitrates, etc.

Three outdoor aquaculture facilities participated in a water quality monitoring project aimed to characterize water temperature during a regular culture production cycle. The facilities included a floating in-pond raceway system (IPRS) in a reclaimed limestone quarry (37 acres in size, 22.5 ft deep) in Miami County; a split-pond system (Production pond 1 - 0.25-acre & waste treatment pond 1-acre) in Logan County; and two earthen ponds used as traditional aquaculture ponds in Union County (1 acre, 4 ft deep each, Pond 3 and 4). The monitoring was performed using automatic data loggers, registering water temperature every hour, 24 hours a day, for 133 days.

RESULTS

Figure 1 – Daily water temperature (oC) in the three main systems.

Figure 2 – Daily water temperature (oC) in the split pond system.

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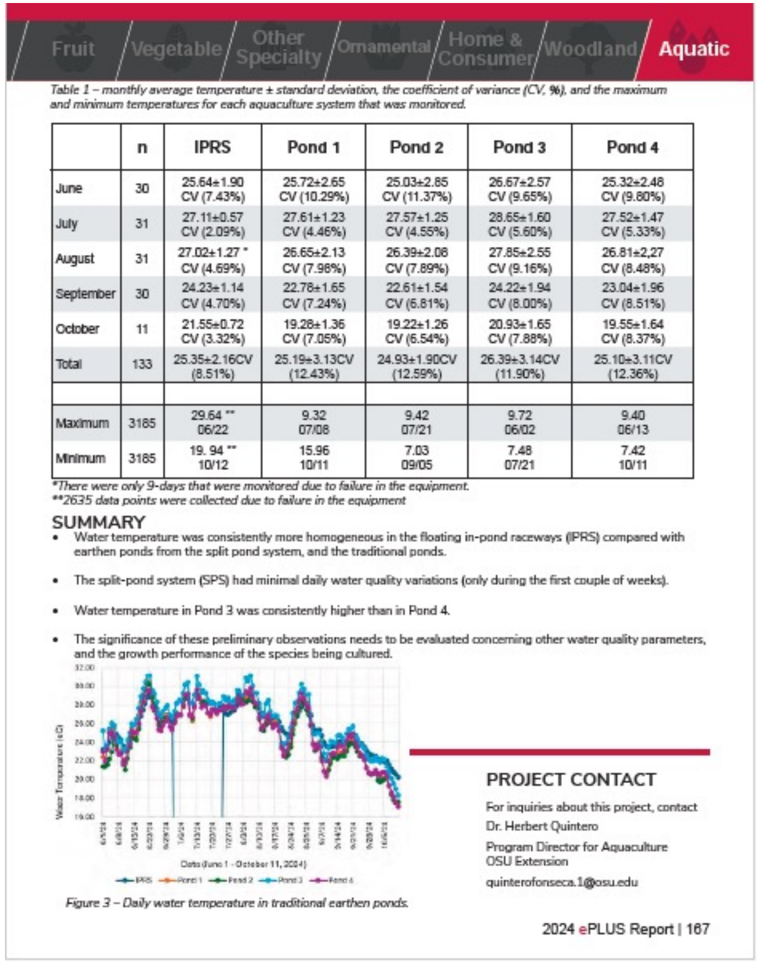

Fruit | Vegetable | Other Specialty | Ornamental | Home & Consumer | Woodland | Aquatic

Table 1 – monthly average temperature ± standard deviation, the coefficient of variance (CV, %), and the maximum and minimum temperatures for each aquaculture system that was monitored.

	n	IPRS	Pond 1	Pond 2	Pond 3	Pond 4
June	30	25.64±1.90 CV (7.43%)	25.72±2.65 CV (10.29%)	25.03±2.85 CV (11.37%)	26.67±2.57 CV (9.65%)	25.32±2.48 CV (9.80%)
July	31	27.11±0.57 CV (2.09%)	27.61±1.23 CV (4.46%)	27.57±1.25 CV (4.55%)	28.65±1.60 CV (5.60%)	27.52±1.47 CV (5.33%)
August	31	27.02±1.27 * CV (4.69%)	26.65±2.13 CV (7.98%)	26.39±2.08 CV (7.89%)	27.85±2.55 CV (9.16%)	26.81±2,27 CV (8.48%)
September	30	24.23±1.14 CV (4.70%)	22.78±1.65 CV (7.24%)	22.61±1.54 CV (6.81%)	24.22±1.94 CV (8.00%)	23.04±1.96 CV (8.51%)
October	11	21.55±0.72 CV (3.32%)	19.28±1.36 CV (7.05%)	19.22±1.26 CV (6.54%)	20.93±1.65 CV (7.88%)	19.55±1.64 CV (8.37%)
Total	133	25.35±2.16CV (8.51%)	25.19±3.13CV (12.43%)	24.93±1.90CV (12.59%)	26.39±3.14CV (11.90%)	25.10±3.11CV (12.36%)
Maximum	3185	29.64 ** 06/22	9.32 07/08	9.42 07/21	9.72 06/02	9.40 06/13
Minimum	3185	19. 94 ** 10/12	15.96 10/11	7.03 09/05	7.48 07/21	7.42 10/11

There were only 9-days that were monitored due to failure in the equipment.
***2635 data points were collected due to failure in the equipment*

SUMMARY

- Water temperature was consistently more homogeneous in the floating in-pond raceways (IPRS) compared with earthen ponds from the split pond system, and the traditional ponds.
- The split-pond system (SPS) had minimal daily water quality variations (only during the first couple of weeks).
- Water temperature in Pond 3 was consistently higher than in Pond 4.
- The significance of these preliminary observations needs to be evaluated concerning other water quality parameters, and the growth performance of the species being cultured.

Figure 3 – Daily water temperature in traditional earthen ponds.

PROJECT CONTACT

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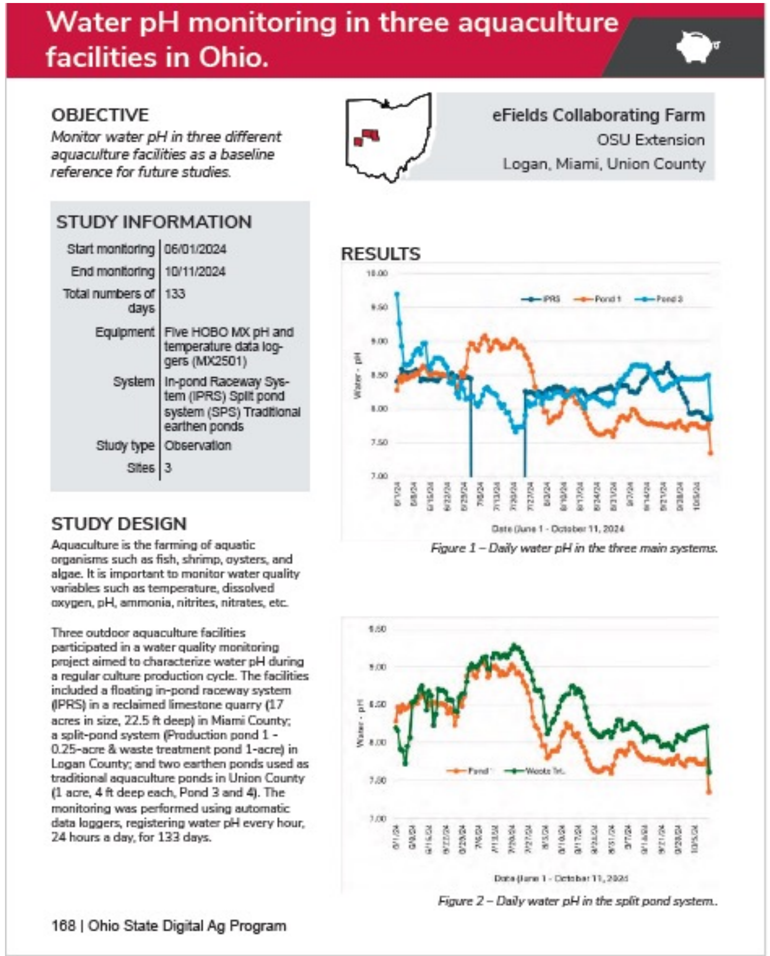
- # 2024 ePLUS Reports.
  - ✓ Water pH monitoring in three aquaculture facilities in Ohio, 168-169 pp.



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Three outdoor aquaculture facilities participated in a water quality monitoring project aimed to characterize water pH during a regular culture production cycle. The facilities included a floating in-pond raceway system (IPRS) in a reclaimed limestone quarry (17 acres in size, 22.5 ft deep) in Miami County; a split-pond system (Production pond 1 - 0.25-acre & waste treatment pond 1-acre) in Logan County; and two earthen ponds used as traditional aquaculture ponds in Union County (1 acre, 4 ft deep each, Pond 3 and 4). The monitoring was performed using automatic data loggers, registering water pH every hour, 24 hours a day, for 133 days.

RESULTS

Figure 1 – Daily water pH in the three main systems.

Figure 2 – Daily water pH in the split pond system.

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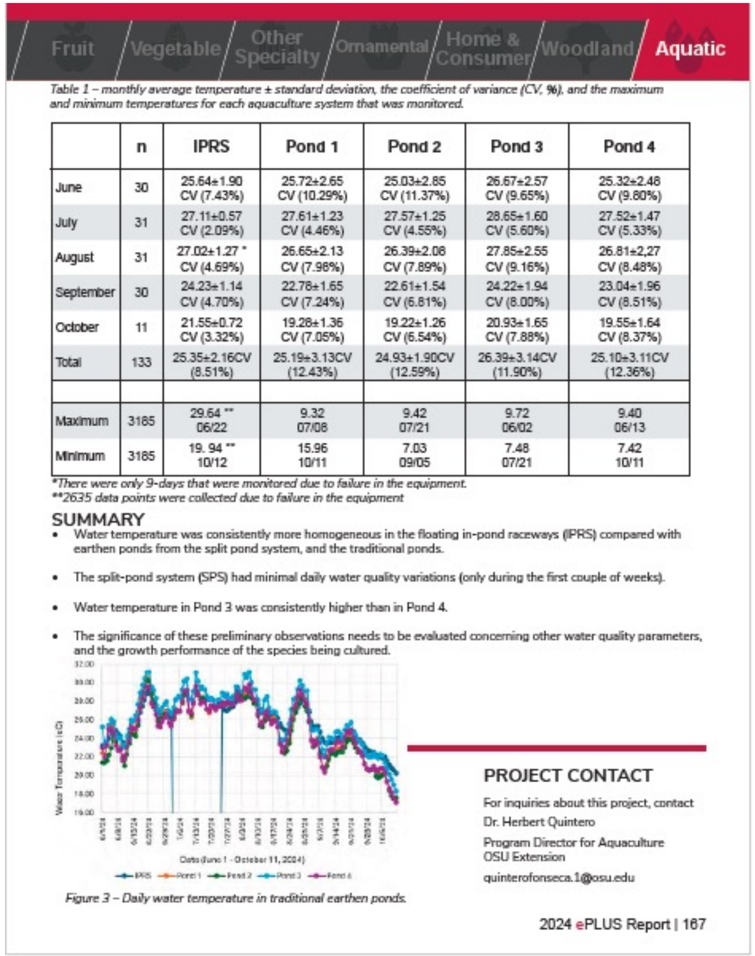

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Capstone Project 2024-2025
Dpt. Of Food, Agricultural, and Biological Engineering (FABE)
The Ohio State University Extension

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- Dr. Lorrayne Miralha

- Sponsor Representative
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- Student TeamM:
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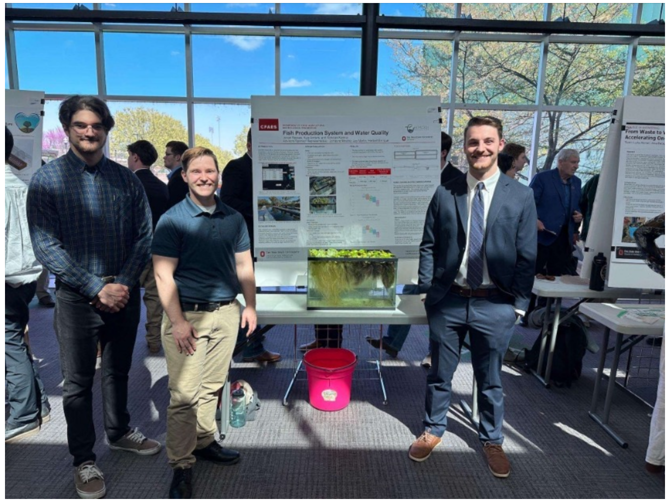
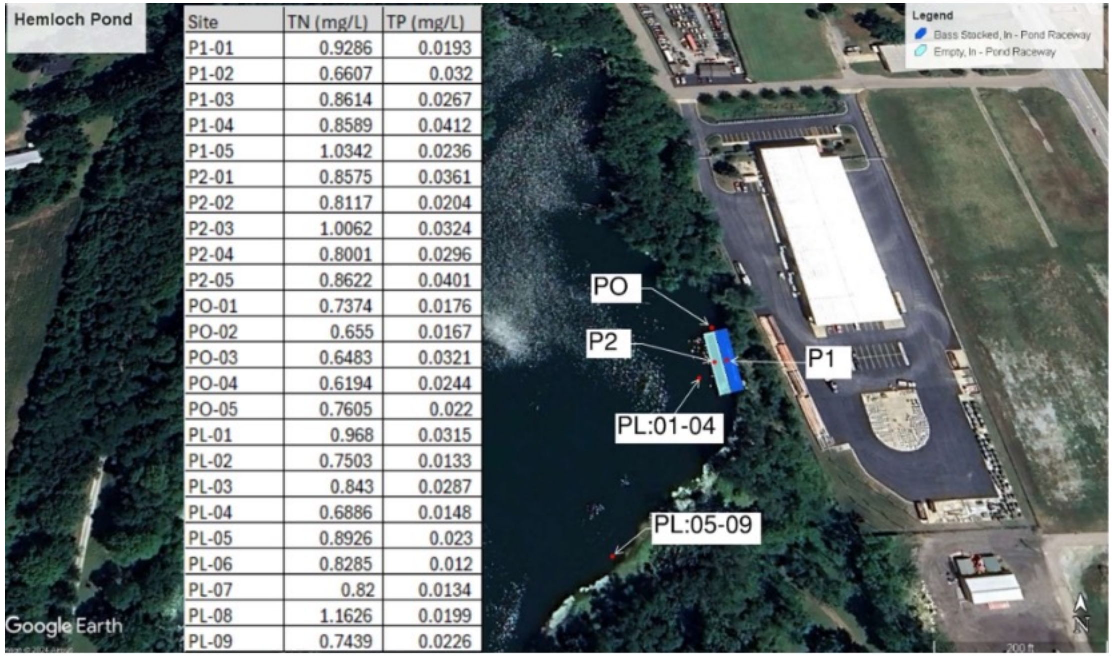
- Kyle Anders
- Nicholas Kankia





Site	TN (mg/L)	TP (mg/L)
P1-01	0.9286	0.0193
P1-02	0.6607	0.032
P1-03	0.8614	0.0267
P1-04	0.8589	0.0412
P1-05	1.0342	0.0236
P2-01	0.8575	0.0361
P2-02	0.8117	0.0204
P2-03	1.0062	0.0324
P2-04	0.8001	0.0296
P2-05	0.8622	0.0401
PO-01	0.7374	0.0176
PO-02	0.655	0.0167
PO-03	0.6483	0.0321
PO-04	0.6194	0.0244
PO-05	0.7605	0.022
PL-01	0.968	0.0315
PL-02	0.7503	0.0133
PL-03	0.843	0.0287
PL-04	0.6886	0.0148
PL-05	0.8926	0.023
PL-06	0.8285	0.012
PL-07	0.82	0.0134
PL-08	1.1626	0.0199
PL-09	0.7439	0.0226

Capstone Project 2024-2025

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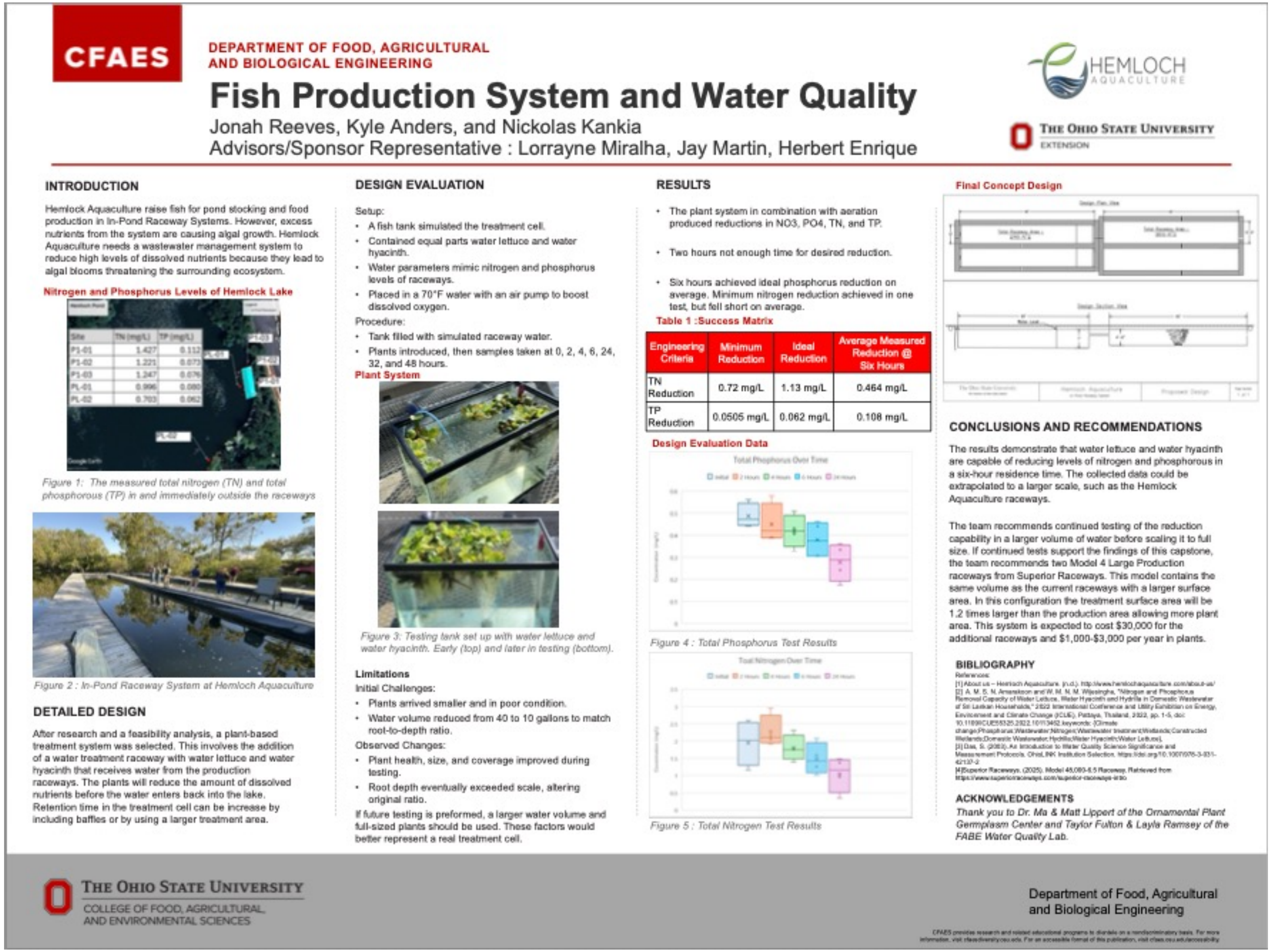

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DEPARTMENT OF FOOD, AGRICULTURAL AND BIOLOGICAL ENGINEERING

Fish Production System and Water Quality

Jonah Reeves, Kyle Anders, and Nickolas Kankia
Advisors/Sponsor Representative : Lorrayne Miralha, Jay Martin, Herbert Enrique

HEMLOCH AQUACULTURE

THE OHIO STATE UNIVERSITY EXTENSION

INTRODUCTION

Hemlock Aquaculture raise fish for pond stocking and food production in In-Pond Raceway Systems. However, excess nutrients from the system are causing algal growth. Hemlock Aquaculture needs a wastewater management system to reduce high levels of dissolved nutrients because they lead to algal blooms threatening the surrounding ecosystem.

Nitrogen and Phosphorus Levels of Hemlock Lake

Site	TN (mg/L)	TP (mg/L)
P1-01	1.427	0.112
P1-02	1.221	0.073
P1-03	1.247	0.076
PL-01	0.996	0.080
PL-02	0.703	0.062

Figure 1: The measured total nitrogen (TN) and total phosphorous (TP) in and immediately outside the raceways

Figure 2 : In-Pond Raceway System at Hemloch Aquaculture

DETAILED DESIGN

After research and a feasibility analysis, a plant-based treatment system was selected. This involves the addition of a water treatment raceway with water lettuce and water hyacinth that receives water from the production raceways. The plants will reduce the amount of dissolved nutrients before the water enters back into the lake. Retention time in the treatment cell can be increase by including baffles or by using a larger treatment area.

DESIGN EVALUATION

Setup:
- A fish tank simulated the treatment cell.
- Contained equal parts water lettuce and water hyacinth.
- Water parameters mimic nitrogen and phosphorus levels of raceways.
- Placed in a 70°F water with an air pump to boost dissolved oxygen.

Procedure:
- Tank filled with simulated raceway water.
- Plants introduced, then samples taken at 0, 2, 4, 6, 24, 32, and 48 hours.

Plant System

Figure 3: Testing tank set up with water lettuce and water hyacinth. Early (top) and later in testing (bottom).

Limitations

Initial Challenges:
- Plants arrived smaller and in poor condition.
- Water volume reduced from 40 to 10 gallons to match root-to-depth ratio.

Observed Changes:
- Plant health, size, and coverage improved during testing.
- Root depth eventually exceeded scale, altering original ratio.

If future testing is preformed, a larger water volume and full-sized plants should be used. These factors would better represent a real treatment cell.

RESULTS

- The plant system in combination with aeration produced reductions in NO3, PO4, TN, and TP.
- Two hours not enough time for desired reduction.
- Six hours achieved ideal phosphorus reduction on average. Minimum nitrogen reduction achieved in one test, but fell short on average.

Table 1 :Success Matrix

Engineering Criteria	Minimum Reduction	Ideal Reduction	Average Measured Reduction @ Six Hours
TN Reduction	0.72 mg/L	1.13 mg/L	0.464 mg/L
TP Reduction	0.0505 mg/L	0.062 mg/L	0.108 mg/L

Design Evaluation Data

Figure 4 : Total Phosphorus Test Results

Figure 5 : Total Nitrogen Test Results

Final Concept Design

CONCLUSIONS AND RECOMMENDATIONS

The results demonstrate that water lettuce and water hyacinth are capable of reducing levels of nitrogen and phosphorous in a six-hour residence time. The collected data could be extrapolated to a larger scale, such as the Hemlock Aquaculture raceways.

The team recommends continued testing of the reduction capability in a larger volume of water before scaling it to full size. If continued tests support the findings of this capstone, the team recommends two Model 4 Large Production raceways from Superior Raceways. This model contains the same volume as the current raceways with a larger surface area. In this configuration the treatment surface area will be 1.2 times larger than the production area allowing more plant area. This system is expected to cost $30,000 for the additional raceways and $1,000-$3,000 per year in plants.

BIBLIOGRAPHY

References:
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[2] A. M. S. N. Amarakoon and W. M. N. M. Wijesingha, "Nitrogen and Phosphorus Removal Capacity of Water Lettuce, Water Hyacinth and Hydrilla in Domestic Wastewater of Sri Lankan Households," 2022 International Conference and Utility Exhibition on Energy, Environment and Climate Change (ICUE), Pattaya, Thailand, 2022, pp. 1-5, doi: 10.1109/ICUE55325.2022.10113462.
[3] Das, S. (2023). An Introduction to Water Quality Science Significance and Measurement Protocols. OhioLINK Institution Selection. https://doi.org/10.1007/978-3-031-42137-2
[4] Superior Raceways. (2025). Model 48,000-6.5 Raceway. Retrieved from https://www.superiorraceways.com/superior-raceways-intro

ACKNOWLEDGEMENTS

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- Tori Same
- Andrew Delac
- Canjie Du