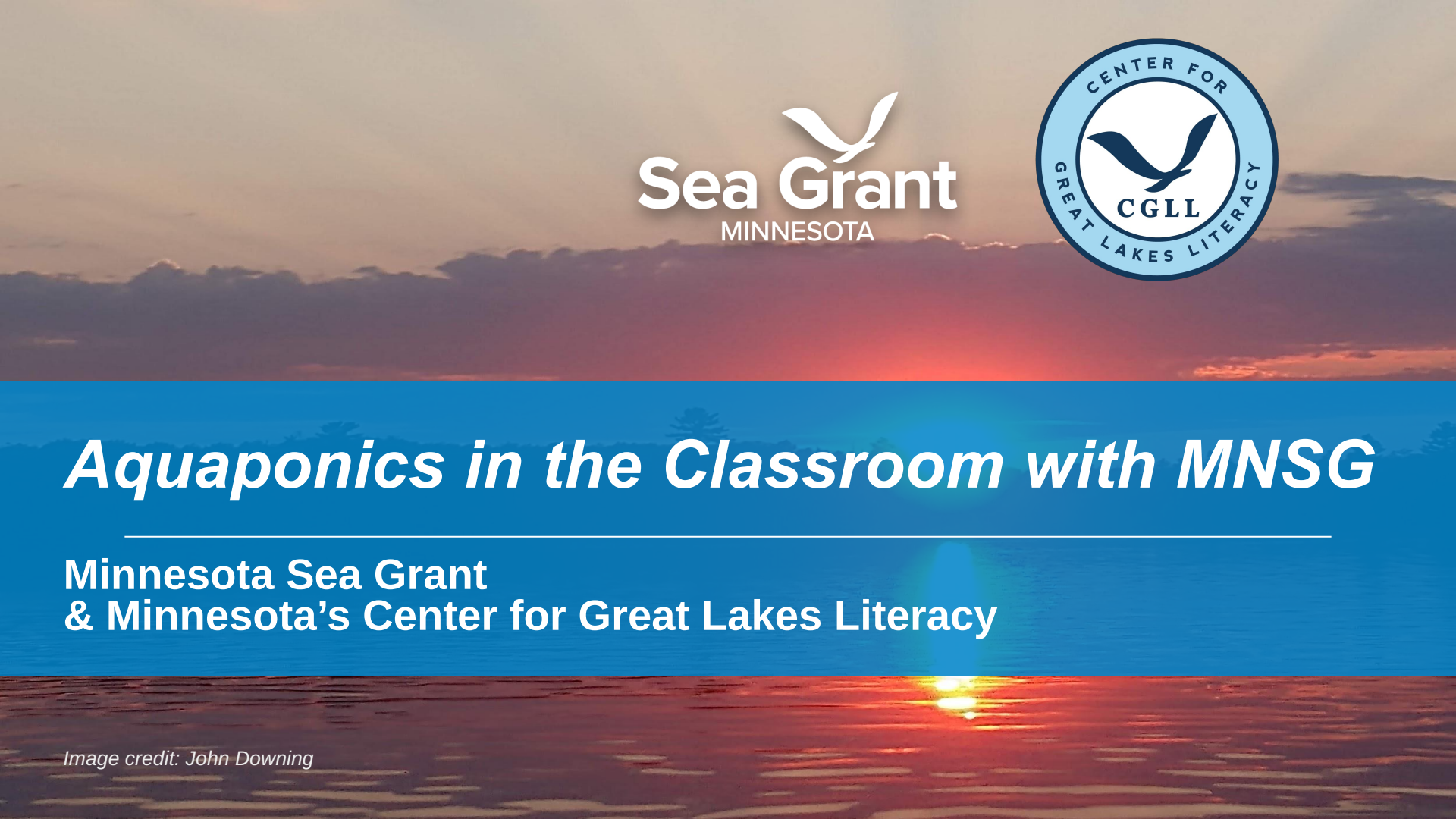


Aquaponics in the Classroom with MNSG

Minnesota Sea Grant
& Minnesota's Center for Great Lakes Literacy

Image credit: John Downing

Aquaponics in the Classroom with MNSG

Audience: Elem, MS, HS, & Afterschool STEM/Science Club Leaders

This session will provide an overview of the Aquaculture Challenge, engage participants with hands-on experience constructing mini aquaponic systems, and outline existing curriculum options and activities that can be adapted within your classroom. The Aquaculture Challenge is an interdisciplinary science competition for high school students that tasks teams to design, construct, and monitor a tabletop aquaponic system. Session leaders will outline the challenge, then work with participants to build mini-systems (an exercise similar to the Aquaculture Challenge) and outline the purpose and function of different system components. Next, session leaders will outline various aquaponic-focused lesson plans, resources, and activities available for adaptation within different classroom settings. The session will conclude with ample time for participants to ask session leaders questions.

THE GREAT LAKES BLUE ECONOMY

Sea Grant MINNESOTA

#240009 | 2024/5

INTRODUCTIONS

Let's get to know each other!

Julia Grenn, Ph.D.

Minnesota Sea Grant

Fisheries & Aquaculture Extension Educator

I am responsible for providing outreach and applied research on fisheries and aquaculture. I will work closely with other Minnesota Sea Grant staff, U of M extension educators, and Sea Grant extension educators across the Great Lakes and nation who are involved in related issues.

INTRODUCTIONS

Let's get to know each other!

Environmental Literacy & Workforce Development Extension Educator

Heidi M.S. Ferris, Ed.D.

I design, coordinate, implement and assess accessible education and workforce development programs focused on Minnesota's water resources and blue economy. These programs align with the University of Minnesota Sea Grant's mission and 2024-2027 Strategic Plan. My role emphasizes collaboration with the Sea Grant Center for Great Lakes Literacy (CGLL)

I develop accessible, research-based K-12 education programs that reflect local needs, Minnesota Sea Grant research and community water-related issues:

water resources **coastal resilience** **blue economy** **sustainable fisheries** **aquaculture** **maritime transportation**

I build and sustain partnerships to enhance environmental literacy and expand workforce development in Minnesota.

The History and Present of Minnesota's Land and Water

University of Minnesota Land Acknowledgement
Office of Diversity & Inclusion

- The University of Minnesota system has campuses that are located on the homelands of the Dakota and Anishinaabe peoples, and acknowledges the eleven Tribal Nations of Minnesota.
- It is important to acknowledge the peoples on whose land we live, learn, and work as we seek to improve and strengthen our relations with our tribal nations.
- We must ensure that our institution provides support, resources, and programs that increase access to all aspects of higher education for our American Indian students, staff, faculty, and community members.

11 Nations of Minnesota

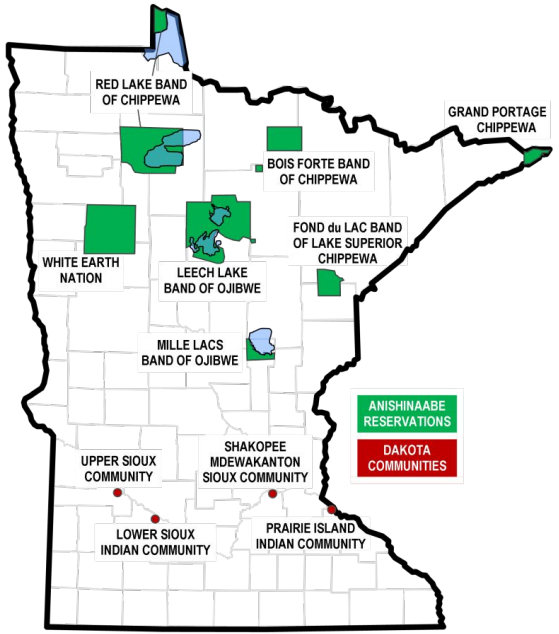


Image credit: Minitex

Working with Stakeholders

Chad Hebert, Yellow Perch aquaponics producer, Women's Environmental Institute aquaponics instructor, and former Little Earth of United Tribes urban farm manager, and project partner, GLAC advisory board member.

Image credit: A. Schrank

Image credit: C. Dettman

Virtual Field Trip of MNSG Facilities!

What is aquaculture and aquaponics?

Aquaculture + Hydroponics = Aquaponics

Breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments

Growing plants in a soilless substrate

Combines aquaculture and hydroponics to grow plants and fish in a single system

What do you know about aquaculture and aquaponics?

Aquaculture Challenge Competition

The competition has four parts. Each team has the option to complete one or more of the four parts in the four months of the competition.

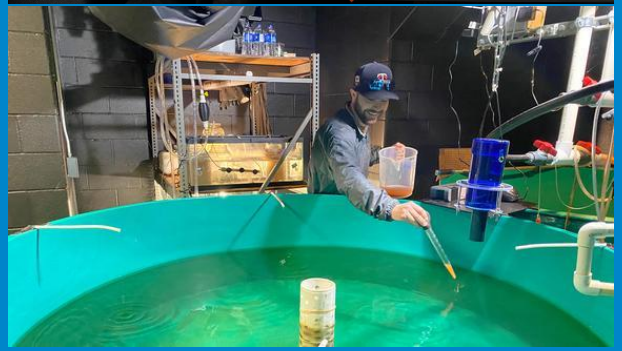
1. Design challenge. Teams selecting this option must design and build an aquaponics system of any size.
2. Monitor challenge. Teams selecting this option must monitor the chemical and biological portions of their aquaponics system. Teams can earn extra points for organized data and automated monitoring.
3. Business challenge. Teams selecting this option must create a business plan targeting aquaculture industry issues and solutions.
4. Seafood challenge: Teams selecting this option must perform a culinary demonstration and outreach project. Teams can earn extra points for demonstrating fish processing and handling skills.

Image credit: A. Schrank

Image credit: C. Dettman

Today's MNSG Aquaponics Engineering Design Challenge:

How can you use the materials at your table to build an aquaponics system model in 60 minutes?



Today's MNSG Aquaponics Engineering Design Challenge:

How can you use the materials at your table to build an aquaponics system model in 60 minutes?

3 main parts of an aquaponics system:

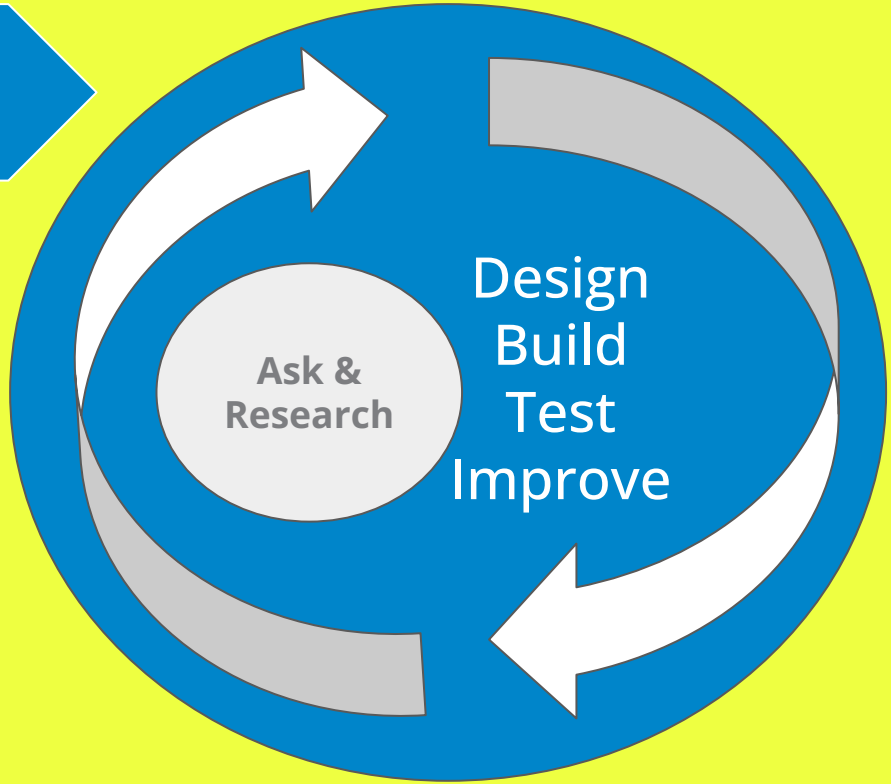
1. Place for fish to live
2. Place for bacteria to live (biofilter)
3. Place for plants to live

5 minute sketch + questions list

Engineering Design Process

Problem Question?

Criteria & Constraints



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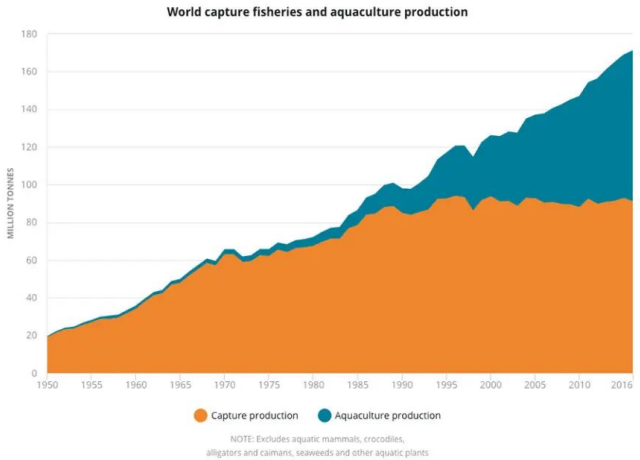
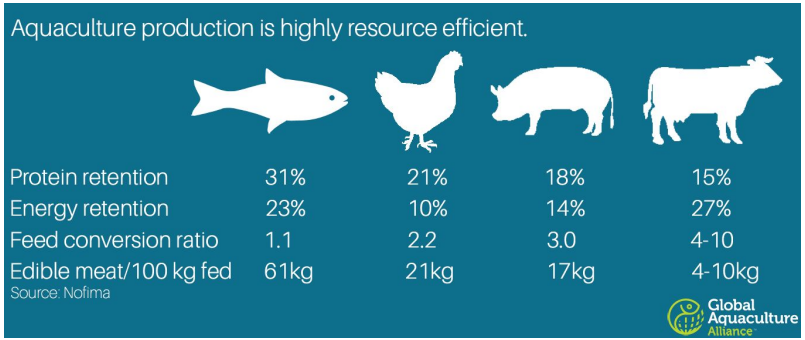
Why is Aquaculture Important?

- Increasing population of people = increasing demand of seafood
- In USA, we import more than we export
  - Over 20 billion trade deficit
- Wild capture fisheries at maximum sustainable yield
- Efficient feed to flesh conversion ratio





Aquaculture Challenge General Timeline of Events

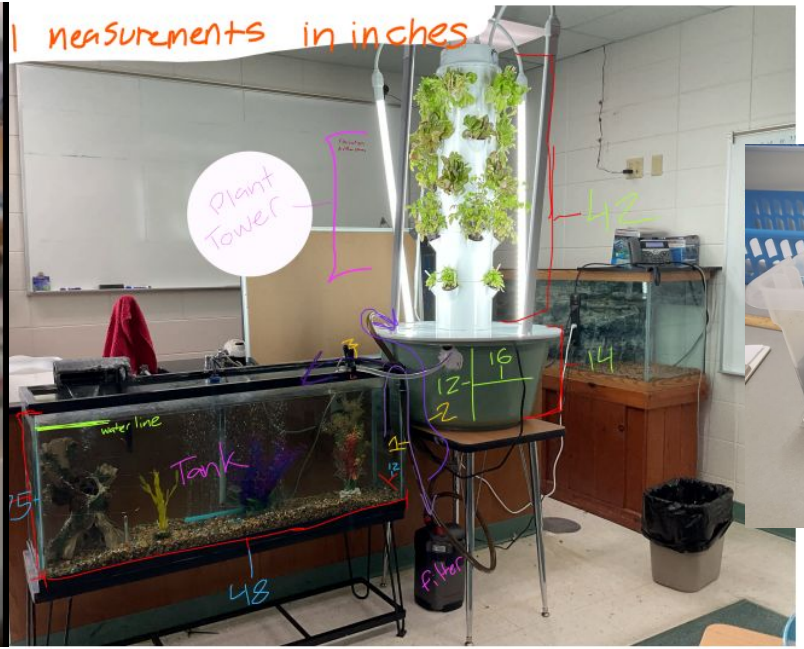
- Oct. 31, 2024: Registration Opens
- Nov. 12-Jan. 12, 2025: Asynchronous Coach Check-In
  - 1a - A 2-3 hour Google Classroom training that introduces the challenge and team requirements. Coaches complete at their own pace
- Early Jan. 2025: Coach Zoom Check-In
  - 1b - Live coach training to review Google Classroom unit. Only attend one.
- Jan. 10, 2025: Last day to register a team. Registration closes at midnight.
- Early Jan. 2025: Virtual open house and team meet and greet.
- Feb. 2025: Milestone 2 Check-In. Teams check in with liaison.
- Mar. 2025: Milestone 3 Check-In. Teams check in with liaison.
- Apr. 2025: Milestone 4 Check-In. Submission prep. Teams prepare for submission with liaison.
- Apr. 25, 2025: Due date for project submissions.
- Early May 2025: Virtual awards ceremony.

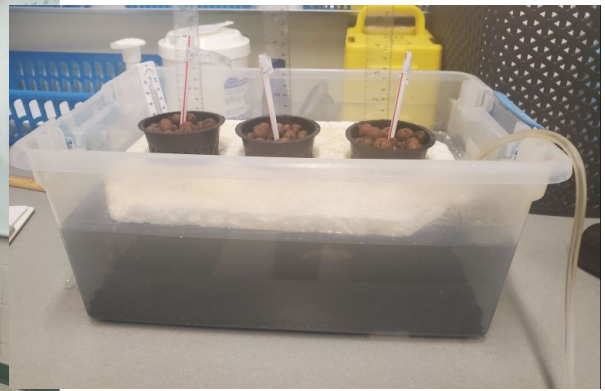
Image credit: C. Dettman

Acknowledgements & Awards

- The 2024 Aquaculture Challenge was created and managed by Michigan Sea Grant and Lake Superior State University. Additional funding and support was provided by North Central Regional Aquaculture Center (NCRAC), Sea Grant Center for Great Lakes Literacy, Sea Grant Great Lakes Aquaculture Collaborative, and Minnesota Sea Grant.
- **In 2025, Harbor City School in Duluth was the first school from Minnesota to participate and also won and award.**

System Examples and Component Overview





What do Aquatic Organisms Need to Grow?

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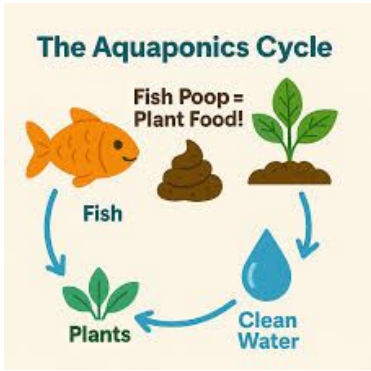
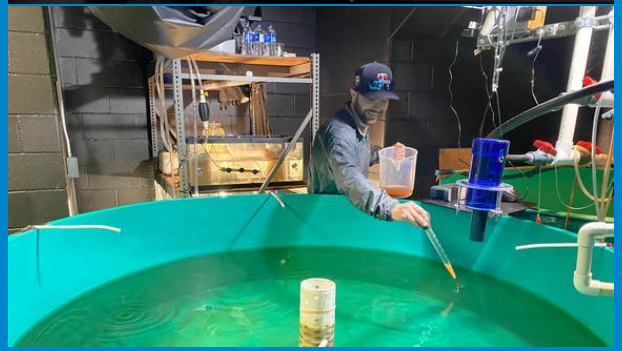
What do you need to add?

- Food
- Oxygen
- Clean Water
- Light/Space

What do you need to remove?

- Carbon Dioxide
- Animal Waste (ammonia, nitrates, other nutrients)





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3 main parts of an aquaponics system:

1. Place for fish to live
2. Place for bacteria to live (biofilter)
3. Place for plants to live

What do you need to add or remove for organism growth?

5 minute sketch/build + questions list

Engineering Design Process

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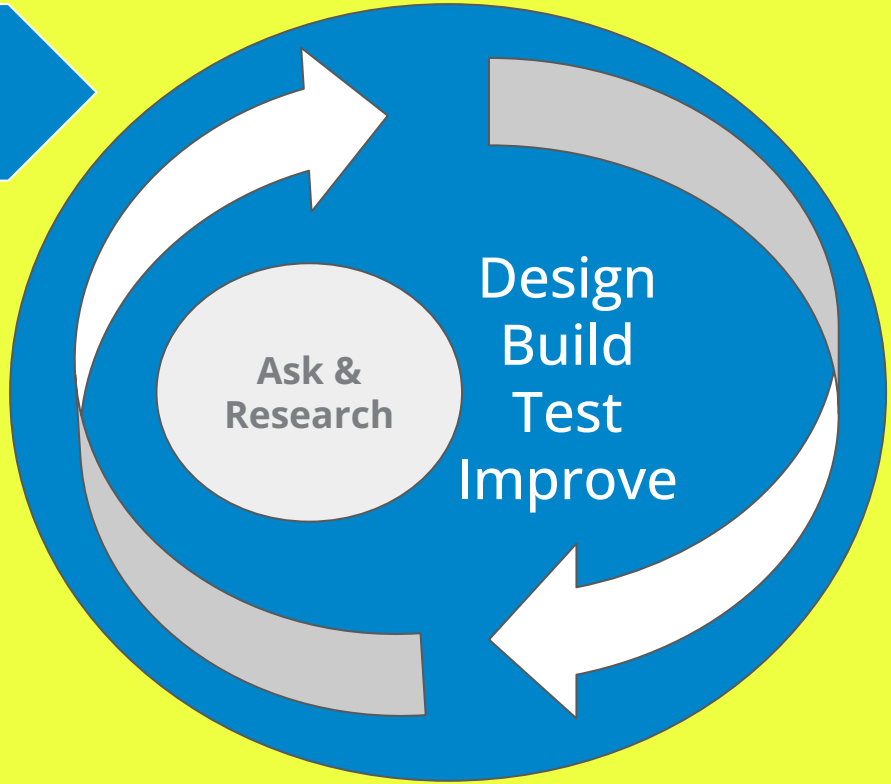
Problem Question?

Criteria & Constraints



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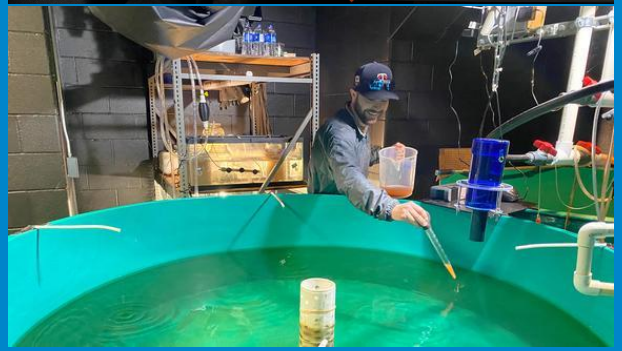

Today's MNSG Aquaponics Engineering Design Challenge:

How can you use the materials at your table to build an aquaponics system model in 60 minutes?

CHECK: Do you have these 3 main parts of an aquaponics system? What did you need to add or remove from your system based on what fish and plants need to grow?

1. Place for fish to live
2. Place for bacteria to live (biofilter)
3. Place for plants to live

15 minute sketch + build + explain

Let's do some research using this MNSG video!

Take a moment to look up other MNSG resources

Today's MNSG Aquaponics Engineering Design Challenge:

How can you use the materials at your table to build an aquaponics system model in 60 minutes?

3 main parts of an aquaponics system:

1. Place for fish to live
2. Place for bacteria to live (biofilter)
3. Place for plants to live

Do you prefer a coupled or decoupled system?

System Examples and Component Overview

Educator Resources at MNSG

Educator Resources

Great Lakes Fresh Fish Finder

MNSG Fisheries and Aquaculture Program

Great Lakes Aquaculture Collaborative >

The Great Lakes Aquaculture Collaborative (GLAC) is a three-year (2019-2022) project to create a regionwide group to foster relevant, science-based initiatives that support aquaculture industries. *Image credit: ©Damian Horațiu Sultănoiu. stock.adobe.com*

Great Lakes FRESH FISH FINDER

Great Lakes FreshFishFinder.org Website >

FreshFishFinder.org was developed to meet a need to directly connect fish producers with consumers after the disruption of traditional markets during the COVID-19 pandemic.

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What about the Aquaculture Challenge and these MNSG resources peaks your curiosity?

Why?

Find out more at:

https://seagrant.umn.edu/programs/educator-resources

Did you meet today's engineering design challenge?

What is missing from your system?

Where is more research needed?

How does your work connect to Minnesota's Blue Economy?

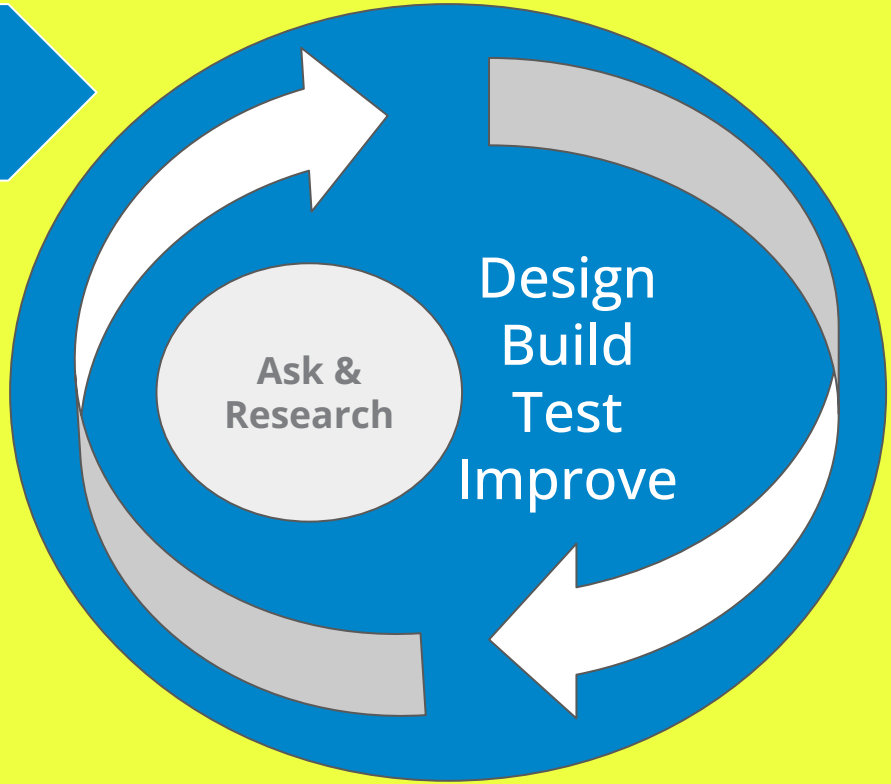
What are 5 interdisciplinary curriculum connections?

Engineering Design Process

Sea Grant MINNESOTA

Problem Question?

Criteria & Constraints



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What do MNSG and CGLL do?

CGLL fosters informed and responsible decisions that advance basin-wide stewardship by providing hands-on experiences, educational resources, and networking opportunities promoting Great Lakes literacy among an engaged community of educators, scientists, and youth.

Vision

Growing a community of Great Lakes literate individuals able to steward the Great Lakes and connected freshwater resources.

Mission

The Center for Great Lakes Literacy (CGLL) engages and inspires teachers, scientists and students to develop a Great Lakes-literate public capable of effectively contributing to the sustainable use of the Great Lakes and connected freshwater resources.

Sea Grant
MINNESOTA

HEALTHY COASTAL ECOSYSTEMS

SUSTAINABLE FISHERIES & AQUACULTURE

RESILIENT COMMUNITIES & ECONOMIES

ENVIRONMENTAL LITERACY & WORKFORCE DEVELOPMENT

CENTER FOR GREAT LAKES LITERACY
CGLL

[8 Great Lakes Literacy Principles]

What are some resources online?

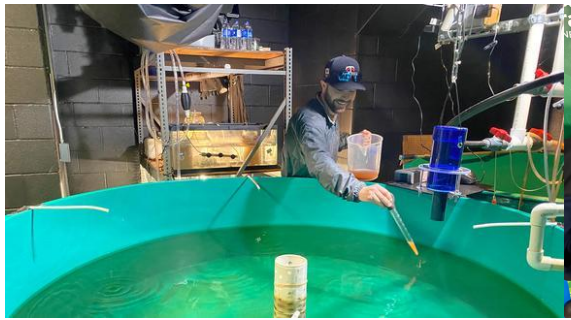
Learning Opportunities at cgll.org:

- Professional learning
  - Shipboard Science
  - Workshops
  - GLLees
- Youth Opportunities
  - GLLees
  - Aquaculture Challenge
  - Bioblitz
  - Students Ask Scientists

Exciting Opportunities!

- **Register for the 2026 Aquaculture Challenge**
- **Tour the Aquaculture Lab at the U of M**

- **Apply for 2026 Shipboard Science**
  - **1 week in July with educators and scientists**
  - **Live aboard the Lake Guradian on Lake Superior.**
  - **Applications open January 1, 2026.**



Explore Minnesota Sea Grant's Education Kits!

GREAT LAKES LITERACY PRINCIPLES

1. The Great Lakes, **bodies of fresh water** with many features, are connected to each other and to the world ocean.
2. **Natural forces** formed the Great Lakes; the lakes continue to shape the features of their watersheds.
3. The Great Lakes influence local and regional **climate and weather**.
4. Water made Earth **habitable**; fresh water sustains life on land.
5. The Great Lakes support a broad **diversity of life and ecosystems**.
6. The **Great Lakes** and **humans** in their watersheds are inextricably **interconnected**.
7. Much remains to be **learned** about the Great Lakes.
8. The Great Lakes are socially, economically, and environmentally **significant** to the region, the nation, and the planet.

GLL Posters available today!