FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

DIVISION OF AQUACULTURE

600 South Calhoun Street, Suite 217
Tallahassee, Florida 32399-1300

Tallahassee Office: (850) 617-7600
Email:
Aquaculture_Education@FDACS.gov
Website: www.FDACS.gov

Tips for Starting a School Aquaculture Program

This publication provides educators with a step-by-step guide on some important factors to consider before incorporating an aquaculture or aquaponics system on their campus. Considering your program goals, spatial limitations and livestock choices are just some of the preliminary components.

CLASSROOM DETAILS: *THE WHERE AND WHO*

The first step is obtaining permission from your school administration before starting to plan!

Administration and educators should be on the same page about the expectations for a system before beginning the planning process. Determine who will have access to the system, especially in the event that you are not available. Enlisting another trusted caretaker ahead of time (e.g., another educator, administrator or maintenance crew member) for backup on days you are not able to be at the school, including the weekends, can provide peace of mind in the event of your absence. Be transparent on your expectations for this caretaker and ensure that they are familiar with the system. The animals in the system will require *daily* care and a plan should be put in place for weekends, long holiday breaks and during the summer.

Consider the role, if any, the students will have in maintaining the system. Including the students in the caretaking portion of the tank is a great learning experience, when coupled with your oversight. Evaluate your students' skillsets, maturity and time commitments to aid you in deciding ways that they can partake. *Remember, you as the educator are the main caretaker of the system.*

A system can be done inside the classroom or outside. Choose carefully, as moving a system after it has already been set up can be extremely difficult. A system inside the classroom allows for easier monitoring and stable environmental conditions, but a system outdoors offers more space and less damage in the event of a system leak or catastrophic failure.

Think about some factors you know are needed to successfully run a system: working electricity, ability to fill the system with proper water and an area to drain water as needed.

Constructing and maintaining a system is time consuming. Try to account for these time commitments during your initial planning phase. The bigger the system, the more elements to maintain. It is recommended to start small and work your way up to a larger system.

PROGRAM GOALS: *THE WHY*

Before even beginning the process of building your system, consider your *why* for wanting to incorporate a system into your classroom. Aquaculture and aquaponics systems are incredible educational tools that require constant daily care. Preemptively making a plan for what you will do with your crops (i.e., terrestrial plants and aquatic organisms) at the end of the school year is recommended.

Potential options include selling or cooking the fish and plants, harvesting only the plants and maintaining the fish from year to year or raising ornamental fish to give away or sell as pets. Creating a plan for your livestock should be considered during the initial planning phase. Review local and federal licensing permits surrounding the sale of aquaculture products.

LIVESTOCK GOALS: *THE WHAT*

Decide the type of fish and plants you want in your system before starting, as design, size and care requirements may vary greatly depending on your species of choice. Not all species can be cared for in the same way, and determining which best fits your program goals and caretaking abilities will set your system up for success. Some species, like tilapia, require special authorizations or permits to be raised in Florida, as highlighted in the Restricted Species Aquaculture: Rules and Regulations publication. Additional regulations may vary county by county and all necessary permitting should be acquired before obtaining any animals or plants. Understand the care requirements that will be demanded of you and your students before establishing a system.

FOOD PRODUCTS:

One of the benefits of an aquaculture or aquaponics system is no shortage on the variety of different fish or plants that can be grown or kept. Many schools with systems start with tilapia and basil, as they are easy to maintain and grow quickly. This ease of growth is great for novice caretakers and allows for students to see aquaculture in action.

Although there are many other species that would thrive in an aquaculture

system, consider the average growth rates and harvest schedule for the plants or animals of your choosing. Plants typically grow faster than fish and may be harvested multiple times before fish reach harvestable size. Carefully planning when you begin to grow certain species and keeping a harvest schedule can ensure that students get the most from the experience and are able to witness the growth of plants or animals without interference from school breaks.

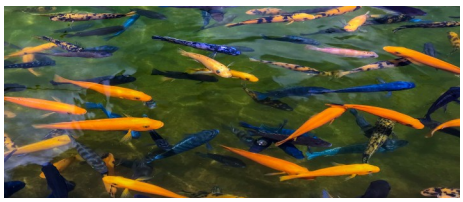
CERTIFICATION REQUIREMENTS:

Additional certification and training may be required if you intend to use or sell the harvested products for human consumption.

An Aquaculture Certificate of Registration issued by the Florida Department of Agriculture and Consumer Services (FDACS) is required before products can be sold.

The Hazard Analysis and Critical Control Points (HACCP) training and certification are required if your school will process the fish onsite.

Determine if your school has the appropriate HACCP certification and familiarize yourself with local regulations regarding the sale of plant and animal products.



ORNAMENTAL PRODUCTS:

Growing fish or plants for food or profit is not the only option when it comes to incorporating a system in your classroom. If you do not want to worry about harvesting or are unable to do so, ornamental products may be an option.

Popular ornamental fish, such as koi, angelfish and cichlid species, are typically better equipped at handling environmental changes outside of what their typical range.

Common decorative plants, such as pothos, bamboo or peace lilies, typically do well in smaller systems and grow tall with minimal external input.

IMPORTANT CONSIDERATIONS:
THE HOW

TEMPERATURE/CLIMATE:

Raising plants and animals together can be challenging, especially when factoring their different needs regarding temperature, pH, salinity and nutrient load. Consider how conditions in the classroom (i.e. a cold classroom) may affect the temperature regulation of the system and consider incorporating a heater if necessary. Monitor the outdoor temperatures as the seasons and outdoor condition change; outdoor systems may experience extreme cold or hot temperatures depending on location and season. This could mean incorporating heaters in the winter and adding appropriate shade during the summer to decrease the chances of the temperature fluctuating to a fatal extreme.

Seasons may also dictate when you plant or harvest certain crops. Consider how the lighting needs of the plants can be met; adding plant lights to indoor systems or shade to outdoor systems may be required to ensure proper growth.

WATER:

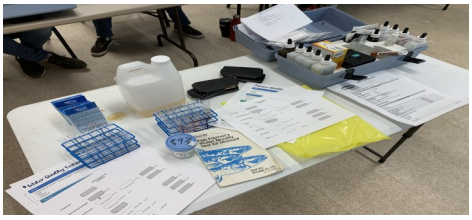
Water quality is arguably the most important and difficult part in maintaining any system.

Water changes are *necessary*. Having easy access to a water source should be considered when choosing your systems location.

It is impossible to generalize water parameters across water sources; it is your responsibility to gather this information. Regardless if the water is coming from a well, rain barrels or straight from the tap, you *need* to know your baseline water parameters before adding it into your system. Purchasing a water quality testing kit can be used to establish a baseline and allow you to check your systems water parameters on a consistent basis.

Well water typically has low oxygen levels, requiring the addition of some type of aeration such as an air stone or aerator. City or municipal water typically fluctuates in levels of pH, ammonia, chlorine and chloramine, requiring treatment. Having treatments readily available, such as pH Up, pH Down, dechlorination tablets, algae gone or bicarbonate of soda, can allow you to easily alter the parameters of the water to acceptable levels. Consider including these treatments and water quality testing kits when establishing a budget for the system.

When you are first starting or restarting your system, the water should be continuously tested several times in a week to ensure it is “nutrient cycling.” Important parameters to monitor include ammonia, nitrite, nitrate and pH.



ELECTRICITY:

Electricity is *necessary* to run vital components of the system, such as pumps and aerators. Find a location for your system where it is easy to access grounded, elevated and covered outlets. Remember water and electricity do not mix but accidents such as spills or splashes may still occur. A lack of electricity means the system is not being properly oxygenated, risking fish mortality.

Become aware of any planned power outages due to maintenance or break shutdowns. Discuss with administration to determine alternative power sources and ways to be alerted in the event of an outage when you are not at the school.

Develop a contingency plan for planned and unplanned outages. Small battery powered aerators can be used in the event that the outage is short lived. Consider keeping a small generator on hand in the event that the outage exceeds 4 hours. How long your system can last without flowing water depends on the type, size and number of fish you have, as well as temperature and age of the system. Dissolved oxygen of the systems will begin to drop immediately in the event of an outage due to a ceasing of flow and aeration.

Generally, systems with more fish, higher temperatures and higher nutrient loads are going to lose oxygen more quickly, leaving you less time to respond. Monitoring dissolved oxygen levels before and after outages can help you determine how quickly the levels will become critical.

BACTERIA CULTURE:

Husbandry is the care, cultivation and breeding of crops and animals.

Although the first step may seem as easy as just adding water to your system, consider that you have not yet made the system livable for your fish and plants. Beneficial bacteria, an essential part of the nitrogen cycle, must first be established before adding animals. This bacteria can come in the form of active biomedia, water or waste sludge from an established system. Unscented ammonia and a small amount of sodium bicarbonate (baking soda) are then added as nutrient sources for the bacteria. *No animals should be added to the system until a sufficient amount of beneficial bacteria has developed (usually 6 to 8 weeks).* This period of "cycling" requires daily testing for ammonia, nitrite and nitrate in order to track the cycling process. Once the bacteria has been successfully maintained for 6 to 8 weeks and a water test shows 0 parts per million (ppm) for ammonia and nitrite, it is now ready for fish and plants to be added to the system. If ammonia levels are not consistently lowering to 0 ppm, this may be an indicator that the bacteria in the tank has died.

ANIMAL HUSBANDRY:

Fish should be monitored daily for activity but also fed on a routine basis. How much and how often you feed them depends on the species and abundance of the fish being kept, water temperature and growth goals.

DO NOT OVERFEED!

A good rule of thumb is to only feed as much as the fish can eat in 5 minutes and remove any uneaten food from the tank. Overfeeding and leaving uneaten food in the tank creates ammonia build up, which is toxic to your fish, and encourages algae buildup. Algae buildup can take nutrients away from plants; clog pipes, pumps and airstones; and cause problems with dissolved oxygen levels. Overfeeding results in more waste being developed, raises pH, puts excess pressure on the filters and increasers the amount of time it would take you to clean the system.

Your fish tank, filter barrels and sumps will need occasional siphoning or cleaning as detritus (fish waste, debris and uneaten food) accumulates. It is recommended to clean the system at least once a month, but the frequency may vary depending on the accumulation of detritus.

Water temperature can also affect your feeding regimen. Typically fish eat more in warm waters and less in cool waters. Take note of how your fish respond to food as the seasons change and adjust accordingly. This change may also result in altering the frequency of cleanings your system requires (i.e., more often in the summer, less often in the winter).

Monitor your system daily and ensure that any changes are noted, especially changes to the sound of the pumps and aerators. Alterations in the sound being produce could be an indicator that your equipment is not functionating properly and may warrant further investigation.

Be aware of your water levels. While evaporation will account for some water loss and need to be replaced occasionally, make note of how often you are needing to do this. Visually and manually inspecting your tank should be a part of your monitoring routine to ensure any leaks are spotted immediately.

The Navigating the "Aquaculture System Checklist" for Educators guides users through parameters to consider and recommended maintenance frequency.

Basic husbandry recommendations include:

* Avoid overcrowding of plants and/or animals
* Be aware of your species' differing environmental and feeding needs
* Promptly remove uneaten food
* Promptly remove dead animals and plants
* Monitor pumps, aerators and water levels to detect any issues early

BIOSECURITY AND SAFETY:

Biosecurity describes procedures intended to protect humans and animals against disease or harmful biological agents.

Exposing your system to harmful biological agents such has cleaners, chemical products or even food and garbage can be detrimental. Preventative measures, including draping a net over your system to prevent debris from entering your tank, and making sure your hands are thoroughly washed and rinsed before working in and around the system should be taken.

To prevent bacterial spread, it is recommended that each system has its own dedicated maintenance and cleaning items. These items can include nets, scrubbers or even decorations. If this is not possible, or you are intending to repropose an item, be sure to disinfect and rinse the items thoroughly before moving them to a new system. Sharing items is a common and easy way to introduce disease, bacteria and pests. One common disease referred too as Ich, is incredibly hard to remove from a system once it has been introduced.

Beneficial bacteria is essential for maintaining a healthy system and keeping your plants and animals alive. Introducing cleaning agents will kill your bacterial culture, plants and animals leading to a system crash. Rinsing items thoroughly is essential for ensuring all cleaning agents are properly removed before reintroducing them to your system.

Even with careful planning, casualties will occur and should be removed immediately from the system. Each city and county has their own regulations when it comes to fish disposal. Discuss this with your administration to determine a disposal plan before the need arises.

Students should be monitored at all times when they are interacting with the system. A system introduces multiple hazards including electricity around water, slip and fall risks, tripping hazards and sharp objects such as fish spines and harvesting tools. Educate students about the risks, how to avoid them and what to do in the event of an emergency. It is essential that you and another trusted caretaker are prepared and knowledgeable about what to do in the event of injury or emergency. Keeping a first-aid kit on hand is one of many steps that can be taken to plan for the unexpected.

BUDGET:

When determining your budget, remember to include the startup of your system as this is often one of the most expensive part. To better determine which system type is right for your school, budget and experience, review the Aquaculture and Aquaponics: Which Is Right for You? publication.

Common items to consider in your budget may include but are not limited to:

* Tanks, stands and grow beds
* Filter
* Plumbing components
* Fish and plants
* Fish food and plant nutrients
* Air and water pumps
* Lights (if indoors)
* Heater (if applicable to species and location)
* Water quality testing kits (be sure to note the ingredients of the kits as some possess harmful chemicals that may not be suitable for student use)
* Water treatments (e.g., pH Up, pH Down, dechlorination tablets, algae gone or bicarbonate of soda)

FUNDING:

Grants and funding opportunities may be found here: FAITC Grants, Aquaculture Information Exchange (AIE) Florida Educator Page, Aquaculture Educator Resources page and grants.gov.

If you are considering obtaining an Aquaculture Certificate of Registration through FDACS, the annual registration fee is waived for each elementary, middle, high or vocational school. Review our publication Benefits of an Aquaculture Certificate of Registration for Educators to better determine if one is right for your school. One of the benefits includes labeling your system as a working farm which allows students to count their hours worked on their schools system towards the farm work requirements of the Florida Aquaculture Association (FAA) Certification exam.

HELPFUL RESOURCES:

Feeding Practices for Recirculating Aquaculture—Iowa State University FA 0002A

Fish Health Management Considerations in Recirculating Aquaculture systems—UF/IFAS, Part 1, Part 2, Part 3

Florida FFA Aquaculture CDE

How to Start a Biofilter—SRAC Publication No. 4502

Kentucky State University Aquaponics Manual

Principles of Small-Scale Aquaponics—SRAC Publication No. 5007

Recirculating Aquaculture Tank Production Systems: Aquaponics—SRAC Publication No. 454

Water Quality Management for Recirculating Aquaculture—Iowa State University FA 0003A

School Aquaculture Program Planner

Administration Permission?

SCHOOL & CLASSROOM DETAILS

Still No ← Go Ask ← No → Yes

How often is water tested?

Square feet allotted for system:

Time to spend with system each week:

Grade or Age:

Budget? (Be sure to include the startup, maintenance, and husbandry costs.) $

GOALS

Ornamental Only

Aquatic Species:

and/or

Does the species need restricted species authorization?

Yes ← Selling? → No

Does the school have the necessary permits and certificates?

Ornamental Fish & Food Plants

Aquatic Species:

and/or

Yes ← Selling? → No

Does the school have the necessary permits and certificates?

Food Products Only

School Culinary Program?

Does the school already have a seafood HACCP program?

Does the school have the necessary permits and certificates?

Aquatic Species:

and/or

Does the species need restricted species authorization?

How will species be acquired?

RESOURCES & HUSBANDRY

Is the system covered?

Feed and materials storage location:

Is water easily accessible?

Water source

Treatment Method:

Water drainage plan:

Is there proper lighting according to each species' need?

☐ Yes ☐ No

Is there constant access to electricity?

Plan for extended school power outages:

Will the school have constant electricity during breaks or closures?

Backup teacher(s) for maintenance:

Plan for system issues:

Plan for school breaks and closures:

Plan for sick or dead fish:

Does the system have FDACS Certification?

Yes

No

Contact FDACS