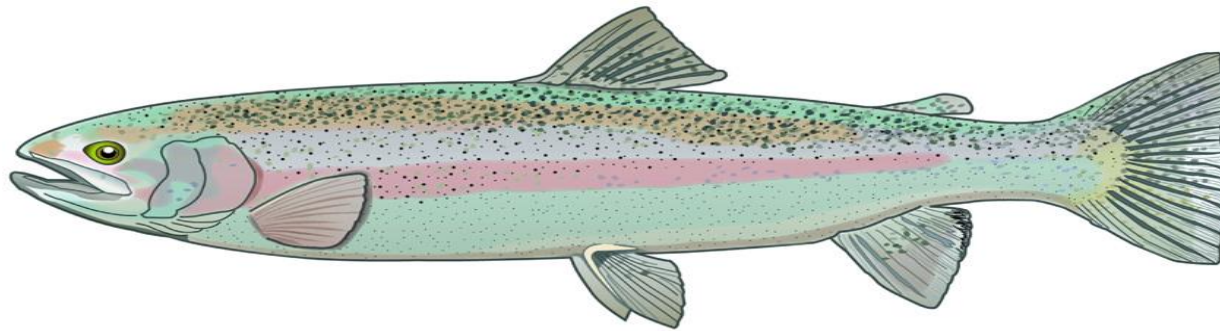




# Aquaponics 101

Maxine Hunter

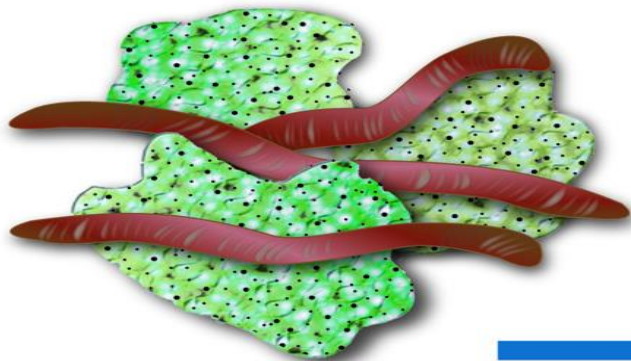
UF/IFAS Extension Marion County  
Residential Horticulture Agent I  
Updated 4/21/20



**FISH**

**1**

FISH  
PRODUCE  
WASTE



**MICROBES  
& WORMS**

**2**

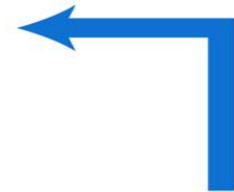
MICROBES & WORMS  
CONVERT WASTE TO  
FERTILIZER FOR PLANTS



**PLANTS**

**3**

PLANTS FILTER  
WATER THAT  
RETURNS TO  
THE FISH



# The Aquaponics Cycle





# What is aquaponics?

- Aquaculture + Horticulture
- Aquaponics is a food production system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a soilless environment.
- Utilizes a recirculating system and natural bacterial cycles to convert fish waste to plant nutrients. The size, complexity, and types of foods grown in an aquaponics system can be very different.



# Benefits of Aquaponics

- Environmentally friendly and sustainable
- Uses less water than traditional gardening (90% less)
- Can be run on solar, gas, or electrical power source
- Recycles nutrients
- Can be made from mostly recycled materials
- Fish and vegetation can be consumed
- Year round, convenient gardening
- Can be built in any space- indoor or outdoor
- Food security- more production in less space
- Organic production



# Types of Aquatic Species

- Goldfish and Koi
- Tilapia
- Bream or crappie
- Bass or perch
- Catfish
- Shrimp, crawfish, lobster
- Ornamentals- cichlids



# Types of Plants

- Ornamentals

- English Ivy
- Heartleaf Philodendron
- Pothos
- Bamboo

- Vegetables

- Cucumbers
- Lettuce
- Herbs
- Tomato
- Peppers
- Squash
- Arugula
- Beans

# What plants are not recommended?

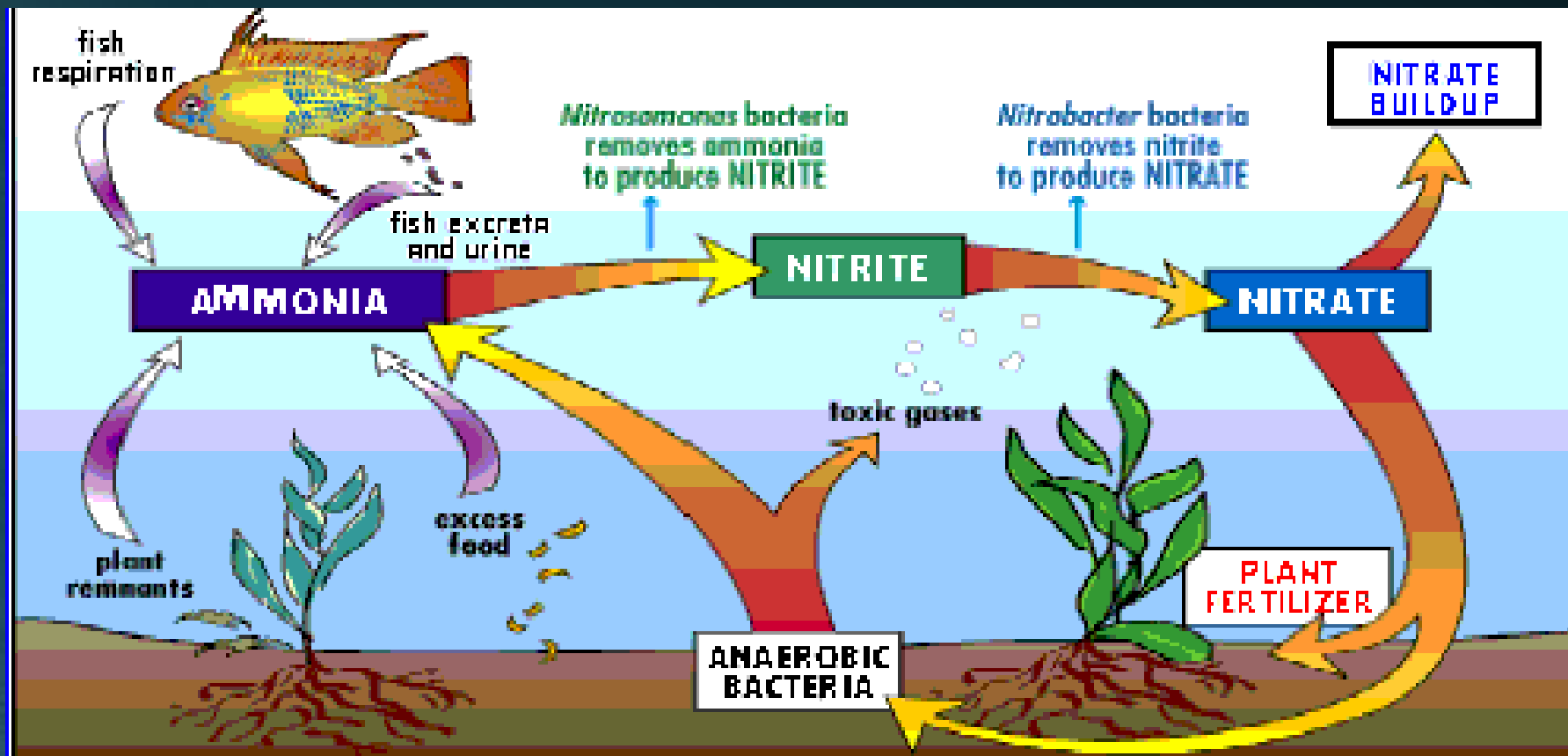
- Ornamentals

- Azaleas
- Calendula
- Zinnias
- Chrysanthemums

- Vegetables

- Blueberries
- Corn
- Perennial plants
  - Strawberries
  - Blackberries
- Root crops
  - Carrots
  - Beets
  - Potatoes
  - Onions

# The Nitrogen Cycle

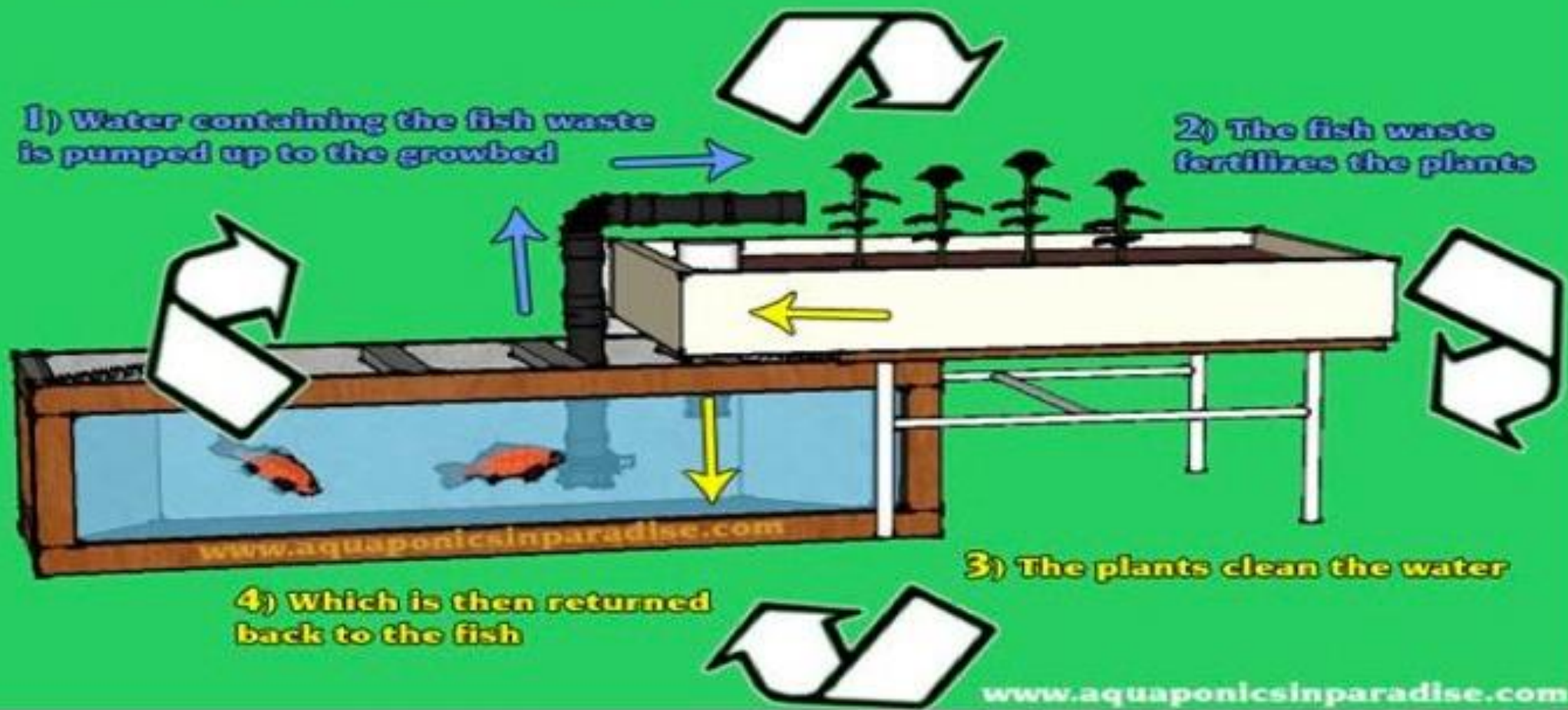


- Thanks to <http://www.pondenterprises.com/filter/nitrogen.html> for the picture.



# Aquaponics

Aquaponics is a self-watering closed-loop system that uses fish effluent and plants in a complementing recirculating environment to grow vegetables at an accelerated rate.



# Types of Aquaponic Systems

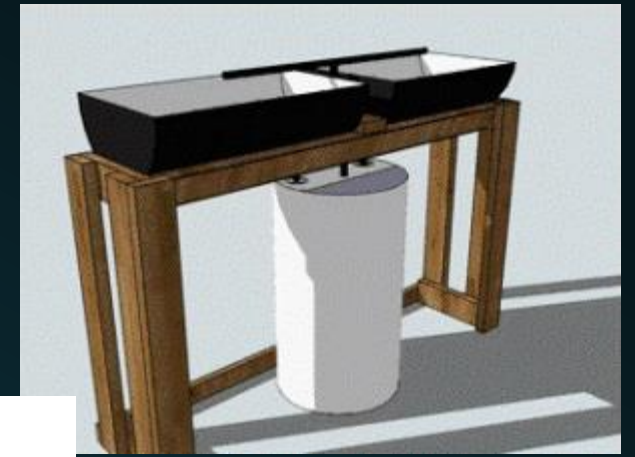
- Floating- Wick system
- Nutrient Film Technique
- Ebb and flow



# Aquariaponics



# Barrel-ponics



# Commercial Aquaponics





# Florida Aquaponic Farms

- Trader's Hill Farm- Hilliard, FL
- Green Acre Aquaponics- Brooksville, FL
- Sahib Aquaponics- Orlando, FL
- Morningstar Fishermen- Dade City, FL
- Norm Avery- St. Johns, FL
- Hydroponics Plus- Delray Beach, FL
- Chatterson Farms- Clermont, FL
- Aquaponic Lynx- Yalaha, FL
- West Coast Aqua Farms- North Port, FL
- Owl Springs Farm- High Springs, FL
- Jareds Farm- Oviedo, FL

# AQUACULTURE & FISHERIES BUSINESS INSTITUTE

AFBI ANNUAL AWARDS

**AQUAPONICS - WORKSHOPS**

November 11-13, 2019 - Commercial Aquaponics Workshop

DEMOPOLIS CATFISH UPDATE MEETINGS

NEWS AND EVENTS

RESEARCH PROJECTS

AQUACULTURE RESOURCES AND BUSINESS LINKS OF INTEREST

CURRENT AQUACULTURE ACTIVITIES

CATFISH FARMER VIDEOS

## AQUAPONICS - WORKSHOPS



Photo by David Cline

Aquaponic Workshops are offered as a response to the community's overwhelming interest in aquaponics. Participants will receive detailed instruction on the basics of aquaponics, a tour of the school's fish and plant

# “Normal Parameters” for Fish Culture

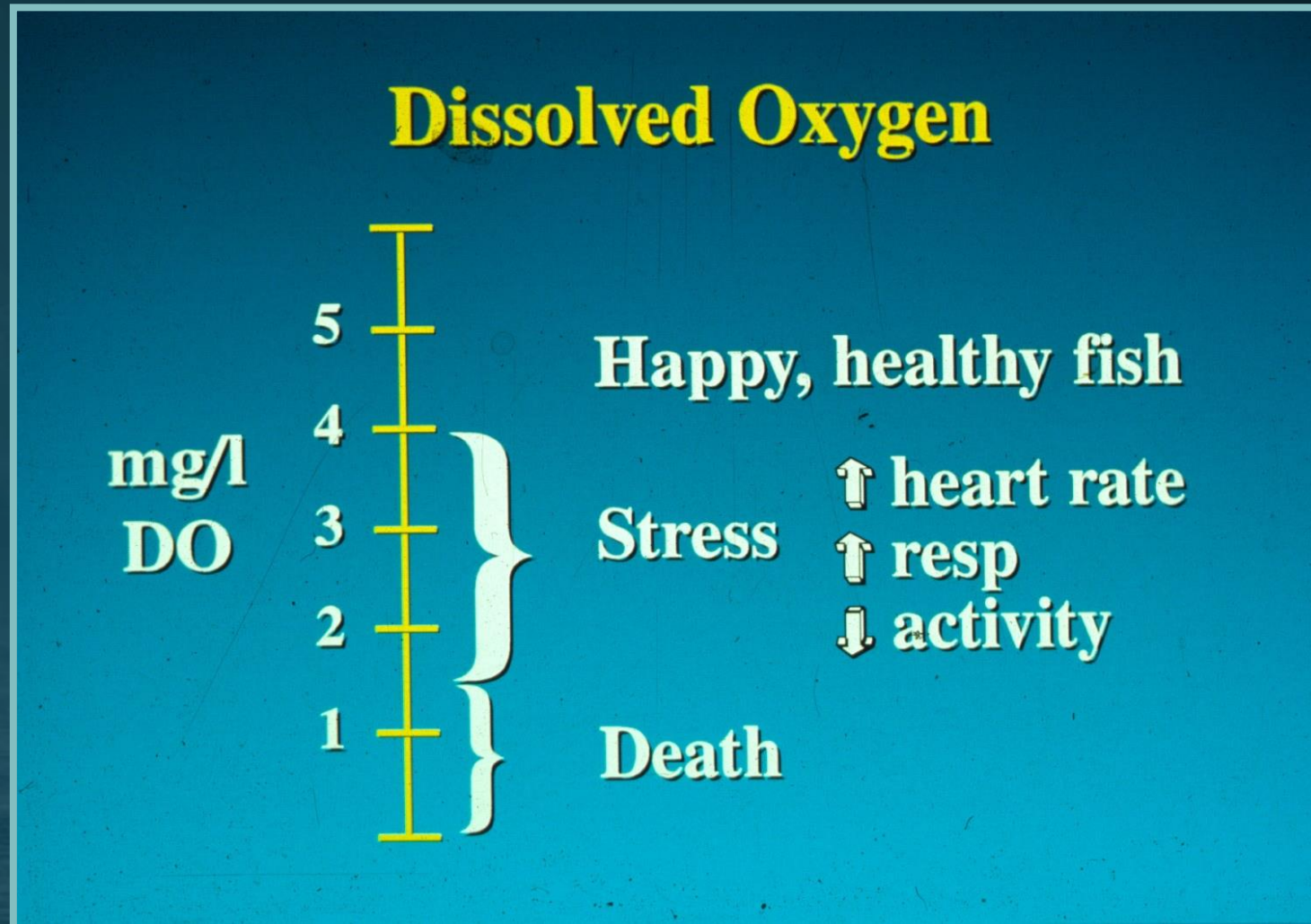
## Fresh Water

## Salt Water

• Dissolved Oxygen:	saturation (Pond: > 5 mg/L)	saturation
• Carbon Dioxide:	<20 mg/L	< 20 mg/L
• <b>pH:</b>	<b>6.5 – 9.0</b>	<b>7.8 – 8.3</b>
• <b>Total Ammonia Nitrogen:</b>	<b>&lt; 1 mg/L</b>	<b>&lt; 0.5 mg/L</b>
• Unionized Ammonia Nitrogen:	< 0.05 mg/L	<0.05 mg/L
• Nitrite:	0 mg/L	0 mg/L
• <b>Nitrate:</b>	< 20 mg/L	< 50 mg/L
• <b>Total Alkalinity:</b>	> 100 mg/L	> 250 mg/L
• Total Hardness:	> 20 mg/L	> 250 mg/L



OK, We do have to mention ...  
**Oxygen**



# pH ... for fish vs plants



**Fresh Water Fish:**  
Prefer pH 6.5-9.0

**Salt Water Fish:**  
Prefer pH 7.8-8.3

**Lethal limits:**  
PH  $\leq$  4.0  
PH  $\geq$  11.0

***Plants: pH of 5.5 – 6.5***

- ✓ Optimal up-take of nutrients
- ✓ Most nutrients water soluble
- ✓ Not a good fit for fish



## *Problems with Acidic pH...*



*Photo Courtesy  
D Petty*

- ✓ Sub-optimal for almost all fish
  - ✓ Poor growth rates
  - ✓ Acidosis....decreased blood pH???
- ✓ Bio-filters (nitrifying bacteria) not happy
  - ✓ Can result in ammonia accumulation
  - ✓ Conversion to **nitrate** compromised



*Photo courtesy  
Bass Pro Shops*

# Ammonia

- **Source:**
  - Fish excrete  $\text{NH}_3$  across gills
  - Fish foods tend to be very high protein (>35%)
- **Ammonia metabolized by bacteria in system:**
  - Excreted as  $\text{NH}_3$ , which ionizes to  $\text{NH}_4^+$ , forming an equilibrium that is pH dependant
  - Higher pH favors  $\text{NH}_3$ , the toxic unionized form
  - Nitrifying bacteria require oxygen, surface area, carbon source (ie. alkalinity)



# Nitrate

**End product of Nitrogen Cycle...**

***This is what the plants have been  
Waiting for!!!!***



# ***What Does it Take for Efficient Biofiltration????***

## **Basic Requirements for Bio-Filter:**

- 1. Surface area**
- 2. Oxygen**
- 3. Alkalinity**
- 4. Nitrogen source**



*Photo from  
Mcarthurwatgardens.com*



*Photo Courtesy  
Netty*



# *Toxins in City Water....*

## • **Chlorine**

- **Highly toxic to fish**
  - **0.02 mg/L clinical disease**
  - **0.04 mg/L lethal**
- **Sublethal exposure common**
  - **Signs include excess mucus, flashing, agitation and chronic mortalities**

## • **Chloramine**

- **Ammonia used to stabilize chlorine molecule**
- **Dechlorination can result in significant levels of ammonia being released**

## *Let's Talk About the Fish....*

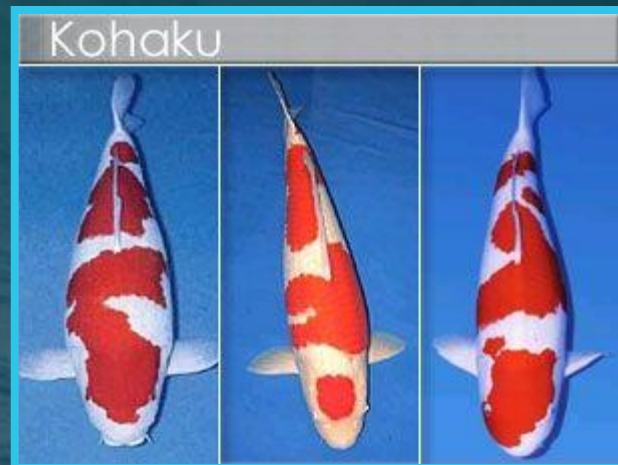
### **Target Species for Aquaponic Production:**

**Channel Catfish**

**Tilapia**

**Koi**

**Other????**



*Photo from  
Carlosar, wikimedia.org*





# Factors that may Decrease the Host Immune System



## **“Stress”**

- *Poor Water Quality*
- *Crowding*
- *Rough Handling*
- *Recent Transport*

## **Inadequate Nutrition**

- *Inadequate Vitamin C*
- *Inappropriate Feeds*

## **Toxin Exposure**

- *Residual Chlorine*

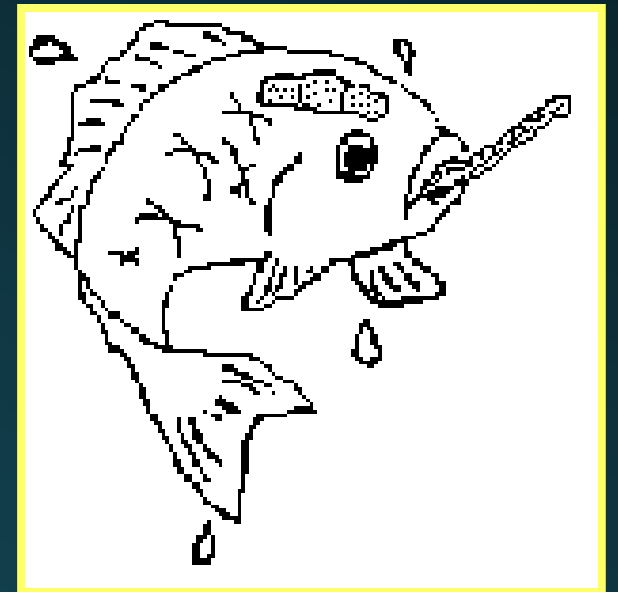
## **Pre-Existing Disease State**

- *Excessive Parasite Load*
- *Sub-Lethal Viral Infection*

# The Bottom Line...

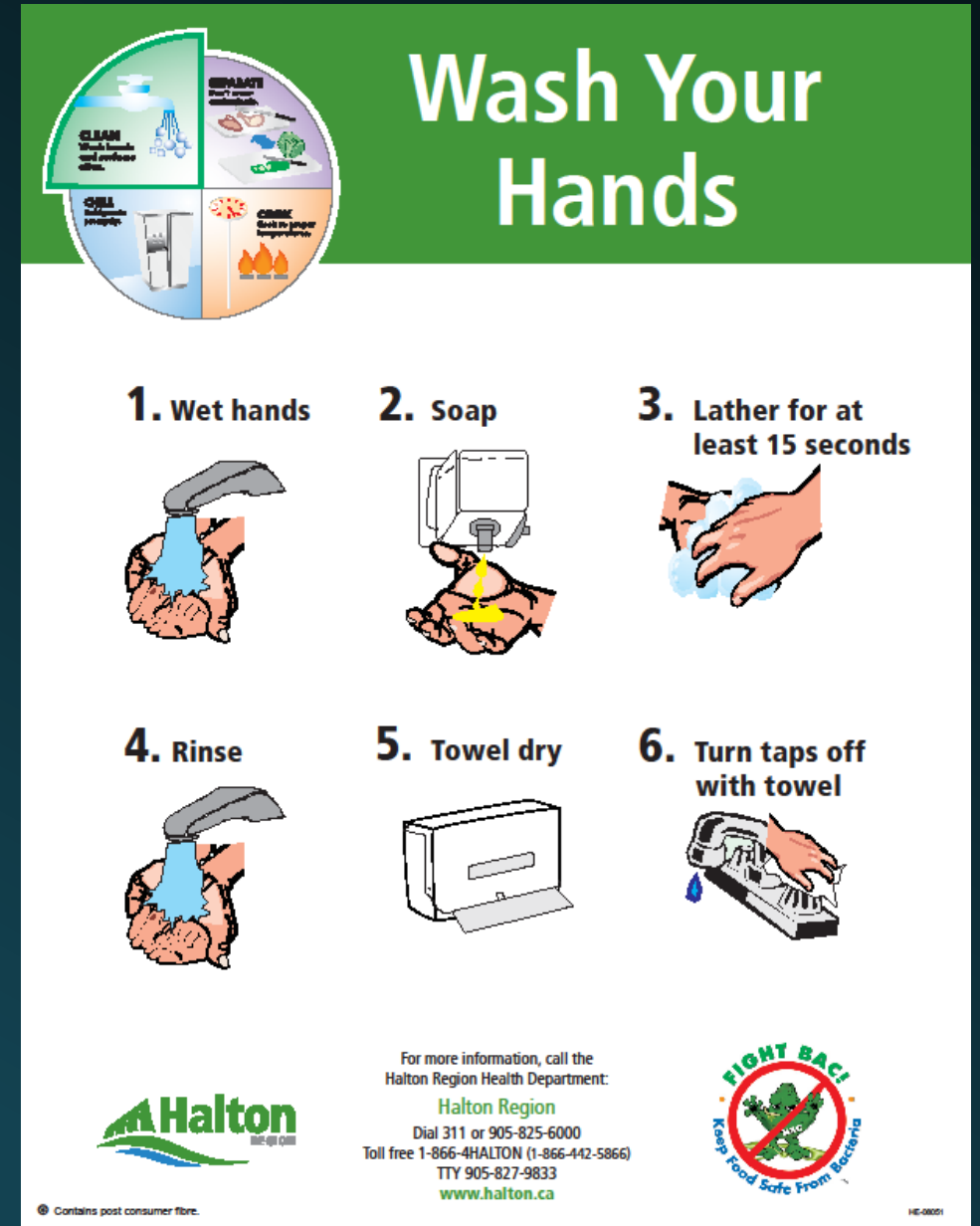
- Know “Normal” so you can recognize “Abnormal”!
- When problems occur, remember that most fish disease problems are multifactorial.
- Be as precise as possible in describing what’s wrong.
- Don’t be afraid to ask for help!

- ✓ Body position
- ✓ Color (change)
- ✓ Feeding
- ✓ Respiration rate
- ✓ Interactions




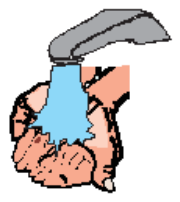
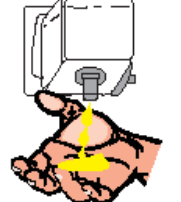

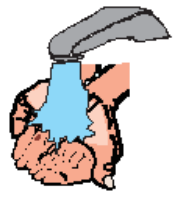
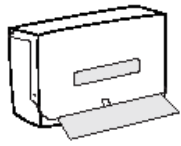

# Sanitation

- Before and After Anything you Touch
- Wash hands for 20 seconds
- Human sanitation
- Harvesting produce safely
- Managing warm-blooded animal feces
- Water sources for fish and produce
- Zoonosis prevention
- Disposing of the system's waste water





**Wash Your Hands**



- 1. Wet hands**  

- 2. Soap**  

- 3. Lather for at least 15 seconds**  

- 4. Rinse**  

- 5. Towel dry**  

- 6. Turn taps off with towel**  


For more information, call the Halton Region Health Department:  
Halton Region  
Dial 311 or 905-825-6000  
Toll free 1-866-4HALTON (1-866-442-5866)  
TTY 905-827-9833  
[www.halton.ca](http://www.halton.ca)



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# Handling produce

GOOD



BAD



## Closing Thoughts...

- **Aquaponics is new and exciting!**
- **Water chemistry is critical**
- **Focus on PH and N-Cycle to start**
- **City water not fish friendly!**
- **Consider**
  - “new” products!**
  - Be Creative!!!!**



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