Fertilization of Yellow Perch Fry Ponds

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Why Fertilize?

- Adding Nutrients (Nitrogen and Phosphorus) in fertilizers to create a Food Web
- Produce and maintain phytoplankton population – Single Cell algae
- Produce and maintain zooplankton population
- Phytoplankton is food source for zooplankton
- Zooplankton is food source for perch fry

Yellow Perch Fry Natural Foods

- Natural foods: start with zooplankton. Rotifers, cladocerans, copepods
- *Daphnia spp*. & *Bosmina spp*. – Water fleas

Figure 1. *Brachionus* spp. is one of many types of rotifers found in fish culture ponds.

Figure 2. *Ceriodaphnia* spp. are important cladocerans found in culture ponds.

Figure 3. Calanoid copepods can be a key component of the zooplankton forage base.

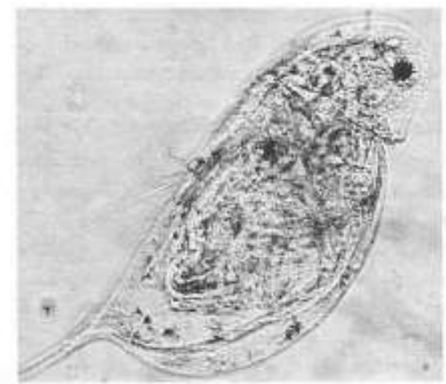

Figure 4. *Daphnia* spp. or 'water fleas' are easily recognizable cladocerans among the zooplankton.

Picture Credit: Plankton Management for Fish Culture Ponds, Morris and Mischke, Tech Bulletin Series #114, NCRAC, USDA

Types of Fertilizers

- Organic Fertilizers
  - Manures, plant meals (cottonseed, alfalfa) or by-products (dried distillers grains)
- Advantages
  - Food source for bacteria, zooplankton eat bacteria
  - Some zooplankton will eat plant meals directly
- Disadvantages
  - Variable nutrient content, especially manures, can effect Nitrogen and Phosphorus levels
  - Decomposition may lead to low D.O. levels

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Types of Fertilizers

- Inorganic Fertilizers
  - Chemically manufactured Nitrogen and Phosphorus
- Advantages
  - Consistent concentration, easier to calculate for pond applications
  - Lower cost than some organics
- Disadvantages
  - May promote blue-green algae in too high concentrations, poor food source for zooplankton

Inorganic Fertilizers

- Ammonium nitrate : 28-0-0
  - 28% Nitrogen, no phosphorus or potassium
- Phosphoric Acid : 0-54-0
- Both are available at farm stores

Application

- Inorganic
  - Once a week, use water to dilute, garden sprayer
- Organics
  - Twice a week, split full dose to prevent too much oxygen demand
- Timing of fertilization is critical
  - Need to start 2 weeks prior to hatch-out of fry
  - If possible, do not fill ponds prior to that (Insect and other predators)

Concentrations

- We follow David Culver's method
  - Walleye Culture Manual 1996 – from NCRAC
- Recommends maintaining concentrations of:
  - 600 parts per billion Nitrogen
  - 30 parts per billion Phosphorus

What is Needed for Calculation?

- Concentration in the fertilizer
- Desired concentration in pond
- Existing concentration in pond
- Volume of the pond

Inorganic Calculations

- From Culver
- Typical 28-0-0 fertilizer has 4 lb N/ gal, or 480 g/L
- 0-54-0 Phosphoric acid has 3.3 lb/gal, or 396 g/L
- Ours was found to be less
  - Nitrogen concentration 396 g / L
  - Phosphorus concentration 237.25 g / L

Calculating Volume of Pond

[Next Few Slides of Calculations are in the Booklet]

Quarter-acre pond

- 148.5 ft x 73.4 ft = 10,900 sq.ft

  X Average depth is 5 ft = 54,500 cubic feet
- Convert to cubic meters

  54,500 ft^3 x 1 m^3 / 35.31 ft^3 = 1,543.5 m^3

Nitrogen Concentration Needed

Target is 600 μg / L (micrograms per Liter)

Formula used:

$$Vnf = \frac{(600 - Np)\,Vp}{Nf \times 1{,}000}$$

Where: Vnf = volume of N fertilizer needed (L)

Np= inorganic nitrogen concentration in pond

Vp = volume of pond

Nf = Nitrogen fertilizer concentration

1,000 = conversion factor L and m^3 and μg and g

$$Vnf = \frac{(600 - Np)\,Vp}{Nf \times 1{,}000}$$

$$Vnf = \frac{(600 - 0)\,1543.5\ m^3}{396 \times 1{,}000} = 2.34\ L$$

Fertilizer needed

- Assumes there is 0 Concentration in pond
- Most ponds this is the case after one week, though exceptions occur

Phosphorus Concentration Needed

Target is 30 μg / L

$$Vpf = \frac{(30 - Pp)\, Vp}{Pf \times 1000}$$

Where:

Vpf = volume of phosphorus needed in pond

Pp = Phosphorus concentration in pond

Vp = pond volume

Pf = Phosphorus concentration in fertilizer

1,000 = conversion factor

$$Vpf = \frac{(30-Pp)\,Vp}{Pf \times 1000}$$

$$Vpf = \frac{(30 - 0)\,1543.5\ m^3}{237.25 \times 1{,}000} = 195\ mL$$

Again, assumes zero concentration of phosphorus in pond

Organic Fertilizer

- Alfalfa meal
- 2 % Nitrogen in Alfalfa meal
- 0.2 % active phosphorus – literature varies in reports
- 50 lb bag gives us 1 lb of N and 0.10 lb P
- Full ¼ acre pond estimated at 54,500 ft^3
- 54,500 ft^3 x 28.32 L/ ft^3 = 1,543,440 L

Organic Fertilizer Calculation

- P – 30 μg/ L Concentration
  30 μg/ L x 1.54 million L (pond)= 46 g needed
  Roughly, 0.1 lb needed
- N – 600 μg/ L Concentration
  600 μg/ L x 1.54 million L (pond)= 926 g needed
  Roughly, 2 lbs needed
  50 lb bag has 1 lb of Nitrogen, 0.1 lb P
- We doubled the amount of alfalfa meal to 100 lbs per week, to give us 600 μg/ L N concentration, but also gave us a 60 μg/ L concentration for P.
  - 10:1 Ratio, remember ideal is 20:1

Keys to Remember

- Need accurate volume of pond
- Accurate concentration of Nitrogen and Phosphorus in fertilizer
- If possible, determine existing concentration in pond – Test equipment is costly
- Use of Secchi disk may help monitor bloom on a rough basis

Current Method

- Switched to alfalfa meal at suggestion of Dr. Joe Morris
- Application technique changed, spread to shallow sides of pond, allow sunlight action
- Mean return of fry was 42 %, though stocking numbers were not replicated

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Timing is critical

The GOAL

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