Oklahoma Aquaculture And Ornamental Fish Ponds Workshop

Langston University School of Agriculture And Applied Sciences

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# Oklahoma Aquaculture and Ornamental Fish Ponds Workshop Program Schedule

7 March 2009

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<th>Time</th>
<th>Session</th>
<th>Speaker/Details</th>
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<tr>
<td>8:00 – 9:00</td>
<td>Registration</td>
<td></td>
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<tr>
<td>9:00 – 9:10</td>
<td>Welcome</td>
<td>Dr. Marvin Burns, Dean, School of Agriculture and Applied Sciences</td>
</tr>
<tr>
<td>9:10 – 9:40</td>
<td>Aquatic Nuisance Species Plan for Oklahoma</td>
<td>Bill Wentroth, Biologist, North Central Region, ODWC</td>
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<tr>
<td>9:40 – 10:10</td>
<td>Aquatic Insect Ecology for the Water Gardener</td>
<td>Ken Williams, Langston University Aquaculture Program</td>
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<tr>
<td>10:10 – 10:30</td>
<td>Refreshment Break</td>
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<tr>
<td>10:30 – 11:00</td>
<td>Native Submergent Vegetation</td>
<td>Dr. Conrad Kleinholz, Leader, Langston University Aquaculture Program</td>
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<tr>
<td>11:00 – 11:30</td>
<td>Buffalo Production as a Pond Management Tool</td>
<td>George Luker, Langston University Aquaculture Program</td>
</tr>
<tr>
<td>11:30 – 1:00</td>
<td>Lunch</td>
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<tr>
<td>1:00 – 1:30</td>
<td>How to Dress a Buffalo Fleecing Demonstration</td>
<td>Dr. Ray Faucette, School of Agriculture and Applied Sciences</td>
</tr>
<tr>
<td>1:30 – 2:00</td>
<td>Constructing a Temporary Ornamental Pond</td>
<td>Dr. Conrad Kleinholz</td>
</tr>
<tr>
<td>2:00 – 2:30</td>
<td>Buffalo Market Report</td>
<td>George Luker</td>
</tr>
<tr>
<td>2:30 – ?</td>
<td>OAA</td>
<td>Discussion Group</td>
</tr>
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Aquatic Nuisance Species Plan for Oklahoma

By Bill Wentroth, Biologist, North Central Region, ODWC

2009 Grass Carp Proposal

PERMIT ONLY TRIPLOID GRASS CARP TO BE STOCKED IN PRIVATE WATERS

Desirable Grass Carp Characteristics

- Control of aquatic vegetation in water bodies
  - Cost is much less than herbicides.
- Control of aquatic vegetation in reservoirs
  - Boomer Lake in Stillwater, OK

Undesirable Characteristics

- Escapement from water bodies
  - Range Expansion Across Oklahoma
- Natural Reproduction of Grass Carp
  - Lake Texoma, OK
- OVER-Control or elimination of aquatic vegetation in reservoirs:
  - Associated Game Fish Decline:
    - Lone Chimney Lake in Pawnee, OK

Triploid Grass Carp

- Reduce the Risk of Establishing a Population in Non-Target Waters.

Proposal for 2010

- Review comments from the public.
- Recommendations for legislation
- Adoption as Law
Additional Proposals for Aquatic Nuisance Species

- Movement of Aquatic Plants
  - Illegal to leave a body of water with aquatic plants attached to equipment.
  - Fines for Violators: Weed Police?

Additional Proposals for Aquatic Nuisance Species

- List of restricted ANS
  - Illegal to have Zebra or Quagga Mussels attached to boat and/or trailer.

Guess What’s In the Future!
Aquatic Insect Ecology for the Water Gardener

By Kenneth Williams, Fisheries Extension Specialist
Langston University Aquaculture Program

Common Aquatic Insects

Mayfly - Hexegenia sp.
Mature and nymph
- Larvae 12-32 mm, typical burrowing forms with tusk. Gills on abdomen.
- Larvae burrow in silt, silt-marl or silt-sand substrate.
- Particle feeders, algae and detritus, may ingest sediment nonselectively. May leave burrows at night.
- Common benthos in most bodies of water, streams, ponds, lakes etc. Spectacular hatches possible along large rivers and lakes.

Mayfly - Hexegenia sp.
Mature and nymph
- Adult – 2-4 triangular shaped wings, well developed eyes, small antennae, non-functional mouth parts. Fore legs usually longest. Elongate abdomen with 2-3 slender tails.

Green darner Anax junius
nymph and mature
- Males brighter colored than females.
- Male and females spend much time “in tandem”.
- Copulation occurs in flight. Female bends tip of her abdomen forward and contacts male genitalia in the second abdominal segment.

Order Odonata - the dragonflies and damselflies
- Green darner Anax junius nymph and mature
- Eggs are laid in or near water.
- This can occur in tandem or the pair may separate. The female then may lay eggs while the male guards her to prevent other males from grabbing her and fly away in tandem.
- Females have ovipositor and insert eggs into plant tissue.
**Dragonfly feeding habits**

- Most dragonflies feed on flying insects caught in the basket-like arrangement of their legs.
- Prey consists of midges, mosquitoes, moths and other flying insects.

**Water mites on dragonflies**

- Many pond species found with many red colored larval water mites attached to the thorax and abdomen.
- The mites do not appear to harm the dragonfly.
- They feed on dragonfly blood for 2-3 weeks before leaving the host.
- On returning to the water they develop into adult mites.

**Green darner *Anax juniqius* nymph**

- Breathe by gills. Draws water into abdomen through anus to bath gills.
- Expulsion of water through the anus is a means of rapid locomotion.
- Feed on small aquatic organisms including small fish and tadpoles.
- They conceal themselves in the mud or among plants and wait for prey.
- Voracious predator. Can cause significant mortality in channel catfish fingerling production ponds.

**Order Odonata the dragonflies and damselflies**

- Common whitetail skimmer - *libellula lydia* nymph and adult.
**Order Odonata** the dragonflies and damselflies

- Double-striped bluet - *Enallagma basidens* nymph and mature.

**Back swimmer – Notonecta undulata**

- Adult notonecta 10-16mm.
- Segmented beak is stout and reaches base of fore legs.
- Hind legs car-like and possess swimming hairs.
- Swim upside down.

**Nepidae – water scorpions**

- Raptorial front legs.
- Breathing tube at abdomen tip formed from cerci. Tube almost as long as body.
- These insects crawl slowly through aquatic vegetation.
- Eggs inserted into aquatic plant tissue.
- Prey on various small aquatic animals captured with front legs.
- They can inflict a painful bite.
- Have wings but seldom fly.

**Giant water bug - Belostoma flumineum**

- Greenish-brown to gray-black. 20-25 mm in length.
- Oval shaped with raptorial front legs.
- Feeds on insects, tadpoles, snails and small fish.
- Can give a painful bite.
- Eggs laid on back of male. He carries them until hatched.

**Giant water bug - Lethocerus americanus**

- Brownish, flattened, elongated oval, raptorial front legs, 38mm or greater in length.
- Feed on insects, tadpoles, snails and small fish.
- Attracted to lights.
- Can give a painful bite.
- Eggs attached to aquatic vegetation, sticks etc.

**Water boatman - Sigara alternata**

- Feed on algae and small organisms.
- Water boatmen do not bite.
- Eggs attached to aquatic plants.
- Important food item for many aquatic animals.
Toad bug - *Gelastocoris oculatus*

- Look and hop like small toads.
- Large projecting eyes.
- Found around moist margins of ponds.
- Feed on other insects. Leap on prey and grasp with front legs.
- Eggs laid in sand.
- Adults spend a portion of life in the sand.

Water strider *Gerris sp.*

- Feeds on insects that fall on the water surface. Short front legs are used to capture food.
- Live on still, quiet protected water.
- Often found in large numbers.
- Eggs laid on the surface of the water on floating objects.

Predaceous diving beetle – many species

- Smooth oval and hard.
- Adults 3-40 mm. brown, black or greenish or yellowish.
- Many species. Found in ponds.
- Hind legs flattened and fringed in long hairs that form paddles.
- They carry air in a chamber under the wings and can remain submerged for a long time.

Predaceous diving beetle – many species

- Feed on small animals and fish.
- Larvae called water tigers.
- They have large sickle-like hollow jaws.
- Suck body fluids of prey through channels in the jaws.

Whirlygig beetle – *Gyrinus sp.*

- Oval black beetle commonly seen spinning on the water surface.
- Lives on or below the surface.
- Rapid swimmers due to strong, flattened mid and hind legs.
- Pair of eyes on upper and lower surfaces of head.

Water scavenger beetle – *Hydrophilini sp.*

- Oval, convex beetles with short clubbed antennae and long maxillary palps.
- Black in color. Up to 40 mm long.
- Metasternum prolonged posteriorly into a long spine in some species.
- May be used to jab into fingers when handling.
**Water scavenger beetle – Hydrophilus sp.**

- Larvae are predaceous and feed on small aquatic animals.
- Larvae mandibles are usually bothed.

**Common mosquito - Culex sp. Larvae**

- Eggs laid in rafts on water surface.
- Larvae feed on algae and organic detritus.
- Larvae breathe through a breathing tube at water surface.
- When resting they hold the body at an angle to the surface.
- Pupal stage also aquatic and active. Pupae are known as “tumblers”.

**Blood worm – Chironomus sp.**

- Often occur in large swarms, usually evening. Swarm makes humming sound.
- Large group. About 670 species.

**Blood worm – Chironomus sp. Larvae**

- 2-20 mm length.
- Found in most environments.
- Bottom dwelling.
- *Chironomus* Bloodworms can live in highly polluted, organically rich waters.
- Over 100 genera

**Encouraging Insects in the Ornamental Pond**

- Floating and submerged aquatic plants
- Emergent aquatic plants
- Variety of substrates
- Sun and shade
- Still to slow moving water
- Slightly “green” water
- Reduce predation

*The End*
Native Submergent Vegetation for Filtration in Ornamental Ponds

By Dr. Conrad Kleinholz, Leader, Langston University Aquaculture Program

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**Issue**

*We Want to Sell Fish*

- Goldfish: $1 - 26
- Koi: $1 - 200

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**Plus,**

Decorative Vegetation

Barley straw (because the UV doesn’t get all the phytoplankton)

Pondside for ‘living algae’

Skimmer (s), for the floating stuff

Aeration (because the waterfall isn’t big enough)

**AND,**

I STILL HAVE TO CLEAN THE ’11 THING, WITH COMPANY COMING!

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**The Next Thing They Try**

Plants! (They are nutrient sponges, right?)

**BUT!**

These are all species of special concern in Oklahoma

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80, they need a pond...

**Acquisition Cost**

- Liner (50,596 sq ft): $300.00
- Decorative Rock (310 tons): $800.00
- 30-40 boulders
- Filter: $1,725.00
- UV Clarifier: $500
- Pump (10 HP): $1,750

**Total:** $4,300

**Operating Cost**

- Pump (500 gph): $35.55/yr
- UV (0.040 gph): $38.03/yr
- Replacement bulb: $80/yr

**Total:** $455.55

**Grand Total:** $4,755.55
What If?
We use NATIVE PLANTS!
- Native to climate
- No restrictive
- No ecosystem wastes
And, best of all:
Some species are alive
ALL year long, so they need no
acclimation time when feeding
starts.

Objectives
- Compare plant growth
  - Rooted vs. nonrooted
  - Temperate vs.
    coolwater
  - Feed vs. none
- Compare nutrient removal
  - WQ analyses
  - Nutrient content
- Compare fish growth

Methods
- Plants stocked mid-June
  08
  - 1.3 kg Ceratophyllum
  - 2.0 kg Najas
- Fish stocked late June 08
  - 20, 20 g koi
- Feeding July 1 – Sept 16
  - 2% bwf
  - 5 d/wk
- WQ
  - Biweekly
    - July 10 – September 17
    - IAN, NO2, PO4, Chla,
      Phaeo
- Plants harvested Sept
  20s
  - Separated to spp.
  - Dewatered, weighed, frozen
  - Nutrient analyses pending
- Fish weighed Sept 20s
  - Returned to tanks

Did It Work?
- Not quite like I hoped

Ammonia - N
- All concentrations ppb
  - Range: 0.914 – 4.252
  - No health concerns <0.1 ppm
- Negatively related to
  - Treatment
    - Plant (with no fish) vs. plant + fish
  - Chlorophyll a
    - $r^2 = .49, p < .01$
- Positively related to
  - PO4
    - $r^2 = .48, p < .01$
  - NO2
    - $r^2 = .49, p < .01$
  - Feed
    - $r^2 = .36, p < .01$
    - $r^2 = .34, p < .01$

Design
- 24 polyethylene tanks
  - 8" diameter
  - 20" water depth
  - 2" sand in plant tanks
  - No substrate in fish tanks
- 12 pairs
  - Plant + fish or no fish
  - Connected via 2" line
  - Water airlifted to plants
  - Return via standpipe
- 4 treatments
  - Randomly assigned
  - Coontail, no fish
  - Coontail (1.3 kg) + fish
  - Naiad, no fish
  - Naiad (2 kg) + fish
- 3 replicates
Nitrite - N

- All values ppb
  - Range
    - 6-917
    - 3.6-7.23
- Positively related to
  - NH₄
    - 9/17 r=0.45, P=0.02
- Negatively related to
  - Treatment
    - 7.23 r=-0.45, P=0.03
    - 8/6/05 r=-0.47, P=0.02
    - 6/21 r=-0.47, P=0.02
  - Vegetation prefers
    - NH₄
    - NO₂

Soluble Reactive Phosphorus

- All values ppb range
  - Range
    - 1.18-917
    - 83-8, 7.23
- Positively related to
  - NH₃
    - 9/17 r=0.62, P<0.01

Chlorophyll a

- All values in ppb range
  - Range
    - 2.45-7.23
    - 422-9, 917
  - Negatively related to
    - NH₃
      - 9/17 r=-0.49, P<0.02

Oh Yeah, the Plants!?

- Coontail
  - No relationships visible
- Naiad
  - No relationships visible
- Pithophora
  - Positively related to
    - SRP
      - r=0.56, P<0.01
    - NO₃
      - r=0.52, P<0.01

What Next?

- Current plants not best?
  - Coontail negative production in all tanks
    - Pithophora
  - Naiad overwhelmed by
    - Phytotelmator
    - Pithophora
- Why?
  - Pithophora growth rate
  - Coontail may like shade

- This year
  - Submerged vs. emergent
    - Naiad or Coontail
    - Cattail
  - But,
    - Neither acceptable
      - Try floaters
      - Water lettuce
      - Duckweed
    - Then, do comparison
**Where the Deer and Fish and Buffalo Roam**

By George Luker, Aquaculture Specialist
Langston University Aquaculture Program

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**More Stuff**

- **Catfish:** $\bar{X} \pm SD$
  - Initial weight: $0.45 \pm 0.064$ lb.; $2,280$ lb./A
  - First harvest: $1.007 \pm 0.168$ lb.; $5,035$ lb./A
  - Market weight: $2.17 \pm 0.19$, $505$ lb./A
  - Second weight: $0.64 \pm 0.05$, $3,200$ lb./A

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**Design**

- **4 Trts – 5 Reps/ea**
  - BMB (26/pond) 104/A.
  - SMB (26/pond) 104/A
  - Both (13 ea./pond)
  - NO Buff
  - = 25 FWD/pond
  - = 2 GC/pond

**Gain**

**Difference Total weight/total head/rep between Feb - Aug**

<table>
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<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Comparison</th>
<th>Diff</th>
<th>P</th>
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<tr>
<td>SMB 104/A</td>
<td>5</td>
<td>1.786</td>
<td>0.368</td>
<td>SMB 104/A vs BMB 104/A</td>
<td>0.773</td>
<td>0.008</td>
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<tr>
<td>SMB 52/A</td>
<td>5</td>
<td>1.955</td>
<td>0.305</td>
<td>SMB 52/A vs SMB 104/A</td>
<td>0.627</td>
<td>0.025</td>
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<tr>
<td>BMB 104/A</td>
<td>5</td>
<td>1.028</td>
<td>0.436</td>
<td>BMB 104/A vs BMB 52/A</td>
<td>0.160</td>
<td>0.515</td>
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<td>BMB 52/A</td>
<td>5</td>
<td>1.182</td>
<td>0.461</td>
<td>BMB 52/A vs SMB 52/A</td>
<td>0.103</td>
<td>0.300</td>
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<td>BMB 104/A vs BMB 52/A</td>
<td>0.458</td>
<td>0.091</td>
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<td>BMB 104/A vs SMB 52/A</td>
<td>0.146</td>
<td>0.575</td>
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*Fisher LSD Method, $0.05$, alpha=0.05*
Mean Number of Days (± SD) at Dissolved Oxygen and Probability

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<tr>
<th>Treatment/Comparison</th>
<th>≤ 9.0</th>
<th>2.01 - 4.0</th>
<th>≥ 4.01</th>
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<tbody>
<tr>
<td>No Buffalo</td>
<td>6.9 ± 6.8</td>
<td>33 ± 11.6</td>
<td>94 ± 13.7</td>
</tr>
<tr>
<td>SMB</td>
<td>6.8 ± 4.3</td>
<td>30 ± 7.0</td>
<td>100 ± 6.8</td>
</tr>
<tr>
<td>BMB</td>
<td>5.0 ± 5.6</td>
<td>37 ± 6.3</td>
<td>91 ± 7.7</td>
</tr>
<tr>
<td>Both</td>
<td>8.0 ± 6.3</td>
<td>32 ± 7.8</td>
<td>97 ± 13.2</td>
</tr>
<tr>
<td>No Buffalo vs. SMB</td>
<td>0.089</td>
<td>0.43</td>
<td>0.15</td>
</tr>
<tr>
<td>No Buffalo vs. BMB</td>
<td>0.50</td>
<td>0.29</td>
<td>0.47</td>
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<tr>
<td>No Buffalo vs. Both</td>
<td>0.10</td>
<td>0.76</td>
<td>0.5</td>
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<tr>
<td>SMB vs. BMB</td>
<td>0.12</td>
<td>0.02</td>
<td>0.004</td>
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<tr>
<td>SMB vs. Both</td>
<td>0.30</td>
<td>0.25</td>
<td>0.30</td>
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<tr>
<td>BMB vs. Both</td>
<td>0.35</td>
<td>0.004</td>
<td>0.10</td>
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Paired t-test

Conclusions

- Pond DO Management
  - SMB > BMB
- Growth rate
  - Production potential: BMB > SMB
- Market Potential
  - Equal
- ∴ Stocking Strategy = Maximize Benefit
  - Pond Specific

Langston University Aquaculture Program
How to Dress a Buffalo, A Fleecing Demonstration
By Dr. Ray Faucette, School of Agriculture and Applied Sciences

How to Fleece a Buffalo Fish
Dr. Ray Faucette, School of Agriculture and Applied Sciences

- Imobilize the fish.
- Begin the first cut at the mid-section of the tail and cut just under the skin and scales.

- Cut an additional strip from the center to the bottom edge of the fish.
- Cut a final strip of skin from center edge to top side of the fish.
- Repeat on the other side.

- Fish with skin removed from one side.
- Cut along the spine from tail to gill cover, slicing through ribs attached to the spine.
Remove the whole side of the fish and repeat on the other side.

Fish with both sides separated from spine.

Slice around the rib cage on each side of the fish.

After cutting away the rib cage, lightly score the side of the fish, taking care to cut just through the remaining skin. Score the fish in serving sized portions.

Cut the rib cage parallel to the ribs in serving sized portions. Chop the spine cross-wise in serving sized portions.

Twist and pull the scored fish to separate into serving sized pieces.
• Bring cooking oil temperature to about 350 degrees F.

• Fry the fish!

• When eating, break the fish open skin side down.
• Intramuscular bones will be exposed for easy removal.

• Intramuscular or "Y" bone removed from fish.

Eat and Enjoy!