I. Project Identification

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Project Title: Using Flathead Catfish to Renovate Ponds overrun with Bullheads, Improving Water Quality Within and Exiting the Ponds

Project Number: FNC 03-453

Project Duration: July 2003 through October 2004

November 17, 2004

II. Project Background

As a farmer with a Fisheries and Wildlife Biology degree, I currently produce fish for pond stocking and human consumption raising fish both indoors and outdoors. The species include largemouth bass, bluegill, channel catfish, walleye, crappie, northern pike, and fathead minnows. I have been in the aquaculture business since 1988 with an internship working for the Iowa Department of Natural Resources. After leaving, I managed the largest indoor aquaculture tilapia facility in the United States before returning to Iowa in 1996 to begin my own aquaculture facility. Since starting my fish farming operation I have expanded into managing private fisheries, monitoring water quality in lakes and streams, controlling aquatic weeds, speaking, consulting, organizing and hosting pond management workshops, providing watershed management and renovating/restoring private lakes.

III. Project Description and Results

The objective of this project was to improve aquatic diversity and water quality in ponds overrun with bullheads, as well as downstream, using flathead catfish. This was to be accomplished by the use of flathead catfish as predators in smaller, shallow ponds to control black bullheads. Flathead catfish were stocked into two separate ponds determined to have excessive bullhead populations. Rather than chemical eradication of the pond this species was used for economic reasons as well as trying control bullhead with a predator that could be produced by fish farmers throughout the Midwest.

Process

In June of 2003 four ponds were sampled for fish populations and depths to determine if they would qualify to have flathead catfish stocked for bullhead control. Ponds needed to meet certain criteria before the catfish would be added.

The criteria included;

1) Must have an average depth of no less than 6 foot, to over-winter the catfish.
2) Must be a minimum of ½ acre in size so 2 catfish could be stocked.
3) Must have a stunted black bullhead population hindering growth of more desirable species.
4) Could not remove flathead catfish by hook and line until after the project was complete in November 2004.

Two ponds were chosen for this study. Pond #1 was 2.33 acres in size and completely inundated with black bullheads between 4-6 inches in length. No other fish were caught when this pond was sampled using gill nets and Fyke nets. Ten flathead catfish were stocked into this pond after initial water samples were taken.

Pond #2 was one acre in size. This pond had a good largemouth bass population but had black bullheads stunted at a size the bass could not eat. Four flathead catfish were stocked after initial water samples were taken.

Water quality parameters were measured every two weeks during from May to mid October. The following parameters were tested in both the pond and discharge stream exiting the pond; water temperature, oxygen, pH, nitrite, nitrate, ammonia (expressed as total ammonia nitrogen), and turbidity. Weather conditions were recorded to aid in clarifying any abnormalities within the water quality parameters.

Population analysis of the ponds was done prior to beginning the renovation process by using gill nets, fyke nets, and seines.

Aquatic vegetation and invertebrate assessments were made initially as well as at project completion.

People

To determine the stocking densities for the flathead catfish, many professionals were contacted to get their opinions on how many catfish and what size to use. Joe Morris, Iowa State University Aquaculture Extension Specialist directed me to contact Dr. Robert Summerfelt, Iowa State University Professor, who had previously worked with Flathead Catfish. Alan Johnson with the Iowa Department of Natural Resources was currently

working with flathead catfish to renovate excess bullhead populations in some public waters. After discussing with these three experts and several others it was decided that four 3-8 pound flathead catfish stocked per acre should provide considerable control of stunted black bullhead population.

Results

The primary objective of this program was to have success in controlling the black bullhead population. In controlling the bullhead population it was hoped the water quality within the pond and water exiting the pond would improve, because the bullheads would no longer be stirring the bottom sediments of the ponds.

Pond #1 was 2.33 acres and 12 feet deep surrounded by a short grass pasture approximately 70-100 feet wide with agricultural crops surrounding it. The pond was fed by tile lines and a small grass waterway entering on the south side. Initially this pond had a substantially large bullhead population. Bullheads were the only fish caught in this pond when initially sampled. Ten flathead catfish were initially stocked into this pond. Fourteen months after the flathead catfish were stocked into this pond no bullheads were found in the population analysis which was sampled using, gill nets, electro-fishing, and seines. No flathead catfish were recovered while conducting the final population analysis. No significant changes occurred in the water quality. Transparency of the water both in the pond and exiting the ponds changed only as the seasons changed. The other water quality parameters such as Nitrite and Nitrate appeared to be directly related to the agricultural seasons. The variables increased in May and June then receded in the following months. Phosphate levels also appeared to follow the planting seasons, coming up in June then decreasing in July and August. No significant weather conditions were reported in either year. Both years had relatively wet springs and extended drought conditions throughout the summer. This pond was about two feet below normal level in 2003, filled to the emergency spillway in the spring of 2004 when the outlet was plugged with corn stocks, then returned to normal before falling to about a foot below normal in the fall of 2004. The aquatic vegetation and invertebrate samples did not change from 2003 to 2004. The benthic invertebrates found indicated good water quality parameters.

Pond #2 was settled in between two steep hills surrounded by brome grass and remnant prairie plants extending about 100 feet around the perimeter of the pond. This pond was one acre in size and 6.5 feet deep. It had a good population of bullheads initially but also had a good bass and bluegill population. Four flathead catfish were initially stocked into this pond. The bullheads were stunted at a size ranging from 5-7 inches in length. Fourteen months after flathead catfish were stocked we found no bullheads, and only a reduced number of bluegills remaining in the pond. The bass population seemed unaffected by the flathead catfish, but they appeared to have a major affect on the bullheads and bluegills. No flathead catfish were recovered from the pond using gill nets, seines and electro-fishing at the conclusion of this study. Once again no significant changes occurred in the water quality results. Nitrites, Nitrates and Phosphates were observed throughout the testing period. No significant changes were observed in the transparency of the water over the duration of the study. Oxygen levels were lower in

Pond #2 versus those levels in Pond #1. The aquatic vegetation and invertebrate samples did not change from 2003 to 2004. The benthic invertebrates in both samples indicated good water quality parameters.

Discussion

From this study it was found that flathead catfish do have an impact on bullhead populations when stocked at a rate of four, 3-8 pound fish/acre. Although no flathead catfish were recaptured at the conclusion of this study, it does not mean that the flathead catfish had not survived. These fish may have been far enough away from the current of the electro-fishing unit and may not have been actively feeding or moving when the gill nets were set. A large area was to be covered in both ponds to find ten and four fish respectively. No flathead catfish offspring were noted in the final sampling results. If the flathead catfish were successful in reproducing there was not a significant number of offspring to indicate a stable or growing population. The results indicating flathead catfish can reduce bullhead numbers in ponds will have an impact on farming operations by allowing fish farmers to rear and stock these flathead catfish as a sport fish that can improve ponds overrun with bullheads. These flathead catfish will not only improve the diversity of current farm ponds but can help eliminate using costly chemicals to completely eradicate fish populations in ponds by controlling bullheads to allow more popular game fish to flourish.

No significant changes occurred in the water quality parameters through one full season of data. However, continued data will be collected to see if, over the long term, these parameters improve. Transparency and Phosphate levels over the next several years will continue to be monitored. The reduction of bottom feeding fish should help improve the quality of the water exiting the ponds and entering the streams however at this time in the study this finding is inconclusive. All water quality data recorded during the study can be found at the Iowater stream monitoring web site located at www.iowater.com. Pond #1 is listed under CVE and CVE discharge. Pond #2 is listed under RS and RS discharge. Graphs indicating parameters collected are included in this report.

This project would benefit from extending the time frame to a minimum of three years. It would allow more data collection on water quality and verification that no flathead catfish had spawned in the pond.

IV. Project Impacts

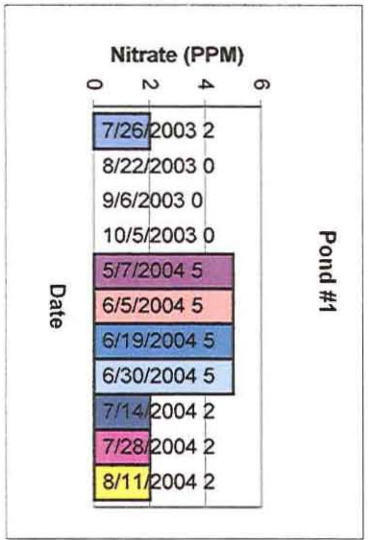
The economic benefits can be measured in several ways. The first is the cost savings using these flathead catfish to control existing stunted bullhead populations rather than using chemicals, to eradicate the entire pond. Using flathead catfish will also have an economic impact on the aquaculture industry by providing us with a fish we can use as a management tool as well as being an important fish for the sport fishery industry. Flathead catfish can sell for $.90 to $4.00 per pound for adult fish. Fingerlings ranging from four to eight inches could easily sell for $1.00 to $1.25 per fish. Aquaculturists could sell these fish as fingerlings or adult fish for stocking or food.

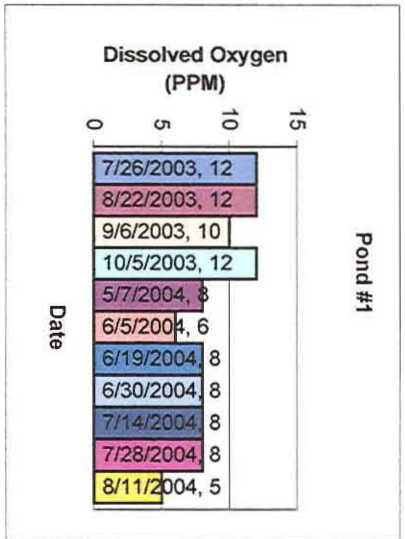
The environmental impacts of this practice include reducing the population of bullheads in small farm ponds. Typically these bullheads make the water more turbid. Controlling their numbers may improve the water quality in the ponds. We did not see a major improvement in the one year study but we will continue to monitor the water quality to see if this happens over the long term.

V. Outreach

A Pond Management workshop is scheduled for June of 2005. The location of this event is yet to be determined, but it will occur in west central Iowa. I will be working with Iowa State Extension Specialist Joe Morris in organizing and preparing materials for this event. We will be developing a Power Point presentation for this event. We were unable to schedule an event this fall due to a late harvest of agricultural crops and compilation of data and pond analysis which occurred in early November. A typical workshop of this nature usually has an attendance of 20 to 60 people.

We will also be working with the North Central Aquaculture Center (NCRAC) and Iowa State University in developing a Fact Sheet to put out to individuals interested in raising flathead catfish for the purpose of lake/pond management or raising these fish for stocking purposes.


Nitrate (PPM)
0
2
4
6
7/26/2003 2
8/22/2003 0
9/6/2003 0
10/5/2003 0
5/7/2004 5
6/5/2004 5
6/19/2004 5
6/30/2004 5
7/14/2004 2
7/28/2004 2
8/11/2004 2
Date
Pond #1


Dissolved Oxygen (PPM)
0
5
10
15
7/26/2003, 12
8/22/2003, 12
9/6/2003, 10
10/5/2003, 12
5/7/2004, 8
6/5/2004, 6
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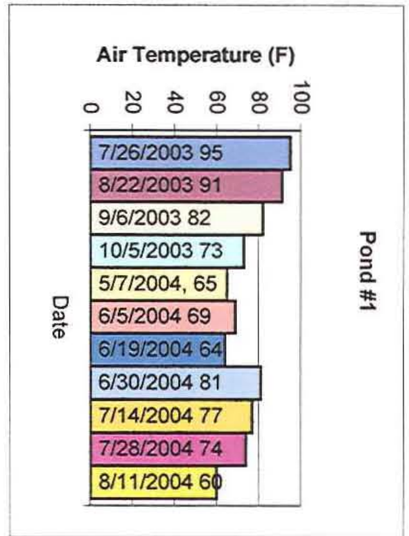
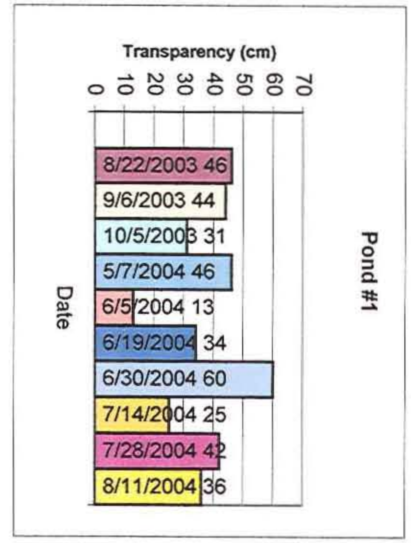
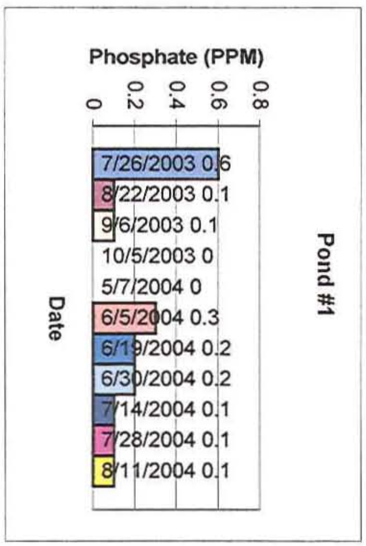
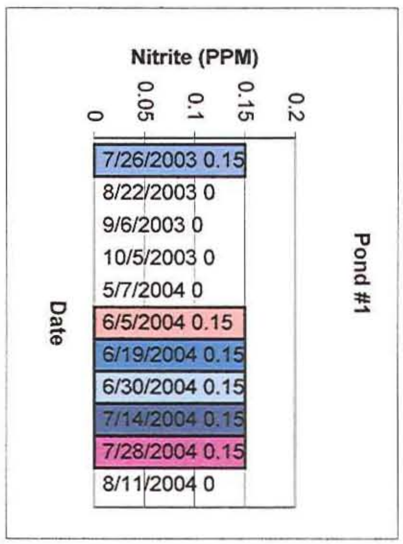
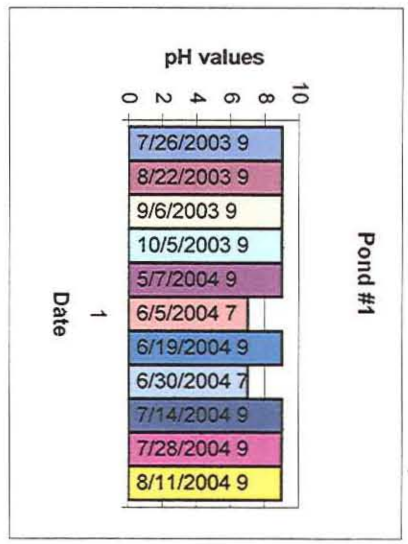
6/30/2004, 8
7/14/2004, 8
7/28/2004, 8
8/11/2004, 5
Date
Pond #1


Air Temperature (F)
0
20
40
60
80
100
7/26/2003 95
8/22/2003 91
9/6/2003 82
10/5/2003 73
5/7/2004, 65
6/5/2004 69
6/19/2004 64
6/30/2004 81
7/14/2004 77
7/28/2004 74
8/11/2004 60
Date
Pond #1


Transparency (cm)
0
10
20
30
40
50
60
70
8/22/2003 46
9/6/2003 44
10/5/2003 31
5/7/2004 46
6/5/2004 13
6/19/2004 34
6/30/2004 60
7/14/2004 25
7/28/2004 42
8/11/2004 36
Date
Pond #1


Phosphate (PPM)
0
0.2
0.4
0.6
0.8
7/26/2003 0.6
8/22/2003 0.1
9/6/2003 0.1
10/5/2003 0
5/7/2004 0
6/5/2004 0.3
6/19/2004 0.2
6/30/2004 0.2
7/14/2004 0.1
7/28/2004 0.1
8/11/2004 0.1
Date
Pond #1


Nitrite (PPM)
0
0.05
0.1
0.15
0.2
7/26/2003 0.15
8/22/2003 0
9/6/2003 0
10/5/2003 0
5/7/2004 0
6/5/2004 0.15
6/19/2004 0.15
6/30/2004 0.15
7/14/2004 0.15
7/28/2004 0.15
8/11/2004 0
Date
Pond #1


pH values
0
2
4
6
8
10
7/26/2003 9
8/22/2003 9
9/6/2003 9
10/5/2003 9
5/7/2004 9
6/5/2004 7
6/19/2004 9
6/30/2004 7
7/14/2004 9
7/28/2004 9
8/11/2004 9
Date
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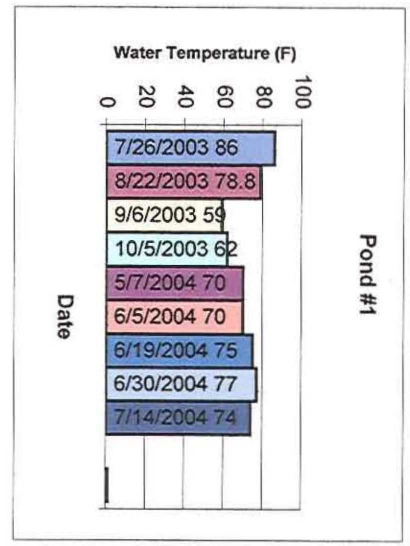
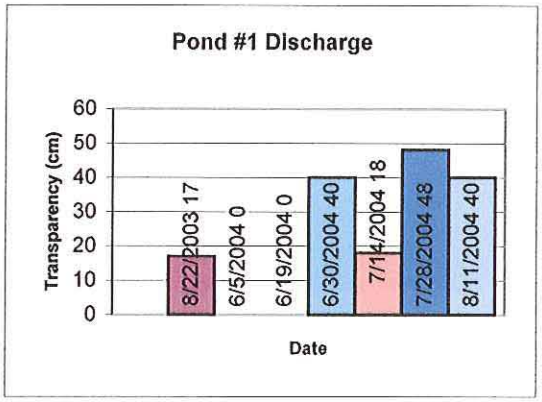
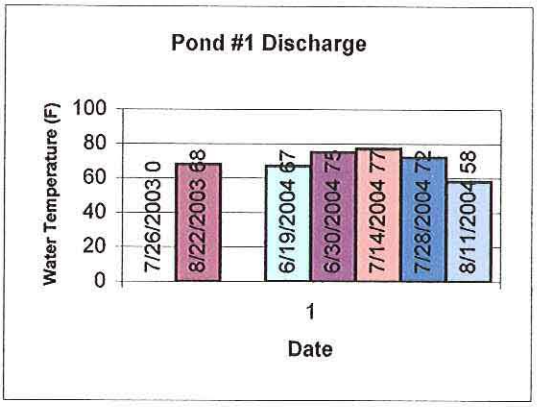
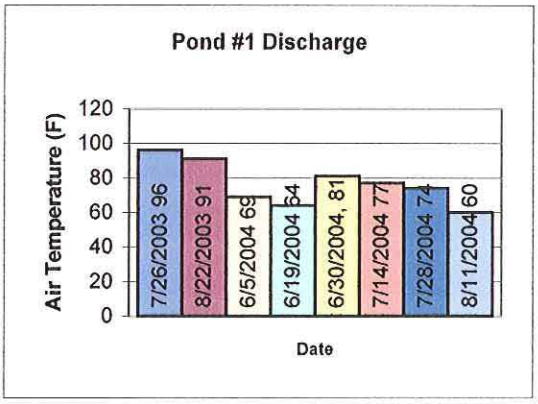
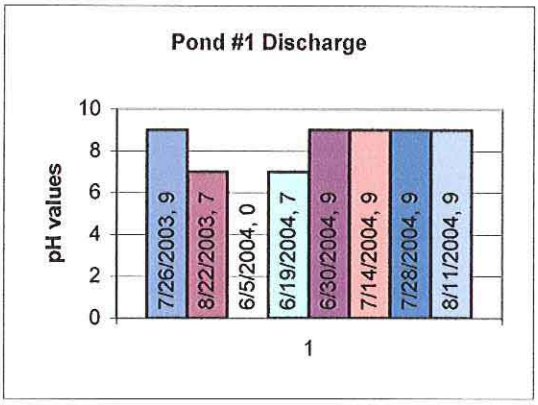

Water Temperature (F)
0
20
40
60
80
100
7/26/2003 86
8/22/2003 78.8
9/6/2003 59
10/5/2003 62
5/7/2004 70
6/5/2004 70
6/19/2004 75
6/30/2004 77
7/14/2004 74
Date
Pond #1


Pond #1 Discharge
Transparency (cm)
60
50
40
30
20
10
0
8/22/2003 17
6/5/2004 0
6/19/2004 0
6/30/2004 40
7/14/2004 18
7/28/2004 48
8/11/2004 40
Date


Pond #1 Discharge
Water Temperature (F)
100
80
60
40
20
0
7/26/2003 0
8/22/2003 68
6/19/2004 67
6/30/2004 75
7/14/2004 77
7/28/2004 72
8/11/2004 58
1
Date


Pond #1 Discharge
Air Temperature (F)
120
100
80
60
40
20
0
7/26/2003 96
8/22/2003 91
6/5/2004 69
6/19/2004 64
6/30/2004, 81
7/14/2004 77
7/28/2004 74
8/11/2004 60
Date


Pond #1 Discharge
pH values
10
8
6
4
2
0
7/26/2003, 9
8/22/2003, 7
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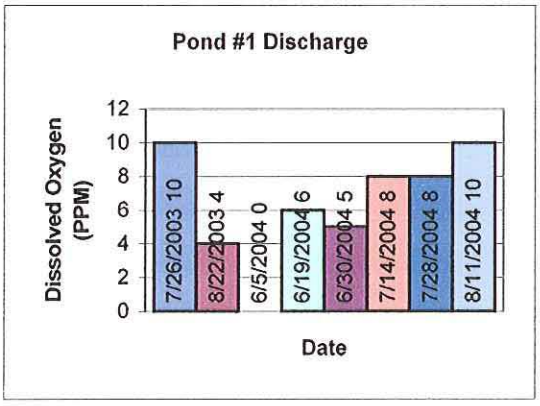
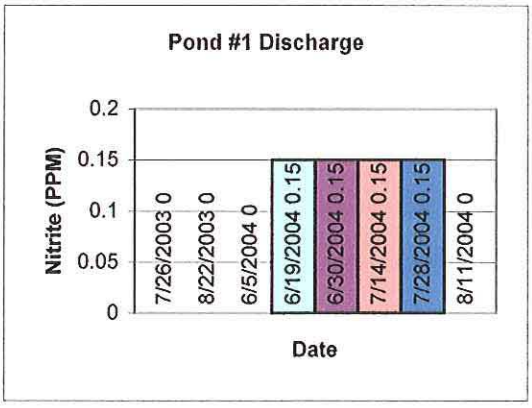
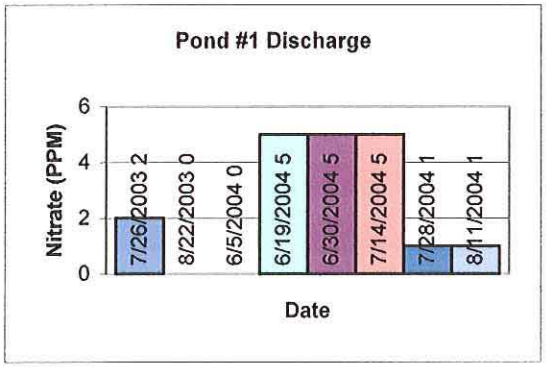
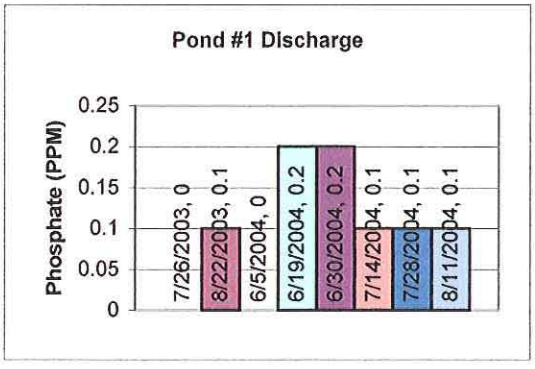
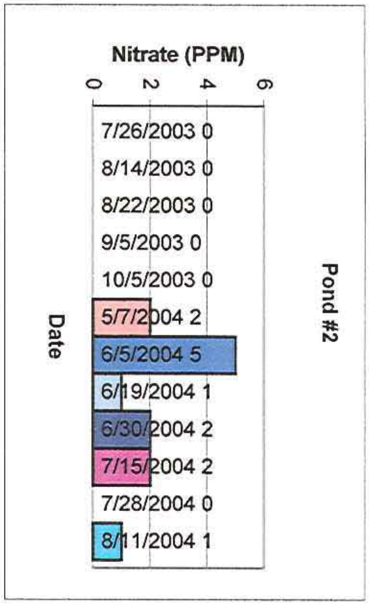
6/19/2004, 7
6/30/2004, 9
7/14/2004, 9
7/28/2004, 9
8/11/2004, 9
1

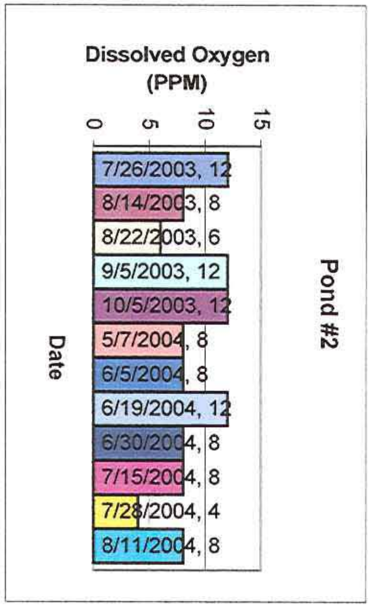

Pond #1 Discharge
Dissolved Oxygen (PPM)
12
10
8
6
4
2
0
7/26/2003 10
8/22/2003 4
6/5/2004 0
6/19/2004 6
6/30/2004 5
7/14/2004 8
7/28/2004 8
8/11/2004 10
Date


Pond #1 Discharge
Nitrite (PPM)
0.2
0.15
0.1
0.05
0
7/26/2003 0
8/22/2003 0
6/5/2004 0
6/19/2004 0.15
6/30/2004 0.15
7/14/2004 0.15
7/28/2004 0.15
8/11/2004 0
Date


Pond #1 Discharge
Nitrate (PPM)
6
4
2
0
7/26/2003 2
8/22/2003 0
6/5/2004 0
6/19/2004 5
6/30/2004 5
7/14/2004 5
7/28/2004 1
8/11/2004 1
Date


Pond #1 Discharge
Phosphate (PPM)
0.25
0.2
0.15
0.1
0.05
0
7/26/2003, 0
8/22/2003, 0.1
6/5/2004, 0
6/19/2004, 0.2
6/30/2004, 0.2
7/14/2004, 0.1
7/28/2004, 0.1
8/11/2004, 0.1


Nitrate (PPM)
0 2 4 6
7/26/2003 0
8/14/2003 0
8/22/2003 0
9/5/2003 0
10/5/2003 0
5/7/2004 2
6/5/2004 5
6/19/2004 1
6/30/2004 2
7/15/2004 2
7/28/2004 0
8/11/2004 1
Date
Pond #2


Dissolved Oxygen (PPM)
0 5 10 15
7/26/2003, 12
8/14/2003, 8
8/22/2003, 6
9/5/2003, 12
10/5/2003, 12
5/7/2004, 8
6/5/2004, 8
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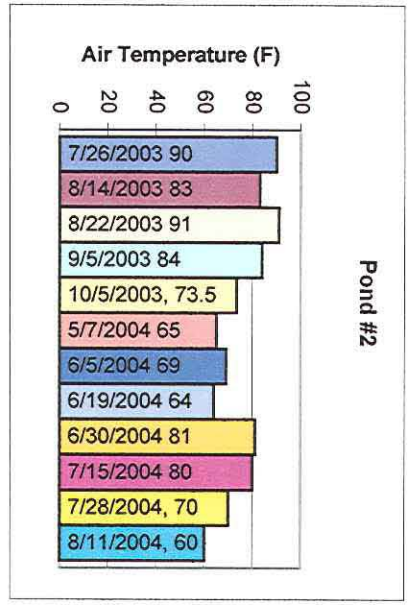
6/30/2004, 8
7/15/2004, 8
7/28/2004, 4
8/11/2004, 8
Date
Pond #2


Air Temperature (F)
0 20 40 60 80 100
7/26/2003 90
8/14/2003 83
8/22/2003 91
9/5/2003 84
10/5/2003, 73.5
5/7/2004 65
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6/19/2004 64
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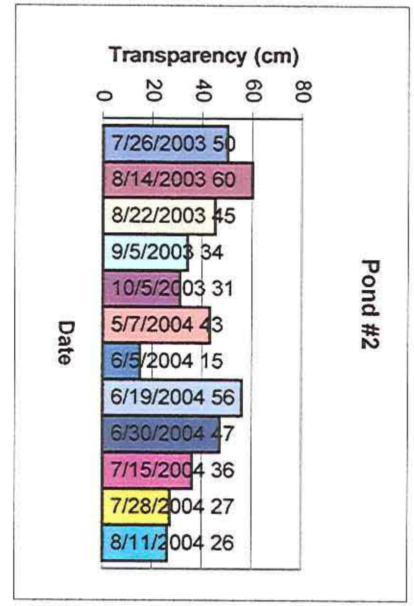
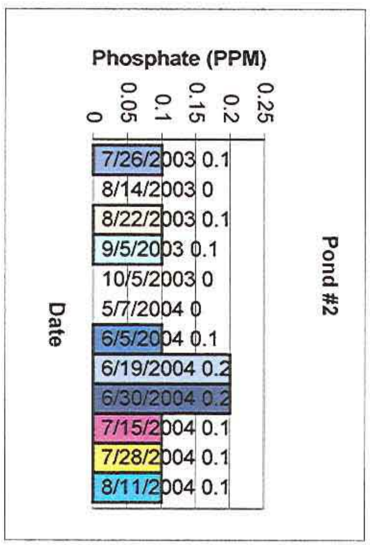
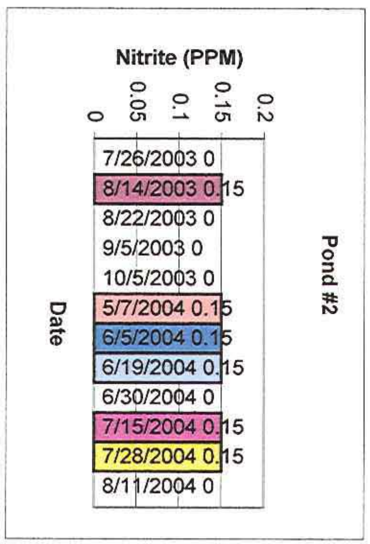
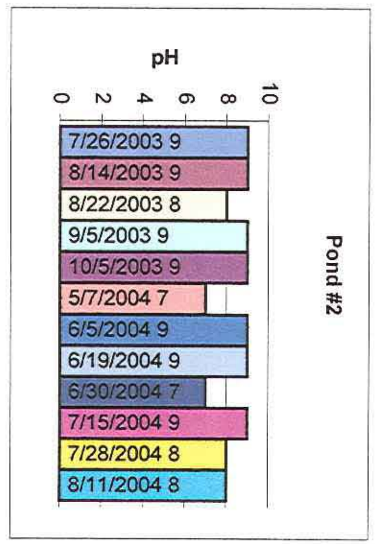
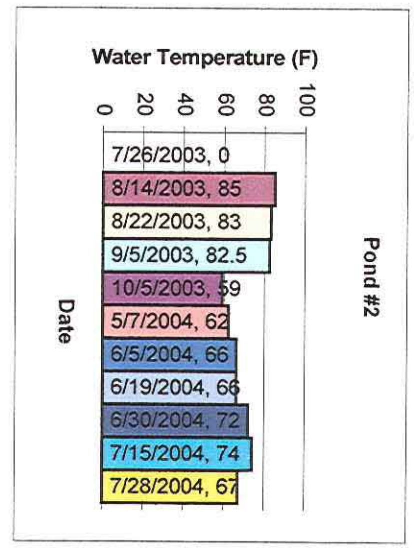
7/15/2004 80
7/28/2004, 70
8/11/2004, 60
Pond #2

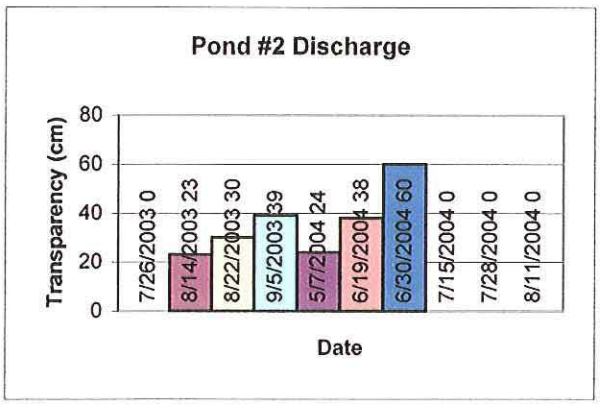

Transparency (cm)
0 20 40 60 80
7/26/2003 50
8/14/2003 60
8/22/2003 45
9/5/2003 34
10/5/2003 31
5/7/2004 43
6/5/2004 15
6/19/2004 56
6/30/2004 47
7/15/2004 36
7/28/2004 27
8/11/2004 26
Date
Pond #2

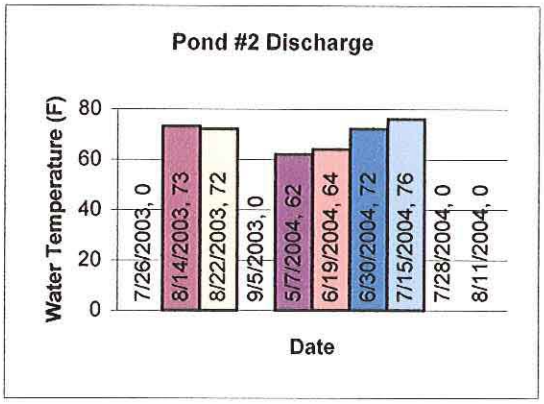

Phosphate (PPM)
0 0.05 0.1 0.15 0.2 0.25
7/26/2003 0.1
8/14/2003 0
8/22/2003 0.1
9/5/2003 0.1
10/5/2003 0
5/7/2004 0
6/5/2004 0.1
6/19/2004 0.2
6/30/2004 0.2
7/15/2004 0.1
7/28/2004 0.1
8/11/2004 0.1
Date
Pond #2

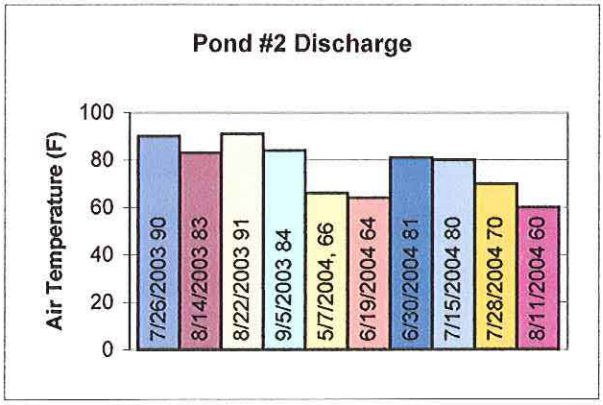

Nitrite (PPM)
0 0.05 0.1 0.15 0.2
7/26/2003 0
8/14/2003 0.15
8/22/2003 0
9/5/2003 0
10/5/2003 0
5/7/2004 0.15
6/5/2004 0.15
6/19/2004 0.15
6/30/2004 0
7/15/2004 0.15
7/28/2004 0.15
8/11/2004 0
Date
Pond #2

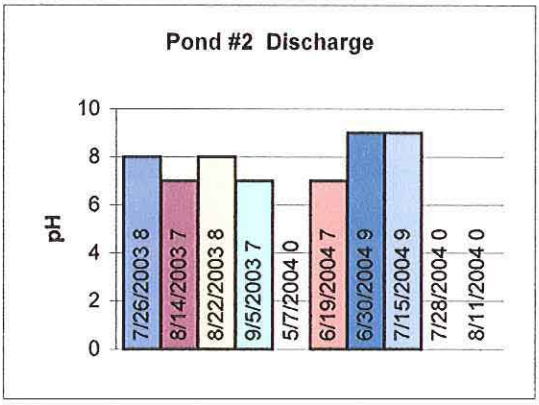

pH
0 2 4 6 8 10
7/26/2003 9
8/14/2003 9
8/22/2003 8
9/5/2003 9
10/5/2003 9
5/7/2004 7
6/5/2004 9
6/19/2004 9
6/30/2004 7
7/15/2004 9
7/28/2004 8
8/11/2004 8
Pond #2

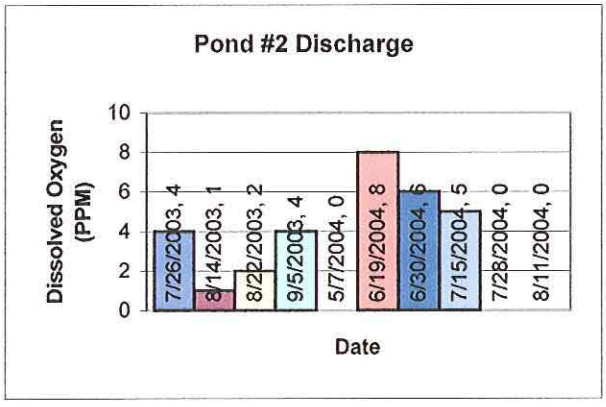

Water Temperature (F)
0 20 40 60 80 100
7/26/2003, 0
8/14/2003, 85
8/22/2003, 83
9/5/2003, 82.5
10/5/2003, 59
5/7/2004, 62
6/5/2004, 66
6/19/2004, 66
6/30/2004, 72
7/15/2004, 74
7/28/2004, 67
Date
Pond #2

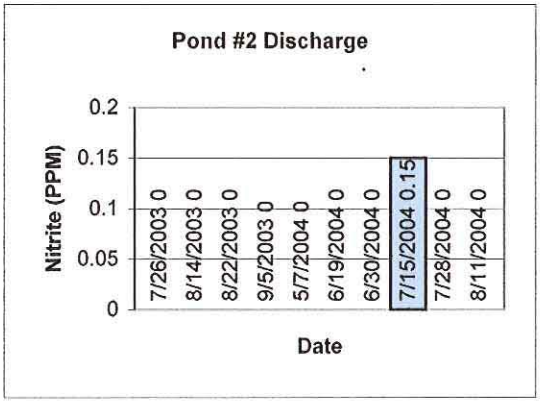

Pond #2 Discharge
Transparency (cm)
0
20
40
60
80
7/26/2003 0
8/14/2003 23
8/22/2003 30
9/5/2003 39
5/7/2004 24
6/19/2004 38
6/30/2004 60
7/15/2004 0
7/28/2004 0
8/11/2004 0
Date

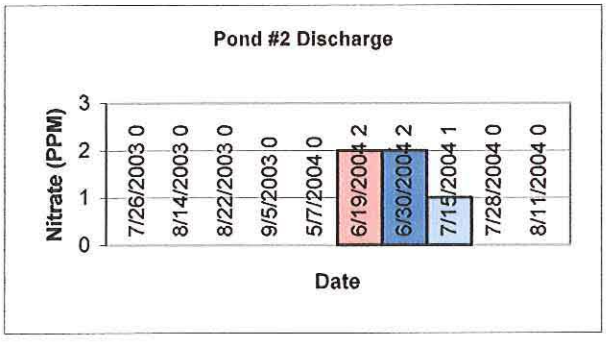

Pond #2 Discharge
Water Temperature (F)
0
20
40
60
80
7/26/2003, 0
8/14/2003, 73
8/22/2003, 72
9/5/2003, 0
5/7/2004, 62
6/19/2004, 64
6/30/2004, 72
7/15/2004, 76
7/28/2004, 0
8/11/2004, 0
Date

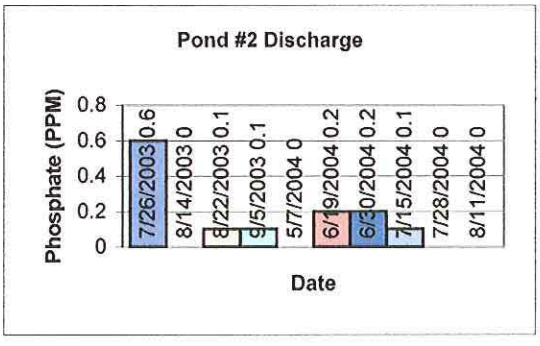

Pond #2 Discharge
Air Temperature (F)
0
20
40
60
80
100
7/26/2003 90
8/14/2003 83
8/22/2003 91
9/5/2003 84
5/7/2004, 66
6/19/2004 64
6/30/2004 81
7/15/2004 80
7/28/2004 70
8/11/2004 60


Pond #2 Discharge
pH
0
2
4
6
8
10
7/26/2003 8
8/14/2003 7
8/22/2003 8
9/5/2003 7
5/7/2004 0
6/19/2004 7
6/30/2004 9
7/15/2004 9
7/28/2004 0
8/11/2004 0


Pond #2 Discharge
Dissolved Oxygen (PPM)
0
2
4
6
8
10
7/26/2003, 4
8/14/2003, 1
8/22/2003, 2
9/5/2003, 4
5/7/2004, 0
6/19/2004, 8
6/30/2004, 6
7/15/2004, 5
7/28/2004, 0
8/11/2004, 0
Date


Pond #2 Discharge
Nitrite (PPM)
0
0.05
0.1
0.15
0.2
7/26/2003 0
8/14/2003 0
8/22/2003 0
9/5/2003 0
5/7/2004 0
6/19/2004 0
6/30/2004 0
7/15/2004 0.15
7/28/2004 0
8/11/2004 0
Date


Pond #2 Discharge
Nitrate (PPM)
0
1
2
3
7/26/2003 0
8/14/2003 0
8/22/2003 0
9/5/2003 0
5/7/2004 0
6/19/2004 2
6/30/2004 2
7/15/2004 1
7/28/2004 0
8/11/2004 0
Date


Pond #2 Discharge
Phosphate (PPM)
0
0.2
0.4
0.6
0.8
7/26/2003 0.6
8/14/2003 0
8/22/2003 0.1
9/5/2003 0.1
5/7/2004 0
6/19/2004 0.2
6/30/2004 0.2
7/15/2004 0.1
7/28/2004 0
8/11/2004 0
Date

SARE Graphs of Total Ammonia Nitrogen