Water Quality Monitoring Report
2005- 2009 Monitoring of
Prairie Pothole Wetlands

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INTRODUCTION

Prior to European settlement, wetland basins covered 4 to 6 million acres, or approximately 11% of Iowa's surface area. Wetlands were part of every watershed in the state, but nearly 95% of them have been drained for agriculture. As Iowa was settled wetlands were drained and developed, resulting in the loss of wildlife habitat, damage to water quality, rapid topsoil erosion, and increased incidents and severity of flooding. The condition of Iowa's remaining wetlands is poorly known.

With the significant degree of hydrologic alteration by ditching, draining, damming, and channel straightening which has occurred in the state, many of Iowa's wetlands have either been lost completely or now exist in a state much different from pre-settlement. These wetland systems provide valuable services such as temporary storage of surface water, carbon storage, natural water filtration for better water quality, and habitat for numerous plant and animal species. Despite the enormous benefits of wetlands and the recently increased public awareness of their essential role in the landscape, wetlands in Iowa still face many obstacles. Continued monitoring of these systems is needed to understand the current condition and the changes to these important landscape features. The overall Iowa DNR strategy is to develop a comprehensive statewide wetland monitoring program that can address all of the inherent variables associated with different types of wetlands, an extremely altered landscape, and cyclic patterns of wet/dry conditions in order to guide management decisions regarding Iowa's wetland resources. This strategy will provide a framework for an ongoing assessment of Iowa's wetland resources and the level of success achieved by our management programs.

The goal of this project was to assess the ecological condition of prairie pothole wetlands in a defined region of north-central Iowa. This project has worked to develop and establish our wetland sampling methods, while providing baseline data regarding the basic chemical, physical, and biological status of Iowa's permanent and semi-permanent wetland resources. The baseline data obtained from our monitoring methods is mainly in the form of numerical values derived from the lab analyses of our samples. This data will be used to begin building a database to interpret ecological condition changes in Iowa's wetlands as the sampling regime and assessment methodology are repeated over time.

METHODS

Site Selection

From 2005 to 2009 a total of 189 wetlands were sampled. Wetland sites were selected using the Generalized Random Tessellation Stratified (GRTS) survey designed by the US EPA EMAP Program at the NHEERL Western Ecology Division Office in Corvallis, Oregon (Diaz-Ramos et al. 1996). The GRTS design includes a reverse hierarchical ordering of selected sites. The updated Iowa Wetland Inventory (partially funded by this grant project) provided the sample frame used to randomly select sites using the GRTS method.
Wetlands classified as upland permanent and semi-permanent pothole wetlands located in Des Moines Lobe Landform Region and Winnebago River watershed of north central and northwest Iowa were targeted for this project. Thus, any other wetlands specifically classified as riverine or some other type was not included in the sample design of this project. To eliminate any questionably classified wetlands along rivers, anything within 50m of a 4^{th} order or larger stream or river was also eliminated. Four multi-density categories of wetland size (based on acres) were used to ensure that a balanced sample selection of sites were included. The four size categories were: 0 – 5 ac, 5 -10 ac, 10 -20 ac, and 20 + ac.

Site reconnaissance and permission gathering trips were conducted for each site in April/May of each year, and production of site maps ensued for each site found to meet acceptance criteria and where permission was granted. Navigation to the general wetland site was done using an Iowa road map or atlas/gazetteer. Once in the area, the updated Iowa NWI mapping was used to verify the location and sampling suitability of each candidate wetland. While at the site, access routes, sampling equipment and personnel needs for that site were evaluated.

Sampling Methods

With the help of existing methods used by other States or those used for research, this project developed and/or adapted existing wetland sampling methods for Iowa wetlands during the process of collecting baseline data on the chemical, physical, and biological components. The development of standardized assessment methods will ensure comparability of data over time and among samplers. Details on specific methods for each major category of parameters are explained below.

Water Quality

During the months of June through July wetland water samples were gathered in the middle of the open water zone of each wetland, as determined by the sample collector. The collectors used a small, lightweight (12ft, 35lb) canoe to access the open water zone using care to minimize sediment disturbance. If the wetland was small or if thick, emergent vegetation entirely filled the open water zone, field crew members simply waded to the middle of the wetland using care to collect the samples from water undisturbed by sediments kicked up from wading. A grab sample of wetland water was collected with a modified bucket scoop to obtain a representative sample from within the water column using standard water sample collection protocol (UHL 1997a). The water was then poured into the appropriate bottles for analysis. Each bottle was properly labeled with the site ID number, date, time of collection, and name of collector. Bottles were then placed into a cooler with ice to cool and avoid direct sunlight until delivery to the laboratory for analysis within the holding time as dictated by the lab. Throughout the duration of this project, all samples were sent to the State Hygienic Lab at the University of Iowa (SHL) to test for an extensive number of potential chemical contaminants which included herbicides, insecticides, PCBs, 12 types of heavy metals, nutrients, and various other parameters such as chlorophyll a, chloride, and suspended solids.

While in the middle of the wetland, field collections of basic physical-chemical measurements were taken with a hand held multi-parameter probe. This probe provided measurements for water temperature and dissolved oxygen concentrations. Separate devices were used to measure pH and turbidity. This data was recorded on standard field sheets. Any additional notes or observations encountered while field crews were at each site were also recorded on these data sheets.

Biological Monitoring

For each year of this project, a subset of the wetlands sampled for contaminants was also surveyed for three important biological communities; aquatic vegetation, fish/amphibians, and invertebrates. In the interest of time and resources during each field season, a subset of wetlands was selected representing a balanced range of human disturbance.

Aquatic Vegetation Surveys – The method adapted and used for our vegetation surveys is one used by Minnesota Pollution Control Agency (MPCA) known as plot releve sampling originally developed by Braun-Blunquet in Europe and currently used by the Minnesota Department of Natural Resources County Biological

Survey and Natural Heritage Programs (Almendinger 1987). Vegetation sampling was conducted from mid-July – mid-August, after most of our contaminants sampling was completed each field season and to coincide with peak vegetation growth.

The plot releve system is a relatively straight forward method in which the field crew personnel select areas within the plant community that are most representative of the overall plant community of that particular wetland site in which to place plot(s) to collect plant data that can be quantified. Several plot size options exist for this method but after trying several, we used four 5m x $5m^2$ plots for a total survey area of $100m^2$ placed on each "side" of a wetland site. The four vegetation plots were only placed once the major plant communities were viewed for each wetland site. This was done after conducting a walk around of the site or a vantage point was found in which to view the entire site from one spot. This was an important step in capturing the most representative plant communities to sample. Plots were laid out by field crews using 5ft garden stakes to mark the corners and four 5m length sections of rope with loops at both ends to quickly link the sides together to form the plot. For consistency, we placed the plots at the interface of the emergent and submergent (open water) zones of each wetland site. Once a plot was established, data for that particular plot and site information was recorded on a modified Releve Data Sheet. All plant species found within the plot were identified by one or more members from the field crew that conducted a standardized 'walk around' within the plot. Another field crew member recorded the information on the data sheet. All plants encountered in the plot were identified to the lowest taxonomic division possible. After conducting the 'walk around' an estimate of the percent cover (proportion of the plot area occupied by that taxa) was recorded for each species.

If a plant species was encountered that was unknown, then it was identified to the lowest taxa possible. It was then collected and placed temporarily into a plastic bag, labeled with the appropriate site information, and later identified if possible using standard wetland plant taxonomic keys.

Invertebrate Surveys – In 2005 aquatic Invertebrate taxonomic composition, densities, and diversity were quantified from 23 wetlands located within the Des Moines Lobe portion of the Winnebago watershed. Wetlands were selected from those sampled for contaminants. Because this was our first year of sampling, these sites were selected using best professional judgment to represent a wide array of human disturbance. Macroinvertebrates were sampled from mid-July to August from two randomly-determined locations in each wetland. At each location, a modified Hess sampler (collection net tied off to form a cylinder) was placed in the water at a depth of approximately 30 cm. All emergent vegetation (including vegetation floating on the water surface) located within the stovepipe cylinder was clipped at the water-air interface and discarded. All submergent vegetation, including submerged components of emergent plants, were clipped off at the sediment surface and transferred to a bucket sieve (500-micron mesh). Submergent vegetation was then placed in a gallon plastic jar and preserved in 95% ethanol. A hand-held aquarium dip net (500-micron mesh) was then used to collect the top 5 cm of sediment contained in the stovepipe cylinder. This material was placed in the bucket sieve, rinsed with water from within the Hess sampler then lightly squeezed to remove as much water as possible and placed in the jar with the vegetation. Finally, the dip was used to sweep the entire water column to remove and preserve any remaining invertebrates. Sweeps were continued until no invertebrates were found in 10 consecutive sweeps. After a day the ethanol was drained and replaced due to the high volume of water contained in the sediments. Such rinsing removed excess water and replaced it with ethanol to ensure adequate preservation. At this time rose Bengal dye was added to the contents to stain invertebrates thereby aiding in reducing processing time in sorting invertebrates from the contents.

Invertebrate sampling was only performed in 2005. During 2006 and 2007 a collaborative research project was initiated with Dr. Tim Stewart (Department of Natural Resource Ecology and Management, Iowa State University, Ames, Iowa) to begin development of a invertebrate IBI for upland, depressional wetlands in north central Iowa.

Fish/Amphibian Surveys - Both the presence/absence and species assemblage of fish can vastly alter the trophic structure and balance within a wetland. Therefore, sampling for fish provided valuable data in assessing the biological assemblage as it relates to invertebrates, water clarity, plant diversity, and overall condition of a wetland. For field seasons 2005 and 2006, Gee minnow traps were used to capture small, (< 8 cm in length) minnow type species of fish and Fyke nets, to capture larger species (> 8 cm in length) of fish. Three basic Gee type minnow traps consisting of two mesh buckets clamped together and a funnel with a 1" diameter hole at each end were placed in each wetland for one overnight (24 hr) period. Each of these traps was baited with a handful of dry dog food for attraction purposes. In addition to this, one Fyke net was also set at the same time for one overnight (24 hr) period. Fyke nets are equipped with a standard 40ft lead set perpendicular to the shoreline that funnels fish into holding box. Both the Gee minnow traps and Fyke net were set in the open water zone at each wetland site. Each fyke net was equipped with a bright colored float attached to the anchor end of the net and labeled with a tag that explained nets are property of the Iowa DNR.

Both types of traps were checked the following day. If fish were present in any of the traps, they were identified by species and tallied. For larger fish species, total length (cm) of 10 randomly selected fish of each species was measured. Crayfish, turtles, and salamanders were often captured as well. These species were also identified and tallied. This information was all recorded on a fish data sheet along with the site ID number, date, collectors' names, and any other relevant notes and observations.

For 2007, Gee minnow traps were not used due to their ineffective capturing of the small fish present in wetlands. Due to their size and the nature of wetlands sometimes having "pockets" of thick stands of submersed aquatic vegetation, there were times when small fish were observed in wetlands, yet the Gee minnow traps didn't always catch them. Instead, customized Fyke nets were purchased that were designed to catch small fish. These nets are the same structurally as the large fish Fyke nets, but are made with a fine seine type mesh to hold small fish and have a 20ft lead. For each wetland site in 2007, one small fish Fyke net and one large fish Fyke net was set for one overnight (24 hr) period to survey the fish in our wetlands. The small fish Fyke nets proved to be much more effective in consistently capturing small minnow type species of fish and were relatively easy to set up and use in the wetlands. It should also be noted that more amphibians were captured in these nets as well.

RESULTS

Water Quality

Pesticides and Metals - Water samples from 126 wetland sites were tested for levels of pesticides and metal elements. During years 2005-2007, 105 pesticides and their metabolites and 12 metals were tested. During years 2008-2009 the water tests were scaled back and tested for 32 pesticides and their metabolites. Three pesticide metabolites were detected the most which included Acetochlor OXA, Acetochlor ESA, and Metolachlor ESA (Table 1). Atrazine had the fourth highest number of detects. 15 different pesticides were detected 10 or more times from 2005-2009 (Table 1). These are most likely residual from pesticide applications used in agricultural practices.

Test	# of Detects	Mean Concentration (ug/L)	Max Concentration (ug/L)
Acetochlor OXA	170	0.284	9.000
Acetochlor ESA	151	0.269	3.100
Metolachlor ESA	131	0.410	5.400
Atrazine	130	0.383	28.000
Alachlor ESA	115	0.069	0.740
Metolachlor OXA	109	0.100	1.500
Desethyl Atrazine	82	0.084	1.900
Metolachlor	79	0.061	2.400
Alachlor OXA	66	0.043	0.300
Acetochlor	40	0.057	1.700
Flumetsulam	30	0.007	0.042
Imazethapyr	19	0.006	0.047
Dimethenamid ESA	12	0.031	0.500
Clomazone	10	0.150	10.000
Desisopropyl Atrazine	10	0.060	1.300
Dimethenamid	9	0.040	1.000
Carbofuran	8	0.052	0.100
Dimethenamid OXA	8	0.027	0.160
Heptachlor epoxide	8	0.056	0.200
Imazapyr	7	0.005	0.016
Nicosulfuron	7	0.011	0.570
Butylate	4	0.054	0.380
delta-BHC	4	0.052	0.100
Endosulfan sulfate	4	0.052	0.100
Lindane (gamma-BHC)	4	0.052	0.100

Table 1. Pesticide and metal detections, mean concentration, and maximum concentration (ug/L) from wetland water samples, 2005-2009.

The mean number of detects for wetland sites were obtained for each year (Table 2). Mean detects in 2008 was lower than in 2006 and 2007 with $p = 0.0408$ and $p = 0.0429$, respectively ($t = 1.97$, $\alpha = 0.05$). Comparisons among other years found the mean number of detects were similar. The number of detects per site ranged from 0 in 2005 to 69 in 2006.

Year	Mean(Detect)	Min(Detect)	Max(Detect)
2005	7.0	0	16
2006	8.4	1	69
2007	8.5	2	19
2008	5.6	1	10
2009	7.0	1	26

Table 2. Mean, minimum, and maximum number of pesticide and metal detects by year for wetland sites.

There were only three arsenic detects, and one copper and zinc detect (Appendix 1). There were zero detects for the other nine metals that were tested.

Water Quality

Nutrients - All wetland sites were tested for three forms of N; ammonia, Total Kjeldahl Nitrogen (TKN), and Nitrate + Nitrite as N and the two forms of Phosphorus; Ortho-Phosphate (ortho-P) and Total Phosphate. Ortho-P was tested in years 2005-2008, but not in year 2009. Mean concentration levels of ammonia were low and less variable than TKN and Nitrate + Nitrite as N (Figure 1). Positive spikes in TKN were mirrored with negative spikes in Nitrate + Nitrite as N.

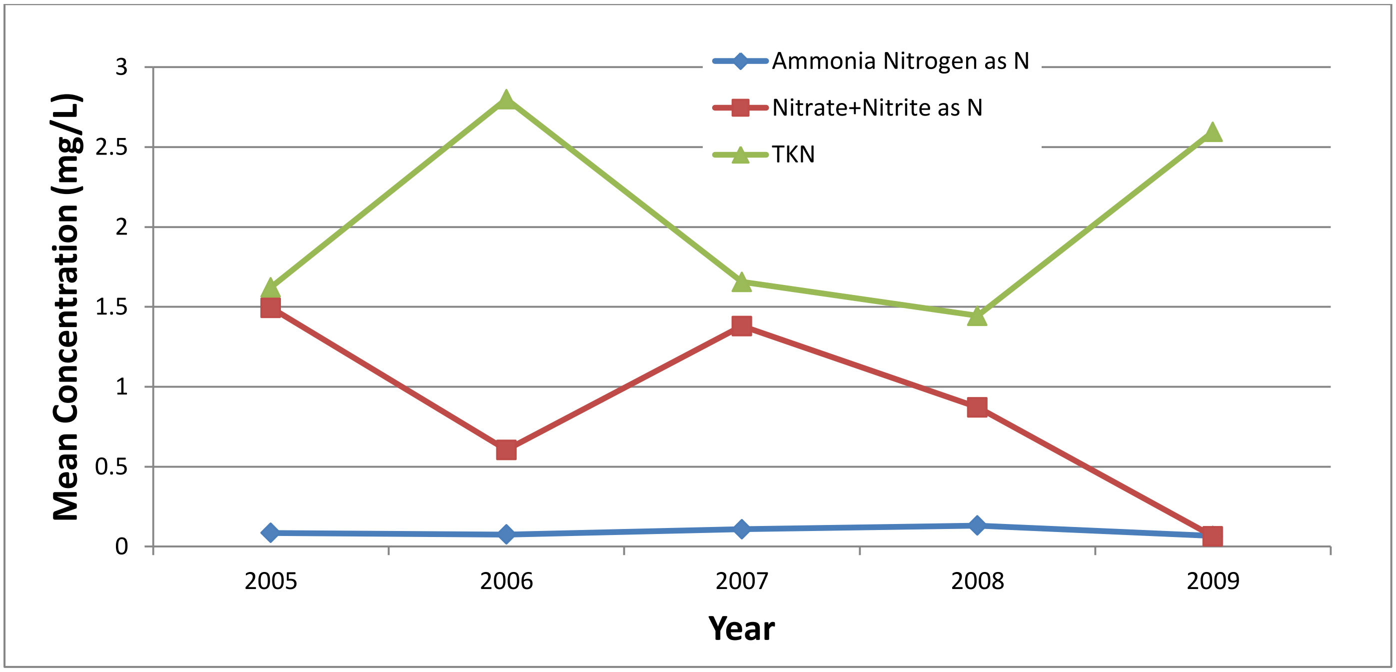

Figure 1. Three forms of Nitrogen measured in pothole wetlands, 2005-2009.

Total Phosphate as P was more variable than ortho-P (Figure 2). Total Phosphate spiked in 2006.

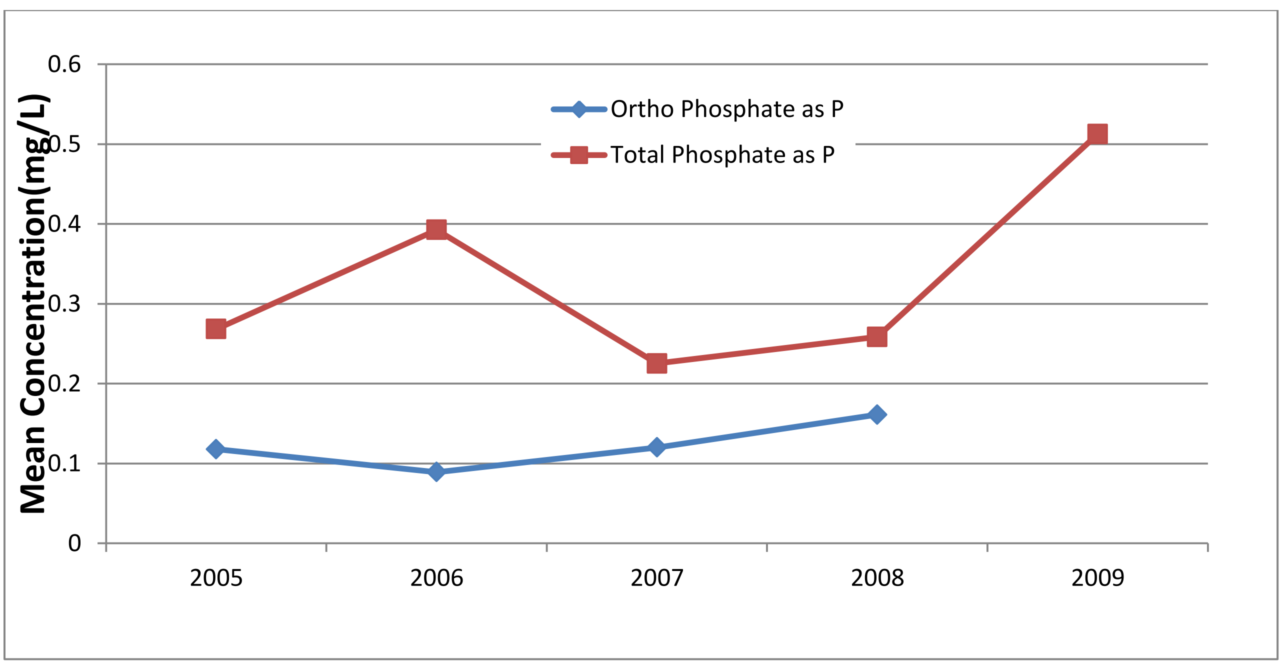

Figure 2. Two forms of Phosphorus measured in pothole wetlands, 2005-2009.

Chloride - Mean chloride levels ranged from about 4.0 to 14.0 mg/L in the 126 wetland sites sampled (Figure 3).

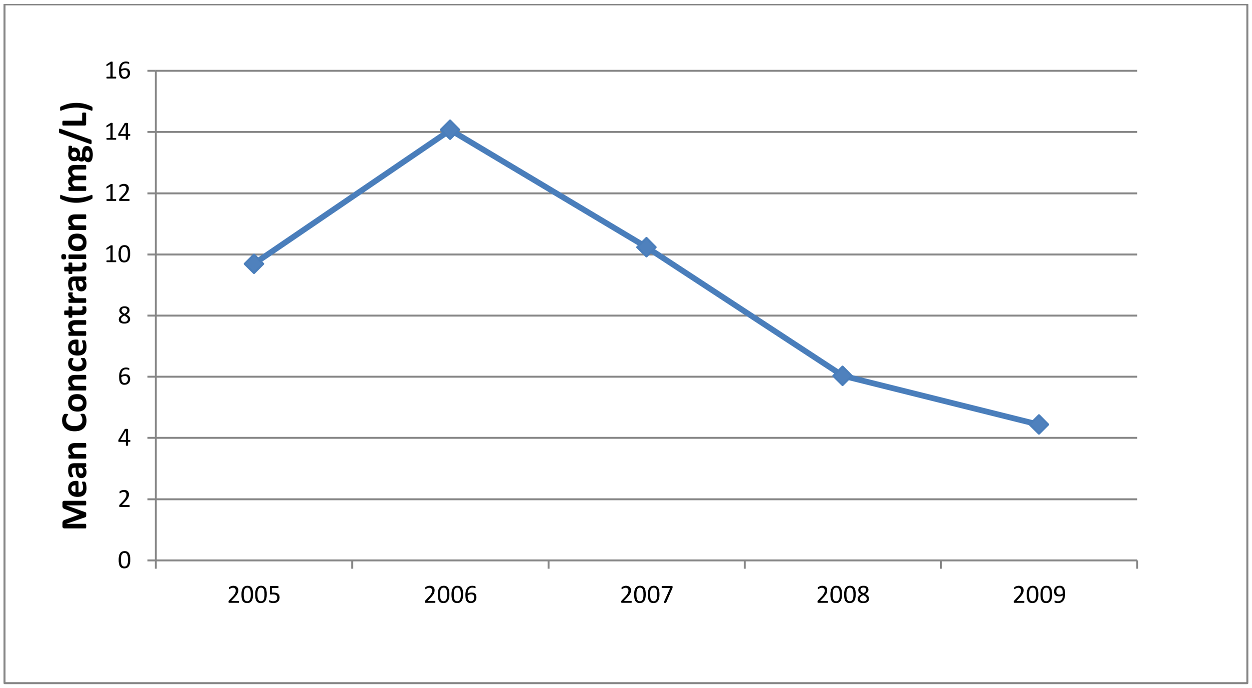

Figure 3. Chloride measured in pothole wetlands, 2005-2009.

Chlorophyll A- Chlorophyll A levels in the 126 wetland sites sampled were similar in all years accept in year 2006 (Figure 4).

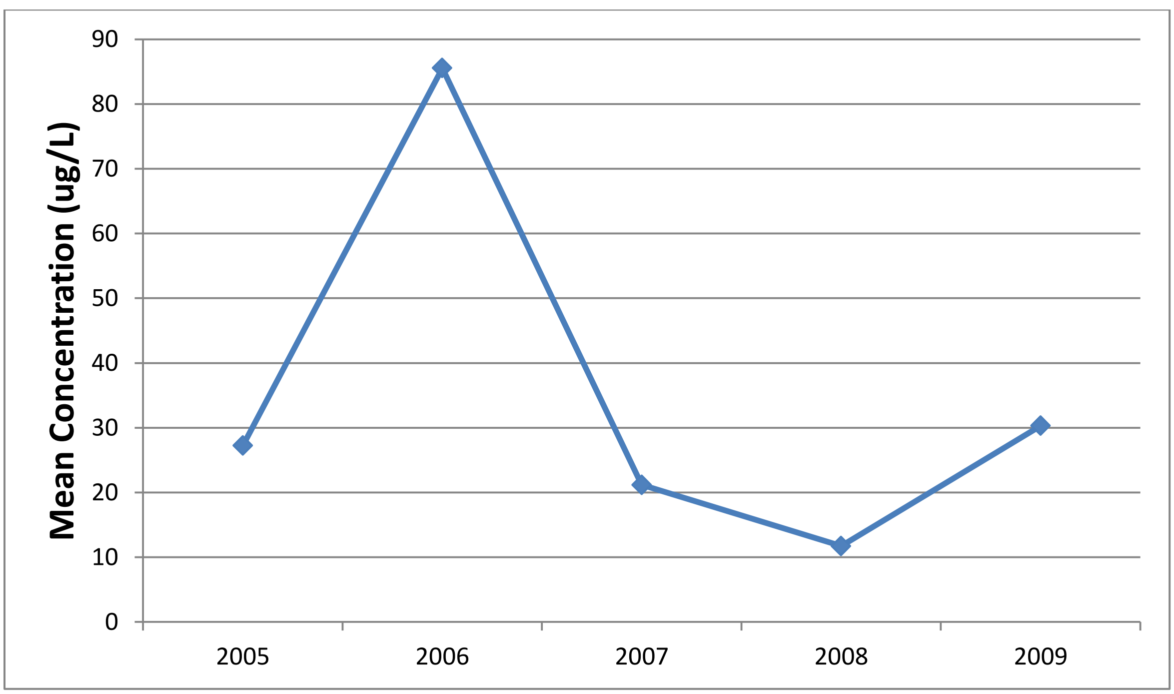

Figure 4. Chlorophyll A measured in pothole wetlands, 2005-2009.

pH- In 2005 to 2009 there were 126 wetland sites sampled for pH (Figure 5). The mean pH was lowest in 2008 (7.69) and highest in 2005 (8.97).

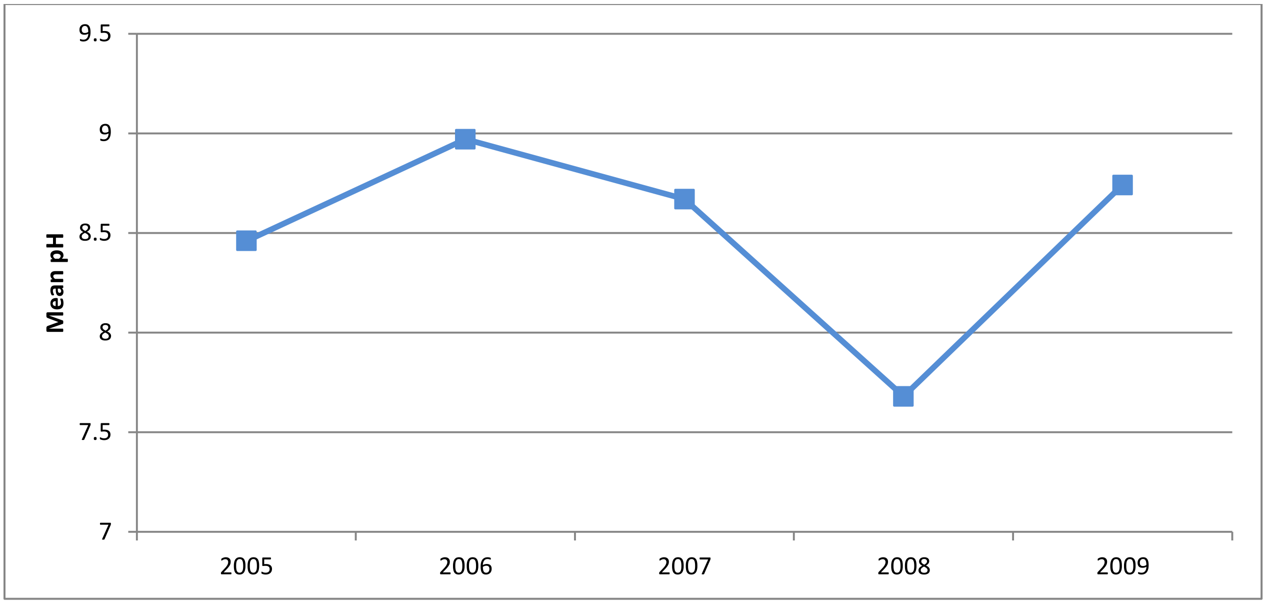

Figure 5. pH measured in pothole wetlands, 2005-2009.

Dissolved Oxygen- In 2005 to 2009 there were 126 wetland sites sampled for dissolved oxygen (DO) (Figure 6). DO levels were lower in 2008 & 2009, 4.96 mg/L and 4.05 mg/L respectively Dissolved oxygen had the most variability of all the parameters measured. This is not surprising because DO levels can change even within a 24 hour period within the same wetland.

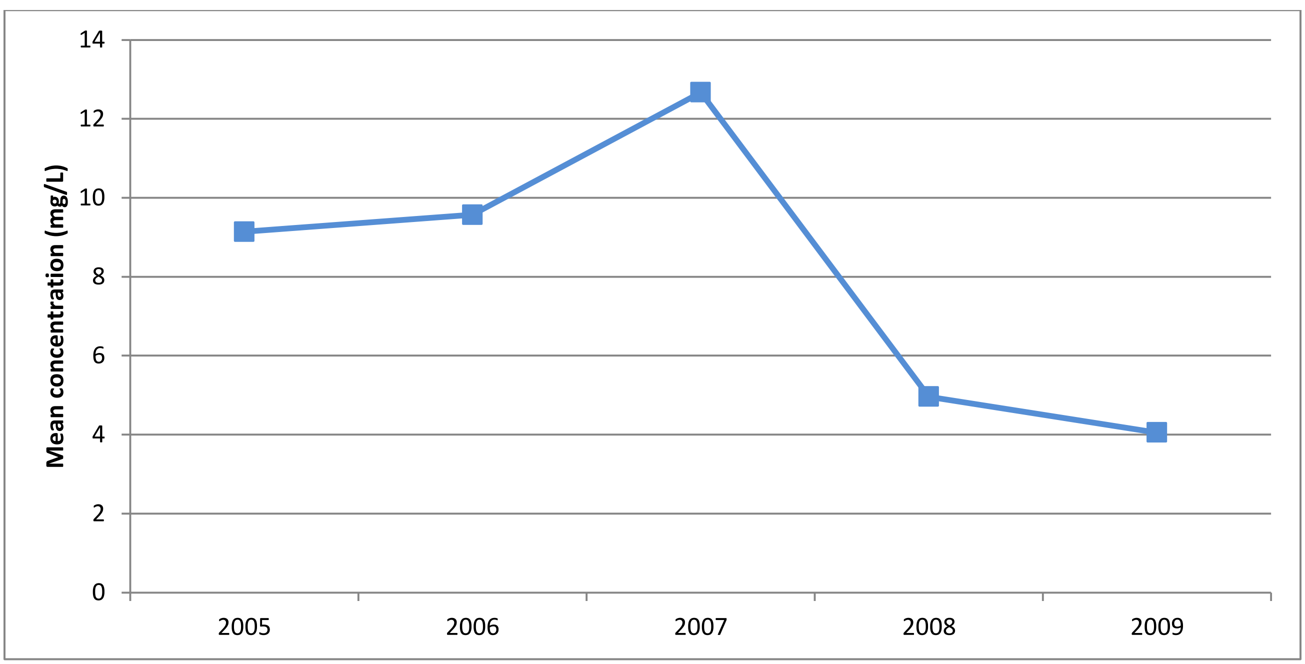

Figure 6. DO measured in pothole wetlands, 2005-2009.

Water Temperature- Water temperature was measured 126 wetland sites in 2005 to 2009 (Figure 7). Temperature was lower in 2008 and 2009.

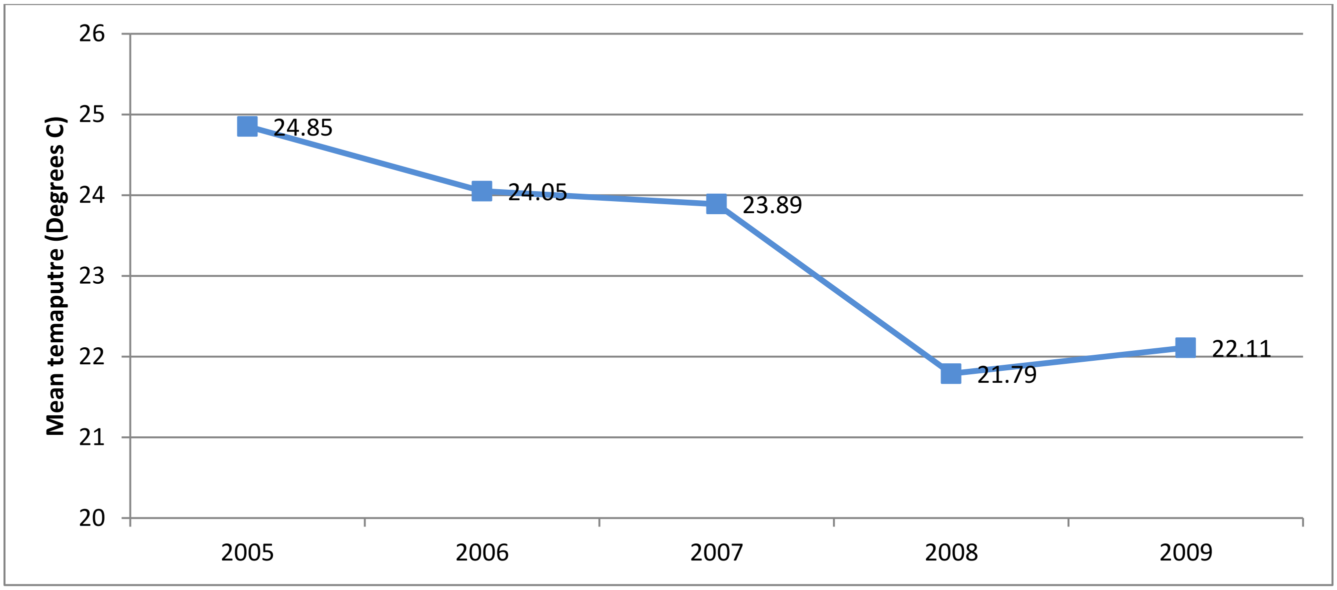

Figure 7. Water temperature measured in pothole wetlands, 2005-2009.

Turbidity- Turbidity was measured 126 wetland sites in 2005 to 2009 (Figure 8). Turbidity was lowest in 2008 and 2009.

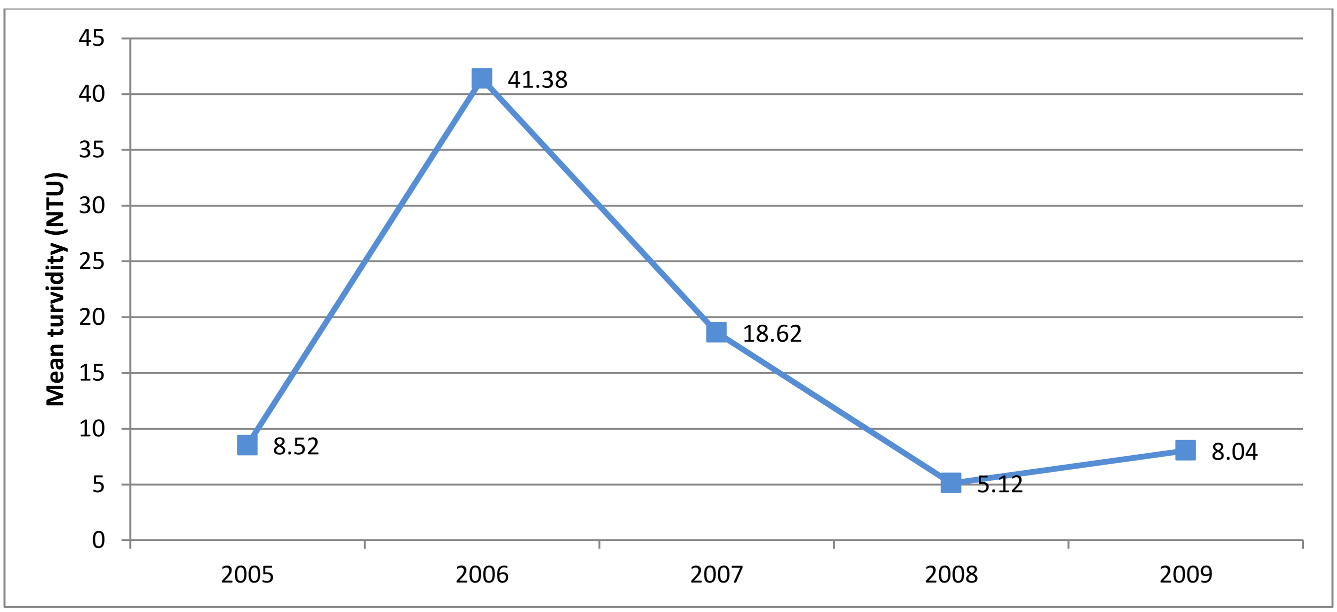

Figure 8. Turbidity measured in pothole wetlands, 2005-2009.

Four water quality measurements spiked in year 2006, these included TKN, Total Phosphate, chloride, and chlorophyll A. In 2006 TKN, chloride, and chlorophyll A levels were the highest during the five years of monitoring. Whether this was coincidence or there was a factor(s) contributing this is unknown.

Biological Monitoring

Reptiles and Amphibians- Due to their water dependent lifecycle amphibians are a good indicator species for wetland quality. One hundred twenty-one of 142, or 85% of wetlands had at least one reptile and/or amphibian species present. Thirteen species of reptiles/amphibians were detected from 2005-2009. The three most common species were tiger salamanders, painted turtles, and leopard frogs (Figure 9). One Iowa threatened species (Blanding's turtle) was detected. A few individual leopard frogs were noted to have physical abnormalities.

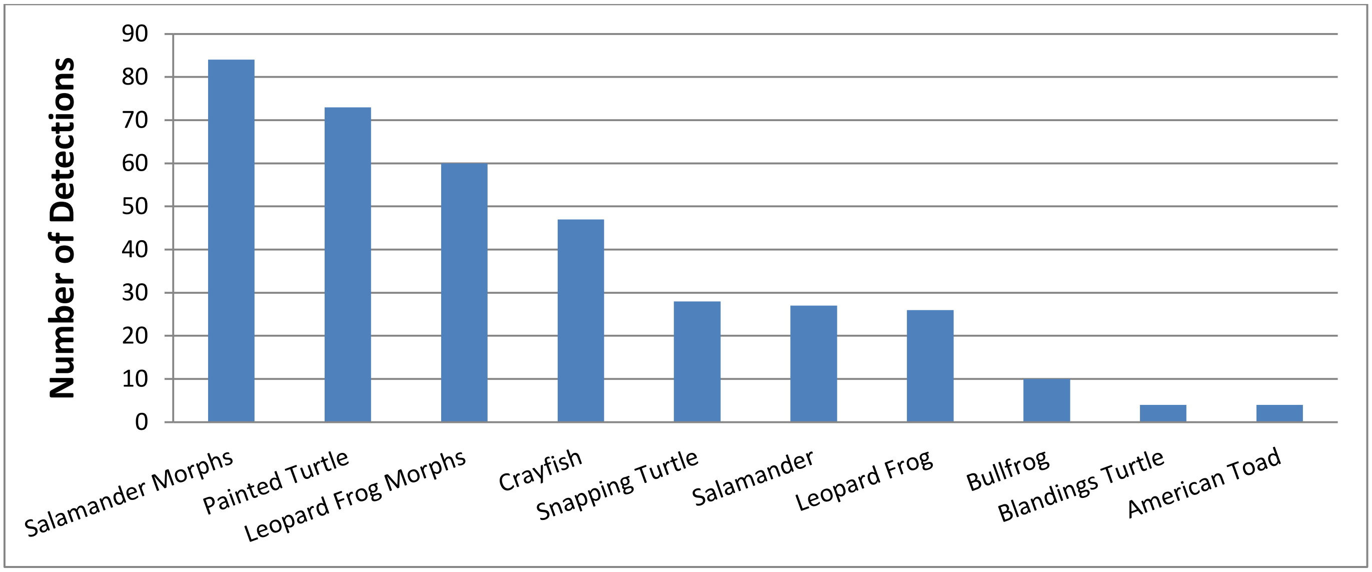

Figure 9. Ten most frequently detected reptile and amphibian species in pothole wetlands, 2005-2009.

Fish- One hundred forty two deep wetlands were checked for the presence of fish. Eighty four of 142, or 59% of deep wetlands had at least one species of fish present. Twenty-nine species of fish were detected from 2005-2009. Seventeen percent of wetlands had carp present, and 26% of wetlands had bullhead (black or yellow) present. The three most frequently detected fish species were fathead minnows, green sunfish, and bullhead (Figure 10). The presence of fish can alter the food web of a wetland as they can consume large numbers of aquatic invertebrates and amphibian larvae. Figure 11 shows the relationship between fish found and salamanders found in 2005-2009.

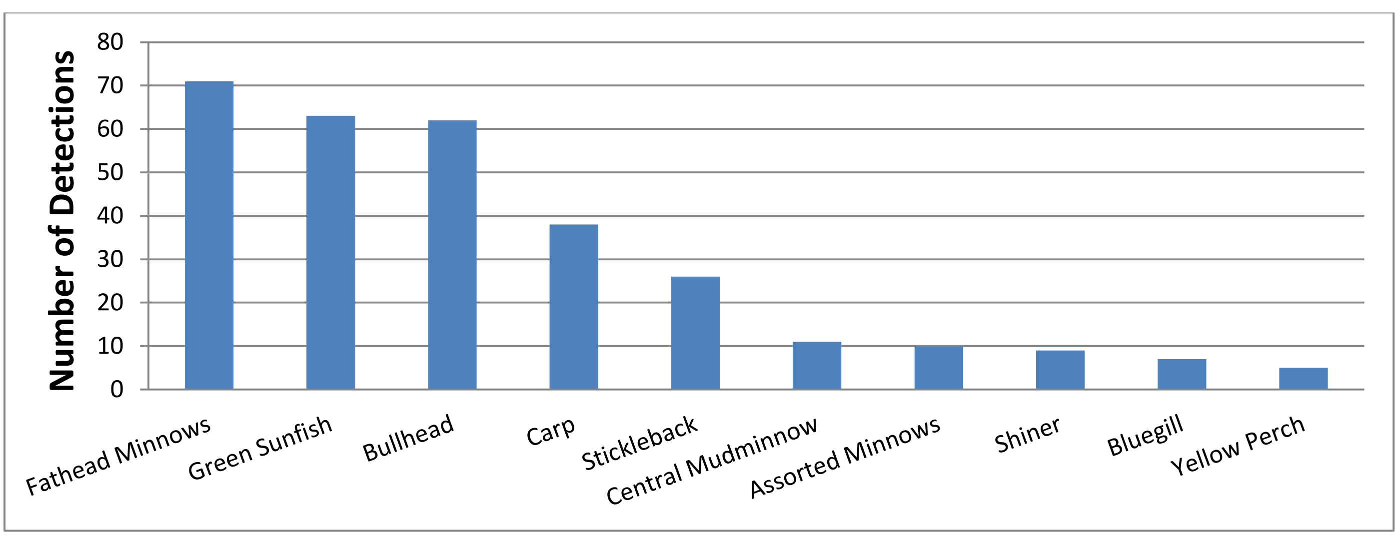

Figure 10. Ten most frequently detected fish species in pothole wetlands, 2005-2009.

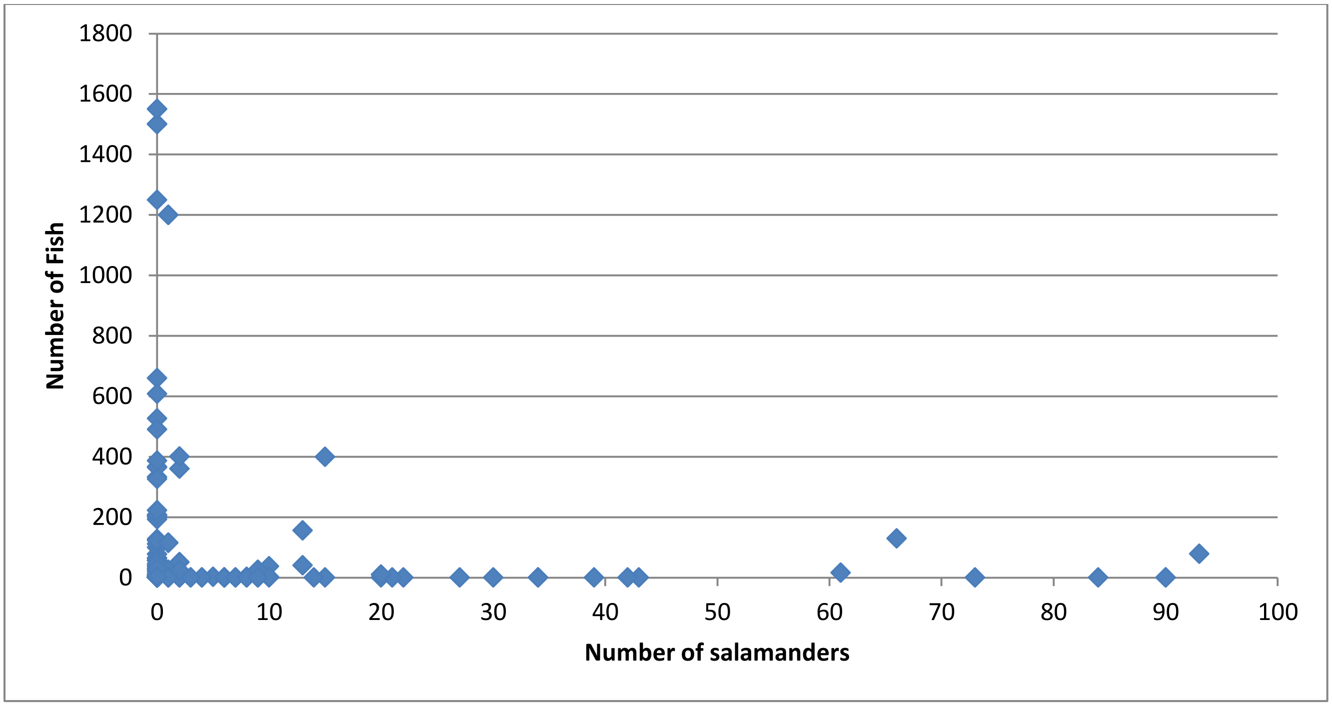

Figure 11. Relationship between the number of fish and the number of salamanders found in wetlands, 2005 to 2009.

Vegetation- Species richness of wetland plants is a good measure of biological diversity within these ecosystems. A total of 70 wetlands at 24 sites had a vegetation survey completed in 2005 to 2009. A total of 105 species of vegetation were detected. Both submerged and emergent species were identified. The three most frequently detected species were narrow-leaf pondweed, small duckweed, and narrow-leaf cattail (Figure 12).

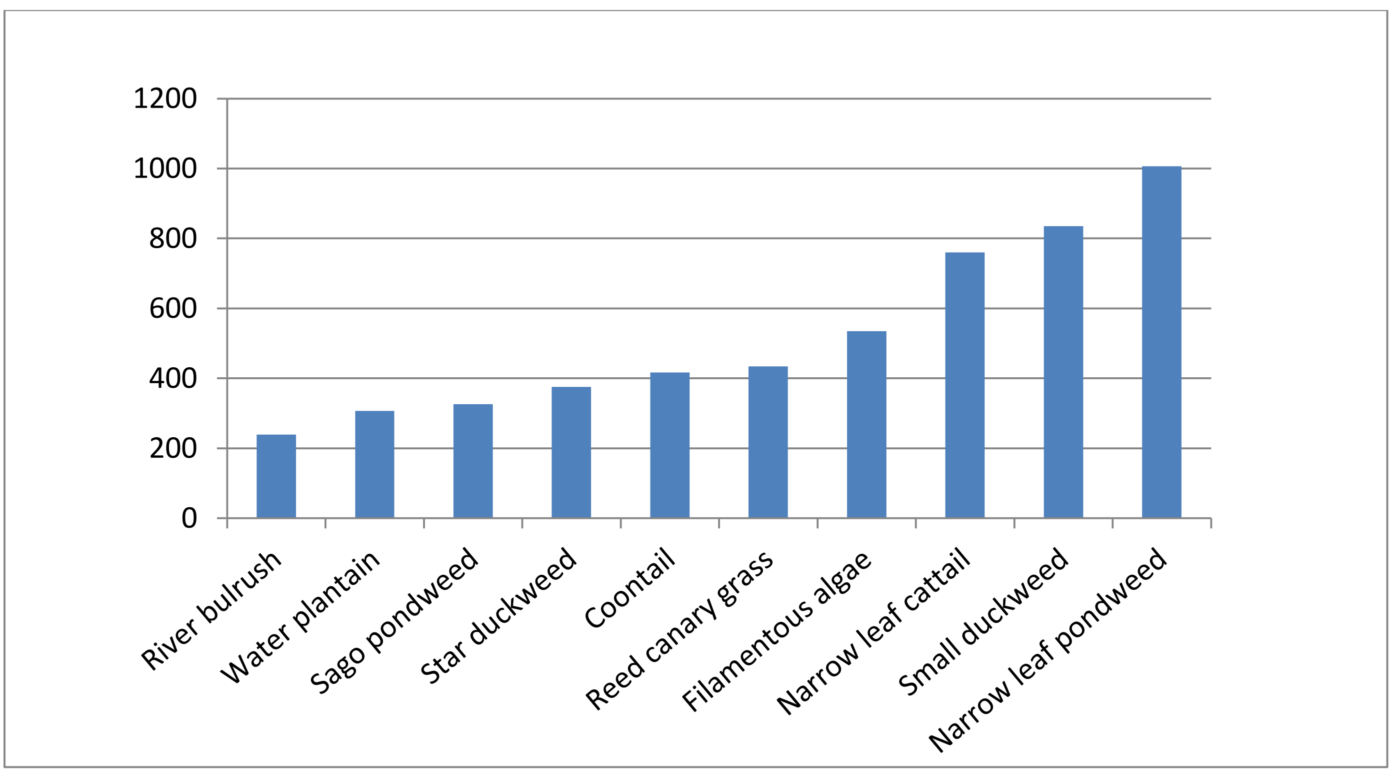

Figure 12. Ten most frequently found vegetation species in pothole wetlands, 2005-2009.

Aquatic Invertebrates- In 2005 a total of 23 wetlands sites were sampled for aquatic invertebrates. A total of 44 taxa were found. The three most frequently detected were Hyallelidae (scuds), Chironominae (midge flies) and Oligochaeta (aquatic worms) (Figure 13).

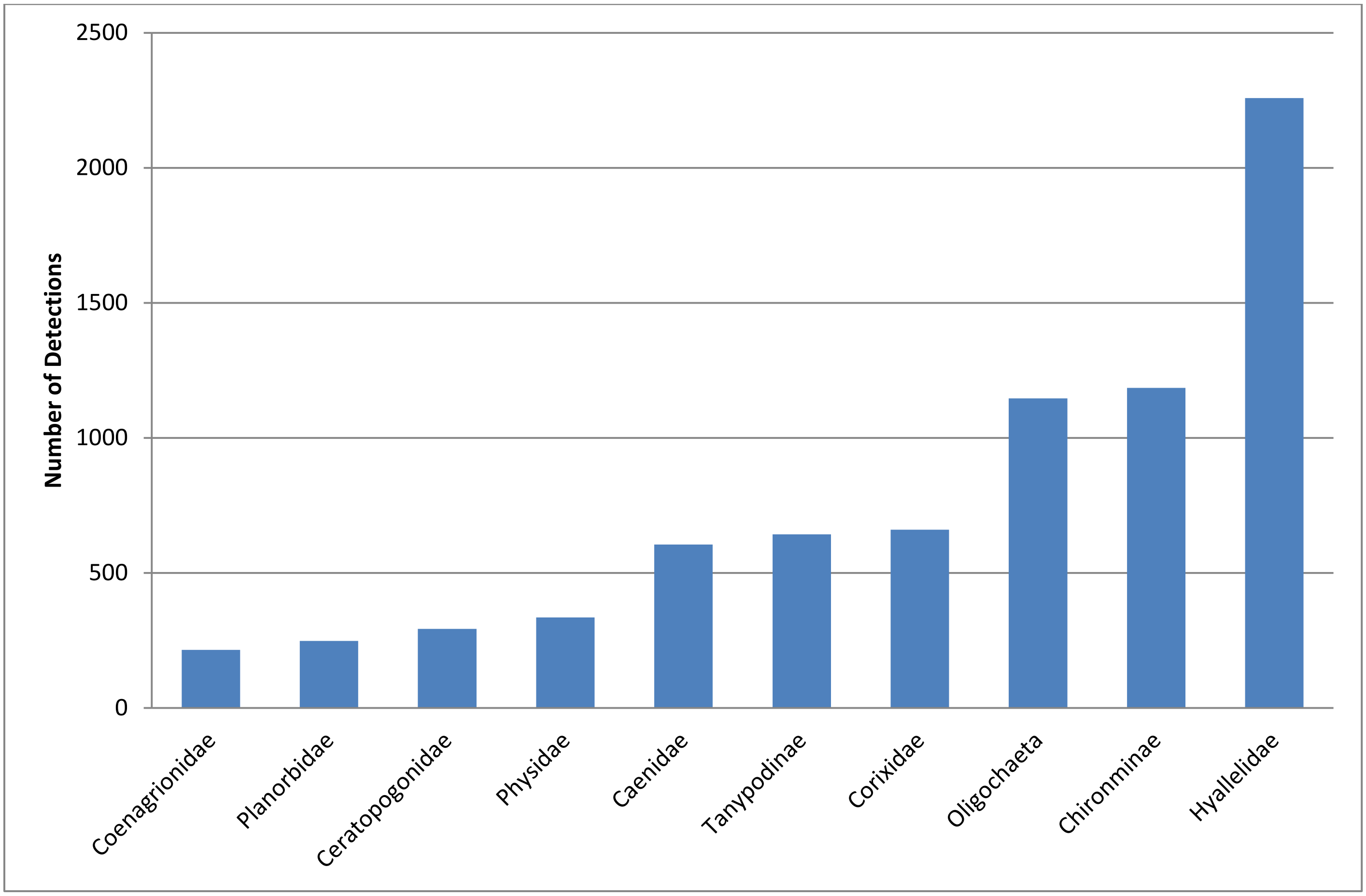

Figure 13. Ten most frequently found aquatic invertebrates found in pothole wetlands, 2005-2009

CITATIONS

Almendinger, J.C. 1987. A Handbook for Collecting Releve Data in Minnesota. Natural Heritage Program, MN Department of Natural Resources, St. Paul, MN.

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Appendix 1.0 All pesticide and metal detections, mean concentration, and maximum concentration (ug/L) from wetland water samples, 2005-2009.

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Butylate	4	0.054	0.38
delta-BHC	4	0.052	0.1
Endosulfan sulfate	4	0.052	0.1
Lindane (gamma-BHC)	4	0.052	0.1
alpha-BHC	3	0.051	0.1
Bentazon	3	1.089	7
Bromacil	3	0.088	4.7
Cyanazine	3	0.192	20
Endrin	3	0.051	0.1
Methoxychlor	3	0.051	0.1
Metsulfuron methyl	3	0.005	0.008
Propachlor	3	0.051	0.1
Simazine	3	0.081	4.2

Total Arsenic	3	0.01	0.02
Trifluralin	3	0.052	0.2
Alachlor	2	0.038	0.47
Aldrin	2	0.051	0.1
Ametryn	2	0.051	0.2
Butachlor	2	0.057	1
Chlorsulfuron	2	0.005	0.018
EPTC	2	0.056	0.91
Metribuzin	2	0.124	11
Pendimethalin	2	0.051	0.1
Picloram	2	0.519	2.4
Prometon	2	0.064	2.1
Propazine	2	0.053	0.46
Rimsulfuron	2	0.007	0.18
Triallate	2	0.05	0.1
2,4-D	1	1.032	5
Aroclor 1016	1	0.504	1
Aroclor 1221	1	0.504	1
Aroclor 1232	1	0.504	1
Aroclor 1242	1	0.504	1
Aroclor 1248	1	0.504	1
Aroclor 1254	1	0.504	1
beta-BHC	1	0.05	0.1
Carbaryl	1	0.05	0.1
Chlordane	1	0.05	0.1
Chlorpyrifos	1	0.05	0.1
DDD	1	0.05	0.1
DDE	1	0.05	0.1
DDT	1	0.05	0.1
Diazinon	1	0.05	0.1
Dichlorvos	1	0.05	0.1
Dieldrin	1	0.05	0.1
Dimethoate	1	0.05	0.1
Disulfoton	1	0.051	0.1
Endosulfan I	1	0.05	0.1
Endosulfan II	1	0.05	0.1
Endrin aldehyde	1	0.05	0.1
Endrin ketone	1	0.05	0.1
Ethoprop	1	0.05	0.1

Fonofos	1	0.05	0.1
Heptachlor	1	0.05	0.1
Imazaquin	1	0.005	0.006
Isofenphos	1	0.05	0.1
Malathion	1	0.05	0.1
Methyl parathion	1	0.05	0.1
Parathion	1	0.05	0.1
Phorate	1	0.051	0.1
Primisulfuron methyl	1	0.005	0.01
Sulfometuron methyl	1	0.005	0.044
Terbufos	1	0.05	0.1
Total Copper	1	0.01	0.02
Total Zinc	1	0.02	0.03
Toxaphene	1	0.504	1
2,4,5-T	0	0.2	0.2
2,4-DB	0	1	1
Acifluorfen	0	0.2	0.2
Aroclor 1260	0	0.504	1
Bromoxynil	0	0.2	0.2
Chloramben	0	0.5	0.5
Chlorimuron ethyl	0	0.005	0.005
Chlorthal-dimethyl	0	0.2	0.2
Dicamba	0	0.5	0.5
Dichlorprop	0	1	1
Dinoseb	0	0.5	0.5
Halosulfuron-methyl	0	0.005	0.005
Imazamox	0	0.005	0.005
Imazapic	0	0.005	0.005
Pentachlorophenol	0	0.5	0.5
Prosulfuron	0	0.005	0.005
Silvex	0	0.2	0.2
Thifensulfuron methyl	0	0.005	0.005
Total Antimony	0	0.005	0.005
Total Cadmium	0	0.001	0.001
Total Chromium	0	0.02	0.02
Total Lead	0	0.01	0.01
Total Mercury	0	0	0
Total Nickel	0	0.05	0.05
Total Selenium	0	0.01	0.01

Total Silver	0	0.01	0.01
Total Thallium	0	0.001	0.001
Triasulfuron	0	0.005	0.005
Triclopyr	0	0.2	0.2
Ammonia Nitrogen as N	189	0.094	2.6
Chloride	189	9.188	46
Chlorophyll A	189	34.38	490
Nitrate + Nitrite Nitrogen as N	189	1.003	27
Ortho Phosphate as P	189	0.122	1.7
Total Alkalinity	189	182.097	330
Total Dissolved Solids	189	249.37	860
Total Fixed Suspended Solids	189	10.524	290
Total Kjeldahl Nitrogen as N	189	1.938	9.7
Total Phosphate as P	189	0.314	3.2
Total Suspended Solids	189	18.484	400
Total Volatile Suspended Solids	189	10.378	120

TOP TEN DETECTS FOR EACH YEAR

Note:
Atrazine was
not tested for
in 2008

Test	Year	# Detects
Atrazine	2005	57
Acetochlor OXA	2005	54
Acetochlor ESA	2005	49
Desethyl Atrazine	2005	48
Metolachlor ESA	2005	47
Alachlor ESA	2005	35
Metolachlor OXA	2005	34
Alachlor OXA	2005	16
Flumetsulam	2005	12
Imazethapyr	2005	9

Test	Year	# Detects
Acetochlor OXA	2006	32
Acetochlor ESA	2006	26
Atrazine	2006	26
Metolachlor ESA	2006	23
Alachlor ESA	2006	21
Metolachlor OXA	2006	21
Desethyl Atrazine	2006	16
Alachlor OXA	2006	11
Flumetsulam	2006	11
Imazapyr	2006	7

Test	Year	# Detects
Acetochlor OXA	2007	29
Atrazine	2007	29
Acetochlor ESA	2007	27
Metolachlor ESA	2007	23
Metolachlor OXA	2007	22
Metolachlor	2007	21
Alachlor ESA	2007	19
Alachlor OXA	2007	12
Desethyl Atrazine	2007	11
Acetochlor	2007	8

Test	Year	# Detects
Metolachlor	2008	33
Acetochlor OXA	2008	32
Acetochlor ESA	2008	31
Metolachlor ESA	2008	27
Alachlor ESA	2008	23
Metolachlor OXA	2008	20
Acetochlor	2008	16
Alachlor OXA	2008	13
Dimethenamid ESA	2008	3
Dimethenamid OXA	2008	2

Test	Year	# Detects
Acetochlor OXA	2009	23
Acetochlor ESA	2009	18
Atrazine	2009	18
Alachlor ESA	2009	17
Metolachlor	2009	15
Alachlor OXA	2009	14
Metolachlor OXA	2009	12
Metolachlor ESA	2009	11
Acetochlor	2009	9
Desethyl Atrazine	2009	7