Standard Gear and Techniques for Fisheries Surveys in Iowa

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CHAPTER 1. STANDARD SAMPLING METHODS FOR IOWA LAKES AND RESERVOIRS

INTRODUCTION

An important objective of the Iowa Department of Natural Resources (DNR) Fisheries Bureau is to provide scientifically valid and defensible data for the effective and efficient management of Iowa's inland public lakes. Given the scale of the resource, the diversity of habitat, abundant lake types, and fish communities, the Department has established this manual of standardized sampling design and techniques for the assessment of Iowa public waters.

For data collection purposes, standardization means to collect data in a consistent manner so valid comparisons can be easily made. Although routine data collection has been standardized in many other disciplines, data from freshwater fish sampling across North America has not (Bonar et al. *In Press*). Previously, most data collection has been standardized only at the local or state level (Bonar and Hubert 2002). Standardized sampling procedures in Iowa were first consolidated by Kline et al. (1995) and have continued to evolve in the years since. The primary objective of this document is to outline procedures and guide biologists on the collection of scientifically sound and comparable data sets both within individual lakes and across the state as a whole. Standardization is better-suited for some uses than others. In this document we refer to standardized sampling as the work required for general or routine fish population assessments and some research studies. This type of standardization can provide a powerful means to compare data to that collected in other regions of the state or at other times. This document will serve as both a guide for future needs and a reference for current standard methodologies in the collection of fishery data in Iowa waters. It is not meant to be all-encompassing, but rather to outline the basic collection methodology that must remain consistent among all fishery sampling.

The quality of sampling determines the usefulness of our data in describing our fisheries. The quality of these data can mean the difference between success and failure in fishery management, and therefore our credibility as fishery scientists depends on these procedures. The Iowa DNR Fisheries Bureau has a strong heritage of letting our data justify our actions. This manual will further serve to improve that heritage.

This manual focuses on the minimum efforts required to evaluate our fishery resources. Our responsibility as fishery management crews is to effectively and efficiently collect the data necessary to manage Iowa's lakes. This means we must avoid collecting "too little" data or collecting excess or exceedingly precise data that "might be useful" someday. Either action reduces our ability to manage the diverse and abundant resources that are available in Iowa. As such, it is clear that a two-tiered approach is necessary for the collection of fishery data throughout the state (Figure 1).

TYPES OF SURVEYS

First, biologists with long term data sets are often primarily concerned with in-lake trends. These data sets are valuable to the management of those individual resources. We will call these surveys ***GENERAL SURVEYS*** **(GS**; Figure 1) and their value lies mostly in within-lake comparisons. Many variables require these data to be collected. While the timing of these data collections (i.e. season) may fall outside the "window" of truly statewide comparable data, as long as these procedures are maintained within a given water body; with the same timing, effort, gear, and location from one survey year to the next, they can provide an important tool for management of fish populations or communities within that water body.

The second tier of data collection will be ***COMPREHENSIVE SURVEYS*** **(CS**; Figure 1). These data will be for **among water comparisons** on a statewide scale. These lakes were originally targeted for the 2001-2005 Iowa Lakes Study. The need to collect comparable data throughout the entire state is of great importance and value. However it is equally important to realistically consider how many water bodies may be sampled in the limited time period that is available each year for CS. Not all lakes in a manager's district can be sampled within the exacting methodology outlined below for CS. The limited window of opportunity makes

it difficult to complete large numbers of these surveys with a reasonable frequency of repetition. Therefore, the number of water bodies included in the CS category has been initially set at 132 lakes, all of which were included in the original 2001-2005 Lakes Study (Appendix A). Additional lakes may be added in the future. This is not to say that any lakes added must be newly constructed or renovated. Lakes added to this list should not be added simply because they are considered to be "high quality" resources. In fact, a cross section of lake quality should be included in this tier of sampling simply to provide an accurate perspective on fishery quality across Iowa.

The following prioritization scheme should serve as a framework for biologists in determining when lakes should be sampled. Appendix A lists all lakes to be included in the CS surveys. It is up to the biologist to apply the following scheme to this list in Appendix A and develop a sampling schedule that meets these requirements.

RATING A) HIGH PRIORITY LAKE; Comprehensive survey once every 5 years**.**
RATING B) MEDIUM PRIORITY LAKE; Comprehensive survey once every 7 years.
RATING C) LOW PRIORITY LAKE; Comprehensive survey once every 10 years.

LAKE RATING CRITERIA
FISH POPULATION QUALITY
WATER QUALITY
PUBLIC USE
LAKE SIZE
LAKE RATING A = MEETS 3 OF 4 CRITERIA
LAKE RATING B = MEETS 2 OF 4 CRITERIA
LAKE RATING C = MEETS 1 OR NONE OF CRITERIA

All surveys, be they GS or CS, must adhere to the data collection, and reporting requirements listed below. Haphazard data collection provides no basis for data comparison either across the state or within a water body and undermines our credibility as fishery scientists. It is our responsibility to maintain the integrity of all fishery data collected from Iowa waters.

1) GENERAL SURVEYS (GS)

Not all lakes within a manager's district can be placed on the COMPREHEHENSIVE SURVEY list. The effort required to sample all water bodies within the limited time frame required for true statewide standardization would not allow for consistent repeated samples to be taken on all water bodies. Rather, managers will likely sample all water bodies within their district, but only lakes earmarked as "COMPREHENSIVE SURVEYS (CS)" as originally defined by the Iowa Lakes Study will be required to meet all CS methodology as defined below. GS are to be conducted based on past survey work but must develop samples that are scientifically sound and defensible. GS must adhere to the same minimal data requirements outlined for CS in terms of minimum sampling effort and length and weight data collection. The main difference between GS and CS is that GS may fall out of phase in terms of timing, compared to CS. For instance, GS may utilize spring fyke netting as opposed to fall fyke netting as in CS. Further, GS may consist of electrofishing surveys only, compared to all three gears utilized in CS (i.e. electrofishing, fyke nets, and hoop nets). Reasons for timing differences may vary, but likely are due to one of the following needs. First, GS are often performed to gather timely data for the immediate assessment of various fish populations. Manpower availability is often greatest in spring and summer, which may be a determining factor in scheduling in which season fishery surveys are performed. It is suggested that GS should emulate the effort required in CS (see specific gear requirements) for all gear utilized. It is only necessary to standardize timing and effort in GS to coincide with past or future GS needs as these data are only utilized for within-lake comparisons Even in GS, data collected in spring should not be compared to data collected in other seasons (i.e. summer or fall surveys).

2) COMPREHENSIVE SURVEYS (CS)

As defined above, GS provide insight into the population trends of individual lakes, or individual populations of fish within lake communities. While they are valuable for individual lake management, there is a growing need for comparable data from a wider geographic range. The major tenet of standard sampling is the idea of sampling at the "same time, same place, same gear, with the same effort." To be truly a standardized sampling regimen, data for CS must be collected in a limited time frame on a "statewide" scale. Therefore, to ensure the collection of this strictly standardized data on this "statewide" scale, the number of lakes included in this category of data collection will be large, but limited in scope (See Appendix A). While GS allow biologists to follow individual fish communities or individual fish populations within fish communities from a single lake, there are seasonal differences in catch rates and structure indices among species across time (Guy and Willis 1991). By limiting all CS to a confined sampling "window" we can then compare entire fish communities from the list of "comprehensive lakes." These comparisons will be important in comparing the effects of many environmental factors on the status and health of statewide fish assemblages. The schedule for sampling each lake earmarked for CS is as prioritized above.

The ability to collect these diverse data on a repeatable scale (at least once every five years) will allow us to track various changes in environmental factors and to evaluate their effects on the status of these same fish communities.

DATA REQUIREMENTS

1) Background information:

Sampling teams must complete the "Fish Sampling Cover Sheet" (See Appendix B) for each survey. These data provide important background information for all surveys. This sheet must be completed for both types of surveys (GS, and CS).

For all target species:

2) LENGTHS AND WEIGHTS

Precise lengths and weights

- Record total length (tenths of inches) and weight (grams or 0.01 lbs).
- Record these lengths and weights on the standard "***Length & Weight Data Sheet***" (See Appendix C).
- In addition, record lengths on a standard "***Throw Away Tally Sheet***" (See Appendix D) which will combine all samples from the entire survey. This sheet is to ensure a minimum of five precise lengths and weights are collected per ½ inch group. The biologist may wish to discard this overall tally sheet following the survey. Additionally, each individual fish length must also be recorded on a standard "***Survey Field Tally Sheet***" (See Appendix E) tally sheet for **each sample** (i.e., each electrofishing run, fyke net, hoop net, or gill net).
- Measure and weigh the first 25 fish regardless of length (1/2 inch group) by species while also tallying by each ½ inch group (this ensures that a minimum of 25 fish/species will be recorded to calculate measures of condition (e.g. Relative Weight (*Wr*)).
- Continue to measure & weigh fish by ½ inch group until a minimum of five individuals per 1/2 inch group have been measured to length and weighed (and recorded on the "Throw Away Tally Sheet" (Appendix D) and the "Standard Survey Tally Sheet" (Appendix E)).
- Following completion of the minimum five fish per ½ inch group, you may discontinue measuring to tenths of an inch and weighing for that ½ inch group (i.e., you must measure and tally to 1/2 inch group on the standard "Survey Field Tally Sheet" but not the "Throw Away Tally Sheet" when the minimum of five fish for that half inch group is reached.

3) TALLY DATA

- Miranda (2007) suggested approximately 75-130 fish were required to estimate proportional stock density (PSD) with 90% confidence that your predicted value was within 80% of the true value for multiple species. He suggested fewer measurements were required in truncated or skewed length frequencies, that is, length frequencies dominated by certain size groups. He further suggested that larger fish species with larger length frequencies required larger sample sizes. He however noted that estimates of PSD required substantially less effort than more precise estimates of length frequency. Therefore, management teams are required to measure the first 200 fish of all target species and these values must be recorded on the standard tally sheet. After this minimum sample size requirement is fulfilled the biologist will normally continue to measure fish from that sample (i.e. electrofishing run, fyke net, hoop net, or gill net) until all fish from that sample are measured to length and tallied. In cases where catch is very high and size variation is small, biologists, at their discretion may determine that more than 200 lengths are not necessary (e.g. all 9-inch bullheads).
    - In this case, take lengths of a representative sample (i.e. 200 lengths recorded on the standard tally sheet).
        - At this point the sampling team may stop collecting lengths and may count individual fish from that sample to obtain valid catch per effort information in the data set.
        - No other fish should be measured and recorded from that sample (e.g. electrofishing runs, fyke nets, hoop nets, or gill nets) once counting has started as it may negatively impact the overall estimate of size structure for that population.
    - If a sampling team has measured only moderate numbers; but less than 200 individuals in prior samples (e.g. electrofishing runs, fyke nets, or hoop nets), and additional samples are extremely large (e.g. >200 individuals), biologist discretion allows counting of fish to begin prior to the minimum 200 lengths. This is especially true if the length frequency of these fish is again dominated by a single size group of fish (e.g. 9-inch bullheads).
        - Once 200 individuals are tallied and samples are not considered to be overly large, biologists may discontinue tallying following the station or nets in which the 200th fish was measured and tallied.
        - <u>If counting occurs, it is up to the biologist to assure that the proportionality of the sample is maintained. That is, the representative sample's length frequency must be proportionally applied to the total count of all fish captured prior to entry into the statewide database.</u>

METHODS

1) ELECTROFISHING (All Species)- COMPREHENSIVE and GENERAL SURVEYS

- Electrofishing for CS must be conducted in spring (May 1 – June 30) when water temperatures are between 60^{o} F and 75^{o} F. GS may be in other seasons but should remain consistent with historic data collections.
- Electrofishing as part of CS must be conducted during the day. GS electrofishing may be conducted according to historic methodology.
- If for ANY reason the biologist believes that the sample is not an effective or representative sample these data must be discarded and the survey must be repeated.

Gear requirements:

- See Appendix F

Station selection

- Stations and their coordinates are fixed locations
- Electrofishing runs must be 15 minutes (900 seconds) in duration (unless the entire shoreline is sampled in less time)
- Suitable water for electrofishing is defined as any area along the shoreline, including islands and known submerged habitat, that is accessible by standard electrofishing boat

Sampling specifics:

- Use pulsed DC current only.
- Collect all target species encountered. Dippers must make equal effort to catch each fish without favoritism for size
- Record lake elevation (+ or – normal pool).
- Record coordinates (UTM), water temperature, and Secchi disk transparency at each location
- Record voltage, frequency, amperage, and duty cycle on the Survey Cover Page.

Target species:

- Bluegill, green sunfish, redear sunfish, largemouth bass, smallmouth bass, common carp, buffalo, walleye, gizzard shad.
- In addition, the presence and relative abundance (common/uncommon) of all nontarget species (e.g. cyprinids) encountered during these surveys should be recorded.

Effort:

Lake Size (acres)	Sampling Effort (Number of 15 minute stations)
< 50	1-2 stations (15 to 30 minutes)
50-150	2-4 stations (30 to 60 minutes)
150-250	3-5 stations (45 to 75 minutes)
250-500	4-6 stations (60 to 90 minutes)
500- 1000	4-8 stations (60 to 120 minutes)
>1000 acres (large lakes and reservoirs)	6-12 stations (90 to 180 minutes)

2) ELECTROFISHING (Species Specific) – TARGETTED SURVEYS (COMPREHENSIVE and TREND) GENERALLY UTILIZED FOR WALLEYE YOY OR YEARLING IDEX

- Generally utilized for walleye yoy or yearling index
  - Electrofishing must be conducted in fall (mid-September to late October) when water temperatures are between 65 ^{o} F and 50 ^{o} F.
  - Electrofishing must be conducted at night.
  - If for ANY reason the biologist believes that the sample is not an effective or representative sample these data must be discarded and the survey must be repeated.

Gear requirements:

- See Appendix F

Station selection

- Stations and their coordinates are fixed locations
- Duration of electrofishing runs should be 15 minutes for CS but may vary for GS
- Suitable water for electrofishing is defined as any area along the shoreline, including islands and known submerged habitat, that is accessible by standard electrofishing boat

Sampling specifics:

- Use pulsed DC current only
- Record lake elevation (+ or – normal pool).
- Collect all target species encountered. Dippers must make equal effort to catch each fish without favoritism for size
- Record coordinates (UTM), water temperature, and Secchi disk transparency at each location
- Record voltage, frequency, amperage, and duty cycle on the Survey Cover Page.

Target species:

- walleye, yellow bass, gizzard shad
- In addition, the presence and relative abundance (common/uncommon) of all nontarget species (e.g. cyprinids) encountered during these surveys should be recorded.

Effort:

Lake Size (acres)	Sampling Effort (Number of 15 minute stations)
< 50	1-2 stations (15 to 30 minutes)
50-150	2-4 stations (30 to 60 minutes)
150-250	3-5 stations (45 to 75 minutes)
250-500	4-6 stations (60 to 90 minutes)
500- 1000	4-8 stations (60 to 120 minutes)
>1000 acres (large lakes and reservoirs)	6-12 stations (90 to 180 minutes)

3) FYKE NETTING - COMPREHENSIVE and TREND SURVEYS

- Fyke netting for CS must be conducted in fall (mid August – mid October) when water temperatures are between 75° F and 60° F. GS fyke netting may be in other seasons but should remain consistent with historic data collections from that same lake.
- Fyke nets must be fished for one night-net. Effort may be repeated over multiple nights. Nets need not be moved from the original location if fished for multiple nights.
- If nets are to be reset and are not moved, data collection and release of fish should occur in a different location.
- If for ANY reason the biologist believes that the sample is not an effective or representative sample these data must be discarded and the survey must be repeated.

Gear requirements:

- See Appendix F

Station selection

- Stations and their coordinates are fixed locations
- Nets must be set during daylight hours, fished overnight, and retrieved the following day. The standard unit of effort is a “net-night”, which is defined as one net set for one night (8 net-nights equals 8 nets set overnight or 4 nets set, run, set, and run again over two days).
- Suitable water for fyke netting is defined as any area that can be effectively fished without obstruction. The water should be just deeper than the height of the first frame or hoop on a gradual slope if possible.
- Utilize the 40 foot lead if possible, but record the lead length used if a shortened lead is necessary on a steep sloped shoreline/waterbody

Sampling specifics:

- All nets must be shoreline sets oriented perpendicular to the shore.
- Record lake elevation (+ or – normal pool).
- Record coordinates (UTM), water temperature, and Secchi disk transparency at each location.

Target species:

- Crappie, bluegill, green sunfish, redear sunfish, common carp, walleye.
- In addition, the presence and relative abundance (common/uncommon) of all nontarget species (e.g. cyprinids) encountered during these surveys should be recorded.

Effort:

Lake Size (acres)	Sampling Effort
< 50	3-5 net nights
50-150	5-8 net nights
150-250	5-10 net nights
250-500	6-15 net nights
500- 1000	8-20 net nights
>1000 acres (large lakes and reservoirs)	10-30 net nights

4) HOOP NETTING - COMPREHENSIVE and TREND SURVEYS

- Baited hoop netting must be conducted in summer (mid June 30 – mid August) when water temperatures are ≥ 75° F. (TREND SURVEYS may also be performed in the fall when water temperatures are ≤ 75° F)
- Nets must be fished in series of three nets set in tandem
- Hoop nets must be fished for three nights (72 h) / series. Effort may be repeated over multiple periods. Nets need not be moved from the original location if fished for multiple sampling periods. If nets are to be reset and are not moved, data collection and release of fish should occur in a different location.
- If for ANY reason the biologist believes that the sample is not an effective or representative sample these data must be discarded and the survey must be repeated.

Gear requirements:

- See Appendix F

Station selection

- Stations and their coordinates are fixed locations
- Nets must be set during daylight hours, and retrieved 72h later. The standard unit of effort is a "series-night", which is defined as one series (three nets in tandem) set for three nights (72h; 8 series nights equals 8 series set for 72 h or 4 series set, run after 72 h, set, and run again after 72 additional hours for a total sampling time of 6 days).

Sampling specifics:

- All nets must be set parallel to shore at a near-constant depth contour.
- An oxygen and temperature profile must be performed prior to setting these nets. Nets should not be placed at a depth within 1-2 feet of the thermocline to prevent channel catfish mortality.
- To reduce turtle bycatch and mortality nets should be placed in at least 6 feet of water if possible.
- Standard bait bags should be placed loose in each of the nets in a series with a 3"x3"x1" piece of Styrofoam or similar size net float to prevent bag loss through hoop net mesh. Bags should be approximately 12" x 12" and composed of 1/8 to ¼-inch mesh.
- Bait should be placed in each bag until full
- One bag should be placed in each net, a similar amount of bait should be placed loose in each net prior to setting.
- If a series is to be reset after running and the bait bag is still full this bait may be reused. Loose bait should be replaced in each net prior to resetting. Partially empty bait bags should be replaced.
- Record lake elevation (+ or – normal pool)
- Record coordinates (UTM), water temperature, and Secchi disk transparency at each location

Target species:

- Channel catfish

Effort:

Lake Size (acres)	Sampling Effort
< 50	3-5 series
50-150	5-8 series
150-250	8-10 series
>250	10-15 series

5) GILL NETTING – COMPREHENSIVE and TREND SURVEYS *OPTIONAL (BETTER SUITED TO WATERS WHERE MOTALITY WILL NOT BE VIEWED AS A PUBLIC RELATIONS ISSUE) - COMPREHENSIVE SURVEYS

- Gill netting must be conducted in fall (early to late October) when water temperatures are between 65-50°.
- Gill nets must be fished for one net-night. Effort may be repeated over multiple nights. Nets need not be moved from the original location if fished for multiple nights.
- If for ANY reason the biologist believes that the sample is not an effective or representative sample these data must be discarded and the survey must be repeated.

Gear requirements:

- See Appendix F.

Station selection

- Stations and their coordinates are fixed locations
- Nets must be set during daylight hours, fished overnight, and retrieved the following day. The standard unit of effort is a "net-night", which is defined as one net set for one night (8 net-nights equals 8 nets set overnight or 4 nets set, run, set, and run again over two days).

Sampling specifics:

- All nets must be shoreline sets oriented perpendicular to the shore.
- Record lake elevation (+ or – normal pool)
- Record coordinates (UTM), water temperature, and Secchi disk transparency at each location

Target species:

- Channel catfish, flathead catfish, white bass, yellow bass, walleye, gizzard shad, common carp, carpsucker
- In addition, the presence and relative abundance (common/uncommon) of all nontarget species (e.g. cyprinids) encountered during these surveys should be recordced.

Effort:

Lake Size (acres)	Sampling Effort
400-1000	3-8 net nights
>1000	8-20 net nights

1) AGE AND GROWTH

Age and growth structures must be collected from all CS lakes every second CS survey . It is recommended that all ageing structures (Table 1) be collected. This will enable accurate estimations of age using structures that are inappropriate for back-calculations. A concerted reasonable effort must be made to obtain a representative sample of fish for age-growth analysis. To further improve consistency all age-growth data will be extracted by the Spirit Lake Research Crew utilizing the newest technology (Image-Pro Plus Image Analysis System), and data analysis programs.

All ageing structures will be placed into scale envelopes on which the following information is recorded: lake name, date of sample, sampling gear used, species, length, weight, and any comments. At the end of each day the scale envelopes should be spread out and allowed to dry completely. This is especially important for spines, which can go rancid quickly if not allowed to dry.

Table 1. Minimum sample size, stock size, and preferred ageing structures for target fish species.

Species	Sample size for lengths and weights	Stock size (inches)	Preferred ageing structures	Sample size for age-growth structures
Black Bullhead	50	6	Pectoral spine	At least 5 fish per 1/2 inch group
Black Crappie	50	5	Scales, otoliths	At least 5 fish per 1/2 inch group
Bluegill	50	3	Scales, otoliths	At least 5 fish per 1/2 inch group
Common Carp	50	11	Scales, dorsal spine	At least 5 fish per inch group
Largemouth Bass	50	8	Scales, Pelvic spines	At least 5 fish per inch group
Northern Pike	50	14	Scales, Pelvic spines	At least 5 fish per inch group
Smallmouth Bass	50	7	Scales, Pelvic spines	At least 5 fish per inch group
White Crappie	50	5	Scales, otoliths	At least 5 fish per 1/2 inch group
Yellow Perch	50	5	Anal spines	At least 5 fish per 1/2 inch group

DATA HANDLING AND ANALYSIS

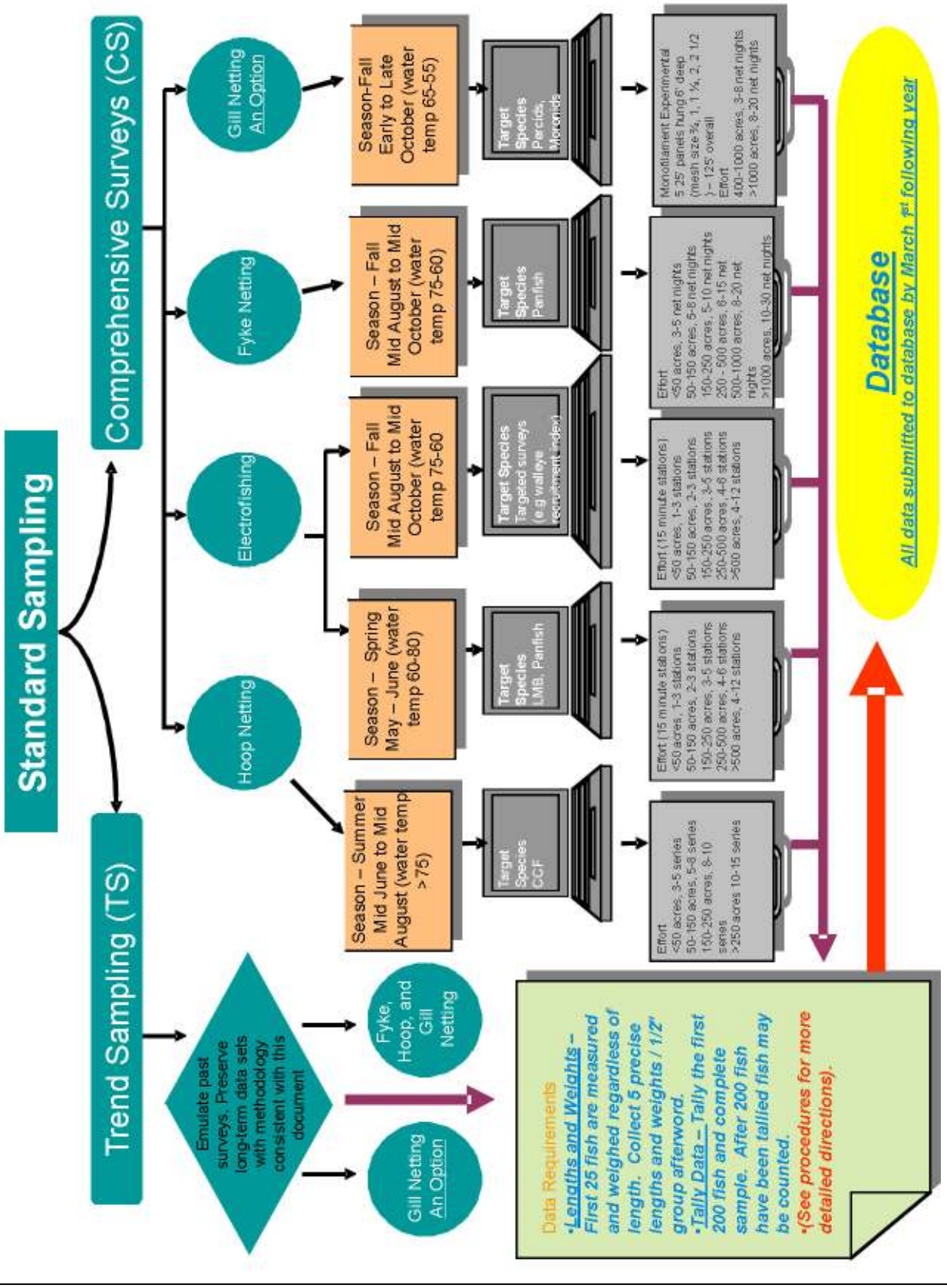
All data must be collected and recorded on the standard sampling data sheets (See Appendix B-E). This includes all data collected in GS. The use of other data sheet formats in place of these standard sheets is not permitted. Data must be entered into the statewide database by March 1 of the year following data collection. This is true even of GS. The following should be determined for all principal species when an adequate sample size is collected.

- Relative Abundance as measured by catch-per-unit-effort (CPUE)
    - Electrofishing – Electrofishing CPUE should be measured as catch/hour (stations = 15 minutes/station)
    - Gill and Fyke nets – CPUE should be measured as catch/net night and is defined as
    - one net set for 24 h.
    - Catfish hoop nets – CPUE should be measured as catch/series night which is defined as three nets set in tandem and set for 72 h.
- It is imperative that if counting occurred during sampling, it is up to the biologist to assure that the proportionality of the sample is maintained. That is, the representative sample's length frequency must be proportionally applied to the total count of all fish captured prior to entry into the statewide database.
- Length-frequency histogram
- Proportional Size Distribution (PSD; Guy et al. 2007)
- Incremental Relative Weight (*Wr*) for all sport fishes using published standards (Anderson and Neumann 1996, Blackwell et al. 2000).
- Mean Relative Weight for all sport fish. Despite cautions from Murphy et al. (1991) mean relative weight, while an instantaneous measure, can be indicative of overall trends in fish populations (e.g. Flammang and Schultz 2007).

APPENDICES

A) LIST OF COMPREHENSIVE SURVEY LAKES BY BIOLOGIST NAME
B) SURVEY COVER SHEET
C) LENGTH AND WEIGHT DATA SHEET
D) THROW AWAY TALLY SHEET
E) STANDARD SURVEY TALLY SHEET
F) LIST OF IOWA STANDARD FISHERY SAMPLING GEARS

Figure 1 – Standard Sampling Flow Chart for Trend and COMPREHENSIVE SURVEYS



Appendix A. List of Comprehensive Survey Lakes by Biologist Name.

				Sampling schedule			
	Lake Name	**County**	**Management team**				
56	Lake Hendricks	Howard	Bill Kalishek				
62	Lake Meyer	Winneshiek	Bill Kalishek				
124	Volga Lake	Fayette	Bill Kalishek				
4	Avenue of the Saints Lake	Bremer	Dan Kirby				
38	George Wyth Lake	Black Hawk	Dan Kirby				
39	Green Belt Lake	Black Hawk	Dan Kirby				
83	Meyers Lake	Black Hawk	Dan Kirby				
85	Mitchell Lake	Black Hawk	Dan Kirby				
107	Silver Lake	Delaware	Dan Kirby				
110	South Prairie Lake	Black Hawk	Dan Kirby				
7	Beaver Lake	Dallas	Ben Dodd				
9	Big Creek Lake	Polk	Ben Dodd				
31	Don Williams Lake	Boone	Ben Dodd				
34	Easter Lake	Polk	Ben Dodd				
45	Hickory Grove Lake	Story	Ben Dodd				
46	Hooper Area Pond	Warren	Ben Dodd				
51	Lake Ahquabi	Warren	Ben Dodd				
81	Mariposa Lake	Jasper	Ben Dodd				
100	Red Rock Lake	Marion	Ben Dodd				
101	Roberts Creek Lake	Marion	Ben Dodd				
102	Rock Creek Lake	Jasper	Ben Dodd				
104	Saylorville Lake	Polk	Ben Dodd				
111	Spring Lake	Greene	Ben Dodd				
112	Springbrook Lake	Guthrie	Ben Dodd				
54	Lake Darling	Washington	Chad Dolan				
55	Lake Geode	Henry	Chad Dolan				
65	Lake of the Hills	Scott	Chad Dolan				
96	Pollmiller Park Lake	Lee	Chad Dolan				
2	Arrowhead Lake	Pottawattamie	Bryan Hayes				
17	Carter Lake	Pottawattamie	Bryan Hayes				
22	Cold Springs Lake	Cass	Bryan Hayes				
28	DeSoto Bend Lake	Harrison	Bryan Hayes				
42	Greenfield Lake	Adair	Bryan Hayes				
52	Lake Anita	Cass	Bryan Hayes				
60	Lake Manawa	Pottawattamie	Bryan Hayes				

Appendix A. Continued.

	Lake Name	County	Management team	Sampling schedule			
67	Lake Orient	Adair	Bryan Hayes				
76	Littlefield Lake	Audubon	Bryan Hayes				
80	Manteno Lake	Shelby	Bryan Hayes				
82	Meadow Lake	Adair	Bryan Hayes				
87	Mormon Trail Lake	Adair	Bryan Hayes				
97	Prairie Rose Lake	Shelby	Bryan Hayes				
123	Viking Lake	Montgomery	Bryan Hayes				
129	Willow Lake	Harrison	Bryan Hayes				
10	Big Spirit Lake	Dickinson	Mike Hawkins				
19	Center Lake	Dickinson	Mike Hawkins				
27	Deer Creek Lake	Plymouth	Mike Hawkins				
30	Dog Creek (Lake)	O'Brien	Mike Hawkins				
33	East Okoboji Lake	Dickinson	Mike Hawkins				
36	Five Island Lake	Palo Alto	Mike Hawkins				
48	Ingham Lake	Emmet	Mike Hawkins				
64	Lake Minnewashta	Dickinson	Mike Hawkins				
68	Lake Pahoja	Lyon	Mike Hawkins				
74	Little Spirit Lake	Dickinson	Mike Hawkins				
77	Lost Island Lake	Palo Alto	Mike Hawkins				
78	Lower Gar Lake	Dickinson	Mike Hawkins				
84	Mill Creek (Lake)	O'Brien	Mike Hawkins				
105	Silver Lake	Dickinson	Mike Hawkins				
108	Silver Lake	Palo Alto	Mike Hawkins				
113	Storm Lake (incl Little Storm Lake)	Buena Vista	Mike Hawkins				
117	Trumbull Lake	Clay	Mike Hawkins				
118	Tuttle Lake	Emmet	Mike Hawkins				
121	Upper Gar Lake	Dickinson	Mike Hawkins				
125	West Okoboji Lake	Dickinson	Mike Hawkins				
8	Beeds Lake	Franklin	Scott Grummer				
14	Briggs Woods Lake	Hamilton	Scott Grummer				
21	Clear Lake	Cerro Gordo	Scott Grummer				
25	Crystal Lake	Hancock	Scott Grummer				
35	Eldred Sherwood Lake	Hancock	Scott Grummer				
53	Lake Cornelia	Wright	Scott Grummer				
69	Lake Smith	Kossuth	Scott Grummer				
75	Little Wall Lake	Hamilton	Scott Grummer				
79	Lower Pine Lake	Hardin	Scott Grummer				
106	Silver Lake	Worth	Scott Grummer				
122	Upper Pine Lake	Hardin	Scott Grummer				
3	Arrowhead Lake	Sac	Lannie Miller				
6	Badger Lake	Webster	Lannie Miller				
11	Black Hawk Lake	Sac	Lannie Miller				

Appendix A. Continued.

				Sampling schedule			
	Lake Name	**County**	**Management team**				
12	Blue Lake	Monona	Lannie Miller				
15	Browns Lake	Woodbury	Lannie Miller				
16	Brushy Creek Lake	Webster	Lannie Miller				
24	Crawford Creek Impoundment	Ida	Lannie Miller				
73	Little Sioux Park Lake	Woodbury	Lannie Miller				
86	Moorehead Lake	Ida	Lannie Miller				
88	Nelson Park Lake	Crawford	Lannie Miller				
90	North Twin Lake	Calhoun	Lannie Miller				
91	Oldham Lake	Monona	Lannie Miller				
114	Swan Lake	Carroll	Lannie Miller				
132	Yellow Smoke Park Lake	Crawford	Lannie Miller				
13	Bob White Lake	Wayne	Mark Flammang				
44	Hawthorn Lake (aka Barnes City Lake)	Mahaska	Mark Flammang				
47	Indian Lake	Van Buren	Mark Flammang				
50	Lacey Keosauqua Park Lake	Van Buren	Mark Flammang				
59	Lake Keomah	Mahaska	Mark Flammang				
63	Lake Miami	Monroe	Mark Flammang				
70	Lake Sugema	Van Buren	Mark Flammang				
71	Lake Wapello	Davis	Mark Flammang				
93	Ottumwa Lagoon	Wapello	Mark Flammang				
98	Rathbun Lake	Appanoose	Mark Flammang				
99	Red Haw Lake	Lucas	Mark Flammang				
127	White Oak Lake	Mahaska	Mark Flammang				
128	Williamson Pond	Lucas	Mark Flammang				
5	Badger Creek Lake	Madison	Gary Sobotka				
26	Dale Maffitt Lake	Madison	Gary Sobotka				
32	East Lake (Osceola)	Clarke	Gary Sobotka				
37	Fogle Lake	Ringgold	Gary Sobotka				
41	Green Valley Lake	Union	Gary Sobotka				
57	Lake Icaria	Adams	Gary Sobotka				
66	Lake of Three Fires	Taylor	Gary Sobotka				
72	Little River	Decatur	Gary Sobotka				
89	Nine Eagles Lake	Decatur	Gary Sobotka				
94	Pierce Creek Lake	Page	Gary Sobotka				
109	Slip Bluff Lake	Decatur	Gary Sobotka				
115	Thayer Lake	Union	Gary Sobotka				
116	Three Mile Lake	Union	Gary Sobotka				
119	Twelve Mile Creek Lake	Union	Gary Sobotka				
126	West Osceola	Clarke	Gary Sobotka				
130	Wilson Park Lake	Taylor	Gary Sobotka				
131	Windmill Lake	Taylor	Gary Sobotka				
1	Arbor Lake	Poweshiek	Paul Sleeper				

Appendix A. Continued.

				Sampling schedule			
	Lake Name	**County**	**Management team**				
18	Casey Lake (aka Hickory Hills Lake)	Tama	Paul Sleeper				
20	Central Park Lake	Jones	Paul Sleeper				
23	Coralville Lake	Johnson	Paul Sleeper				
29	Diamond Lake	Poweshiek	Paul Sleeper				
40	Green Castle Lake	Marshall	Paul Sleeper				
43	Hannen Lake	Benton	Paul Sleeper				
49	Kent Park Lake	Johnson	Paul Sleeper				
58	Lake Iowa	Iowa	Paul Sleeper				
61	Lake MacBride	Johnson	Paul Sleeper				
92	Otter Creek Lake	Tama	Paul Sleeper				
95	Pleasant Creek Lake	Linn	Paul Sleeper				
103	Rodgers Park Lake	Benton	Paul Sleeper				
120	Union Grove Lake	Tama	Paul Sleeper				

Appendix B. Survey Cover Sheet

Fish Sampling Cover Sheet (v. 2-08) **Sampling Type: General / Comprehensive**

Sampling Gear: Electrofishing / Fyke Nets / Hoop Nets / Gill Nets

Lake Name	**County**	**Shocker Settings:**	Volts	Amps:
Date	**Time**	Pulse Width:	Pulses/sec:	
Survey Crew		**Electroshocking:**	**Day / Night**	
Lake Level (in)	**Cond. (µmhos/cm)**	**Targetted Survey: Y / N;**	**If yes, species:**	
+_____-_____				
Surface Water Temp °F	**Air Temp °F**	**Hoop Nets:**	**Baited/Unbaited Single/Tandem**	
Wind Direction (circle) NW / N / NE / E / SE / S / SW /W		**Gill Nets:**	**Exp. 125' / Std. 100' / 160' / 320'**	
Comments				

Boat Ramp Condition (circle) Good / Fair / Poor / Unusable Location Note: _____

Gully Erosion (circle) None Observed / Slight / Moderate / Severe Location Note: _____

Shoreline Erosion (circle) None Observed / Slight / Moderate / Severe Location Note: _____

Rooted Aquatic Vegetation (circle) None Observed / Slight / Moderate / Severe Species Note: _____

Green Algae (circle) None Observed / Slight / Moderate / Severe Location Note: _____

Blue-Green Algae (circle) None Observed / Slight / Moderate / Severe Location Note: _____

ANS Species (circle) None Observed / Few / Many Species/Location Note: _____

Depth Profile data necessary only for hoop net surveys

Depth	°F	ppm O_2	Depth	°F	ppm O_2	Depth	°F	ppm O_2
Surface			16'			32'		
1'			17'			33'		
2'			18'			34'		
3'			19'			35'		
4'			20'			36'		
5'			21'			37'		
6'			22'			38'		
7'			23'			39'		
8'			24'			40'		
9'			25'			41'		
10'			26'			42'		
11'			27'			43'		
12'			28'			44'		
13'			29'			45'		
14'			30'			46'		
15'			31'			47'		

Lowest DO Reading Limited by cable length? (circle) True / False

Was the DO meter calibrated today? (circle) True / False

Note regarding Site ID (on the tally sheets): record site ID as the initials of the sampling type (EF, FN, HN, GN) and the number of the site sampled. Keep these site numbers consistent, as they will be used from year-to-year to access the location information for the site that you sampled.

Appendix C. Length and Weight Data Sheet

Electrofishing/Fyke/Hoop/Gill Net Field Length & Weight Data Sheet **(circle one) (v. 7-07)** **Page of**

Date: Lake:

	Species		Species		Species		Species		Species	
	Length	Weight	Length	Weight	Length	Weight	Length	Weight	Length	Weight
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
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32										
33										
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35										
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40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										

Turtles: record species and carapace length in left-over boxes, enter in database

Appendix D. Throw Away Tally Sheet

Throw Away Tally Sheet – Use to record 5 fish per ½" group for length/weight data sheet

you can also use this sheet for keeping track of fish sampled for age & growth work

Length (in)				Length (in)		
2.0 – 2.4				2.0 – 2.4		
2.5 – 2.9				2.5 – 2.9		
3.0 – 3.4				3.0 – 3.4		
3.5 – 3.9				3.5 – 3.9		
4.0 – 4.4				4.0 – 4.4		
4.5 – 4.9				4.5 – 4.9		
5.0 – 5.4				5.0 – 5.4		
5.5 – 5.9				5.5 – 5.9		
6.0 – 6.4				6.0 – 6.4		
6.5 – 6.9				6.5 – 6.9		
7.0 – 7.4				7.0 – 7.4		
7.5 – 7.9				7.5 – 7.9		
8.0 – 8.4				8.0 – 8.4		
8.5 – 8.9				8.5 – 8.9		
9.0 – 9.4				9.0 – 9.4		
9.5 – 9.9				9.5 – 9.9		
10.0 – 10.4				10.0 – 10.4		
10.5 – 10.9				10.5 – 10.9		
11.0 – 11.4				11.0 – 11.4		
11.5 – 11.9				11.5 – 11.9		
12.0 – 12.4				12.0 – 12.4		
12.5 – 12.9				12.5 – 12.9		
13.0 – 13.4				13.0 – 13.4		
13.5 – 13.9				13.5 – 13.9		
14.0 – 14.4				14.0 – 14.4		
14.5 – 14.9				14.5 – 14.9		
15.0 – 15.4				15.0 – 15.4		
15.5 – 15.9				15.5 – 15.9		
Length (in)				16.0 – 16.4		
2.0 – 2.4				16.5 – 16.9		
2.5 – 2.9				17.0 – 17.4		
3.0 – 3.4				17.5 – 17.9		
3.5 – 3.9				18.0 – 18.4		
4.0 – 4.4				18.5 – 18.9		
4.5 – 4.9				19.0 – 19.4		
5.0 – 5.4				19.5 – 19.9		
5.5 – 5.9				20.0 – 20.4		
6.0 – 6.4				20.5 – 20.9		
6.5 – 6.9				21.0 – 21.4		
7.0 – 7.4				21.5 – 21.9		
7.5 – 7.9				22.0 – 22.4		
8.0 – 8.4				22.5 – 22.9		
8.5 – 8.9				23.0 – 23.4		
9.0 – 9.4				23.5 – 23.9		
9.5 – 9.9				24.0 – 24.4		
10.0 – 10.4				24.5 – 24.9		
10.5 – 10.9				25.0 – 25.4		
11.0 – 11.4				25.5 – 25.9		
11.5 – 11.9				26.0 – 26.4		
12.0 – 12.4				26.5 – 26.9		
12.5 – 12.9				27.0 – 27.4		
13.0 – 13.4				27.5 – 27.9		
13.5 – 13.9				28.0 – 28.4		
14.0 – 14.4				28.5 – 28.9		
14.5 – 14.9				29.0 – 29.4		
15.0 – 15.4				29.5 – 29.9		
15.5 – 15.9				>30.0 in enter length (0.1 in)		

Appendix E. Standard Survey Tally Sheet

Electrofishing/Fyke/Hoop/Gill Net Field Tally Sheet (circle one) (v. 7-07) **Date:** **Page** **of**

Lake: Site ID: UTM:

Wave Intensity (Circle) Calm/Slight/Moderate/Severe/Extreme **Sechi** (in) **Fyke Net Lead Length** (ft.)

Start Time: AM / PM End Time: AM / PM Time Total: **Shock** - **#** Netters:

Length (in)				Length (in)		
2.0 – 2.4				2.0 – 2.4		
2.5 – 2.9				2.5 – 2.9		
3.0 – 3.4				3.0 – 3.4		
3.5 – 3.9				3.5 – 3.9		
4.0 – 4.4				4.0 – 4.4		
4.5 – 4.9				4.5 – 4.9		
5.0 – 5.4				5.0 – 5.4		
5.5 – 5.9				5.5 – 5.9		
6.0 – 6.4				6.0 – 6.4		
6.5 – 6.9				6.5 – 6.9		
7.0 – 7.4				7.0 – 7.4		
7.5 – 7.9				7.5 – 7.9		
8.0 – 8.4				8.0 – 8.4		
8.5 – 8.9				8.5 – 8.9		
9.0 – 9.4				9.0 – 9.4		
9.5 – 9.9				9.5 – 9.9		
10.0 – 10.4				10.0 – 10.4		
10.5 – 10.9				10.5 – 10.9		
11.0 – 11.4				11.0 – 11.4		
11.5 – 11.9				11.5 – 11.9		
12.0 – 12.4				12.0 – 12.4		
12.5 – 12.9				12.5 – 12.9		
13.0 – 13.4				13.0 – 13.4		
13.5 – 13.9				13.5 – 13.9		
14.0 – 14.4				14.0 – 14.4		
14.5 – 14.9				14.5 – 14.9		
15.0 – 15.4				15.0 – 15.4		
15.5 – 15.9				15.5 – 15.9		
Length (in)				16.0 – 16.4		
2.0 – 2.4				16.5 – 16.9		
2.5 – 2.9				17.0 – 17.4		
3.0 – 3.4				17.5 – 17.9		
3.5 – 3.9				18.0 – 18.4		
4.0 – 4.4				18.5 – 18.9		
4.5 – 4.9				19.0 – 19.4		
5.0 – 5.4				19.5 – 19.9		
5.5 – 5.9				20.0 – 20.4		
6.0 – 6.4				20.5 – 20.9		
6.5 – 6.9				21.0 – 21.4		
7.0 – 7.4				21.5 – 21.9		
7.5 – 7.9				22.0 – 22.4		
8.0 – 8.4				22.5 – 22.9		
8.5 – 8.9				23.0 – 23.4		
9.0 – 9.4				23.5 – 23.9		
9.5 – 9.9				24.0 – 24.4		
10.0 – 10.4				24.5 – 24.9		
10.5 – 10.9				25.0 – 25.4		
11.0 – 11.4				25.5 – 25.9		
11.5 – 11.9				26.0 – 26.4		
12.0 – 12.4				26.5 – 26.9		
12.5 – 12.9				27.0 – 27.4		
13.0 – 13.4				27.5 – 27.9		
13.5 – 13.9				28.0 – 28.4		
14.0 – 14.4				28.5 – 28.9		
14.5 – 14.9				29.0 – 29.4		
15.0 – 15.4				29.5 – 29.9		
15.5 – 15.9				>30.0 in enter length (0.1 in)		

Fish Counts (non-game species, species tallied in previous samples, etc.):

Species						
Count						

Appendix F. List of Iowa Standard Fishery Sampling Gears.

1. Boat-Mounted Electrofishing units
    a. Current: Pulsed Direct Current (PDC)
    b. Frequency: 60 Hz (60 pulses per second)
    c. Coffelt VVP 15: adjust frequency to 60 Hz and pulse width (duty Cycle) to 25%
       Coffelt Mark 22: Adjust frequency (incremental) to 60 Hz; duty cycle of 25% is the default
       Wisconsin box: Adjust frequency to 60 Hz and duty cycle to 25%
    d. Duty Cycle/Pulse Width: 25% (i.e., ~ 4 ms pulse width)
        i. Adjust the duty cycle or pulse width adjustment knob on the control box. The latter measure (found on Coffelt VVP-15's) is actually expressed as a percentage (because it's changing the duty cycle; duty cycle=[(frequency x pulse width/1 s) x 100]).

2. Modified Fyke nets
    a. 2ft x 4ft x 3/4 in mesh with 40 ft lead

3. Hoop nets
    a. Fiberglass frames, largest of which is 2 ½ ft, 11 ft overall length
    b. Throat restricted approximately 8" from cod end of last throat
    c. 36 in bridles, nets set in tandems of 3

4. Gill nets
    a. Monofilament experimental gill nets, five panels 25 ft each (overall length 125 ft)
    b. Mesh sizes of ¾, 1, 11/2, 2, 2 ½ in

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CHAPTER 2. FISH STOCKING POLICY

INTRODUCTION

In many instances a successful fishing trip is dependent upon a stocking program. To this end, the Iowa Department of Natural Resources expends approximately 40% of the funds allocated to the Fisheries Bureau for fish culture and propagation.

Much effort and money is expended to produce hatchery fish and it is imperative that these fish be used prudently. The fish stocking policy is being established to insure beneficial use through standardized statewide stocking rates and to acquaint new biologists with the most beneficial species and stocking rates to use in various circumstances. Rathbun Hatchery's HACCP plan for preventing the stocking of non-target species is included in Appendix 1 and Appendix 2.

AUTHORIZED USES OF HATCHERY FISH

Hatchery reared and stocked fish are beneficially used in one or a combination of seven categories (Table 1). These include: 1) after initial impoundment, renovation, or winterkill; 2) to alter the forage web; 3) to provide a put-and-take fishery; 4) to provide a trophy fishery; 5) for population maintenance; 6) to improve the genetic integrity of fish stocks; and 7) aquatic vegetation control. Each situation is discussed in more detail.

1. *Stocking Following Initial Impoundment, Renovation or Winterkill.*

Stocking new or renovated waters is obviously necessary to develop a desirable sport fishery. The initial stock should be of a magnitude that will provide angler harvest and brood stock for future propagation. Nearly all of the fish produced by hatcheries are available for this type of stocking. The primary consideration is to stock species suited to the available habitat.

Hatchery fish must be introduced into new or renovated waters before contamination by undesirable fish. Therefore, it is important to coordinate impoundment or renovation with hatchery fish availability (Table 2).

Winterkill presents a special fish stocking problem because fish mortality is usually incomplete and other fish management techniques are normally required to create a balanced fish population. Fish stocking and other management techniques must be integrated with particular reference to winterkill severity, documented winterkill frequency, and projected fishing pressure.

In areas where winterkill occurs more frequently than once/5 years, only largemouth bass or northern pike stocking will be approved.

2. *Stocking to Alter the Forage Web.*

Many fish communities do not effectively utilize available forage. Introduction of a species which will augment this community also benefits the sport fishery. An optimum candidate species is one that will maintain itself once established; however, because aquatic forage webs are complex, consideration should be given possible adverse effects upon the existing sport fishery.

Gizzard shad, emerald shiners, or other prey species, and flathead catfish, hybrid striped bass and white bass may be used to alter the forage web in a body of water.

3. Put-And-Take Stocking.

Put-and-take stocking is the most intensive and expensive stocking method. It should be conducted only when the following conditions are met:

A. The introduced species is the only sport fishery the resource will support.

B. Successful natural reproduction of the introduced species does not occur or is inadequate to sustain a fishable population.

C. The receiving water provides the stocked species with adequate habitat for survival and natural food for maintenance.

D. Angler pressure far exceeds the ability of the water to provide a harvestable population.

E. The introduced species lends itself to intensive culture at a reasonable cost and is highly susceptible to angling.

In Iowa, coldwater streams and selected urban waters are the only resources presently available that meet all of the above criteria. The goal of put-and-take stocking is to provide a sustained fishery. To prevent "boom and bust" fishing success, small plants of fish are made at frequent intervals. Put-and-take stocking involves rearing the fish to catchable size and making a large number of plants; thus, anglers that utilize the resource are typically required to purchase a special fee to support the added expense of the stocking program.

4. *Trophy Fish Stocking*.

Fishery Management biologists are responsible for recommending trophy fish introductions. When considering a trophy fish candidate, ability to reproduce is of little importance, but good survival and rapid growth to a large size are paramount criteria as is the ability of hatcheries to produce the candidate. Trophy fish are usually maintained by stocking small numbers of large fingerlings.

Production of fingerling trophy fish is quite costly and cannot be wholly justified through cost benefit evaluation. However, there is an intangible aesthetic value to fisherman knowing that catching a trophy fish is possible and the intangible value to the Department in publicity when a trophy fish is creeled.

Muskellunge and striped bass hybrids are currently used in Iowa as trophy fish.

Because trophy fish introductions are costly and may be controversial, approval from the Fisheries Chief is required before new trophy fish programs are implemented.

5. *Maintenance Stocking*.

Maintenance stocking can be beneficial when natural reproduction is inadequate to sustain a fishable population, providing the habitat is suitable for growth and survival. The species must be highly sought by anglers. Walleye stocking is a good example of a beneficial maintenance stocking program. This species is highly sought by anglers, natural reproduction is insufficient to sustain the fishery but the habitat lends itself to good growth and survival.

The Department provides channel catfish to numerous County Conservation Boards for cage rearing in waters under their jurisdiction that are under fish management agreements with the Fisheries Bureau. This is a specialized type of maintenance stocking that nearly simulates a put-and-take fishery. This cooperative program is beneficial to the Department because of lower fish production expense, but greater benefits come from public relations and periodic contacts the management biologist maintains with each participating County Board.

Maintenance stocking to augment existing fish populations is very costly. Historically, maintenance stocking programs have been the most overused of all rationale for stocking. Because of the expense and the sometimes questionable results obtained, the management biologist should closely investigate each body of water in which maintenance stocking is anticipated. All maintenance stocking must receive prior approval from the Fisheries Chief.

Channel catfish, walleye, largemouth bass, northern pike, brook, brown, and rainbow trout have been used for maintenance stocking programs.

6. Stocking to Biologically Remove Aquatic Vegetation.

Grass carp have been experimentally introduced into selected waters throughout Iowa. These fish consume large quantities of vegetation and when stocked in adequate numbers control submerged vegetation. Although grass carp effectively control vegetation, they are not a cure-all and will not correct other serious fish management problems.

7. *Stocking to Improve the Genetic Diversity*.

Research has shown in several situations where the stocking of genetically different stocks have resulted in improved survival and/or natural reproduction of the target species. Propagation of French Creek brown trout and South Pine brook trout from wild populations and stocking the resultant fingerlings in other suitable coldwater streams have resulted in significantly improved survival and/or the development of self-sustaining populations. Research has also documented improved survival rates of Mississippi River strain walleye in eastern Iowa interior rivers when compared to the use of Spirit Lake strain. Management and Research staffs should consider the potential influence genetics can have on survival, growth and natural reproduction of all species being considered for stocking; and minimize, where practical, the mixing/contamination of genetic strains.

STOCKING GUIDELINES FOR INDIVIDUAL SPECIES

BLUEGILL

1. Bluegill may be stocked in all new or renovated lakes, impoundments and reservoirs.

2. Autumn or spring plants of 1"+ fingerling will be utilized.

3. Stocking density will not exceed 1,000 fish/acre in waters < 500 surface acres and will not exceed 500/acre in waters > 500 acres.

4. Spring impoundment of new waters will necessitate stocking adult fish.

5. Management biologists will be responsible for collecting and transporting adult bluegill.

CHANNEL CATFISH

1. Two inch (2") channel catfish may be stocked in all new or renovated lakes and impoundments at a rate not to exceed 100/acre.

2. Maintenance stocking will be accomplished using 7"-10" fingerling. Annual stocking will not exceed 28/acre in waters < 100 acres, 20/acre in waters 100-250 acres, 7/acre in waters 250 – 1,000 acres, 3/acre in waters >1,000 acres. Waters < 10 acres shall be stocked every other year at 56/acre.

3. Fish used in County Conservation cage programs will be at least 4" fingerling. Annual stocking density will not exceed 100/acre in lakes < 25 acres, 75/acre in lakes 25-50 acres, and 50/acre in lakes >50 acres.

4. Maintenance stocking of channel catfish in all Iowa rivers is generally prohibited. Stocking of 2" fingerling is permissible following severe winterkill or pollution caused mortality. Stocking rate will not exceed 250/acre.

CRAPPIE (WHITE AND BLACK)

1. Adult crappie may be stocked in lakes.

2. Management biologists will be responsible for collecting and transporting adult crappie for stocking.

3. Fingerling crappie will not be propagated in the fish hatcheries.

GIZZARD SHAD

1. Adult gizzard shad may be introduced as a forage base into water >1,000 acres.

2. Management biologists will collect and transport adult shad for stocking.

GRASS CARP

1. Stocking density will not exceed 10 fish/acre.

2. Size of fish at stocking should be 8 – 10 inches.

3. Depending upon hatchery production, grass carp should be stocked as early in the summer as possible to utilize the available food supply so maximum growth will occur during the first summer.

4. Restocking at a reduced level is recommended when necessary to maintain desired vegetation control

5. Grass carp will be restricted from natural lakes or other lakes where the long-term effect of vegetation control on water quality and phytoplankton blooms is uncertain.

6. Grass carp may be stocked in new or renovated lakes only with approval of the Fisheries Chief.

LARGEMOUTH BASS

1. Largemouth bass will be stocked two consecutive years in all new or renovated lakes, impoundments, and reservoirs as 1-2 inch fingerlings.

2. Stocking rates will be as follows:

	1st Year	2nd Year
Surface area < 500 acre	70-100/acre	100/acre
Surface area > 500 acre	35-50/acre	50/acre

3. Stocking of large fingerling (5") bass will be limited to experimental projects conducted by either research or management biologists or where minimal largemouth bass recruitment is documented.

4. 5" LMB may be stocked in the fall in new or renovated lakes not to exceed 5/acre.

MUSKELLUNGE

1. Muskellunge introductions will be limited to Big Creek, Brushy Creek, Clear Lake, Hawthorn, Lake MacBride, Lost Grove, Pleasant Creek, Spirit Lake, Three Mile, and West Okoboji.

2. Stocking will consist of 10" fingerlings stocked at a rate not to exceed ½ per acre.

3. Spring stockings should be used whenever possible.

NORTHERN PIKE

1. Fingerling (2"-3") northern pike may be stocked in any lake >40 acres that contains an existing fish population. Stocking density may not exceed 5/acre.

2. Northern pike fry may be stocked following winterkill at a density of 1,000/acre.

3. Northern pike will not be stocked in waters containing muskellunge.

4. Northern pike fry may be stocked in inland streams at a rate not to exceed 1,000/acre.

5. Fingerling (2"-3") northern pike may be stocked in riverine systems. Stocking rate may not exceed 5/acre.

SMALLMOUTH BASS

1. Smallmouth bass stocking should generally be confined to streams.

2. Prior approval from the Fisheries Chief is required before any lake stockings.

3. Smallmouth bass will be stocked only following severe winterkill, a pollution event, or new lake situations if the community structure warrants this introduction.

4. Stocking rate for swim-up fry will not exceed 50/acre.

5. Stocking rate for 2" fingerling should not exceed 5/acre.

STRIPED BASS HYBRIDS

1. Striped bass hybrid introductions should be limited to on-stream reservoirs of more than 5,000 acres and the Mississippi River.

2. The Fisheries Chief must approve introduction of striped bass hybrids into any other waters.

3. Fingerling (1"-2") will be stocked at a density not to exceed 10/acre.

TROUT (BROOK, BROWN AND RAINBOW)

1. Put-and-take

    a. Stocking quotas and species will be determined by management and hatchery biologists primarily as a function of angler pressure, with habitat quality and quantity a secondary criteria.

The put-and-take stream stocking program should begin near April 1 and conclude no later than the end of November.

b. Put-and-take trout should not be stocked in waters that already support self-sustaining populations of that particular species.

c. Walk-in and lightly fished streams should be stocked no more than once each week. Most heavily fished streams should be stocked at least twice a week.

d. Put-and-take trout may be stocked in urban waters between November and March to create urban winter trout fisheries. New urban put-and-take trout fisheries require the approval of the Fisheries Chief.

2. Put-and-grow

a. Designated put-and-grow trout streams should be stocked annually with fingerling (2"-4") brown or brook trout at density commensurate with the habitat quantity and quality as determined by the management biologist.

b. Fingerling trout should not be stocked into waters that already support self-sustaining populations of that particular species.

c. All requests for fingerling brown trout should be for first generation (F_1) progeny of wild brown trout.

d. Fingerling brook, brown, and rainbow trout may be stocked into put-and-take and special trout streams when such stockings have shown contribution to the adult population.

WALLEYE

1. Walleye fry and fingerling will usually not be stocked in the same lake during a single season.

2. Walleye fry will be stocked in natural lakes at the following or lower rates :

3,000 – 4,500/acre in lakes > 1,500 acres
3,000/acre in lakes < 1,500 acres

3. Walleye fry stocked in flood control reservoirs will be planted at a rate not to exceed 1,000/acre.

4. Walleye fry stocking in other impoundments will be planted at a rate not to exceed 3,000 acre.

5. Walleye fingerling (2") may be stocked in appropriate interior rivers at a rate of 400/mile at a stream drainage area of approximately 1,200 square miles. Stocking rates should be adjusted appropriately for rivers with smaller or larger watersheds. Interior rivers in the Mississippi River drainage should receive Mississippi River strain fingerlings whenever possible.

6. Walleye fingerling stocking may occur only when it is documented that fry plants are unsuccessful.

7. Walleye fingerling stockings may be made in lakes > 500 acres.

8. Walleye fingerling (2") stocking rate should be no more than 15/acre in flood control reservoirs and no more than 30/acre in other impoundments.

9. Large (4”-8”) walleye fingerling stockings should be between 10 -30/acre, with greater numbers stocked in waters that have high fishing pressure.

WHITE BASS

1. White bass may be introduced as adults into lakes with suitable habitat.

2. White bass should not be introduced unless gizzard shad or similar forage are present.

MISCELLANEOUS FISH SPECIES

1. Any fish species not listed in these guidelines will need prior approval from the Fisheries Chief.

Table 1. Authorized stocking programs by fish species.

SPECIES	NEW, RENOVATED OR WINTERKILL WATERS	ALTER FORAGE WEB	PUT-AND-TAKE	TROPHY	MAINTENANCE	GENETIC INTEGRITY	AQUATIC VEGETATION CONTROL
Bluegill	X						
Brook trout			X		X	X	
Brown trout			X		X	X	
Channel catfish	X		X		X		
Crappie	X						
Flathead catfish		X		X			
Gizzard shad		X					
Grass carp							X
Largemouth bass	X				X		
Muskellunge				X			
Northern pike	X				X		
Rainbow trout			X		X		
Smallmouth bass	X						
Striped bass hybrid		X		X			
Walleye	X				X	X	
White bass	X	X			X		

HATCHERY FISH PRODUCTION

Many successful fish stocking programs are dependent upon the hatcheries to produce specific sized fish at designated times (Table 2). Occasionally, such specific requests cannot be filled because the size of fish requested is unavailable on the requested date. This section is designed to lessen the frequency of such requests.

The following table indicated the size and month fish are available from Iowa hatcheries:

Table 2. Availability of hatchery produced fish by size and month.

SPECIES	SIZE	AVAILABILITY
Bluegill	1”-2”	October or March
Channel catfish	Fry	June
Channel catfish	2”	August
Channel catfish	6”-10”	September – October
Largemouth bass	Fry	Early June
Largemouth bass	1”-2”	Late June
Largemouth bass	5”	September
Muskellunge	10”+	October - May
Northern pike	Fry	April
Northern pike	3”	June
Smallmouth bass	3”	September
Striped bass hybrid	Fry	May
Striped bass hybrid	2”-3”	July
Walleye	Fry	May
Walleye	4”-8”	September-October
Trout	Catchable	Yearly

Table 2 does not include all of the fish or size of fish that may be stocked in Iowa waters, but it lists all those most commonly requested. The availability of species or sizes not listed can be determined by contacting the Fish Culture Supervisor.

PROCEDURE FOR FILING REQUEST FOR STATE PRODUCED FISH

1. All requests will originate with the fisheries management or research biologist, following consultation with the Regional Supervisor.

2. Fish stocking requests will be done on the Fish Stocking Request spreadsheet form.

3. The management biologist and/or research biologist will have forms completed and forwarded to the Regional Supervisor by December 15.

4. Regional Supervisor will review the requests, make appropriate corrections or changes, and forward the requests to the Fisheries Chief, with a copy to the Fish Culture Supervisor, by January 1.

5. The Fish Culture Supervisor will compile a statewide fish stocking request.

6. The Fisheries Chief and Fish Culture Supervisor will review the request for hatchery production. Consideration will be given to the production capabilities of hatcheries. If hatcheries cannot meet requests of management and research, appropriate changes will be made at this time. All changes will be made after consultation with Regional Supervisors.

7. The Fish Culture Supervisor will approve the request for hatchery production by January 15. The request approved by the Fish Culture Supervisor will include only those fish the Fish Culture Section is reasonably sure of producing or procuring from other sources.

8. Once the stockings have been approved and hatchery production assigned, a fish stocking worksheet will be compiled and circulated to all fisheries biologists by March 1. It will be each hatcheries responsibility to inform management or research biologists of fish stockings before they occur.

CHANGES IN STATE STOCKING COMMITMENTS

The Management Biologist should complete a Change Order for all changes in approved stocking commitments. The routing should be from the management or research biologist to the Regional supervisor for approval. The Regional Supervisor should then send the changes to the Fisheries Chief who will forward to the Fish Culture Supervisor. The Fish Culture Supervisor will forward the Change Order to the hatchery or hatcheries involved in the stocking change.

In case of any change in hatchery production, the Fish Culture Supervisor will inform the Fisheries Chief concerning species, number, size, and fish availability. The Fisheries Chief will contact the Research Supervisor and the Regional Supervisors who will determine from the area biologists their fish needs. Regional Supervisors and the Research Supervisor will make requests for these fish to the Fisheries Chief who will then plan distribution. In case of fish shortage, the Fisheries Chief will determine stocking priority.

PUBLIC INFORMATION STOCKING PROGRAM

The final approved fish stocking worksheet will be distributed by March 1. The area manager will be responsible for providing this information to Conservation Officers, Park Rangers, Wildlife Biologists, and other Department employees.

The management biologist will also provide information to the public through meetings if a major project is involved or to the news media.

Appendix 1. ANS-HACCP Plan – 7” Channel Catfish for stocking as sportfish in Iowa.

1) Product Description
2) Flow Diagram
3) Potential Hazards
4) Hazard Analysis Worksheet
5) HACCP Plan Form

1) Product Description

Firm Name:	Rathbun Fish Hatchery
Firm Address:	15053 Hatchery PL Moravia IA 52571
Species of fish:	7” Channel Catfish (Ictalurus punctatus) grown in lined and circulating ponds.
Cultured or wild harvested:	Cultured
Harvest method:	Drained from lined 1 acre ponds and .05 acre circulating ponds
Method of distribution and storage:	Loaded into tub with nets then craned up to truck and dumped at lake
Intended use and consumer:	To be stocked in lakes across the state of Iowa for put, grow, and take fishery

2) Flow Diagram

Step 1	Fry are obtained from Missouri DOC. Our truck goes to Chesapeake, MO State Fish Hatchery and brings back 1-2 week old catfish fry. Water source is spring water that is run through a solar pond. Water clarity is extremely high and no fish are present in water supply.

⇩

Step 2	Fry are stocked into ponds directly from truck. Some may be held in start tanks for 1-2 weeks until pond space is available.

⇩

Step 3.	Fry are fed through out the summer. Water that is added passes through 2 filters equipped with 300 micron screens. The first filter is the main hatchery inlet filter fit with .3 mm openings. The second filter is the research building filter with .3 mm openings that will be used when water is pumped to the ponds. $1.00/hour to pump, $72.00 to flush one pond. Seven inch fish that are moved to circulating ponds in March of their second year will be treated with antimycin on the truck before they are stocked in July. They also will be run across the sort table before they are loaded.

⇩

Step 4.	Antimycin – Treatment with antimycin has been discontinued due to lack of product availability.

⇩

Step 5.	When fish are to size (7”) the pond is drained into the kettle the day before harvest.

⇩

Step 5.	Fish are dip netted from the kettle and visually examined for foreign fish or other ANS. The hatchery crew will build a sorting table to be used in the kettle which will be operated by permanent employees. This will be the ultimate test of the filters.

⇩

Step 6.	Fish are loaded onto trucks using crane equipped with bucket.

⇩

Step 7.	Trucks for distribution are filled with water from tank room which has been run through sand filters (.12 mm) and UV radiation treatment. Water on the trucks can be discharged into the lakes because of this treatment.

⇩

Step 8.	Fish are stocked at lakes, normally from boat ramps. If determined needed, Fish Management will be responsible for building cages which can be discharged into at the boat ramps. This will allow management staff to visually inspect the fish one more time before they are released into the lake. Hatchery staff will coordinate delivery schedules with management staff but both parties must realize coordination of deliveries will be tricky and should devote adequate time for this extra step.

⇩

Step 9.	Mark Flamang will provide information to the hatchery regarding yellow bass and shad populations in Rathbun Lake so hatchery staff can chart fish detection at harvest with fish population in Lake. This will allow us to determine if our detection techniques are working.

3) Potential ANS Hazards (List relevant species)

1) ANS Fish and Other Vertebrates. Examples: Eurasian ruffe, round goby, Asian carps, non-native amphibians, etc.

   Yellow bass, gizzard shad, bluegill, crappie, Asian carp, green sunfish, orangespotted sunfish

2) ANS Invertebrates. Examples: zebra mussels, Asian clams, spiny water fleas, rusty crayfish, etc.

None known.

3) ANS Plants. Examples: Eurasian watermilfoil, hydrilla, giant salvinia, water chestnut, etc.

None known.

1) Harvest or Aquaculture Step (from flow diagram)	(2) Identify potential ANS hazards introduced or controlled at this step (1)	(3) Are any potential ANS hazards significant? (Yes/No)	(4) Justify your decisions for column 3.	(5) What control measures can be applied to prevent the significant hazards?	(6) Is this step a critical control point? (Yes/No)
Obtain fry from Missouri Department of Conservation	Fish/Other Vert. Any species other than channel catfish.	NO	Hatchery water supply is a spring not surface water.	Visual inspect Clear water	NO
	Invertebrate NA	NA	NA	NA	NA
	Plant NA	NA	NA	NA	NA
Stock fry into ponds	Fish/Other Vert. Any species other than channel catfish.	NO	No additional water added to truck during transport.	Do not add water to tanks during transit.	NO
	Invertebrate NA	NA	NA	NA	NA
	Plant NA	NA	NA	NA	NA
Add H_2O to ponds during culture season	Fish/Other Vert. Any species other than channel catfish.	YES	Eggs or fry 1/8" in diameter or less.	Smaller screen for gravity flow or pump through research 300µ screen	YES

	Invertebrate NA	NA	NA	NA	NA
	Plant NA	NA	NA	NA	NA

(1) Harvest or Aquaculture Step (from flow diagram)	(2) Identify potential ANS hazards introduced or controlled at this step (1)	(3) Are any potential ANS hazards significant? (Yes/No)	(4) Justify your decisions for column 3.	(5) What control measures can be applied to prevent the significant hazards?	(6) Is this step a critical control point? (Yes/No)
Harvest catfish from ponds	Fish/Other Vert. Any species other than channel catfish. Frog, turtles	YES	Past observation at fish harvest.	Antimycin pond prior to harvest. $500/pond	YES
	Invertebrate NA	NA	NA	NA	NA
	Plant NA	NA	NA	NA	NA
Load catfish from ponds	Fish/Other Vert. Any species other than channel catfish. Frog, turtles	YES	Past observations during loading operations	Visually inspect dip nets of fish via sort table device.	YES
	Invertebrate NA	NA	NA	NA	NA
	Plant NA	NA	NA	NA	NA
Unload catfish into lakes	Fish/Other Vert. Any species other than channel catfish.	NO	Prior control measures. No water added during transport	None required	NO

	Invertebrate				
	Plant				

(1) Harvest or Aquaculture Step (from flow diagram)	(2) Identify potential ANS hazards introduced or controlled at this step (1)	(3) Are any potential ANS hazards significant? (Yes/No)	(4) Justify your decisions for column 3.	(5) What control measures can be applied to prevent the significant hazards?	(6) Is this step a critical control point? (Yes/No)
	Fish/Other Vert.				
	Invertebrate				
	Plant				
Firm Name: Rathbun Fish Hatchery			Species of Fish: Channel Catfish		
Firm Address: Moravia, IA 52571			Cultured, wild harvested, or both: Cultured		
Signature: Date:			Intended Use and Consumer: Stocking into Iowa lakes/ponds. Anglers of Iowa.		

4) ANS-HACCP Plan Form

(1) Critical Control Point (CCP)	(2) Significant Hazard(s)	(3) Limits for each control Measure	Monitoring				(8) Corrective Actions(s)	(9) Verification	(10) Records
			(4) What	(5) How	(6) Frequency	(7) Who			

Firm Name:	Species of Fish:
Firm Address:	Method of Storage and Distribution:
Signature:	Intended Use and Consumer:
Date:	

Appendix 2. ANS-HACCP Plan –Phase III Walleye for Rathbun Fish Hatchery.

1) Product Description

Firm Name:	Rathbun Fish Hatchery
Firm Address:	15053 Hatchery PL Moravia IA 52571
Species of fish:	8 – 10” walleye grown in circulating ponds.
Cultured or wild harvested:	Cultured
Harvest method:	Seined from circulating ponds
Method of distribution and storage:	Loaded into tub with dipnet then craned up to fish distribution truck
Intended use and consumer:	To be stocked in lakes across the state of Iowa for grow and take fishery

2) Potential Hazards	
1)	ANS Fish and Other Vertebrates.
	Yellow bass, gizzard shad
2)	ANS Invertebrates.
	None known.
3)	ANS Plants.
	None known

3) Flow Diagram					
(1) Harvest or Aquaculture Step	(2) Identify potential ANS hazards introduced or controlled at this step (1)	(3) Are any potential ANS hazards significant? (Yes/No)	(4) Justify your decisions for column 3.	(5) What control measures can be applied to prevent the significant hazards?	(6) Is this step a critical control point? (Yes/No)
Harvest walleye from ponds	Any species other than walleye	YES	Past observation at fish harvest.	Filtering of supply water and filling truck with filtered water	YES
Loading walleye onto truck	Any species other than walleye	YES		Visually inspect dip nets of fish via sort table device.	YES

Unload walleye into lakes		NO	Prior control measures. No water added during transport	None required	NO

Firm Name: Rathbun Fish Hatchery	Species of Fish: Walleye
Firm Address: Moravia, IA 52571	Cultured, wild harvested, or both: Cultured
Signature:	Intended Use and Consumer: Stocking into Iowa lakes/ponds. Anglers of Iowa.
Date:	

4) ANS-HACCP Plan Form

(1) Critical Control Point (CCP)	(2) Significant Hazard(s)	(3) Limits for each control Measure	Monitoring				(8) Corrective Actions(s)	(9) Verification	(10) Records
			(4) What	(5) How	(6) Frequency	(7) Who			

Firm Name:	Species of Fish:
Firm Address:	Method of Storage and Distribution:
Signature:	Intended Use and Consumer:
Date:	

CHAPTER 3. REGULATIONS

INTRODUCTION

One of the most common activities associated with fisheries management has been the utilization of regulations. In consideration of regulations, the most important consideration is biology. Our credibility as biologists is both respected and expected by the angling public. Therefore, the utilization of regulations for other than biologic reasons will necessarily lack the result the public expects, and will undermine our credibility with the angling public. Therefore, most fishery biologists would prefer not to regulate unless it is necessary.

However, although most biologists are more adept at dealing with fish than people, it is almost certain social and ethical concerns will arise, and a biologist will be forced to deal with these issues. Social limits were initially imposed with the hope they might distribute harvest among anglers, but research has not borne this out. This concept may occur in small, heavily fished waters or where daily bag limits are extremely restricted. Where liberal panfish limits are imposed it is done mostly for social reasons. Bag limits place a value on an important resource, but it also gives anglers a target to aim for and creates high-grading, which can lead to increased angling mortality. The recently instituted 25 bag limit on panfish (bluegill; crappie; yellow perch) was brought before the Natural Resource Commission as a strictly sociological regulation. Iowa DNR research has shown that very few anglers exceed this limit, which is why it has little or no biological impact on our water bodies. The few anglers that do catch large numbers of panfish create an impression that overharvest is occurring; this is a timeless issue, and the better the fishing, the more overharvest is perceived. Habitat, including water quality, remains the most important factor driving Iowa's fish populations.

When considering implementation of a regulation, biologists should first document that overharvest problems exist. Overharvest in freshwater sport fisheries is usually considered to be a point where size structure of a population (i.e., "quality" to anglers) is negatively impacted. While recruitment overfishing, that is harvest of adults to the point where they can not produce sufficient young, is primarily a marine issue, it has been suggested certain freshwater stocks have suffered from similar issues in recent years. However, for purposes of this Chapter, we will consider over harvest to mainly affect size structure of populations.

Regulations are tools to be used in conjunction with other management practices such as stocking, habitat manipulation, or even watershed protection. The key to fishery regulation is to utilize them with a given set of objectives, just as you would any other fishery management activity. Regulations can take a number of forms; however, most regulations will fall under bag or creel limits, length limits, gear restrictions, and season closures.

CREEL LIMITS

Often the public has multiple misconceptions regarding the utility of creel or bag limits in maintaining or improving Iowa fish populations. While there may be specific and very rare exceptions, it is generally accepted within the profession that creel limits need to be too restrictive to do any good, if over harvest truly exists. As a result, the very restrictive nature of such regulations has generally not been acceptable to most anglers. For example, Gabelhouse (1984) observed that 70% of adult largemouth bass were harvested from a Kansas lake in a 4 ½ month period, despite angler harvest rates of less than 1.5 bass per trip. Any change in bag limit would have had no impact on the rate or extent of over harvest in this fishery.

In Iowa, we have seen similar trends in panfish populations. In fact, we receive more complaints about panfish when the fishing is good, than when the fishing is fair, or even poor. When the fishing is good, anglers see a lot of panfish being harvested and they become very concerned about the potential over harvest of our panfish stocks.

To evaluate the efficacy of panfish bag limits we conducted extensive creel surveys on the Iowa Great Lakes (12 year data set), pools 9-13 of the Mississippi River (7 year data set), Swan Lake (3 year data set), and Lake Rathbun (2 year data set). These systems were selected since they are all known for their excellent panfish fisheries and they are geographically diverse representing most of the major habitat types in Iowa.

Completed trip information were obtained from boat, shore, and ice anglers. Using this information, we were able to determine the impact of Fish Hogs, and determine the effectiveness of various daily bag limit scenarios.

The first thing we noted is that the vast majority of anglers fishing for panfish harvested less than 10 fish on each fishing trip, and only a very small minority of anglers actually harvested more than 20 panfish on each trip. This was true for all the datasets we examined -- from the backwater pools of the Mississippi River to the natural lakes in NW Iowa, to the small and large impoundments in southern Iowa.

Table 1 demonstrates the potential effect of various bag limits on yellow perch, bluegill, and crappie populations across the State of Iowa. To be biologically effective, the daily bag limit on panfish would have to be reduced to about 5 fish per day, which would reduce panfish harvest

Table 1. Relationship between proposed daily bag limits and the percent of harvest reduction for Iowa panfish.

Proposed daily bag limit	Potential reduction in harvest (%)	Proposed daily bag limit	Potential reduction in harvest (%)
0	100%	16	10%
1	76%	17	9%
2	61%	18	7%
3	51%	19	6%
4	44%	20	5%
5	38%	21	4%
6	34%	22	3%
7	30%	23	2%
8	26%	24	1%
9	24%	25	0%
10	21%	26	0%
11	19%	27	0%
12	17%	28	0%
13	15%	29	0%
14	13%	30	0%
15	11%	31	0%

about 38% statewide and may spread out the harvest of panfish to more anglers.

LENGTH LIMITS

If repeated fishery surveys indicate excessive harvest a special regulation may be implemented to prevent over harvest and depletion of fish stocks. Today a variety of size limits, including both minimum and maximum size limits, slot limits, and catch and release regulations have been successfully utilized to maintain favorable fish populations, community structure, and quality angling. Figure 1 is a generalized model for different types of length limits available for application in Iowa waters.

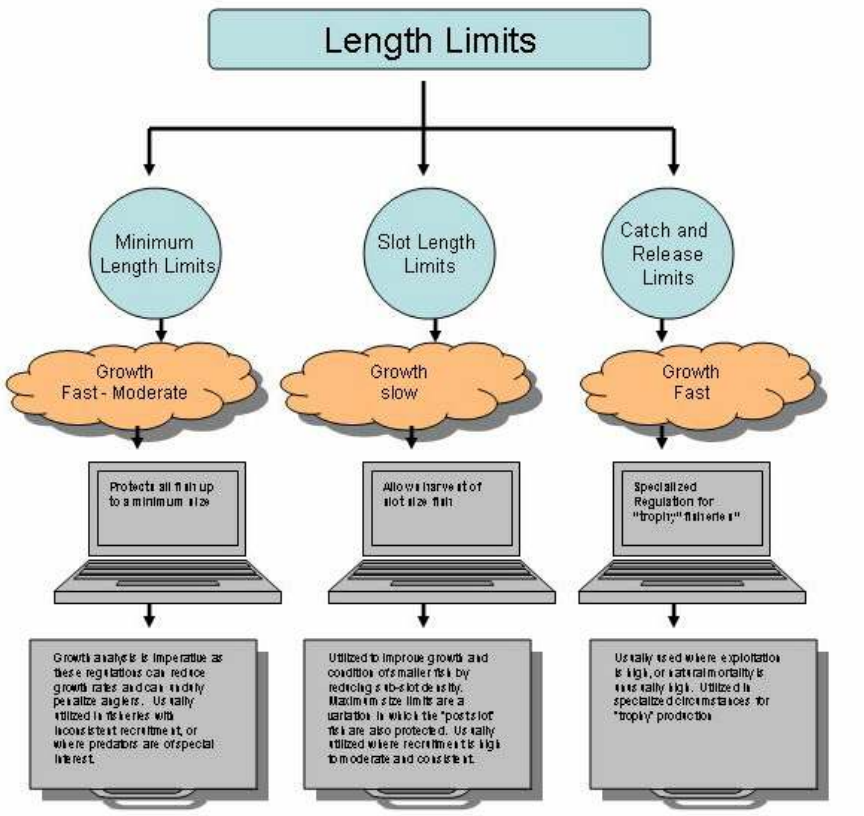

Figure 1. Generalized conceptual model of length regulations most often used to address fishery management concerns in Iowa waters.

Minimum Length Limits

Under minimum length limits fish below a designated length must be released. Minimum length limits are generally imposed to lower both angling and total mortality in highly vulnerable populations and to reduce exploitation of fish before they reach sexual maturity.

Minimum size limits have often been successful in fisheries where harvest is high or recruitment is low or inconsistent. However, in some heavily fished waters the size composition may shift with few individuals available at sizes above the minimum length limit and "stockpiling" (e.g. Johnson and Anderson 1974) may occur. Under this condition intraspecific competition may lead to reduced growth rates and "stunting" may occur.

Slot Length Limits

Slot length limits prohibit harvest from a designated length range and fish captured within that range must be released. Slot length limits are usually applied to fisheries where recruitment is high and growth of the target species is slow. In addition to allowing harvest of large individuals, the regulation encourages harvest of fish below a given length range to reduce the overall density of smaller fish in the population. Yet these regulations provide substantial catch and release angling for fish within the protected length range. The theory behind slot length limits is to channel the energy tied up in biomass of small fish up through the extended length range of the species.

Maximum size limits

Maximum size limits are rare but in situations where large fish must be protected (e.g. to protect spawning fish or to provide a "trophy" fishery) where growth rates need to be improved a maximum size limit may be considered. For instance, in a largemouth bass fishery where the biologists wishes to provide an increased opportunity of catching a large (>19 inches) largemouth bass, yet recruitment is high and growth is slow, they may consider a maximum size limit of 12 or 13 inches to promote harvest of small fish, but protection of large fish. A similar tool to a maximum size limit may be a high slot length limit. For instance, a slot length limit of 13-21 inches on largemouth bass would provide a similar result as a 13 inch maximum size limit. Maximum size limits, like slot length limits, are generally applied to fisheries with high and consistent recruitment.

Catch and Release Regulations

Catch and release regulations are usually applied to important fisheries (usually black bass or salmonids) where "trophy" product is desired. Under this type of regulation all fish are captured and returned immediately to the water. The principal objective is to reduce fishing mortality, thereby maintaining high catch rates for the target species, while improving the overall size distribution. Recruitment under this type of regulation is usually low to moderate and angling mortality is potentially high. Special attention to growth rates should be given as "stockpiling" can occur under such regulations and the "trophy" status of the fishery can be lost due to slowing growth coupled with moderate levels of natural mortality. In addition, fisheries subject to consumption advisories may also be subject to such regulations so as to allow for angling recreation despite the fact that the fish are classified as inedible.

Gear Restrictions

Although mainly utilized in coldwater trout streams, gear restrictions are another potential regulation. Currently, any trout fishery in Iowa with a special regulation, including 14-inch minimum length limits or catch and release regulations are also subject to artificial lure restrictions also. Artificial lures are defined as lures that do not contain or have applied to them any natural or human-made substance designed to attract fish by the sense of taste or smell.

Season Closures

While not widely utilized, season closures are an important means of managing overexploited fisheries in times of extremely high vulnerability, e.g., for walleye in the Iowa Great Lakes.

Data Requirements:

In addition to a well-established set of objectives, a regulation change should be preceded by several measures of the rate functions of the target species. Measures of growth rate, recruitment, and mortality are essential in determining which, if any regulation change should be made. Growth rate either length at age or incremental growth can suggest the utility of certain regulation choices prior to implementation. For example, if growth of walleye in a water body is slow, protection of the fishery with a minimum length limit is unlikely to have beneficial affects. In fisheries with low recruitment a slot length limit would be a suspect choice.

Data modeling is currently available and the utility of these programs will continue to improve. Currently, several models area available to model specific dynamics of fish populations. Models such as FAST (Slipke 2000) are available, allowing biologists to interpret large amounts of sampling data. The program provides for the evaluation of proposed minimum, slot, and bag limits on very low to heavily exploited fisheries.
FAST requires age-structure data and uses the Jones modification of the Beverton-Holt equilibrium yield equation (see Ricker 1975) to compute both a yield-per-recruit and a dynamic pool model. For the dynamic pool model, the entire population is simulated over time similar to Ricker's (1975) dynamic pool model. Besides yield, FAST provides the analyst with a host of predicted population parameters including for example the number of fish harvested and dying naturally, mean weight and length of harvested fish, number in the population above and below some lengths of interest, total number of fish and biomass in the population, stock density indices, number of age-1 fish, and the Spawning Potential Ratio (SPR).

Regulation Evaluation

Effects of regulations should be evaluated. These evaluations should always be relative to the specific biological objectives established prior to regulation implementation. Alterations to the regulation may be necessary. In addition, sometimes regulations may be removed if changes in the population are observed. Common changes might include changes in growth or recruitment. Consistent evaluation of the fishery is required to make such judgments.

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CHAPTER 4. FISH HABITAT ENHANCEMENT

INTRODUCTION

Fisheries are a valuable natural resource in the Upper Mississippi River (UMR), providing and estimated US$350M (1993 estimate) in economic benefits annually. Habitat degradation can negatively impact UMR fish resources, and habitat rehabilitation projects designed to mitigate habitat losses are often monetarily expensive and physically demanding. In years 1988-2003, approximately US$146M was spent to improve UMR fish and wildlife habitat through Habitat Rehabilitation and Enhancement Projects (HREPs) implemented as part of the Environmental Management Program. HREPs have restored, protected, or enhanced over 27,000 ha of UMR habitat and projects encompassing 30,000 additional hectares are in design or under construction. The UMR is a multi-jurisdictional and multi-use resource, which can encumber habitat improvement efforts targeting fishery resources. Successful habitat initiatives usually require careful planning and consensus building with multiple management entities and stakeholders. Design details and exhaustive discussions for most habitat features discussed in the section can be found in the Upper Mississippi River System Environmental Management Program Design Handbook (http://www.mvr.usace.army.mil/EMP/designhandbook.htm , March 2007).

BACKWATER LAKE DREDGING

Description

Backwater dredging with hydraulic or mechanical dredges can be used to increase the amount of deepwater habitat in off-channel areas and to reconnect backwater habitats to channel habitats. Dredging removes substrate that has accumulated due to sedimentation and typically relocates the sediment to a nearby disposal location.

Site Selection

Site selection is the most important aspect of a backwater dredging project. Ideally, the site should be naturally isolated from water inputs coming from the main channel, side channels, or tributary streams. Many quality target sites can be recognized by identifying backwaters that once maintained quality fisheries, but have degraded over time. Dredged material is difficult and expensive to move long distances, so consideration should be given to the availability of near-site disposal locations.

Construction

The shape, depth, width, and length of dredge cuts can be tailored to individual projects, but project cost is dependent upon the amount of material removed and the complexity of design. Planners should recognize that it is necessary to over-cut width to compensate for sloughing of side walls. As a rule of thumb, dredge cuts should be a minimum of 6 feet deep, which allows for 4-foot of open water under 2-foot of ice cover.

Placement

Preference should be given to areas that reconnect backwaters to channel habitats and therefore improve fish and angler access to backwater areas. These areas are typically located in downriver ends of backwater complexes. The lifespan of dredge cuts is affected by sediment

delivery from channel areas so planners should make efforts to place cuts in protected areas of backwaters.

Considerations

Project planners need to remain cognizant of the cost/benefit ratio and the anticipated lifespan of dredging projects. Dredging is an expensive undertaking, and poorly planned projects will provide marginal long-term benefits to anglers and fisheries. Projects should consider potential beneficial uses for dredged material (e.g., floodplain forest improvements) and possible benefits and detriments to non-fish resources.

WATER LEVEL MANAGEMENT

Description

Large-scale (e.g., UMR pool) and small-scale (e.g., moist soil unit) water level management is used to improve vegetation and substrate characteristics of habitat within river areas where natural hydrology has been modified by impoundment or levees. Typically, these management activities use water control structures to induce periods of water-level drawdown that stimulate vegetative growth and subsequent water-level rises that flood vegetation produced in the period of drawdown.

Site Selection

Application of water level management for fisheries purposes should be limited to areas where there are preexisting modifications to the natural hydrological cycle due to dams, levees, or water control structures. These sites include moist-soil units, levee districts, and impounded reaches of the mainstem Mississippi River.

Considerations

As a general rule, floodplain sequestration provides no benefits to fisheries resources, and water level management is a contentious habitat management tool due to the multi-use and multi-jurisdictional nature of the Upper Mississippi River. Fisheries managers need to remain cognizant of the original intent of water control structures (e.g., moist soil units for waterfowl, dams for navigation) and work with primary management authorities to practice water level management that provides fisheries benefits without sacrificing the intent of control structures. Water level management can harm individuals within some animal populations (e.g., native mussels), and ultimately the manager must weigh potential detriment to individuals against potential benefits at the population, community, and ecosystem level. River ecology theory and scientific study supports the adoption of policies that promote natural flood-pulse and drought sequences for overall ecosystem health and function.

SHORELINE STABILIZATION

Description

Shoreline stabilization uses vegetation, man-made substrates, or inert natural materials to prevent erosion of banks. These structures can improve fisheries habitat via maintenance of bathymetric diversity and by providing shoreline habitat.

Site Selection

Target sites include areas of active erosion, such as the heads of islands, and shorelines subject to high wind fetch.

Construction

Shorelines that are frequently subjected to high water current, or waves, are most commonly stabilized with rip-rap over crushed material. Native grass plantings provide a suitable stabilization material in situations where contact with erosive waters is infrequent and shoreline slope is gradual or moderate. Biotechnical stabilization is also applied in low-impact situations and uses a combination of vegetation (commonly willows) and structural materials such as rock groins or sand mounds to decrease erosive energy. The US Army Corp of Engineers has expertise in the application and design of stabilization features.

Considerations

The US Army Corps of Engineers and contractors are responsible for shoreline stabilization that occurs as part of channel maintenance and habitat projects on the UMR. Stabilization follows fairly rigid design details, but there are opportunities to provide project engineers or contractors with options for additional fish habitat benefits from shoreline stabilization. For example, woody debris can be incorporated in some situations to increase overhead cover along shorelines.

RIVER TRAINING STRUCTURES

Description

River training structures include features such as wing dams, weirs, closing dams, and revetments that are engineered to alter the flow, or stage, of water in riverine systems. Traditionally, these features have been used to “control” local hydrological characteristics for the benefit on navigation, but more recently these features have been used to alter habitat for the benefit of aquatic organisms.

Site Selection

Target sites include areas with preexisting river training structures that do not currently benefit fisheries, and in some cases, areas undergoing habitat rehabilitation using features other than training structures (i.e., training structures are a necessary addition for the overall form and function of a habitat project).

Construction

Construction of these structures will require consultation with Army Corps of Engineers and associated contractors. Federal guidelines dictate the primary design details of training structures, but in some cases there are opportunities for modifications that benefit fisheries.

Considerations

As a general rule, river training structures do not benefit fisheries of the UMR. Training structures compromise overall ecosystem function due to impacts upon sediment and water transport. Fisheries managers should not promote the use of training structures but they must

recognize that the UMR is a dual purpose resource (navigation and recreation). There are opportunities to mitigate the negative impacts of training structures through involvement with planning and construction of structures. Examples include the notching of wing-dams for fisheries benefits and minimizing closing-dam heights in side channels. Habitat project managers should give preference to project designs that do not require training structures.

SIDE CHANNEL RESTORATION

Description

Side channels of the UMR have degraded due to sedimentation, altered hydrology, and construction of channel training structures. Side channel restoration uses a multitude of habitat improvement techniques to improve bathymetric and hydrological diversity in side channel habitats. Examples of restoration elements include the following: closing-dam notching, closing dam removal, large woody debris anchoring or reintroduction, boulder clusters, and environmental dredging.

Site Selection

Target sites include secondary or tertiary channels that have degraded due to training structures or altered hydrology.

Construction

Construction techniques are numerous and a good overview is provided in the Upper Mississippi River System Environmental Management Program Design Handbook

Considerations

Project managers should be cautious of projects that confine or restrict movement of side channels. Projects that use hydrological forces to improve habitat conditions are most likely to succeed and will in general have more long-term benefits. Remain cognizant of the fact that side channel loss and creation is a natural process in large river systems, especially in tertiary or smaller side channels. For that reason, it may be most prudent to focus on improvements to secondary side channels that will in turn benefit smaller side channels.

AERATION

Description

Aeration improves fisheries habitat by incorporating oxygen into hypoxic water using gravity-fed water from channel habitats or mechanical devices.

Site Selection

Preferred sites are generally contiguous backwater areas that maintain marginal fisheries due to infrequent periods of hypoxia or anoxia.

Construction

Mechanical aeration currently has limited utility and application within the UMR, due to costs

associated with installation, operation, and maintenance. Gravity-fed water systems have been frequently included in habitat rehabilitation projects and use water control structures to introduce oxygen-rich waters from channel habitats into hypoxic areas. Multiple case histories (e.g., Browns Lake Iowa, Finger Lakes Minnesota) provide valuable construction considerations.

Placement

Placement of gravity fed systems is limited to areas where oxygen-rich (i.e., channel water) borrow water is adjacent to lentic areas subject to periods of hypoxia. Optimal borrow water is low in suspended sediments and is introduced in the upstream portions of hypoxic systems. Maintenance and operation are important considerations when placing gravity systems, with easily accessible sites providing the most suitable placement locations.

Considerations

Gravity-fed aeration systems have been largely successful habitat rehabilitation tools, but project planners need to remain mindful that borrow water can exacerbate sedimentation problems in some lentic systems. Gravity-fed systems represent a long-term maintenance and operations commitment, and operations policy and responsibilities should be considered prior to project completion. Post-project monitoring is recommended for adaptive management and operations fine-tuning.

TRIBUTARY AND FLOOD PLAIN RESTORATION

Description

Human modifications have altered the form and function of the Upper Mississippi River floodplain and tributary streams. The health of the UMR fish community and many populations is dependent upon annual flood pulses (floodplain connection) and tributary inputs, or refuge. In northern reaches of the UMR (Pools 1-13), impoundment has permanently inundated some sections of river, which has resulted in a loss of floodplain habitat and typical “flood-pulse” cycles. In southern reaches of the UMR (Pools 13 – Open River), floodplain sequestration provides additional stressors through isolation of the channel from the floodplain. Channel straightening and levees are common in lower reaches of tributary streams and rivers. Tributary modifications have led to channel incision, loss of aquatic floodplain habitat, and loss of ecosystem function. Tributary and floodplain restoration is a complex and costly habitat restoration technique, but it holds great importance for the long-term stability of UMR fisheries.

Site Selection

Target sites include tributary streams that have been straightened or leveed, as well as mainstem locations with altered hydrology, levees, or permanent inundation caused by dams.

Construction

Construction includes deconstruction of levees, forest improvement techniques, grassland improvement techniques, restoration of channel meanders, island creation, and reconnection of floodplain habitats. Island creation, forest improvement, and grassland improvement have met general acceptance and have been applied in multiple locations on the UMR, but other techniques are less accepted and have applied in few locations. The Upper Mississippi River

System Environmental Management Program Design Handbook provides exhaustive Chapters devoted to island construction, floodplain restoration, and tributary restoration.

Considerations

System ecologists and fisheries managers are well aware of the potential benefits of floodplain and tributary restoration. Despite a nearly universal acceptance among aquatic scientists and managers, restoration of floodplains and tributaries may be the most contentious issue currently facing habitat restoration on the UMR. Levee districts and wildlife management agencies are resistant to restoration that decreases their ability to manage water movement to and from floodplain areas of the UMR and its' tributaries. Successful restoration projects will require extensive efforts towards educational activities and consensus building. Management biologists pursuing floodplain or tributary restoration will need to be well versed in historical claims and legal precedents concerning water rights.

HABITAT IMPROVEMENT IN TROUT STREAMS

Habitat improvement has been conducted in Iowa's coldwater trout streams for at least the past 70 years, with possibly the first work being completed by the Civillian Conservation Corps in the 1930's Today in-stream habitat improvement of trout streams concentrates on improving the diversity of overhead cover, flow and substrate. The most important feature of a quality trout stream is to have an intact and functioning watershed. Without this feature in-stream habitat improvement will not achieve the desired results.

BANK STABILIZATION

Description

Protecting stream banks with rock rip-rap will result in increased in-stream cover for invertebrates and fish. This technique will also stop the direct input of silt to the stream which generally results in an increase in exposed gravel substrate adjacent to and immediately downstream of the stabilized stream bank. Water quality downstream of the project site will also be improved by this technique

Site Selection

Place this technique in a segment of the steam that has an actively eroding stream bank.

Construction

The eroding stream bank must be sloped back at a minimum of a 2:1 slope before placing the rock. The rock used should be at least 50% two foot diameter boulders or larger. Class E rip-rap will always meet this specification. Shot rock can also be used but care must be taken to ensure that it will meet the 50% requirement. The rock is placed from the underwater toe of the bank up to an elevation one foot above the bank full height. Rock thickness when placed on the bank must be a minimum of two feet. One ton of rock will cover one lineal foot of stream bank to a height of six feet. Once placed, the above water portion of the rock is completely covered with dirt that had been stockpiled from the bank shaping. Remaining dirt is then spoiled behind the stream bank site at a depth not to exceed six inches. All disturbed areas are then seeded to a grass mixture of your choice, which should always include a quick cover crop such as oats or annual rye.

An alternative method is to use a much flatter slope on the stream bank, up to as great as 6:1. With this technique rock is placed from the underwater toe of the bank to a height of one foot above normal water levels. Above this height the bank is protected with an erosion control fabric up to approximately the bank full elevation. In situations where the eroding bank is in a straight segment of stream and the watershed is well protected and not prone to flashy runoff events, the rock can be omitted and the placement of the erosion control fabric will began at the waters edge. All disturbed areas are then seeded to a grass mixture of your choice, which should always include a quick cover crop such as oats or annual rye.

Placement

The sloping of stream banks and the placement of rock requires heavy equipment such as track excavators and experienced operators. Erosion control fabric is placed by hand using wooden stakes to hold the fabric in place. The ideal time for placement is late summer or early fall, when the streams are more apt to be at normal low water levels.

Considerations

Bank stabilization is often used in conjunction with other habitat improvement techniques. This technique works well in streams that have good connection with their floodplain and are not incised streams. It is applicable in coldwater streams throughout the Paleozoic plateau and Iowan surface landform regions. Make sure that the entire length of stream bank that is actively eroding is addressed when applying this technique. If only a portion of the active erosion is stabilized, this technique will fail. Permits are always required from the Army Corps of Engineers for this activity. DNR permits are also required if the watershed area exceeds 100 square miles. Other local permits such as city or county may also be needed.

BANK HIDES

Description

Wooden bank hides (Figure 1) are used to increase the overhead cover for trout and other coldwater fish species. They are usually placed in conjunction with bank stabilization.

Site Selection

Place bank hides in a segment of the steam that has ample water depth to keep the hides always underwater. The standard height of a bank hide is fourteen inches, so at least 15 inches of water depth during the lowest flow periods is needed. If the bank hides are placed in locations where the water depth is not sufficient to keep them always submerged, the wood will be exposed to air and rapidly deteriorate. Bank hides are generally placed on the outside bends of streams where there is good water flow to keep them free of silt deposition. Multiple bank hides may be placed side-by-side at a site if adequate depth and flow are present.

Construction

Bank hides are constructed from hardwood lumber. The standard bank hide is 8 ft long, 2 feet wide, 14 inches high, with three stringers sticking 2 ft out the back. It takes 8 ¼ pieces of 2 inch thick x 8 inch wide x 8 feet long boards, and 36 inches of 4 inch x 4 inch stock to construct one bank hide. Assembly is conducted using structural steel screws. Construction is done

completely out of the water and the finished bank hide is then lowered in place. Once in the stream the bank hide is held in place by rock. First, rock is placed over the stringers to temporarily hold the structure in place. Then large boulders are individually placed on the front edge of the bank hide, one boulder immediately adjacent to the next, until the entire edge of the hide is covered with boulders. Rock is then placed to fill in over the top and back of the entire bank hide. Dirt and rock are then placed above the bank hide to match with the existing slope of the stream bank. Specifications and techniques for placing the rock are identical to those for bank stabilization. The dimensions of the bank hide can deviate from the standard when working in smaller streams.

Placement

The placement of bank hides requires heavy equipment such as track excavators and experienced operators.

Considerations

Bank hides are generally placed in areas of active bank erosion where bank stabilization is also being conducted. This is one of the best techniques for increasing overhead cover in a trout stream. It is also one of the most expensive habitat improvement techniques. The wood for constructing bank hides is usually obtained from the Forestry Bureau's Yellow River Forest saw mill. This helps to contain costs for this practice. Permits are always required from the Army Corps of Engineers for this activity. DNR permits are also required if the watershed area exceeds 10 square miles. Other local permits such as city or county may also be needed.

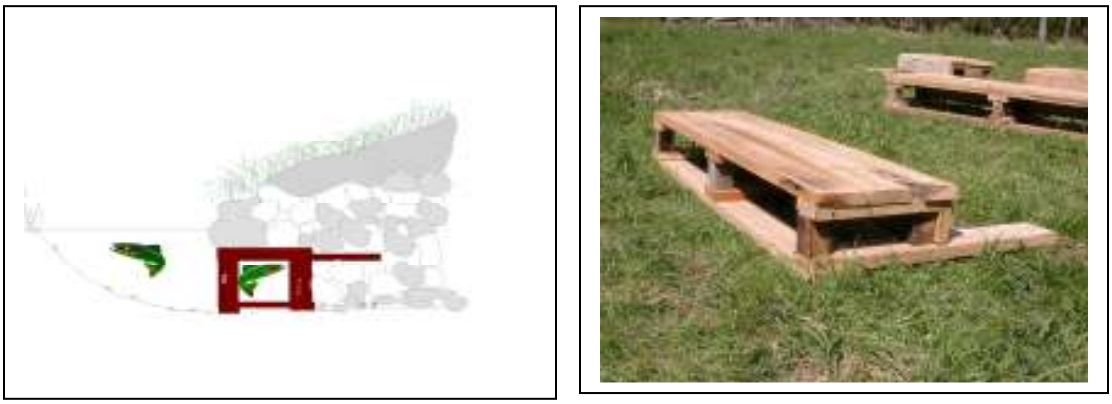


Figure1. Bank hide cross section (left panel) and completed bank hide.

Logs and Root Balls

Description
The placement of logs and rootballs increases overhead cover for trout and other coldwater fish species (Figure 2). They are usually placed in conjunction with bank stabilization.

Site Selection

Logs and root balls are placed in locations where the water is either too shallow or too deep to accommodate bank hide placement. They are often used in the same general locations as bank hides. Logs and root balls are commonly placed on the outside bend of a stream where water

flow is sufficient to keep them free of silt deposition. They should be placed where the water depth is sufficient to always keep them covered even during severe low flow periods. Multiple logs and root balls can be placed at one site.

Construction

Logs and root balls are usually acquired on site. Since these are often placed in conjunction with bank stabilization, trees that are grubbed out during the bank shaping process are salvaged for this use. Hardwood trees are very desirable but not easily obtained. Soft wooded trees such as boxelder are much more common, but need to be at least an 8 inch diameter to be used. A log is a clear section of tree trunk cut to a ten foot length. A root ball is a ten foot section of tree trunk with the root ball still attached. Both are placed in the same manner. After the stream bank has been shaped back to the appropriate slope, a ten foot long trench is dug perpendicular to the stream bank and below the water level. The log or root ball is then placed in this trench with 2-3 feet sticking out past the edge of the stream bank. The trench is then refilled with dirt and the stream bank is stabilized.

Placement

The placement of logs and root balls requires heavy equipment such as track excavators and experienced operators.

Considerations

Logs and root balls are generally placed in areas of active bank erosion where bank stabilization is also being conducted. Materials can be brought in from off site if needed. Permits are always required from the Army Corps of Engineers for this activity. DNR permits are also required if the watershed area exceeds 10 square miles. Other local permits such as city or county may also be needed.

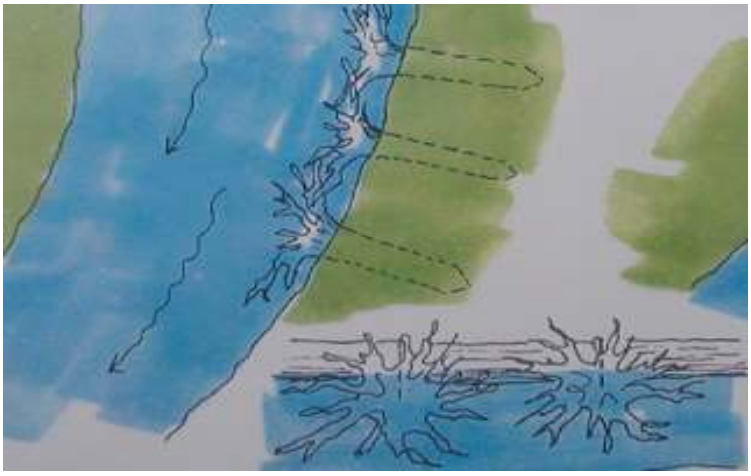


Figure 2. Typical root ball placement

BOULDER CLUSTERS

Description

Large boulders can be placed singly or in clusters to provide an area of current break and overhead cover for trout and other coldwater fish species. They can also be used to deflect flow into other structures such as bank hides (Figure 3).

Site Selection

Boulders can be placed virtually anywhere in a trout stream and function as cover areas for trout. The best potential sites are areas that are not now holding trout due to uniform current velocities or lack of overhead cover. Unlike bank hides, logs and root balls, boulders do not have to be placed adjacent to a stabilized stream bank, but may be placed in the middle of the stream channel. In fact, they function best if placed well away from the stream bank. Ideal locations for boulders are flat pools with uniform velocity and depth, and deep runs that lack bottom diversity. Avoid areas that are known trout spawning locations as the boulder placement will disrupt flow and potentially harm egg survival.

Construction

Generally use boulders a minimum of 2 feet in diameter. Place either one large boulder or a cluster of one large and numerous smaller boulders in one location. If multiple clusters are used in one area, position the second cluster so that it is in the path of the main current being deflected from the first cluster. Place the third cluster so that it is in the deflected current from the second cluster, etc.

Placement

The placement of boulders usually requires heavy equipment such as track excavators and experienced operators. Boulders can also be placed by hand. Stockpile the boulders on shore immediately adjacent to the placement site. Purchase a cargo net with loop handles around the entire perimeter. Roll each individual boulder on to the cargo net and have 4-6 people carry the net to the drop off point in the stream. If you are using volunteers to do this, you can be guaranteed that they will never again show up for a habitat work day.

Considerations

Boulder clusters do not provide as high a quality of trout habitat as bank hides or logs and root balls. However they can be useful in providing midstream holding areas for trout. Permits are always required from the Army Corps of Engineers and the DNR for this activity. Other local permits such as city or county may also be needed.

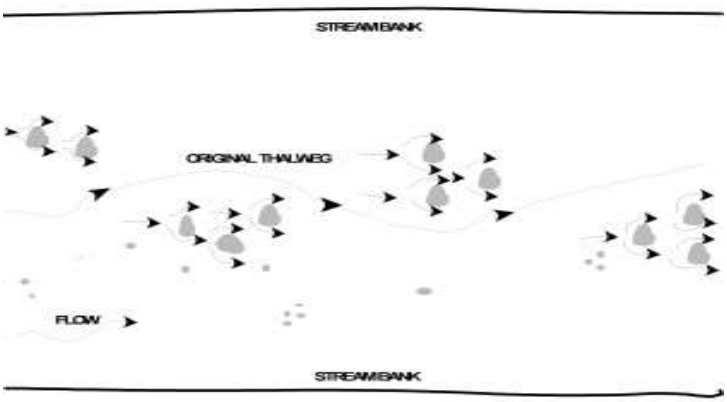


Figure 3. Placement of boulder clusters

Habitat restoration on the Missouri River has accelerated with the 1999 expansion of the Missouri River Fish and Wildlife Mitigation Project and the listing of pallid sturgeon as an endangered species in 1990. Aquatic habitat restoration is concentrated on re-creation of off-channel habitat virtually eliminated by the Bank Stabilization and Navigation Project and the development of shallow sand bar habitat along the channel borders. Habitat rehabilitation techniques are experimental. Physical and biological monitoring is associated with projects to determine response.

CHUTES

Description

Secondary channels were abundant prior to the BSNP. Flow-through chutes can provide low velocity, shallow sand bar habitat that is limited in the main channel. Side chutes also increase the range of discharges over which slow, shallow water is present (Jacobson et al, 2004).

Site Selection

Ideal sites for side channel chutes are remnant channels isolated by closing structures. Site selection considers several factors including river slope, real estate and bed degradation.

Construction

Chutes may either be constructed to ultimate width or cut as a pilot channel and allowed to erode to ultimate width, both techniques are being utilized. A chute with natural form and function is preferred if it can be created. Width is controlled by the size of the inlet and outlet to the river. Ratio of chute length to river length should be less than 1 to provide enough velocity to prevent deposition. Habitat complexity can increased with addition of large woody debris.

Considerations

Chutes are limited in scope as projects are prohibited from causing negative impact to the BSNP. Long term stability and biological response is uncertain. Habitat restoration could be enhanced with discharges emulating the natural hydrograph.

BACKWATERS

Description

Seasonally connected wetlands and oxbow lakes were common on the historic river. Closing structures, channel incision and lack of connecting flows have isolated these off-channel habitats. Backwaters provide spawning, nursery and feeding areas that are critical to the life history of many Missouri River fishes.

Site Selection

Low elevation areas adjacent to the main channel.

Construction

Passive connectivity is critical to allow immigration of adult spawning fish and drift of egg and larval fish. Connectivity allows emigration of fish production to the main channel. The backwater should a have high shoreline development index. Shoreline slope should be shallow to provide nursery areas for larval fish. Deep water should as be available to concentrate adult fish for anglers. Habitat used in lakes and impoundments, such as, brush or rock piles should also be considered.

Considerations

Sedimentation of backwaters is inevitable. Periodical dredging or excavating will be necessary to maintain desired depth. Habitat restoration could be enhanced with discharges emulating the natural hydrograph.

CHANNEL TOP WIDENING

Description

The navigation channel was constructed and is maintained through a series of revetments and wing dikes. Modification of river structures could provide bank erosion to widen river top width as much as 175 feet without jeopardizing the navigation thalweg (National Resource Council 2002). Structure modifications create a diversity of depth and current velocity adjacent to the navigation channel. Types of structure modifications include wing dike, bank and revetment notches. Wing dike notches are excavated riverward of the bank, bank notches are excavated into the bank. Revetment notches form pool habitat behind the revetment.

Site Selection

Dike fields in public property where erosion could occur. Acquisition or sloughing easements are also possible.

Construction

Notches should be constructed to divert maximum allowable discharge without impacting navigation. Constructed elevation of the notch should allow flow at a wide range of discharge.

Considerations

Habitat restoration could be enhanced with discharges emulating the natural hydrograph.

FISH HABITAT IN LAKES

The Iowa DNR Fisheries staff has used several habitat enhancements on Iowa waters to improve catch rates for anglers. Some of the enhancements are constructed on the dry or frozen bottom while others can be placed from a boat in existing water. Each habitat enhancement brings its own limitations and benefits that are usually directed towards a specific species, season, or angling type. Some of the common enhancements are tree piles, rock reefs and mounds, spawning attracting areas, stake beds, benched jetties, and bank hides, e.g. Material for small scale projects can be salvaged from other uses at little or no cost. Cement blocks, cable spools, old picnic tables, metal trash cans and broken concrete from construction sites as well as many other materials can be turned into excellent fish habitat. Volunteer labor can be utilized to minimize the time and effort to construct many types of enhancements.

TREE PILES

Description

Tree piles can provide cover for several species and are readily available near most water bodies. Some prey species use the cover for shelter from predators while others use the piles as possible ambush sights.

Site Selection

Placement locations can vary widely. All depths and locations can offer some benefits to many species during some period of the year. Site selection should be based on a combination of factors. Those might include the natural bottom contour, where angling activity would best occur to avoid conflicts with other activities, siltation, behavior patterns of the desired fish species, as well as any other concerns. Anglers can find submerged locations easier when some of the branches are left exposed. Deeper piles offer shelter during summer months and piles placed in the deepest areas can provide excellent cover for winter panfish.

Construction

Securing the trees to the bottom can be done by either staking with fence posts or weighting with heavy objects, commonly concrete blocks. Number 9 soft steel wire can be used to tie the trees to the anchoring devices and will last for 3 to 5 years. Copper or aluminum wire will last indefinitely but is more expensive. Polypropylene rope works well also but wave movement may cause abrasion. Screw-in fence anchors and steel cable have been used to secure large brush piles to the bottom of dry lake bottoms. Weighted trees can be placed in the ice and will likely sink in the general vicinity but may move when ice melts or cause hazards to other winter uses.

Placement

Placement of trees in open water requires a large boat or working platform. Trees can be weighted then either hauled or towed out to needed areas. This method is labor intensive

and smaller trees are requires but four people can readily place up to 30 trees during a half days effort (Figure 4).

Considerations

Cedar trees are usually abundant on the surrounding public property or from neighboring road ditches. Trees that have grown alone usually have a bushier shape and provide more cover per tree. Trees grown in tight groups often lack the side branches that provide the shelter. Other tree species can be beneficial but have drawbacks. Hedge trees, (Osage Orange) are quite bushy and contain very long lasting branches but the thorns are difficult to work with and often puncture tires. Hardwoods such as oaks can also be a source of trees. They are usually more desirable as timber and therefore may have offer greater aesthetic benefits if left. Surplus Christmas trees do not offer long term habitat and their branches are thin and break down quickly.

Figure 4. Tree piles.

SPAWNING AREAS

Description

Male panfish make shallow depressions in the loose bottom material to create a site for the female to lay eggs. Usually many males frequent a small area. Sand, pea gravel, and limestone chips have been used to create areas in many Iowa lakes.

Site Selection

Water depths should be 18 to 42 inches depending on expected water clarity, near existing shoreline access areas when possible, and where sediments will not eventually cover the site. Areas with deeper water, submerged rock, and or flooded timber nearby can be even more productive because the additional sheltered areas offer places for pre-spawn fish to stage or other to safely retreat should danger arise. Excellent areas would be the corners on each side of an existing jetty where the jetty connects to the shoreline, areas near submerged road crossings, the sides of small steep side coves, or the corners of the dam (Figure 5).

Construction

Limestone chips from local quarries work well for this purpose and are readily available near most locations. The chips are commonly used to resurface “Oil and Chip” roads. Pea gravel mined from river beds is best but delivery to remote areas may escalate the cost to above feasible limits. A typical dump truck load will cover an area approximately 30 feet by 60 feet approximately 6 inches thick. Length and width can vary but long, narrow areas that follow the bottom contour would offer greater angler access.

Placement

Spawning areas on dry or frozen bottoms are easy to construct. Very little site preparation is needed and many times the material is only dumped from a truck then shaped to the desired depth by a small tractor and blade. Placement in open water can be done by an excavator. The machine can reach several feet form shore and easily sprinkle and shape the material with the bucket. Material can be placed on the ice but movement during the thaw can occur.

Considerations

Material transportation can become a large portion of the final cost. Pea gravel provides excellent habitat characteristics but availability is usually dependant on local river mining. The limestone chips are common in many parts of the state. Quarries commonly crush them in early summer but usually make only quantities needed for local road projects. Therefore availability may be a problem during the off season. They are also available with or without fines. The material without fines would be less likely to pack and panfish may prefer this over the material with fines. Sand is readily available throughout the state but course sand is sometimes harder to find. The course sand particles will not pack together and will offer characteristics similar to that of pea gravel or limestone chips. The cost of each material type delivered to the site must be evaluated to create the largest benefits possible. An illustration of a typical location is shown below.

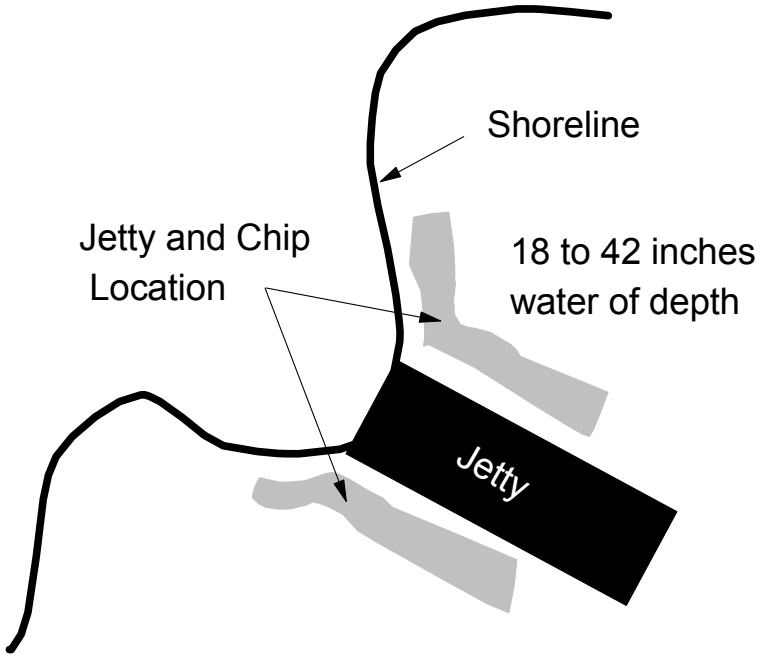


Figure 5. Jetty design and site location.

SHALLOW ROCK PILES

Description

Shallow rock piles (Figure 6) will hold many species of fish during all open water seasons. The rock surfaces attract many invertebrate species and the cavities provide shelter areas to fish.

Site Selection

Sites in clear water, away from possible silt sources, and adjacent to additional submerged rock flats work well. The face of the dam or areas along armored shoreline stretches can offer these characteristics and can be easily utilized by both boat and shore anglers.

Construction

These piles usually consist of two to three typical dump truck loads of screened riprap or clean salvaged concrete.

Placement

Material placed to form a reef six feet wide perpendicular to shore starting in two feet and extending into eight feet of water works well. A long reaching excavator would easily reach both the unloading area and the outer edges of the reef. The top should be at least two feet under the normal pool level. Several piles can be placed along a given stretch of shoreline. An illustration of a Shallow Rock Pile is shown below.

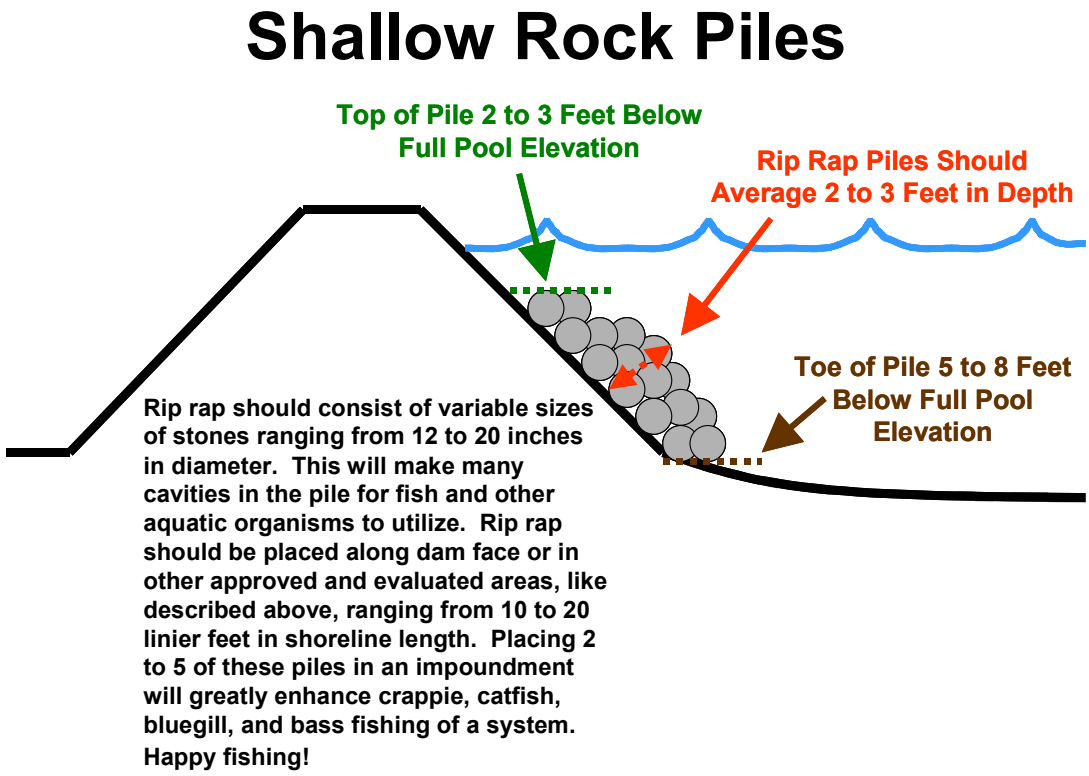


Figure 6. Shallow rock piles.

Considerations

These piles should last many years if placed below the typical wave and ice line. Impacts to boating traffic should be minimal because they are very close to existing shoreline. Screened riprap is slightly more expensive but the extra cavities offered by the lack of fine material should attract more fish.

Figure 7. Rock fields.

ROCK FIELDS

Description

The face of a dam or a stretch of armored shoreline can attract many fish species throughout the year. The rock surfaces and cavities provide excellent attachment areas for invertebrates. These cavities provide sites for higher food chain members or fish to find shelter from even larger predators. Larger predators in turn, frequent these areas searching for prey. The areas thus become popular angling sites. The addition of rock covered areas to other parts of a water body should also attract fish.

Site Selection

The recommended characteristics of a possible area would be a location large and open enough to freely troll or drift across, with naturally occurring drop-offs nearby, and or gradually deepening water depths of four feet descending into eight or nine feet. These areas should also be located such that any deposited or suspended sediments would not cover the site.

Construction

The material can be dumped over a dry or frozen bottom or barges can be used when available to place material in open water. The rock used at these locations does not usually freeze so softer, less expensive rock could be purchased (Figure 7).

Placement

The rock should nearly completely cover the bottom but does not need to be excessively thick and in many cases spreading is minimal. Any irregularities left during placement would further accent the area. The material should not be packed into the bottom.

Considerations

Screened riprap (Figure 8), when available, might be a better choice than non-screened or pit run rock because of its ability to provide more cavities with fewer fines. The screening process would also remove any excessively large pieces whereby allowing the available tonnage to cover a larger area. Native field stone also works well when available. Rock Field locations are submerged and sometimes difficult to locate. Therefore, they should be as large as feasible.

Figure 8. Screened riprap.

STAKE BEDS

Description

Fish attracting areas made from individual oak stakes or fiberglass strips (Figure 9) have been placed in many locations of several Iowa water bodies. These areas often contain from several hundred to a few thousand pieces. This type of configuration allows crankbaits to be pulled through the stake bed with minimal snagging or perpendicular bobber fishing to occur with ease. Panfish and largemouth bass commonly utilize these areas during early and mid summer months.

Site Selection

Stakes should be placed in areas with approximately eight feet of water depth. Potential stake bed sites with adequate water depths within casting distance of shore usually do not

naturally occur. Excavation for fill material used in jetty construction often creates suitable areas. The stake bed can cover a varied water depth but shorter stakes should be used in shallower areas. A clearance of two feet over the top of the stakes at normal pool to avoid damage by boats should be targeted.

Construction

Two methods of construction have been used in the past. Individual pieces can be pressed into the bottom sufficiently as to not float away or fall over. Spacing should be approximately twelve inches. Individual stakes can also be nailed together into individual rows with shorter stakes serving as the cross links. Several constructed rows can be nailed together to form an eight foot cube. These cubes can then be weighted with cement blocks and sunk in open water.

Placement

Pressing individual stakes into the soft lake bottom is the fastest method of placement. Individual stakes can also be placed from a boat or while wading.
This method works well during a drawdown where the potential site is partially flooded. Cubes can be lowered into open water from a boat or placed on the ice. Both of these methods are more labor intensive and are only used when other methods are not an option.

Considerations

Oak stakes are readily available from the State Forest Sawmill but are heavy, may float out, and may need to be pointed before pressing in the bottom. Transportation can become a problem because of the weight of the stakes. Surplus fiberglass step ladder legs acquired from the manufacturer have been used in several southern Iowa lakes. The fiberglass stakes will last indefinitely, will not float, and should be less susceptible to hook snagging. Availability is unpredictable and transportation from the factory to the desired location can be expensive because of the distance.


Figure 9. Stakebeds.

BENCHED JETTY MODIFICATION

Description

Fishing jetties (Figure 10) are popular access points for the shoreline angler. The riprap and deepened sides attract fish of several species. The addition of a bench or shelf below the water's surface for spawning panfish can further enhanced the jetty's fish attracting ability. This bench also helps stabilize some of the jetty's side erosion.

Site Selection

Benches are most beneficial on calm jetty sides with no siltation sources nearby. Natural or man-made deepened areas nearby also enhance the site. Water depths over the bench can vary and should be approximately equivalent to with the typical water clarity available during the panfish spawning season. Any deep flooded timber or trees nearby may further enhance the attracting ability of the area.

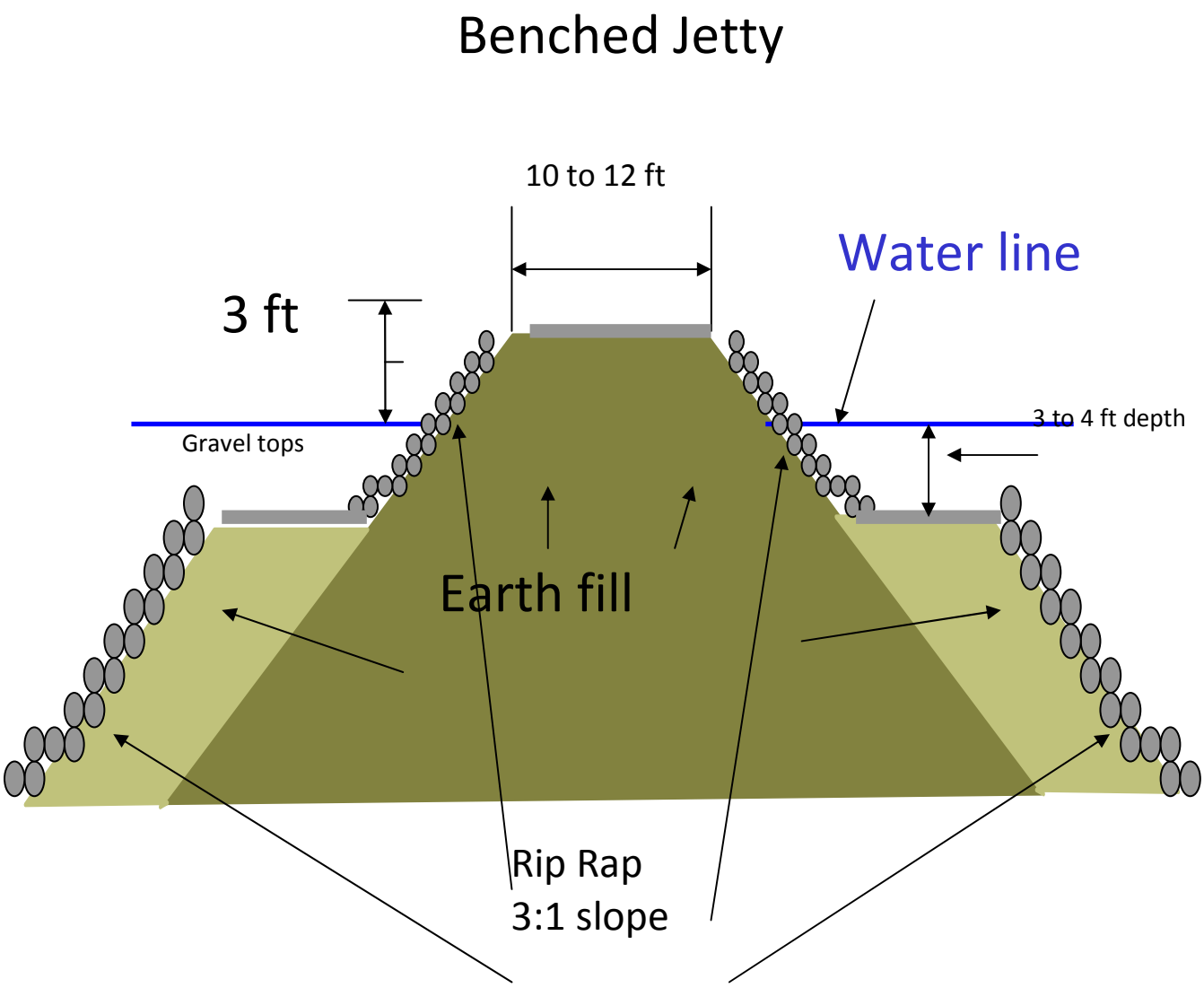


Figure 10. Benched jetty.

Construction

Benches can be part of the design of newly constructed jetties with little additional cost. Jetties constructed on dry bottoms are usually earthen fill from the immediate area and barrow areas can be specified that result with the formation of the bench. Benches at least ten feet wide can then be topped with limestone chips or pea gravel similar to that used when constructing spawning beds. The jetty sides and toe areas below the bench should be riprapped. Benches can be added to existing jetties either while dry or submerged. Dry construction is easiest because fill or excavation of the surrounding area is readily visible and accessible.

Placement

Placement usually requires heavy construction equipment and is part of a contract with a private construction contractor.

Considerations

Benches are an inexpensive addition to a newly constructed jetty that brings the fish to the angler's feet. Water clarity and siltation are two important factors that affect the life expectancy and attracting ability of the bench. When incorporated into the jetty's initial design, have little or no influence on the final cost. This combination of features adds a variety of high quality habitat to an area the angler frequents. An illustration of a typical benched jetty is shown below.

CHAPTER 5. LAKE RESTORATION PERMITTING & AUTHORIZATIONS

INTRODUCTION

Submission of permit applications and/or letter for authorization are required whenever a lake project involves water release, shore line armoring, construction of a jetty, fish habitat, and/or boat ramp. Most restoration projects involve lowering the conservation pool or completely draining the lake. Normally the lake's water elevation is manipulated after the Labor Day holiday. Most projects call for the construction phase to begin in early winter with an early spring completion date. Advanced planning is a must, in order to receive the necessary permits, authorization and federal funding prior to project construction.

Water Release Authorization:

A request letter to lower the lake's water level should to be submitted to the Flood Plain Section Supervisor at DNR Wallace State Office Building, 502 E. 9th Street, Des Moines, IA 50319. The request shall contain the lake's name, a legal description location, a date to begin water release, to what elevation the water will be lowered, project duration, the method used to release water, and the purpose for water release.

Authorization requires public involvement. A pubic meeting or new release announcing the proposed project with an invitation to comment can be completed before or after the request for authorization. Most often, public involvement occurs before the Fisheries Bureau commits to a lake project. If completed, documentation of public involvement should be included in or attached to the letter of request for authorization. If not complete the authorization letter will be conditioned to obtain public input prior to water release.

The biologist is responsible in obtaining authorization and receiving public comment. Normally it takes approximately two weeks to obtain an authorization letter.

Permit to apply chemical:

A permit is required to apply any chemical to a public water. The DNR Water Quality Bureau issues this permit in accordance to Administrative Code EP[567] Chapter 66; Pesticide Application to Waters. Chapter 66 can be found at http://www.legis.state.ia.us/Rules/Current/iac/gnac/gnac2184/gna2185.pdf. The application is to be mailed to Iowa DNR Water Supply Section at 401 SW 7th Suite M, Des Moines, IA 50309 - 4611.

The biologist is responsible in obtaining the permit. The information must be submitted on department Form 542—1409 entitled “Aquatic Pesticide Application to Prohibited Waters — Permit Application Form” (Table 1). The completed application form should be filed with the department at least 90 days prior to the anticipated period of aquatic pesticide application. The permit is issued for the period of time requested in the application, or such period of time as the department deems appropriate under the circumstances, but in no case shall the permit be valid for longer than the calendar year in which it was issued.

A permit may be denied if any of the following conditions are found to be applicable:

a. Water quality data show a water quality standards violation for the aquatic pesticide, or its ingredients, within the same lake, wetland or reservoir as the requested area for aquatic

pesticide application, or downstream of the requested area for aquatic pesticide application; or
b. Water quality testing by a public or private water supply or by the department has found quantifiable levels of the aquatic pesticide in its raw or finished water within the last four years. The testing would be applicable if conducted within the same lake, wetland or reservoir as the requested area for aquatic pesticide application or if conducted downstream of the requested area for aquatic pesticide application; or
c. The applicator does not possess a current Category 5—aquatic pest control certificate from DALS; or
d. The requested application of aquatic pesticide is not following label instructions for use of the aquatic pesticide; or
e. The active or inactive ingredients in the aquatic pesticide are regulated under the Safe Drinking Water Act (SDWA); or
f. A public or private water supply intake is within 2000 feet of the requested area of the aquatic pesticide application in a lake, reservoir, or wetland, or the public or private water supply intake is within 100 feet upstream or 2000 feet downstream of the requested area of the aquatic pesticide application in a river or stream; or
g. A shallow well, as defined in rule 567—40.2(455B), is located within 50 feet of the aquatic pesticide application area.

Other Permits and Federal Grant Approval:

All restoration projects require other permits and some may be cost shared with federal to Sport Fish Restoration funds. Obtaining the needed permits and federal grant approval is the most time consuming and project timing is of the up most importance. A construction contract can not be consummated until permits have been issued and a federal grant proposal approved.

One permit application covers all required permits. The application is know as "Joint Application Form - Protecting Iowa Waters" and can be found at: http://www.iowadnr.com/other/files/jointpermit.pdf. Copies of the application are sent to the Army Corps of Engineers, Iowa DNR Flood Plain Section and Iowa DNR Sovereign Land coordinator. The Engineering and Realty Services Bureau (ERSB) is responsible for applying for permits. However Des Moines Office Fisheries staff on certain occasions may submit an application.

The permit application and the federal grant proposal is based on the scope of work described in the Project Request submitted to the Engineering and Realty Services Bureau (ERSB). A PR must be submitted at least six months prior to bid letting. The Project Request is developed by the biologist with the aid of the ERSB Facilities Engineer. Once the PR is submitted it is imperative that project scope does not change unless the permit application and grant proposal are amended. Altering the project's scope after-the-fact will be in violation of an issued permit and may cause loss of federal grant money.

The grant proposal is normal written by Des Moines Office Fisheries staff. This proposal consists of a project description component and environmental review component. The project description component describes the project's need, objective, benefit, approach and location. The environmental review component assesses environmental affects of the project and must comply with the National Environmental Policy Act. Public input, wetlands, threatened/endangered species, accessibility and archaeological resources are the key issues that need to be addressed in the review. Federal agencies will not make grant funding available

until all environmental issues are fully addressed. Environmental issues are most responsible for delay in issuance of a permit and approval of grant money.

The biologist is responsible for public input. This is done early in project planning and before the DNR commits to the project. The Des Moines office staff assesses all other environmental issues. Investigating the presence of archaeological resources is what often holds up grant and permit approval. An archaeological investigation is required for all restoration projects. This investigation, a written report of its findings, its review and approval by state and federal agencies must be undertaking from the time the lake's water level is lowered and a construction contract let. General this time frame is from Labor Day to mid-January or approximately 130 days. Of these 130 days; approximately 18 days are need to lower the lake, 45 days to conduct an archaeological survey and submit a report, 30 days for agency review, a 30 day public review notice issued by the Army Corps of Engineers and seven days to issue permits and approve grant money.

The short project duration period makes it difficult to complete all restoration project steps on time. However it is possible when there is good communication among the biologist, Des Moines Office staff and ERSB

Table 1. Form No. 542-1409

IOWA DEPARTMENT OF NATURAL RESOURCES

Aquatic Pesticide Application to Prohibited Waters
PERMIT APPLICATION FORM

Applicant Name	Address
Area Code/Phone No.	Name of Receiving Water (lake, river, stream).

Department of Agriculture and Land Stewardship--Category--5 (Aquatic Pest Control) Certificate Number (or enclose a copy of the Certificate)

Purpose of Applying the Aquatic Pesticide.
(Ex. to control submerged weed growth around the dock)

Brief Description of Location of Aquatic Pesticide Application (include address of frontage property).
Sec: _____ Twp: _____ Range: _____ County _____

Describe Area of Aquatic Pesticide Application (include sketch on Side 2 of this form)
(Ex: 50' along both sides of 200' boat dock and walkway located on the west side of Green Beach 80 feet South of Highway 1)

1) Describe the Time Period:
_____
(Ex. Beginning June 15 through September 15)

2) Frequency of Aquatic Pesticide Application:
(Ex. Once every 30 days as needed.)

3) Rate of Pesticide Application:

1) Brand Name of Aquatic Pesticide:

2) Manufacturer:

3) EPA Pesticide Registration No:

4) Listing & % by Weight of Active Ingredient:

Name and Location of Known Public and Private Water Supply Intakes within 2,000 feet of Application Area and wells within 50 feet (must be included in the sketch).

	Internal use only			
Permit No:		Date Issued:		

Table 1. Continued.

	Form No. 542-1409
For Sketch of Application Area	
(Include important physical features within 2,000 feet of application area)	
I CERTIFY THAT THE INFORMATION CONTAINED IN THIS APPLICATION IS TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE.	
Signature	Date

CHAPTER 6. FISH RENOVATION POLICY

INTRODUCTION

A total renovation of a lake's fisheries population should be done as a last resort and all other less drastic measures should be utilized first, including supplemental stocking, summer or winter drawdowns, habitat and watershed improvement, physical manipulation and regulation changes. Total renovation is a time-tested and efficient fisheries management technique. Response of fish populations in a new-lake situation is predictable and will succeed in producing excellent results within two or three years.

OUTLINE

NEED FOR LAKE RENOVATION
- Low catch rates (<0.5 fish/angler) of game fish for three years
- Large numbers of rough fish (>150 lbs. Per acre)
- Large numbers of stunted panfish

COMMUNICATIONS
- Intra-departmental
- Stakeholders
- Public meeting

PERMITS
- Permit to apply chemical-Water Quality Bureau
- Water release permit—Flood Plains Bureau
- Permit from county landfill to dispose of fish

PLANNING
- Obtain hydographic maps and aerial photos of the lake
  - Calculate volume of lake and amount of chemical to treat at desired concentration
  - Divide lake into equal parts for treatment
  - Determine amount of chemical needed in each lake segment

- Treatment of private waters in the watershed
  - Determine if undesirable fish are present
  - Obtain permission from landowner
  - Obtain fish for restocking of private waters

PROMISCUOUS OR LIBERALIZED FISHING
- Definition of promiscuous and liberalized fishing
- Publication of liberalized or promiscuous fishing

FISH SALVAGE

- Determine number of salvageable fish
- Collect fish using suitable gear and transport to chosen lakes
  - Collect largemouth bass with electrofishing boat
  - Collect channel catfish with baited hoop nets

HABITAT IMPROVEMENTS

Draw up comprehensive plan for habitat improvement
Dewater lake, if possible for effective habitat work
Assemble and coordinate other public personnel and volunteer groups to construct habitat.

EQUIPMENT

Lake applicators

Boat and motor

Boat bailer, sprayer or pump for deep water application
Tank (not galvanized steel) to mix and dilute chemical
Buckets or pumps for filling tanks and mixing chemical
Bung wrench to open drums
Safety gear: pfd, rubber gloves, rain gear and goggles or face mask
Bucket of clean water (to rinse chemical from skin in case of accident)

Watershed applicators

Backpack sprayer or drip station barrel
Safety gear: rubber gloves, rain gear and goggles or face mask
Waders or hip boots
Buckets for mixing chemical and filling backpack sprayers/drip stations
Vehicles to transport crews and chemical

DEWATERING

Dewatering should be considered because of reduced chemical cost and a better chance of success

Dewatering can be accomplished by adjusting outlet gate or by siphoning

Public and private landowners adjacent to lake should be kept informed of plans to dewater the lake

CHEMICAL RENOVATION

Partial or selective treatment

Total renovation

Time of year
Calculate amount of chemical needed
Acquire chemical well in advance of project
Carefully plan renovation of lake and watershed

FISH CLEANUP

Dead fish will be cleaned up only by necessity

Dead fish will be picked up as safety dictates or in waters with high public use

Fish will not be picked up after natural kills or small renovations in remote areas

RESTOCKING

Restocking of fish will be done according to established procedures and rates as outlined in the policy manual

Any deviation from the policy manual should be cleared with the district supervisor and Bureau chief

Hatchery branch shall be notified of the renovation well in advance to allow for additional production needs

OTHER FISH MANIPULATION TOOLS

Summer drawdown for fish population manipulation may be considered as an alternative to chemical population reduction. Summer drawdown will concentrate forage size fish, usually stunted panfish populations, and increase their vulnerability to predation. This concentration also increases the angler catch of larger individuals of the problem species, but decreases the bass catch because of the increased availability of prey. Best results occur if the drawdown occurs in June and decreases the volume of the lake to 50 percent of the full lake volume.

Summer destratification has been used in the past as a tool to control unbalanced panfish populations. Axial flow pumps or pumped air aeration systems can be used to destratify the lake; this action should be initiated in April and continue for at least six months to have the desired effect. Candidate lakes should be destratified every other year to obtain positive results. This tool has been used to increase the growth and improve the size structure of both panfish and largemouth bass populations.

Netting is an expensive and time-consuming method of fish population control. There are advantages to using nets as a management tool: you can remove the target species without damaging desirable fish populations, thin stunted populations, collect fish for restocking, this activity is popular with the public, will eliminate fish cleanup and causes a minimal disturbance to public areas. The disadvantages are substantial: it takes an enormous amount of time and effort to achieve the desired effect and you will never eliminate an undesirable species. This technique may be reasonably effective in very small lakes or ponds.

NEED FOR LAKE RENOVATION

It should be obvious to the biologist which lake is in need of total renovation due to their sampling regime. Several reasons for renovation include low catch rates of game fish, an extremely high standing stock of rough fish, an unbalanced game fish population composed of a high percentage of stunted or slow-growing panfish or the introduction of exotic species such as yellow bass, white perch, common carp, or Asian carp. An intensive survey that estimates the population and biomass of the problem species may be in order. Once the management biologist has decided that a complete chemical renovation is necessary, these steps should be taken prior to and following the renovation.

COMMUNICATIONS

Informational exchange is an important part of any lake renovation. The district supervisor should be the first to be informed of the intent by the biologist to renovate a lake. The supervisor should be informed of the problem and also be aware of all of the steps taken prior to coming to the conclusion of renovation.

Knowledge of lake ownership, i.e. state, county or city is required and informing representatives of the governing body about the renovation should be made well in advance of the project.

A public meeting should be held in the vicinity of the lake at least six months prior to the actual renovation and the public given a chance to have input into the project. Some of the topics of the public meeting should be, but are not limited to: justification for the renovation, fish population parameters of the lake, scheduled work plan, restocking efforts, and liberalized or

promiscuous fishing dates. Local media including newspapers, radio and television stations as well as the I & E Bureau of the DNR should be notified of the public meeting and the pending renovation.

PERMITS

At least three months prior to the renovation, permits to apply the chemical should be obtained from the Water Supply Section of the Water Quality Bureau of the DNR (515-725-0360). If the plans include lowering the water level of the lake, a water release permit should be obtained from the flood plains section of the DNR (515-281-6930). The biologist will be asked to locate and report all wells within a designated distance of the lake to the local municipal drinking water supply managers in order to prevent contamination of the drinking water of local residents or facilities. A permit may also be needed from the county landfill or county sanitarian to deposit dead fish into the county landfill if fish pick up is required. It is presently unlawful to bury dead fish and the county landfill is the only viable option for their deposition.

PLANNING

The management biologist and his team must plan carefully for the renovation to be professional and successful. Electronic aerial photos and contour maps are available from numerous sources <Link>. Hard copies of these electronic images should be printed for use in planning and logistics. With these maps, the amount of chemical needed to treat the lake and watershed should be calculated. The lake and watershed should be divided into areas that will take similar amounts of effort to treat. Two or more person teams should be organized with clear instructions as to the assigned task(s). Lake and watershed maps with zones carefully marked along with travel instructions should be prepared for each work team. These watershed maps and directions are very important for workers treating streams and ponds to ensure areas are treated efficiently and in the proper order. If chemical application involves work on private land then landowner permission needs to be secured ahead of time. Arrangements must be made with park managers or rangers to have areas to store chemical and stage the project. For in-lake treatment barrels of chemical need to be delivered to boat ramp areas where tractors are available to load boats and aid in getting boats and trailers in and out of the water. Watershed treatment trucks need to be loaded with the proper amount of chemical and equipment needed to treat selected zones. Hatcheries should be notified by December of the year prior to the renovation in order to insure the proper fish for restocking.

PROMISCOUS OR LIBERALIZED FISHING

Lakes scheduled for renovation are commonly opened up for promiscuous or liberalized fishing. Promiscuous fishing involves any technique or gear, other than explosives, chemical or stupefying substances that can be used to harvest fish that would otherwise be wasted. Commonly, promiscuous fishing entails the use of nets and seines to capture fish. Liberalized fishing is the relaxing of angling laws including bag and length limits, method of take and the number of rods that can be used at one time A positive public relations image and a reduction in fish cleanup are advantages of promiscuous and liberalized fishing. Relaxed fishing laws prior to the renovation are to be coordinated with the local DNR conservation officers, pertinent resource managers and the central office. Promiscuous fishing is typically opened two to three months before scheduled renovation whereas liberalized fishing is opened after April 1st. Both liberalized and promiscuous fishing requires the individual to have a valid fishing license in their possession. Publication of promiscuous or liberalized fishing activities should be accomplished through local public media sources and the I & E Bureau of the DNR.

FISH SALVAGE

The fisheries biologist should determine the value of any portion of the fish population in the lake to be renovated. In most situations there are very low numbers of large bass or other predator fish that can be moved to nearby lakes in which they can provide a valuable function. These fish can usually be effectively collected with an electrofishing boat and hauled to the stocking sites. Sometimes high numbers of channel catfish can be hoop netted and hauled to lakes where they can provide fishing opportunities. In addition to the biological value, this activity does provide valuable positive public relations for the Department of Natural Resources. In the past, fish salvage and fish rescue was a far more important part of the fish renovation process but because of the large amount of time and effort expended for the number of fish actually moved it was decided that the cost benefit ratio was too high.

HABITAT IMPROVEMENTS

A comprehensive habitat improvement program should be initiated at all lakes that are totally renovated, especially if the lake has been lowered or dewatered. A detailed plan should be drawn up and cost estimates be obtained a year before the actual project takes place. Habitat placement procedures are usually easier and more effective when a lake is dewatered. Special attention should be given to shoreline rejuvenation, jetty construction, reef and island construction and riprap placement work in dewatered lakes. The biologist should coordinate with park managers, construction services engineers, and local DNR personnel that have access to heavy equipment for assistance in placing rock and other structure types in the dewatered lakes. Local fishing clubs, boy scout troops and other service organizations will often be eager to assist in assembling and placing habitat structures.

EQUIPMENT

All fish toxicant applicators should possess a commercial pesticide applicator permit for aquatic pest control. All label warnings and procedures listed on the toxicant containers should be read and followed. Equipment required for application of rotenone would include:

Lakes (maps)

1) boat and motor, 2) boat bailer or sprayer or gas pump for deep water application, 3) tank (to dilute chemical), 4) buckets or pump for mixing chemical and water, 5) bung opener, 6) rubber gloves, rain gear, life jackets and goggles or face mask, 7) bucket of clean water (to rinse chemical from face or skin in case of an accident).

Watershed (maps)

1) backpack sprayer (with spare tips and screens) and/or drip station barrel 2) rubber gloves, rain gear and goggles or face mask. 3)waders or hip boots 4) buckets for mixing chemical and water, 5) Careful planning is necessary to provide workers with enough trucks to get to their work areas.

DEWATERING

Dewatering prior to renovation is desirable, if possible, because of reduced chemical costs and increased probability of success. Dewatering in many lakes can be done by manipulating the lake's gated structure or planning the kill to coincide with spillway maintenance. The DNR

Construction Services Engineer for the area should be consulted of any attempt to adjust the gated structure or drawdown. In some situations, a siphon pipe can be used to draw off water to the desired levels; six to ten inch diameter flexible tile can be used to form the siphon. This procedure can be used to successfully remove two to three feet of water from the lake. When possible, completely dewatering a lake will significantly reduce chemical cost and help assure complete fish renovation. When lowering lake levels, downstream adjacent public and private landowners must be kept informed of plans in order to minimize negative effects.

CHEMICAL RENOVATION

Partial or Selective Treatments

In the past, partial and selective chemical renovation techniques have been used to decrease the fish density in order to provide additional food and space for slow growing fish populations. This technique has proven to be ineffective and has not been used for years by the Department. A partial kill may be used in investigative work, such as cove sampling, to obtain more complete samples of the fish community.

In the past two chemicals have been used for chemical renovations of lakes in Iowa: antimycin and rotenone. The use of antimycin has been discontinued because of safety reasons and the decision that rotenone was a more effective toxicant.

Total Renovation

Traditionally, rotenone treatments have been made in September, after Labor Day, to decrease conflicts with other water recreation and insure sufficiently high water temperatures to achieve total kills. The lake will detoxify and be safe for stocking fish in two to four weeks; the warmer the water, the sooner the lake will detoxify. Lowering a cage with live fish into the lake and checking them after several hours can determine if the lake is still toxic.

In recent years, total renovations using rotenone have been planned for late fall/early winter application to reduce the need for cleanup of dead fish and to reduce the amount of chemical needed. When water temperatures are below 40 degrees Fahrenheit, three parts per million of chemical is sufficient to totally eliminate all fish life. The ideal situation is to apply the chemical within a day or two of ice up. Rotenone under these conditions will stay toxic for up to three months and will assure a complete kill.

Concentrations of rotenone are based on an estimate of the volume (acre feet) of the body of water to be treated. These parameters can be easily calculated from electronic data that was acquired when the lake to be treated was mapped. With modern techniques it is a simple task to obtain accurate measurements of the lake volume at each one foot contour level.

After the volume of water to be treated is determined, the amount of chemical can be calculated. One gallon of liquid rotenone will treat one acre-foot of water at three parts per million. Rotenone should be acquired early and kept in an area where it will not freeze. Since the chemical usually comes in 30-gallon drums, which are heavy and awkward to move, arrangements should be made to store the chemical as close as possible to the lake. Follow label instructions in all phases of transporting, storing and handling the containers of rotenone, as well as the actual application.

Total lake renovations also involve the streams and ponds in the watershed. All streams and ponds located in the watershed of the target lake will be renovated. Streams with a continuous flow can be treated effectively with drip stations. The apertures should be adjusted to deliver the chemical at a measured rate and each drip station should be started at the proper time in order to drive the fish downstream and kill them efficiently. This should be done prior to treating the main lake. It is also important to treat all connected marshes and the shallow water areas in the target lake to eliminate unwanted fish and freshwater sources. Recent aerial photos are necessary to locate ponds and tributaries in areas in the middle of the section or some distance from roads or streets. All pond outflows (plunge pools) need to be checked regardless of water flows downstream from ponds. The plunge pools immediately downstream of ponds should be checked and treated with rotenone in order to remove areas of possible escapement of stream fishes.

Most lake applications of chemical should be made with boat bailers for shallow water and pumps to apply the toxicant to deep water (>10 ft). Marshy areas remaining in the lake basin should be treated with hand sprayers or high-pressure pumps. In ideal situations aerial application could be used from helicopters or small planes. All renovations should have sufficient manpower available to apply the total toxicant in less than 8 hours.

FISH CLEANUP

Because cleanup of dead fish is labor intensive and unpleasant, fish should be cleaned up only when necessary. Small fish kills in remote areas need not be picked up, but renovations in waters with high public use will require cleanup. In the past, fish were disposed of by giving them to any willing member of the public and were used as fertilizer in gardens, spread on crop fields or sent to rendering. New regulations require more careful disposal. All permits required for fish disposal should be acquired well in advance of the renovation.

RESTOCKING

Restocking following total renovations will be done according to established procedures and rates as outlined in the fish stocking chapter of the policy manual. Any deviations will be cleared through the branch supervisor. Advance planning and stocking requests are mandatory to allow hatcheries to anticipate production needs.

CHAPTER 7. FISH KILL INVESTIGATIONS

INTRODUCTION

Fish kills occur for a variety of reasons. Some kills are natural and others are caused by the release or spill of a toxicant. Fish managers are responsible for assessing the fish loss and compiling reports.

1) **Fish kills with a responsible party**

Kills in which a responsible party is found, investigators should follow the guidelines outlined in the American Fisheries Society Special Publication 30 or the most current American Fisheries Society Publication available. Most kills will be investigated using the protocol *Streams Accessible at and Beyond and Crossings (Strata I, II, and III*) on page 21 of AFS Publication 30 (Southwick and Loftus 2003). Kills on lakes or ponds require making counts on randomly selected shoreline segments and expanding them for the entire shore length with dead fish..

Streams

Figure 1 is an example of a field sheet that fish counts can be recorded for each sample segment. Many fish species require a length to determine the fish value. This field sheet (Fig. 1) helps breakdown the length categories for common stream species.

Figure 1. Fish kill investigation sheet.

FISHKILL INVESTIGATION

DATE _____ **STRATUM #** _____

WATER _____ **SAMPLE LENGTH** _____

COUNTY _____ **INVESTIGATORS** _____

LOCATION _____

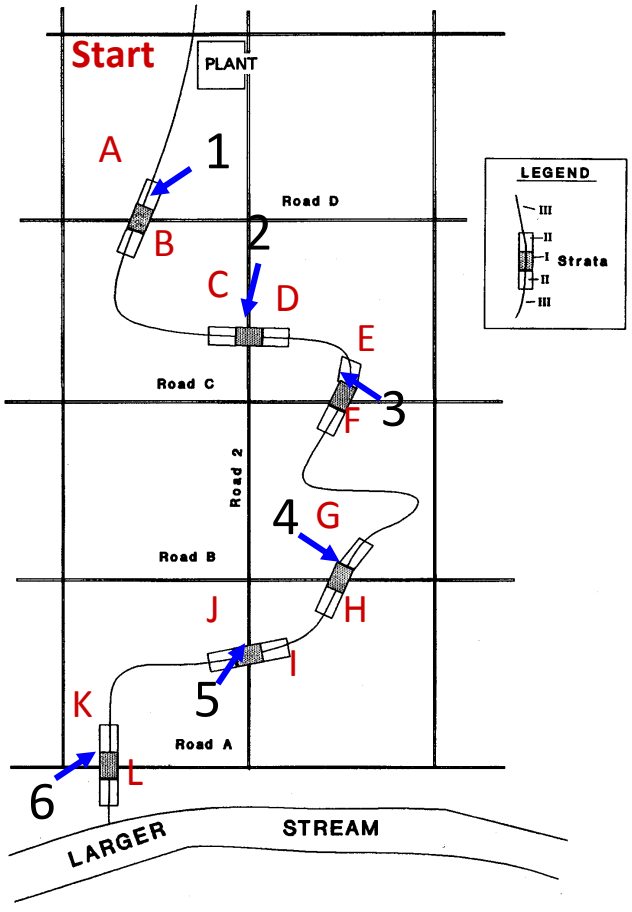
	NUMBER
MINNOWS SHINERS CHUBS DACE	

	INCH CLASS															>15 - LIST INDIVIDUAL LENGTHS
SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
COMMON CARP																
STONEROLLER																
FATHEAD MINN.																
REDHORSE																
W SUCKER																
N. HOGSUCKER																
OTHER SUCKERS																
C CATFISH																
BULLHEADS																
MADTOMS, ETC.																
BUFFALOS																
CARPSUCKERS																
BLUEGILL																
G. Sunfish																
	1"			2"				3"								
DARTERS																

Strata I segments usually include the distance of 50 yards above and 50 yards below the midpoint of each road crossing. All stratum I sites may be counted. On long kills, every other or every third crossing (Stratum I) may be counted to save time. The counts are expanded to include the entire length of Stratum I sites, if not all sites are counted.

Stratum II segments are usually 100 yard stream segment just outside the influence of road crossings (Stratum I segment) in both the upstream and downstream directions. Counts conducted on Stratum II sites are used for the expansion of fish killed in the Stratum III areas.

Stratum I and II count locations should be selected in a random or unbiased manner. The first order of business once on site is to determine the beginning and end of the kill. A contact to the Environmental Services Division field personnel will help in locating the start of the kill. Occasionally, the kill will still be extending downstream while on site. Under these circumstances, a sampling strategy can be started and expand the site selection as the kill proceeds downstream (Figure 2).



Stratum 1

1	2
3	4
5	6

Stratum 2

A	B
C	D
E	F
G	H
I	J
K	L

or

A	B	C
D	E	F
G	H	I
J	K	L

Figure 2. Sampling strategy for fish kill investigation.

Records should be kept for mileage, expenses, and time involved investigating and reporting. These items will be used for assigning a value for investigation costs. Current hourly wages should be used for biologist, technicians, and seasonal staff (Table 1) plus 12.8% overhead. The current vehicle mileage rate (Table 1) is used to get travel costs for the kill investigation. Additional field notes should include any odor, turbidity, ice coverage, and flow conditions. A GPS coordinate for the start and end of the kill, using Map Datum Nad 83, will be needed for the kill report. Digital photography should be used whenever possible to document fish loss and count locations.

Table 1. Wages and Expenses For Fish Kill Investigations (based on values as of 2007).

Hourly Wages
https://www.iowaonline.state.ia.us/idopapptrack/ICPJobClassPrompt.asp

- use an additional 12.8% overhead for benefits
- actual hourly wages should be used and can be located on your online warrant

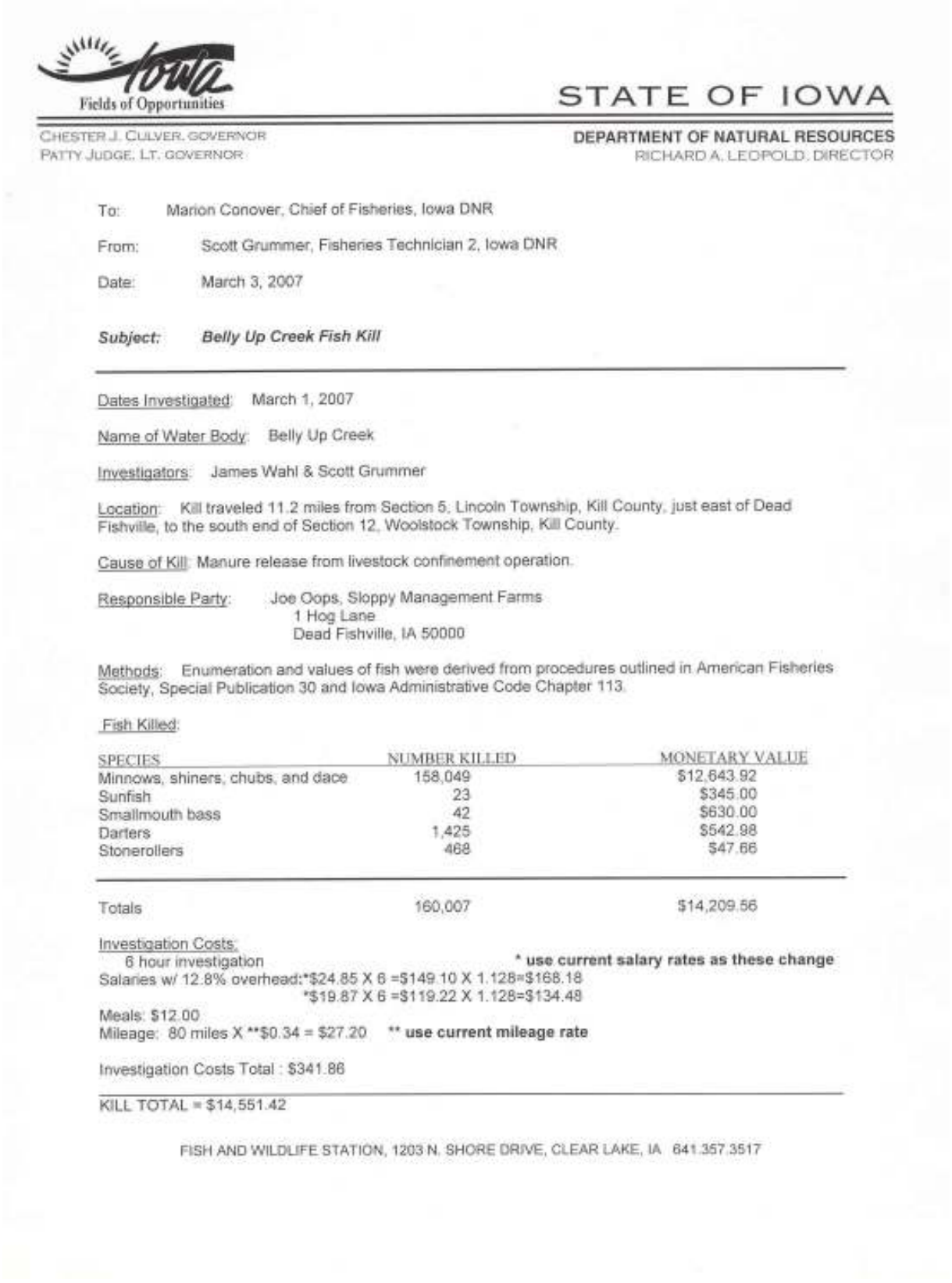
Travel Expenses(2007)

- Lunch - $8.00
- Dinner - $15.00
- Mileage – $0.34/mile

Fish values are based on those published in Southwick and Loftus (2003). The only exception is for game fish (catfish, bullhead, northern pike, muskellunge, trout, white bass, yellow bass, wipers, black bass, crappie, sunfish, rock bass, warmouth, yellow perch, walleye, sauger), which are valued at $15 per fish, unless Southwick and Loftus (2003) establishes a higher value. For example, a 19 inch northern pike would have a value of $48 using Southwick and Loftus (2003). These values give a total dollar amount for fish killed, based on the numbers expanded from the fish counts.

Reporting is required to several different people. The Fisheries Bureau Chief, immediate Supervisor, and the Environmental Services field staff should receive a report similar to Figure 3. The database manager (Jamie Mootz, 2007) should receive the summary report in Figure 4.

Figure 3. Fishkill report form.



Iowa
Fields of Opportunities

STATE OF IOWA

CHESTER J. CULVER, GOVERNOR
PATTY JUDGE, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
RICHARD A. LEOPOLD, DIRECTOR

To: Marion Conover, Chief of Fisheries, Iowa DNR

From: Scott Grummer, Fisheries Technician 2, Iowa DNR

Date: March 3, 2007

Subject: ***Belly Up Creek Fish Kill***

Dates Investigated: March 1, 2007

Name of Water Body: Belly Up Creek

Investigators: James Wahl & Scott Grummer

Location: Kill traveled 11.2 miles from Section 5, Lincoln Township, Kill County, just east of Dead Fishville, to the south end of Section 12, Woolstock Township, Kill County.

Cause of Kill: Manure release from livestock confinement operation.

Responsible Party: Joe Oops, Sloppy Management Farms
1 Hog Lane
Dead Fishville, IA 50000

Methods: Enumeration and values of fish were derived from procedures outlined in American Fisheries Society, Special Publication 30 and Iowa Administrative Code Chapter 113.

Fish Killed:

SPECIES	NUMBER KILLED	MONETARY VALUE
Minnows, shiners, chubs, and dace	158,049	$12,643.92
Sunfish	23	$345.00
Smallmouth bass	42	$630.00
Darters	1,425	$542.98
Stonerollers	468	$47.66
Totals	160,007	$14,209.56

Investigation Costs:
6 hour investigation *** use current salary rates as these change**
Salaries w/ 12.8% overhead:*$24.85 X 6 =$149.10 X 1.128=$168.18
*$19.87 X 6 =$119.22 X 1.128=$134.48
Meals: $12.00
Mileage: 80 miles X **$0.34 = $27.20 **** use current mileage rate**

Investigation Costs Total : $341.86

KILL TOTAL = $14,551.42

FISH AND WILDLIFE STATION, 1203 N. SHORE DRIVE, CLEAR LAKE, IA 641.357.3517

Figure 4. Fishkill database report form.

Iowa Department of Natural Resources

Fish Kill Report Form

DATE OF KILL:

Name of Waterbody:	**UTM North:**	**UTM East:**
Legal Location: T___N R__E/W Section ____	**Nearest Town:**	**County:**

Indicate Cause:

Natural Causes	Man-made Causes	
☐ Unknown ☐ Columnaris ☐ Gas Bubble Disease ☐ Bacteria/Parasite/Disease ☐ Summerkill (general symptoms) ☐ Winterkill ☐ Low DO ☐ Temperature ☐ Spawning Stress	☐ Unknown ☐ Animal Waste- Open Feedlot ☐ Animal Waste- Confinement ☐ Animal Waste- Land Applied ☐ Animal Waste- Unknown/Other ☐ Municipal Wastewater ☐ Private Septic ☐ Chlorinated Water ☐ Petroleum ☐ Soil Runoff ☐ Pesticides ☐ Fertilizer ☐ Other Chemical/Industrial ☐ Organic Waste (milk, silage, etc) ☐ Ammonia- Nonpoint/unspecified	Select If known. ➢ Animal Type ☐ Cattle (Beef/Dairy) ☐ Hogs ☐ Poultry ☐ Multiple Types

Waterbody Type:	**Length/Area of Kill:**

FISH KILLED

Species	**Size of Fish**	**Number Killed**

Investigation Expenses:

Fish Total:	**Investigation Total**:	**Grand Total:**

DNR Contact/Investigator:	**Responsible Party:**

Other Comments:

2) Fish kills with no responsible party, <3 miles in length (this includes natural kills)

Caution should be used! Verify that no responsible party will be found. Contact the ESD field staff to see if their investigation is complete.

Perform a minimum of one Stratum II count (100yds) near the middle of the killed stretch. Expand the count for the entire kill distance to get a rough estimate of the fish lost. Use AFS Publication 30 fish values and $15 per game fish for a total kill value. Keep track of time and mileage for an investigation cost amount.
Use current salary rates plus 12.8% overhead. Send summary reports to your immediate Supervisor and Environmental Services field staff (Figure 3). The database manager needs report form in Figure 4.

3) Fish kills with no responsible party, >3 miles in length (this includes natural kills)

Caution should be used! Verify that no responsible party will likely be found. Contact the ESD field staff to see if their investigation is complete.

Perform a minimum of two randomly selected Stratum II counts within the killed stretch. Expand these counts for the entire kill distance to get a rough estimate of fish lost. Use AFS Publication 30 fish values and $15 per game fish for a total kill value. Keep track of time and mileage for an investigation cost amount. Use current salary rates plus 12.8% overhead. Send summary reports to Supervisor and Environmental Services field staff (Figure 3). The database manager needs report form in Figure 4.

REFERENCES

Southwick, R.I., and A.J. Loftus, editors. 2003. Investigation and monetary values of fish and freshwater mussel kills. American Fisheries Society, Special Publication 30, Bethesda, Maryland.

CHAPTER 8. CHANNEL CHANGE INVESTIGATION PROCEDURES

INTRODUCTION

The Iowa DNR Flood Plain Section (FPS) solicits comments from the Fisheries and Wildlife bureaus on channel changes or other development which may cause significant adverse effects on the wise use and protection of water resources, water quality, fish, wildlife and recreational facilities or uses. Regulatory authority to comment is given in Environmental Protection [567] Chapter 70.5(3d). Environmental Protection [567] Chapter 71 lists the category and thresholds of when a flood plain permit is required. Criteria for permit approval are given in Environmental Protection [567] Chapter 72. Chapter 72 further describes when variances are allowed and lists streams sections where channel changes are not permitted. These rules may be viewed at: http://www.legis.state.ia.us/Rules/Current/iac/gnac/gnac2184/gna2185.pdf. Key sections of these chapters are given in Appendix A.

SUBMISSION OF A CHANNEL CHANGE APPLICATION

The United States Army Corps of Engineers (COE) and the Iowa DNR have specific and different regulatory roles designed to protect the waters within and on the State's boundaries. Protecting Iowa's waters is a cooperative effort between the applicant and the two regulatory agencies. An application package has been designed to assist an applicant in initiating the permit process with both agencies for construction, excavation or filling in a water of the state or on a floodplain. This application covers all permits needed for these types of activities. However other state and federal permit may be needed when an activity's scope of work extends beyond construction, excavation or filling in a water of the state or on a floodplain.

The applicant submits one copy of the application to the COE and two copies to the DNR to the agency addresses listed in the package. The application package is available at: http://www.iowadnr.com/other/files/jointpermit.pdf.

CHANNEL CHANGE REVIEW PROCEDURES

A DNR FPS engineer solicits for fish and wildlife comments after receiving and logging an application. This solicitation is through the Fisheries Bureau. This Bureau acts as the primary contact to coordinate a fish and wildlife response and to resolve project issues.

The Fisheries Bureau will forward an application to the appropriate fish and wildlife biologists for an investigation and to compile a report of findings. Whenever possible the request will be sent electronically. In most cases the biologist closest to the project site is responsible for coordinating a joint investigation and report. Under Chapter 70.5(3a) *Inspection:* "Agency personnel may make one or more field inspections of the project site when necessary to obtain information about the project. Submission of the application is deemed to constitute consent by the applicant for the agency staff and its agents to enter upon the land on which the proposed activity or project will be located for the sole purpose of collecting the data necessary to process the application, unless the applicant indicates to the contrary on the application." **However out of courtesy, the biologists should make an attempt to contact the applicant in order to gain permission to trespass.**

The fish and wildlife biologist team is given 30 days to investigate and submit comments. Exceptions to the 30 day requirement are allowable in the event of unsuitable site conditions. The team is expected to provide a written report on the Field Survey Form (Appendix B) and give recommendations based on investigation findings. The Fisheries Bureau will use the investigation report to compile a formal response to the FPS. The purpose of the formal response is to provide a consistent message that is statewide. The FPS engineers take the formal response seriously and will deny an application solely based on fish and wildlife comments. In addition, a permit may be altered or conditioned based on recommendations. Buffer strip mitigation requirements placed in the permit are also recorded in the property deed. The applicant is responsible to maintain mitigation requirements as described in the flood plain permit.

A recommendation to deny an application is based on irretrievable losses to fish and/or wildlife or when a species of concern (state and/or federal threatened/endangered species) is present. When a project is denied sufficient information must be provided, in the written report, as to why mitigation is not feasible and what, if any, alternatives are available to the applicant. The trend in recent years has been to deny channel change proposals except when 1) stream location is threatening a public/private road, bridge or building; or 2) when a governmental agency is proposing a project that is in the public's best interest. Flood protection is an example of a project that is in the public's best interests. Mitigating impacts to an off site location should be avoided unless it will definitely benefit fish and wildlife.

It is acceptable to propose channel modifications if they will reduce destruction of fish and/or wildlife habitat. Simply moving the channel over and away from structures or actively eroding banks and keeping the meanders nearly intact is a reasonable alternative; especially when the applicant has sound justification for altering the stream channel.

Assessment of Wildlife Species and Habitat Impacts**:**

References provided in Appendix D are available to identify channel change impacts to wildlife. When determining mitigation for wildlife losses, calculate the total area of habitat that has been lost or will be lost as a direct result of the project. This includes the lost of riparian edge along the stream. Also, that area of land that could not be farmed because of the meandered portion of the stream should be considered for mitigation (Figure 1). Be specific and accurate in determining these losses.

Also be specific when giving mitigation recommendations. State the number of acres to be replace, the location of these acres, species of shrubs to be planted, and the type of grass to be seeded. Mitigation to replace habitat loss must be on land void of beneficial habitat to wildlife.

Assessment of Fish Species and Habitat Impacts:

References provided are available to identify channel change impacts to fish. Fisheries mitigation should be required as a minimum on any project which adversely impacts game fish species and sensitive species (channel catfish, smallmouth bass, Topeka shiner, etc.). Mitigation for forage fish, (suckers, minnows, darters) should be based on their importance to game fish populations in the project area and in association with larger streams. Assessment of project impacts to other aquatic species such as mussels should be considered when making mitigation recommendations. Wherever in-stream mitigation is requested, be sure to describe the number and type of structures (gabions, riffles, bank armoring, etc) recommended. Keep in

mind that a structure can not impede stream flow and fish movement. Leaving the old channel unfilled should never be considered as mitigation. These areas rapidly fill with sediment and lose their value to aquatic life. A pilot channel proposed to serve only during flood events is not to be considered. This type of channel may eventually erode and begin serving as the principle channel. To prevent stream bed degradation, a proposal in which stream bed elevation is lower at the upstream or downstream end of the channel change should always be denied.

Assessment of Fish and Wildlife Losses for Unauthorized Projects:

In order to assess the losses incurred during unauthorized projects, we need to know what was previously present. Our only recourse in these cases is to work off the latest aerial photos plus taking notes of similar habitat types immediately upstream and down stream of the project area. The least we can do on unauthorized project is to try to mitigate fish and wildlife losses. The most we can do is to restore flow to the original channel if the old channel remains open. It is very difficult to have the stream restored its original channel without solid information. However we have been successful in doing so.

When fisheries mitigation is needed for authorized or unauthorized projects, we suggest a combination of one or more of the following methods: 1) rock riprap along the toe of banks and in areas of the streambed; 2) installation of in-stream devices such as riffles or deflectors to create pool areas; and 3) some channel realignment.

APPENDIX A

CHAPTER 70
SCOPE OF TITLE—DEFINITIONS—FORMS—RULES OF PRACTICE
"Channel change" means either (a) the alteration of the location of a channel of a stream or (b) asubstantial modification of the size, slope, or flow characteristics of a channel of a stream for a purpose related to the use of the stream's flood plain surface rather than for the purpose of actually using the water itself, or putting the water to a new use. (NOTE: Diversions of water subject to the permit requirements of Iowa Code sections 455B.268 and 455B.269 usually are not channel changes.) Increasing the cross-sectional area of a channel by less than 10 percent is not considered a substantial modification of the size, slope, or flow characteristics of a channel of a stream.

"Protected stream" means a stream designated by the department as a "protected stream" in 567—Chapter 72.

"Stream" means a water source that either drains an area of at least two square miles or has been designated as a protected stream in 567—Chapter 72.

567—70.4(17A,455B,481A) Requesting approval of flood plain development.
70.4(1) *Development needing approval*. Any development in a floodway or flood plain which exceeds the thresholds in 567—Chapter 71 and is not otherwise regulated by a department flood plain management order or a department-approved, locally adopted flood plain management ordinance requires a department flood plain development permit.

70.4(2) *Applying for a flood plain development permit*. Application for a flood plain development permit shall be made on DNR Form 36 or a reasonable facsimile thereof. The application shall be submitted by or on behalf of the person or persons who have or will have responsibility by reason of ownership, lease, or easement for the property on which the project site is located.

The application must be signed by the applicant or a duly authorized agent. Completed applications along with supporting information shall be mailed or otherwise delivered to the Flood Plain Management Section, Environmental Protection Division, Iowa Department of Natural Resources, Wallace State Office Building, Des Moines, Iowa 50319.

70.5(3) *Project investigation*. The department shall make an investigation of a project for which an application is submitted. The following are standard procedures for an investigation of an application.

c. Solicitation of expert comments on environmental effects. For channel changes or other development which may cause significant adverse effects on the wise use and protection of water resources, water quality, fish, wildlife and recreational facilities or uses, the department shall request comments from the fish and wildlife division of the department or other knowledgeable sources.

CHAPTER 71
FLOOD PLAIN OR FLOODWAY DEVELOPMENT—WHEN APPROVAL IS REQUIRED

567—71.2(455B) Channel changes. Approval by the department for the construction, operation, and maintenance of channel changes shall be required in the following instances.

71.2(1) *Rural areas.* In rural areas:
a. Channel changes not otherwise associated with road projects in or on the floodway of any stream draining more than 10 square miles at the location of the channel change.
b. Channel changes associated with road projects in or on the floodway of any stream draining more than 10 square miles at the location of the channel change whereby either (i) more than a 500-foot length of the existing channel is being altered or (ii) the length of existing channel being altered is reduced by more than 25 percent.

71.2(2) *Urban areas.* In urban areas channel changes on any river or stream draining more than 2 square miles at the location of the channel change.

71.2(3) *Protected streams*. Channel changes at any location on any river or stream designated as a protected stream pursuant to division III of 567—Chapter 72.

71.2(4) *Channel change by drainage district*. Rule 72.2(455B) applies to channel changes sponsored by a drainage district. However, approval is not required for repair and maintenance of a drainage district ditch as defined in 70.2(455B) if the drainage area of the ditch at the location of the proposed work is less than 100 square miles.

CHAPTER 72
CRITERIA FOR APPROVAL

567—72.2(455B) Channel changes. The following criteria shall apply to channel changes.
72.2(1) *Percent reduction in length.*

a. Streams draining over 100 square miles. For streams (other than protected streams) draining more than 100 square miles, no more than a 10 percent reduction in the original length of the existing channel through any contiguous parcel(s) of the applicant's(s') property will be allowed.

b. Rural streams draining 10 to 100 square miles. For streams (other than protected streams)

draining between 10 and 100 square miles in rural areas, no more than a 25 percent reduction in the original length of the existing channel through any contiguous parcel(s) of the applicant's(s') property will be allowed.

c. Urban streams draining 2 to 100 square miles. For streams (other than protected streams) draining between 2 and 100 square miles in urban areas, no more than a 25 percent reduction in the original length of the existing channel through any contiguous parcel(s) of the applicant's(s') property will be allowed.

d. Protected streams. For protected streams no channel changes will be allowed, because of actual or potential significant adverse effects on fisheries, water quality, flood control, flood plain management, wildlife habitat, soil erosion, public recreation, the public health, welfare and safety, compatibility with the state water plan, rights of other landowners, and other factors relevant to the control, development, protection, allocation, and utilization of the stream. Protected stream status does not prohibit bank stabilization measures; tree maintenance or removal; maintenance or installation of tile outlets; machinery crossings, including concrete drive-throughs and bridges; boat or canoe ramps; or other structures permitted by the department; nor restrict riparian access to the protected stream for such uses as livestock watering or grazing. Protected stream status does not affect current cropping practices or require the establishment or maintenance of buffer strips, filter strips or fences along protected streams.

72.2(7) *Fish and wildlife habitat and public rights.* The channel change shall not have a significant adverse effect on fish and wildlife habitat or public rights to use of the stream. Conservation easements and other conditions may be required to mitigate potential damages to the quality of water, fish and wildlife habitat, recreational facilities, and other public rights.

72.2(8) *Soil erosion.* The tillage of land along the reach of a straightened stream shall be prohibited or modified when necessary to hold soil erosion to reasonable limits. Zones of land in which tillage shall be prohibited along the straightened reach shall be set on a case-by-case basis with consideration given to topography, soil characteristics, current use, and other factors affecting propensity for soil erosion. The tillage prohibition shall be recorded by the department in the office of the appropriate county recorder and shall run with the land against the applicant and all successors in interest to the land subject to the prohibition.

72.31(2) *Channel change variances.* The department may grant variances to the criteria stated in this chapter for channel changes (other than channel changes on protected streams) only in the following instances:
(a) For comprehensive flood control projects in urban areas where channelization is the best alternative available;
(b) for public projects such as roads or road grade protection where a channel change is the only reasonable and practicable alternative;
(c) in cases whereby natural channel erosion has significant probability of eroding the structural stability of a building or other structure and bank erosion control measures are not feasible or practical under the circumstances;
(d) in other cases where the applicant can clearly show that there are no adverse effects on the public interest.

72.31(3) *Protected stream channel change variance*. The department may grant variances to the prohibition of channel changes on protected streams for those cases listed in 72.31(2)*"b," "c,"* and *"d,"* but such variances will be with provisions for mitigation of environmental damage.

567—72.32(455B) Protected stream information. The following describes the variance procedure and the relation of hydrologically connected streams to protected streams:

72.32(1) *Protected streams variance procedure.* The variance shall be requested as part of the permit application and review process provided for in rules 567—70.3(17A,455B,481A) to 70.5(17A,455B,481A) and decisions on the variance request may be appealed in accordance with rule 567—70.6(17A,455B,481A). If the applicant is denied a permit to channelize a protected stream, the applicant may appeal to the environmental protection commission. The appeal will normally be heard by an administrative law judge but the applicant may request that the commission hear the appeal directly. If a proposed decision of an administrative law judge would affirm the denial of the permit, the applicant may appeal the administrative law judge's decision to the commission. If, on appeal, the commission affirms the denial of the permit, the applicant may appeal to the district court.

72.32(2) *Hydrologically connected streams.* Streams or waters that are hydrologically connected to protected streams are not protected streams unless specifically listed as protected streams in 72.50(2). The environmental protection commission considers the streams and waters that are hydrologically connected to streams proposed to become protected streams as one of the factors in the decision-making process to add streams to the list of protected streams in a rule-making procedure. Subrule 72.51(7) lists the other factors that affect the decision.

72.32(3) *Protected stream activities.* Protected stream status does not prohibit bank stabilization measures; tree maintenance or removal; maintenance or installation of tile outlets; machinery crossings, including concrete drive-throughs and bridges; boat or canoe ramps; or other structures permitted by the department; nor restrict riparian access to the protected stream for such uses as livestock watering or grazing. Protected stream status does not affect current cropping practices or require the establishment or maintenance of buffer strips, filter strips, or fences along protected streams except as may be required to mitigate environmental damage associated with a channel change on a protected stream.

567—72.50(455B) Protected streams.

72.50(1) *Protected streams defined*. Protected streams shall include streams designated as protected streams pursuant to the procedures of 72.51(455B), which upon designation will be listed in 72.50(2). Streams hydrologically connected to protected streams are not protected streams unless specifically listed as protected streams in 72.50(2).

72.50(2) *List of protected streams.* Streams designated as protected streams are listed in this section.

72.51(7) *Basis for protected stream designation*. Commission determination of whether or not to classify a stream as a protected stream shall be based on the balancing of the costs and benefits of possible flood plain development as it would affect the following factors: (a) maintenance of stream fishery capacity; (b) water quality preservation; (c) wildlife habitat preservation; (d) flood control; (e) flood plain management; (f) existing flood plain developments; (g) soil erosion control; (h) the needs of agriculture and industry; (i) the maintenance and enhancement of public recreational opportunities; (j) the public's health, welfare and safety; (k) compatibility with the state water plan; (l) property and water rights of landowners; (m) other factors relevant to the control, development, protection, allocation,
and utilization of the nominated stream and water hydrologically connected to it.

APPENDIX B

Stream Channel Change Investigation
Field Survey Form

Date: _____

Applicant: _____

Stream: _____ County: _____

Legal Description_____

Description of Project Area
Topography_____
_____

Drainage Area: _____ Stream Distance_____

Ave. Channel Width _____ Ave. Water Depth_____ Max. Water Depth_____

Bottom Substrate Type_____

Stream Type: Intermittent ___ Permanent ____ Warmwater ____Coldwater ____

Confluence with_____within_____miles

Cover types associated with stream corridor _____
_____
_____
_____
_____

Instream habitat types: _____
_____
_____
_____

Fish and Wildlife species frequenting or inhabiting the stream (list and describe abundance-rare, moderate, abundant) _____
_____
_____
_____
_____

Describe Channel Change Proposal _____
_____
_____

_____
_____

Fish and Wildlife Impacts _____
_____
_____
_____
_____

Project Alternatives _____
_____
_____
_____
_____

Staff Recommendation:
Deny Application: (give justification) _____
_____
_____
_____
_____

Accept Application with mitigation or without mitigation (circle one and give justification for mitigation) _____
_____
_____
_____
_____

Fish Biologist_____ Wildlife Biologist_____

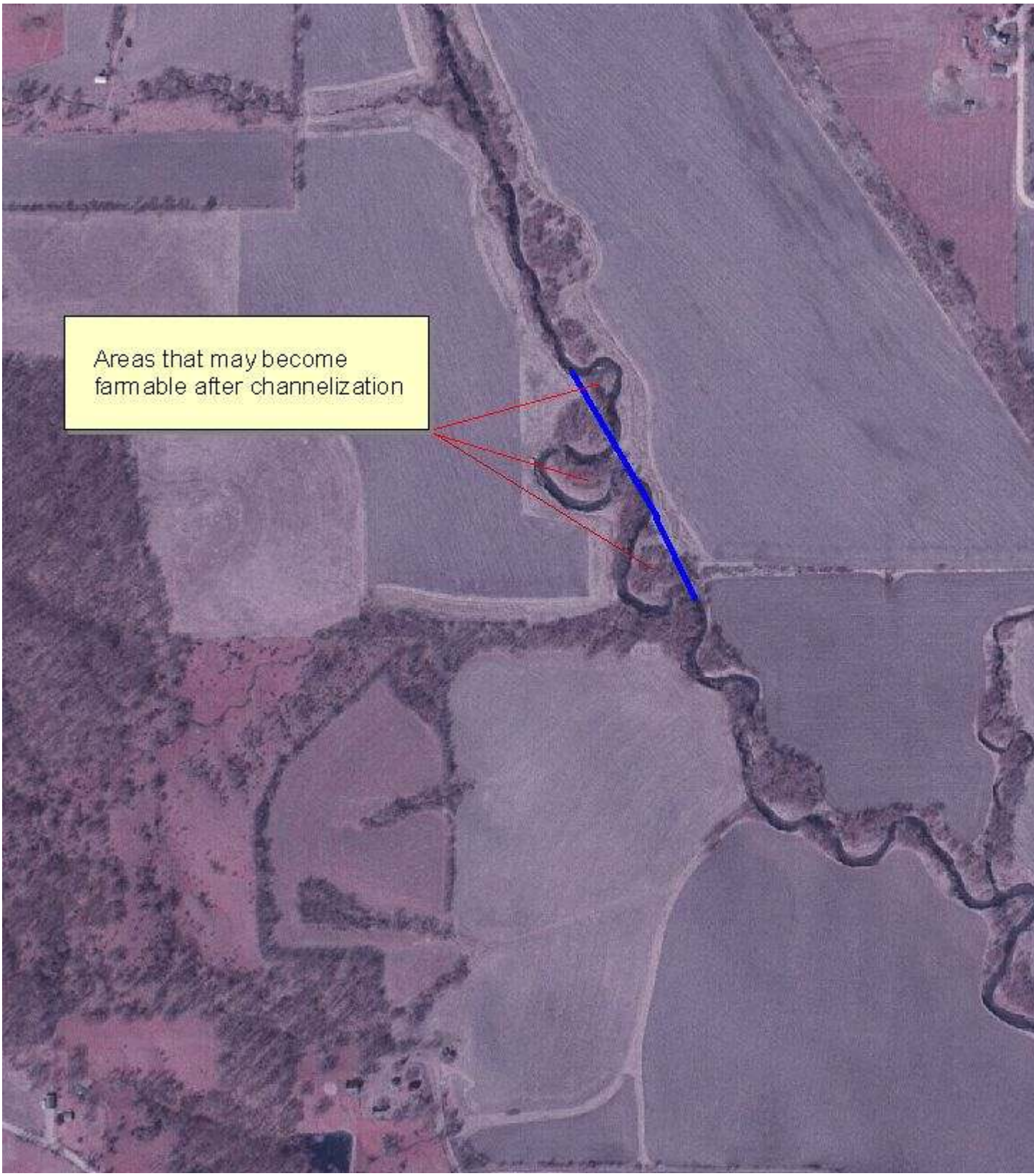


Figure 1. Area of land that could not be farmed because of the meandered portion of the stream that should be considered for mitigation .

REFERENCES

A Study of the Effects of Stream Channelization and Bank Stabilization on Warm Water Sport Fish in Iowa. Subproject No. 1 -- Inventory of Major Stream Alterations in Iowa. Ross V. Bulkley, Iowa Cooperative Fishery Research Unit, Iowa State University, Ames

> "When settlers first broke the prairie sod, it is reasonable to assume that from 1,000 to 3,000 more miles of stream existed in the state than are present today." Since 1900 estimates of stream loss for the Missouri River drainage are 1,240 miles and for the Mississippi River drainage 1,775 miles.

Subproject No. 2 A Study of the Impact of Selected Bank Stabilization Structures on Game Fish and Associated Organisms. Arthur L. Witten and Ross V. Bulkely.

> Four types of bank stabilization structures installed mainly for highway protection -- revetments, retards, permeable jetties, and impermeable jetties -- were studied during the summer and fall of 1974 to determine their impact upon game fish habitat in Iowa streams.
>
> "Stream alterations can have great impact on fish populations by reducing cover (logs, overhanging banks, etc.) increasing sediment carrying capacity, and eliminating pools and riffles. Pools are necessary for the survival of fish in some streams, particularly in the late summer low-water period. Additionally, the change in substrate caused by channelization may drastically reduce populations of fish food organisms and hinder their re-establishment."
>
> "Permeable jetties and retards deepened the channel near the structures."
>
> "Two factors, the short length of the jetties and the small diameter of rocks used, limited the value of bank stabilization jetties studied in improving the stream habitat for game fish. None of the jetties projected more than a few meters into the stream. To significantly improve game fish habitat, jetties should extend at least one-third stream width out into the channel. Longer jetties cause the formation of larger scour holes and backwaters, and thus increase habitat diversity."
>
> "Large-diameter boulders (greater than one cubic meter) would have increased habitat diversity more than the smaller diameter rocks found in the structures studied. Large boulders create backwater and slow-water pools along the bank, and fish use the resulting eddies for cover and nesting. In contrast, small rocks provide better bank stability and are hydraulically more efficient, but have much less effect on fish habitat."
>
> "The rock structures studied fostered the growth of certain invertebrates (notably mayflies and caddis flies), and these same invertebrates were a significant part of the diet of game fish found near the structures. The small impermeable jetties, however, seemingly did not present enough rock substrate to make a significant difference in invertebrate abundance. The much more extensive rock revetments presented enough rock substrate to support abundant rock-dwelling invertebrates."
>
> "A long rock jetty, extending far enough into the stream to produce a scour hole, would combine most of the advantages noted in the structures studied. From the standpoint of

habitat improvement, rock seems superior to steel as a construction material, and structures which cause the formation of scour holes superior to those which do not deepen the stream."

Subproject No. 3 -- Some Effects of Short-Reach Channelization on Fishes and Fish Food Organisms in Central Iowa Warm-Water Streams. Lawrence Robert King and Kenneth D. Carlander.

Six central Iowa steams were studied in 1974 to determine whether fish and fish food organisms were affected by short-reach channelization associated with bridge replacement in the last 15 years.

"More fish species were collected by electroshocking in unchannelized than in channelized locations in five of the six streams and in the sixth the number of species was the same in both localities. The most evident impact of short-reach channelization is the removal of cover in the altered area and the loss of stream length."

Subproject No. 4 -- The Effects of Long-Reach Channelization on Habitat and Invertebrate Drift in Some Iowa Streams. David William Zimmer and Roger W. Bachman.

"Relationships between channel morphometry, habitat diversity, and invertebrate drift density were studied in 11 natural and channelized stream segments of the upper Des Moines River Basin during 1974 and 1975. The most obvious effect of channelization on stream habitat was a reduction in the diversity of water depth and current velocity. There was a significant (P=.05) positive correlation between channel sinuosity and the variability of stream depth and velocity. Invertebrate drift density, expressed as biomass and total counts, was also correlated with channel sinuosity. Sinuous streams had greater concentrations of drifting organisms than did straight channels. The impact of channelization on habitat diversity and invertebrate drift density might be minimized if channels were designed with greater sinuosity index values.

Effects of Stream Channelization of Fishes and Bottom Fauna in the Little Sioux River, Iowa. Completion Report No. A-035-IA Iowa State Water Resources Research Institute. Douglas R. Hansen and Robert J. Muncy.

Differences in certain physical factors, bottom fauna, and fish populations were evaluated in channelized and unchannelized portions of the Little Sioux River, Iowa, during 1969-71.

"Recorded water temperatures showed greater daily fluctuations during summer in the channelized section. Maximum and mean daily water temperatures averaged 0.3C and 1/3C, greater, respectively, in the channelized section during July. Consistently higher turbidities were measured in the channelized section during a period of low runoff, averaging 31.2 percent higher than the unchannelized section."

"Removal of stream bank cover was an important factor contributing to such conditions as higher water temperatures and higher suspended sediment loads from channel erosion in the channelized section. Higher maximum and mean daily water temperatures could approach upper lethal levels of such species as walleye."

An Evaluation of Steam Modification in the Olentangy River, Ohio, Clayton J. Edwards, Bernard L. Griswold, and Gary C. White.

"Comparisons of fish species composition and relative, abundance were made between a natural section of the Olentangy River, Ohio; a section modified in 1970 by the construction of artificial riffle-pool structures; and a section modified conventionally in 1950 by shortening, widening, and deepening the channel. Thirty-six species ere collected in the natural area, 34 in the riffle-pool area, and 28 in the conventionally modified area."

Effects of Channel Modification of the Luxapalia River, Dale H. Arnen, H. R. Robinette, John E. Fraiser, and Marion Gray.

"Biological data collected over a period of two years from an old channelized segment, an unchannelized segment, and a newly channelized segment revealed the following: There were no evident differences in water Quality between the three segments with the exception of turbidity which was higher in the newly channelized segment. Species diversity of macroinvertebrates and fish was much greater in the unchannelized segment. Average weight of largemouth bass was much greater in the unchannelized that either of the channelized segments."

"Studies of abundance of furbearers associated with the river were obtained by night-lighting, sign count, and trapping. Muskrat and beaver were far more numerous in the unchannelized segment than in either the old or new channelized segments."

Channeling is detrimental to wildlife. The combination of channeling and tiling allows for more intensive farming of floodplain areas. Wildlife losses occur as the habitat diminishes. Wildlife population is directly related to the amount of interspersion of cover, or amount of "edge". Edge can be defines as the zone where tow types of cover comes together, such as where food and nesting cover meet.

In channeling a stream the linear length of the stream is reduced as is the amount of edge.

Aldo Leopold, in his book of Game Management, review edge as follows:

Game as an Edge-effect; Law of Interspersion. Game is a phenomenon of edges. It occurs where the types of food and cover which it needs come together, i.e.; where their edges meet. Every grouse hunter knows this when he selects the edge of a woods, with its grape tangles, haw-bushes, and little grassy bays, as the likely place to look for birds. The quail hunter follows the common edge between the brushy draw and the weedy corn, the snipe hunter the edge between the marsh and the pasture, the deer hunter the edge between the oaks of the south slope and the pine thicket. Even the duck hunter sets his stool on the edge between the tules and the celery beds. Wight finds that pheasants nest in the outer edge of the hayfield where it adjoins the fencerow; the Grouse Report finds that grouse nest on the edge where the young heather adjoins the old; Stoddard and Maxwell say that bobwhite and Hungarian partridge often choose the edges of open roads or trails for nesting. Even wild turkeys show a curious tendency to nest at the edge of trails. We do not understand the reason for all of these edge-effects, but in those cases where we can guess the reason, it usually harks back either to the desirability of simultaneous access to more than one environmental type, or the greater richness of border vegetation, or both."

"It will also be observed that edge-effects are most numerous in game of low mobility and high type requirements. I know of few convincing instances where edges attract mobile, one-type game like geese, or buffalo, or antelope, or plover, or sea-ducks."

"The linear mileage of type edges available in any block of range is, as a matter of geometry, proportional to the degree of interspersion."

Reuben E. Trippenser, in Wildlife Management of Upland Game and General Principles, reviews interspersion or diversified cover.

Food and Cover Development. The successful propagation of quail in their natural habitat depends upon the development of a diversified cover, which for best results should contain cropland, grassland, brushland, and woodland in about equal proportions and will distributed in small units. Diversification effects a more nearly uniform distribution of coveys, discourages wandering, and improves productivity. Where diversification is lacking, the birds tend to migrate locally to more attractive habitat elsewhere.

"Extensive areas of cropland in large continuous units can be greatly improved as a quail habitat by the development of cover lanes, or strip that traverses the tract at intervals. These lanes encourage the quail to make use of range previously avoided because proper approach and escape cover were lacking. In a habitat of this nature suitable cover is sparse and often widely scattered in small islands entirely isolated from similar units. Here the problem is one of providing safe avenues of travel along which the birds can move from one cover unit to another or to spots in the adjacent fields or cropland where food is plentiful."

Fish Populations of Iowa Rivers and Streams. Technical Bulletin No. 3 Vaughn Paragamian, Iowa Department of Natural Resources, May 1990

"Total standing stocks ranged from 10.9 lbs/ac in a channelized reach of the Chariton River (Southern Iowa Drift Plain) to almost 2,300 lbs/ac in the East Fork Des Moines River (Des Moines Lobe). Analysis of variance comparisons of the means showed habitat quality was the main factor for significant differences ($P<0.05$) between total standing stocks of fish. Further comparisons indicated there was no difference in total standing stocks of fish within and between landforms. Altered streams had significantly lower standing stocks of fish ($P<0.05$) than unaltered sites. Headwater streams were important to sport fish, while habitat quality and diversity was the most important factor to fish abundance and biotic diversity."

"Cylinder Creek, a ditched stream in the Des Moines Lobe, was uniform in depth, substrate, current velocity and thus provided little habitat to fish."

"The importance of headwater streams to sport fish populations of larger rivers is not well documented, but 86% of the smaller second and third order streams were inhabited by young-of-the-year of one or more species of sport fish important to the fisheries of larger receiving streams. These small streams appear to be important spawning and nursery sites for sport fish that may later recruit to larger streams; however, a better understanding of this relationship is needed."

An Evaluation of Effects of Weirs in Walnut Creek, Seven Mile Creek, and Turkey Creek on Fish Abundance and Movement, Completion Report to the Iowa Department of Natural Resources

Fisheries Bureau Contract No: 01-8250-02, Chris J. Larson, Gary J. Atchison, and Bruce W. Menzel, February 2003.

> "Fish population sampling efforts in southwest Iowa tributary streams indicate a lack of species diversity and reduced gamefish populations following 11 years of grade control weirs constructed in streams to control erosion. Over 400 of these weirs have been constructed in this region since 1992, yet 400+ more are proposed or under construction. Most of the structures are of one design, involving a 4 foot high sheet piling dam and a 4:1 (length: height) back slope constructed of rock rip-rap. In 2000, Iowa Department of Natural Resources (IDNR) fisheries personnel, in conjunction with Iowa State University (ISU) Natural Resource and Ecology Department, and Hungry Canyons Alliance (HCA) implemented a 2-year study on the effects of modified and unmodified grade control weirs on fish population dynamics and movement. The study was conducted on three southwestern Iowa tributary streams. The lowermost six weirs on Walnut Creek were modified from 4:1 back slopes to 20:1 back slopes during the winter of 2000-2001. The existing 4:1 weirs in Turkey Creek and Seven Mile Creek were not modified. Personnel from the ISU began studying fish movement patterns in selected stream reaches from May through July of 2001 and 2002. Hoop nets and minnow traps with used to capture fish at predetermined sites. Selected species were monitored using mark and recapture techniques. All channel catfish, bullheads, flathead chubs and creek chubs were marked with site specific fin clips or tags for subsequent recapture information and movement analysis. Results of the two-year study indicate some bi-directional movement of channel catfish and flathead chubs over 20:1 modified weirs with very limited movement for all species over 4:1 weirs."

> "Numerous studies have been conducted on the possible impacts on fish populations from restricted fish migration opportunities. Dams and weirs have been implicated in the decline of numerous fish species. Potential consequences of restricted up or downstream fish passage include the disruption of migration behavior and reproductive activity and impeded access to foraging and wintering areas. These factors may combine to limit growth, recruitment, overwinter survival, and population size (Wlosinski et al, 2000, Dames et al, 1989). As more of these structures have been built, a concern has developed that these stream blockages have promoted decline of migratory fishes."

Recovery of Prairie Fish Assemblages at the Transition from Channelized to Nonchannelized: Implications for Conservation of Natural Channels, Jason C. Vokoun, Natural Areas Journal Volume 23 (4), 2003.

> "Fish assemblages were systematically sampled along the transition from channelized to unchannelized reaches in seven streams in northern Missouri, USA. Streams ranged in size from 4th to 8th order. Maximum species richness was reached 3-4 km downstream from the end of channelization. A limited core group of 10 species was present at most of the sites (channelized and unchannelized locations), and a diverse group of 45 species was present at relatively few sites (rarely channelized locations). The core group consisted largely of tolerant, omnivorous species and contained no top carnivores. The 45-species divers group included a greater proportion of intolerant, benthic invertivorous, lithophilous, and carnivorous species. The effect of channelization extended well into unchannelized reaches and should be considered by conservation planners."

Downstream Natural Acres as Refuges for Fish in Drainage-Development Watersheds, James E. Luey and Adelman, Ira R., 1980. Transactions of the American Fisheries Society, 109:332-335

> "Agricultural drainage development in southwestern Minnesota involves installation of tiles to drain subsurface water, creation of tributary ditches, and channelization of existing streambeds. The presence, abundance, and diversity of fishes collected in downstream unmodified areas of drainage-developed and undeveloped streams indicate that any downstream impacts are much less severe than impacts demonstrated by others within developed areas. These natural areas appear to serve as reservoirs for stream biotas and should be preserved as refuges for fish species inhabiting those streams."

Mitigating Effects of Artificial Riffles and Pools on the Fauna of a Channelized Warmwater Stream, Clayton J. Edwards, etc., 1984. American Journal of Fisheries Management, 4:194-203.

> "The effect of stream channelization on macroinvertebrates, fish, and the sport fishery was studied in the Olentangy River at Columbus, Ohio. Macroinvertebrate abundance, diversity indices, standing stock in the benthos, and drift were significantly lower in a channelized area than in either a natural area or a channelized area mitigated with artificial riffles and pools. Predominant macroinvertebrates were moving-water forms in the natural and mitigated areas, and burrowing forms in the channelized areas. Diversity indices and relative abundance of game fish were significantly lower in the channelized area than in the natural and mitigated area. However, some nongame species became relatively abundant in the mitigated area when compared to the natural area. Composition of the sport fishing catch and catch rates accurately reflected the predominant fish community in each area. The biota in the area mitigated with artificial riffles and pools was similar to the biota in the natural areas."

Standing Stocks of Fish in Some Iowa Streams, with a Comparison of Channelized and Natural Stream Reaches in the Southern Iowa Drift Plain. Vaughn L. Paragamian, 1987 Proc. Iowa Academy of Science 94(4): 128-134.

> "Comparisons were made of fish populations inhabiting 11 channelized and natural stream reaches in the Southern Iowa Drift Plain and two drainage ditches in the Des Moines Lobe. Total standing stocks of fish ranged form 14 kg/ha at a channelized site on the Chariton River to 1,344 kg/ha at an unchannelized site on the same river. Number of fish species ranges from six to 16. Channelized sites contained fewer fish and substantially lower standing stocks of fish than natural reaches; however the number of species sampled was often similar. The abundance of sport fish was significantly higher in the natural stream reaches, particularly channel catfish, flathead catfish, bullhead and carp. The major differences in fish populations were due to habitat quality and diversity found in the natural sites as compared to the homogeneous habitat of channelized reaches."

Movements of Channel Catfish and Flathead Catfish between the Missouri River and a Tributary, Perch Creek. Dames, R.H., Coon, T.G. and Robinson, J.W. 1989. Transactions of the American Fisheries Society. 118:670-679, 1989.

Fish Passage Through Dams on the Upper Mississippi River. Wlosinski, J.H. and Surprenant, C. 2000. Coordination Report (draft copy), Mississippi River Long Term Resource Monitoring Station, On Alaska, Wisconsin.

CHAPTER 9. AQUATIC PLANT SAMPLING

Goals of a standardized plant sampling regime:

1. Be efficient, taking a day or less to complete.
2. Be repeatable.
3. Be unbiased, sampling all aquatic habitats and species present.
4. Obtain data that are quantifiable, and allow statistical comparisons.
5. Be flexible, allowing the surveyor to do both a cursory and a more comprehensive sample based on objectives, e.g. produce a plant distribution map, find frequency of occurrence and track changes over time, give surveyor a way to track changes in density.
6. Positive ID of aquatic plant samples.
7. Incorporate data into a web-based database.

INTRODUCTION

Vegetation is an important facet of lake ecology. Invertebrates use aquatic plants, young of the year (YOY) fish escape predation in both submersed and emergent vegetation, and fish feed on organisms associated with vegetation. Birds, amphibians, and terrestrial animals also associate with aquatic plants for food and cover. Despite the obvious benefits of aquatic vegetation, too much can be a detriment. Both the eutrophic conditions of many of Iowa's lakes and increasing numbers of post-renovation lakes with clear water can lead to algal blooms impairing water quality as well as nuisance growths of vascular plants inhibiting recreational use (Henderson 1996), and causing slow growth and an imbalance in sportfish populations (Mitzner 1978; Colle and Shireman 1980; Valley et al. 2004).

For these reasons control of nuisance plant growths has been a primary concern of lake managers. Both herbicides and grass carp (*Ctenopharygodon idella*) have been used to control aquatic plants, though results short of vegetation eradication (a common result of grass carp stocking) have not been well documented.

Iowa does not have a standard method for surveying aquatic plants, making documentation difficult. Unbiased results can be documented and managers will be better equipped to make sound management decisions by developing a standard method of vegetation sampling.

Several methods are available to survey aquatic plants and the variety of sampling regimes continues to grow with further advances in technology. Geographical Information Systems (GIS) and Global Positioning Systems (GPS) have been beneficial in mapping aquatic vegetation coverage. Hydroacoustics, point-intercept and transect surveys are being used to assess biovolume, biomass, presence/absence data, and frequency of occurrence. Each method is designed to analyze different aspects of a plant community and careful consideration needs to be addressed when deciding on a method to use.

Hydroacoustic equipment is used to assess plant abundance in lakes and in recent years, with the introduction of GPS, hydroacoustics has become more useful and reliable. Bathymetric and biovolume maps of aquatic vegetation can be constructed from one survey.
Additional surveys must be conducted if species richness and emergent vegetation maps are objectives of the sampling methodology. Sounding equipment and software used to analyze the data is expensive and technical training is required to operate the equipment and software package.

Point-intercept sampling is most suited for whole lake or large plot assessments (Madsen 1999). Stratified random point sampling is the most common method of point intercept sampling used to assess aquatic vegetation in lakes and is used by the Long Term Resouce Monitoring,LTRM, on the Upper Mississippi River,UMR, (Yin, et. al. 2000). Points are set up on a grid at predetermined distances and are given GPS coordinates. Each point is then located on the lake using a GPS unit and sampled from a boat. One drawback is that, especially on long, narrow lakes, areas close to shore may not be well represented in the survey therefore biasing your data. Bruce (2006) compared the stratified random point intercept method to a modification of transect sampling and found fewer species in the point intercept survey. Additional species found with the modified transect were characteristic of near shore aquatic habitats.

Transects are a versatile aquatic plant sampling method and can be modified to fit the objectives of the study (Titus 1993). Generally, snorkeling or diving is employed to observe and enumerate plant species that intersect a line or are contained along a line within a predetermined width in water greater than 3 feet (Madsen 1999). Madsen and Bloomfield (1993) found the transect method strong in indicating species composition of a community and charting the distribution of species. Transects can also be useful in charting the effect of management practices on species diversity in small plots.

JUSTIFICATION

With the above goals in mind, we have elected to use a transect method as a first approach to sample aquatic vegetation in Iowa lakes.

Random Transect Survey

Setting Up Transects

1. Total number of transects are determined by the total surface acres of the lake (Quist et al. 2007). Transect starting locations will be randomly selected around the perimeter of the lake using ArcView (Figure 2).
    a. <100 acres = 13 transects
    b. 100 - 250 acres = 19 transects
    c. 250 - 500 acres = 25 transects
    d. 500 – 1,000 acres = 29 transects
    e. 1,000 acres = 49 transects

2. Transect starting locations will be marked with UTM coordinates using the NAD83 map datum.
    a. Map datum options can be found in the setup screen of your GPS unit.

Site Selection and Location

1. Vegetation transects
    a. Randomly select points at full pool height around edge of lake using GIS software.
    b. Transects run perpendicular to the shore into the lake at each point.

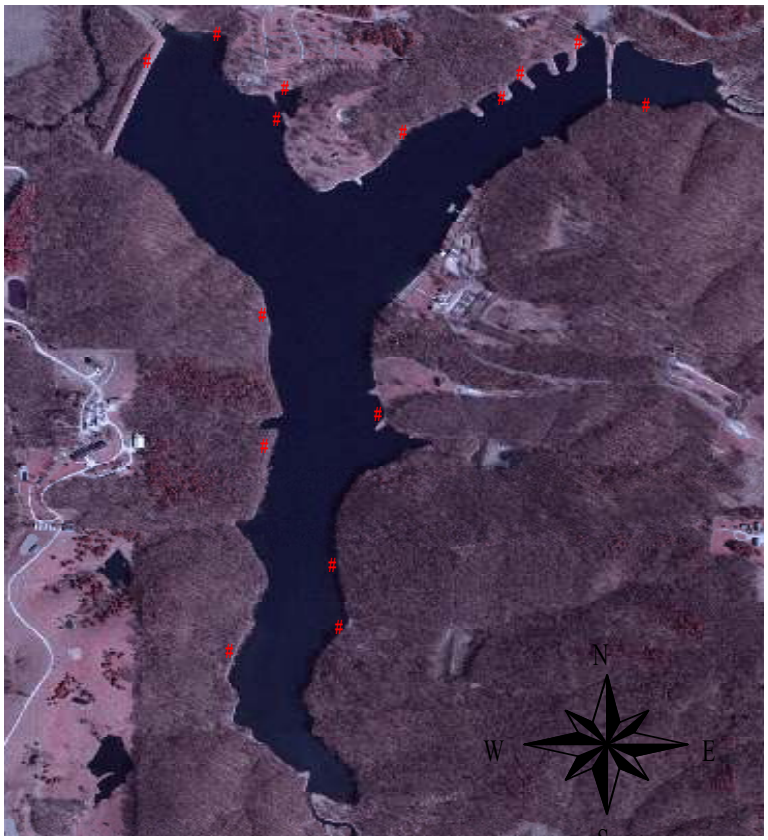


Figure 2. Lake showing randomly chosen vegetation transect locations.

Survey Procedures

1. **Timing:** surveys will be conducted from May 1st through September 30th. All samples should be taken on a single day or on consecutive days if more time is needed. Most plant species obtain maximum biomass and maturity in July and August, therefore these are the most favorable times to sample.

    a. When surveying specifically for curly-leaf pondweed (*Potamogeton crispus*) timing will typically be in May compared to early August with other species based on its life cycle (Borman et al. 1999). Curly-leaf is also known to change growing patterns from one system to another (Madsen, 2005). Though uncharacteristic, curly-leaf plants have been found sprouting in July with 81˚F water temperatures (L. Bruce, pers. comm)

2. **Water level** must be taken before each survey is started (i.e. how far above or below the outlet structure is the water level).

    a. The location used to calculate lake level should be a permanent fixture on the lake and be marked with UTM coordinates for future survey use. Outlet or other permanent structures are preferred over docks, stakes, or trees.

3. **Transects** will be sampled perpendicular from the shoreline outward at 2' contour depth increments to a minimum of 8' of water, i.e. a minimum of five samples will be collected at each transect . Each transect will always start at the water's edge and continue outward perpendicular to shore. Transects are complete when two consecutive samples taken in water are void of vegetation and water depths have been sampled out to at

least 8' depth, or water depth starts to decrease instead of increase i.e. you start to go up the other shoreline or an island.

Stations along the transect at each contour will be collected at the beginning of each contour, i.e. if you are sampling the 2' contour the sample will be collected as soon as the water depth reaches 2' not somewhere between the 2' and 4' contour. Depth will be determined using the sample rake and not sonar equipment.

Vegetation is only sampled out to 16' of water and recorded as both rake and individual species density. After the 16' contour has been sampled one additional rake grab will be collected at the 18' contour and vegetation will be recorded as present or absent.

Example: Lost Lake is 6' low and the protocol is to sample every 2' of contour change. The first sample is located at the waters edge. Rake grabs at contour depths 2', 4', and 6' did not have vegetation but you still continue sampling on the contours until you reach 8' of water.

4. **Floating hoop/quadrate:** is only used to sample emergent and floating leafed vegetation. If only submersed vegetation is present the double sided rake will be the only sampling equipment used for that specific sample point. Always sample emergent and floating leafed species with the hoop before pulling a rake sample.

Sampling a transect for emergent and floating leafed species.

1. A 1-m (3.3-ft) diameter hoop/quadrate will be used to sample emergent and floating leafed vegetation (Figure 3). The hoop will be placed over the same area the rake sample will be collected. If emergent and/or floating leafed vegetation is found on the 1st sample point the edge of the hoop will be placed where the water meets the shoreline so the entire area of the hoop is in the water. Emergent and floating leafed species should be evaluated before submersed species are sampled.

Figure 3. Floating hoop used to sample emergent and floating vascular plants.

2. After the hoop is placed on the water, percent coverage of all emergent and/or floating leafed plants is recorded together. Plants must be on the surface or breaking the surface to be considered for the plant coverage rating. When floating in a mat, filamentous algae will be included in floating plant density as ALGAE.

3. Wind-rowed submersed vegetation, and submersed vegetation without floating leaves will not be included in the emergent/floating leafed coverage.

4. Each sample will then be visually separated by individual species and recorded as a percent of the total plant material seen inside the quadrate. Each plant species has a four to six letter code (Appendix 2) for recording on datasheets. The percentages should add up to 100 for each station on the transect.

Sampling on a transect for submersed species

1. Samples of submersed plant species will be collected using a double sided rake (Figure 4). Two garden rakes measuring 14" wide and having 14, 2-inch long teeth, are welded together and attached to an extendable pole (Yin et al. 2000). If emergent or floating leafed plants have been sampled first, the rake should be placed in the same location as the floating hoop. Depth should be read on the pole. Substrate composition should be noted and recorded at this time.

2. To sample submersed species, the rake will be dropped to the bottom and twisted 180 degrees. If the rake has more than a strand or two of vegetation or is muddy, before estimating rake density or pulling the rake into the boat, pull the rake horizontally (swish) through vegetation-free water to rinse and compact vegetation on the rake head (Yin et al. 2000). If there are long strands of vegetation trailing the rake during this maneuver, catch them with the leading tines of the rake while underwater, and then pull the rake into the boat.

Figure 4. Twenty-foot long, two-headed rake used for submersed vegetation sampling.

3. After the rake has been pulled out of the water plant material still hanging off the rake head (i.e. not on the rake pole) can be added to the tines. Plant strands hanging off the rake pole should be ignored. In some instances where plant strands are added to the rake tines gentle compaction of the plants on the tines may be warranted (Figure 5).

Figure 5. Lightly compact vegetation on the rake after plant strands have been added to the rake head.

4. Density of the entire rake sample will be estimated as a percentage (Table 1). These estimates should be based on an average of the entire rake, i.e. if one side of the rake has 20 percent coverage and the other side has 40 percent coverage the rake density estimate entered on the data sheet would be 30 percent.

5. The entire rake sample will then be taken off the rake head and separated by individual species. This can be done either with visual observation, or by physically going through the sample. We recommend the former until each sampler's ability becomes more proficient. Proficiency will develop with more experience. Abundance of each species is then recorded as a percent of the whole sample. (Again, do not include plants that are on the rake pole.) These individual species percentages should add to 100. Each plant species has a code for recording on datasheets. Filamentous algae will be included in submersed plant density as a single species – noted as ALGAE.

6. Data sheets are posted at: http://www.iowadnr.com/fish/programs/library.html

Table 1. Examples of plant rake densities.

Voucher Specimen Collection

1. As new species are encountered, they should be saved as a voucher specimen. Digital photos should be taken at the same time to include with the pressed plant. It is always recommended to press plants that have seeds or fruiting structures. Many times these are the only thing that will allow the plant to be keyed to species. Other structures to take and things to note when taking an unknown plant from the field for lab i.d. include: substrate type, water depth, plant height, root type, growth form and abundance. There is a note-taking sheet on the web (with the data sheet) for field use that will be helpful when taking samples for lab i.d. and voucher purposes.

2. Plants collected in the field should be stored in water until you identify and press them, coolers or zip-lock bags filled with water work well for storing plants in the field.

3. The Cold Springs office and the Decorah office will be available to help you with plant i.d. Send us your digital photos and we'll do what we can to identify to species.

4. Plant presses are designed to dry the plant as quickly as possible (Figure 6). To press a delicate, submersed or floating leafed plant, the specimen can be floated in a pan of water and a piece of newspaper slid underneath and carefully lifted out. Place this wet paper on top of other newspapers to dry excess moisture without desiccating the plant. Flowers or fruiting structures should be clearly visible, move leaves and stems if necessary. Label specimen with date sampled, lake, and species (if known).

5. Especially with emergent species, pull, clean and press a portion of the plant's roots. Stems can be cut or folded, and plant height noted in the field notes. Always press the seed head with the plant. Thick structures may need to be cut in half before pressing.

6. Plant presses are arranged for plant pressing in the following sequence of steps:

    a. Bottom of plant press
    b. Cardboard
    c. Blotter paper(thick paper towel)
    d. Newspaper
    e. Plant
    f. Newspaper

g. Blotter paper(thick paper towel)
h. Cardboard
i. Top of plant press
j. Wrap straps around frame and tighten.

7. The press should be put in a warm place to speed the drying process (e.g. inside a vehicle on a warm day).

8. Multiple plants can be preserved in one plant press at the same time as long as there is only one plant between each layer of newspaper, blotter paper, and cardboard.

Figure 6. Plant press showing layers of material in sequence for one specimen.

9. Once pressed and dried, specimens on the newspaper can be saved in a clear plastic sheet protector with field and i.d. notes. Sheets can be stored in a large envelope. Cold Springs staff will mount your plants onto herbarium sheets. This will insure that the plants don't deteriorate, and provide a long-term record.

Equipment

1. Aquatic Plant Identification Book
2. List of species present if available
3. Zip-Lock bags for voucher specimen collection
4. Cooler with ice for bagged plants
5. Double sided rake
6. Floating quadrate
7. GPS Unit (preferably a Garmin model Map 76 or Map 76S)
8. Digital camera
9. Tub for sorting plants after each sample (boat washout deck works great)
10. Data sheets (waterproof paper)
11. Two anchors
12. Depth rod sectioned into 6" increments
13. Sonar
14. Secchi disk
15. Permanent marker
16. Laminated species list/code
17. Extra push pole other than the sampling rake

18. Extra batteries for GPS and digital camera

Sampling Definitions

- Transect – Line extending perpendicular from shore out to the edge of vegetation.
- Stations – Plant sampling points at fixed depth contours along each transect.
- UTM- Universal Transverse Mercator is a grid of coordinates used to designate transects and other georeferenced locations, i.e., water sample locations, fish sampling stations, etc.
- GPS- Hand held Global Positioning System used to mark starting locations for each transect.
- ArcView- Geographical Information System used to download coordinates from handheld GPS unit and to randomly select transects.
- Full pool- Level at which water begins to flow out of the lake.

Plant Identification Links

- www.plants.usda.gov
  - Contains plant codes used on data sheets
  - Keys to identify aquatic plants
- http://aquaplant.tamu.edu/database/index.htm
  - Texas A&M Plant Identification
  - Contains several color photographs
- http://www.ecy.wa.gov/programs/wq/plants/plantid2/categories.html
  - Washington State Plant Identification
- http://sdafs.org/reservoir/
  - Southern Division AFS Reservoir Committee
  - Contains information about site selection for aquatic plant establishment
- http://www.npwrc.usgs.gov/resource/type_i.htm
  - Northern Prairie Wildlife Research Center Plant Identifcation
  - Useful keys for identifying aquatic plants

HACCP Approach

Refer to HACCP found in the procedures manual.

References

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Appendix 1

Submersed			Emergent (con't)		
Common Name	**Scientific Name**	**Plant Code**	**Common Name**	**Scientific Name**	**Plant Code**
Bladderwort	*Utricularia macrorhiza*	UTMA	Burreed, Giant	*Sparganium eurycarpum*	SPEU
Brittle Naiad	*Najas minor*	NAMI	Cattail	*Typha sp.*	TYPHA
Bushy Pondweed / Slender Naiad	*Najas flexilis*	NAFL	Cattail, Common	*Typha latifolia*	TYLA
Canada Waterweed	*Elodea canadensis*	ELCA7	Cattail, Hybrid	*Typha × glauca*	TYGL
Southern Naiad	*Naja guadalupensis*	NAGU	Cattail, Narrowleaf	*Typha angustifolia*	TYAN
Coontail	*Ceratophyllum demersum*	CEDE4	Giant Reed	*Phragmites australis*	PHAU7
Pondweed	*Potamogeton sp.*	POTAM	Marsh Milkweed	*Asclepias incarnata*	ASIN
Pondweed, Claspingleaf	*Potamogeton richardsonii*	PORI2	Pickerelweed	*Pontederia cordata*	POCO14
Pondweed, Curlyleaf	*Potamogeton crispus*	POCR3	Prairie Cordgrass	*Spartina pectinata*	SPPE
Pondweed, Flatstem	*Potamogeton zosteriformis*	POZO	Purple Loosestrife	*Lythrum salicaria*	LYSA2
Pondweed, Floatingleaf	*Potamogeton natans*	PONA4	Reed Canarygrass	*Phalaris arundinacea*	PHAR3
Pondweed, Fries	*Potamogeton friesii*	POFR3	Rice Cutgrass	Leersia oryzoides	LEOR
Pondweed, Horned	*Zannichellia palustris*	ZAPA	Sedge	*Carex sp.*	CAREX
Pondweed, Illinois	*Potamogeton illinoensis*	POIL	Smartweed	*Polygonum sp.*	POLYG
Pondweed, Largeleaf	*Potamogeton amplifolius*	POAM5	Spikerush	*Eleocharis sp.*	ELEOC
Pondweed, Leafy	*Potamogeton foliosus*	POFO3	Spikerush, Small's	*Eleocharis palustris*	ELPA3
Pondweed, Longleaf	*Potamogeton nodosus*	PONO2	Sweet Flag	*Acorus americanus*	ACAM
Pondweed, Sago	*Stuckenia pectinatus*	STPE15	Water Horsetail	*Equisetum fluviatile*	EQFL
Pondweed, Small	*Potamogeton pusillus*	POPU7	Water Plantain	*Alisma plantago-aquatica*	ALPL
Muskgrass	*Chara vulgaris*	CHVU	Water Smartweed	*Polygonum amphibium*	POAM8
Watermilfoil, Eurasian	*Myriophyllum spicatum*	MYSP2	Water Willow	*Justicia americana*	JUAM
Watermilfoil, Northern	*Myriophyllum sibiricum*	MYSI	**Floating leafed**		
Water Stargrass	*Heteranthera dubia*	HEDU2	American Lotus	*Nelumbo lutea*	NELU
White Water Crowfoot	*Ranunculus aquatilis*	RAAQ	Duckweed, Big	*Spirodela polyrrhiza*	SPPO
White Water Crowfoot II	*Ranunculus longirostris*	RALO2	Duckweed, Little	*Lemna minor*	LEMI3
Widgeon Grass	*Ruppia maritima*	RUMA5	Duckweed, Star	*Lemna trisulca*	LETR
Wild Celery	*Vallisneria americana*	VAAM3	Mexican Water-fern	*Azolla mexicana*	AZME
Emergent			Pondweed, Floatingleaf	*Potamogeton natans*	PONA4
Arrowhead	*Sagittaria sp.*	SAGIT	Pondweed, Illinois	*Potamogeton illinoensis*	POIL
Arrowhead, Broadleaf	*Sagittaria latifolia*	SALA2	Pondweed, Longleaf	*Potamogeton nodosus*	PONO2
Arrowhead, Narrowleaf	*Sagittaria cuneata*	SACU	Waterlily, Fragrant	*Nymphaea odorata odorata*	NYODO
Blue Flag Iris	*Iris versicolor*	IRVE2	Waterlily, White	*Nymphaea odorata tuberosa*	NYODT
Bulrush	*Schoenoplectus sp.*	SCHOE	Waterlily, Yellow	*Nuphar lutea variegata*	NULU
Bulrush, Hardstem	*Schoenoplectus acutus*	SCAC3	Watermeal	*Wolffia columbiana*	WOCO
Bulrush, River	*Schoenoplectus fluviatilis*	SCFL11	Water Clover	*Marsilea spp.*	MARSI
Bulrush, Softstem	*Schoenoplectus tabernaemontani*	SCTA2	Water Shield	*Brasenia schreberi*	BRSC
Burhead, Upright	*Echinodorus berteroi*	ECBE2	**Other Codes**		
Burreed	*Sparganium sp.*	SPARG	Algae	*All species*	ALGAE
Burreed, Floating	*Sparganium emersum*	SPEM2	No Aquatic Vegetation		NOAQVEG
Quillwort	*Isoetes sp.*	ISOET	Unknown Species	*Unknown Species*	UNK

Source : http ://plants.nrcs.usda.gov/cgi_bin/topics.cgi?earl=dl_state.html

Appendix 2 (Cover Sheet)

Date _____ **Lake Code** _____ **Lake Level (in) +**_____-_____

Time _____ **Secchi Disk (in)**_____ **Algae Bloom?** Y / N_____

Wave Intensity (circle) Calm / Slight / Moderate / Severe / Extrer **Air Temp °F**

Wind Direction (circle) NW / N / NE / E / SE / S / SV **Conductivity (µmhos/cm)**_____

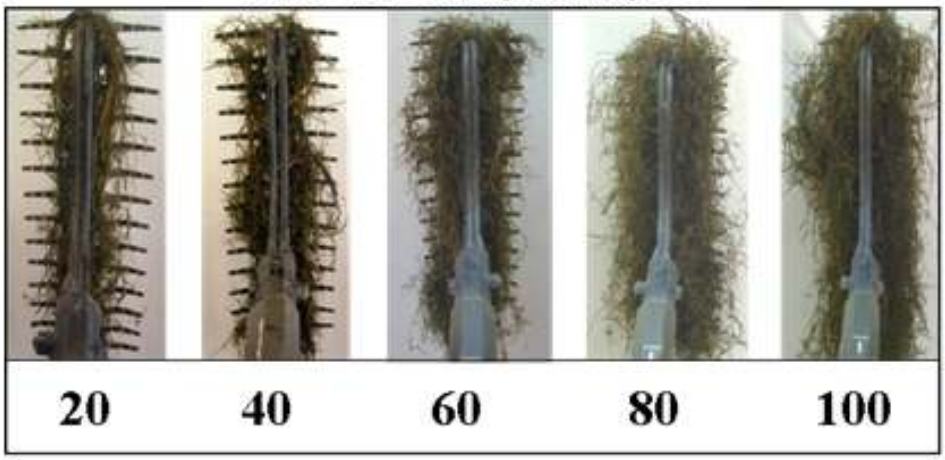
Comments _____

Survey Crew _____

Depth	°F	ppm O_2	Depth	°F	ppm O_2	Depth	°F	ppm O_2
1			16			32		
2			17			33		
3			18			34		
4			19			35		
5			20			36		
6			21			37		
7			22			38		
8			23			39		
1			24			40		
9			25			41		
10			26			42		
11			27			43		
12			28			44		
13			29			45		
14			30			46		
15			31			47		

Lowest DO Reading Limited by cable length? (circle) True / False
Was the DO meter standardized today? (circle) True / False

Rake % Density Examples[1]



Single Species Plant Abundance[2]
Individual species collected at each station of a transect will be broken down into 1% increments and recorded as a percent. These densities should add to 100%.

Appendix 2 (Data Sheet)

Date:	Lake Code:

EMERGENT AND FLOATING LEAF									
Transect:	Edge	2'	4'	6'	8'	10'	12'	14'	16'
Total % Cover									
Species Code	Single Species % Plant Abundance[2]								
SUBMERSED									
Rake Density[1]									
Species Code	Single Species % Plant Abundance[2]								
ADDITIONAL SPECIES"									
Substrate Type*									
etation Greater than 16' (circle) YES /	Additional Comments:								

EMERGENT AND FLOATING LEAF									
Transect:	Edge	2'	4'	6'	8'	10'	12'	14'	16'
Total % Cover									
Species Code	Single Species % Plant Abundance[2]								
SUBMERSED									
Rake Density[1]									
Species Code	Single Species % Plant Abundance[2]								
ADDITIONAL SPECIES"									
Substrate Type*									
etation Greater than 16' (circle) YES /	Additional Comments:								

* *Substrate codes* : **be**=bedrock; **bo**=boulder; **ri**=riprap; **co**=cobble; **gr**=gravel; **sa**=sand; **si**=silt; **cl**=clay; **mu**=muck; **de**=detritus

** Additional species will *not* be given a percent cover or percent density. If location is between stations "T" for true will be recorded on both contours on the line for that additional species.

CHAPTER 10. IOWA FISHING TOURNAMENT PERMIT PROCEDURE GUIDELINES

INTRODUCTION

Organized fishing tournaments have grown significantly in number and popularity over the last twenty years in Iowa. These tournaments range in size from a few boats where a small club or business get together for some camaraderie and friendly competition to the national tournaments with hundreds of participants and large amounts of prize money and prizes. These tournament participants, in addition to the regular anglers at a given lake, tend to concentrate an above average number of people at a given boat ramp or area. It is therefore imperative to have some form of permitting or tournament regulation in place to properly manage the fisheries resource as well as prevent overcrowding of the boat ramps and potential confrontation.

The increased number of tournaments, possible user conflicts and the protection of the resource have dictated the need for some form of regulation of tournament activities. A permitting system has been developed to serve and inform all interested parties of the facility use, daily management and law enforcement related to the recreational and fisheries resources of Iowa.

APPLICATION PROCESS

A Fishing Tournament Application, Permit and Report Form may be obtained from any Iowa DNR Fisheries Office or can be obtained online at www.iowadnr.gov. The tournament applicant must mail the completed application to the fisheries biologist managing the respective water body at least thirty (30) days prior to the event. The biologist will return approved original applications to the applicants as well as sending copies to the area parks manager and the conservation officer of the county where the tournament is to be held. The fisheries biologist can stipulate any special conditions or limitations that they deem necessary for the safety of the participants or the protection of the resource.

POST TOURNAMENT INFORMATION

The biologist may require information related to the completed tournament from the tournament sponsor. This information may include but is not limited to the number of anglers, tournament hours, numbers and sizes of fish caught or any immediate mortality. This report must be returned to the biologist within thirty days of the tournament completion.

CHAPTER 11. CURRENT AQUATIC INVASIVE SPECIES LAW AND RULE

INTRODUCTION

Following are Iowa's Aquatic Invasive Species Law and Rule current as of 1 January 2008. Please check with the ANS Coordinator for clarification or to see if changes have occurred. All boat ramps should be posted with Stop Aquatic Hitchhiker signs or alert signs indicating which AIS is/are present in the waterbody.

Code of Iowa Chapter 456A
Regulation and Funding – Natural Resources Department

456A.37 Aquatic Invasive Species –Prevention and Control.

1. Definitions. As used in this section:

a. "Eurasian watermilfoil" means myriophyllum spicatum, a submerged aquatic weed that invades lakes, ponds, reservoirs, and other bodies of water.

b. "Infestation of an aquatic invasive species" means an infestation of Eurasian watermilfoil that occupies more than twenty percent of the littoral area of a body of water or an infestation of any other species defined as an aquatic invasive species in this section.

c. "Aquatic invasive species" means a species that is not native to an ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health including but not limited to habitat alteration and degradation, and loss of biodiversity. For the purposes of this section, "aquatic invasive species" are limited to eurasian watermilfoil, purple loosestrife, and zebra mussels, except as provided in subsection 4.

d. "Purple loosestrife" means lythrum salicaria, a wetland plant that invades marshes, lakeshores, and other wetlands.

e. "Watercraft" means any vessel which through the buoyance of water floats upon the water and is capable of carrying one or more persons.

f. "Zebra mussel" means dreissena polymorpha, a small mussel that invades lakes, rivers, and other bodies of water.

2. Aquatic invasive species management plan. Before January 1, 2005, the commission shall prepare a long-term statewide aquatic invasive species management plan. The plan shall address all of the following:

a. The detection and prevention of accidental introductions into the state of aquatic invasive species.

b. A public awareness campaign regarding aquatic invasive species.

c. The control and eradication of aquatic invasive species in public waters.

d. The development of a plan of containment strategies that at a minimum shall include all of the following:

(1) The participation by lake associations, local citizens groups, and local units of government in the development and implementation of lake management plans where aquatic invasive species exist.

(2) Notice to travelers of the penalties for violation of laws relating to aquatic invasive species.

3. Grants. The director of the department of natural resources shall accept gifts, donations, and grants to aid in accomplishing the control and eradication of aquatic invasive species.

4. Rulemaking. The commission shall adopt rules pursuant to chapter 17A for the implementation and administration of this section. The rules shall do all of the following:

a. Restrict the introduction, propagation, use, possession, and spread of aquatic invasive species.

b. Identify bodies of water with infestations of aquatic invasive species. The department shall require that bodies of water be posted as infested. The department may prohibit boating, fishing, swimming, and trapping in infested bodies of water.

If the commission determines that an additional species should be defined as an “aquatic invasive species”, the species shall be defined by the commission by rule as an “aquatic invasive species”.

5. Prohibitions.

a. A person shall not do any of the following:

(1) Transport an aquatic invasive species on a public road.

(2) Place a trailer or launch a watercraft that contains or to which an aquatic invasive species is attached in public waters.

(3) Operate a watercraft in a marked aquatic invasive species infestation area.

b. A person who violates this subsection is subject to a scheduled fine pursuant to section 805.8B, subsection 5.

Section 805.8B Navigation, recreation, hunting, and fishing scheduled violations.

5. Aquatic invasive species violations. For violations of section 456A.37, subsection 5, the scheduled fine is one hundred dollars.

Chapter 90
Aquatic Invasive Species

571--90.1(456A) Definitions. As used in this chapter:

“Commission” means the natural resource commission.

“Department” means the department of natural resources.

“Director” means the director of the department of natural resources.

"Introduce" means to release a species into waters of the state. "Introduce" does not include the immediate return of a nonnative species to waters of the state from which it was removed.

"Transport" means to cause a species to be moved into or within the state, and includes accepting or receiving the species for transportation or shipment. "Transport" does not include the unintentional transport of a species within a water of the state or to a connected water of the state where the species being transported is already present.

"Watercraft" means a device used or designed for navigation on water.

571--90.2(456A) Aquatic invasive species. For the purposes of this rule, the following species and any hybrids, cultivars, or varieties of the species are designated as aquatic invasive species.

90.2(1) Aquatic invasive plants.

Brittle naiad	Najas minor
Curlyleaf pondweed	Potamogeton crispus
Eurasian watermilfoil	Myriophyllum spicatum
Flowering rush	Butomus umbellatus
Purple loosestrife	Lythrum salicaria, Lythrum virgatum
Salt cedar	Tamarix spp.

90.2(2) Aquatic invasive fish.

Bighead carp	Hypophthalmichthys nobilis
Black carp	Mylopharyngodon piceus
Round goby	Neogobius melanostomus
Rudd	Scardinius erythrophthalmus
Ruffe	Gymnocephalus cernuus
Silver carp	Hypophthalmichthys molitrix
White perch	Morone americana

90.2(3) Aquatic invasive invertebrates.

Fishhook waterflea	Cercopagis pengoi
New Zealand mudsnail	Potamopyrgus antipodarum
Quagga mussel	Dreissena bugensis
Rusty crayfish	Orconectes rusticus
Spiny waterflea	Bythotrephes cederstroemi
Zebra mussel	Dreissena polymorpha

90.2(4) Federal noxious weed list. For purposes of this rule, the aquatic plants listed in Code of Federal Regulations, Title 7, Section 360.200, are also designated as aquatic invasive species.

90.2(5) Injurious wildlife species. For purposes of this rule, aquatic species listed in Code of Federal Regulations, Title 50, Section 16.11 through 16.15, are also designated as aquatic invasive species.

571--90.3(456A) Restrictions.

90.3(1) A person shall not possess, introduce, import, purchase, sell, barter, propagate, or transport aquatic invasive species in any form in this state, except:

a. By written permission of the director;

b. For disposal as part of a harvest or control activity;

c. When a species is being transported to the department, or to another destination as directed by the department, in a sealed container for purposes of identifying the species or reporting the presence of the species;

d. When the specimen has been lawfully acquired dead and, in the case of plant species, when all seeds are removed or are otherwise secured in a sealed container;

e. In the form of herbaria or other preserved specimens; or

f. When a species is being removed from watercraft and equipment, or when a species is caught by an angler and immediately returned to the water from which it came.

90.3(2) A conservation officer, other licensed peace officer, or employee of the department may seize or dispose of all specimens of aquatic invasive species unlawfully possessed, introduced, imported, purchased, sold, bartered, propagated, or transported in the state.

571—90.4(456A) Infested waters.

90.4(1) Designation of infested waters. The department shall designate infested waters of the state. The department shall publish the names of infested waters in the fishing regulations brochure each year and provide notice through other available means where practical. At any time, the department may designate additional waters or remove from designation those waters that are no longer infested.

90.4(2) Restricted activities on infested waters. The department may restrict boating, fishing, swimming, and trapping in infested waters of the state. When determining when to restrict activities in infested waters, the department shall consider:

a. The extent of a species' distribution within the state;

b. The likely means of spread for a new species; and

c. Whether restrictions specific to infested waters containing a specific species will effectively reduce that species' spread.

These rules are intended to implement Iowa Code section 456A.37 as amended by 2004 Iowa Acts, House File 2357.

Standard Procedures for Controlling Aquatic Invasive Plants with Herbicides

Waterbodies infested with aquatic invasive plants will be treated on a case by case basis and coordinated by the ANS Coordinator. Individual situations may require deviations from or may react differently to the standards below. Changes in herbicide formulations or new herbicides developed for the aquatic environment may change these standard treatment procedures.

Additional standard procedures may be added as new control techniques are developed or as additional aquatic invasive plant species are found in Iowa. Permits should be applied for well in advance of herbicide application. All label directions need to be followed when applying aquatic herbicides.

Eurasian Watermilfoil Whole Lake/Pond Sonar Treatment

Sonar is a selective, systemic herbicide that results in a slow kill of Eurasian watermilfoil and eliminates the threat of an oxygen deficit due to a large mass of vegetation decaying at one time. Plants begin to show signs of chlorosis (i.e., turn pink or white) within 7-10 days of application with a complete kill taking 30-90 days. There are no restrictions on swimming, fishing, or drinking after Sonar application; however, there are irrigation restrictions.

Treatment should begin when Eurasian watermilfoil is first observed to be growing in the spring. The lake/pond should be treated at 8ppb Sonar determined by the following equations:

mean depth (ft) x ppb Sonar x 0.027 (Sonar AS) = quarts of Sonar per surface acre

mean depth (ft) x ppb Sonar x 0.054 (Sonar Q) = pounds of Sonar per surface acre

The goal while treating Eurasian watermilfoil is to maintain a Sonar concentration above 5ppb for about 45 days. In most cases, a FasTEST sample to monitor the Sonar concentration should be taken two weeks after the initial treatment date. FasTEST sampling instructions and bottles will be provided by the ANS Coordinator. FasTEST results are sent to the ANS Coordinator 2-3 days after the sample is shipped, and additional instructions are sent to the biologist at that time. If the Sonar concentration has dropped to 5ppb or below, additional Sonar should be applied to bump the concentration back up to 8ppb. If the Sonar concentration is above 5ppb, no bump is needed at that time. A second FasTEST sample should be taken 4 weeks after the treatment date and/or 2 weeks after the bump. Again, the ANS Coordinator will get the FasTEST results and send any additional instructions to the biologist at that time.

Brittle Naiad Whole Lake/Pond Sonar Treatment

Sonar is a selective, systemic herbicide that results in a slow kill of brittle naiad and eliminates the threat of an oxygen deficit due to a large mass of vegetation decaying at one time. Plants begin to show signs of chlorosis (i.e., turn pink or white) within 7-10 days of application with a complete kill taking 30-90 days. There are no restrictions on swimming, fishing, or drinking after Sonar application; however, there are irrigation restrictions.

Treatment should begin when brittle naiad is first observed to be growing in the spring or summer. Brittle naiad reproduces by seeds, and the timing of seedling emergence can vary from year to year. The lake/pond should be treated at 15ppb Sonar determined by the following equations:

mean depth (ft) x ppb Sonar x 0.027 (Sonar AS) = quarts of Sonar per surface acre

mean depth (ft) x ppb Sonar x 0.054 (Sonar Q) = pounds of Sonar per surface acre

The goal while treating brittle is to maintain a Sonar concentration above 10ppb for about 45 days. In most cases, a FasTEST sample to monitor the Sonar concentration should be taken two weeks after the initial treatment date. FasTEST sampling instructions and bottles will be provided by the ANS Coordinator. FasTEST results are sent to the ANS Coordinator 2-3 days after the sample is shipped, and additional instructions are sent to the biologist at that time. If the Sonar concentration has dropped to 5ppb or below, additional Sonar should be applied to

bump the concentration back up to 8ppb. If the Sonar concentration is above 5ppb, no bump is needed at that time. A second FasTEST sample should be taken 4 weeks after the treatment date and/or 2 weeks after the bump. Again, the ANS Coordinator will get the FasTEST results and send any additional instructions to the biologist at that time.

Eurasian Watermilfoil and Brittle Naiad Spot Treatment

Several different herbicides can be used for controlling small areas of Eurasian watermilfoil and brittle naiad. Herbicide selection should be based on size of area to be treated, herbicide exposure time, turbidity, herbicide water use restrictions, presence of nontarget plants, and ease of application. Chemicals that are effective on both Eurasian watermilfoil and brittle naiad are 2,4-D (e.g., Navigate, Aqua-Kleen), diquat (e.g., Reward), endothall (e.g., Aquathol K), and triclopyr (e.g., Renovate). Spot treatment with any of these herbicides usually results in short-term control and may need to be repeated in subsequent years.

HACCP Step 1 - Activity Description	
Facility: Iowa Department of Natural Resources	**Site**: Statewide rivers and streams
Project Coordinator: Jason Euchner	**Project Description**: Backpack electroshocking
Site Manager: Fisheries biologist & technician	
Address: 1436 255th St. Boone, IA 50036	
Phone: 515-432-2823	

Project Description (Who, What, Where, When, How & Why)
Who: Fisheries management and research biologists & technicians What: Backpack electroshocking When: Spring through fall Where: Statewide rivers and streams How: Backpack electroshocker Why: To sample fish populations, collect fish, or tag fish

HACCP Step 2 - Potential Hazard Identification
Vertebrates: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Invertebrates: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail
Plants: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
Other Biologics: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
Others:

HACCP Step 3 - Flow Diagram

Task # 1	Dip nets and backpack electroshocker obtained from storage.
	□
Task # 2	Crew and gear travel to sample location.
	□
Task # 3	Crew enters water and begins sampling.
	□
Task # 4	Fish are kept or released. Kept species are preserved and brought back to station for identification or collection.
	□
Task # 5	Crew puts gear back in truck.
	□
Task # 6	Crew and gear travel back to station or new site.
	□
Task # 7	Gear is stored at station.

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Dip nets, backpack electroshocker obtained from storage.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment is clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Equipment is clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment is clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment is clean.		No
Crew and gear travel to sample location.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment is clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Equipment is clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment is clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment is clean.		No
Crew enters water and begins sampling.	Vertebrate: nonnative fish species (Asian carp, white	No	Staying in same system until sample		No

	perch, round goby, ruffe)		is complete.		
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Staying in same system until sample is complete.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Staying in same system until sample is complete.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Staying in same system until sample is complete.		No
Fish are kept or released. Kept species are preserved and brought back for identification or collection.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Fish are placed in preservative.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Will not collect these species.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Will not collect these species.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Minimal amount of water taken from system, then preservative is added which will eliminate chance of transport.		No
Crew puts gear back in truck.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	Yes	Possible to have eggs or small fish on gear and in nets.	Clean all gear and nets before putting in storage or going to another location.	Yes

	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	Yes	Possible to be on gear or nets.	Clean all gear and nets before putting in storage or going to another location.	Yes
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	Yes	Possible to be on gear or nets.	Clean all gear and nets before putting in storage or going to another location.	Yes
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	Yes	Possible to be on gear or nets.	Clean all gear and nets before putting in storage or going to another location.	Yes
Crew and gear travel back to station or new site.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment is clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Equipment is clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment is clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment is clean.		No
Gear is stored at station.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment is clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail	No	Equipment is clean.		No

	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment is clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment is clean.		No

HACCP Step 5 - HACCP Plan
Critical Control Point #1: Task # 5: Crew puts gear back in truck.
Significant Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Control Measures: Clean all gear and nets before putting in storage or going to another location.
Limits for Control Measures: Clean all gear and nets before storing or traveling to another location.
Monitoring: What? Debris on gear and nets
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: Clean gear and nets until free of debris.
Supporting Documentation:
Critical Control Point #2: Task # 5: Crew puts gear back in truck.
Significant Hazards: Invertebrate: zebra mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail
Control Measures: Clean all gear and nets before putting in storage or going to another location.
Limits for Control Measures: Clean all gear and nets before storing or traveling to another location.
Monitoring: What? Debris on gear and nets
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: Clean gear and nets until free of debris.
Supporting Documentation:

Critical Control Point #3: Task # 5: Crew puts gear back in truck.
Significant Hazards: Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
Control Measures: Clean all gear and nets before putting in storage or going to another location.
Limits for Control Measures: Clean all gear and nets before storing or traveling to another location.
Monitoring: What? Plant fragments on gear and nets
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: Clean gear and nets until free of plant fragments.
Supporting Documentation:

Critical Control Point #4: Task # 5: Crew puts gear back in truck.
Significant Hazards: Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
Control Measures: Clean all gear and nets before putting in storage or going to another location.
Limits for Control Measures: Clean all gear and nets before storing or traveling to another location.
Monitoring: What? Debris on gear and nets
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: Clean gear and nets until free of debris.
Supporting Documentation:

Facility: Iowa Department of Natural Resources	**Activity**: Backpack electroshocking
Address: 1436 255th St. Boone, IA 50036	
Signature:	**Date**:

HACCP Plan

HACCP Checklist:
Backpack electroshocking

Facility	Iowa Department of Natural Resources
Site	Statewide rivers and streams
Coordinator	Jason Euchner
Manager	Fisheries biologist & technician
Address	1436 255th St., Boone, IA 50036

☐ **Task # 1: Dip nets, backpack electroshocker obtained from storage.**

☐ **Task # 2: Crew and gear travels to sample location.**

☐ **Task # 3: Crew enters water and begins sampling.**

☐ **Task # 4: Fish are kept or released. Keep species are preserved and brought back for ID or collection.**

☐ **Task # 5: Crew puts crew back in truck.**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
- ☐ Control measures were implemented
  Control Measures: Clean all gear and nets before putting in storage or going to another location.
- ☐ Control limits were maintained
  Control Limits: Clean all gear and nets before storing or traveling to another location.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: Clean gear and nets until free of debris.

- ☐ Hazards were contained
  Hazards: Invertebrate: zebra Mussel, quagga mussel, rusty crayfish, spiny waterflea, New Zealand mudsnail
- ☐ Control measures were implemented
  Control Measures: Clean all gear and nets before putting in storage or going to another location.
- ☐ Control limits were maintained
  Control Limits: Clean all gear and nets before storing or traveling to another location.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: Clean gear and nets until free of debris.

- Hazards were contained
  Hazards: Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
- Control measures were implemented
  Control Measures: Clean all gear and nets before putting in storage or going to another location.
- Control limits were maintained
  Control Limits: Clean all gear and nets before storing or traveling to another location.
- Corrective actions were (performed if necessary)
  Corrective Actions: Clean gear and nets until free of plant fragments.

- Hazards were contained
  Hazards: Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
- Control measures were implemented
  Control Measures: Clean all gear and nets before putting in storage or going to another location.
- Control limits were maintained
  Control Limits: Clean all gear and nets before storing or traveling to another location.
- Corrective actions were (performed if necessary)
  Corrective Actions: Clean gear and nets until free of debris.

Task # 6: Crew and gear travel back to station or new site.

Task # 7: Gear is stored at station.

HACCP Plan

HACCP Step 1 - Activity Description	
Facility: Iowa Department of Natural Resources	**Site**: Statewide
Project Coordinator: Jason Euchner	**Project Description**: Boat electroshocking
Site Manager: Fisheries biologist & technician	
Address: 1436 255th St Boone, IA 50036	
Phone: 515-432-2823	

Project Description (Who, What, Where, When, How & Why)
Who: Fisheries management and research biologists & technicians What: Boat electroshocking When: Spring through fall Where: Statewide rivers and lakes How: Electroshocking boat Why: To sample fish populations, collect fish, or tag fish

HACCP Plan

HACCP Step 2 - Potential Hazard Identification
Vertebrates: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Invertebrates: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
Plants: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
Other Biologics: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
Others:

HACCP Plan

HACCP Step 3 - Flow Diagram

Task # 1	Load equipment at station.
Task # 2	Travel to sample location.
Task # 3	Launch boat.
Task # 4	Sample and collect fish for surveys or tagging.
Task # 5	Measure and tag fish.
Task # 6	Release fish back into water. (If collecting fish for fishing clinic or state fair, refer to fish hauling HACCP.)
Task # 7	Load boat onto trailer.
Task # 8	Travel back to station or another location.

HACCP Plan

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Load equipment at station.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No
Travel to sample location.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No
Launch boat.	Vertebrate: nonnative fish species (Asian carp, white	No	Equipment should be clean.		No

	perch, round goby, ruffe)				
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No
Sample and collect fish for surveys or tagging.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Sampling and collecting fish, not moving to another system.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Sampling and collecting fish, not moving to another system.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Sampling and collecting fish, not moving to another system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Sampling and collecting fish, not moving to another system.		No
Measure and tag fish.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Measuring and tagging fish, not moving to another system.		No

	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Measuring and tagging fish, not moving to another system.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Measuring and tagging fish, not moving to another system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Measuring and tagging fish, not moving to another system.		No
Release fish back into water. (If collecting fish for fishing clinic or state fair, refer to fish hauling HACCP.)	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Will not release nonnative species back into system.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Will not release nonnative species back into system.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Will not release nonnative species back into system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Will not release nonnative species back into system.		No
Load boat onto trailer.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	Yes	Possible to have in or on boat.	Drain fish tanks and bilge and inspect boat for presence of standing water.	Yes
	Invertebrate: zebra mussel, quagga mussel, rusty	Yes	Possible to have in or on boat.	Drain fish tanks and bilge and	Yes

HACCP Plan

	crawfish, spiny waterflea, New Zealand mudsnail			inspect boat for presence of standing water.	
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	Yes	Possible to be on boat or trailer.	Inspect and remove any plant fragments before leaving ramp.	Yes
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	Yes	Possible to have in or on boat.	Drain fish tanks and bilge and inspect boat for presence of standing water.	Yes
Travel back to station or another location.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No

HACCP Plan

HACCP Step 5 - HACCP Plan
Critical Control Point #3: Task # 7: Load boat onto trailer.
Significant Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Control Measures: Drain fish tanks and bilge and inspect boat for presence of standing water.
Limits for Control Measures: If in known infested location, pressure wash boat and allow to dry.
Monitoring: What? Presence of standing water
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: If water still standing in boat, move to a location that allows water to drain from boat.
Supporting Documentation:
Critical Control Point #4: Task # 7: Load boat onto trailer.
Significant Hazards: Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
Control Measures: Drain fish tanks and bilge and inspect boat for presence of standing water. Decontaminate motor if in known infested area.
Limits for Control Measures: If in known infested location, pressure wash boat and allow to dry and decontaminate engine cooling system.
Monitoring: What? Presence of standing water
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who?

HACCP Plan

Crew
Evaluation & Corrective Actions: If water still standing in boat, move to a location that allows water to drain from boat.
Supporting Documentation:
Critical Control Point #5: Task # 7: Load boat onto trailer.
Significant Hazards: Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
Control Measures: Inspect and remove any plant fragments before leaving ramp.
Limits for Control Measures: Do not leave ramp until all plant fragments are removed from boat, trailer, and equipment.
Monitoring: What? Plant fragments
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: If in known infested location, pressure wash boat and equipment before traveling to another location.
Supporting Documentation:
Critical Control Point #6: Task # 7: Load boat onto trailer.
Significant Hazards: Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicema (VHS)
Control Measures: Drain fish tanks and bilge and inspect boat for presence of standing water.
Limits for Control Measures: If in known infested location, pressure wash boat and allow to dry.
Monitoring: What? Presence of standing water.
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who?

HACCP Plan

Crew	
Evaluation & Corrective Actions: If water still standing in boat, move to a location that allows water to drain from boat.	
Supporting Documentation:	
Facility: Iowa Department of Natural Resources	**Activity**: Boat electroshocking
Address: 1436 255th St Boone, IA 50036	
Signature:	**Date**:

Fish Hauling HACCP

HACCP Checklist:
Boat Electroshocking

Facility	Iowa Department of Natural Resources
Site	Statewide
Coordinator	Jason Euchner
Manager	Fisheries biologist & technician
Address	1436 255th St, Boone, IA 50036

☐ **Task # 1: Load equipment at station.**

☐ **Task # 2: Travel to sample location.**

☐ **Task # 3: Launch boat.**

☐ **Task # 4: Sample and collect fish for surveys or tagging.**

☐ **Task # 5: Measure and tag fish.**

☐ **Task # 6: Release fish back into water. (If collecting fish for fishing clinic or state fair, refer to fish hauling HACCP.)**

☐ **Task # 7: Load boat onto trailer.**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
- ☐ Control measures were implemented
  Control Measures: Drain fish tanks and bilge and inspect boat for presence of standing water.
- ☐ Control limits were maintained
  Control Limits: If in known infested location, pressure wash boat and allow to dry.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: If water still standing in boat, move to a location that allows water to drain from boat.

- ☐ Hazards were contained
  Hazards: Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
- ☐ Control measures were implemented
  Control Measures: Drain fish tanks and bilge and inspect boat for presence of

standing water. Decontaminate motor if in known infested area.

- Control limits were maintained
  Control Limits: If in known infested location, pressure wash boat and allow to dry and decontaminate engine cooling system.
- Corrective actions were (performed if necessary)
  Corrective Actions: If water still standing in boat, move to a location that allows water to drain from boat.

- Hazards were contained
  Hazards: Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
- Control measures were implemented
  Control Measures: Inspect and remove any plant fragments before leaving ramp.
- Control limits were maintained
  Control Limits: Do not leave ramp until all plant fragments are removed from boat, trailer, and equipment.
- Corrective actions were (performed if necessary)
  Corrective Actions: If in known infested location, pressure wash boat and equipment before traveling to another location.

- Hazards were contained
  Hazards: Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
- Control measures were implemented
  Control Measures: Drain fish tanks and bilge and inspect boat for presence of standing water.
- Control limits were maintained
  Control Limits: If in known infested location, pressure wash boat and allow to dry.
- Corrective actions were (performed if necessary)
  Corrective Actions: If water still standing in boat, move to a location that allows water too drain from boat.

Task # 8: Travel back to station or another location.

Fish Hauling HACCP

HACCP Step 1 - Activity Description	
Facility: Iowa DNR	**Site**: Statewide
Project Coordinator: Jason Euchner	**Project Description**: Fish collection and transport
Site Manager: Local Biologist or Technician	
Address: 1436 255th St, Boone, IA 50036	
Phone: 515-432-2823	

Project Description (Who, What, Where, When, How & Why)
Who: Iowa DNR fisheries personnel What: Fish collection for use at fish clinics, the state fair, and other events When: During sampling season Where: Statewide How: With standard electrofishing and netting Why: To have live display fish at fish clinics, the state fair, and other events

Fish Hauling HACCP

HACCP Step 2 - Potential Hazard Identification
Vertebrates: Asian Carp, round goby, white perch, ruffe
Invertebrates: zebra mussels, quagga mussels, spiny waterflea
Plants: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed
Other Biologics: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)
Others:

Fish Hauling HACCP

HACCP Step 3 - Flow Diagram

Task # 1	Fill hauling unit at station and neutralize chlorine and chloramines.
Task # 2	Collect fish following HACCP plans for boat electrofishing and netting.
Task # 3	Use fish at clinic, event, or state fair.
Task # 4	Return fish back to originating waterbody and ramp, or dispose of fish.
Task # 5	Clean hauling unit and allow to dry.

Fish Hauling HACCP

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Fill hauling unit at station and neutralize chlorine and chloramines.	Vertebrate: Asian carp, round goby, white perch, ruffe	No	Tank should be clean from previous uses.		No
	Invertebrate: zebra mussels, quagga mussels, spiny waterflea	No	Tank should be clean from previous uses.		No
	Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed	No	Tank should be clean from previous uses.		No
	Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)	No	Tank should be clean from previous uses.		No
Collect fish following HACCP plans for boat electrofishing and netting.	Vertebrate: Asian carp, round goby, white perch, ruffe	Yes	Could be collected during this task.	Refer to HACCP plans for boat electrofishing and netting.	No
	Invertebrate: zebra mussels, quagga mussels, spiny waterflea	Yes	Could be collected during this task.	Refer to HACCP plans for boat electrofishing and netting.	No
	Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed	Yes	Could be collected during this task.	Refer to HACCP plans for boat electrofishing and netting.	No
	Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)	Yes	Could be collected during this task.	Refer to HACCP plans for boat electrofishing and netting.	No
Use fish at clinic, event, or state fair.	Vertebrate: Asian carp, round goby, white perch, ruffe	No	Fish and water are not being released anywhere.		No

Fish Hauling HACCP

	Invertebrate: zebra mussels, quagga mussels, spiny waterflea	No	Fish and water are not being released anywhere.		No
	Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed	No	Fish and water are not being released anywhere.		No
	Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)	No	Fish and water are not being released anywhere.		No
Return fish back to originating waterbody and ramp, or dispose of fish.	Vertebrate: Asian carp, round goby, white perch, ruffe	Yes	Eggs could be in water or on fish in tank.	Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.	Yes
	Invertebrate: zebra mussels, quagga mussels, spiny waterflea	Yes	Veligers could be present in water.	Water and fish can only be released back at originating boat ramp or disposed of properly. Cannott be released into nearest waterbody to event.	Yes
	Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed	Yes	Plant fragments could be present in tank.	Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into	Yes

Fish Hauling HACCP

				nearest waterbody to event.	
	Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)	Yes	Biological hazards could be present in water.	Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.	Yes
Clean hauling unit and allow to dry.	Vertebrate: Asian carp, round goby, white perch, ruffe	No	Hauling unit should be clean.		No
	Invertebrate: zebra mussels, quagga mussels, spiny waterflea	No	Hauling unit should be clean.		No
	Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed	No	Hauling unit should be clean.		No
	Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)	No	Hauling unit should be clean.		No

Fish Hauling HACCP

HACCP Step 5 - HACCP Plan
Critical Control Point #1: Task # 4: Return fish back to originating waterbody and ramp, or dispose of fish.
Significant Hazards: Vertebrate: Asian carp, Round goby, white perch, ruffe
Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
Limits for Control Measures: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
Monitoring: What? Water and fish
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Fisheries biologist or technician
Evaluation & Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody.
Supporting Documentation:
Critical Control Point #2: Task # 4: Return fish back to originating waterbody and ramp, or dispose of fish.
Significant Hazards: Invertebrate: zebra mussels, quagga mussels, spiny waterflea
Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
Limits for Control Measures: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
Monitoring: What? Water and fish
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Fisheries biologist or technician
Evaluation & Corrective Actions:

Water and fish cannot be released anywhere other than originating waterbody.
Supporting Documentation:
Critical Control Point #3: Task # 4: Return fish back to originating waterbody and ramp, or dispose of fish.
Significant Hazards: Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed
Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
Limits for Control Measures: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
Monitoring: What? Water, fish, and plant fragments
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Fisheries biologist or technician
Evaluation & Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody. Check for plant fragments as tank is draining.
Supporting Documentation:
Critical Control Point #4: Task # 4: Return fish back to originating waterbody and ramp, or dispose of fish.
Significant Hazards: Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)
Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
Limits for Control Measures: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
Monitoring: What? Water and fish
Monitoring: How? Visual
Monitoring: Frequency? Once

Fish Hauling HACCP

Monitoring: Who? Fisheries biologist or technician	
Evaluation & Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody.	
Supporting Documentation:	
Facility: Iowa DNR	**Activity**: Fish collection and transport
Address: 1436 255th St, Boone, IA 50036	
Signature:	**Date**:

HACCP Checklist:
Fish collection and transport

Facility	Iowa DNR
Site	Statewide
Coordinator	Jason Euchner
Manager	Local Biologist
Address	1436 255th St,, Boone, IA 50036

☐ **Task # 1: Fill hauling unit at station and declorinate.**

☐ **Task # 2: Collect fish following HACCP plans for boat electrofishing and netting.**

☐ **Task # 3: Use fish at clinic, event, or state fair.**

☐ **Task # 4: Return fish back to originating waterbody and ramp, or dispose of fish.**
CRITICAL CONTROL POINT

- ☐ Hazards were contained
  Hazards: Vertebrate: Asian carp, round goby, white perch, ruffe
- ☐ Control measures were implemented
  Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
- ☐ Control limits were maintained
  Control Limits: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody.

- ☐ Hazards were contained
  Hazards: Invertebrate: zebra mussels, quagga mussels, spiny waterflea
- ☐ Control measures were implemented
  Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
- ☐ Control limits were maintained
  Control Limits: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
- ☐ Corrective actions were (performed if necessary)
  Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody.

- Hazards were contained
  Hazards: Plant: brittle naiad, Eurasian watermilfoil, curlyleaf pondweed
- Control measures were implemented
  Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Canno't be released into nearest waterbody to event.
- Control limits were maintained
  Control Limits: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
- Corrective actions were (performed if necessary)
  Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody. Check for plant fragments as tank is draining.

- Hazards were contained
  Hazards: Other Biologic: VHS (viral hemorrhagic septicemia), LMBV (largemouth bass virus)
- Control measures were implemented
  Control Measures: Water and fish can only be released back at originating boat ramp or disposed of properly. Cannot be released into nearest waterbody to event.
- Control limits were maintained
  Control Limits: Water and fish must be released back at originating waterbody and ramp. If not releasing fish back into water, dispose of fish properly.
- Corrective actions were (performed if necessary)
  Corrective Actions: Water and fish cannot be released anywhere other than originating waterbody.

Task # 5: Clean hauling unit and allow to dry.

HACCP Step 1 - Activity Description	
Facility: Iowa Department of Natural Resources	**Site**: Statewide
Project Coordinator: Jason Euchner	**Project Description**: Fish netting
Site Manager: Fisheries biologist & technician	
Address: 1436 255th St. Boone, IA 50036	
Phone: 515-432-2823	

Project Description (Who, What, Where, When, How & Why)
Who: Fisheries management and research biologists & technicians What: Fish netting (passive & active) When: Spring through fall Where: Statewide rivers and lakes How: Passive & active nets Why: To sample fish populations, collect fish, or tag fish

HACCP Step 2 - Potential Hazard Identification
Vertebrates: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Invertebrates: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
Plants: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
Other Biologics: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
Others:

HACCP Step 3 - Flow Diagram

Task # 1	Load equipment at station.
Task # 2	Travel to sample location.
Task # 3	Launch boat and travel by boat to sample location.
Task # 4	Set nets if using passive gear, use nets if using active gear.
Task # 5	Travel back to ramp.
Task # 6	Load boat onto trailer.
Task # 7	Travel back to station.

HACCP Step 4 - Hazard Analysis					
Task	**Hazard**	**Probable?**	**Justification**	**Control Measures**	**CCP?**
Load equipment at station.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No
Travel to sample location.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No
Launch boat and travel by boat to	Vertebrate: nonnative fish species (Asian carp, white	No	Staying in system.		No

sample location.	perch, round goby, ruffe)				
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Staying in system.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Staying in system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Staying in system.		No
Set nets if using passive gear, if using active gear use nets.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Staying in system.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Staying in system.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Staying in system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Staying in system.		No
Travel back to ramp.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Staying in system.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New	No	Staying in system.		No

	Zealand mudsnail				
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Staying in system.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Staying in system.		No
Load boat onto trailer.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	Yes	Possible to be in or on nets and other equipment.	Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area. Allow nets to dry before using in another waterbody.	Yes
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	Yes	Possible to be in or on nets and other equipment.	Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area. Allow nets to dry before using in another waterbody.	Yes
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	Yes	Possible to have fragments in nets or on equipment.	Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area. Allow nets to dry before using in another	Yes

				waterbody.	
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	Yes	Possible to be in or on nets and other equipment.	Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area. Allow nets to dry before using in another waterbody.	Yes
Travel back to station.	Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)	No	Equipment should be clean.		No
	Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail	No	Equipment should be clean.		No
	Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad	No	Equipment should be clean.		No
	Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)	No	Equipment should be clean.		No

HACCP Step 5 - HACCP Plan
Critical Control Point #1: Task # 6: Load boat onto trailer.
Significant Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.
Limits for Control Measures: If in known infested system, pressure wash nets and equipment.
Monitoring: What? Presence of standing water or mud on nets and equipment.
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions: Rewash all equipment and let dry before using again.
Supporting Documentation:
Critical Control Point #2: Task # 6: Load boat onto trailer.
Significant Hazards: Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything and decontaminate motor if in known infested area.
Limits for Control Measures: If in known infested system, pressure wash nets and equipment and decontaminate engine cooling system.
Monitoring: What? Presence of standing water or mud on nets and equipment.
Monitoring: How? Visual
Monitoring: Frequency? Once
Monitoring: Who? Crew
Evaluation & Corrective Actions:

Rewash all equipment and let dry before using again.

Supporting Documentation:

Critical Control Point #3:
Task # 6: Load boat onto trailer.

Significant Hazards:
Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad

Control Measures:
Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.

Limits for Control Measures:
If in known infested system, pressure wash nets and equipment.

Monitoring: What?
Presence of plant fragments or mud on nets and equipment.

Monitoring: How?
Visual

Monitoring: Frequency?
Once

Monitoring: Who?
Crew

Evaluation & Corrective Actions:
Rewash all equipment and let dry before using again.

Supporting Documentation:

Critical Control Point #4:
Task # 6: Load boat onto trailer.

Significant Hazards:
Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicema (VHS)

Control Measures:
Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.

Limits for Control Measures:
If in known infested system, pressure wash nets and equipment.

Monitoring: What?
Presence of standing water or mud on nets and equipment.

Monitoring: How?
Visual

Monitoring: Frequency?
Once

Monitoring: Who?
Crew

Evaluation & Corrective Actions: Rewash all equipment and let dry before using again.	
Supporting Documentation:	
Facility: Iowa Department of Natural Resources	**Activity**: Fish netting
Address: 1436 255th St. Boone, IA 50036	
Signature:	**Date**:

HACCP Checklist:
Fish Netting

Facility	Iowa Department of Natural Resources
Site	Statewide
Coordinator	Jason Euchner
Manager	Fisheries biologist & technician
Address	1436 255th St., Boone, IA 50036

- ☐ **Task # 1: Load equipment at station.**

- ☐ **Task # 2: Travel to sample location.**

- ☐ **Task # 3: Launch boat and travel by boat to sample location.**

- ☐ **Task # 4: Set nets if using passive gear, use nets if using active gear.**

- ☐ **Task # 5: Travel back to ramp.**

- ☐ **Task # 6: Load boat onto trailer.**
  CRITICAL CONTROL POINT

  - ☐ Hazards were contained
    Hazards: Vertebrate: nonnative fish species (Asian carp, white perch, round goby, ruffe)
  - ☐ Control measures were implemented
    Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.
  - ☐ Control limits were maintained
    Control Limits: If in known infested system, pressure wash nets and equipment.
  - ☐ Corrective actions were (performed if necessary)
    Corrective Actions: Rewash all equipment and let dry before using again.

  - ☐ Hazards were contained
    Hazards: Invertebrate: zebra mussel, quagga mussel, rusty crawfish, spiny waterflea, New Zealand mudsnail
  - ☐ Control measures were implemented
    Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area. Decontaminate motor.
  - ☐ Control limits were maintained
    Control Limits: If in known infested system, pressure wash nets and equipment.

Decontaminate engine cooling system.

- Corrective actions were (performed if necessary)
  Corrective Actions: Rewash all equipment and let dry before using again.

- Hazards were contained
  Hazards: Plant: Eurasian watermilfoil, curlyleaf pondweed, brittle naiad
- Control measures were implemented
  Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.
- Control limits were maintained
  Control Limits: If in known infested system, pressure wash nets and equipment.
- Corrective actions were (performed if necessary)
  Corrective Actions: Rewash all equipment and let dry before using again.

- Hazards were contained
  Hazards: Other Biologic: largemouth bass virus (LMBV), viral hemorrhagic septicemia (VHS)
- Control measures were implemented
  Control Measures: Clean nets and equipment off when leaving area. Drain water. Pressure wash everything if in known infested area.
- Control limits were maintained
  Control Limits: If in known infested system, pressure wash nets and equipment.
- Corrective actions were (performed if necessary)
  Corrective Actions: Rewash all equipment and let dry before using again.

- **Task # 7: Travel back to station.**

Waterbody	Species	County	Year Discovered	Status
Big Sioux River	bighead carp	Woodbury	1997	present - no control
Cedar River	bighead carp	Linn		present - no control
Chariton River	bighead carp	Appanoose	1995	present - no control
Des Moines River	bighead carp	multiple	1996	present - no control
East Nodaway River tributary	bighead carp	Adams	2004	present - no control
Iowa River	bighead carp	Johnson	2003	present - no control
Mississippi River	bighead carp	multiple	2003	present - no control
	silver carp	Lee	2003	present - no control
	zebra mussel	multiple	1992	present - no control
	Eurasian watermilfoil	multiple	unknown	present - no control
	brittle naiad	multiple	2003	present - no control
Missouri River	bighead carp	multiple	1995	present - no control
	silver carp	multiple	unknown	present - no control
Ottumwa Lagoon	bighead carp	Wapello	2002	present - no control
Pee Dee Creek/Soap Creek tributary	bighead carp	Davis	2004	present - no control
West Platte River	bighead carp	Union	2004	present - no control
Chariton River	silver carp	Appanoose	2007	present - no control
Airport Lake	Eurasian watermilfoil	Chickasaw	2002	treated in 2003 and 2004, continue monitoring
Beeds Lake	Eurasian watermilfoil	Franklin	2000	eradicated
Camp Sunnyside Pond	Eurasian watermilfoil	Polk	2001	treated in 2002 and 2005, continue monitoring
Clear Lake	zebra mussel	Cerro Gordo	2005	unknown - will monitor this fall and spring
Casey Lake	brittle naiad	Tama	2003	treated in 2004, continue monitoring
Crawford Creek Lake	brittle naiad	Ida	2003	treated in 2004, treatment scheduled for 2006
Crystal Lake	Eurasian	Hancock	1993	eradicated

	watermilfoil			
Eldred Sherwood Lake	brittle naiad	Hancock	2005	treatment scheduled for 2006
	Eurasian			
Grundy County Lake	watermilfoil	Grundy	2003	treated in 2004, continue monitoring
Hannen Lake	brittle naiad	Benton	2004	treatment scheduled for 2006
	Eurasian			
Horseshoe Pond	watermilfoil	Jackson	2000	eradicated
	Eurasian			
Keg Creek Lake	watermilfoil	Mills	1999	eradicated
	Eurasian	Buchana		
Koutny Pond	watermilfoil	n	1995	treated in 1996, 1998, 2003, continue monitoring
		Buchana		
	brittle naiad	n	2003	treated in 2004, continue monitoring
		Van		
Lacey-Keosauqua Lake	brittle naiad	Buren	2004	treated in 2005, contine monitoring
Lake Geode	brittle naiad	Henry	2004	continue monitoring
		Van		
Lake Sugema	brittle naiad	Buren	2004	continue monitoring
Lake Wapello	brittle naiad	Davis	1998	continue monitoring
		Woodbur		
Little Sioux Park Pond	brittle naiad	y	2003	treated in 2004, continue monitoring
	Eurasian			
Mile Hill Lake	watermilfoil	Mills	1999	treated in 2000, treatment scheduled for 2006
	Eurasian	Black		
Mitchell Avenue Pit	watermilfoil	Hawk	1998	eradicated
Moorehead Park Pond	brittle naiad	Ida	2003	treated in 2004, continue monitoring
		Van		
Morris Park Pond	brittle naiad	Buren	2004	treated in 2005, continue monitoring
Nelson Park Pond	brittle naiad	Crawford	2003	treated in 2004 and 2005, continue monitoring
	Eurasian			
Ottumwa Pond	watermilfoil	Wapello	2002	treated in 2003, continue monitoring
Pleasant Creek Lake	brittle naiad	Linn	2003	continue monitoring
	Eurasian			
Red Rock Pond	watermilfoil	Marion	2003	treated in 2004, continue monitoring
	Eurasian			
Rudd Lake	watermilfoil	Floyd	2003	treated in 2004, continue monitoring

Scott “A” Lake	Eurasian watermilfoil	Fremont	1999	eradicated
Scott “B” Lake	Eurasian watermilfoil	Fremont	2003	treated in 2004, treatment scheduled for 2006
Siems Park Ponds	Eurasian watermilfoil	Kossuth	2003	treated in 2004, treatment scheduled for 2006
Snyder Bend	Eurasian watermilfoil	Woodbury	1996	eradicated
South Prairie Lake	Eurasian watermilfoil	Black Hawk	1998	eradicated
Southwood Ponds	brittle naiad	Woodbury	2005	treated in 2005, continue monitoring
Sportsman’s Lake	Eurasian watermilfoil	Palo Alto	1998	treated in 1999, treatment scheduled for 2006
St. Benedicts Pond	Eurasian watermilfoil	Kossuth	1994	treated in 1995, 1998, 2003, and 2004; will continue spot treatments
Sweet Marsh	Eurasian watermilfoil	Bremer	1997	treated in 1997, 2001, and 2004; treatment scheduled for 2006
Volga Lake	brittle naiad	Fayette	2004	continue monitoring
Walnut Acres Campground Pond	Eurasian watermilfoil	Jones	2002	treated in 2003, treatment scheduled for 2006
Walnut Creek Marsh	Eurasian watermilfoil	Ringgold	1994	eradicated
Willow Lake	brittle naiad	Harrison	2004	treated in 2004 and 2005, continue monitoring
Wilson Grove Pond	Eurasian watermilfoil	Bremer	1996	treated in 1997, treatment scheduled for 2006
Yellow Smoke Lake	brittle naiad	Crawford	2003	treated in 2004, continue monitoring
Rathbun	zebra mussel	Appanoose	2007	observed on boat docked at marina

Waterbody	Site	County	River Mile	Lat N	Long W	Report Date	Report Source	Comments
Mississippi River	Lock and Dam 19	Lee	364			09/03/03	Bernie Schonoff	below dam at Keokuk; have not been observed above
Des Moines River	Keosaqua	Van Buren	51	588551	4509921	06/24/03	Mark Flammang	32.1 in., 13.2 lbs.; collected during standard sampling
Des Moines River	Otummwa	Wapello	90			07/28/03	Mark Flammang	100's of them jumping around the boat while sampling near Cliffland Access
Chariton River	Below Rathbun Dam	Appanoose				8/1/2007	Mark Flammang	

Waterbody	County	Year(s) Discovered	Tier	Range	Section	Treatment (Results)*	Comments
Airport Lake	Chickasaw	2002	96N	13W	35	Sonar whole lake in 2003 (EWM observed in 2005)	
Beeds Lake	Franklin	2000	92N	20W	19,20	Navigate spot treatment in 2000 (no EWM observed)	
Bob Pyle Marsh	Story	2004	85N	24W	5	none	did not observe in 2005
Camp Sunnyside Pond	Polk	2001	79N	24W	2	Sonar whole lake in 2002 (EWM observed in 2004), Sonar whole lake in 2005 (unknown), Did not observe 2007	
Crystal Lake	Hancock	1993	97N	25W	9,10,15,16	Sonar whole lake in 1994 (no EWM observed)	
Grundy County Lake	Grundy	2003	88N	15W	6	Sonar whole lake in 2004 (no EWM observed)	
Horseshoe Pond	Jackson	2000	84N	3E	30	NA	private pond
Keg Creek Lake	Mills	1999	71N; 72N	43W; 43W	4,5; 23,33	NA	
Koutny Pond	Buchanan	1995	87N	10W	36	NA (EWM observed in 1997, 2002)	Sonar whole lake for brittle naiad in 2004 (BN observed in 2005)
Maxwell Pond	Story	2002	82N	22W	22	NA	private pond
Mile Hill Lake	Mills	1999	72N	43W	10,15	NA (EWM observed in 2005)	
Mississippi River	multiple	Unknown				none	
Mitchell Avenue Pit	Black Hawk	1998	89N	12W	31	NA	
O'Brien Addition Pond	Emmet	2002	100 N	34W	34	none	did not observe in 2003, 2004
Ottumwa Pond	Wapello	2002				Sonar whole lake in 2003 (no EWM observed)	private pond
Plainfield Lake	Bremer	2005	93N	14W	19		

Red Rock Pond	Marion	2003	76N	19W		Sonar whole lake in 2004 (no EWM observed)	USACE treated
Riverton Marsh	Fremont	2006					observed by Gabe Stevenson while hunting
Rudd Lake	Floyd	2003	96N	17W	19, 20	Sonar whole lake in 2004 (no EWM observed)	
Scott “A” Lake	Fremont	1999	70N	43W	16	NA	
Scott “B” Lake	Fremont	2003	70N	43W	16	Reward spot treatment in 2004 (EWM observed in 2005)	
Siems Park Ponds	Kossuth	2003	95N	30W	9	Sonar whole lake in 2004 (EWM observed in 2005)	
Snyder Bend	Woodbury	1996	86N	47W	7,8,9,16,17	Sonar whole lake in 1998 (no EWM observed)	
South Prairie Lake	Black Hawk	1998	89N	14W	35	NA	
Sportsman’s Lake	Palo Alto	1998	96N	31W	19	Sonar fall whole lake in 1998 (EWM observed in 2003,2007)	treatment planned for 2004 was postponed due to high water, few EWM plants were observed in 2005
St. Benedicts Pond	Kossuth	1994	95N	27W	30	Sonar whole lake all ponds in 1995 (EWM observed in 1997), Sonar whole lake all ponds in 1998? (Ewm observed in 2002), Sonar whole lake main pond in 2004 (EWM observed in 2005)	
Sweet Marsh	Bremer	1997	93N	12W	35	multiple chemical and physical treatments since 1997 (EWM observed most years in reservoir and Martens Lake	

						channel)	
Walnut Acres Campground Pond	Jones	2002	86N	3W	15,16	Sonar whole lake in 2003 (EWM observed in 2005)	
Walnut Creek Marsh	Ringgold	1994	68N	30W	17	NA	
Winnebago Bend	Woodbury	2002	86N	47W	28,29,31,32,33	none	did not observe in 2003
Wilson Grove Pond	Bremer	1996	93N	11W	13	NA (EWM observed in 2005)	
Yamakowski Pond	Linn	2006					private pond
Martinn Zauug	Pocahontas	2007				NA	private pond

* No data on treatment details are available if treatment happened before November 2000

Brittle Naiad Locations					
Waterbody	**County**	**Years(s) Discovered**	**Treatment (Results)**	**Treatment Priority/Reason**	**Comments**
Bergfeld Pond	Dubuque	2005		high/isolated location, small	
Bitterman Pond	Buchanan	2005		This is a 1/2 acre private pond that would take a couple ounces at most.	
Brushy Creek Lake	Webster	2006			
Casey Lake	Tama	2003	Sonar whole lake in 2004 (brittle naiad observed in 2005)	low/low use, close proximity to other infestations; however has been treated in the past	
Crawford Creek Lake	Ida	2003	Sonar whole lake in 2004 (brittle naiad observed in 2005)	low/low use, close proximity to other infestations; however has been treated in the past	
Dog Creek Lake	O'Brien	2006			
Eldred Sherwood Lake	Hancock	2004		high/isolated location, small	
Grundy County Lake	Grundy	2006			
Hannen Lake	Benton	2004		medium/medium use, somewhat isolated	
Hickory Hollow Pond	Tama	2006			private pond in subdivision in Casey Lake watershed
Koutny Pond	Buchanan	2003	Sonar whole lake in 2004 (brittle naiad observed in 2005)	low/low use, close proximity to other infestations; however has been treated in the past for both brittle naiad and Eurasian watermilfoil	
Indian Lake	Van Buren	2005			

Lacey-Keosauqua Lake	Van Buren	2004	Sonar whole lake in 2005 (unknown)	medium/medium use, small; however close proximity to other locations	
Lake Geode	Henry	2004		medium/high use; however big and close proximity to other infestations	
Lake Miami	Monroe	2005		medium-low/somewhat isolated; however low use and big	
Lake Sugema	Van Buren	2004		low/large, close proximity to other infestations	
Lake Wapello	Davis	1998	Reward spot treatment	low/big, close proximity to other infestations; however has been spot treated in the past	
Little Sioux Park Pond	Woodbury	2003	Sonar whole lake in 2004 (no brittle naiad observed in 2005)	low/low use, close proximity to other infestations; however has been treated in the past	
Meadow Lake	Adair	2006			
Mississippi River	multiple	2003		none	
Moorehead Park Pond	Ida	2003	Sonar whole lake in 2004 (no brittle naiad observed in 2005)	low/low use, close proximity to other infestations; however has been treated in the past	
Morris Park Pond	Van Buren	2004	Sonar whole lake in 2005 (unknown)	high/small, dense brittle naiad caused fish kill; however close proximity to other infestations	
Nelson Park Pond	Crawford	2003	Sonar whole lake in 2004 (brittle naiad observed in 2005); Sonar whole lake 2005 (unknown)	low/low use, close proximity to other infestations; however has been treated in the past	
Pleasant Creek Lake	Linn	2003	Reward spot treatment	low/large, close proximity to other infestations; however high use and has been spot treated in the past	
Snyder	Woodbury	2005		low/large, close proximity to other	

Bend				infestations	
Southwood Ponds	Woodbury	2005	Reward spot treatment in 2005	low/low use, close proximity to other infestations	
Tug Fork West	Van Buren	2005		low/connected to Lake Sugema	
Volga Lake	Fayette	2004		high/isolated, medium use; however big	
Willow Lake	Harrison	2004	Reward spot treatment in 2004, 2005	low/low use, close proximity to other infestations; however has been spot treated in the past	
Yellow Smoke Lake	Crawford	2003	Sonar whole lake in 2004 (brittle naiad observed in 2005 & 2007)	medium-low/close proximity to other locations; however medium use and has been treated in the past	
White Oak Lake	Mahaska	2006			
Wild Wood Lake	Jackson	2006			small private lake and housing development just north of Canton
Lake Iowa	Iowa	2007			
Private Pond	Blawk Hawk	2007			small private pond in housing development
Lake Meyer	Winneshiek	2007			

CHAPTER 12. FISHERIES BUREAU NEW EMPLOYEE ORIENTATION PROGRAM

- All new employees will enroll in and complete the 1-day department-wide orientation schedule in the central office at the earliest opportunity and within the first three months of employment.

- The first line supervisor will spend a minimum of one entire day with the new employee during the first week of work. The time will be used to define the work to be accomplished, opportunities for assistance, procedures to follow, and an orientation of the Fisheries Bureau staffing and location.

- Lead workers and/or first line supervisors will provide mentoring of new employees on a daily basis for the first month of employment. Due to logistics, remote mentoring may occur. Voice connection is preferred over email.

- New employees are expected to spend a minimum of one day on site with fisheries personnel located at each of the 18 field stations and the central office. The new employee will schedule the site visits with the approval of their supervisor. This should be accomplished any time during the first year of employment. Host employees should provide a worthwhile experience for the new employee through participation in field project activities wherever possible.

- A one hour orientation will be scheduled with a representative from each of the four other bureaus within the Conservation and Recreation Division. The supervisor of the new employee will schedule this orientation. The bureau representative should be someone located close to the new employee's place of work. This orientation should be completed within the first six months of employment.

- New employees will be scheduled to work the State Fair at the earliest opportunity. This is a good venue to meet other DNR employees and obtain a pulse of our public.