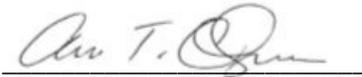

New Hampshire Department of Environmental Services (NHDES) Protocols for Collection, Identification, and Enumeration of Freshwater Fishes

A1 Title and Signature Page

Document Title: New Hampshire Department of Environmental Services (NHDES) Protocols for Collection, Identification, and Enumeration of Freshwater Fishes

Lead Organization: NH Department of Environmental Services
Water Division-Watershed Management Bureau

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Preparer's Signature: 

Organizational Affiliation/Address: NH Department of Environmental Services
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Preparation Date: November, 2013

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A3 Introduction (History, Justification)

The development and implementation of state-level biological assessment techniques and thresholds is directed under Sections 303 and 304 of the Clean Water Act. The US Environmental Protection Agency further clarified its position on the applicability of biological assessment programs in its 1991 statement of policy indicating that biological surveys shall be integrated into State water quality programs to help restore and maintain the biological integrity of the Nation's waters.

The primary goals of biological assessment programs are to determine "aquatic life use" status for applicable waterbodies, make decisions for specific permitting and regulatory actions, assist in setting planning and management priorities for waterbodies in need of controls, and prepare water quality reports.

Since 1997, NH DES has collected biological data from wadable streams with the goal of developing indices that can be used to estimate the overall ecological integrity of the biological community. Current New Hampshire water quality standards (Env-Wq 1700) define Biological and Aquatic Community Integrity as the ability to "maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region". The indices developed under the bioassessment program are meant to provide a numeric interpretation of the narrative standard outlined above.

The purpose of this document is to provide a detailed description of the collection and processing methods utilized for freshwater fish samples in order to compute a Indices of Biotic Integrity (IBIs) necessary for making biological assessments of wadeable streams and rivers.

A4 Definitions

Back-pack electroshocker: Backpack electrofisher generators are typically battery powered. They employ a transformer to pulse the current before it is delivered into the water. The anode is located at the end of a long, 2 meter pole and is usually in the form of a ring. The cathode is a long, 3 meter braided steel cable that trails behind the operator. The electrofisher is operated by a deadman's switch on the anode pole.

A5 Field Procedures for Fish Collection

The Biomonitoring Program fish assessment protocol is an intensive effort and is adapted from the United States Environmental Protection Agency's Rapid Bioassessment Protocols (US EPA 1999). The methodology is designed for wadeable streams and rivers, and uses backpack electrofishing equipment to capture fish for identification and enumeration.

A5.1 Sampling Season

Surveys are conducted at a time when fish populations are most stable and variability is minimized by seasonal migration. Extremes in flow conditions can result in non-seasonal migration of certain species seeking less stressful habitat conditions. Therefore, sampling should also be avoided during periods of natural high or low flows.

Fish surveys are conducted by the biological monitoring program from the end of June through September, but may be extended into October if necessary. The sampling time frame represents a stable fish assemblage, when fish tend to remain in a particular localized area and is most likely to include the full range of resident species. If a survey is requested or required later in the fall, New Hampshire Department of Fish and Game is contacted for advice on avoiding fall spawning species.

A5.2 Fish Collection Permits

Prior to any fish surveys, a scientific collection permit must be obtained from the New Hampshire Fish and Game Department (NH F&G). A written letter to the commissioner of the NH F&G from the head of the biomonitoring program is sent out well ahead (e.g. 3 months) of the scheduled sampling period in order to obtain the necessary permit. The request must also contain the tentative sites planned for collection. Once approved, a hard copy of the permit is carried by the biomonitoring program field operations team at all times. See attachment A for an example scientific permit request letter, attachment B for an example scientific permit application and attachment C for an example scientific collection permit.

At the end of the field season, a report must be submitted to the NH F&G summarizing the results of the survey efforts. The report must include the stations sampled, including the exact location; a list of species encountered and the number of each species captured; the incidence of mortality for each species; and whether any of the species are included on state or federal threatened and endangered (T&E) species lists. Any sites known to contain T&E species must be approved for sampling prior to when the actual field work occurs.

A5.3 Training and Safety for Electrofishing

Electrofishing equipment can be hazardous if not operated competently by trained individuals. It is the policy of the biological monitoring program that any individual operating electrofishing equipment be trained by the current biological program manager before any field sampling.

As part of the training, all new field crew personnel are required to read the operation and safety manuals supplied by the manufacturer of the electrofishing equipment. A copy of the manuals for the current equipment used by the biological monitoring program is included in appendix XX. In addition, all individuals participating in electrofishing activities must have current CPR training. Opportunities to attend a CPR course will be identified and offered to all field crew personnel prior each field season.

At the completion of these activities and readings field personnel are required to sign a waiver (Appendix D-2) verifying that they have read and fully understand the hazards involved and the required safety protocols prior to any actual field survey work.

The biological program manager will also provide "hands on" training prior to "live" sampling allowing all field crew members to understand the various roles on the shocking crew team and instream safety precautions used to minimize the likelihood of injury related to electroshocking. Field crew members are required to practice these procedures and safety measures during all field operations. Failure to do so will result in their removal from the shocking crew.

In addition to above safety measures, all field crew members are required to wear protective equipment, including waders and rubber gloves at all times. If a member does not have these basic items, they will not be allowed to be in the water during the shocking. Wading belts and



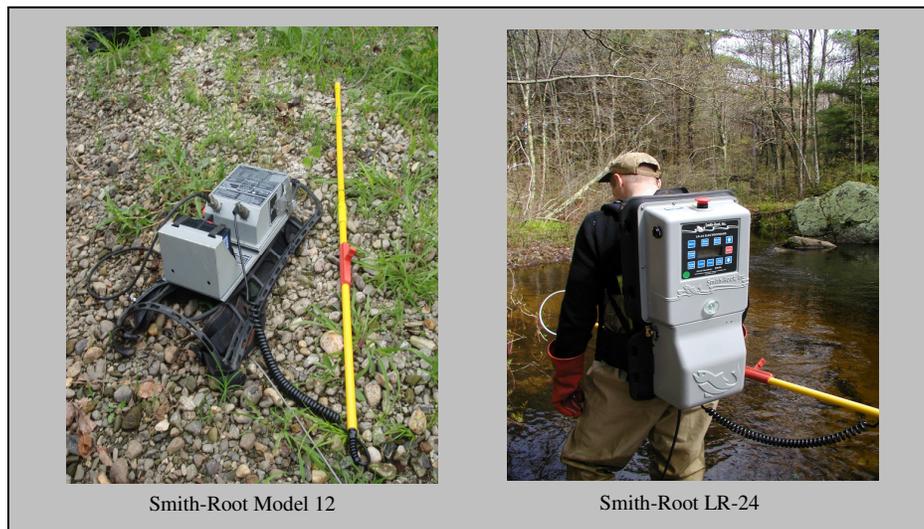
life jackets are also available if a crew member chooses to use them. Field crew members are also strongly urged to wear polarized sunglasses and a hat during sampling to minimize accidents and increasing sampling efficiency.

In order to ensure safety and efficiency in fish sampling efforts as well as equipment longevity, equipment must be inspected and appropriately maintained. Inspections of electrofishing equipment will be completed prior to each sampling event. Pre-operation

inspections shall include: a visual check of electrical connections, wires, and shocking battery. Any loose connections, worn or frayed wires, leaking or cracked batteries will preclude any and all electroshocking activities until repairs can be made. In addition, an instream test shall be performed prior to any sampling. The instream test is designed to check the shocker settings and performance, as well as the integrity of each field crew member's waders and gloves. The instream test will also be used to test the various built in safety mechanisms (e.g. tilt) on the electroshocker. At the end of the season a final inspection of each electroshocker will be completed so that any necessary repairs can be identified and completed.

A5.4 Equipment and Materials

The Biological Monitoring Unit utilizes two separate electroshocker models (Model 12 and LR-24) manufactured by Smith-Root, Inc. Both utilize DC (direct current) power generated from a 24 volt gel cell deep cycle battery. Each unit has a variety of waveform settings to accommodate a range of environmental conditions, specifically those related to in-stream specific conductance. Manuals for operation and care of each electroshocker are available for reference through the Biomonitoring Program or at www.smith-root.com.



A5.5 Rational for Stream Length to be Fished

An accurate representation of the fish species present and their relative numbers at any given sample location is imperative in order to effectively assess biological condition. The first step towards this goal is the establishment of suite of standardized sampling protocols. Initially, this is accomplished by defining a representative sample reach from which a fish sample is collected. For the biological monitoring unit this means sampling a stretch of river or stream with the goal of capturing 95% of the species which are present. Figure XX demonstrates the basic relationship between number of fish species captured relative to the distance sampled; simply stated as the sampling distance increases the maximum number of species captured plateaus. Beyond this distance, additional sampling captures few new species, and thus, is unnecessary to obtain a representative sample of the resident fish

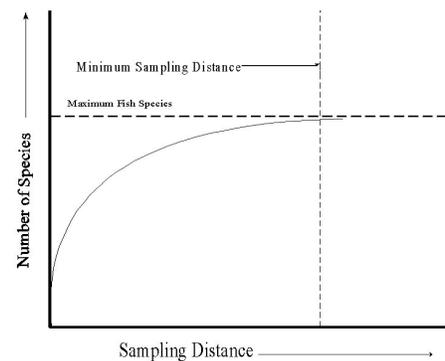


Figure 4-2. Basic relationship between the number of species vs. sampling distance

community. The distance necessary to capture the majority of the species present is a function of stream order, geomorphologic characteristics, gradient, and other physical factors.

A5.6 Fish Collection Procedure

For wadeable streams in New Hampshire, a minimum distance of 150 meters is employed. This distance has been established as a reasonable minimum to optimize the representation of the resident species. For streams with wetted widths in excess of 30 feet but less than 50 feet, the wetted width is multiplied by 20 to determine the length of the stream reach. For streams over 50 feet wide, a visual survey of the habitat types is completed prior to establishing a set reach length. For these larger wadeable streams, the goal is to sample at least two of each habitat types observed. For some projects, reach lengths may not conform to these basic rules depending on the overall goals of the sampling effort.

Regardless of reach length, normal sampling will include a single pass through the study reach working in an upstream fashion. Sampling in an upstream direction eliminates problems of turbidity from the field crew and facilitates netting of fish as they drift towards the crew. Different fish species will inhabit a variety of microhabitat types and effort is made to shock all niches present in the stream reach.

The field sampling crew is comprised of one shocker, a minimum of two netters, and one person to carry a 5-gallon aerated bucket to place fish into for recovery. Netted fish are immediately transferred to the 5 gallon bucket upon capture. The individual operating the shocker serves as the point person on the field crew and dictates the pace and direction of shocking. The netters generally flank, and stay slightly behind, the shocker, while the person carrying the bucket stays behind both the netters and shocker. Communication between all crew members must be clear and continuous as to the expected direction of travel, pause intervals for fish transfer and repositioning, necessary rest periods, or emergencies. In the case of an immediate need to discontinue shocking field crew members, an "alert call" such as "out" will be utilized.

In some cases, two or more shock crews may be necessary to effectively shock a sample reach. In these cases, each shock crew proceeds in an upstream fashion at an approximately equal pace to maximize capture efficiency. The need for multiple shock crews is relatively infrequent and is dictated by stream size.



Numbers, species and shock time in seconds are recorded to determine the catch per unit of effort (CPUE), providing another level of standardization for making comparisons between sites. The programmed waveform for the pass should also be noted (i.e. Voltage setting,

pulse width/pulse frequency). Initial settings should be 60Hz at 6ms which is the I5 mode setting (Figure 4-3). Initial chemical data including pH, temperature, dissolved oxygen and conductivity are made on the Biomonitoring Site Information Sheet (Appendix A-1) before electrofishing. Conductivity levels as well as the targeted species or size class to be captured, will dictate the waveform settings of the backpack shocker. Where macroinvertebrate monitoring is scheduled to take place in conjunction with fish community assessments, the kicks sites or rock basket placement should be within close proximity to the fish sampling reach.

A5.7 Fish Data Processing Procedure

Fish collected during the survey are processed and data recorded after completion of the single pass. Generally, fish are processed at the upstream end of the sample reach by recording the

number of individuals for each species captured. The following reference guides are referred to for fish identification: *Freshwater Fishes of New Hampshire* (Scarola, 1987) and *Fishes of Vermont* (Langdon et al. 2006). For species in the trout family (Salmonidae), a separate tally, the number of young-of-the-year (YOY), are also recorded. The incidence of mortality is also tracked for each species with a target of less than 5% mortality for any one species. All data are recorded on a standardized fish collection data



sheet (Appendix A-2). Fish less than 25mm in length are not included in the tabulation. If small fish (<25mm) are especially abundant and can be identified, then an appropriate note will be made on the field sheet. External anomalies will be noted on the field sheets as well as an estimation of the number of fish exhibiting the anomaly. After identification and enumeration, all fish are immediately released back into the stream or river. Un-identifiable fish may be photographed or retained for identification back in the laboratory. Finally, the cumulative "shock time" displayed by the electroshocker and shocker settings (e.g. waveform, frequency, voltage, duty cycle) is recorded on the data sheet. The time represents the actual duration, usually in seconds, electric current was discharged into the water. Generally, this shock time ranges from 1,000 - 2,000 seconds, but can be lower or higher depending on the level of effort needed to effectively shock the sample reach.

A6 Quality Assurance and Quality Control

Quality Assurance and Quality Control (QAQC) is performed for fish identification by having an experienced fish taxonomist identify fish species. Field identification manuals, including "Freshwater Fishes of New Hampshire," by John. F. Scarola and "Fishes of Vermont," by

Richard W. Langdon et al. are referred to in the field for less common species. When a fish can not be identified in the field, they are retained for laboratory identification. All species retained are preserved in formalin and labeled with date, site and staff responsible for collection.

A8 Data Sheets

The Fish Collection Data Sheet includes a table to record species, size, weight and number. See Attachment D.

Attachment A: Example Scientific Collection Permit Request Letter



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner



April 11, 2013

Scott Decker
NH Fish and Game Department
Inland Fisheries
11 Hazen Drive
Concord, NH 03301

Subject: NH Department of Environmental Services Scientific Collection Permit Request

Dear Mr. Decker,

The NH Department of Environmental Services (NH DES) is requesting a scientific collection permit to collect fish for the year 2013. The permit will allow NH DES to participate in the U.S. Environmental Protection Agency's (EPA) National Rivers and Stream Assessment for 2013 and other NH DES Biomonitoring Program projects as needed.

There will be six EPA and DES staff assigned to one or more of the above mentioned fish collection projects. They include the following:

David Neils, NH DES
Steve Landry, NH DES
Andy Chapman, NH DES
Tom Faber, EPA
Hilary Snook, EPA
Dave McDonald, EPA

The following sites for fish collection have tentatively been identified to include:

Connecticut River (Monroe, Walpole, Lyme, Claremont, Northumberland and Columbia)
Merrimack River (Concord, Pembroke)
Androscoggin River (Errol)
Contoocook River (Concord, Greenfield)
Chocorua River (Tamworth)
Back Creek (Deerfield)

Moose River (Gorham)
Baker River (Wentworth)
Hale Brook (Nashua)
Unnamed Stream (Hinsdale) (42.7567N, -72.4633)

NH DES will notify F&G of any changes to the above plan.

The collection method will be electrofishing by boat or back-pack. In instances where boat shocking is completed, NH DES staff will accompany EPA staff on an EPA owned and operated equipment vessel. Most fish will be identified to species and then returned. A limited number of specimens of recreationally important fish species will be harvested for fish tissue analysis. In a limited number of cases, tissue plugs on separate individuals will be taken, as well as whole fish harvesting, for the purposes of tissue analysis. For fish that have plugs removed antibiotic salve will be placed over the wound and the fish released. Some voucher specimens may also be retained to confirm the species identification by laboratory inspection.

In addition, macroinvertebrate collections will be at various locations throughout the state in 2013. Individuals will be collected through the use of artificial substrates (rock baskets) that are deployed for a period of 6 - 8 weeks. Taxa collected are primarily from the Class Insecta and other arthropods. Samples will be preserved in 70% ethanol and identified by an NH DES retained contractor.

In all cases a complete account of the taxa capture and identified, including any mortality will be provided the NH F&G at the end of the field season.

Should you have any questions, please do not hesitate to contact me directly at andrew.chapman@des.nh.gov or 603-271-5334

Thank you,



Andy Chapman
Biomonitoring Program
NH DES Watershed Management Bureau

Cc: Dave Neils (via email)

Attachment B: Example Scientific Collection Permit Application



New Hampshire Fish and Game Department
11 Hazen Drive, Concord, NH 03301

APPLICATION FOR SCIENTIFIC LICENSE

I

Fee: \$26.00 - Waivers of the fee specified in RSA 214:29 shall only be granted to educational and non-profit institutions and governmental agencies.

1. Name: Andy Chapman		2. Date: April 11, 2013
3. Affiliation or Company Name: NH Dept. of Environmental Services		
4. Mailing Address: 29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095		
5. Telephone #: 603-271-5334	6. Fax #: 603-271-7894	7. E-mail: andrew.chapman@des.nh.gov
8. Purpose of study: The NH Department of Environmental Services would like to request a scientific collection permit from NH Fish and Game (F&G) to collect fish for the year 2013. The permit will allow DES to participate in the fish collection protocol in support of the U.S. Environmental Protection Agency's National Rivers and Stream Assessment for 2013 and other DES Biomonitoring Program projects for the purposes of reporting on the condition of the fish community and completing water quality assessments.		
Records of all species will be retained by NH DES and reported to NH F&G at the end of the field season. Data records will include the exact location of collection (lat/long), method of collection, abundance of each species, length of a portion of the individuals at select sites, mortality due to collection/handling, and number of specimens reserved for identification confirmation or laboratory identification. In most cases, digital photographs will be utilized for identification confirmation or laboratory identification.		
9. Method of collection: Electrofishing, by boat and back-pack		10. Dates of collection: June-September, 2013
11. Waterbody or specific location(s) of collection: Below are the known locations that are expected to be sampled. In some instances, alternative or additional sites may be sampled depending on accessibility or additional project needs. Locations sampled beyond this list will be reported the NH F&G prior to sampling.		
Connecticut River (Monroe, Walpole, Lyme, Claremont, Northumberland and Columbia) Merrimack River (Concord, Pembroke) Androscoggin River (Errol) Contoocook River (Concord, Greenfield) Chocorua River (Tamworth) Back Creek (Deerfield) Moose River (Gorham) Baker River (Wentworth) Hale Brook (Nashua) Unnamed Stream (Hinsdale) (42.7567N lat., -72.4633 long.)		
12. Specific target species of wildlife to be taken and/or possessed: All species for a given site may be temporarily possessed for species, length measurement, and age class identification before being returned to the stream. In addition, some species may be taken for fish tissue analysis (toxics) or species confirmation (QA/QC) by an EPA contracted laboratory or unknown species identification in the laboratory. We will review the NH Endangered and Threatened Species list so as to ensure no T&E species are taken.		
13. Number of target species to be taken and/or possessed: Any number of species for a given site may be temporarily possessed before being returned to the stream. In addition, some species may be taken for fish tissue analysis (toxics) or species confirmation (QA/QC) by an EPA contracted laboratory or for unknown species identification. For fish tissue analysis, the target species will only be those of recreational pursuit for human consumption (see attached table). No more than 5 fish (abundant, same species) will be collected at each site for whole fish toxic analysis by an EPA contracted laboratory. No more than 30 fish will be collected for species confirmation to be conducted by an outside laboratory (QA/QC). Lastly, up to 20 additional fish may be collected for unknown species. We will review the NH Endangered and Threatened Species list so as to ensure no T&E species are taken.		

14. Final disposition of specimens collected: Most fish will be identified for species and age class, then returned to the stream reach where collected. No more than 5 fish (abundant, same species) will be collected at each site for whole fish toxic analysis by an EPA contracted laboratory. No more than 30 fish will be collected and sent to an EPA contracted laboratory for species confirmation. Up to 20 additional fish may be collected for unknown species identification.		
15. Name(s) of person(s) to be listed as <u>subpermittee(s)</u> : David Neils, NH DES Steve Landry, NH DES Tom Faber, EPA Hilary Snook, EPA Dave McDonald, EPA		
16. Copies of this permit shall be carried by permittee or subpermittees while engaged in the activities permitted under the scientific license. 17. This permit expires on December 31 of year issued. An annual report of specimens collected is required (see reverse side).		
18. Signature of Applicant: 		
FOR OFFICE USE ONLY		
Approved by:		
Inland Fisheries Div.	Wildlife Div.	Marine Div.
Executive Director	Date Issued	Permit Number
SPECIAL PERMIT CONDITIONS:		

REPORTING REQUIREMENTS

The licensee shall submit a report of study results by January 31 for period covered by the scientific permit to include the following information:

- (1) The name and address to which the scientific permit was issued;
- (2) The purpose and objective of the study;
- (3) Species and number wildlife taken;
- (4) Age and sex, if known, of wildlife taken;
- (5) Location(s) where species were taken or collected, including a map for those wildlife species tracked under this license;
- (6) Date received or collected;
- (7) Disposition of the wildlife; and
- (8) Location where specimens are held, if applicable.

Attachment C: Example Scientific Collection Permit



New Hampshire Fish and Game Department

HEADQUARTERS: 11 Hazen Drive, Concord, NH 03301-6500
(603) 271-3421
FAX (603) 271-1438

www.WildNH.com
e-mail: info@wildlife.nh.gov
TDD Access: Relay NH 1-800-735-2964

SCIENTIFIC LICENSE #F2013-74

April 12, 2013

To Whom It May Concern:

Under the authority contained in RSA 214:29, permission is hereby granted to **Andy Chapman, NH Department of Environmental Services, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095, Ph. 603-271-5334** to collect and possess various species of freshwater fish from several streams in New Hampshire in support of the U.S. Environmental Protection Agency's National Rivers and Stream Assessment for 2013 and other DES Biomonitoring Program projects for the purposes of reporting on the condition of the fish community and completing water quality assessments.

Time of collection: June – September, 2013

Collection sites: Connecticut River, Merrimack River, Androscoggin River, Contoocook River, Chocorua River, Back Creek (Deerfield), Moose River, Baker River, Hale Brook (Nashua), Unnamed Stream (Hinsdale). Other streams as necessary.

Target species: Various species of freshwater fish.

Method of collection: Fish will be sampled by backpack and/or boat electrofishing.

Final disposition of specimens collected: Fish will be returned to the waterbody where they were collected in good condition. In addition, some species may be taken for fish tissue analysis (toxics) or species confirmation (QA/QC) by an EPA contracted laboratory or for unknown species identification. No more than 5 fish (abundant, same species) will be collected at each site for whole fish toxic analysis by an EPA contracted laboratory. No more than 30 fish will be collected for species confirmation to be conducted by an outside laboratory (QA/QC). Lastly, up to 20 additional fish may be collected for unknown species.

Sub-permittees: David Neils, Steve Landry, Tom Faber, Hilary Snook, Dave McDonald

This permit, or a copy, shall be carried with the permittees while engaged in any activity allowed under this permit and shall be displayed to any New Hampshire Fish and Game Department Conservation Officer or employee upon request.

This permit shall expire December 31, 2013, unless sooner revoked or rescinded.

A report of findings shall be submitted to the Executive Director by January 31, 2014.


 Glenn Normandeau
 Executive Director

GN/srd

cc: Law Enforcement Division, Inland Fisheries Division

REGION 1
629B Main Street
Lancaster, NH 03584-3612
(603) 788-3164
FAX (603) 788-4823
email: reg1@wildlife.nh.gov

REGION 2
PO Box 417
New Hampton, NH 03256
(603) 744-5470
FAX (603) 744-6302
email: reg2@wildlife.nh.gov

REGION 3
225 Main Street
Durham, NH 03824-4732
(603) 868-1095
FAX (603) 868-3305
email: reg3@wildlife.nh.gov

REGION 4
15 Ash Brook Court
Keene, NH 03431
(603) 352-9669
FAX (603) 352-8798
email: reg4@wildlife.nh.gov

Attachment D: Fish Collection Data Sheet

Date:	Electrofishing Info		Data Entry	
Site ID:	Equipment Model:		Data entered into database	
Waterbody:	Back-pack Setting:		Initials: Date:	
Town:	Shock Time (s):		Data transcribed/ QC	
Visit #:	Pass #:		Initials: Date:	
Fishing Crew/Notes:				
Species:		Min	Max	Tally
	1			
	2			
	3			
	4			
	5			

Species:		Min	Max	Tally
	1			
	2			
	3			
	4			
	5			

Species:		Min	Max	Tally
	1			
	2			
	3			
	4			
	5			

Species:		Min	Max	Tally
	1			
	2			
	3			
	4			
	5			

Species:		Min	Max	Tally
	1			
	2			
	3			
	4			
	5			

For Full Datasheet See: <
 "\\HAZDESP3\WATERSHED\BIOLOGY\Biomonitoring\Sampling\Data Sheets\C-2_Fish
 Collection\20140508 Fish Collection Datasheet.xls"

Attachment E: Fish Collection Waiver for Electrofishing Equipment.

To assist the NHDES Biological Monitoring Program with fish collection by electrofishing

methods, I _____, have read the New Hampshire Department of

Print Name

Environmental Services (NHDES) Protocols for Collection, Identification, and Enumeration of

Freshwater Fishes and reviewed the appropriate SOP and safety manuals, available from the

NHDES Biolomonitoring Program and or from the manufacturer which can be found on-line at

www.smith-root.com.

Signature

Date