



MassDEP

**Massachusetts Department of Environmental Protection
Bureau of Water Resources
Division of Watershed Management
Watershed Planning Program**

STANDARD OPERATING PROCEDURE

Fish Collection Procedures for Evaluation of Resident Fish Populations

CN 75.3

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**Prepared and
Approved by:**

Daniel A Davis

Date: 4/2/25

Daniel Davis, Monitoring Coordinator

Approved by:

A handwritten signature in black ink, appearing to be "Jasper Sha".

Date: 7/17/25

Jasper Sha, QA Analyst

Approved by:

A handwritten signature in black ink, appearing to be "Shervon De Leon".

Date: _____

Shervon De Leon, Monitoring Section Chief



LIST OF REVISIONS

<u>Revision Date</u>	<u>Revision</u>	<u>Pages #s</u>	<u>CN/ (Old CN if applicable)</u>	<u>Initials</u>
2019	Original		CN 075.2	
February 2025	Minor edits throughout plus removal of habitat data collection. Updated field sheets to most recent versions.	Complete document	CN 075.3	DD

TABLE OF CONTENTS

LIST OF REVISIONS	2
1.0 SCOPE AND APPLICATION	3
2.0 SUMMARY	3
3.0 SAFETY CONSIDERATIONS.....	3
4.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING.....	3
5.0 APPARATUS, EQUIPMENT AND MATERIALS.....	3
6.0 REAGENTS.....	4
7.0 CALIBRATION	4
8.0 PROCEDURE.....	4
9.0 QUALITY CONTROL.....	7
10.0 INTERFERENCES.....	7
11.0 PREVENTIVE MAINTENANCE.....	7
12.0 CORRECTIVE ACTIONS	8
13.0 WASTE AND POLLUTION PREVENTION	8
14.0 REFERENCES	8



1.0 SCOPE AND APPLICATION

This SOP is intended to document and guide field procedures necessary for the collection, enumeration and speciation of fish assemblages in streams and rivers as monitored by Massachusetts Department of Environmental Protection Watershed Planning Program (MassDEP WPP).

2.0 SUMMARY

Monitoring of the stream fish assemblage is an integral component of the MassDEP WPP water quality management program, and its importance is reflected in state stream class and use-support designations. Assessments of the fish assemblage must measure the overall structure and function of the ichthyofaunal community to adequately evaluate biological integrity and ultimately protect surface water resource quality.

3.0 SAFETY CONSIDERATIONS

The safety of all personnel involved is ensured through the adequate education, training, and experience of all members of the fish collection team. At least one biologist with training and experience in electrofishing techniques and fish taxonomy is involved in each sampling event. Staff and assistants are trained in proper field safety techniques, including electrofishing safety precautions and unit operation procedures identified by the electrofishing unit manufacturer. It is recommended that at least two fish collection team members be certified in CPR and that a portable AED be brought on electrofishing surveys. Any lab work with alcohol preservative is consistent with the intent and provisions of WPP's Lab Safety Plan.

4.0 SAMPLE COLLECTION, PRESERVATION AND HANDLING

See Section 8.0.

5.0 APPARATUS, EQUIPMENT AND MATERIALS

Equipment

- Backpack electrofishers (battery and gas-powered; e.g. Smith Root Model 12/15, Coffelt Mark 10.BP4, Halltech HT-2000 or equivalent)
- Backpack or barge-specific anode wands (they differ by manufacturer and pin type)
- Barge electrofisher (gas powered; e.g. Smith Root Model SR6, SR7 or equivalent)
- Dip nets
- Block nets (i.e., seines)
- Arm-length insulated waterproof gloves
- Chest wader equipped with wading cleats
- Polarized sunglasses



- Livewells (cooler, buckets, cage, or other)
- Jars and/or plastic bags for voucher/reference specimens
- Ethanol or isopropanol (for short and long term storage of voucher specimens)
- Measuring board (500 millimeter minimum, with 1 millimeter increments)
- Tape measure or rangefinder
- Fish survey data forms
- Pens
- Pencils
- Waterproof labels
- Clipboard
- First aid kit
- AED (Automated External Defibrillator)
- Decontamination spray system (typically NaCl or KCl solution)

6.0 REAGENTS

NA

7.0 CALIBRATION

NA

8.0 PROCEDURE

Massachusetts DEP has chosen to use a consistent, standardized method based on the fish protocols in USEPA's *Rapid Bioassessment Protocols For Use In Streams And Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish* (Barbour et al. 1999) in order to improve data comparability among wadeable sampling sites throughout the state.

Fish collection procedures should focus on a multihabitat approach, allowing the sampling of habitats in relative proportion to their local availability. Each sample reach should contain riffle, run and pool habitat, when available. Whenever possible, the sample reach should be sampled sufficiently upstream of any bridge or road crossing to minimize the hydrological effect on overall habitat quality. Wadeability and accessibility may ultimately govern the exact placement of the sample reach. Prior to 2025, a habitat assessment was performed (and in some cases physical/chemical parameters were measured) concurrently with fish sampling to document and characterize available habitat specifics within the sample reach. In 2025 WPP stopped collecting habitat data at fish population and CWF survey sites in favor of using the data collected during macroinvertebrate survey habitat assessments.



All fish sampling gear types are generally considered selective to some degree; however, electrofishing has proven to be the most comprehensive and effective *single* method for collecting stream fishes. Pulsed DC electrofishing is the method of choice to obtain a representative sample of the fish community at each Massachusetts sampling station. The accurate identification of each fish collected is essential, and species-level identification is required. Field identifications are acceptable; however, voucher specimens must be retained for laboratory identification if there is any doubt about the correct identity of the specimen. Because the collection methods used are not consistently effective for young-of-year (YOY) fish or fish less than 20 millimeters total length, and because the inclusion of YOY may seasonally skew bioassessment results, YOY fish, (with the exception of salmonids), are not targeted for collection.

Laboratory analyses are conducted and/or supervised by a fisheries professional trained in fish taxonomy. Quality assurance and quality control must be a continuous process in fisheries monitoring and assessment, and must include all program aspects (i.e., field sampling, measurement, laboratory processing, and data recording).

Several options exist for electrofisher configuration and field team organization; however, procedures will always involve pulsed DC electrofishing and a minimum 2-person team.

Examples include:

- Backpack electrofisher with on hand-held anode pole and a trailing or floating cathode. The electrofisher unit operator manipulates the anode with one hand and has a second hand free for use of a dip net. The remaining team member(s) also aid in the netting of specimens, and in addition are responsible for specimen transport to buckets or livewells.
- Barge electrofisher with two hand-held anode poles and a trailing/floating cathode. Two team members are each equipped with an anode pole and a dip net. Each is responsible for electrofishing and the netting specimens. A third team member tends cable and assists in netting fish and transporting fish to the livewell. The remaining team member will follow supervising the operation, controlling the flow of electricity via two hand operated switches, and pushing the barge through the sample reach.

Procedures

1. A representative 80-120 meter stream reach is selected which includes a diversity of primary physical habitat characteristics within the reach (i.e., riffle, run, and pool habitats, when available). The sample reach should be located away from the influences of major tributaries and bridge/road crossing (e.g., sufficiently upstream to decrease influences on overall habitat quality) unless those structures might provide thermal or depth refugia for local species.
2. Collection via electrofishing begins at a shallow riffle, or other physical barrier at the downstream limit of the sample reach and terminates at a similar barrier at the upstream end of the reach. In the absence of physical barrier, block nets should be set at the upstream and downstream ends of the reach prior to the initiation of any sampling activities.



3. Fish collection procedures commence at the downstream barrier. A minimum 2-person fisheries crew (for backpack electrofishing) or 4-person fisheries crew (for barge electrofishing), proceeds to electrofish in an upstream direction using side-to-side or bank-to-bank sweeping technique to maximize area coverage. When using the barge electrofisher, 2 handlers of anode wands work side to side from the middle of the stream to each outer bank and back towards the center of the stream. All wadeable habitats within the reach are sampled via a single pass, which terminates at the upstream barrier. Fish are held in live wells (or buckets) for subsequent identification and enumeration.
4. Sampling efficiency is dependent, at least in part, on the field team's ability to see and net the stunned fish. Therefore, each team member should wear polarized sunglasses when doing so increases visibility, and sampling should only be conducted during periods of optimal water clarity and flow.
5. All fish (with the exception of YOY) are collected within the sample reach. It should be noted that all salmonids (including YOY) are collected. Fish are identified to species. Fish which cannot be positively identified in the field are brought back to the laboratory for identification. At least three individuals (when available) of each questionable type should be retained. Fish which could be state or federally listed as special concern, threatened or endangered are photographed and released unharmed.
6. Fish which are retained as voucher specimens are placed in a plastic bag on ice and may then be placed in HPDE jars which contain ethanol. The fish should be completely immersed in the ice or the ethanol solution and the bag or jar should contain a label that includes station number and/or location information, collection date, and collector's name. The label should be filled out in pencil. In the case of the fish placed on ice, long term preservation of voucher samples requires a switch to ethanol. Voucher specimens are stored in a flammables cabinet. When vouchers are no longer needed, they can be offered to museums, universities, other agencies, volunteer or other groups. If they are not wanted, the jars contents are emptied into a 5-gallon bucket in the sink (not to exceed about ½ gallon), the fish removed and disposed as trash, and the bucket filled with tap water until it overflows into the sink. The diluted alcohol in the bucket is then carefully emptied down the drain.
7. Young-of-year fish (with the exception of salmonids) less than twenty millimeters (total length) are not identified or included as a representative of a given species unless it is the only fish of that species collected. Specimens that can be identified in the field are counted, examined for external anomalies, (i.e., deformities, eroded fins, lesions, and tumors) and recorded on field data sheets.
8. Field notes and a general site diagram are recorded on the "Field Data Sheet: Fish." The stream name, a station identification code (i.e. watershed number and station number separated by a dash or other code), names of field team members ("investigators"), location description (e.g., upstream of a road crossing), municipality, should be recorded on this sheet. Also record the date, time of day, shocker start time, duration of sampling (in seconds), and maximum and mean stream widths. Also ensure that either Fish Population Survey (Total Pickup) or CWF Only (Partial Pickup) is selected depending on survey type. For CWF protocols see SOP CN 533.1.



9. Record the weather condition at the time of collection and for the past 24 hours if there have been severe weather events. Note any local conditions that may have impacted the sample (channelization, unsampleable areas, notable weather events, new construction/conditions). Note general condition of the habitat and the habitats sampled (e.g., vegetation, proportion of habitat types, depth, weight) on the Field Data Sheet.

9.0 QUALITY CONTROL

Fish bioassessment data quality and comparability are assured through the utilization of qualified fisheries professionals and consistent methods.

Quality control must be a continuous process in fish bioassessment that includes all program aspects, from field collection and preservation to habitat assessment, sample processing, and data recording

Field identification of fish must be conducted by qualified/trained fish taxonomists, familiar with Massachusetts ichthyofauna. Questionable records are prevented by preserving select specimens and those that cannot be readily identified in the field for laboratory verification and /or examination by a second qualified fish taxonomist. Specimens must be properly preserved and labeled (refer to procedure no. 5). When needed, chain-of-custody forms must be initiated following sample preservation and must include the same information as the sample container labels.

All field equipment must be in good operating condition, and a plan of routine inspection, maintenance and/or calibration must be developed to ensure consistency and quality of field data. Field data must be complete, legible, and should be entered on standardized field data forms and chains-of custody for all anticipated sampling site, as well as copies of all applicable SOPs.

10.0 INTERFERENCES

NA

11.0 PREVENTIVE MAINTENANCE

11.1 Electrofishing (boat)

The Honda generator oil needs to be changed once per year. All items should be checked for tightness (tightened if necessary) prior to each survey. The mercury outboard should be winterized with engine fogger each winter. The electrofishing control box should be stored in the fish preparation laboratory when not in use. The hull of the electrofishing boat and anode ring/droppers should be cleaned with steel wool once per year.

11.2 Backpack electrofishing gear

Smith Root Model 20 batteries should be re-charged immediately after use. The electrode ring and rat tail cathode should be cleaned with steel wool twice per year or as needed to keep them shiny and bright. The gas powered electrofisher should be winterized by adding gas stabilizer to the main and spare fuel tanks each winter. The anode ring and rat tail cathode should be cleaned with steel wool once per year or as needed to keep them shiny and bright.



Halltech HT-2000 batteries should be re-charged immediately after use. The electrode ring and rat tail cathode should be cleaned with steel wool twice per year or as needed to keep them shiny and bright. The gas powered electrofisher should be winterized by adding gas stabilizer to the main and spare fuel tanks each winter. The anode ring and rat tail cathode should be cleaned with steel wool once per year or as needed to keep them shiny and bright.

11.3 Barge Electrofisher

The Honda generator oil needs to be changed once per year when in active use. All items should be checked for tightness (tightened if necessary) prior to each survey. The electrofishing control box should be stored inside when not in use. The hull of the electrofishing barge, the cathode plate, and the anode rings should be cleaned with steel wool once per year or as needed.

12.0 CORRECTIVE ACTIONS

Corrective actions to ensure safety and data quality include:

- On-site field direction by the crew leader during the survey. In addition to pre-training, on-the-job direction is practiced as needed to ensure capture efficiency and safe working conditions.
- Review of data package by **crew leader** following survey. This ensures that all data forms are complete and accurate.

13.0 WASTE AND POLLUTION PREVENTION

Wherever possible, waste is minimized. Voucher collection is only done when needed to fill gaps in the collections. Fish which could be State or Federally-listed as species of special concern, threatened or endangered are photographed and released unharmed.

NOTE: For all equipment, care must be taken to avoid transporting aquatic vegetation to other locations within waterbodies and to other waterbodies. This is done by thoroughly inspecting and cleaning boats and equipment of all plant fragments both before launching and after take out.

14.0 REFERENCES

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.



15.0 APPENDICES (FIELD SHEETS)



BIOLOGICAL SURVEYS OF WATERS: FISH SAMPLING LOG

Date: ____/____/____ Waterbody: _____ Town: _____

Location (road crossing, directions, etc.): _____

GPS Coordinates (NAD 1983/WGS 1984-decimal degrees): Lat _____ Long _____

Sampling Gear and Effort: (circle all methods that apply, circle options in parenthesis that apply)

Boat Shocking (DAY / NIGHT) | # Runs _____ Total Seconds _____ Amps _____ Range (H / M / L / Auto) % of Range _____

Boat Description _____

Barge Shocking | Total Seconds _____ # Electrode Poles _____ PPS and Mode _____ Amps _____ Volts _____

Barge Description _____

Backpack | # Backpacks _____ # Passes _____ Total Seconds _____ Amps _____ Volts _____ Freq. _____ P. Width _____

Seine | Seine Length (m) _____ Bag (Y / N) # of Hauls _____ Mesh Size _____ Set Method (Wading / Boat)

Gillnet | (DAY / NIGHT / OVERNIGHT) Avg. Net Length (m) _____ # Nets Set _____ Avg. Set Time (hrs) _____ Mesh Size _____

Fyke Net | Length (m) _____ # Nets Set _____ Mesh Size _____ Avg. Set Time (hrs) _____

Reach/Site Data: % Run _____ % Riffle _____ % Pool _____ % of Reach Sampled _____

Measured ->

Estimated ->

Reach Length (m) _____ Reach Avg Width (m) _____ Avg Depth (m) _____ Max Depth (m) _____

Fish Data: Voucher ☐ Fishless Sample ☐ Stream Dry ☐ No Sample Conducted ☐

Habitat Data: EPA Habitat Assessment Field Data Sheet ☐

Water Chemistry: Profile (Attached) ☐ Surface ☐ Depth (m) _____ Temp (°C) _____ Cond. _____ DO _____ pH _____

Crew (last names):

Comments: (Habitat, Sampling Efficiency, Local Conditions, etc.)

_____	_____
_____	_____
_____	_____
_____	_____

Office Use Only:

SARIS/PALIS _____

SAMPLE ID _____

Date Entered _____

Entered By _____



FIELD SAMPLING LOG INSTRUCTIONS

Please refer to the following instructions to complete the "Biological Survey of Waters: Fish Sampling Log" datasheet. The instructions follow the datasheet section by section and will help make data entry and interpretation easier and more consistent.

1. Date and Location Information: This information is crucial since, while in the field, it is the only way to keep all the data gathered at one site separate from other sites. These fields should be repeated identically on the Fish Sampling Log, the Length Frequency Sheets, and the Voucher Collection bottle. Use the following conventions when writing the information on the data sheets:

Date: use 00/00/0000 format. **Waterbody Name:** use the full name of the waterbody, include the "river," "stream," "lake," "pond," or "reservoir" designation. **Town:** include the town(s) in which the sample was conducted. **Location:** write in any verbal descriptions that will clarify the location of the sample. Include any information that would allow the location of the site on a topo map or GIS, for example: distance, upstream or downstream, from road crossings, or high tension lines. **GPS Coordinates:** Use NAD83 or WGS84 format and decimal degrees (e.g. 42.40776). These settings can be configured on your GPS using the manual provided. Although this might seem redundant with "Location Information," they are both valuable during the data entry process.

2. Sampling Gear and Effort: This section lists most of the standard sampling techniques and the variables that we will use to quantify and standardize effort. Some items will be circled; others will require entry of specific numbers. Circle any and all methods used during the sample. For example, if night boat shocking was conducted, circle "Boat Shocking" and "NIGHT." If seining was also conducted, circle that too. The variables for each of the methods should be filled out with the following conventions:

Boat and Barge Shocking: **Seconds** are the total number of seconds that power is generated and is taken from the timer on the unit. Make sure to reset the seconds after each sampling effort, and include total number of runs, or unique sampling stretches within a waterbody. **Amps** are recorded from the meter and will vary during the course of the sample, record the average amperage observed. **Range** refers to High or Low and should be recorded as an H or L in the blank. **% of Range** refers to the setting on the box titled "PERCENT OF." Read the percent off the scale and enter it in the blank. **PPS and Mode** refer to the Pulses per second and AC or DC current. This dial is on the bottom right of the Smith-Root box and will read "120 DC" or "60DC", etc. If using an electroshocking unit with different output units, use the comments section of the data sheet to record the appropriate settings used during the sample.

Backpack Shocking: These variables are taken from the backpack and stream measurements. **Total Seconds** are the total number of seconds that power is generated and is taken from the timer on each unit. **Length** refers to the number of meters of the stream that are shocked. **Amp** meters are found on some backpacks and the reading will vary during the sample and as the probes get closer/further apart. Record an average amp reading from the meter. Set the **Volts** by using the dial on the side of the backpack. **Frequency and Width** refer to pulse frequency (number of pulses per second) and pulse width. These are also set with dials on the side of the shocker. In general, these should always be set to "1" and "5". If using an electroshocking unit with different output units, use the comments section of the data sheet to record the appropriate settings used during the sample. Always record the **number of backpacks** used for each survey.

Seining: Record the **length** of the seine being used (in meters), whether or not the seine has a sown-in **bag** (circle "Y" if it does, "N" if it does not) and the **number of seine hauls** conducted during the sample. Include **mesh size** (mm) and **deployment method**.

Gillnetting: Circle **DAY**, **NIGHT**, or **OVERNIGHT**, fill in the blanks for **average net length**, the **number of net sets** (if you set 3 nets 2 times, there were 6 net sets) and the average set time (if you set 3 nets for 2 hours and 3 nets for 4 hours, then the average would be 3 hours), and **mesh description** (most of the new nets are 1 to 2" experimental mesh). Always include the **number of nets** set for each survey.

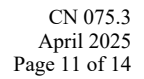
3. Data Collected: These fields will give us an idea of what other data sheets and forms will accompany the cover sheet. We have used two types of **EPA Habitat Forms**. Check the box next to each form used. **Water Chemistry Information** can be recorded on this form in one of two ways. If a profile is conducted in a lake, pond, or reservoir, check the box next to profile and then fill out a water chemistry data sheet. If surface water information is gathered on any waterbody, check the box marked "Surface" and then enter as many parameters as possible on the following lines. If **No Fish Were Collected** during the sample, please check the box that indicates that the sample effort resulted in no fish. If the stream was not sampled because it was dry, check the box that indicates **Stream Dry**. For stream/river surveys, visually estimate the % of available habitat occupied by pools, riffles, and runs. In addition, estimate the average and maximum depth of sampled water. Measure the **average width** (min of 3 measurements) and **total length** of the reach sampled.

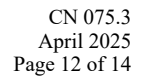
4. Crew. Simply write in the last names of the crew members involved in the sample.

5. Comments. Any Comments can be added to this section that relate to sampling efficiency (e.g. "water very high/turbid, efficiency was low") or key habitat characteristics (e.g. "large culvert prevents fish passage," "heavily channelized reach," etc.).

6. Office Use: The Sample ID and SARIS/PALIS numbers will be entered in Westborough during the data entry process.

MASSWILDLIFE







Fish Population Data Sheet – MassDEP

Field	Notes	Example
Project:	This is the project code assigned at the beginning of the year.	Taunton 2019
Sample ID Code:	Not used currently.	Blank
Waterbody:	The official river name.	Charles River
Location:	Description of access point.	Parking lot off of Jameson Road, Amherst MA
Start Date/Time:	Time that shocking begins. (i.e., not arrival time)	07/12/2020 12:20
End Date/Time:	Time that shocking ends. (i.e., not departure time)	07/12/2020 12:55
Site ID:	Project-specific site id (as opposed to uniqueid)	CR01
Fish ID By:	Last name of fish ID person.	Mitchell
Gear:	Backpack Shocker, Barge Shocker, Shock Boat	Backpack
Shock Time:	The number of seconds of shock time (counter on shock unit or calculated by start/end time)	1285 seconds
Voltage:	The voltage setting for the shock unit (use the voltage used for the majority of the sample)	250V
Frequency:	The frequency of the shock signal used by the unit (typical is 60hz)	60hz
Personnel:	Last name, first initial of each person on crew. Begin with permanent staff.	P Mitchell, D Davis, E Johnson
Representative?	An indication of whether the crew believes the fish population collected is representative of the fish that are within that reach. If answering Yes this means we will use the data for any and all fish pop purposes. If no, then we can only prove that some fish were there and not make statements on the entire population.	Yes
Efficiency:	Efficiency is how well you think you did at picking up the fish you could have collected. This can be Low, Medium, or High. Efficiency is not in and of itself enough to validate/invalidate a sample. That is a function of the representativeness assessment.	Medium
Code:	Letter code for fish species (see official list)	P

*Anomaly: D = Deformities; E = Eroded fins; F = Fungus; L = Lesions; M = Multiple; S = Emaciated; T = Tumors; P = Parasites; Y = Young of year; Z = Other

Field Sheet Log#: _____

UniqueID: _____

[https://mass.gov-my.sharepoint.com/personal/daniel_davis_mass_gov/Documents/Electrofishing/_FishPopulationFieldSheet2024 Proposed.docx](https://mass.gov-my.sharepoint.com/personal/daniel_davis_mass_gov/Documents/Electrofishing/_FishPopulationFieldSheet2024%20Proposed.docx)



Fish Population Data Sheet – MassDEP

Field	Notes	Example
Common:	Common name of fish (as a check against incorrect code)	Pumpkinseed
Tally:	This is the area for marking fish either in excess of the 25 measured/weighed. This could be counted but not collected, tally marks, or numbers that are added together. It is not a count of any of the 25 measured fish.	12 observed, 8, 9, 12, 44, 16
Grand Total	This is the total of all fish from this column including those in the Tally section AND the measured/weighed column. Since we DO measure/weigh all salmonids even past 25, fish number 26-50 would be in a separate column and totaled separately.	126
Length (mm)	Total length of fish (nose to last part of the tail fully extended). This is different than Fork Length or Standard length [to the caudal peduncle])	
Weight (g)	Weight in grams to the tenths place	1.5
Abnormal	Single letter code indicating any abnormalities. For multiple abnormalities use M. Young of year designation trumps any abnormalities.	P
*Anomaly: D = Deformities; E = Eroded fins; F = Fungus; L = Lesions; M = Multiple; S = Emaciated; T = Tumors; P = Parasites; Y = Young of year; Z = Other		
Sample Notes	This is the place to note anything about the site visit that is noteworthy such as, reach was only 80 meters, backpack broke, water level too high, staff became sick, etc.	Bubba kicked us out of the river for crossing his land. Partial sample only.
Field Sheet Log#	Office assigned field sheet log number.	
UniqueID:	Unique ID for the site	W1212, F1212
Survey Type	Allows classification in database to include or exclude for either only CWF designation or population analysis if a full fish pop survey is conducted.	Circle CWF or Fish Pop

*Anomaly: D = Deformities; E = Eroded fins; F = Fungus; L = Lesions; M = Multiple; S = Emaciated; T = Tumors; P = Parasites; Y = Young of year; Z = Other

Field Sheet Log#: _____

UniqueID: _____

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