

**STANDARD OPERATING PROCEDURES
FOR THE COLLECTION OF
FISH COMMUNITY DATA
FROM WADEABLE STREAMS & RIVERS
FOR AQUATIC LIFE USE SUPPORT
ASSESSMENTS**



Bureau of Water Protection and Land Reuse
Water Planning and Management Division
79 Elm Street
Hartford, CT 06106

APPROVAL PAGE

SOP Title: STANDARD OPERATING PROCEDURES FOR THE COLLECTION OF FISH
COMMUNITY DATA FROM WADEABLE STREAMS & RIVERS FOR AQUATIC LIFE USE
SUPPORT ASSESSMENTS

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Originator Name: Meghan Lally

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APPROVALS:

Originator:

Meghan Lally
Print Name

Meghan A. Lally
Signature

Date: 5/24/2019

Program Supervisor/Quality Assurance Control Officer:

Christopher J. Bellucci
Print Name

Christopher J. Bellucci
Signature

Date: 5/28/19

REVISIONS PAGE

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Wadeable Streams & Rivers

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1.0 SCOPE AND APPLICATION

1.1 Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish a uniform procedure for the collection of fish community data from perennial streams and rivers in Connecticut. Data collected following these procedures can be used to calculate a fish multi-metric index (Kanno et al. 2009) and Biological Condition Gradient (BCG) tier assignment (Stamp and Gerritsen 2013) which are used to guide biennial surface water quality assessments. Water quality assessments are completed by the Department of Energy and Environmental Protection (DEEP) to evaluate aquatic life use support in perennial stream segments per state water quality standards and federal Clean Water Act requirements. This SOP will provide for consistency and efficiency of the sampling effort while maintaining proper safety protocols.

1.2 Applicability

The procedures outlined in this SOP are applicable to all personnel involved in the planning, coordination, preparation, conducting and/or reporting of fish community data collection from streams and rivers for the purposes of monitoring and assessing surface water quality.

Generally, sampling locations are expected to be first to fourth order, freshwater stream and river segments. This SOP does not apply to activities conducted on or within tidal and/or non-wadeable stream segments, wetlands, and/or lentic systems.

2.0 TRAINING REQUIREMENTS & SAFETY CONSIDERATIONS

2.1 Special Training Requirements

Applicable special training requirements are noted in Table 2.1.

Table 2.1. Special Training Requirements for Personnel Involved in WPLR Fish Community Data Collection					
<i>Project Function</i>	<i>Course or Description</i>	<i>Trained by</i>	<i>Training Frequency</i>	<i>Trainees</i>	<i>Certifications/ Records</i>
Safety	First Aid/CPR	CT Fire Academy	Every 2 years	All Field Staff	DEEP personnel office
Safety	Electrofishing Safety	Project Manager	Every Spring	All participating Field Staff	Project Manager records
Safety	Electrofishing Safety (FWS-CSP2202-OLT)	USFWS (Online Course)	Every 5 years	WPLR Crew Leaders	Project Manager records
Safety and Data Comparability	Principles of Electrofishing (Presentation & field practice session)	Project Manager	Every Spring	All participating Field Staff	Project Manager records
Species Identification	Species Identification	Project Manager w/ Field Crew Leaders	Every Spring; Ongoing throughout season	All participating Field Staff	Project Manager records

2.2 Health & Safety Considerations

The following section outlines health and safety precautions that should be taken in association with performance of fish community data collection:

- a. The SOP is to be read by all participants in the sampling effort prior to the survey.
- b. A briefing is to be held the first day of the field season to review safety procedures and potential general hazards. During each field day site specific hazards will be noted prior to the commencement of sampling.
- c. The crew leader is responsible for insuring a first aid kit, atlas and traffic safety equipment are present in at least one field vehicle. The crew leader will have a cell phone available during the entire duration of the sampling trip.
- d. All electrofishing crews must consist of a minimum of three individuals.
- e. All participants will wear proper personal protection clothing and equipment, including waders. Breathable waders are not to be worn, as these waders do not provide sufficient protection against electric shock. Rubber gloves will be worn by any person(s) operating a backpack electrofishing unit and are required for all crew members when using a tote-barge unit (i.e. “stream shocker”). All personal protection clothing and equipment will be inspected for damage prior to each day’s use. Any damaged personal protection clothing and equipment will be reported to the project supervisor and replaced or repaired before use. If during sampling, gloves or boots begin leaking, the individual will cease participation in sampling until protective gear can be replaced.
- f. All field equipment must be in good working condition.
- g. Electrofishing equipment maintenance, testing and safety inspection will be completed as advised by the manufacturer. Crews will follow the Electrofishing Safety guidelines outlined by the manufacturer (refer to Smith-Root 2012). The battery to the electrofishing unit will only be connected immediately prior to sampling. Never touch electrodes when the backpack electroshocker is turned on.
- h. Crews will sample only as far as it is possible to safely wade; some areas of stream may be unreachable with a backpack electrofishing unit.
- i. If an individual begins to fall while sampling, he or she will loudly shout the word “Off!” to alert the team member closest to the backpack unit (or stream shocker) to immediately turn the unit (or power source) off. If a fall has taken place and protective gear has become wet inside, the sampling is temporarily suspended and a replacement person or equipment is put in place or sampling is resumed once the equipment has become dry.
- j. If any crew member is injured during sampling, the event will be reported to the field crew lead, and, if needed medical treatment (e.g. first aid) will be administered at the time of the injury. If additional emergency medical treatment is needed, 911 will be contacted and the project supervisor notified immediately thereafter. All injuries will be reported to the project supervisor and documented as required by Agency policies.
- k. The field crew lead is responsible for taking notice of unauthorized people and/or animals standing on the bank or within the sampling reach. If members of the public come within approximately 100 feet, the crew will cease electrofishing. The crew lead will explain to the member of the public the risks to them (and/or their pet) and ask them to please leave for their own safety.

1. No sampling will take place during heavy rain or lightning. Sampling will occur when stream flows are stable and approximate median values or below for the period as determined by use of a nearby United State Geologic Survey (USGS) real-time stream flow gage.

2.3 Permits, Notifications and Permissions

The project lead is responsible for obtaining collecting permits prior to the electrofishing field season and for submitting any required post-sampling permit reports at the conclusion of the season. The project lead is also responsible for obtaining any necessary landowner permissions if electrofishing will require the crew to sample on or to cross private property. The field crew leader is responsible for confirming with the project lead that all necessary permissions have been obtained prior to conducting sampling.

The project lead is responsible for providing the Fisheries Division and State Environmental Conservation Police (EnCon) with the Division's electrofishing schedule (e.g. a list of locations and corresponding survey date) prior to the commencement of the electrofishing season.

3.0 FIELD TRIP PREPARATION

N3.1 Verify Suitable Flow and Weather Conditions

Prior to sampling, the crew leader will verify that weather and flow conditions at the anticipated time of sampling will be suitable. Sampling can occur when flows are stable and are within approximate median values or lower for the period as determined by use of a nearby United State Geologic Survey (USGS) real-time stream flow gage:

<http://waterdata.usgs.gov/CT/nwis/current?type=flow>. Recent rainfall amounts will also be evaluated on the National Weather Service website: http://www.srh.noaa.gov/ridge2/RFC_Precip/

3.2 Determine Equipment & Supply Needs

When determining equipment needs, the size of the sampling crew and the size of the waterbodies to be sampled will be considered. Additional equipment may be needed to support additional crew members. A field checklist of the required equipment and supplies is located in Appendix A. In addition, the field crew lead is responsible for packing all necessary data sheets and site maps, and a field bag with a first aid kit, road atlas, and traffic safety equipment.

3.3 Equipment Inspection

All equipment should be inspected for condition and the presence of all required parts and accessories prior to sampling (Table 3.1). Any malfunctioning equipment should be reported immediately to project supervisor. Upon completion of equipment condition review, place gear in vehicle.

Table 3.1. Field Equipment Inspection Requirements			
Equipment	Inspection Frequency	Focus of Inspection	Inspection Instructions
Backpack Electrofishing Units	Pre and post sampling	Wire connections, fuses, output meter, straps	<ul style="list-style-type: none"> • Examine straps, buckles, cables, connectors • Verify battery cover latches are functional • Verify 2 magnets are inside of battery cover • Ensure quick release system is properly functioning
Backpack Unit Batteries	Pre sampling	Maintain Proper Charge	<ul style="list-style-type: none"> • Verify fully charged using battery charger. • Check to ensure no signs of damage or leakage.
Probes: - Anode pole with ring - Cathode 'rat tail	Pre and post sampling	Condition of head, cables, connectors	<ul style="list-style-type: none"> • Examine connections to ensure free from corrosion; remove scale by using fine grit sandpaper. • Inspect for broken connector pins. • Ensure cable insulation is undamaged and wire is not frayed.
Nets: - Net heads - Short net handles - Long net handles - Aquarium Nets	Pre sampling	Integrity of mesh and handle	<ul style="list-style-type: none"> • Examine net heads for holes, rips, tears; mend any found or replace with new mesh. • Examine net head frame for loose wire, loss of protective guard. • Examine net poles for general condition; ensure free of cracks in handles.
YSI Equipment	Pre sampling	Battery, cables, general condition	<ul style="list-style-type: none"> • Verify batteries are fully charged. • Check condition of probe tip. • Ensure instrument is calibrated.
Digital Camera Setup: - Digital camera - Travel case - Batteries - Memory card	Pre sampling	General condition, battery, memory card	<ul style="list-style-type: none"> • Verify battery is fully charged. Ensure extra batteries packed. • Verify memory card is present.
Garmin GPS Device	Pre sampling	General condition, battery	<ul style="list-style-type: none"> • Verify batteries are fully charged. • Pack extra batteries
Flagging tape	Pre sampling	General condition	<ul style="list-style-type: none"> • Verify presence of suitable amount
Table 3.1. Field Equipment Inspection Requirements			

Equipment	Inspection Frequency	Focus of Inspection	Inspection Instructions
Hip Chain Measuring Device	Pre sampling	Amount of line remaining, working condition	<ul style="list-style-type: none"> • Verify hip chain is functional. • Pack extra rolls of string
5-gallon handled buckets	Pre sampling	General condition; integrity of handle	<ul style="list-style-type: none"> • Verify handle is present and in good condition • Check to ensure no holes or cracks in bucket
Large Plastic Bins	Pre sampling	General condition	<ul style="list-style-type: none"> • Check general condition
Plastic Spare Gear Bin	Pre sampling	General condition	<ul style="list-style-type: none"> • Check general condition
Fish key(s)	Pre sampling	General condition	<ul style="list-style-type: none"> • Check general condition; ensure photographs and text are legible
Fish Measuring Boards	Pre sampling	General condition	<ul style="list-style-type: none"> • Ensure scale is legible
Fish Voucher Preservation Bags and specimen containers	Pre sampling	General condition	<ul style="list-style-type: none"> • Verify presence of suitable amount • Verify bags are unused and without holes • Ensure presence of matching lids
Ethyl alcohol	Pre sampling	General condition	<ul style="list-style-type: none"> • Verify presence of suitable amount
Water Containers, ½ gallon (1 per site to be sampled)	Pre sampling	General condition	<ul style="list-style-type: none"> • Ensure suitable quantity and presence of matching lids
Coolers	Pre sampling	General condition	<ul style="list-style-type: none"> • Ensure lids close securely • Check for leaks
Pencils, permanent markers	Pre sampling	General condition	<ul style="list-style-type: none"> • Check general condition
Clipboards	Pre sampling	General condition	<ul style="list-style-type: none"> • Check general condition

3.4 Sign Out

The field crew lead will record the crew's destination(s) and field staff on the calendar in main lab area. (Prior to the start of the season the project supervisor will produce a list of staff contact numbers, including cell phone numbers, which will be posted in a visible area of the main lab.)

4.0 FIELD METHODS

Fish community sampling occurs during the fish index period June 1 through August 31.

4.1 Establish Sample Reach

The field crew lead will determine the appropriate sample reach length (Table 4.2). The distance necessary to capture the majority of the species present is a function of stream order, presence of target habitat (e.g. riffle and pools), geomorphologic characteristics, gradient, and several other physical factors. The standard distance is 100m.

- For small, narrow streams, sample reach length may be less than 100 meters due to the presence of natural or manmade obstructions (e.g., deep pool, heavy brush, dams).
- For larger, wider streams, sample reach length may approach 150m in order to adequately sample a representative range of habitats (e.g. pool, riffle) within the reach.

- For those streams that are wadeable but too wide to adequately sample with two backpack units, the shoreline method of electrofishing may be employed (Beauchene 2010). When using the shoreline method, crews will sample 150m along each bank for a total length of 300m.

The crew leader will identify the sample reach start point and end points. Start and end points for each segment are defined to ensure representation of each habitat type (*i.e.*, riffles, pools, runs) typical for that stream segment. Upper and lower boundaries of the segment are ideally defined by natural impediments to fish travel, such as shallow riffles.

The actual sample reach length will be measured by walking the reach with a hip-chain measuring device attached. At the conclusion of the sample, stream width will be measured, using the hip chain device, at one or more points within the sample reach which represent average reach width. (Width is recorded on the datasheet by the field crew leader.)

4.2 Physical and Chemical Field Measurements

The field crew leader will assign one crew member to collect a surface water chemistry grab sample and YSI readings at the start of the reach prior to sampling.

The surface water quality 'grab sample' is collected using a triple rinsed ½ gallon containers. The container is labelled with stream name, station ID, date and time of collection. After collection the sample is placed on ice in the cooler for transport back to the Windsor lab. (Refer to DEEP QAPP for Ambient Physical, Chemical, and Bacterial Monitoring and associated SOPs.)

The YSI measurements are collected in the middle of the stream reach, downstream of the reach start point. Temperature and conductivity are measured and reported to the field crew leader. Values are to be recorded on the datasheet along with the measurement time (which typically corresponds with the surface water chemistry grab sample time.)

4.3 Site Photographs

The field crew leader will assign one crew member to document site conditions by taking site photographs. At both the start of the sample reach and the end of the sample reach a pair of upstream and downstream photographs are taken from stream center using a digital camera. Photographs are intended to document flow conditions at the time of sampling, and the condition of instream and riparian habitat.

4.4 Establish Crew Member Roles

Crew size will be determined by the project lead. Larger streams will require additional crew members and equipment. The crew lead will assign each crew member a role (e.g. backpack operation, netting, fish transport) prior to sampling.



Figure 4.1. A four-person electrofishing crew operating a single backpack electrofishing unit. One individual operates the backpack (center), netters follow to the right and left of the backpack, and a crew member remains in the back with a bucket to contain stunned fish.



Figure 4.2. Crew configuration will vary depending on the number of crew members available and the width and depth of the stream to be sampled. Shown above is a four-person crew with two backpack units and two netters. In this case, one netter also maintains the collection bucket.

4.5 Assemble and Distribute Equipment

The individual(s) charged with operating the backpack units will be outfitted with electrical gloves and an electrofishing backpack unit. (If using a stream shocker, crew members will be assigned to

operate the two probes. When using the stream shocker all crew members will be outfitted with electrical gloves.)



Figure 4.3. A Smith-Root backpack electrofishing unit. The black rat tail is visible in the operator's left hand and the anode (pole with ring) in her right hand. Note the red on/off switch located on the anode pole handle Note the red on/off button at the top of the unit.

Crew members assigned to the role of netting fish will be given a dip net corresponding to the size of fish expected to be caught and the complexity of habitat to be sampled.

Crew members charged with containing the stunned fish (i.e. fish transport) will be given a dip net and one or more 5-gallon buckets. Water will be added to the bucket(s) to a depth suitable to hold fish in a healthy state. (If using a stream shocker fish will be placed into a large bin mounted on the canoe. The crew member charged with fish transport will also be responsible for maintaining the forward direction of the stream shocker unit, including pulling the boat through riffles as needed.)

If being utilized, holding tanks will be placed alongside the stream, typically either at a predefined distance (e.g. 50m) or at the upstream end of large pools. Whenever possible, tanks will be placed in a shaded section of the stream to help maintain proper water temperature and oxygen levels.

4.6 Set-Up and Test Electrofishing Unit

The crew lead will oversee the testing and operation of the electrofishing backpack units (or stream shocker). The units will initially be set to a frequency of 60 Hz and 25% duty cycle. Then based upon the measured conductivity within the reach, the crew lead will adjust the voltage setting until a desired output of 0.3 amps (0.2-0.4 amp range) is achieved.

Output is tested by placing the anode ring and cathode cable approximately 12 inches (30 cm) apart in ankle deep water. The backpack operator is instructed to "Go on" and the crew lead will read the measured output (i.e. amps). If the output exceeds 0.4 amps, the voltage setting is

reduced until the target output is achieved; if the output is less than 0.2 amps, the voltage setting is increased, without exceeding 450 volts, until the target output is achieved. If the target output cannot be achieved by adjusting the voltage, the duty cycle and frequency may be adjusted (e.g. to 12% and 30 Hz, respectively) until the desired output is achieved.

The backpack is at an optimal setting when the output is both within the target 0.2-0.4 amp range, and the fish response is satisfactory. Fish response is tested by placing the cathode rat tail behind the operator and the anode ring in the water in front of the operator. A satisfactory response consists of fish beginning to illicit a forced response (twitch) when the backpack is turned on. Ideally, fish will swim into the net while following the anode. Recovery time is zero and the fish is able to swim normally immediately upon being placed in the holding bin. In general, if it takes more than 5 seconds for a fish to recover settings are too high and the voltage should be reduced.

While sampling, adjustments to field strength are made as needed (e.g. adjustments to voltage) based on observed sampling efficiency in order to maximize capture, while minimizing mortalities.

4.7 Fish Sample Collection

Fish community data are collected in permanent sections of stream. Protocols utilized for survey efforts are a combination of those established by the DEEP Fisheries field monitoring team (Hagstrom et al 1995), EPA RBP methods (Plafkin et al 1989), and DEEP Planning and Standards Division (Beauchene 2010).

Prior to starting the pass, one of the crew members (typically the individual charged with maintaining the collection bucket) attaches a hip chain measuring device to their waist. The string is tied off to a point at the start of the survey reach and stopped at the conclusion of shocking. Although the string is biodegradable, when the shocking run is completed, a crew member is assigned to collect the string and dispose of it in the trash back in the laboratory.

The crew proceeds to shock the stream reach utilizing the appropriate shocking methodology given the site stream width.

TRADITIONAL SHOCKING METHOD

- Fish sampling commences at the downstream barrier in the reach. The crew proceeds to electrofish in an upstream direction, using a side-to-side or bank-to-bank sweeping technique to maximize coverage area. All permanent habitats within the reach are sampled via a single pass, which terminates at the upstream barrier.
- All stunned fish regardless of size are netted and placed into a holding container/bucket until the entire reach has been sampled. (American Eel should be kept in a separate holding unit as the mucus that covers their skins can irritate and damage the gills of other fish species.)

SHORELINE METHOD

- Each fish community sample will consist of a paired pass consisting of a single pass along the left bank, followed by a single pass along the right bank of the sample reach.
- The backpacker will proceed in an upstream direction, starting from the downstream most point along the left bank in the survey segment.
- All fish within 5 meters of each stream bank throughout the sample reach are netted and placed into a holding container/bucket until the end of the sampling run (i.e. until both

banks are sampled). (American Eel should be kept in a separate holding unit as the mucus that covers their skins can irritate and damage the gills of other fish species.)



Figure 4.8. When using the Traditional method, the backpacker(s) traverse the stream reach as they move upstream, working back and forth across the stream to cover as much habitat as possible within the reach. The crew in figure A (top) is operating tandem backpacks to cover a wider stream segment. The crew in figure B (bottom) is sampling a narrower reach and requires the use of only a single backpack electrofisher to ensure adequate coverage.



Figure 4.9. When using the 'Shoreline' method, only the first 5m of the stream, from the water's edge are electrofished. Both shorelines in the reach are surveyed; the results are combined to produce one set of data for the reach.



Figure 4.10. A crew uses the shoreline method to sample a large stream. The crew is currently headed upstream (thick yellow dashed line) sweeping the 5m of stream closest to the shore along the right bank (facing downstream). Upon completion the crew will proceed to the opposite side of the stream and sample the 5m of stream closest to the shoreline along the left bank (dashed purple line).

The individual with the holding bucket will monitor the health of the fish and make transfers to holding tanks or fish bins if fish appear stressed or overcrowded. Signs of stress to look for that could indicate low oxygen levels include:

- Hyperactivity in salmonids or sluggish behavior in other species;
- Very fast movements of gill covers;
- Fish come to the surface and appear to gulp air; and/or
- Fish start to keel over.



Figure 4.11. Fish in the holding buckets are monitored for signs of stress. The fish in the white bucket (top) appear to be in relatively good health, while the fish in the blue bin (bottom) are showing signs of stress, including keeling over.

At the completion of the sampling run, energized time, run time, amps, and total shocking distance for the reach is recorded on the field datasheet (Appendix B). Also, the type of electroshocking unit used and the settings are recorded. All electroshocking equipment is turned off.

4.8 Fish Identification, Measurement and Data Recording

Fish are measured for total length and identified to species as follows:

- a. At the conclusion of the sampling run, each fish is identified to species and total length is recorded in centimeters. Total length is the maximum total length from the anterior-most part of the fish to the tip of the longest caudal fin rays, when the lobes of the caudal fin are compressed dorso-ventrally. Total length measurements are *rounded down* to the nearest centimeter.



Figure 4.12. A measuring board is used to determine total fish length. Caudal fin lobes are compressed dorso-ventrally before making the measurement.

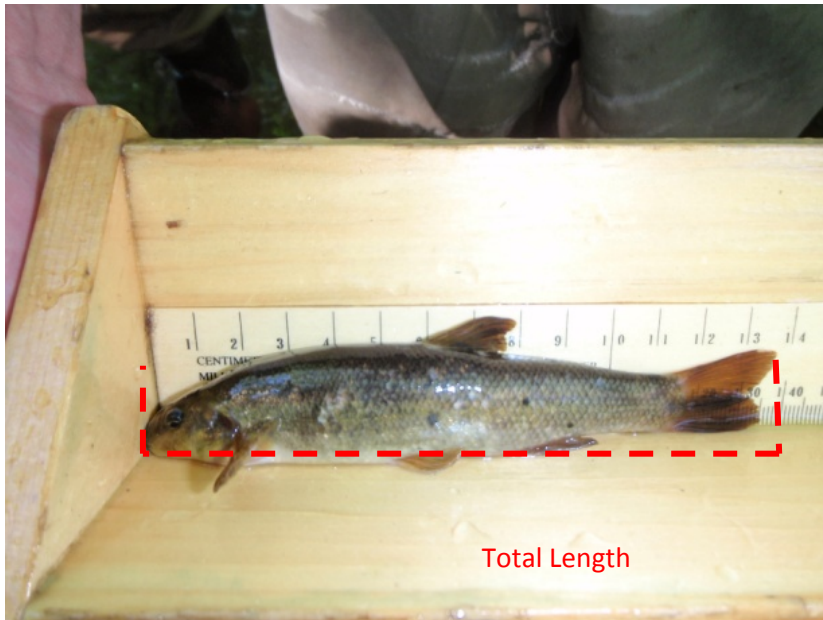


Figure 4.13. A measuring board is used to determine maximum total fish length (from 'nose tip' to 'tail tip').

Field staff fish identifications are supported using identification keys, if needed, (Appendix C) and are supervised and confirmed by the crew leader prior to recording.

- b. Fish species are tallied by centimeter class on the field datasheet (Appendix B), using the standard species code list (Appendix D). The data recorder places a single tally mark for each measured species in the appropriate centimeter class on the datasheet. When fish are abundant in the sampled stream reach, the first 100 individuals of each species will be measured to the nearest centimeter class. All subsequent individuals will be tallied by species, but not measured, to obtain a total count (Hagstrom et al. 1989).



Figure 4.14. Field crew members work together to identify each fish to species and measure total length. One crew member is assigned to record the data (species/total length) on the field datasheet.

The field crew leader reviews each field datasheet before leaving the monitoring location. Any errors are reconciled by a single line through the error and initialed upon correction.

- c. Occasionally, fish specimen are not able to be definitively identified to species. If appropriate, the specimen can be adequately photo documented for later species identification or, alternatively, labelled with location and date and preserved for future laboratory analysis. Any such vouchers are recorded on the data sheet.
- d. If a potential new species record is discovered, the specimen will be both field photographed and preserved for later verification/documentation purposes.



Figure 4.15. An example fish 'voucher' photograph. Before being released any fish that are unidentifiable, unusual or unique should be photographed. Whenever possible, the photograph should include the site name, station ID and sampling date.

4.9 Review Datasheets and Labels

Before leaving the field survey site, the crew leader will check the field datasheet and all labels (e.g. sample containers, fish tissue samples, fish vouchers), to ensure all necessary fields have been completed and site location and sampling information (e.g. date, time, etc.) on all datasheets/labels for a given site match. Data sheets should be compiled and given to the crew leader.

Before leaving the site, the crew leader completes the “Sampling Conditions” section on the reverse of the field datasheet, noting flow conditions, netting efficiency, field strength, and channel coverage success.

4.10 Clean and Store Equipment for Transport

At the conclusion of the survey, rinse all equipment used in-stream with stream water. Turn off all electronic devices and store in appropriate storage cases for transport. Remove the battery from the backpack electroshocker and store separately for transport. Field datasheets are stored in a metal storage box/clipboard in the field until return from the sampling trip.

5.0 POST-SAMPLING ACTIVITIES

5.1 Water Chemistry Sample Storage

If water chemistry samples were collected, store or process them according to established agency protocols. (Refer to DEEP QAPP for Ambient Physical, Chemical, and Bacterial Monitoring and associated SOPs.)

5.2 Equipment Cleaning & Storage

- a. Wipe down and/or clean exterior of sampling equipment and clothing with a soap and water, scrub brush and hose at the field headquarters prior to storing the gear. To prevent the introduction of nuisance organisms such as *Didymosphenia spp.*, additional disinfection per Agency protocols are followed for all gear between sample locations.
- b. Sand electroshocking probes to remove corrosion, if needed.
- c. Place all electroshocking unit batteries on the charger and set to be recharged.
- d. Detach net heads from net handles and arrange net heads to dry.
- e. Hang waders to dry.
- f. Empty, clean, and dry all coolers.
- g. Replace and recharge GPS unit and digital camera batteries. If needed, replace digital camera memory card with a new/empty card.
- h. Return multiparameter sondes to the water laboratory and store according to manufacturer specifications.
- i. If sampling the following day, replace any used sampling bottles/containers. Replace any additional items used up during sampling (e.g. first aid kit materials, hip chain string, etc.)

5.3 Process Site Photographs

Digital photographs are uploaded from the camera disk to the trip folder within the appropriate Monitoring Data by Year folder on the M:\ drive following each sampling trip. Each photo is renamed to indicate location and date, such as ‘HowellsBrk_5318_DS_06272012’ (i.e., “[StreamName]_[StationID]_[PhotoNote]_[mmddyyyy]”).

5.4 Voucher Specimens

Place all fish voucher and crayfish samples in the freezer in the DEEP field lab for storage until they can be further identified by a fisheries expert. Prior to freezing, check to ensure all labels contain the date and location (i.e. site number, waterbody, landmark, and town) that the sample was collected on/from. The crew lead is responsible for notifying the project manager of any such specimens. The project manager is responsible for following up on the verification of identifications and updating data records accordingly.

6.0 DATA MANAGEMENT

Fish community data are stored in the DEEP water monitoring database. Field datasheets will be reviewed and approved by the field crew leader in the field and, if different, the project lead upon return. Once approved, crew members are assigned to enter the metadata from the trip (e.g., date, sites, times of sampling, types of samples, number of containers, field crew members, purpose of trip, etc.) into the water monitoring database and to enter length frequency data into a digital file for eventual database upload. Once the field data have been reviewed and approved by the project supervisor, the data are uploaded to the database by the project manager. Upon completion of entry into the database, the hard copy field datasheets are filed by the project manager at the DEEP Windsor Laboratory.

7.0 DATA ANALYSIS

Fish community data collected in association with the project are used to assess aquatic life use support in relation to water quality assessments. For each site monitored, a fish community multimetric index (MMI) and biological condition gradient (BCG) score are calculated. Calculations are dependent on average stream width, which is measured in the field, and watershed area, which is determined using desktop GIS analysis. Length frequency data are imported into electronic 'calculators' developed to automate computation of these metrics. The results are reviewed by the project manager and project supervisor and evaluated for consistency with field observations prior to inclusion in the biennial integrated water quality report (IWQR). The final MMI and BCG scores considered for IWQR purposes are stored in a separate IWQR reporting database for easy future reference if needed.

The data are also queried and evaluated on an as-needed basis to provide information for additional projects and reports.

8.0 QUALITY ASSURANCE & QUALITY CONTROL

Field staff identifications are supervised and confirmed by crew leader. Unique or unusual specimens, including those fish that cannot be identified to species in the field, are documented with digital photographs. Fish that cannot be identified in the field are preserved and brought back to the field laboratory for further identification.

All field datasheets are verified for completeness and accuracy by the field crew leader before leaving a sampling site. The data management officer reviews all field datasheets before data are uploaded to the database.

Any deficiencies identified during field sampling visits are documented on the field datasheet and forwarded to the project supervisor. The project supervisor, monitoring staff and the field crew supervisors will discuss and reach consensus regarding any field sampling deviations. Most deviations involve stream flow, habitat, or accessibility issues. Corrective actions are decided and based upon the intended use of the data. If it is determined that conditions will jeopardize the usability of the data, sampling is suspended until the issue can be resolved.

Any real-time changes to this SOP, including sampling effort or location, are to be made only by the project supervisor or the field crew leader. If such changes are necessary they are to be made in such a manner as to not jeopardize the validity and comparability of the fish community data. If a change is made, it is the responsibility of the individual executing the change (e.g. project supervisor or crew leader) to ensure that the change is documented and distributed to project staff and officers for review.

9.0 REFERENCES

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APPENDIX A. Fish Community Monitoring Equipment List

Electrofishing Equipment Checklist

ELECTROFISHING UNITS

	2*	Backpack Electrofishing Units (*Ask Crew Lead which BPs are needed for day)
	4*	Batteries for Electrofishing Units (*Load Test before packing)
	3	Anode poles with ring
	3	Rat tail' cable cathodes

2 LARGE STORAGE BINS w/:

	3	Construction buckets w/ hose-covered handles
	2	Small fish measuring boards
	3	Long fish measuring boards
	3	Aquarium nets
	4-6	Large net heads, various shapes (1 per crew member)
	2	Small hexagonal net heads
	4-6	Short net handles (1 per crew member)
	2	Long net handles

BASKET BACKPACK:

	2	Hip chain measuring devices w/ string installed
	5+	Rubber electrofishing glove pairs (black, forearm length) - 1 per crew member needed
	1*	YSI (*check battery charge)
	1*	Digital camera in case with memory card and extra battery (*check battery charges)
	1*	GPS unit (*check battery charge)
	1	Metal field clipboard w/ datasheets and sharp pencils
	1	Field thermometer (Store in metal clipboard)
	2	wooden clipboards
	1	measuring tape, 30m+
	2-3	Fish ID card rings

SMALL BIN:

	2	Rolls hip chain string (extra) - store in ziplock bag
	1	Flagging tape roll
	6+	Plastic storage bags (for fish preservation)
	6+	Manila labels
	6+	Plastic containers w/ lids (for fish preservation)
	3+	Sharpie markers
	3+	Extra pencils
	1	Bottle of isopropyl alcohol
	1	Wrench

H2O CHEMISTRY SUPPLIES:

	9	1/2 gallon plastic water chemistry containers (stored in milk crate)
	1*	Milli-Q chemistry, 1/2 gallon (*First sample day of the week only; label and place in cooler on ice)
	1	Large cooler w/ ice bags
	1	Small cooler w/ ice bags & water bottles (*esp during HOT weather)

MISCELLANEOUS:

	waders for each crew member
	Road Atlas - 1 per car
	Car GPS units - 1 per car --> program to go to first site
	First aid kit (brown bag) - 1 per car
	AED - check turns on - 1 per crew

APPENDIX B. Common Fishes Likely to be Found While Electrofishing in Connecticut Wadeable Streams & Rivers

Fish

Snake-like Body

- Eel
- Sea Lamprey

Rounded Body

- Pumpkinseed
- Bluegill
- Redbreast
- Green

Elongated/Streamlined body form

Ventral mouth

- White sucker
- Cutlips minnow
- Longnose Dace

Duck-bill like mouth

- Redfin Pickerel
- Chain Pickerel

Long chin whiskers

- Brown Bullhead
- Yellow Bullhead

Uniformly bright silver body

- Fallfish
- Common Shiner
- Golden shiner

Colored dots on side of body

- Atlantic Salmon
- Brook Trout
- Rainbow Trout
- Brown Trout

Dark stripe on side

- Blacknose Dace
- Creek Chub

Small fish large pectoral fins

- Slimy Sculpin
- Tessellated Darter

Start here with a fish

Elongated/Streamlined body form

Snake-like body

Rounded body form

Red spot on gill



Purplish spot on gill

Elongate spot on gill



Black spot base of dorsal fin

Has a normal mouth, head, eyes and fins

Yes=Eel



No=Sea lamprey



Elongated/Streamlined body form part 1



Ventral mouth

Duck-bill like mouth

Long chin whiskers

thick round lips
(White Sucker)

dark chin whiskers
(Brown bullhead)



light chin whiskers
(Yellow bullhead)



Short less than 1/2 length of the head
(Redfin Pickerel)

lower-lip very small
(Cutlips minnow)



Longer than 1/2 length of the head
(Chain Pickerel)

normal looking lips
(longnose dace)



Elongated/Streamlined body form part 2



Colored dots on side of body



Deeply forked tail
(Atlantic Salmon)



Pink tint on side
(Rainbow trout)



Anal fin with white black red
(Brook Trout)



Adipose fin red/orange
(Brown Trout)



Small fish large pectoral fins



Body taller than wide
(tessellated darter)



Body wider than tall
(Slimy sculpin)



Elongated/Streamlined body form part 3:



Uniformly bright silver body



Dark margin on scales mouth in front of head (Fallfish)



No dark margin on scales
Lateral line does not steeply dip to belly
(Common shiner)



No dark margin on scales
Lateral line does dip to belly
(Golden shiner)



Dark stripe on side

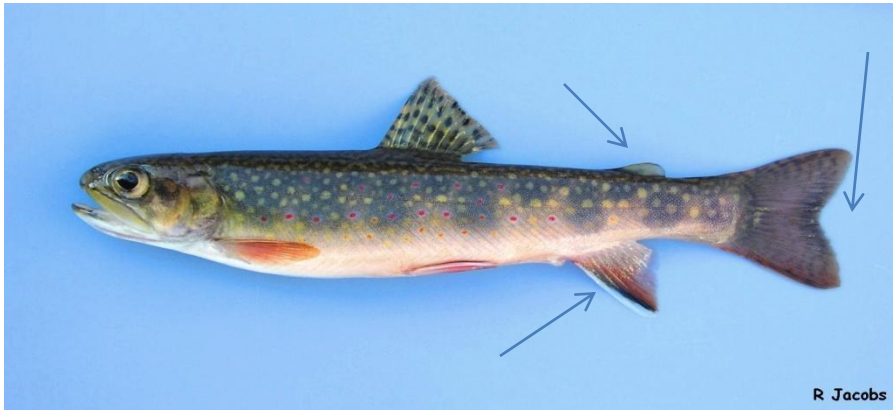


Stripe across nose scales too small to see



No stripe across nose, purplish tint,
Scales are visible





R Jacobs

Eastern Brook Trout (WBK or BK):

- very small scales
- Tail is not deeply forked
- large mouth in front of head
- dark green dorsal surface
- white or pink ventral surface
- dark body light colored spots
- pelvic/pectoral fins have white outer edge then black then red



R Jacobs

Brown Trout (WBN or BN):

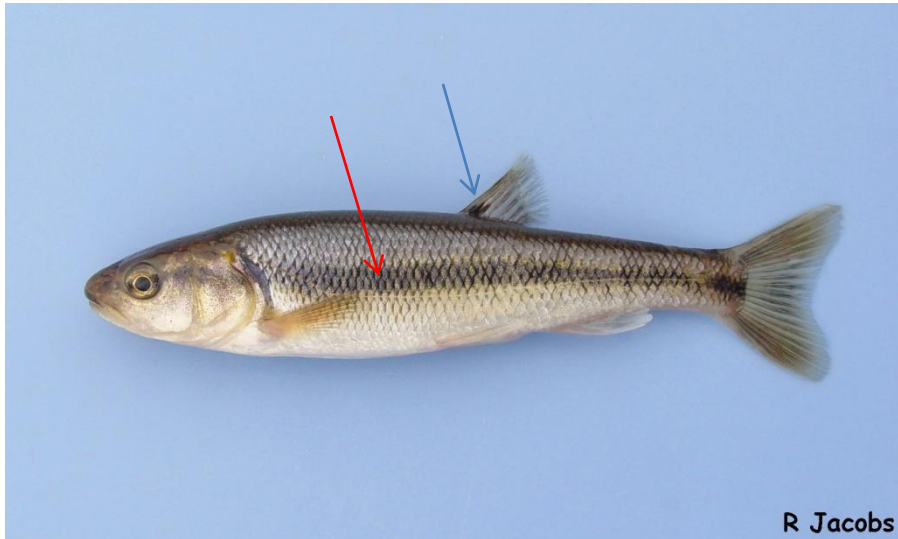
- very small scales
- Tail is not deeply forked
- large mouth in front of head
- light colored body dark colored spots
- fins greenish no red in fins
- red/orange color on adipose fin



R Jacobs

Atlantic Salmon fry/smolt (SA):

- very small scales
- Tail is deeply forked
- large mouth in front of head
- very large pointed pectoral fins
- light to creamy ventral surface
- dark body light colored spots
- no red on adipose fin or pelvic/pectoral fins



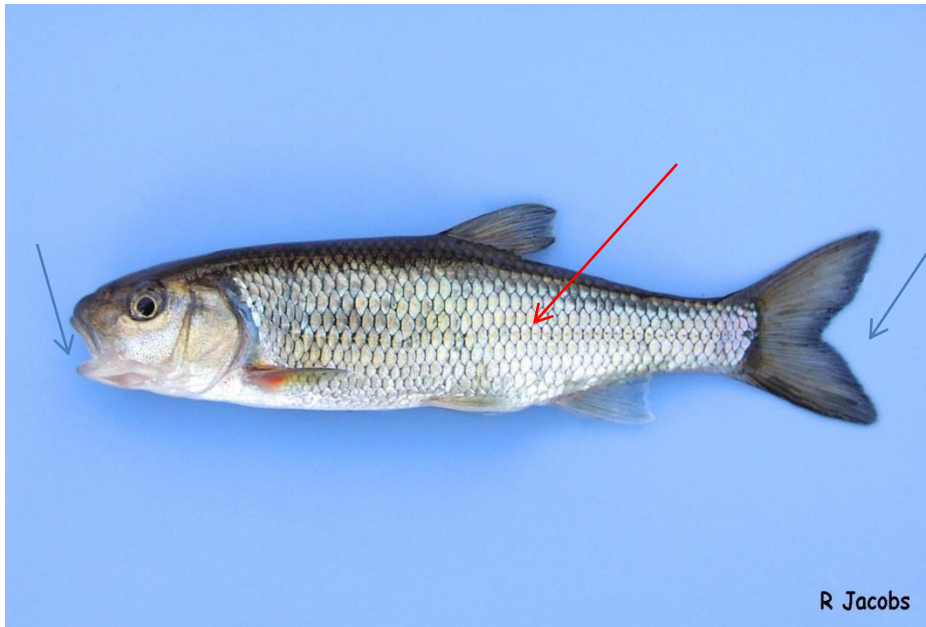
Creek Chub Minnow (CR):

- medium size scales
- purplish hue on dorsal surface
- Tail is rounded
- mouth is in front of head
- lower lip is normal
- spot at base of dorsal fin
- sometime a stripe on side



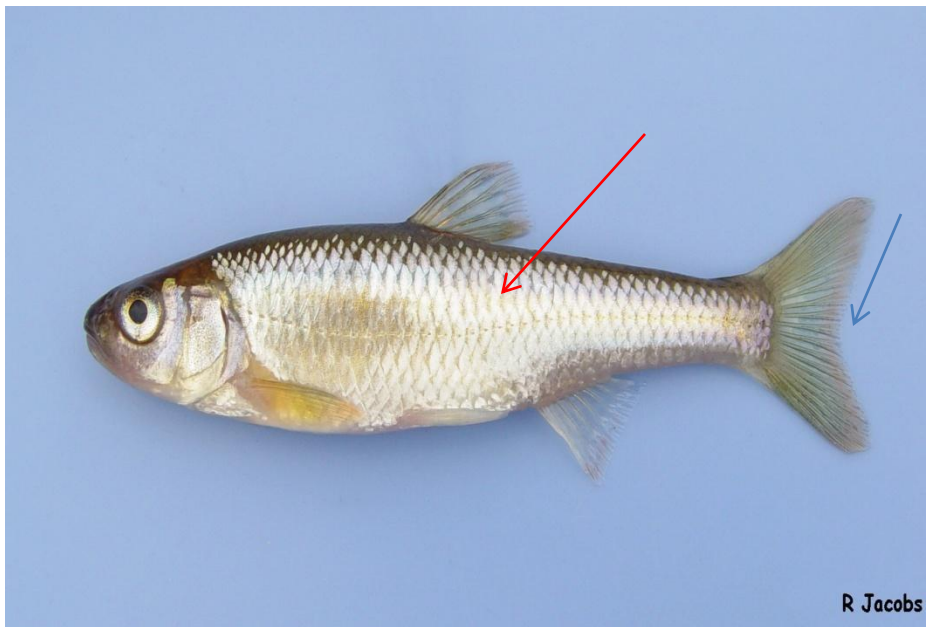
Blacknose dace minnow (BL):

- very small scales
- very dark stripe
- dorsal surface is tan
- ventral surface is creamy
- mouth in front of head
- stripe across nose from eye
To eye.



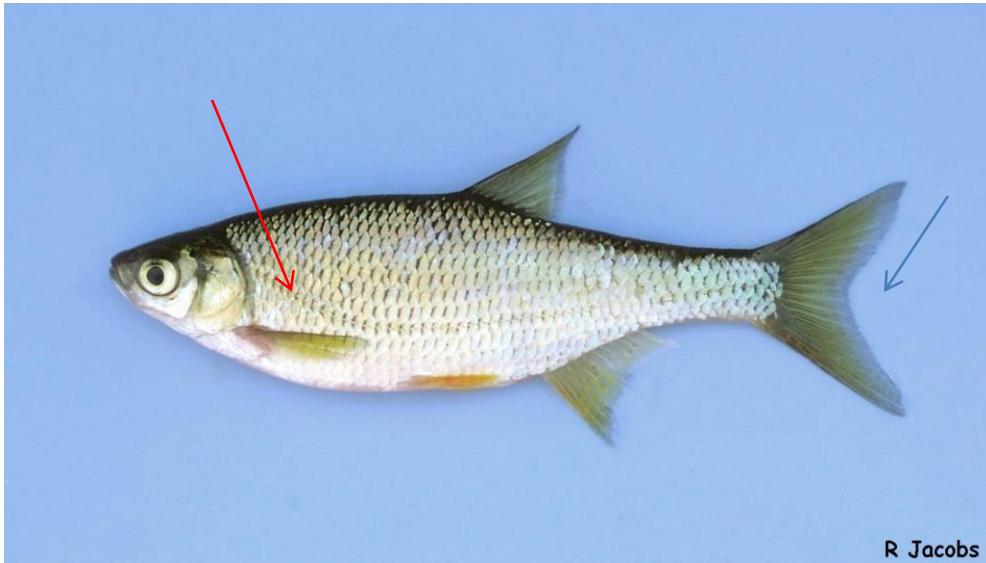
Fallfish (FF):

- silver minnow
- large scales with black margin
- large mouth
- forked tail
- scales do not fall off easily



Common Shiner (CS):

- silver minnow
- large scales No black margin
- Tail is not forked
- scales do fall off easily
- males can be brightly colored purple
And red, with nose tubercles



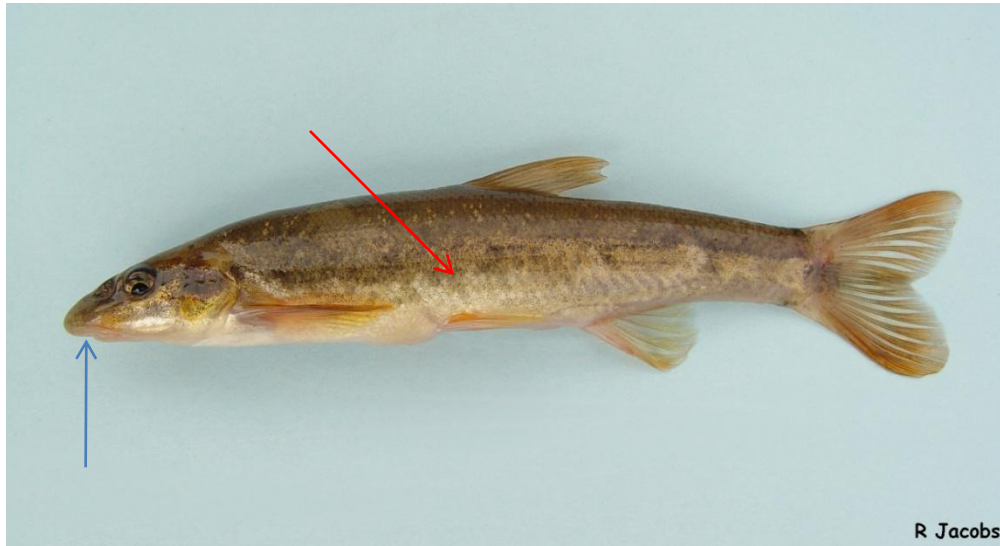
Golden Shiner (GS):

- silver/yellowish minnow
- large scales slight black margin
- Tail is forked
- scales fall off easily
- Lateral line takes a very deep Bend towards belly.



Cutlips Minnow (CM):

- medium size scales
- slight purplish hue sometimes
- Tail is rounded
- mouth is under head
- lower lip is greatly reduced

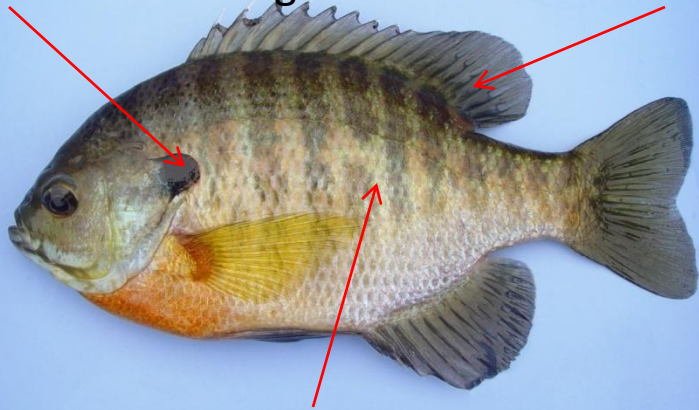


- Longnose dace minnow (LD):
- very small scales
 - usually no stripe
 - dorsal surface is dark brown
 - ventral surface is creamy
 - mouth under head
 - no stripe across nose from eye
- To eye
- very streamlined, shark-like



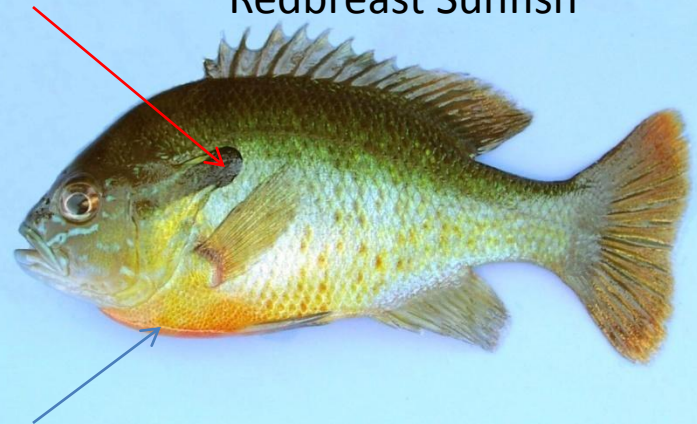
- White Sucker (WS):
- large scales
 - usually no stripe
 - uniformly colored sometimes brownish
 - mouth under the head
 - large lips
 - can be quite large

Bluegill Sunfish



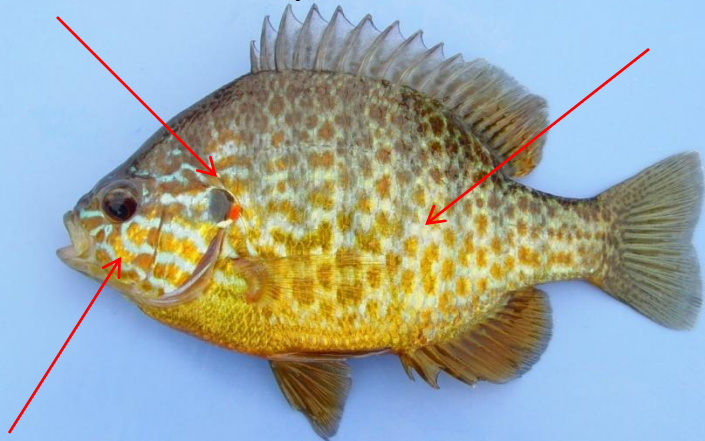
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Redbreast Sunfish



R Jacobs

Pumpkinseed Sunfish



R Jacobs

Green Sunfish



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Bluegill Sunfish (BG):

- large scales
- sharp spines in dorsal fin
- Vertical stripes (tiger)
- no color to spot on gill cover
- has a dark spot at base of dorsal fin
- round body shape

Pumpkinseed Sunfish (PS):

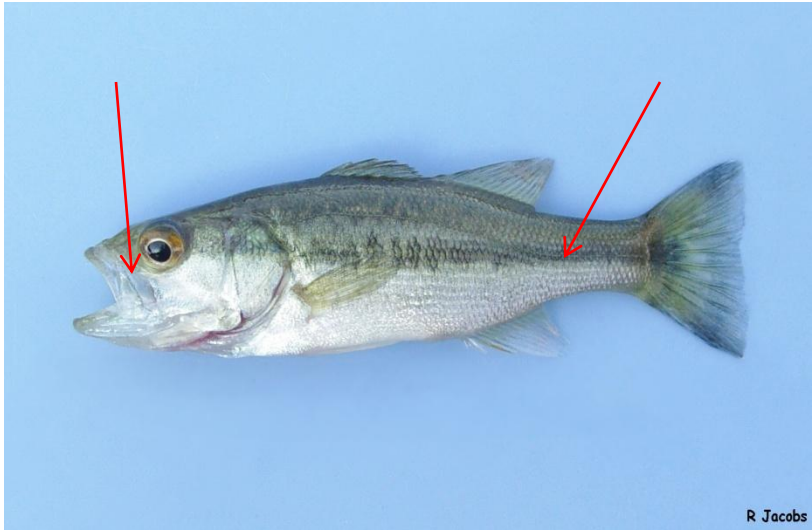
- large scales
- sharp spines in dorsal fin
- Vertical stripes (tiger) less obvious
- Speckled appearance
- Red spot on gill cover
- no dark spot at base of dorsal fin
- Turquoise lines on face
- round body shape

Redbreast Sunfish (RS):

- large scales
- sharp spines in dorsal fin
- Vertical stripes (tiger) less obvious
- usually more uniform green color
- dark orange to reddish chest and belly
- No red spot on gill cover
- no dark spot at base of dorsal fin
- Turquoise lines on face
- Long black earlobe on gill cover

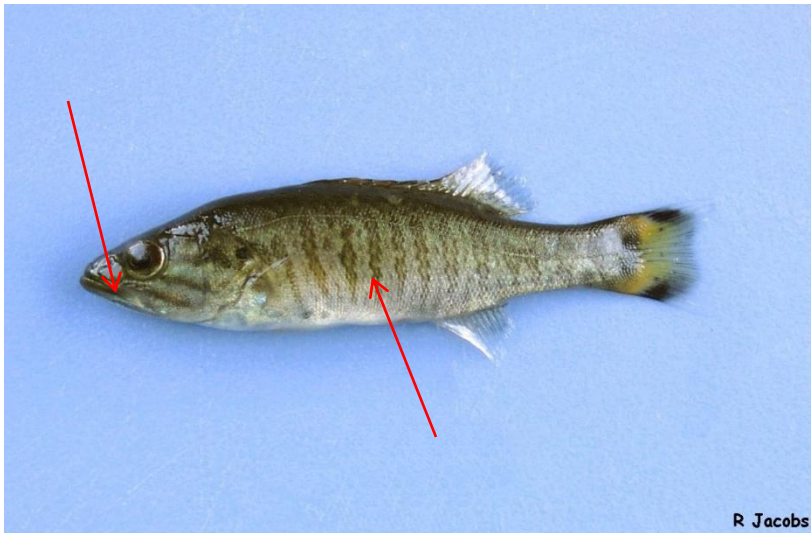
Green Sunfish (GR):

- large scales
- sharp spines in dorsal fin
- Vertical stripes (tiger) sometimes
- Purple to lavender spot on gill cover
- no dark spot at base of dorsal fin
- Turquoise lines on face
- more streamlined than round body shape



Largemouth Bass (LM):

- large scales
- usually horizontal stripe
- dorsal surface is dark green
- ventral surface is creamy
- mouth in front of the head
- Jaw extends past the centerline Of the eye



Smallmouth Bass (SM):

- large scales
- usually vertical stripes (tiger)
- dorsal surface is dark green
- ventral surface is creamy
- mouth in front of the head
- Jaw does not extend past the Centerline of the eye

Tessellated Darter



R Jacobs

Slimy Sculpin



R Jacobs

Tessellated Darter



R Jacobs

Slimy Sculpin



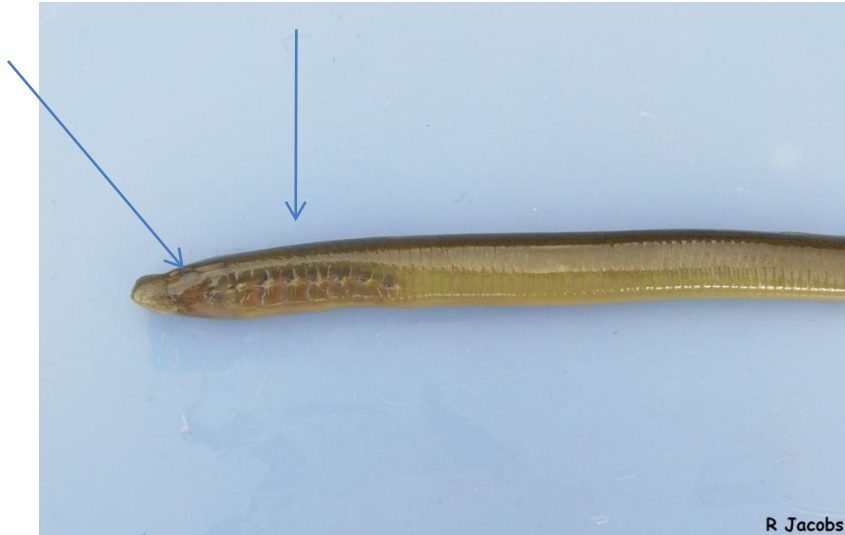
R Jacobs

Tessellated Darter (TD):

- small fish
- small scales
- "w" pattern on side
- eyes on top of the head
- large pectoral fins
- from front view much taller than wide
- small head compared to body
- small mouth

Slimy Sculpin (SC):

- small fish
- small scales
- "w" pattern on side
- eyes on top of the head
- large pectoral fins
- from front view much wider than tall
- very large head compared to body
- huge mouth



Sea Lamprey (SL):

- no scales
- no eyes
- no fins
- gill slits along side of head
- snake like
- U-shaped mouth



American Eel (AE):

- no scales
- eyes
- has fins
- snake like
- regular mouth in front of head



Brown Bullhead (BB):

- no scales
- sharp spines in dorsal and pectoral fins
- Chin whiskers are dark colored
- underside usually creamy white



Yellow Bullhead (YB):

- no scales
- sharp spines in dorsal and pectoral fins
- Chin whiskers are light colored
- underside may be yellowish white










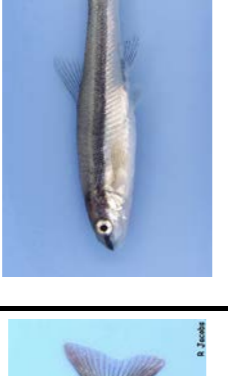
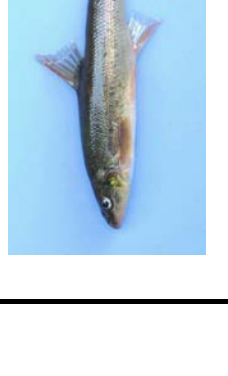
Redfin Pickerel (RP):

- small scales
- red/orange pelvic and pectoral fins
- large duck-bill like mouth
- mouth is less than $\frac{1}{2}$ the total length of the head
- Not larger than about 20 cm



Chain Pickerel (CP):

- small scales
- large duck-bill like mouth
- mouth is more than $\frac{1}{2}$ the total length of the head
- can be larger than 20 cm


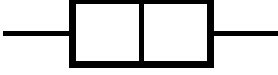


Species		Description	Habitat	Reproduction	Feeding
Fallfish		12-17" long Smaller fish are bright silver; larger fish are dull silver	Clear streams and lakes and ponds Young prefer riffles, adults pools Does not tolerate muddy water	Spawns in groups in late spring (April-June) Males build nests with stream gravel. Round nest can be 4' wide & 1.5' high After spawning, females float belly-up then recover and spawn again Males develop pink tint to the head	Eats insects, small fish crayfish & plant materials
Creek Chub		6-12" long Somewhat cigar-shaped body is dark with a purple sheen on the sides Dark spot at base of dorsal fin Sometimes heavily covered with the parasite that causes black spot disease - resulting in the fish looking like it was sprinkled with black sand	Found in all but the fastest moving waters of streams Rarely inhabits lakes	Spawns in spring (May) Male build nests in gravel by digging small pits. Several females deposit eggs in nest After spawning, females float belly-up then recover and spawn again Males develop pink color	Eats insects, fish, crayfish and plant materials
Common Shiner		3-4" long Silver colored with large diamond-shaped scales Hybrid of this species are common	Found in streams. Avoids areas of fast current Tolerates some silt, but not muddy water	Spawns in late spring (May-June) Males either build nests at the upstream side of riffles or use nests of other minnow species Spawns both as groups and individual pairs Males develop blue-colored backs and red bellies	Eats a variety of organisms including insects, larval fish and plant material
Golden Shiner		5-10" long Body deep & compressed Lateral line noticeably dips down in the middle of the body Golden or grassy colored with red fins	Generally a lake species, but found anywhere there is quiet, weedy, clean, shallow water	Spawns in late spring/mid summer (May-July) Scatters adhesive eggs over algae and other aquatic vegetation	Eats insects, small fish & algae Feeds in midwater and at the surface
Spottail Shiner		3-4" Silver colored with slight gold tint Loses scales easily when handled Dark spot on tail	Found in a variety of habitats Prefers large lakes & streams Often found over sandy bottoms	Spawn in groups in late spring/early summer (May-June) in sandy areas. Scatters eggs No parental care is given	Eats algae, insects, fish eggs and larvae
Fathead Minnow		2-3" long Heavy-bodied with small mouth Lateral line ends under dorsal fin Dark colored with a brass tint on sides	Prefers slow moving water in streams & ponds Tolerates muddy water & is found in roadside ditches Also tolerates salt in water	Spawns in late spring (May-June) Deposits adhesive eggs in nest on underside of logs, roots, rocks & lilly pads Males guard the nest until the eggs hatch	Eats mostly algae
Cutlips Minnow		3-5" long Stubby body shape Slate gray in color Lower jaw has 3 lobes	Found in pools in streams where there is clean gravel & cobble Stays on the bottom among the stones	Spawns in late spring (May-June) Males build nests by dropping pebbles into a round pile Several females deposit eggs in one nest. Nests are abandoned after spawning	Eats mainly aquatic insects & mollusks Has unusual habit of feeding on the eyes of other fish
Blacknose Dace		2-3" long Upper part of body is dark with speckles; lower part of body is light with fewer speckles	Found in clear streams with current Avoids stillwater & fast currents	Spawns in late spring (May-June) Males establish territories over gravel in shallow riffles Males develop green tint and red fins	Eats aquatic insect larvae, algae and fish eggs
Longnose Dace		3-5" long Shark-like in appearance: prominent snout & underslung mouth Olive to brown on back shading to cream on belly	Only found in riffle areas of streams	Spawns in late spring (May-June) in shallow riffles over a gravel bottom Males guard territories	Bottom feeder, eats fish eggs & insects (especially black fly larvae)

APPENDIX C. Ambient Fish Community Sampling Field Data Form

AWQ ID#:	Waterbody:	Date:	Crew Lead:
-----------------	-------------------	--------------	-------------------

Dominant Substrate (circle) 1 = silt/clay 2 = sand 3 = gravel 4 = cobble 5 = small boulder (1-2ft) 6 = large boulder (>2 ft) 7 = bedrock %Embedded: _____	Adj Land Use : <i>Left Right</i> Forested <input type="checkbox"/> <input type="checkbox"/> Agriculture <input type="checkbox"/> <input type="checkbox"/> Residential <input type="checkbox"/> <input type="checkbox"/> Urban <input type="checkbox"/> <input type="checkbox"/>	Instream Habitat: <input type="checkbox"/> Riffle/Pool Seq <input type="checkbox"/> Cascade/Pool <input type="checkbox"/> Step-Pool <input type="checkbox"/> Deep Run <input type="checkbox"/> Glide/Pool (LG) <input type="checkbox"/> Dry (____%) <input type="checkbox"/> Other:
Comments:		

YSI FIELD DATA							
Reading	At HOBO?	Time	Temp C	Sp Cond (ms/cm)	TDS	pH	Notes:

SAMPLING CONDITIONS	Very Low	Average	Very High	
Flow Conditions				% Bankfull: _____ Avg depth: _____
Netting Efficiency				# of Netters: _____
Field Strength				
Channel Coverage				

VOUCHER INFORMATION

FISH Voucher(s):	
Quantity: _____	Photo <input type="checkbox"/>
	Preserved <input type="checkbox"/>
Comments:	

MUSSEL Voucher(s):	
Quantity: _____	Photo <input type="checkbox"/>
	Preserved <input type="checkbox"/>
Comments:	

CRAYFISH Voucher(s):	
Quantity: _____	Photo <input type="checkbox"/>
	Preserved <input type="checkbox"/>
Comments:	

Additional Comments:

COMMON FISH SPECIES CODES:

AE = American Eel; SA = Atlantic Salmon; BC = Black Crappie; BL = Blacknose Dace; BG = Bluegill; LA = Brook Lamprey; BK = Brook Trout; BB = Brown Bullhead; BN = Brown Trout; CP = Chain Pickerel; CS = Common Shiner; CR = Creek Chub; CM = Cutlips Minnow; FF = Fallfish; GS = Golden Shiner; GR = Green Sunfish; LM = Largemouth Bass; LD = Longnose Dace; PS = Pumpkinseed; RW = Rainbow Trout; RS = Redbreast Sunfish; RP = Redfin Pickerel; RB = Rock Bass; SL = Sea Lamprey; SC = Slimy Sculpin; SM = Smallmouth Bass; TD = Tessellated darter; TT = Tiger Trout; WS = White Sucker; YB = Yellow Bullhead; YP = Yellow Perch; HY = Hybrid Sunfish; CE = Unknown Sunfish; CY = Unknown Minnow

APPENDIX D. Fish Species Code List

Fish Species Code List

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
AE	American Eel	<i>Anguilla rostrata</i>
AL	Alewife	<i>Alosa pseudoharengus</i>
AS	American Shad	<i>Alosa sapidissima</i>
BB	Brown Bullhead	<i>Ameiurus nebulosus</i>
BC	Black Crappie	<i>Pomoxis nigromaculatus</i>
BD	Bridled Shiner	<i>Notropis bifrenatus</i>
BG	Bluegill	<i>Lepomis macrochirus</i>
BK	Brook Trout, Stocked	<i>Salvelinus fontinalis</i>
WBK	Brook Trout, Wild	<i>Salvelinus fontinalis</i>
BL	Blacknose Dace	<i>Rhinichthys atratulus</i>
BM	Bluntnose Minnow	<i>Pimephales notatus</i>
BN	Brown Trout, Stocked	<i>Salmo trutta</i>
WBN	Brown Trout, Wild	<i>Salmo trutta</i>
BO	Brook Stickleback	<i>Culaea inconstans</i>
BS	Banded Sunfish	<i>Enneacanthus obesus</i>
BU	Black Bullhead	<i>Ameiurus melas</i>
BW	Bowfin	<i>Amia calva</i>
CA	Common Carp	<i>Cyprinus carpio</i>
CC	Channel Catfish	<i>Ictalurus punctatus</i>
CE	Unknow Sunfish	<i>Juvenile Centrarchid</i>
CH	Creek Chubsucker	<i>Erimyzon oblongus</i>
CM	Cutlips Minnow	<i>Exoglossum maxillingua</i>
CP	Chain Pickerel	<i>Esox niger</i>
CR	Creek Chub	<i>Semotilus atromaculatus</i>
CS	Common Shiner	<i>Luxilus cornutus</i>
CY	Unknown Minnow	<i>Juvenile Cyprinid</i>
FF	Fallfish	<i>Semotilus corporalis</i>
FM	Fathead Minnow	<i>Pimephales promelas</i>
FS	Fourspine Stickleback	<i>Apeltes quadracus</i>
GC	Grass Carp	<i>Ctenopharyngodon idella</i>
GF	Goldfish	<i>Carasius auratus</i>
GR	Green Sunfish	<i>Lepomis cyanellus</i>
GS	Golden Shiner	<i>Notemigonus crysoleucas</i>
HY	Hybrid Sunfish	<i>Hybrid Sunfish</i>
LA	Brook Lamprey	<i>Lampetra appendix</i>
LD	Longnose Dace	<i>Rhinichthys cataractae</i>
LL	Burbot	<i>Lota lota</i>
LM	Largemouth Bass	<i>Micropterus salmoides</i>
LN	Longnose sucker	<i>Catostomus catostomus</i>
MM	Central Mudminnow	<i>Umbra limi</i>
NP	Northern Pike	<i>Esox lucius</i>

NS	Ninespine Stickleback	<i>Pungitius pungitius</i>
PS	Pumpkinseed	<i>Lepomis gibbosus</i>
RB	Rock Bass	<i>Ambloplites rupestris</i>
RP	Grass Pickerel/Redfin Pickerel	<i>Esox americanus</i>
RS	Redbreast Sunfish	<i>Lepomis auritus</i>
RW	Rainbow Trout	<i>Oncorhynchus mykiss</i>
SA	Atlantic Salmon	<i>Salmo salar</i>
SB	Striped Bass	<i>Morone saxatilis</i>
SC	Slimy Sculpin	<i>Cottus cognatus</i>
SD	Swamp Darter	<i>Etheostoma fusiforme</i>
SL	Sea Lamprey	<i>Petromyzon marinus</i>
SM	Smallmouth Bass	<i>Micropterus dolomieu</i>
SS	Spottail Shiner	<i>Notropis hudsonius</i>
TD	Tessellated darter	<i>Etheostoma olmstedii</i>
TT	Tiger Trout	<i>S. fontinalis x S. trutta</i>
WA	Walleye	<i>Stizostedion vitreum</i>
WC	White Catfish	<i>Ameiurus catus</i>
WP	White Perch	<i>Morone americanus</i>
WS	White Sucker	<i>Catostomus commersoni</i>
YB	Yellow Bullhead	<i>Ameiurus natalis</i>
YP	Yellow Perch	<i>Perca flavescens</i>
ZZZ	NO FISH CAUGHT	<i>Sans poisson</i>