Section 10
Aquatic Vertebrates

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Vertebrate sampling is intended to collect all but the rarest fish and aquatic amphibian species in a reach and their abundances in the collection should be relative to their proportionate abundance in the water body. Data on species richness, species guilds, abundance, size and anomalies are used to assess ecosystem condition. In rivers, vertebrates are collected first. Boat electrofishing equipment is used as the principal sampling gear (Section 10.1.1), and only the boat personnel are involved in collecting aquatic vertebrates. In addition to gathering data on the assemblage, fish specimens are retained for analysis of tissue contaminants (Section 11).

10.1 Sample Collection

Depending on the survey region, rivers are sampled along one bank for a distance equal to either 40 or 100 times the wetted width in the vicinity of the point of entry. The mean channel width is measured with a laser range finder and estimated from maps and at the top of the reach. In the relatively fast, cold, oligotrophic, or species-depauperate rivers of some regions, lower total fish catches and efficiency of capture (compared with those in relatively slow, warm, eutrophic, or species-rich rivers) necessitate a greater sampling reach length. To capture a sufficient number of fish in rivers of some regions, sample reaches 100 Channel-Widths long may be specified for regional surveys, based largely upon fish capture requirements. River reaches 40 channel widths long are specified in the Mid-Atlantic region, for example, whereas 100 channel-width long reaches are specified in Pacific Northwest rivers.

10.1.1 Electrofishing

Because vertebrates are collected using electrofishing units, safety procedures must be followed at all times (refer to Section 2). Primary responsibility for safety while electrofishing rests with the crew leader. Electrofishing units have a high voltage output and may deliver a fatal electrical shock. While electrofishing, avoid

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contact with the water unless sufficiently insulated against electrical shock and, do not touch objects outside the boat. Use watertight rubber linesman's gloves. If gloves develop a leak or become wet inside, use another pair or stop fishing until they are repaired and thoroughly dry. Avoid contact with the anode and cathode at all times due to the potential shock hazard. At no time while the electrofisher is on should a team member reach into the water for any reason. If it is necessary for a team member to reach into the water to pick up a fish or something that has been dropped, do so only after the electrical current has been turned off. Do not electrofish when navigating major rapids and wait for the second boat to clear them. Do not resume electrofishing until all nontarget individuals are clear of the electroshock hazard or obstacle. The boat units have three kill switches. Insure that these work before fishing. Do not make any modifications to the electrofishing unit that interrupt the current or that would make it impossible to turn off the electricity.

Crew members must complete CPR and first aid courses. They should be strong swimmers and, as appropriate, complete a white water rescue course. Wear a life jacket when in a boat and avoid operating electrofishing equipment within 20 feet of nontarget organisms. Discontinue activity during thunderstorms, heavy rain or if the top or inside of the boat is wet. Crew members should keep each other in constant view or communication while electrofishing. For each site, know the location of the nearest hospital with a defibrillation unit. Although the crew leader has authority, each crew member has the responsibility to question and modify an operation or decline participation if it is unsafe. Use hand signals to communicate direction and power on or off because of generator noise, and avoid colliding with obstacles overhead and in the water. Rest if the team becomes fatigued, and drink lots of water.

Gasoline is extremely volatile and flammable. Its vapors readily ignite on contact with heat, spark or flame. Never attempt to refill the generator while it is running. **Always allow the generator to cool before refilling.** Keep gasoline out of direct sunlight to reduce volatilization and vapor release. Always wear gloves and safety glasses when handling gasoline. Keep gasoline only in approved plastic containers and store in a tightly closed container.

Boat electrofishing sampling procedures are presented in Table 10-1. Record information on the Vertebrate Collection Form as shown in Figure 10-1. If the river cannot be sampled by electrofishing, complete the "NOT FISHED" field on the form. Select the initial voltage based on the measured conductivity of the river (see Section 5). Select the initial frequency based on the expected size of fish. If fishing success is poor, increase the pulse width first and then the voltage. Increase the frequency last to minimize mortality or injury to large fish.

The electrofishing boat is a 14 -16 ft. inflatable raft or john boat modified for two persons and all fishing equipment. Boat configuration consists of a frame mounted generator and electrofishing control box, port and starboard cathodes, and two anodes extending out over the bow. Alternatively, the john boat itself may be used as the cathode. The boat is maneuvered by one operator seated near the stern, and the vertebrates are collected and identified by one netter operating from the bow. Prior to fishing, determine that the netter is wearing gloves and both team members are clear of all electrodes. Wear polarized sunglasses to aid vision. Start the electrofisher, set the timer to zero, and depress the foot pedal to begin fishing. Starting at the top of the reach and along the designated

Table 10-1. Procedure to Collect Aquatic Vertebrates by Boat Electrofishing.

Onshore at launch site

a. Check generator oil and fill tank with gas (wipe up any spillage).
b. Clip cathodes to sides of frame & connect their cables to the cathode outlet (if the fishing site is distant, keep electrodes in boat).
c. Connect anode cables to outlets (if the fishing site is distant, keep anodes on poles in the boat).
d. Connect generator and pulsator.
e. Confirm that all gear for the day and a spare vehicle key are in the boat.
f. Put on a life jacket and gloves.
g. Go to step 2 & 3 below to assess electrofisher performance.

1. Complete the header information on a copy of the Vertebrate Collection Form. Indicate the transect being sampled in the "TRANSECT" field on the form.
2. Select river bank for fishing (left for odd numbered sites, right for even) unless immediate hazards or obstructions preclude this. Stay along the selected bank throughout the day's fishing to the degree it is safely navigable; do not switch back and forth between banks unless the river aspect is unchanging and the selected side is not representative (e.g., very sunny and shallow) of both. Using the rangefinder, determine a downstream point that is 10 mean channel widths distant (this is the profile length). Record this distance on the field sheet.
2. Check all electrical connections and potential conductors and place the anodes and cathodes in the water. Fill livewell and put on linesman gloves. Verify that all electrical switches are off, that all non-target organisms are clear of the water or two boat lengths away, and that boat surfaces are dry.
3. Start generator, switch to pulsed DC, a frequency of 30 pps, low range and 40%. Increase % (voltage) as needed to roll fish. If success is poor, reduce %, switch to high range, and again increase % as needed. If effectiveness is still low, switch to 60 pps and repeat the process. If the current (amperage needle) is reduced, switch back to low range to avoid overloading the generator. Switching should occur when power is off. Netter activates safety switches and insures that when either is employed current ceases. Verify that fish are rolled and relaxed but not rigid. Record settings on field sheet in comments section and start cleared clocks.
4. With system activated and safety switches on, begin fishing downstream near shore. Maneuver the boat or anode to cover a swath two-three meters wide, at an oars length from shore, near cover, and at depths less than three meters wherever possible. Do not place the boat in danger in order to fish particular habitats; cut the generator and stow the gear before negotiating hazards.
5. Place fish directly in livewell as soon as possible; do not hold them in the electrical field. Pay special attention to netting small and benthic fishes as well as fishes that respond differently to the current--not just the big fish that move to the surface. Try to net all fish seen, but in productive systems this will be impossible. Do not chase individual fish with the boat or lean far out from the boat to net them. If benthic fish are being missed, pivot the boat occasionally or hold the net behind the anode and along the bottom so some are collected.
6. Cease sampling at the end of the profile. Process the fish quickly and carefully, returning them to the water unless they are vouchered. Be sure that the data sheet is completed accurately and completely, and that voucher specimens are taken. Record the "Total Shock Time," "TOTAL FISHING TIME," and "SHOCK DISTANCE" on the Vertebrate Collection Form. If no aquatic vertebrates were collected, complete the "NONE COLLECTED" field on the Vertebrate Collection Form.
7. Complete field collections and field sheets for other indicators taken at the end of the profile. Return to step 1 for each of the subsequent 9 profiles, but begin downstream from where fish were released.

shoreline, fish in a downriver direction. Adjust voltage and output according to sampling effectiveness and incidental mortality to specimens.

The netter uses an insulated dip net to retrieve stunned individuals, which are then deposited into a livewell for later processing (Section 10.2). Change the water in the livewell

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SITE NAME: BEAVER RIVER DATE: 8 5 98 VISIT: 0 [X] 2 3

SITE ID: ORRV 98-999 TEAM ID (X): [X] 2 3 4 5 6 7 8

ID BY (NAME): J. DOE TRANSECT (X): [X] B C D E F G H I J A (stream)

TOTAL SHOCK (button) TIME (xxxx) 270 seconds TOTAL FISHING TIME (xxx) 6 minutes SHOCK DISTANCE (m) 400

SAMPLE ID (BARCODE) 243360 ☐ NOT FISHED ☒ NONE COLLECTED

SPECIMENS

TAG NO	SPECIES CODE	COMMON NAME	TOTAL NUMBER		VOUCHERED COUNT	LENGTH (mm)		ANOMALIES		NUMBER OF MORTALITIES	FLAG
			TALLY	COUNT		MIN.	MAX.	CODE	COUNT		
	PROS WILL	MOUNTAIN WHITEFISH	卌 11	7	1	110	390	HM	1	0	F1
	ONCOMYKI	RAINBOW TROUT	卌 1	6	0	105	390	NO	0	0	
	COTTZZZZ	UNKNOWN COTTIA	1111	4	4	30	182	NO	0	0	
	CATOMACR	LARGESCALE SUCKER	1111	4	2	103	598	LE	1	0	
	PTYCOREG	NORTHERN SQUAWFISH	1	1	1	184		NO	0	0	

FLAG	COMMENTS
	NOTE: ALL VOUCHERED SPECIMENS FOR ALL SPECIES ARE NOT TAGGED (NO TAG NUMBER)
	AND ARE LOOSE IN SAMPLE CONTAINERS. THIS APPLIES TO THIS TRANSECT, AS WELL AS
	ALL OTHERS FISHED.
F1	EIGHT ADDITIONAL WHITEFISH TAKEN OVER THE COURSE OF THE ENTIRE REACH → ANOTHER STUDY

Flag Codes: F1, F2, etc. = Misc. flags assigned by field crew. Explain all flags in Comments section. LENGTH - enter single fish as minimum.

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Figure 10-1. Vertebrate Collection Form.

periodically to minimize mortality prior to processing. If individuals show signs of stress (loss of righting response, gaping, gulping air, excessive mucus), stop and process them. This should only be necessary on very warm days, in long reaches, or if very large numbers of individuals are collected. Electrofishing may also need to cease at times to immediately process and release specimens (e.g., listed species or large game fish or if fish appear to be stressed due to temperature and/or low DO) as they are netted (see Section 10.2). If periodic processing is required, be sure to release individuals upriver and away from the shoreline to reduce the likelihood of collecting them again.

At the completion of electrofishing each profile, record the total operating time (shock time) and total fishing time shown on the electrofisher timer and the distance sampled by electrofishing on the Vertebrate Collection Form (Figure 10-2). If no aquatic vertebrates were collected, indicate this on the form as shown in Figure 10-2. During this project, specimens should be processed after completion of every transect when possible to provide data on catch per unit effort.

10.2 Sample Processing

Sample processing involves tallying and identifying fish, examining individual specimens for external anomalies, obtaining length measurements from selected specimens, preparing voucher specimens for taxonomic confirmation and archival at a museum, and selecting specimens to prepare samples for fish tissue contaminants (see Section 11). Process collections as quickly as possible to minimize stress to live specimens. The netter is responsible for identifying, measuring, and examining aquatic vertebrates contained in the livewell. At the end of each profile, the netter processes fish from the livewell while the operator records information on the field data forms.

10.2.1 Taxonomic Identification and Tally

Table 10-2 presents the procedure for identifying and tallying aquatic vertebrates. Record identification and tally data for each species on the Vertebrate Collection Form as shown in Figure 10-1. Also record comments and data for additional species on the Vertebrate Collection Form. The team is to be provided with a list of standardized names (required) and species codes (optional) for aquatic vertebrate species that are expected to be collected (see Appendix C for an example).

Taxonomic identification should be performed only by trained ichthyologists familiar with the fish species and other aquatic vertebrate taxa of the region. Use taxonomic reference books and other materials that contain species descriptions, ranges, and identification keys to make species identifications in the field. Where there are many individuals of easily identified species, processing may be facilitated by keeping a tally count of the number of individuals of each species as it is taken from the livewell and totaling the tally once processing is complete.

To minimize handling, process threatened and endangered species first, and immediately return all individuals to the river. If conditions permit and stress to individuals will be minimal, photograph such fish for voucher purposes (Section 10.2.3). Photographs of fish, fish too large to voucher, fish anomalies, and the sites themselves are very informative to those of us who cannot be in the field. Be sure to photograph the site number so we can link photos and places. Indicate if photographed with an "F" series flag for the species on page 1 of the Ver-

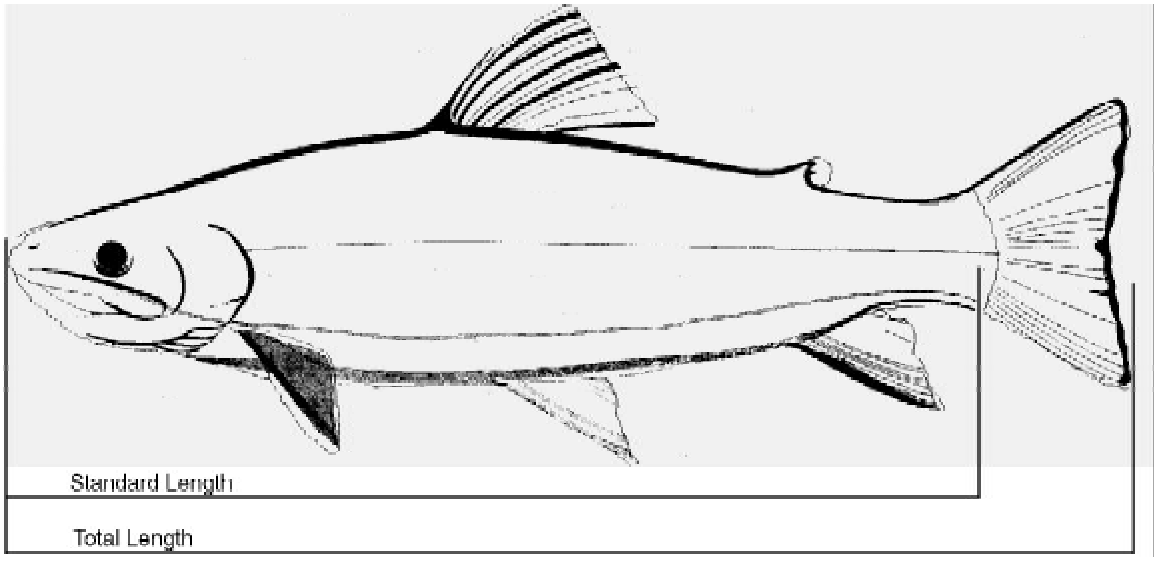


Figure 10-2. Fish length measurements (modified from Lagler, 1956).

Table 10-2. Procedure To Identify, Tally, And Examine Aquatic Vertebrates.

1. Complete the header information on the form, then record the common name (from a standardized list) and species code on the first blank line in the "SPECIMENS" section of the Vertebrate Collection Form. If a species cannot be positively identified, assign it an "unknown" species code from the list provided.
2. Examine each fish individually; small-sized fish species may be handled in small manageable groups to speed processing.
3. To minimize handling, threatened and endangered species should be identified, counted, and returned immediately to the stream. If conditions permit and stress to individuals will be minimal, photograph fish for voucher purposes. Indicate if photographed on data sheet with flags and comments. If protected fish have died, they should be vouchered in formalin. At the earliest possible time, the appropriate state officials should be notified.
4. Sport fish and very large specimens should be identified, measured for total length to the nearest mm, examined for external anomalies, and released. Record all information on the vertebrate collection form. Keep voucher specimens (up to 5) of smaller individuals of each species. If no smaller individuals are collected, photograph each species and indicate so on the data form. Large, questionable species should be placed on ice and then frozen.
5. Identify all other species in the livewell.
6. Tally the number of individuals collected (use the "Tally" box on the Vertebrate Collection Form if necessary) and record the total number in the "Count" field on the form.
7. Measure the total length of the largest and smallest individual to provide a size range for the species. Record these values in the "Length" area of the Vertebrate Collection Form.
8. Measure the total length of each individual (up to 30) and record the lengths in the boxes on the Vertebrate Length Recording Form (2 lines of boxes per species). For smaller species, measure and record lengths of a random set (up to 30) of the individuals collected.
9. Examine each individual for external anomalies and note the types of anomalies observed. After all of the individuals of a species have been processed, record the anomaly code and the total number of individuals affected in the "Anomalies" area of the Vertebrate Collection Form.
10. If individuals have died due to the effects of electrofishing or handling, record the total number of mortalities on the Vertebrate Collection Form.
11. Follow the appropriate procedure to prepare voucher specimens and/or to select specimens for tissue samples. Release all remaining individuals into the river.
12. Repeat Steps 1 through 11 for all other profiles.

tebrate Collection Form (Figure 10-1) and record a notation in the comments section. If protected fish have died, they should be prepared as voucher specimens and preserved in formalin. Notify the appropriate state officials as soon as possible.

If a species cannot be confidently identified in the field (e.g., small individuals or suspected hybrids), record it as an "unknown" species on the Vertebrate Collection Form, using one of the names (and code) provided for unknowns from the standardized list (see Figure 10-1 for an example). If possible, flag unknown species with an "F" series flag and provide your best guess at an identification in the comments section of the form.

10.2.2 External Examination and Length Measurements

During the tallying procedure for each species (Table 10-2), examine each individual for the presence of external anomalies. External anomalies may result from sublethal environmental or behavioral stress, diseases, and toxic chemicals. Readily identified external anomalies, include deformities, eroded fins, lesions, tumors, diseases and parasites. Codes for different types of anomalies are presented in Table 10-3. Record the types of anomalies observed and the number of individuals affected on the Vertebrate Collection Form as shown in Figure 10-1.

Blackening and exopthalmia may occasionally result from electrofishing. Injuries due to sampling are not included in the tally of external anomalies, but should be noted in the comments section of the Vertebrate Collection Form (Figure 10-1). Care should be taken in the early stages of electrofishing to use the most effective combination of voltage and pulse width while minimizing injury to fish. Blackening from electrofishing usually follows the myomeres or looks like a bruise. If fish die due to the effects of sampling or processing, record the number for each species on the Vertebrate Collection Form (Figure 10-1).

For each species, use a measuring board or ruler to determine the total length (Figure 10-2) of the largest and smallest individuals (this is a check on your measurements of total lengths recorded on the Vertebrate Length Recording Form [Figure 10-3]). Use of "tick marks" on the length form will aid you in determining maximum and minimum lengths for a profile. Measure individuals on the right side, and slide fish to touch the "Bump Board" on the measuring board. Measure total length to the nearest millimeter (mm) and record these values on the Vertebrate Collection Form as shown in Figure 10-1. Measure the total lengths of up to 30 individuals and record these values on the Vertebrate Length Recording Form as shown in Figure 10-3.

10.2.3 Preparing Voucher Specimens

With the exception of very large individuals and protected species, collect vouchers of all species allowed by collecting permits to provide a permanent, archived, historical record of fish collections. Prepare the voucher sample for a site according to the procedure presented in Table 10-4. Retain additional specimens of the appropriate species for the fish tissue contaminants sample (Section 11). For each species, voucher specimens take priority over specimens for the tissue contaminants sample.

Voucher specimens for each species are counted and placed into individual nylon mesh bags (1 bag per species). Nylon stockings or

Table 10-3. External Anomaly Categories and Codes.

Categories	Code	Definition
Absent	AB	Absent eye, fin, tail.
Blisters	BL	In mouth, just under skin.
Blackening	BK	Tail or whole body with darkened pigmentation.
Extensive black spot disease	BS	Small black cysts (dots) all over the fins and body.
Cysts	CY	Fluid-filled swellings; may be either small or large dots.
Copepod	CO	A parasitic infection characterized by a worm-like copepod embedded in the flesh of the fish; body extends out and leaves a sore/discoloration at base, may be in mouth gills, fins, or anywhere on body.
Deformities	DE	Skeletal anomalies of the head, spine, and body shape; amphibians may have extra tails, limbs, toes.
Eroded fins	EF	Appear as reductions or substantial fraying of fin surface area.
Eroded gills	EG	Gill filaments eroded from tip.
Fungus	FU	May appear as filamentous or "fuzzy" growth on the fins, eyes, or body.
Fin anomalies	FA	Abnormal thickenings or irregularities of rays
Grubs	WG	White or yellow worms embedded in muscle or fins.
Hemorrhaging	HM	Red spots on mouth, body, fins, fin bases, eyes, and gills.
Ich	IC	White spots on the fins, skin or gills.
Lesions	LE	Open sores or exposed tissue; raised, granular, or warty outgrowths.
Lice	LI	Scale-like, mobile arthropods.
Mucus	MU	Thick and excessive on skin or gill, or as long cast from vent.
None	NO	No anomalies present.
Other	OT	Anomalies or parasites not specified (Please comment).
Scale anomalies	SA	Missing patches, abnormal thickenings, granular skin
Shortened operculum	SO	Leaves a portion of the gill chamber uncovered
Tumors	TU	Areas of irregular cell growth which are firm and cannot be easily broken open when pinched. (Masses caused by parasites can usually be opened easily.)
Leeches	WL	Annelid worms which have anterior and posterior suckers. They may attach anywhere on the body.
Exophthalmia	EX	Bulging of the eye.

panty hose may substitute for nylon bags. Each bag contains a numbered tag (Figure 10-4). Record the tag number and the number of individuals vouchered for each species on the Vertebrate Collection Form as shown in Figure 10-1. Single specimens of easily identified and distinct species (e.g., sandroller, smallmouth bass) may be placed directly in the jar.

The preceding steps are critical to enable us to link a species' field and lab identifications with the number of individuals so named. If done correctly, we can estimate the number of individuals collected from the proportions in the bag, even if a presumed single species turns out to be 2 or 3 species (this is one reason we voucher as many specimens of a species as possible). It is useful to pre-

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SITE NAME: BEAVER RIVER DATE: 8 5 98 VISIT: 1 2

SITE ID: CRRV 98-999 TEAM ID (X): 1 2 3 4 5 6 7 8

MEASURED BY (NAME): J. DOE

SPECIES CODE	COMMON NAME	LENGTH (MM) OF INDIVIDUAL FISH														
ONCOMYKI	RAINBOW TROUT	315	300	270	185	160	170	350	340	160	270	340	345	310	280	105
		180	310	160	185	260	180	390	340	315	310	110	290	360	290	180
CATOMACR	LARGESCALE SUCKER	472	426	150	103	150	120	500	485	358	486	500	560	507	598	140
		250	530	170												
PROSWILL	MOUNTAIN WHITEFISH	330	300	340	320	335	123	110	370	390	300	320	315	320	350	310
		242	340	330	325	340	305	325	335	270	320	320	110	310	320	345
PTYCOREG	NORTHERN SQUAWFISH	210	220	220	346	220	395	382	375	265	330	380	320	290	215	410
		465	330	250	240	220	430	385	325	184	285	340				
COTTZZZZ	UNKNOWN COTTIA	98	70	66	90	85	70	72	63	81	70	35	72	65	70	80
		30	30	194	182											
CATOCOLU	BRIDGEUP SUCKER	210	160	248	171	185	186	249	130	160	170	380	325	190	180	205
		230	264	230	260	175	110	100	194	260	155	260	125	180	190	220
ACROALUT	CHISELMOUTH	225	180	220	200	203										
RHINCATA	LONGNOSE DACE	150	95	70												

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VERTEBRATE LENGTH RECORDING FORM - STREAMS/RIVERS - 1

Figure 10-3. Vertebrate Length Recording Form.

Table 10-4. Guidelines and Procedures for Preparing Aquatic Vertebrate Voucher Specimens.

Determine the voucher category of a species and the number of specimens to include in the voucher sample based on the following guidelines. NOTE: Category 3 species should be processed first.

A Category 1 — Large easily identified species OR adults may be difficult to identify OR the species is uncommon in that region. Examples include:

Centrarchids Catostomids Cyprinids Ictalurids Salmonids

1. Preserve 1-2 small (<150 mm total length) adult individuals per site plus 2-5 juveniles. If only large adults are collected, reserve smallest individuals until voucher procedure is complete and preserve ONLY if space is available.

   • NOTE: Individuals with a total length > 160 mm should be slit on the lower abdomen of the RIGHT side before placing them into the container.

2. Photograph if considered too large for the jar and place in bag on ice for freezing (Do not retain large gamefish). All photographs should include (1) a card with the stream ID, date, species code, and common name, and (2) a ruler or some other object of known length to provide some indication of the size of the specimen.

3. Retain additional individuals for the tissue contaminant sample.

B. Category 2 — Small to moderate-sized fish OR difficult to identify species. Examples include:

Lampreys Minnows Sculpins Sticklebacks Sunfish

1. Preserve up to 20 adults and juveniles (ideally several per profile). If fewer than 20 individuals are collected, voucher all of them. Voucher samples take priority over tissue contaminant sample.

2. Retain additional individuals for tissue contaminants sample.

C. Category 3 — Species of "special concern." These are state or federally listed species.

1. Photograph as in Step 1.A.2 and then release immediately.

2. If specimens have died, proceed to Step 2 and include them as part of the voucher sample. Flag the species with an "F" series flag on the Vertebrate Collection Form and note it is a listed species in the comments section of the form. Notify the appropriate state officials as soon as possible.

3. Place the voucher specimens in a bucket with two carbon dioxide tablets (e.g., Alka Seltzer®) and a small volume of water. When specimens are anaesthetized, transfer them to a nylon mesh bag. Record the number of individuals included in the voucher sample in the "Vouchered Count" field for the species on the Vertebrate Collection Form.

4. Select a "FISH-BAG" tag that has the same ID number (barcode) as the voucher sample jar (Step 3). Record the tag number in the "Tag No." field on the corresponding line for the species on the Vertebrate Collection Form. Place the tag into the mesh bag and seal.

(continued)

Table 10-4. Continued.

5. Immediately place the bag into a container (½ or 1 gal plastic jar) large enough to hold all voucher specimens and half-filled with 10% formalin. Use additional jars if necessary to avoid tight packing and bending of voucher specimens.

6. Repeat Steps 1 through 4 for all species collected.

7. Prepare two "FISH-JAR" labels (each having the same ID number [barcode]) by filling in the stream ID and the date of collection. Place one label into the sample jar. Cap tightly and seal with plastic electrical tape.

8. Attach the second label to the outside of the sample container by covering it with a strip of clear tape. Record the voucher sample ID number (barcode) on page 1 of the Vertebrate Collection Form. Record general comments (perceived fishing efficiency, missed fish, gear operation, suggestions) in blank lines of form. NOTE: If more than one jar is required, use labels that have the same ID number printed on them and flag.

9. Place the preserved sample in a suitable container with absorbent material. Store the container in a well-ventilated area during transport. Follow all rules and regulations pertaining to the transport and shipment of samples containing 10% formalin.

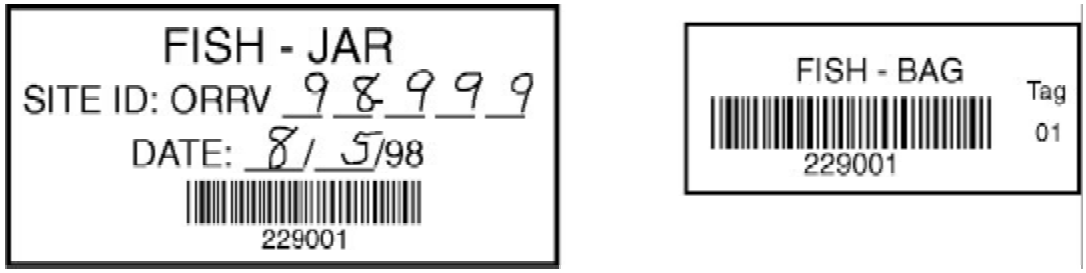


Figure 10-4. Completed voucher sample label and specimen bag tag for aquatic vertebrates.

serve vouchers of sculpins, lampreys and other difficult species from throughout the reach.

Place specimen bags together into a large plastic sample container. Preserve voucher specimens with a 10% formalin solution. See Section 3 for instructions for preparing a buffered formalin solution. Larger voucher specimens (total length > 160 mm) should be slit on the lower abdomen of the RIGHT side to allow for complete fixation of internal tissues and organs. If a fish is too large for a jar, photograph and place in bag on ice. Flag on recording sheet; freeze at lab separately from tissue. Start with a concentrated solution of formaldehyde and dilute to the final volume with water. The final volume of 10% formalin in the sample container should equal the total volume of specimens. Use

additional containers if necessary and avoid tight packing of specimen bags.

Delays in carrying out the anaesthetization and preservation procedures, overpacking a sample container, or an inadequate volume of preservative will produce unidentifiable specimens.

Formaldehyde (37%) and formalin (10% formaldehyde by volume) are extremely caustic agents and may cause severe irritation on contact of vapors or solution with skin, eyes or mucus membranes. It is a potential carcinogen. Contact with vapors or solution should be avoided. Wear gloves and safety glasses and always work in a well-ventilated area. In case of contact with skin or eyes, rinse immediately with large quantities of water. Store stock solution in sealed containers in safety cabinet or cooler lined with vermiculite. If possible, transport outside of the passenger compartment of a vehicle.

A set of two sample labels is completed for each sample container as shown in Figure 10-4. Place one label inside each sample container, and attach the second label to the outside of the jar with clear tape. Record the sample ID number on the Vertebrate Collection Form as shown in Figure 10-1. Carefully complete the collection form at each transect. Tag numbers must be linked to each species, and each bag of species. Be careful with fish names and their spellings (computers see errors as different species). Some museums may also require that a separate collection card be completed and inserted into each jar of voucher specimens.

10.3 Equipment and Supplies

Figure 10-5 is a checklist of equipment and supplies required to conduct protocols described in this section. This checklist may differ from the checklists presented in Appendix A, which are used at a base site to ensure that all equipment and supplies are brought to the stream site. Field teams are required to use the checklist presented in this section to ensure that equipment and supplies are organized and available to conduct the protocols efficiently.

Equipment and Supplies for Aquatic Vertebrates		
Qty.	Item	
1	14 ft. boat with frame mounted electrofishing gear (anodes, cathodes, control box)	
3	Oars (1 as extra)	
2	Dip nets, long handled	
1	Dip net, short handled	
1	Generator and filled gas can; rag	
1	Fire extinguisher	
2	Anodes and cathodes (Spare)	
1	Livewell cooler	
1	Measuring board and ruler	
2	Pesola scales for weighing primary tissue samples	
2	Buckets (5 gallon)	
1	Seat cooler with ice	
1	Air pump, hose and fitting	
2	Personal floatation devices	
many	Boat straps and ropes	
1	Tool box (Leatherman, duct tape, spare oarlock, straps, electrical tape, fuses, zipties)	
1 roll	Aluminum foil	
2	Dry bags	
1	Boat repair kit	
1	First aid kit	
3	Taxonomic reference books and keys for fishes of the region	
1	List of vertebrate species common names (and species codes, if required)	
1	List of external anomaly codes	
15-20	Small nylon mesh bags for holding voucher specimens (bags can also be constructed from sections of nylon stockings or panty hose)	
1	Small fillet knife or scalpel for preparing larger voucher specimens for preservation	
2 ea.	1/2- or 1-gallon screw-top plastic jars for voucher sample	
2 L	10% (buffered) formalin solution	
1	Cooler to hold formalin solution and preserved voucher sample jars	
1 pr	Safety glasses	
1 pr	Chemical-resistant gloves	
1	Topographic map(s)	
1 ea	Laser rangefinder, stopwatch, camera and film, whistles	
2	Pruning saw and sheath	
	Rubber Linesman gloves, clipboards, polarized glasses, ziplock bags	
4	Carbon dioxide tablets (Alka-Seltzer® or equivalent)	
1	Sheet of pre-printed jar labels (4) and voucher bag tags (36), all with same preprinted sample ID number (barcode)	
1 pr	Scissors for cutting labels	
1 roll	Plastic electrical tape	
1 pkg.	Clear tape strips	
	Soft lead pencils for recording data and completing tags	
	Fine-tipped indelible markers for completing sample labels	
10+extras	Vertebrate Collection Form	
1 + extras	Vertebrate Length Recording Form	
1	Field operations manual	
1 set	Laminated sheets of aquatic vertebrate procedure tables and/or quick reference guides	

Figure 10-5. Equipment and Supplies for Aquatic Vertebrates.

10.4 Literature Cited

Lagler, K.R. 1956. Freshwater Fishery Biology. 2nd. Edition. William C. Brown Co., Dubuque, Iowa.

McCormick, F.H. 1993. Fish. pp. 29-36 IN: R.M. Hughes (ed.). Stream Indicator Workshop. EPA/600/R-93/138. U.S. Environmental Protection Agency, Corvallis, Oregon.