



**STANDARD OPERATING PROCEDURE FOR:
FISH SAMPLING WITH GILL NETS**

TVA-KIF-SOP-31

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1.0 PURPOSE

The objective of this Standard Operating Procedure (SOP) is to define the standard method for sampling fish with gill nets relative to the ash spill at Kingston Fossil Plant (KIF). This SOP describes the procedures necessary to maintain appropriate documentation and proper sample handling for sample integrity.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks are thoroughly evaluated prior to conducting field activities. The *Site-Wide Safety and Health Plan (SWSHP)* provides a description of potential hazards and associated safety and control measures. Potential hazards associated with the planned tasks are thoroughly evaluated prior to conducting field activities. A pre-Job Safety Analysis (JSA) to identify potential hazards is discussed at each sampling event (see Table 4). Sampling is only conducted by properly trained personnel.

If samples will be processed for contaminant analysis, powder-free nitrile gloves are worn while decontaminating sampling equipment, handling fish to be processed for contaminant analysis, and packing samples. At a minimum, nitrile gloves must be changed prior to the collection samples at each site, or as necessary to prevent the possibility of cross-contamination with the sample or the sampling equipment.

Additionally, a Float Plan is completed prior to traveling anywhere on a water vessel. A Float Plan includes a description of the water vessel, specifies who is on board, provides a description of the safety equipment being carried, and indicates destination and expected time of return.

2.1 Gill Net Considerations

Gill nets are effective sampling tools for the collection of commercial fish species and some sport fish species (such as temperate basses, sauger, and walleye). Fish are caught when they become entangled in the mesh. Nets are set in an area from which collections are sought, usually left overnight, and checked the next day.

Gill nets are used to collect fish from rivers or reservoirs under varied environmental conditions. A variety of gill nets are available for specific sampling needs. Horizontal sinking nets have enough weight on the leadline to make them rest on the bottom, with the floatline suspending the mesh in a curtain-like fashion. Horizontal floating gill nets have more floats and fewer weights, allowing the mesh to be suspended from the water surface. Vertical gill nets are designed so that the mesh extends in a vertical rather than horizontal orientation and may be set in either the floating or sinking configuration

described. Vertical gill nets are normally employed to determine seasonal vertical distribution of selected species.

Experimental gill nets employ several panels (sections) of various mesh sizes in succession rather than one mesh size throughout the length of the net. This allows a more complete collection of various size classes of most species, as well as smaller species that may not be taken with larger mesh nets. Experimental gill nets usually include panels of 25-mm, 38-mm, 51-mm, 64-mm, and 76-mm mesh sizes.

Mesh size may be varied to suit specific sampling needs. If a general collection of most species present in a study area is desired, an intermediate mesh is a good choice such as 38-mm bar mesh (length of one mesh strand measured between the knots). If a larger species (such as paddlefish) is being sought, larger mesh nets (up to 127- or 152-mm mesh) may be employed. Length of gill nets can also be varied to suit sampling needs. Most gill nets used by TVA range in length from 15.2-m to 91.2-m, with 30.4-m or 38.0-m most often used.

Trammel nets are a variation of gill nets that utilize a "wall" of much larger mesh (about 45.7-cm or larger) suspended on each side of the small, more standard size mesh panel. In theory, the fish pushes the smaller mesh through an opening in the larger mesh, forming a bag in which the fish is caught (Hubert, 1983).

When gill nets are set in non-flowing waters, few problems are encountered other than underwater obstructions upon which the net may become snagged. When nets are set in flowing waters, they are much more likely to become snagged as the current moves them along the bottom, unless sufficient weight is used to prevent any movement. Nets set in rivers are particularly susceptible to becoming fouled with debris, particularly leaves in fall and winter months.

Gill nets are often used simply to collect fish of certain species for various purposes, such as for tissue analysis for contaminants. In such cases, the requirement cited below for quantitative and qualitative sampling is not applicable.

3.0 PROCEDURES

This section documents general operating procedures and methods associated with collecting samples of fish using gill nets. Any deviations in these procedures are approved by the Project Manager and Quality Assurance (QA) Officer and are fully documented. Field work progresses as deviations are approved or resolved.

Field sampling crews are responsible for performing work in accordance with this procedure and other applicable procedures, keeping proper records, and reporting problems to the crew leader.

3.1 Pre-Job Preparation

The Project Manager is responsible for overall implementation of this procedure and ensuring that it complies with current regulations and standards as these are subject to change. The Project Manager is also responsible for the following activities:

- a. Coordination with appropriate regulatory agencies to ensure that appropriate documentation and/or permits are obtained.
- b. Review project work control documents including the site-specific *Quality Assurance Project Plan* (TVA-KIF-QAPP), SWSHP, and appropriate SOPs to determine appropriate field protocols.
- c. Refer to specific Sampling and Analysis Plan (SAP) to ensure project objectives are met such as sample type (individual animal, composite), sample size (necessary biomass/volume of material needed and number of specimens needed to meet those requirements), number of replicates, and sample locations (transects, random, stratified).
- d. Identify approximate sample-station locations. If necessary, make a reconnaissance visit of perspective sampling locations to evaluate their suitability.
- e. Discuss project objectives and potential hazards with project personnel.
- f. Coordinate with Field Team Leader to verify that appropriate field equipment and safety gear are available.
- g. Make sure that training requirements and needs have been identified and that project personnel complete the necessary training.
- h. Ensure appropriate laboratories to perform analyses have been identified and confirm that they have been contacted and are prepared to receive the samples.

3.2 Field Preparation

The Field Team Leader is responsible for implementation of the field collection process. The Field Team Leader confirms that samples are safely collected, that decontamination protocols are followed to maintain sample integrity, and that the associated data are accurate and well-documented. The Field Team Leader is also responsible for the following activities:

- a. Gather equipment necessary for completing the collection and sampling activities (refer to Table 1.).
- b. Provide a summary of potential hazards (or review JSA worksheet in Table 4) and appropriate safety equipment to the field sampling team.

- c. Confirm that QA and quality control (QC) protocols are followed.
- d. Maintain documentation of field activities and Chain-of-Custody (COC) records in accordance with the *Field Documentation* SOP (TVA-KIF-SOP-06).
- e. Prior to departure to the field (a week in advance if possible), notify the appropriate district office of the state fish and wildlife agency of the sampling schedule and of the area where electrofishing will be conducted.
- f. Coordinate with personnel processing fish for contaminant analysis, if applicable.

3.3 Sampling Preparation

Procedures for sampling preparation are as follows.

- a. For fish community surveys, locate site where net is to be set using GPS unit (which has already been pre-loaded with net sites). If only specific fish species are targeted, net sites are selected in the field based on professional judgment of best likelihood of collecting the targeted specie(s). Tie gill nets to either a secure object on shore by the floatline (floatline and leadline are secured for vertical net sets) or fished offshore by anchoring both ends of the leadline.
- b. If the net is to be fished near shore, tie the floatline to a tree, rock, or other secure object. If the net is to be fished out away from the shore, secure an anchor to the leadline and a float to the floatline with enough leader to allow the net and anchor to reach the bottom of the reservoir without pulling the float under. Drop the anchor (with leadline) and float (with floatline) in the water.
- c. Reverse the boat slowly (in a manner that is perpendicular to the shoreline) while pulling the net from the tub by the floatline and playing it out over the bow of the boat. Clear any tangles encountered.
- d. When the opposite end of the net is reached, stop backing the boat to allow slack in the net.
- e. Secure the second anchor to the leadline at the other end of the net. Drop the second anchor in the water.

3.4 Sample Collection

Sample collection procedures are as follows.

- a. When the net is tended, lift one end of the net and begin slowly pulling the net into the boat.
- b. Remove fish and any debris as the net is pulled into the boat and place the net in the tub so it can be easily removed when reset.

- c. If using a data logger, record the number and type of species removed from the net directly into the data logger. If using a *Reservoir Fisheries Field Data Form* (Table 2), record the number and type of species removed from the net on this form.
- d. Record any life history information required, such as length (mm) and weight (g), and overall health observations. Record other project specific information required in the SAP.

Note: Weigh the fish using a scale that has been calibrated using check weights. See Table 5 for *Weekly Balance Check* scale calibration table.

- e. Release live fish not needed for the project. If fish are retained for contaminant analysis, see Section 3.4.1. Puncture the air bladder of dead fish not needed with a knife and allow them to sink to the bottom of the reservoir or river in water over three meters deep.
- f. Preserve fish of questionable identity or vouchers specimens of rarely captured species in 10% formalin and retain for taxonomic verification. (Refer to JSA in Table 4 for safety and handling precautions for formalin.) Pierce the body cavity of large specimens (≥ 210 mm in length) to allow penetration by the preservative. Label specimen jars with site, reservoir or river name, date of collection, river mile, and collector's name(s).

Pictures of specimens taken with a camera can substitute for preservation (refer to *Photograph Management SOP*, TVA-KIF-SOP-26). Include in the picture a numbered tag or some other method of identifying which fish is being photographed and record the tag number in the data logger or on a *Reservoir Fisheries Field Data Form* (Table 2).

Note: Specimen known to be an endangered species must be released immediately unless prior arrangements (such as permits) have been made for their collection. If a mortality of an endangered species occurs, the specimen must be preserved and the Project Manager notified within 12 hours of the mortality.

- g. At the end of the sampling day, review the data in the data logger and check for errors (such as key punch). If *Reservoir Fisheries Field Data Form* (Table 2) is used, check the field form for completeness and correctness of data entered. As soon as possible, enter the data from the field form into a data logger.
- h. After returning from the field, mend sizable rips or holes and remove debris from nets before the nets are stored.

3.4.1 Fish Collected for Contaminant Analysis

Sample integrity should be maintained by preventing the loss of contaminants of potential concern (COPC) that might be present in the sample and taking precautions to avoid possible introduction of extraneous contaminants during handling. The loss of COPC can be prevented in the field by ensuring that the sample collected remains intact, that is, sample collection procedures should be performed with the intention of minimizing the laceration of fish skin. Preventable sources of extraneous contamination can include the sampling gear, oils and greases on boats, spilled fuel, skin contact, contact with soil or sand, boat motor exhaust, and other potential sources. Potential sources should be identified before the onset and during sample collection, and appropriate measures taken to minimize or eliminate them.

- a. Maintain sample integrity through careful and controlled sample handling, storage, and preservation procedures.
- b. Wear powder-free nitrile gloves when handling fish to be processed for contaminant analysis.
- c. When removing a fish from the gill net that will be retained for analysis, take care to prevent the fish from coming into contact with other surfaces (such as boat deck) to prevent introduction of contaminants.
- d. Place fish in separate resealable plastic bags for each species and site. Samples must be appropriately labeled with site, reservoir or river name, date of collection, river mile, and collector's name(s).
- e. Immediately place bags containing fish in a cooler with ice; ensure ice completely covers the fish. Maintain use of *Biota Field Sampling Form* (Table 3) for sample custody.
- f. Transport samples on wet ice to the laboratory or processing location. Fish placed on wet ice should undergo initial processing and be frozen within 48 hours. Initial processing usually involves measuring and weighing, and potentially filleting of fish. No fish with flesh deteriorated beyond that desired for human consumption can be included in the sample. Coordination with personnel processing the fish is critical during the collection process.
Note: If fish are needed alive for analysis, transport them in aerated containers with water from the site.
- g. Maintain samples under appropriate chain of custody in accordance with *Sample Labeling, Packing, and Shipping SOP* (TVA-KIF-SOP-07).

3.5 Recording Data

Data are recorded in the data loggers, using the appropriate computer program, following sampling events. In the absence of a data logger, the *Reservoir Fisheries Field Data Form* (Table 2) is used.

3.5.1 Data Loggers

Data loggers are only operated by personnel experienced with the appropriate computer program.

Site information not already contained in the data logger is recorded upon arrival at the KIF Project Site. Site information includes reservoir name, river name, river mile, and other abiotic site information to help describe location. Global positioning system (GPS) receivers are used to indentify exact sample locations. GPS coordinates taken in the field are down loaded to laptop computer upon returning from the field.

- a. Enter the date as MMDDYY. (Time is automatically recorded on the data logger.)
- b. Record the crew leader's initials in the data logger.
- c. Record each sample transect (net) and the corresponding transect number on the data logger.
- d. Record the number of each species collected, lengths and weights if applicable, and any abnormalities observed (such as scoliosis, blind eye, or fungus)
- e. When transects are completed, review information for errors.
- f. Submit data logger files to the Project Manager for final technical review.
- g. After successful review, upload data files to TVA's project server.

3.5.2 Reservoir Field Data Form

In the absence of a data logger, the *Reservoir Fisheries Field Data Form* (Table 2) is used.

- a. Record time at the start of each transect run using "military" time (for example, 3:00 p.m. is recorded as 1500).
- b. At the top of the form, list the reservoir name, river mile, sample date, net number, habitat type (such as gravel, rock, bluff, mud, or brush) at the location of the net, and check the Experimental Gill Net (XGN) line.
- c. Record the date as MMDDYY.

- d. Include initials of the members of the sample crew with crew leader's initials listed first.
- e. Use the comments section to denote any factors that were observed that may have caused inconsistent catch data (such as a poor net set, net fouled with debris, or net vandalized).
- f. In the appropriate columns, list the common name of each species collected (such as largemouth bass), the number of each species collected, lengths and weights if applicable, and any abnormalities observed (such as scoliosis, blind eye, or fungus). The SAP lists which species of fish, if any, need to be measured and weighed.
- g. After gill nets are retrieved, review information on field form(s) for errors.
- h. At the end of the sample day, again check the field form(s) for completeness and correctness of data entered. As soon as possible, the crew leader enters the data from the data form into a data logger. The crew leader signs and dates the data form citing that the data were entered.
- i. Submit data logger files and completed field forms to the Project Manager for final technical review.

3.6 Sample Labeling and Sealing

Samples are labeled and custody sealed in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

After samples are prepared for shipping, an EQUIS-based COC form is prepared, and the samples are shipped or delivered to the appropriate laboratory.

3.7 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, are maintained by the Field Team Leader. Information is entered into the field logbook by the appropriate field team member using waterproof ink. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks document those collection and sampling characteristics specific to this SOP and as defined in the SAP.

The Field Team Leader and/or designee reviews the field logbook entries on a weekly basis at a minimum (daily review is preferred) for completeness and accuracy and indicates this review by initialing the entries. The Field Team Leader is also responsible for the completion of required data collection forms.

3.8 Decontamination and Waste Management

Sampling equipment decontamination is performed in a manner consistent with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08). Investigation-derived wastes produced during field sampling or decontamination is managed in accordance with *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12).

4.0 REFERENCES

- Tennessee Valley Authority (TVA). *Decontamination of Equipment* SOP (TVA-KIF-SOP-08), 2010.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), 2009.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), 2010.
- TVA. *Photograph Management* SOP (TVA-KIF-SOP-26), 2009.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), December 18, 2009.
- TVA. *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), 2010.
- TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (SWSHP), 2009.

Table 1: Suggested Fish Sampling with Gill Nets Checklist for Equipment and Materials

Item Description	Check
Health & Safety	
Personal floatation devices	
Fire extinguisher	
Hard hat, steel-toed boots, and hearing protection	
Safety glasses and eyewash	
First aid kit	
Rain gear and insulated coveralls (if necessary)	
Sunscreen, whistle, and knife	
Nitrile gloves for sample processing and leather gloves for sample handling	
Boat paddles	
Paperwork	
Job Safety Analysis	
Field logbook and indelible ink pens	
Map of sample area and vicinity	
Reservoir Fisheries Field Data Form (Table 2)	
Metal clipboard and pencils	
Sample labels and COC forms (Biological Field Sampling Form)	
MSDSs	
Equipment	
Appropriately sized boat and motor (typically a 20-ft boat with 90-horsepower motor) with temperature gauge and depth finder	
Gill nets appropriate for project (including two spare nets)	
Tool kit with spare parts for motor (spark plugs, spare drain plug), twine/monofilament line for field net repairs, net needle, duct tape, spare prop	
Dragging hook for recovering lost nets	
Rope for anchors and floats	
Marker floats (one per net), clearly marked "TVA" or marked tags attached to the float line on the shoreline end of the net	
Anchors (two 5-kg weights per net)	
Net picks and net hook	
Data logger (Intermec CT60 XRT; Windows XP Tablet PC Edition)	
Galvanized net tubs (15- to 20-gallon tubs)	
Live tank for holding fish until they are processed (when needed)	
GPS unit (pre-loaded with all net sites to be sampled)	
Measuring board (900 mm) for quantitative surveys	
Resealable plastic bags for samples	
Ice Chest(s) and ice for samples	
Digital Camera	
Appropriate lighting (Q-beams, overhead light, flashlights) if sampling after dark	
Platform weighing scales	
Six 1-qt and two 1-gal sample jars & 1-liter formalin (if chemically preserved samples needed)	
Decontamination	
Laboratory grade detergent (such as Liqui-Nox or Alconox Powdered Precision Cleaner)	

Table 2. Reservoir Fisheries Field Data Form

RESERVOIR _____	RUN/NET# _____	SHEET _____ OF _____
SITE _____	DUR _____	ELECTRO _____ XGN _____
DATE _____	HABITAT _____ / _____	

COMMENTS:

SPECIES	NO.	LENGTH	WEIGHT	YOY	ABNORMALITY
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Table 4. Job Safety Analysis (JSA) Worksheet

Number:		Job: Use of Entrapment/Entanglement Gear (i.e., gill nets, seines, and fyke, hoop, and trap nets).		Date: August 10, 2010	
Page 1 of 4		Supervisor: Sandra S. Robertson		Plant / Facility:	
Skills Required: Boat Operation		Reviewed By: Tyler F. Baker		Analysis By: Dennis S. Baxter	
Skills Required: Boat Operation		Reviewed By: Tyler F. Baker		Approved By: Dennis H. Yankee	
Required Personal Protective Equipment: PFD, foul weather gear for various weather conditions					
Tools and Equipment Required: Boat with depth finder, GPS, B-1 class hand portable fire extinguisher, paddles, boat hook, nets, floats, rope, anchors(concrete), dragging hook, net picks, knife, pocket knife, first aid kit, sun screen, live well tank or wash tub, bucket, tool box, spare boat plug, and spare trailer bulbs					
Job Preparation: Read and understand JSA's pertaining to work performed and project work plan Conduct pre-job briefing Implement two-minute rule upon arriving at job site					
Hazardous Materials: Gasoline, Formaldehyde (Formalin)				Special Requirements: Boating Safety Certification, Review MSDS sheets	
Number	Sequence of Basic Job Steps	Potential Accidents or Hazards	Recommended Safe Job Procedures		
1.	I. Pre Job Safety Discussion Crew Leader conducts safety discussion to ensure crew members are aware of project-specific procedures before starting field work.	Back strain, foot injury, slips, trips and falls.	Crew leader reviews sampling procedures and safety topics (weather, hazards, back strain) before gear is loaded and sampling begins. Crew leader should review Safe Boat Operation JSA prior to work.		
2.	All trailer and vehicle lights should be checked before leaving for the field.	Improperly lit vehicles are illegal and create an accident hazard on the highway.	Crew leader and Operator of vehicle should check all trailer and vehicle lights to ensure they are in good working order.		
3.	Crew leaders should ensure that safety equipment (e.g., first aid kits, fire extinguishers, and life jackets) are available. Each employee should have foul weather gear available.	Without the proper PPE's, the employees are at risk for injury.	All crew members should have basic first aid training and be knowledgeable of the proper use of fire extinguishers. Crew members must always wear a personal floatation device while on the water.		
4.	Before conducting a sample, physical factors such as weather, water flow, etc., should be taken into consideration.	Examples of project-specific potential hazards include, but are not limited to, netting in thunderstorms with lightning, freezing weather when ice may form on boat decks and cause a slipping hazard, and areas of extremely fast current such as those existing near turbine discharges of hydroelectric dams which can increase the danger of falling overboard due to sudden shifts in boat position.	Sampling should never be conducted when there is a danger of lightning strikes. Extreme caution should be exercised when sampling in freezing weather and/or in areas of fast current to avoid falling overboard. If sampling conditions are considered unsafe, the crew leader has the option and responsibility to postpone sampling until more favorable conditions occur.		

Table 4. Job Safety Analysis (JSA) Worksheet (continued)

5.	Preserving samples with formalin	Formalin is a known carcinogen. Do not expose skin or eyes to chemical.	Read the Material Safety Data Sheets (MSDS). Ensure ample ventilation. Use appropriate protective equipment (i.e., gloves and safety glasses). Fill jar with water before adding formalin to reduce risk of eye injury in the event that formalin was splashed
6.	II. Gear Preparation A. Ensure all necessary equipment is available and in good working order. B. Ensure gunwales of boat are free of sharp edges or rough or irregular surfaces that can cut or snag nets or ropes.	A. Tangled nets can cause an injury to fingers and hands. Tubs which have jagged edges can cause cuts or lacerations. B. Sharp edges or rough or irregular surfaces can damage sampling equipment, snag the equipment and cause the boat to lurch suddenly (possibly resulting in personnel falling overboard), or causing personal injury.	A. Ensure that nets are free of tangles and debris, and that storage tubs are free of any jagged edges which might snag the net. B. Inspect front and gunwales of boat for sharp edges or rough or irregular surfaces. If such is found, either change boats or have the problem areas repaired.
7.	III. Loading Equipment into the Boat and Tow Vehicle A. Heavy tubs of nets, net anchors, and tool boxes should be loaded in the boat and tow vehicle in a manner such that the load is properly distributed. B. Ensure entrapment gear (e.g., trap nets and hoop nets) is loaded properly. C. Ensure proper loading of lightweight objects such as empty tubs, floats, rope, etc.	A. Improper weight distribution can cause boat to sway uncontrollably while towing, potentially resulting in an accident. Net weights can cause foot injuries if not handled and stored properly. Back injuries can occur if proper lifting techniques are not employed. B. If this equipment is not properly stored, it could bounce out of the boat on rough roads or curves and cause a hazard to following traffic. C. Lightweight objects can easily blow out of the boat while trailering, causing a hazard to following/oncoming traffic.	A. Net anchors, heavy tubs of nets and tool boxes should be stored in the boat just forward of the rear axle of the trailer. The load should be braced or tied to prevent shifting. If the load in the boat exceeds the towing capacity of the tow vehicle, load some of the gear in the back of an additional vehicle. Exercise caution while loading anchors to prevent dropping them on your feet. To prevent back injuries, two people, using proper lifting techniques, should load tubs of nets and other heavy equipment into boat and vehicle. B. Lay this type of equipment flat on the bottom of the boat and brace it or tie it in place. C. Secure lightweight materials by placing them in enclosed compartments, tying them down, weighting them, or by loading them in the tow vehicle.
8.	IV. Deployment of Nets A. Anchor leading edge of net.	A. Cuts, insect bite or stings, animal bites, noxious plants, and falling overboard are potential hazards.	A. If tie-off or anchor rope is to be cut, always cut away from the body to avoid injury. If net is to be anchored to an onshore object, carefully inspect the shore area for wasp or hornet nests (or other biting/stinging insects), snakes or other potentially dangerous animals, and poisonous or other noxious plants. Exercise caution to avoid falling overboard due to boat collision with underwater objects or boat operator putting engine in reverse.

Table 4. Job Safety Analysis (JSA) Worksheet (continued)

<p>8.</p>	<p>B. Ensure that float(s), weight(s), and any other items to be deployed with the net are available at the proper location(s).</p> <p>C. Boat operator slowly runs the boat in reverse while other personnel guide the net into the water from the bow of the boat.</p> <p>D. Continue to deploy net until rear anchor line is reached.</p> <p>E. Ensure that net is straight by pulling on end.</p> <p>F. Drop anchor and float into the water. Depending on the type of net (e.g., hoop nets), the float rope may need to be pulled taut once the anchor is released to stretch the anchor rope.</p> <p>G. If wings/leads are present on the sampling gear, the boat operator should navigate to the proper position so the wings/leads can be set. Set wings/leads and throw out appropriate anchors at approximately 45° to the throat of the net. Then tighten the net's rear anchor line to ensure net is fishing properly.</p>	<p>B. Tripping and falling overboard arc potential hazards.</p> <p>C. Tripping, falling overboard and receiving cuts from net mesh arc potential hazards.</p> <p>D. Grasping the net can cause the hands to become entangled in the netting. This could result in being pulled overboard.</p> <p>E. Back or muscle strain injuries are potential hazards.</p> <p>F. Being pulled overboard and back injuries are potential hazards.</p> <p>G. Possible hazards are being pulled overboard and strained muscle or back injury.</p>	<p>B. Use caution to avoid feet and/or hands becoming entangled in ropes or attachment lines.</p> <p>C. Employees working nets should not wear jewelry (e.g., rings) which might catch in the net. Wearing these items can cause finger injuries and could result in being pulled overboard by net. Watch out for net mesh tangling around buttons on clothing.</p> <p>D. Allow net to slide over the boat deck, or to slide through the hands. Do not attempt to grasp the net.</p> <p>E. Caution should be exercised to prevent undue muscle or back strain.</p> <p>F. Exercise caution to avoid being pulled overboard. In situations where heavy pulling is required, the rope can be tied with a slip knot to the net rail of the boat to help avoid injury.</p> <p>G. Exercise caution to avoid being pulled overboard. Lift and throw anchors carefully, using proper lifting techniques, to avoid muscle strains and back injuries. Use appropriate weights for existing conditions, i.e., do not use excessive weight.</p>
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Table 4. Job Safety Analysis (JSA) Worksheet (continued)

9.	<p>V. Checking/Retrieving Nets</p> <p>A. Boat operator approaches the appropriate float from "downstream." Float should be approached from the "downstream" side. This refers to the direction in which the float is drifting and, depending on wind direction and currents, is not necessarily down river of the sampling site.</p> <p>B. Boat crew retrieves float and pulls net onto bow of boat. Depending on the sampling gear involved, only a portion of the net may be brought into the boat. This would be true of certain trap nets and fyke nets.</p> <p>C. If sampling is to be continued, fish are removed from the net and the gear reset. If sampling is not to be continued, the gear is stored either in tubs or in the bottom of the boat.</p>	<p>A. Falling overboard is a potential hazard.</p> <p>B. Potential hazards are falling or being pulled overboard and strained muscles or back injury.</p> <p>C. Potential hazards or accidents are slipping, tripping, falling overboard; and punctures, cuts, or abrasions from fish spines, operculum, gill rakers, or teeth. Leaving fish, fish spines, and/or fish hooks in nets increases the possibility of puncture wounds and cuts as nets are being handled.</p>	<p>A. To reduce the possibility of falling overboard, the boat crew should be braced for any sharp turns or changes in speed made by the boat operator.</p> <p>B. For large heavy nets, an electric winch may be used to pull the net thereby reducing the possibility of muscle strain.</p> <p>C. The boat should be kept as neat as possible during these operations to maximize working room. The boat deck should be periodically washed with water between samples. Washing the deck cleans it of fish slime and reduces the possibility of accidents due to slipping. Keeping the boat neat minimizes the risk of injury due to tripping. Caution should be exercised while removing fish from nets, especially gill nets, to avoid cuts, punctures, and abrasions. All fish, fish spines, and any fish hooks should be removed from nets before storing.</p>
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- 1. Struck By (SB)
- 2. Struck Against (SA)
- 3. Contact By (CB)

- 4. Contact With (CW)
- 5. Caught On (CO)
- 6. Caught In (CI)

- 7. Caught Between (CBT)
- 8. Foot Level Fall (FLF)
- 9. Fall to Below (FB)

- 10. Overexertion (OE)
- 11. Exposure (E)

