

**A Biosecurity Manual
for Inland Fisheries
Division Hatcheries**

by
**Carl Kittel, Rob Schmid,
Reese Sparrow, Jim Mathews,
Dale Lyon, and Dennis Smith**

**Management Data Series
No. 276
2013**



INLAND FISHERIES DIVISION
4200 Smith School Road
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INTRODUCTION

The confirmation of the presence of zebra mussels *Dreissena polymorpha* in Texas waters, first in Lake Texoma (April 2009) and recently in Ray Roberts Reservoir (July 2012) and other water bodies, has heightened the need for increased biosecurity. As the conservation agency of Texas, Texas Parks and Wildlife Department (TPWD) is taking a proactive approach to preventing further spread of zebra mussels in the state and to prevent introductions of new aquatic nuisance species (ANS). The TPWD is asking the public to be conscientious about cleaning and disinfecting trailers and boats, when they move from one water body to another, because preventing the spread of ANS is important to maintaining the health of aquatic resources. Further, TPWD fish hatcheries staff is taking practical steps toward achieving the goals of the agency, including the development of effective cleaning and disinfection procedures for all TPWD equipment used in public waters. It is hoped that these procedures will serve as a model for the public in the joint effort to prevent the spread of ANS and fish pathogens in the state.

The great effort TPWD has directed toward the management of zebra mussels in the state is predicated on the severe damage this ANS can cause to aquatic resources and water-related industries. The economic impacts associated with zebra mussels were estimated to be \$3.1 billion from 1993 to 1999 and \$5 billion from 2000 to 2010 in the Great Lakes region (Colorado DNR 2008; USGS 2011). According to the Colorado Department of Natural Resources Lake Pueblo Zebra Mussel Response Plan (2008), zebra and quagga mussels can cause serious economic losses in the millions or billions of dollars to governments and industry. The report stated that in Colorado, zebra mussels cause problems with water transport, water treatment facilities, irrigation facilities, drinking water facilities, water-based recreation, game fish, endangered fish, native mussels, and ecosystems. The Missouri Department of Conservation (MDC) Zebra Mussel Prevention Policy (2005) emphasizes the need to develop and implement best management practices to protect equipment and facilities from zebra mussels and to prevent its spread into un-infested areas. The Missouri report noted that it would be devastating to MDC fish hatcheries, if zebra mussels got into the water supplies or the hatchery facilities and infrastructure. This concern was based on the fact that in addition to the cost of eradicating zebra mussels from hatcheries after introductions, the hatcheries would serve as vectors and spread this invasive organism around the state. TPWD Inland fish hatcheries share these concerns and thus, have developed the biosecurity plan in this document.

The threat of ANS to fish hatcheries extends beyond zebra mussels. Other ANS and fish pathogens can inadvertently be transported with fish distributed among hatcheries and subsequently be spread among public water bodies through hatchery activities. Golden alga *Prymnesium parvum*, Apple snails *Ampullariidae sp.*, fish pathogens including viruses such as Viral Hemorrhagic Septicemia (VHS), Koi Herpes Virus (KHV), Spring Viremia of Carp (SVC), bacteria and parasites; as well as nuisance aquatic plants (e.g., Giant Salvinia *Salvinia molesta*, Hydrilla *Hydrilla verticillata*, and Water Hyacinth *Eichhornia sp.*) could all be spread among hatcheries and public water bodies. In addition to zebra mussels, apple snails, golden alga, and KHV are known to occur in some Texas waters. Conversely, quagga mussels, VHS, and SVC have not been identified as present in Texas. Nonetheless, the biosecurity plan takes a holistic approach to address as many as possible of the ANS potential risks that are associated with hatchery activities, especially fish distribution.

The goals of the biosecurity program in Inland Fisheries Division hatcheries are to prevent (1) the spread of ANS already present in Texas and (2) importation of new ANS. The strategies outlined herein to achieve these goals include monitoring and detection, treatments, and quality assurance and control. These strategies or associated procedures should be periodically updated as new information about ANS invasions and new technologies and treatments become available. Updates may also aim to ensure staff competence in performing the procedures to achieve program goals.

Success of this biosecurity plan requires training of staff to implement the strategies in this manual and sharing of information among the branches of the Inland Fisheries Division. Analytical Services, Habitat Conservation, and Management branches have information about the distribution of fish pathogens and ANS that the hatcheries need to implement the biosecurity program.

FISH PATHOGENS AND AQUATIC NUISANCE SPECIES MANAGEMENT

Monitoring

Early detection is essential to preventing introductions of ANS into Texas or spreading of these organisms around the state. Thus, monitoring is an important first step in the defense against infestation of hatcheries with fish pathogens and ANS. Hatchery staff should treat all fish-hauling units returning from fish-stocking trips as well as loads of fish coming to a hatchery as potential sources of contamination. Contaminants of concern include fish pathogens, zebra mussels, golden algae, and other ANS.

Pathogens.—Presence of aquatic disease-causing organisms is monitored statewide by the Analytical Services' fish health biologist. For fish hatcheries, monitoring should be done to ensure fish safety and survival or to prevent spreading diseases among hatcheries or public water bodies.

Zebra mussels.—Based on water quality characteristics, zebra mussel infestation risk levels have been assigned to Inland Fisheries Division hatcheries (Table 1; R. McMahon, University of Texas, Arlington, personal comm.). Essentially, all hatcheries are at risk; therefore, every effort should be made to prevent infestations. To better manage the risk, knowledge of where populations of zebra mussels are known to exist is necessary for planning, requiring the need for early detection through routine monitoring.

Hatchery staff should examine fish-hauling units and fish coming to a hatchery for presence of zebra mussels. Ponds should be monitored for presence of zebra mussels particularly during fish harvest by examining structures that are usually under water (e.g., concrete structures, battens, and valves).

Management staff should monitor at-risk lakes and hatchery water sources for zebra mussels using the best available technologies. Monitoring should use the most reliable technique available (Frischer et al. 2012) or a combination of techniques to improve effectiveness, including net tows to check for veligers by microscopy (e.g., cross-polarized light microscopy), imaging flow cytometry or DNA-based polymerase chain reaction (PCR), and DNA testing of water samples. Hatchery managers and staff should be notified of any new water bodies that are determined to have zebra mussels.

Golden alga.—Toxic golden alga *Prymnesium parvum* occurs in several Texas public waters, including Lake Diversion and Possum Kingdom Lake which supply water to Dundee and Possum Kingdom fish hatcheries, respectively. Staff at these hatcheries should routinely monitor incoming and pond water for presence of golden alga cells and toxicity, and manage threats to fish using the *P. parvum* management plans (Smith 2005; Lyon et al. 2005). Briefly, *P. parvum* management should include monitoring for presence of algal cells and toxicity and treating, if necessary, before stocking and during culture and harvest of fish. Harvested fish are rinsed with well water or *P. parvum*-free water before loading into hauling tanks, which must also be free of the alga or toxicity. Strict adherence to the *P. parvum* management plan is essential to preventing fish kills or transfer of the alga to other hatcheries or water bodies that are stocked with fish.

Management staff should identify water bodies infested with golden alga and the status of the fisheries to determine eligibility or priority for stocking with hatchery-produced fish. A complete inventory of lakes infested with golden alga should help hatchery staff better manage the alga to prevent its spread in the state.

Hydrilla, Giant Salvinia, and other invasive plants.—Invasive aquatic plants in public waters are monitored and controlled by the Aquatic Habitat Enhancement group within Inland Fisheries Habitat Conservation Branch. Fish hatchery staff has the responsibility to prevent the spread of invasive plants by ensuring none of these plants are carried on fish-hauling units during fish distribution. Thus, fish-hauling units must be checked for invasive plants before outgoing or return trips.

Treatments

The treatment goals for this program are to prevent fish disease organisms and other ANS from other sources access to Inland Fisheries Division hatcheries and to control positively identified ANS on these facilities. Success depends on timely and effective use of strategies and procedures outlined in this document.

Stations for disinfection and cleaning.—Each fish hatchery must have a cleaning station (CS), preferably located near the entrance and as far away as possible from ponds and other water-holding systems. These CS should have similar design and operational procedures among hatcheries to maintain operational familiarity among staffs. The structure should be an open pole barn (50 x 30 ft) to allow drive through. One or both sides of the barn should be partially or completely covered, depending on proximity to water-holding systems. The floor may be gravel, concrete, or asphalt with a drain that discharges all wastewater into a sewer system or drain field. The drain field should be exposed to direct sunlight and not to overflow into any water body. There should be electricity available for adequate lighting and equipment operation. Water should be available to supply the hose to the heated pressure washer.

Equipment and materials for the CS should include:

- A tank for holding the cleaning chemical (Virkon[®] Aquatic) solution.
- Water source and hot water pressure washer(s).
- Electricity and lighting.
- Safety gear and chemical wash-off area.
- Telephone for emergencies.
- Boat motor cleaning tank.

Fish hauling equipment cleaning.—All components (including tank, trailer, truck, nets, and other accessories) of fish-hauling units returning from fish distribution trips must be disinfected and thoroughly cleaned at the CS immediately on arrival or as soon as possible after inclement weather. Cleaning must follow established protocols, including using safety gear for personal protection (Appendix A). Only after complete cleaning should a fish-hauling unit be returned to the designated parking area or become available for another fish-hauling trip. The cleaned fish-hauling unit should be allowed to dry in the sun, when possible.

Quality Assurance and Control

To ensure procedures are followed to achieve the goal(s) of the Biosecurity Program, a quality assurance and control program should be implemented at each hatchery. This program involves monitoring of the hauling-unit cleaning process by the facility manager or a designee (observer). The program consists of three steps:

1. Monthly monitoring of the hauling-unit cleaning of 10% of all trips, or of at least one trip per month, when fish-hauling units are in use. An observer watches the cleaning activities of a driver at the cleaning station and completes a check list (Appendix B), noting strengths and weaknesses. Cleaning performance is discussed with driver, as needed; or used in staff training to promote group proficiency.
2. Monitoring data are stored in a Hazard Analysis and Critical Control Points (HACCP) plan binder for at least two years. The binder should be available for staff review.
3. Monitoring data for each month should be entered into the Hatchery Status Report located on the N: drive.

ANS Spreading Prevention

Fish distribution.—Transfer of fish among hatcheries, or among hatcheries and reservoirs, is a potential pathway for spreading pathogens and ANS because water from the receiving water body is often used to temper the fish on the fish-hauling unit before delivery or stocking. This water transfer for acclimation can contaminate the pump and fish-hauling unit. To avoid or minimize this risk, tempering of fish and transfer of water should be avoided, when possible.

If water must be pumped from a water body into a hauling tank to temper fish before stocking or to transport brood fish to a hatchery, steps must be taken to minimize the potential for spreading ANS. For example, where available, a 40- μ m canister filter should be used to eliminate all life stages of zebra mussels as well as other ANS.

Split loads.—Stocking a load of fish into multiple water bodies (split-load stocking) is of particular concern due to the increased chance of encountering ANS species or pathogens and spreading them among the target water bodies and the hatchery. To avoid this risk, split-load stocking should be avoided, if possible. If split-load stocking is necessary, the risk should be minimized by following these steps (see Appendix C for details):

1. Reduce the number of water bodies receiving the split-load stockings, if possible.
2. Sequence the stockings: begin with the site with the least risk and end with the site that presents the greatest risk.
3. Don't transfer water from one site to another.
4. Don't temper Catfish and Trout if the water temperature difference is less than 5°C.
5. Don't temper fish while in hauling tank; if necessary, temper fish in a trash can or other appropriate container.
6. Discard water used for tempering fish on land, avoiding flow into a water body.
7. Disinfect or clean equipment before leaving each site.

Handling of Fish Produced by Others

Trout delivery to TPWD hatcheries.—The TPWD Trout program involves purchasing fish from commercial producers who deliver them to the hatcheries. To prevent transfer of disease agents and ANS to TPWD hatcheries, the following steps must be taken:

1. A disease and ANS inspection certification is required for each fish source (farm or grower) annually. The certification should be in hand before accepting any fish deliveries from a source.
2. Instruct vendor(s) to not split fish loads between TPWD and other customers. Only compartment(s) or loads of fish dedicated for TPWD should be accepted.
3. Vendor(s) must avoid water exchange during transport of fish between the source farm and the TPWD hatchery receiving the fish.
4. These ANS and disease prevention measures must be included in the supplier contract specifications. In addition, communication between TPWD and the Trout supplier should be ongoing to assure ANS transfer prevention is maintained.

Catfish.—Catfish purchased for the Neighborhood Fishing Program are delivered to TPWD staff at the stocking sites. The commercial fish-hauling trucks that deliver these fish should not be allowed on any TPWD hatchery before or after fish deliveries.

Fish from Federal hatcheries.—Occasionally, TPWD staff transports fish from Federal hatcheries for stocking into state waters. Only cleaned fish-hauling units must be used for these stocking trips; and after loading fish at a Federal hatchery, the fish-hauling unit must not go to any TPWD hatchery. After stocking fish, the fish-hauling unit should, according to protocol, go to the CS for cleaning. This procedure must be followed when fish are transported from any non-TPWD hatchery.

Collection or Transfer of Fish from Infested Waters

See appendices D and E for guidelines on collection of fish from waters infested with zebra mussels and other ANS, respectively.

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TABLE 1.—Zebra mussel infestation risk levels for Texas Parks and Wildlife Department Inland Fisheries Division hatcheries (R. McMahon, University of Arlington, personal comm.).

Hatchery ^x	Risk level by physical factor					
	Temperature	pH	Calcium concentration	Conductivity	Dissolved oxygen conc.	Risk level
A.E. Wood	Good	Good	Good	Good	Good	High
Dundee	Good	Good	Good	Good	Good	High
ETFH	Good	Good	Poor (<12 mg/L)	Poor	Good	Low
PK	Good	Good	Good	Periodically marginally high	Good	Moderate to High
TFFC	Good	Moderate	Poor (<12 mg/L)	Poor	Good	Low

^xETFH is East Texas Fish Hatchery, PK is Possum Kingdom State Fish Hatchery, and TFFC is Texas Freshwater Fisheries Center.

APPENDIX A

Disinfection and Cleaning of Fish-hauling Units

The pivotal component of the TPWD plan for controlling ANS is proper disinfection and cleaning of fish-hauling units after each use. A review of existing ANS prevention plans indicated that hot-water pressure washing is the most effective method for removing ANS and pathogens from fish-hauling units (Missouri Department of Conservation 2005; USDA 2013; Bowker et al. 2013). Further, hot-water pressure washing has the broadest application without being unduly destructive to fish-hauling units. A dedicated cleaning station is required for effective use of hot-water pressure washers at each hatchery. For equipment that cannot be pressure washed, use of a 1% Virkon[®] Aquatic solution for disinfection is recommended. Detailed procedures, current as of May 2013, for disinfecting and cleaning fish-hauling units are presented below. These procedures should be reviewed and updated as new information becomes available or at least once every five years.

These protocols and procedures are to be implemented by all Inland Fisheries Division hatcheries to prevent the spread of ANS, fish pathogens, and other harmful organisms among hatcheries and public water bodies. Thus, they must be used for cleaning fish-hauling units and other equipment when delivering fish to public waters, transferring fish between hatcheries, or bringing brood fish from a lake or river to a hatchery. Because risks and procedures may differ with fish hauling activities (e.g., fish stocking in the wild versus fish procurement from the wild or fish stocking into reservoirs versus into hatchery ponds), all staff must be trained to implement the correct procedures relevant to the type of fish hauling activity.

PROCEDURES

Disinfection.—Currently, chlorine is the best broad-spectrum chemical recommended for disinfecting equipment in the field. For proper treatment, surfaces to be disinfected should be in contact with the chlorine (≥ 250 mg/L) solution for at least 10-15 min to kill or deactivate any ANS of concern. The chlorine solution may be rinsed off the fish-hauling unit upon return to the hatchery as long as there has been a 15-min contact time.

Preparation of chlorine solution.—For a 250-mg/L chlorine solution, mix 5 mL of 6% sodium hypochlorite solution with 1 L of water. Glass tubes or vials, each with 5 mL of sodium hypochlorite, should be kept in fish-hauling units along with spray bottles (each with 1 L of water) for quick preparation of solutions. In addition, or alternatively, vials of sodium hypochlorite (20 mL each for mixing with 4 L of water) may be kept in the fish-hauling unit if one-gallon sprayers are to be used to spray the chlorine solution on equipment. It is recommended that fresh 250-mg/L chlorine solutions be prepared just before trips or in the field. For chlorine solutions stored in spray bottles for at least a week, the strength of the chlorine must be verified with test strips before use. If no test strip is available, or the strength of the chlorine is in doubt, a new batch of solution must be prepared.

Hot-water pressure washing.—Hot water from a hot-water pressure washer is the best treatment for the widest range of aquatic pests, as it removes pests from surfaces or kills them with high temperatures. Low-pressure spray of hot water gets the surfaces of a fish-hauling unit

to high temperatures more quickly than high-pressure spray of hot water, especially in cold weather. Water for pressure washing must reach the recommended temperatures (60-72°C or 140-160°F) and must be applied to all surfaces or areas of the fish-hauling unit, including inside of valves and drain pipes, under lips, capped pipes, agitators, etc. After spraying a tank and equipment clean, all surfaces must be rinsed with low-pressure flow of hot water to achieve temperatures in the recommended range. Testing of the low-pressure flow to achieve 60°C within one minute was performed at AEW to confirm that the temperature can be achieved.

Procedural steps:

1. Disinfection and cleaning of fish-hauling unit
 - A. After stocking fish into a public water body:
 1. Drive fish-hauling unit away from water body so wastewater or chemicals do not drain into the water body.
 2. Thoroughly inspect and remove any plant materials, animals, excess organic matter, or mud from the fish-hauling unit.
 3. Thoroughly spray all equipment (including the hauling tank, air stones, agitators, pumps, nets, hoses, etc.) and gear (including personal gear, waders, gloves, etc.) with chlorine solution (≥ 250 mg/L).
 4. Return to hatchery.
 - B. Back at the hatchery:
 1. Drive directly to the cleaning station.
 2. Use the hot-water pressure washer to clean the fish-hauling unit and other equipment that can withstand pressure washing, such as trash cans and hoses.
 3. After hot-water cleaning, pump 1% Virkon[®] Aquatic solution through all pumps and hoses, and dip all gear and equipment that cannot be cleaned with the hot-water pressure washer in Virkon[®] Aquatic solution. Virkon[®] Aquatic is a proprietary powdered mixture of potassium peroxymonosulfate, sulfamic acid, and sodium chloride. Note: Use of a breathing mask is recommended when handling the powder; but once dissolved, the solution is relatively non-toxic.
 4. Park fish-hauling unit in designated area.
 5. Allow fish-hauling unit and other equipment to dry for 24 h before reuse, if possible.
 - C. Before next trip:
 1. Rinse inside of hauling tank before filling with water to transport fish.

APPENDIX B

Monitoring of Cleaning and Disinfection of Fish-Hauling Units

Monitoring of staff performance in following established procedures is critical to proper implementation of any Hazard Analysis and Critical Control Points (HACCP) plan. The cleaning of fish-hauling units associated with 10% of the fish-hauling trips (or at least one trip per month), if trips are made, should be monitored by an observer. The monitoring form below, which serves as a check list, should help insure that plan procedures are consistently followed to achieve the desired results. The form should be filled out during the monitoring process, noting strength and weakness in the performance of the driver. Monitoring results must be discussed with the driver and among staff members during training to reinforce or improve proficiency. Further, results of the monitoring program should be summarized and included in the monthly Hatchery Status Reports.

Cleaning and Disinfection of Fish-Hauling Units Monitoring Check List

Month:	Name:			
	Observers Initials:			
	Date:			
1) Follow hot-water pressure washer SOP (Appendix. F)				
2) Reach 140°F before starting disinfection				
3) Pre-treat floor drains with chlorine, if in building				
4) Pull in-tank plugs and dip in Virkon				
5) Pull air stones out of tank for pressure washing				
6) Pull water pump (if used) and rinse with Virkon				
7) Dip intake /discharge hoses in Virkon				
8) Dip broom in Virkon				
9) Dip nets in Virkon (including handles)				
10) Dip personal gear (e.g., boots, rain gear) in Virkon				
11) Dip DO meter probe in Virkon				
12) Buckets/trash cans - apply Virkon or pressure wash				
13) Record before/after volumes of chlorine in sprayer				
14) Remove water discharge cap at rear of tank				
15) Remove "gun barrel" plugs (over-flow)				
16) Open tank drain valves				
17) Pressure spray trailer deck (must be at 140°F)				
18) Pressure spray under trailer				
19) Pressure spray trailer wheels/wheel wells, tires				
20) Pressure spray inside of hauling tanks				
21) Pressure spray under lip of hauling tank compartment				
22) Spray from discharge tube up through compartments				
23) Spray front and back of trailer				
24) Spray truck bed if water got in it				
25) Spray truck wheels, tires, wheel wells				
26) Spray truck grill, lights, wind shield, mirrors				
27) Remove tip for low pressure hot water wash to heat all surfaces				
28) Treat any water from the fish-hauling unit that is on the floor with chlorine, if in building				
29)				
30)				
31)				

APPENDIX C

Proper Handling of Split-Load Stockings

Stocking a load of fish into more than one water body (split-load stockings) should be avoided, if possible. The decision to do split-load stocking must be based on information about the water bodies involved. Staff should be aware of water bodies that have identified ANS and routinely stocked with fish. Hatchery managers should help staff become familiar with the information. However, we cannot be sure of having complete knowledge of all ANS and disease organisms in any water body or knowledge of the infestation status of all water bodies. Thus, all water bodies should be suspect and treated as potential sources of pathogens and ANS. Follow the steps below to determine the feasibility of split-load stockings.

- A. Know the following about the water bodies to be stocked:
 1. What threatened and endangered species are present?
 2. What pathogens of concern and ANS are present or suspected to be present?
 3. If some or all water bodies have pathogens or ANS, can they be stocked with minimal risk?
 4. If yes, proceed to B; otherwise, avoid split-load stocking.

- B. Steps for split-load stocking:
 1. Plan the stocking sequence before the trip.
 2. Sequence stockings from the least impacted to the most impacted water body.
 3. Do not pump water from the water body to be stocked into hauling tank to acclimate the fish.
 4. If necessary, temper fish in trash cans or other containers several feet away from the fish-hauling unit.
 5. Do not introduce water from the water body into empty fish-hauling tank.
 6. Disinfect all equipment and gear at the stocking site before moving to the next site by spraying all equipment (trash can, nets, boots, waders, gloves, hoses, etc.) with 250-mg/L chlorine solution.

APPENDIX D

Transfer of Fish from Waters Infected with Zebra Mussels

Transferring fish from waters infected with zebra mussels is likely to result in spreading this organism to receiving waters or hatcheries, unless steps are taken to kill all mussels on the fish and in the hauling water.

According to Edwards et al. (2002), a 1-h potassium chloride (750 mg/L) treatment followed by a 2-h formalin (25-mg/L) treatment, in the same water, can kill zebra mussels. This treatment is considered safe for transporting juvenile fish for up to 7 h (D. Harris, Pueblo state fish hatchery, Pueblo, Colorado, personal comm.). An alternate treatment for fish that can withstand 10-ppt salt concentration is a 24-h treatment with 1% sodium chloride to kill all larval stages of zebra mussel and most newly settled juveniles (Kastner et al. 1997).

The KCl-formalin treatment should be used for transferring Striped Bass brood fish from the Trinity River system and Lunkers and other fish species from unsecure source waters (TPWD hatcheries excluded). These species include White Bass and black bass (Florida Largemouth Bass, Smallmouth Bass, Guadalupe Bass, and Northern Largemouth Bass).

Transfer of fish from waters infested with zebra mussels:

1. Fill fish-hauling unit with water from a source free of zebra mussels or filter the water through a $\leq 40\text{-}\mu\text{m}$ screen to exclude all life stages of zebra mussels.
2. Load fish into hauling tank with as little water as possible from the water body.
3. Use the KCl-formalin treatment to transport the fish to the hatchery.
4. At the hatchery, net brood fish from hauling tank, dip for 30 s in saltwater (3% NaCl solution or 30 ppt) before placing them in holding tanks. The salt solution should be made with water un-infested with zebra mussels.
5. Dispose of hauling water and saltwater on a designated area exposed to sunlight and away from water-holding systems.
6. Water spills should be treated with Clorox or high test hypochlorite powder (HTH) dry calcium hypochlorite.
7. Clean, disinfect, and park the fish-hauling unit and allow it to dry as described in Appendix A.

APPENDIX E

Transfer of Fish from Waters Infested with Other Invasive Organisms

- A. Golden alga (see *P. parvum* management plans for details):
 1. Fill fish-hauling unit with well water or treated water (UV- or ozone-treated water).
 2. Rinse each net of fish with *P. parvum*-free water (e.g., well water) before transfer into hauling tank.
 3. After loading fish, check fish-hauling unit to verify the water is *P. Parvum*-free before leaving the collection site or hatchery to deliver the fish.
 4. Upon return to hatchery, drive to the cleaning station to clean and disinfect fish-hauling unit (Appendix A).

- B. Apple snails, aquatic plants, and others:
 1. Know if invasive species are suspected or known to occur in fish source water body.
 2. Fill fish-hauling unit with un-infested water.
 3. Look for and remove invasive or non-fish organisms during loading of fish-hauling unit with fish.
 4. If fish-hauling unit has come in contact with potentially infested water, visually inspect the unit for the presence of invasive species (adults or juveniles), and physically remove or rinse off any invasive organisms found.
 5. Upon return to the hatchery, drive to the cleaning station to clean and disinfect fish-hauling unit (Appendix A).

- C. Bacteria and Virus:
 1. Follow all disinfection, cleaning, and drying protocols after the fish are delivered (Appendices A and F). This should kill or inactivate any single-cell organisms that may have been in suspension in the water.
 2. Internal infections: These organisms, when inside fish or in other organisms not killed in step 1, are not affected by the external treatments in step 1. Thus, the fish brought to the hatchery must be watched for signs of disease. Fish with disease symptoms should be treated as quickly as possible after proper diagnosis of the disease.

APPENDIX F

Hot-Water Pressure Washer Standard Operating Procedure

To start hot-water pressure washer:

1. Check gas in Honda engine; fill with gas, if needed.
2. Check oil in Honda engine; add oil, if low; use AMSOIL 10-30. DO NOT OPERATE with low oil level.
3. Check diesel in water heater; fill with diesel, if low.
4. Pull spray gun trigger to release pressure before attempting to start engine.
5. Turn on gas for Honda engine.
6. Turn on choke.
7. Set throttle at about mid-point.
8. Turn the key to start engine; turn off choke when engine starts.
9. Turn on the water.
10. Turn water heater control to high.
11. Put on personal safety gear (gloves, eye protection, and apron), as needed.
12. Ready to start washing.

To stop hot-water pressure washer:

1. Turn water heater control to off position.
2. Pull trigger on spray gun and run for 10 seconds.
3. Throttle engine down to low.
4. Turn off the water.
5. Pull trigger again to release pressure.
6. Turn Honda engine key to off position.
7. Coil and store spray hose.
8. Put away safety gear.
9. Report to supervisor any malfunction, equipment failure, or missing gear.

Fish Stocking HACCP Plan

APPENDIX G

Fish Stocking Hazard Analysis and Critical Control Points (HACCP) Plan

HACCP Step 1 - Activity Description	
Facility: TPWD Inland Fisheries Hatcheries	Site: All Inland Hatcheries
Project Coordinator: Carl Kittel	Project Description: Fish Stocking
Site Manager: Hatchery Managers	
Address: 507 Staples Road San Marcos, TX 78666	
Phone: 512-353-0313	

Project Description (Who, What, Where, When, How & Why)
<p>Fish of various sizes are stocked into public waters from TPWD fish hatcheries. Fish are harvested from ponds or tanks and loaded on fish-hauling units. Fish-hauling units are driven by TPWD staff to designated stocking sites where fish are stocked by netting them out of tanks and directly stocking them, netting them into live wells in boats for boat stocking, or draining compartment water with fish directly into water body.</p> <p>Fingerlings may need to be acclimated to conditions of receiving water in some cases. In all cases, it is important to avoid transferring unwanted ANS from one location to another. Specifically, avoid bringing disease organisms or zebra mussels to the hatchery where they can become established to cause havoc.</p>

Fish Stocking HACCP Plan

HACCP Step 2 - Potential Hazard Identification

Vertebrates:

Invertebrates:

Zebra Mussels, Quagga Mussels, and Apple Snails

Plants:

Hydrilla, Giant Salvinia, and Water Hyacinth

Pathogens:

Viral Hemorrhagic Septicemia (VHS), Koi Herpes Virus (KHV), Spring Viremia of Carp (SVC), and Trematodes

Others:

Fish Stocking HACCP Plan

HACCP Step 3 - Flow Diagram

Task # 1	Prepare fish-hauling unit and fill hauling tank with water from the hatchery
□	
Task # 2	Add salt and no-foam to the water and load fish on the fish-hauling unit
□	
Task # 3	Transport fish to stocking site(s), acclimate and stock fish. Drain water from fish-hauling tank onto land and avoid any water flowing into an adjacent water body. Then spray inside of tank with chlorine solution
□	
Task # 4	Return to hatchery; clean fish-hauling unit; and complete records

Fish Stocking HACCP Plan

HACCP Step 4 - Hazard Analysis						
Task	Hazard	Probable?	Justification	Control Measures	Critical Control Point (CCP)	
Prepare fish-hauling unit and fill-hauling tank with water from the hatchery	Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails	No	Not present at hatcheries		No	
	Plant: Hydrilla, Giant Salvinia, and Water Hyacinth	No	Not present at hatcheries		No	
	Other Biologic: VHS, KHV, SVC, and Trematodes	No	Not present at hatcheries		No	
Add salt and no-foam to the water and load fish on fish-hauling unit	Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails	No	Not present at hatcheries		No	
	Plant: Hydrilla, Giant Salvinia, and Water Hyacinth	No	Not present at hatcheries		No	
	Other Biologic: VHS, KHV, SVC, and Trematodes	No	Not present at hatcheries		No	
Transport fish to stocking site(s), acclimate and stock fish, drain water, and disinfect fish-hauling unit with chlorine solution	Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails	Yes	Could be transported from one stocking site to another	Spray equipment with chlorine and do not transport non-hatchery water	Yes	
	Plant: Hydrilla, Giant Salvinia, and Water Hyacinth	Yes	Could be transported from one stocking site to another	Clean plant materials off fish-hauling unit and spray equipment with chlorine	Yes	
	Other Biologic: VHS, KHV, SVC, and Trematodes	Yes	Could be transported from one stocking site to another	Spray equipment with chlorine and do not transport non-hatchery water	Yes	

Fish Stocking HACCP Plan

Return to hatchery, clean fish-hauling unit and complete records	Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails	Yes	Could be present in remaining water in fish-hauling unit	Wash fish-hauling unit with hot-water pressure washer	Yes
	Plant: Hydrilla, Giant Salvinia, and Water Hyacinth	Yes	Could be present in remaining water in the fish-hauling unit	Wash fish-hauling unit with hot-water pressure washer	Yes
	Other Biologic: VHS, KHV, SVC, and Trematodes	Yes	Could be present in remaining water in the fish-hauling unit	Wash fish-hauling unit with hot-water pressure washer	Yes

Fish Stocking HACCP Plan

HACCP Step 5 - HACCP Plan

Critical Control Point #1:

Task # 3: Deliver fish to designated stocking site(s), acclimate and stock fish, drain water, and disinfect hauling tank

Significant Hazards:

Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails

Control Measures:

Spray equipment with chlorine and do not transport non-hatchery water

Limits for Control Measures:

Drain water from hauling tank compartment(s) with no fish; then spray compartments and equipment with chlorine

Monitoring: What?

Removal of water and complete spraying of empty tanks and equipment with chlorine

Monitoring: How?

Driver observation

Monitoring: Frequency?

Each time

Monitoring: Who?

Truck driver

Evaluation & Corrective Actions:

Re-spray areas not covered with chlorine solution

Supporting Documentation: Record before and after chlorine volumes in sprayer

Critical Control Point #2:

Task # 3: Deliver fish to designated stocking site(s), acclimate and stock fish, drain water, and disinfect hauling tank

Significant Hazards:

Plant: Hydrilla, Giant Salvinia, and Water Hyacinth

Control Measures:

Clean plant materials off fish-hauling unit and spray equipment with chlorine

Limits for Control Measures:

Drain water from hauling tank compartment(s) with no fish and spray compartments and equipment with chlorine

Monitoring: What?

Removal of water and complete spraying of empty tanks and equipment with chlorine

Monitoring: How?

Driver observation

Monitoring: Frequency?

Each time

Monitoring: Who?

Truck driver

Fish Stocking HACCP Plan

<p>Evaluation & Corrective Actions: Re-spray areas not covered with chlorine solution</p>
<p>Supporting Documentation:</p>
<p>Critical Control Point #3: Task # 3: Deliver fish to designated stocking site(s), acclimate and stock fish, drain water, and disinfect hauling unit</p>
<p>Significant Hazards: Other Biologic: VHS, KHV, SVC, and Trematodes</p>
<p>Control Measures: Spray equipment with chlorine and do not transport non-hatchery water</p>
<p>Limits for Control Measures: Drain water from hauling tank compartment(s) with no fish and spray empty compartment(s) and equipment with chlorine</p>
<p>Monitoring: What? Removal of water and complete spraying of empty tanks and equipment with chlorine</p>
<p>Monitoring: How? Driver observation</p>
<p>Monitoring: Frequency? Each time</p>
<p>Monitoring: Who? Truck driver</p>
<p>Evaluation & Corrective Actions: Re-spray areas not covered with chlorine</p>
<p>Supporting Documentation:</p>
<p>Critical Control Point #4: Task # 4: Return to hatchery, clean fish-hauling unit, and complete records</p>
<p>Significant Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails</p>
<p>Control Measures: Fish-hauling unit is washed with hot-water pressure washer</p>
<p>Limits for Control Measures: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used</p>
<p>Monitoring: What? Completeness of cleaning, rinsing, and achieving temperature with washing water</p>
<p>Monitoring: How? Temperature strips and observation</p>

Fish Stocking HACCP Plan

<p>Monitoring: Frequency? Driver each trip, and Hatchery Manager 10% of trips</p>
<p>Monitoring: Who? Driver and Hatchery Manager or Biologist</p>
<p>Evaluation & Corrective Actions: Re-wash fish-hauling unit and equipment</p>
<p>Supporting Documentation:</p>
<p>Critical Control Point #5: Task # 4: Return to hatchery, clean fish-hauling unit, and complete records</p>
<p>Significant Hazards: Plant: Hydrilla, Giant Salvinia, and Water Hyacinth</p>
<p>Control Measures: Fish-hauling unit is washed with hot-water pressure washer</p>
<p>Limits for Control Measures: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used</p>
<p>Monitoring: What? Completeness of cleaning, rinsing, and achieving temperature with washing water</p>
<p>Monitoring: How? Temperature strips and observation</p>
<p>Monitoring: Frequency? Driver each trip and Hatchery Manager 10% of trips</p>
<p>Monitoring: Who? Driver and Hatchery Manager or Biologist</p>
<p>Evaluation & Corrective Actions: Re-wash fish-hauling unit and equipment</p>
<p>Supporting Documentation:</p>
<p>Critical Control Point #6: Task # 4: Return to hatchery, clean fish-hauling unit, and complete records</p>
<p>Significant Hazards: Other Biologic: VHS, KHV, SVC, and Trematodes</p>
<p>Control Measures: Fish-hauling unit is washed with hot-water pressure washer</p>
<p>Limits for Control Measures: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used</p>
<p>Monitoring: What? Completeness of cleaning, rinsing, and achieving temperature with washing water</p>

Fish Stocking HACCP Plan

Monitoring: How? Temperature strips and observation	
Monitoring: Frequency? Driver each trip and Hatchery Manager 10% of trips	
Monitoring: Who? Driver and Hatchery Manager or Biologist	
Evaluation & Corrective Actions: Re-wash fish-hauling unit and equipment	
Supporting Documentation:	
Facility: TPWD Inland Fisheries Hatcheries	Activity: Stocking
Address: 507 Staples Road San Marcos, TX 78666	
Signature:	Date:

Fish Stocking HACCP Plan

HACCP Checklist: Stocking

Facility TPWD Inland Fisheries Hatcheries
Site All Inland Hatcheries
Coordinator Carl Kittel
Manager Hatchery Managers
Address 507 Staples Road, San Marcos, TX 78666

- Task # 1: Prepare fish-hauling unit and load water.**
- Task # 2: Add salt and no-foam to water and load fish on fish-hauling unit.**
- Task # 3: Deliver fish to designated stocking site(s), acclimate and stock fish, drain water, and disinfect fish-hauling unit with chlorine spray.**

CRITICAL CONTROL POINT

- Hazards were contained.
Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails.
- Control measures were implemented.
Control Measures: Spray equipment with chlorine and do not transport non-hatchery water.
- Control limits were maintained.
Control Limits: Drain water from tank compartments with no fish and spray empty compartments and equipment with chlorine.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-spray areas not covered with chlorine spray.

- Hazards were contained.
Hazards: Plant: Hydrilla, Giant Salvinia, and Water Hyacinth.
- Control measures were implemented.
Control Measures: Clean plant materials on fish-hauling unit and spray equipment with chlorine solution.
- Control limits were maintained.
Control Limits: Drain water from tank compartments with no fish and spray empty compartments and equipment with chlorine.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-spray areas not covered with chlorine spray.

Fish Stocking HACCP Plan

- Hazards were contained.
Hazards: Other Biologic: VHS, KHV, SVC, and Trematodes.
- Control measures were implemented.
Control Measures: Spray equipment with chlorine and do not transport non-hatchery water.
- Control limits were maintained.
Control Limits: Drain water from compartments with no fish and spray empty compartments and equipment with chlorine.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-spray areas not covered with chlorine spray.

- Task # 4: Return to hatchery, clean fish hauling unit, and complete records.**
CRITICAL CONTROL POINT
- Hazards were contained.
Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails.
- Control measures were implemented.
Control Measures: Fish-hauling unit is washed with hot-water pressure washer.
- Control limits were maintained.
Control Limits: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-wash fish-hauling unit and equipment.
- Hazards were contained.
Hazards: Plant: Hydrilla, Giant Salvinia, and Water Hyacinth.
- Control measures were implemented.
Control Measures: Fish-hauling unit is washed with hot-water pressure washer.
- Control limits were maintained.
Control Limits: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-wash fish-hauling unit and equipment.
- Hazards were contained.
Hazards: Other Biologic: VHS, KHV, SVC, and Trematodes.
- Control measures were implemented.
Control Measures: Fish-hauling unit is washed with hot-water pressure washer.

Fish Stocking HACCP Plan

- Control limits were maintained.
Control Limits: Fish-hauling unit and equipment are cleaned with hot-water pressure washer or rinsed with Virkon where hot-water pressure washer cannot be used.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-wash fish-hauling unit and equipment.

Fish Collecting HACCP Plan

APPENDIX H

Fish Collection Hazard Analysis and Critical Control Points (HACCP) Plan

HACCP Step 1 - Activity Description	
Facility: TPWD Inland Fisheries Hatcheries	Site: All Inland Hatcheries
Project Coordinator: Carl Kittel	Project Description: Collecting Fish (Broodfish, ShareLunkers, etc.)
Site Manager: Hatchery Manager	
Address: 507 Staples Road San Marcos, TX 78666	
Phone: 512-353-0313	

Project Description (Who, What, Where, When, How & Why)
<p>Broodfish may be collected from wild sources in Texas or elsewhere (e.g., Florida Largemouth Bass from Florida) and transported to TPWD hatcheries. Fish are caught, transported to a TPWD fish-hauling unit to be delivered to a TPWD hatchery. It is important to avoid, or at least limit, the introduction of Aquatic Nuisance Species and aquatic disease organisms to TPWD fish hatcheries.</p>

Fish Collecting HACCP Plan

HACCP Step 2 - Potential Hazard Identification

Vertebrates:

Invertebrates:

Zebra Mussels, Quagga Mussels, and Apple Snails

Plants:

Hydrilla, Giant Salvinia, and Water Hyacinth

Other Biologics:

VHS, KHV, SVC, and Trematodes

Others:

Fish Collecting HACCP Plan

HACCP Step 3 - Flow Diagram

Task # 1	Prepare fish-hauling unit and load water at the hatchery
	□
Task # 2	Load fish on fish-hauling unit and add chemical treatments
	□
Task # 3	Deliver fish to hatchery and unload fish into pond or tanks
	□
Task # 4	Dispose of water, clean fish-hauling unit, and complete records

Fish Collecting HACCP Plan

HACCP Step 4 - Hazard Analysis

Task	Hazard	Probable?	Justification	Control Measures	Critical Control Point (CCP)
Load fish on hauling unit and add chemical treatments	Plant: Hydrilla, Giant Salvinia, Water Hyacinth	Yes	Plants could be on fish-hauling unit if it got in the water	Use water from hatchery and avoid loading any plant material on the fish-hauling unit	No
	Invertebrate: Zebra Mussels, Quagga Mussels, Apple Snails	Yes	They could be transported in the water or on the fish as veligers	Hatchery water can be used; hauling water is treated with KCl and formalin; load fish with as little water as possible	Yes
	Other Biologic: VHS, KHV, SVC, Trematodes	Yes	They could be present in the water, in the fish, or on the fish	Only target fish species are loaded on fish-hauling unit; hatchery water is used and as little water as possible is transferred with fish	No
Deliver fish to hatchery and unload fish into pond or tanks	Plant: Hydrilla, Giant Salvinia, Water Hyacinth	Yes	Plant material could be transferred into ponds or tanks with the fish	Fish are rinsed and observed plant material is removed	No
	Invertebrate: Zebra Mussels, Quagga Mussels, Apple Snails	Yes	They could be on the fish or in the water transferred into ponds or tanks	Fish are rinsed in salt solution and as little water as possible is transferred with fish	No
	Other Biologic: VHS, KHV, SVC, Trematodes	Yes	They could be present in the water, in the fish or on the fish	Fish are rinsed in a salt solution and as little water as possible is transferred with fish	No

Fish Collecting HACCP Plan

Dispose of water, clean fish-hauling unit, and complete records	Plant: Hydrilla, Giant Salvinia, Water Hyacinth	Yes	Plant material could be present in the water or left on fish-hauling unit and transported on the next trip	Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water	Yes
	Invertebrate: Zebra Mussels, Quagga Mussels, Apple Snails	Yes	They could be present in the water or survive on the fish-hauling unit to be transported on the next trip	Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water	Yes
	Other Biologic: VHS, KHV, SVC, Trematodes	Yes	They could be present in the water or survive on the fish-hauling unit to be transported on the next trip	Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water	Yes

Fish Collecting HACCP Plan

HACCP Step 5 - HACCP Plan	
Critical Control Point #1:	Task # 2: Load fish on fish-hauling unit and add treatment chemicals to water
Significant Hazards:	Invertebrate: Zebra Mussels, Quagga Mussels, Apple Snails
Control Measures:	Hatchery water can be used; hauling water is treated with KCl and formalin; load fish with as little water as possible
Limits for Control Measures:	Apply KCl for at least one hour followed by formalin for at least two hours
Monitoring: What?	Chemical additions
Monitoring: How?	Complete application of pre-measured chemicals at recommended time intervals
Monitoring: Frequency?	Once
Monitoring: Who?	Truck driver
Evaluation & Corrective Actions:	Re-treat later
Supporting Documentation:	
Critical Control Point #2:	Task # 4: Dispose of water, clean fish-hauling unit, and complete records
Significant Hazards:	Plant: Hydrilla, Giant Salvinia, Water Hyacinth
Control Measures:	Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water
Limits for Control Measures:	Water is properly discarded on land, and fish-hauling unit are properly cleaned with hot-water pressure washer
Monitoring: What?	Water disposal and cleaning procedure
Monitoring: How?	By observation and check-list on random-check basis
Monitoring: Frequency?	10% of loads
Monitoring: Who?	Truck driver and hatchery manager or biologist
Evaluation & Corrective Actions:	

Fish Collecting HACCP Plan

Re-clean
Supporting Documentation:
Critical Control Point #3: Task # 4: Dispose of water, clean fish-hauling unit, and complete records
Significant Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, Apple Snails
Control Measures: Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water
Limits for Control Measures: Water is properly discarded on land, and fish-hauling unit is properly cleaned with hot-water pressure washer
Monitoring: What? Water disposal and cleaning procedure
Monitoring: How? By observation and check-list on random-check basis
Monitoring: Frequency? 10% of loads
Monitoring: Who? Truck driver and hatchery manager or biologist
Evaluation & Corrective Actions: Re-clean
Supporting Documentation:
Critical Control Point #4: Task # 4: Dispose of water, clean fish-hauling unit, and complete records
Significant Hazards: Other Biologic: VHS, KHV, SVC, Trematodes
Control Measures: Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water
Limits for Control Measures: Water is properly discarded on land, and fish-hauling unit is properly cleaned with hot-water pressure washer
Monitoring: What? Water disposal and cleaning procedure
Monitoring: How? By observation and check-list on random-check basis
Monitoring: Frequency? 10% of loads

Fish Collecting HACCP Plan

Monitoring: Who? Truck driver and hatchery manager or biologist	
Evaluation & Corrective Actions: Re-clean.	
Supporting Documentation: <div style="background-color: #4b4b00; height: 20px; width: 100%;"></div>	
Facility: TPWD Inland Fisheries Hatcheries	Activity: Collecting Fish (Broodfish, ShareLunkers, etc.)
Address: 507 Staples Road San Marcos, TX 78666	
Signature:	Date:

Fish Collection HACCP Plan

HACCP Checklist:

Collecting Fish (Broodfish, ShareLunkers, etc.)

Facility TPWD Inland Fisheries Hatcheries
Site All Inland Hatcheries
Coordinator Carl Kittel
Manager Hatchery Manager
Address 507 Staples Road, San Marcos, TX 78666

- Task # 1: Prepare fish-hauling unit and load water at the hatchery.**
- Task # 2: Load fish on fish-hauling unit and add treatment chemicals.**

CRITICAL CONTROL POINT

- Hazards were contained.
Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails.
- Control measures were implemented.
Control Measures: Hatchery water can be used; treat hauling water with KCl and formalin, and load as little water as possible with fish.
- Control limits were maintained.
Control Limits: Apply KCl for at least one hour followed by formalin for at least two hours.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-treat later.

- Task # 3: Deliver fish to hatchery and unload fish into pond or tanks.**
CRITICAL CONTROL POINT

- Task # 4: Dispose of water, clean fish-hauling unit, and complete records.**

CRITICAL CONTROL POINT

- Hazards were contained.
Hazards: Plant: Hydrilla, Giant Salvinia, and Water Hyacinth.
- Control measures were implemented.
Control Measures: Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit pressure washed with heated water.
- Control limits were maintained.
Control Limits: Water is properly discarded on land, and fish-hauling unit is properly cleaned with hot-water pressure washer

Fish Collection HACCP Plan

- Corrective actions were performed, if necessary.
Corrective Actions: Re-clean.
- Hazards were contained.
Hazards: Invertebrate: Zebra Mussels, Quagga Mussels, and Apple Snails.
- Control measures were implemented.
Control Measures: Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water.
- Control limits were maintained.
Control Limits: Water is properly discarded on land, and fish-hauling unit is properly cleaned with hot-water pressure washer.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-clean.
- Hazards were contained.
Hazards: Other Biologic: VHS, KHV, SVC, and Trematodes.
- Control measures were implemented.
Control Measures: Water is carefully discarded on land avoiding run off into water bodies, and fish-hauling unit is pressure washed with heated water.
- Control limits were maintained.
Control Limits: Water is properly discarded on land, and fish-hauling unit is properly cleaned with hot-water pressure washer.
- Corrective actions were performed, if necessary.
Corrective Actions: Re-clean.

Texas Parks and Wildlife Department
4200 Smith School Road, Austin, Texas 78744

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