Appendix E

Best Management Practices for Collection and Transport of Salmonid Eggs and Juveniles

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Title: Salmon Egg Transport

SOP # SCF-TRN-002-02

Effective Date: April 1, 2013

1.0 Introduction

2.0 Purpose

This is a Standard Operating Procedure (SOP) for the transportation of Central Valley (CV) spring-run Chinook salmon eggs within the context of the San Joaquin River Restoration Program (SJRRP). CV spring-run Chinook salmon are listed as threatened under both the Federal Endangered Species Act and the California Endangered Species Act requiring that this SOP set a high standard.

2.1 Scope

This SOP will be followed by all personnel within the SJRRP for the transportation of spring-run Chinook salmon eggs.

2.2 Planning

Early planning and coordination will occur within the Conservation Facility and Reintroduction Monitoring Subgroups.

3.0 Procedures

3.1 Summary of methods

Possible adverse effects to eggs include: ionic and respiratory disturbance of the egg membrane, injury due to jostling, or death if the membrane is ruptured or punctured (ADFG 2010, Thedinga et al. 2005). To minimize these effects, eggs would be placed in a specialized shipping container to reduce excessive movement and limit damage to the egg membrane. The eggs would not be transported until they are fairly resistant to ―shock, at the eyed-egg stage.

Eggs will be wrapped in non-chlorinated water soaked cheesecloth or burlap to keep moist, and placed in a specialized Styrofoam shipping container. Eggs will be cooled using non-chlorinated ice and transported in a dark environment.

2.0 Equipment and Supplies

The following equipment will be needed:

- Specialized Styrofoam egg shipping container
- Non-chlorinated ice
- Cheese cloth and/or burlap
- Thermometer

- Iodine
- 5 gallon Plastic Bucket

4.0 Procedure

Possible adverse effects to eggs include: ionic and respiratory disturbance of the egg membrane, injury due to jostling, or death if the membrane is ruptured or punctured (ADFG 2010, Thedinga et al. 2005). To minimize these effects, eggs would be placed in a specialized shipping container to reduce excessive movement and limit damage to the egg membrane. The eggs should not be transported until they enter the eyed-egg stage when they are less effected by handling.

Eggs will be wrapped in non-chlorinated water soaked cheesecloth or burlap, to keep moist, and placed in a specialized Styrofoam shipping container, and will be cooled using non-chlorinated ice and transported in a dark environment.

Below is the procedure for transporting spring-run Chinook salmon eggs.

- Prior to leaving facility, ensure all equipment is in proper working order, and all equipment has been properly decontaminated.
- Upon arrival on site, prepare specialized containers. Put non-chlorinated ice in bottom portion of container and place perforated insert on top of ice. Use wet cheese cloth with stream/hatchery water (non-chlorinated).
- Place eggs in cheesecloth or burlap, and properly wrap/tie to secure eggs.
- Place eggs on top of the perforated insert and place lid on container. Eggs must be cooled and kept moist, and transported in a dark environment.
- Record transportation start time.
- Upon arrival at release site, record transportation end time. Carefully remove eggs, keeping eggs in cheese cloth. The temperature of the eggs should be taken and a sharp rise in temperature increase should be avoided when transferring eggs to water. Disinfect eggs with a 10 minute bath treatment using a solution containing 100 parts per million (ppm) of free iodine.
- Eggs should be placed at an acceptable egg incubator at the appropriate density and water flow.

5.0 Qualified Personnel

Transportation of donor stock from donor watersheds to the Conservation Facility, or to the San Joaquin River will be accomplished by personnel from either the CDFG or USFWS with previous experience transporting live fish

5.1 Roles and responsibilities

Name	Department	Title	Role	Responsibilities
Paul Adelizi	CDFG	Environmental Scientist	Conservation Facility lead	Transportation, Receiving eggs and fish at facility
Matt Bigelow	CDFG	Environmental Scientist	Collection/Release of Fish Safety Officer	Transportation/Holding fish in the field.
Patrick Ferguson	CDFG	Environmental Scientist	CDFG Donor Stock Collection Lead	Collection, Transport

5.2 Safety and training

All personnel working with fish will be properly trained in safe handling procedures described above.

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Title: Adult and Juvenile Salmon Transport

SOP # SCF-TRN-001-03
Effective Date: March 15, 2013

1.0 Introduction

1.1 Purpose

This is a Standard Operating Procedure (SOP) for the transportation of adult and juvenile spring-run Chinook salmon within the context of the San Joaquin River Restoration Program (Program). The protocol provides techniques that will reduce negative impacts while transporting this ESA threatened species.

1.2 Planning

1.2.1 Be certain that required permits are issued and copies are present if required. Receive prior approval for fish movements from the CDFW Fish Health Lab.

1.2.2 Necessary worksheets to accompany fish transport:

- Vehicle and Trailer Inspection Checklist (Appendix A)
- Fish Transport Data Sheet (Appendix B)

1.3 Scope

This SOP must be followed by all personnel within the SJRRP for the transportation of adult and juvenile Chinook salmon to and from the Conservation Facility.

1.4 Summary of Methods

To minimize the potential negative effects of transporting juveniles, transfer protocols will be followed to:

- Use appropriate hauling equipment
- Monitor and maintain dissolved oxygen
- Provide isotonic conditions to maintain ionic balance with use of salt
- Temper the transport water to within 2 °F when receiving and releasing fish to minimize temper shock to fish
- Maintain an appropriate fish density during transport
- Use handling methods to minimize stress to fish

2.0 Equipment Description

Both juvenile and adult salmon will be transported in a 500-gallon insulated aluminum fish hauling tank or similar tank that has a proven history for safely hauling live fish.

Hauling tanks must have a redundant aeration system that includes both mechanical aerators and gaseous diffused oxygen. Fish should be easily loaded and unloaded to and from the tank with no harm to fish (See Appendix A: Additional Equipment). The single-compartment tank is designed to be transported by, at minimum, a one-ton flatbed truck, or a heavy-duty transport trailer with gross vehicle weight rating of approximately 10,000 lbs. The tank is made of double-wall aluminum, insulated with 2 inch polyurethane foam, with the dimensions 46" wide x 84" long x 42" high. The tank is fitted with a 12" x 16" dump gate for easy release of large salmon and has a large 41" x 48" hinged lid to allow easy access to fish. Oxygen gas is supplied to the tank using compressed oxygen gas cylinders and one Pointfour micro-bubble diffuser and one oxygen soaker hose. Additional oxygenation and CO2 degassing is provided by two Fresh Flow®, 75 GMP, 12-volt, impeller-driven aerators. The aerators will be powered by the vehicle's 12-volt electrical system. Aerator indicator lights and oxygen gas flow meters will be viewable by the driver at all times.

3.0 Procedures

3.1 Equipment Decontamination

Equipment should be disinfected anytime there is a risk of disease or invasive species transfer, particularly when traveling between hatchery facilities and after equipment has been used on a river system. Empty tanks and equipment should be disinfected with 200 ppm chlorine or PVP Iodine for at least 1 hour. The chlorine and iodine should be neutralized with sodium thiosulfate and rinsed before being used for a new group of fish. One liter of 200 ppm available chlorine is neutralized by 1.5 g of sodium thiosulfate (Timmons and Ebeling, 2007).

3.2 Pre-inspection

3.2.1 Complete worksheet from Appendix A.

3.2.2 Ensure all equipment is in proper working order, and has been properly decontaminated.

3.2.3 Check all batteries and backup batteries (i.e. aerators, sensors, etc.) to make sure they are fully charged. If transportation will occur over several days, bring proper battery chargers.

3.2.4 Make sure all oxygen tanks contain sufficient oxygen for transport and for potential delays. To estimate oxygen requirement, anticipate using 1 liter per minute per 100 lbs of fish. If transportation will occur over several days, transportation staff should be made aware of locations near, en-route, etc. to fill oxygen tanks.

3.2.5 If using equipment which requires gasoline to operate (i.e. water pump, generator etc.), check fuel levels in equipment and gas cans. If

equipment requires oil or other fluids, check those levels and bring back-up fluid.

3.3 Transporting Juveniles and Adults

3.3.1 Arrival on site

3.3.1.1 Make sure all gates and ports on the tank are closed or sealed.

3.3.1.2 Add sodium chloride and anti-foaming agent to tank in the appropriate amounts. Salt should be added at 0.8 % or 6.4 lbs per 100 gallons.

3.3.1.3 Fill tank with cold stream/hatchery water (< 58 F) immediately prior to transport. If using stream water, use portable screened pump to fill tank.

3.3.1.4 Turn on oxygen to appropriate level. Transport water would be oxygenated using compressed oxygen gas with oxygen stones and impellor-driven aerators.

3.3.1.5 Add ice (non-chlorinated) if necessary to cool water.

3.3.2 Adding Fish

3.3.2.1 If possible, transfer fish into tank with “in-water” techniques, such as purse-style stretchers that hold both fish and water. Fish may be transferred directly into the holding tank OR may be transferred into small cages within the holding tank.

3.3.2.2 Oxygen levels and water temperature should be monitored and recorded approximately every hour.

3.3.2.3 Add fish up to the maximum allowable density. Maximum density for Chinook larger than 1.5 inches is 0.5 lbs per gallon (Piper et al. 1982).

3.3.2.4 Just prior to transport, take dissolved oxygen percentage (DO%), dissolved oxygen parts per million (DO ppm), and water temperature, and record on transportation datasheet.

3.3.2.5 Look for mortalities. Record and remove all mortalities. All mortalities should immediately be placed in a properly-labeled specimen bag and placed in a cooler on ice. These fish will go to CDFW pathology.

3.3.2.6 Record start of transport time.

3.3.3 During Transport

3.3.3.1 Drive slowly and carefully. The weight of the water will impair the braking and cornering ability of the vehicle. Sloshing water will also stress the fish.

3.3.3.2 The truck will be stopped after 30 minutes of transportation and each hour thereafter for visual inspection of the life-support system and fish health and wellbeing.

3.3.3.3 Dissolved oxygen levels will be monitored and maintained near saturation during transport.

3.3.3.4 All mortalities should immediately be placed in a properly-labeled specimen bag and placed in a cooler on ice. These fish will go to CDFW pathology.

3.4 Backup

3.4.1 A gas-powered AC/DC generator may be needed when hauling high densities of fish to operate aerators in the event of failure of the vehicle's electrical system.

3.4.2 In the event that the vehicle becomes immobilized, a towing company will be used to tow the vehicle to the release location. If the tank is used on the trailer, a backup vehicle will be used to complete the delivery.

3.5 Fish Release

3.5.1 Record end time and take oxygen level and water temperature measurement in tank. Record on datasheet.

3.5.2 Look for mortalities. Record and remove all mortalities. All mortalities should immediately be placed in a properly-labeled specimen bag and placed in a cooler on ice. These fish will go to CDFW pathology.

3.5.3 Take water temperature of receiving water and record on datasheet.

3.5.4 Temper transport water to within 2 ºF of the receiving water by pumping receiving water directly into the transportation tank until desired temperature is reached.

3.5.5 Transfer fish from tank into receiving water with "in-water" techniques if possible, such as purse-style stretchers that hold both fish and water.

3.5.6 River water from donor watersheds will be considered to contain pathogens. Release transport water into quarantine tanks and/or release water at predetermined appropriate location on dry ground where there is no drainage to the hatchery or aquatic area.

4.0 Qualified Personnel

Transportation of donor stock from donor watersheds to the Conservation Facility or to the San Joaquin River will be accomplished by personnel from either the CDFW or USFWS with previous experience transporting live fish. Personnel transporting juvenile and/or adult Chinook salmon must have experience using one-ton 4-wheel drive truck with heavy-duty suspension and a gross vehicle weight rating (GVWR) of 12,500 pounds equipped with a 500-gallon Aquaneering® fish transport tank.

5.0 Roles and responsibilities

Name	Department	Title	Role	Responsibilities
Paul Adelizi	CDFW	Environmental Scientist	Conservation Facility Lead	Transportation, Receiving eggs and fish at facility
Matt Bigelow	CDFW	Environmental Scientist	Collection/Release of Fish Safety Officer	Transportation/Holding fish in the field.
Patrick Ferguson	CDFW	Environmental Scientist	CDFG Donor Stock Collection Lead	Collection, Transport

5.1 **All personnel working with fish will be properly trained in safe fish-handling procedures described above.**

5.2 **All personnel operating transportation equipment must be able to couple and uncouple the truck from the trailer and have the ability to troubleshoot the aeration and oxygenation equipment.**

5.3 **All personnel with no prior experience operating the trucks while hauling water in tanks will have to successfully demonstrate their ability to operate such an equipped vehicle to the CDFW SJRRP safety officer.**

6.0 References

Timmons, Michael B. and James M. Ebeling, 2007. Recirculating Aquaculture. Ithaca, NY, Cayuga Aqua Ventures, 629 p.

Wurts, William A. 1995. Using salt to reduce handling stress in channel catfish. World Aquaculture, 26(3): 80-81.

7.0 Appendices: All field forms/data sheets

Appendix A

Fish Transportation Check List

To be carried out before transporting fish and when a change of driver takes place.
Vehicle Number _____ Date:_____

	Check ☑ if in good Condition	Comments		Check ☑ if in good Condition	Comments
	Tires			Wipers	
	Tire Tread			Lights	
	Tire Pressure			Horn	
	Tire Condition			**Trailer**	
	Rim Condition			Tires	
	Wheel Nuts			Safety Chains attached	
	Dust Caps			Break Line attached	
	Engine			Trailer Lights	
	Oil Level			Extra Fuses	
	Steering Fluid			**Fish Transport Supplies**	
	Coolant			Oxygen Supply	
	Break Fluid			Aerators Functioning	
	Battery Water Level			Proper Oxygen Stones	
	Hoses			Non iodized Salt	
	Belts			Anti-Foaming Agent	
	Wiring			Nets	
	Other			Buckets	
	Emergency Lights			Water Pump	
	Steering System			Generator	
	Brakes Operation			Gas and oil for Gen.	
	Loose Objects			Loose Objects	
	Tool Kit			Multi Meter	
	Transport Receipt			Cooler for Morts	
	Spare Tire			Ice for Cooler	
	Jack			Sample Bags	
	Blocks for Tires			**Applicable Permits**	

Appendix B

Fish Transport Data Sheet

Transfer Date_____ Staff_____

Pickup Location_____ Pickup Time_____

Source Water Temp and DO at Time of Pickup _____

Transport Tank Temp and DO at Time of Pickup_____

Release Location(s) and Time(s)_____

_____

Delivery point water temp and DO at time of delivery _____

Amount of salt added (use 32LB for 500 gallon Tank)_____

Hourly Transport Data

Time	Temperature	DO	Comments.

Table 1. Types, concentrations and quantities* of food-grade salts used in live fish transport water. (Wurts 1995)

Chemical name	Common name	Concentration	Teaspoons per gallon	Cups per 100 gallons	Pounds per 100 gallons
Sodium chloride	feed mixing or table salt	8 g/l (0.8% salt)	4 3/4	9 3/4	6.4
Calcium sulfate	agricultural gypsum	125-250 mg/l (as $CaSO_4$)	1/4 - 4/10	1/2 - 8/10	0.18-0.36
Sodium bicarbonate	baking soda	100-200 mg/l (as $Ca(HCO_3)$)	1/8 - 1/4	1/4 - 1/2	0.14-0.28

* Amounts listed assume a starting concentration of zero (none present). For accuracy, concentrations should be checked before, during and after the addition of each salt. Use level household measures.