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Fish Stocks and Fisheries

Subproject I: Identification of Wild and Hatchery-reared
Anadromous Fish Stocks

Study I: Tagging and Marking Anadromous Fish

Job 3: Steel head Marking Trailers

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ABSTRACT

The Idaho Department of Fish and Game has initiated a steelhead marking program which will enable a selective harvest of hatchery and wild fish in an attempt to conserve wild stocks. The program is designed to remove adipose fins from all hatchery-reared steelhead in Idaho. To accomplish this objective we turned to past experience in marking fish to design and build two specialized marking trailers. Combined, they provide the capability to fin clip Idaho's entire planned production of hatchery-reared steelhead smolts within the necessary time frame. This report describes in detail the various systems of the trailers and their construction.

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INTRODUCTION

In 1976 Department personnel designed and built a mobile tagging unit to facilitate the marking of fish with coded wire tags. This mobile unit has functioned very efficiently since that time and has been used in several types of fish marking operations. The experience gained in the design, construction and operation of this unit was invaluable in the construction of the adipose marking trailers. These new trailers incorporated those features which have proven to be efficient. At the same time, new technology in both equipment and materials allowed us to improve upon several features. We also solicited advice from those individuals involved in various marking projects for other agencies. Department personnel also have utilized several marking trailers owned by other agencies. These units each have good features which were included wherever possible.

The following criteria were established to direct the design and construction of the marking trailers:

1. Allow fish to be moved through the system in the least stressful manner possible.
2. Designed to handle large numbers of fish.
3. Comfortable for personnel, especially during the winter months.
4. Simple to operate with mechanical equipment kept to a minimum.
5. All features and mechanical equipment would require little or no maintenance during operation.
6. Totally independent with all systems self-contained and necessary equipment and facilities to complete a mark operation.
7. Built to withstand high moisture.
8. A recirculating, constant temperature anesthetic system.
9. Ease of accessibility for personnel bringing fish into the trailer.
10. Require minimal time to set up and take down to facilitate moves between raceways or ponds.
11. Disinfectable to prevent the spread of disease between hatcheries.
12. Easy to tow.

OBJECTIVES

To provide an effective working environment for marking the state's hatchery-reared steelhead as an aid to improved management of wild and hatchery stocks in the fisheries.

TRAILER CONSTRUCTION

The outside dimensions of the trailer body are 8'7" x 34'0". Interior dimensions are 8'0" x 33'4" x 6'10" high. The overall length of the trailer is 40 feet. All framing in the walls is 2" x 4" fir studs placed 16" on center (O.C.). The ceiling is constructed with 2" x 6" trusses 24" O.C. The floor consists of all steel construction. The trailers are

built to meet all building codes of the state of Idaho as well as all laws pertaining to highway safety regulations. All electrical wiring for the running lights and taillights are automotive type. The entire trailer unit is designed and built to withstand extremely high moisture conditions.

Chassis

The chassis consists of two main stringers of 2" x 8" x 1/4" walled tubing. Cross bracing is 2" x 6" x 1/4" walled tubing placed 4' O.C. The floor supports consist of 6" channel placed 24" O.C. and perpendicular to the main stringers. The entire chassis is mounted to an axle assembly composed of three axles each capable of 5,800 lbs. The wheels are 950 x 16.5 automotive type. The chassis is built to withstand a minimum of 20,000 lbs. stationary weight. The floor construction is designed to give a full width flat floor interiorly. The rear of the chassis is modified to allow a slide-in bumper. Attached to this bumper is a 4' x 8' aluminum deck which folds up during travel. This deck provides a work surface during fish loading operations. The underside of the chassis is insulated, covered with galvanized sheeting and undercoated. All chassis components are painted black.

Floor Construction

The floor is constructed with 11 gauge metal plate in 4' widths. All seams are welded smooth to give a continuous and flat surface for proper drainage. The plating is turned upward 4" at each end to make a continuous sidewall to prevent moisture from entering the walls. Full width channels are welded into the floor near the front and rear of the work area. These collect water and drain to the outside. The front 6' of the trailer floor is modified to be 2" higher. This area is the office and the increase in elevation prevents any water from draining into the office area. The office area contains 3/4" exterior plywood subflooring and is covered with linoleum. The metal floor in the work area is primed and painted with a commercial epoxy flooring system. Sand was embedded in the paint during application with the aid of a sandblaster to provide a non-slip surface.

Sidewall Construction

Sidewalls consist of studding insulated with R13 fiberglass. Exteriorly, the studs are covered with foam board and aluminum siding. The siding is installed horizontally with proper corner and top moldings. Interiorly, the walls are covered with 3/8" medium density overlay (MDO). All seams are caulked with automotive caulking to prevent fatigue due to vibration and still be paintable. The MDO is rabbeted to overlap the metal sidewall 3/4". The lower 4' is covered with plastic laminate

which extends 3/4" below the MDO. The area between the plastic laminate and the metal sidewall is filled with silicone rubber to make a waterproof flooring to wall system. The exposed MDO is painted with polyurethane flooring enamel.

Roof Construction

The roof contains 6" of R19 fiberglass insulation. Exterio rally it is covered with 1/2" exterior plywood and galvanized roofing. The roofing is coated with an aluminum based coating and provides a surface which can be walked on to store pipes, etc. Interiorally, the ceiling is covered with MDO and painted to match the sidewallis. A total of three roof vents are installed for ventilation purposes.

Heating System

The heating system consists of a 60,000 BTU, LPG, fan-forced furnace. Ductwork installed interiorally on the right wall transfers heat the full length of the unit.

Electrical Sysstem

The trailer's electrical system is designed to accommodate the various hatchery electrical systems now in use and still be compatible with those new hatcheries planned for the future. The trailer operates on 240-110V single phase. When this type of service is available, the unit can be plugged in direct to the power source. If the power source is 480V three phase, a transformer located on the front of the trailer reduces the power to the needed voltage. A cord reel with 150' 10-6 SO cord, along with the transformer, is stored inside a metal box located on the front. Also located in this front storage box is the breakaway electrical system and the electrical controls for the power levelers. A separate compartment to the side of the box is used for miscellaneous storage.

Interiorally, the electrical system consists of a breaker panel with seven circuits each leading to either lights, furnace, pumps or electrical outlets. There are eight 2' x 4' fluorescent light fixtures in the work area and one in the office area. A series of 110V electrical outlets are located in the ceiling on each side of the trailer as well as in the office area. A separate circuit leads to the furnace and work bench outlet. The recirculating anesthetic pump is on its own 240V circuit. A switch located at the anesthetic fill tank controls this pump.

Exteriorally, outlets are located at the front, rear and at all four corners on the sides. There are also 240V electrical outlets located at the lower corners. These are controlled by two, three-way switches located interiorally and exteriorally at the rear of the trailer. These outlets are for the water supply pump and the switches allow the pump to

be turned off easily from inside or outside the trailer. Exterior lighting includes flood lights located by each door and in the center and rear of the trailer over the fish loading area. At the front of the trailer is located a motor base receptacle unit. This receptacle allows a 110V extension cord to be plugged into the trailer. Wiring from this receptacle leads to the breaker panel and can provide electrical power to the office, lights and furnace. This can only be used when the unit is not plugged into either a 240V or 480V power source.

Doors and Windows

There are two steel exterior doors, one located on each side of the trailer. There are nine windows which give adequate lighting to the interior. Four 36"W x 30"L double-pane, insulated, sliding glass windows are located on the left side and three windows of the same dimensions are located on the right side. Two smaller 18"W x 30"L windows are located at the rear and on each side of the fish entry pipe. Interiorly, the windows were cased with pine and each Joint sealed with silicone rubber sealant. The bottom of the casings were all slanted at a five degree angle to allow condensation to drain to the floor and not into the interior wall. Exteriorly, detachable folding steps give access to the trailer. Handholds have also been provided for safety purposes.

Cabinetry

Cabinetry in the office area includes a desk, lower cabinets and work area, overhead cabinets and combination "L" shaped boot rack, coat rack and lunch box shelf. All cabinets are made of birch with all work surfaces covered with plastic laminate.

Special Framing

Wall framing was modified in the rear of the trailer to allow that portion to be removable. This allowed the section to be left out while the rest of the trailer was being completed. This was necessary to allow the installation of the work console at a later date. The work console was installed after the majority of the trailer was completed. Once the work console was set inside, the removable framing was reinstalled, secured, and the exterior and interior portions completed in the same manner as the other walls.

Miscellaneous

A ladder was installed at the front of the trailer to give access to the roof area. On the roof, a side rail and pipe racks were installed to attach and store 220 of aluminum irrigation pipe. This is used to return fish to the raceways after marking.

Four power levelers are installed 10' from each corner and are used to level and stabilize the unit. These units each have a lift capacity of 6,500 lbs. The controls for these levelers along with the 12V DC battery power source are located in the front electrical box.

Suspended from the ceiling are four switches which control an exterior buzzer. This provides a communication system between workers netting the fish and the clippers inside the trailer.

WORK CONSOLE CONSTRUCTION

General

The console performs seven basic functions within the trailer: 1) water delivery, 2) fish delivery, 3) fish anesthetizing, 4) anesthetic cooling, 5) fish holding, 6) fish return, 7) waste water return, and 8) excised fin removal.

The console units provide a work area for 16 people. Each function of the console is actually a separate system.

Fish Entry System

Exteriorly, the fish entry system consists of a hopper connected to a 4" entry pipe that tranverses the rear wall. Water from the interior console is piped to the hopper and is sprayed in from the end of the hopper to carry the fish into the interior. The hopper is attached with a quick coupler and can be positioned at the rear or either side of the trailer for ease in loading fish. The system is also designed to accept a small fish pump at a later date.

Interiorly, the 4" pipe leads to a device which can dewater the delivery system. This dewaterer was designed to handle the excess volume of water delivered with a fish pump. This dewaterer can be controlled so that the water entering can also be used to operate the console and fish holding tanks. A 4" x 6" channel extends from the dewaterer full length of the console. Small gate openings are located directly over the fish holding tanks. Fish can be diverted from this central fishway into either side of a fish holding tank located below the entry system. At the far end of the fishway a screen prevents any fish from passing the last holding tank. Any excess water passes through the screen and into the drain pipe. A plexiglass cover prevents any fish from flipping out, yet allows for visual observation if any problems should arise. The cover also serves as a small table area for specially designed freeze brand boxes.

Fish Holding Tanks

A total of four tanks (22' x 60" x 20") receive fish from the center fish delivery channel. These tanks serve not only as fish holding tanks, but also as heat exchangers for the anesthetic water. Each tank has a 3" water inlet and a 4" outlet equipped with a standpipe. The inflowing water upwells into a lower tank and then flows upward through a heat exchange unit in a series of openings which give even distribution of water to the fish holding area. The 4" outlet leads to a 4" fish return pipe and fish can be flushed out of the system in an emergency. Bottom screens prevent the fish from entering the heat exchangers, and dividers on both sides of the standpipe prevent fish from leaving the tank and divides the holding tank into two fish holding areas each accessible by two people. Thus, a total of 16 people have direct access to a supply of fish and can work at their own pace. The tanks each rest on four legs and together the 16 legs support the entire console.

Fish Return System

The fish return system consists of a 3" x 5 1/2" channel running full length of the console between the anesthetic troughs and the fish delivery channel. This channel acts as the main drain for the fish holding tanks. Water in the tanks flows upward and into the fish return channel thus supplying the needed water to transport the marked fish outside. Two channels, one on each side, lead to the rear console area and a small fish collection trough. This trough has the capability of receiving dividers which direct the marked fish into one of two 4" pipes, one leading to each side of the trailer. The fish return system also includes the drain pipe leading from each of the standpipes in the fish holding tanks. This pipe leads only to the right side of the trailer and allows unmarked fish in the holding tanks to be returned to a separate raceway or pond.

Water Delivery System

Water is delivered to the console by a submersible pump through a 3" flex hose which attaches at the rear of the trailer. The water on entering the trailer is controlled by a series of valves. Water can be diverted to the fish hopper, each of the four tanks together or singly and the anesthetic tank. Small hose bibs installed into the water line allow the attachment of garden hoses for cleaning purposes.

Waste Water System

The waste water system consists of the three 4" drains of the fish delivery system and the fish return system. Tank drains consist of the overflow into the fish return system and the standpipe located between the two dividers. The standpipe was designed to evacuate fish quickly from

the holding tanks in case of mechanical problems. Anesthetic water is drained from the heat exchangers and the collection tank into the fish and water return pipe.

Anesthetic System

The fish anesthetic system is a closed, recirculating system. It consists of 10" wide x 7" deep troughs attached to the fish return channel between and at the ends of the fish holding tanks. The troughs between the holding tanks provide work areas for two markers. The troughs located at each end provide only one work station. Together the six 4' long troughs and the four 2' long troughs provide 16 work stations in the trailer. Each of these troughs are divided into smaller work areas for anesthetizing fish. Each marker has the capability of having two small "sink" areas.

Each of the troughs drain into a 1 1/2" x 3" channel located at the bottom of each return channel. This makes a total channel depth of 7" or the same as the trough. This small channel extends to the rear of the console and empties the anesthetic into an anesthetic holding surge tank.

The anesthetic tank is 22" x 22" x 18" deep and is located between the two 4" drain pipes leading from the collection box and forward enough to collect the anesthetic as it comes from the collection channels. The tank acts as a collector, surge tank, filter and oxygenator for the anesthetic system. As the anesthetic comes from the collector channel, it pours over a fine meshed, perforated plate backed, inclined screen. This screen removes excised fins from the anesthetic system allowing the screen to be self-cleaning. It also breaks up the water and oxygenates it as it falls into the tank below. Located on the outside edge is a trough that collects the fins as they move off the edge. A small tube brings water from the fishway and directs it along the screen retaining bracket and into the back trough to flush the fins into the drain. The small trough also acts as the overflow when the recirculating pump is turned off and the anesthetic from the troughs drains into the tank. Underneath the anesthetic tank is located a 1/2 horsepower centrifugal pump which is used to circulate the anesthetic from the tank through the heat exchangers and into the troughs. From the troughs the water is gravity fed back to the tank.

The heat exchangers are located in the bottom of four fish holding tanks. The exchangers are small 3/4" thick tanks located 1" from the bottom of the tank. Two 1 1/2" pipes lead to these small tanks. One pipe is the inlet and the other the outlet. Small dividers direct the water in a flow pattern within the tank before it exits and passes on to the next tank. The four tanks are connected in series so that the anesthetic passes from one to another and then exits the last exchanger. From the last exchanger the anesthetic is piped back along the console and into each of the troughs. The main supply pipe to the exchangers also is the drain when the pump is turned off and the drain valve is opened. In order for this to function, four valves are located on the main pipe between the

inlet and outlet of each exchanger. These valves are closed to divert the anesthetic into the heat exchanger. When opened, both the outlet and the inlet act as drains back into the main pipe.

The actual cooling of the anesthetic takes place when inflowing water upwells underneath the tank and then passes through small tubes into the fish holding area. Thus the exchangers are cooled by water below and above. Together they provide 80 square feet of surface area for heat exchange. Additional heat exchange area is provided as the anesthetic drains from the troughs and runs beneath the fish collection trough. Together they provide more than enough capability to keep the anesthetic water temperature the same as the fish holding temperature. Because there is in excess of 150 gallons per minute of water circulating within the trailer, neither the water temperature in the fish holding tanks nor the anesthetic water is different from that in the outside raceways.

Plumbing

All plumbing consists of PVC or ABS plastic pipe and brass valves. All pipes carrying fish were sanded smooth in the various Joints and fittings to prevent abrasion to the fish. In addition, large gaps in Joints were filled with silicone. The same procedures were used on all aluminum pipes leading from the trailer.

ACKNOWLEDGMENTS

I Would like to express my thanks for those many departmental and outside agency personnel that contributed to the design and building of these trailers.

A job well done is certainly in order for many Department personnel at the Headquarters office especially David Ortmann and the Fishery Bureau staff, along with Dee Fotl in Purchasing. Other administrative staff have also been of great help in the payment of many bills.

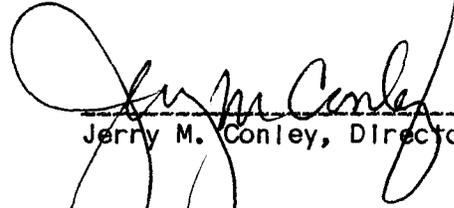
In the construction phases, Department employees Todd Garlie, Arnie Miller and Lance Nelson deserve thanks for the willingness to work extra long hours to complete the trailers. Temporary laborers and constructions workers Don Beck, Pat Laney, Everett Connerly, Jerry Spencer and Owen Mundell also went the extra mile in trying to complete an arduous task on time. Employees of P&M Proven Parts and Smith Root, Inc. were also instrumental in the trailer's completion and their expertise and input made these units more functional.

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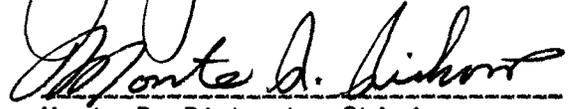
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