

Senior Capstone Design

Project: [Alternate Aquaculture Vaccine Delivery System](#)

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Design Validation Plan & Results (DVP&R)

Requirement	Test	Test Subject	Target Date	Result	Recommendation
All prototypes must meet animal handling and use requirements.	Build prototypes to meet all required specs.	Lab Test Prototype	11/6/20		
Provide minor puncture or break in the skin of (1-5g) rainbow trout without causing serious injury.	Puncture the skin of fish carcasses with a needle to determine force and depth requirements	Fish carcasses	7/24/20	Force requirements were not determined. Skin thickness was found to be ~.25mm. The .5 mm roller required a lot of force to puncture the skin of the fish.	Find someone with a small scale to determine force requirements. A longer needled roller with every other needle ring removed could be a possible solution.
Initial Prototype must create skin punctures in a minimum of 65% of the fish	Do test run and manually count punctured carcasses.	Fish carcasses	9/18/20	Tests showed too much force required	Design new rollers using hypodermic needles.
The initial prototype must weigh less than 15 pounds.	Weigh the prototype system on the scale in GJ 126	Initial Prototype	9/18/20	Goal Accomplished	
Initial prototype to be tested on euthanized fish.	Insert euthanized fish to identify punctures made by rollers.	Initial Prototype	8/30/20	Test failed, and led to advanced iterations.	
The initial prototype must fit within the vaccination tanks currently used in the lab.	Insert initial prototype into vaccination tanks in the lab	Initial Prototype	9/18/20	Size constraint met	
Microneedle Roller must be able to provide a minor break in the skin of fish without the use of external force from the operator	Insert fish carcass into initial prototype and check fish carcass for punctures	Initial Prototype	9/18/20	Microneedle roller is not able to provide minor puncture in skin of fish without excessive force	Implementation of larger diameter rollers with reduced needle density is required.
Initial Prototype must be free of tight spaces that cannot be thoroughly cleaned.	Spray with water to identify buildup areas.	Initial Prototype	9/18/20	All areas of the chute and roller mount are easily accessible by sponge for cleaning. Needled rollers are not easily cleaned by sponge but can be sprayed with pressure to be cleaned	If cleaning becomes an issue for fish technicians, a brush may be implemented for use in cleaning the microneedle rollers.
Initial prototype must be durable enough to undergo a minimum of 100 cycles.	Use prototype for up to 100 cycles.	Initial Prototype	9/18/20	Prototype used on euthanized fish for proof of concept.	
Final Prototype must pump enough fluid to ensure fish do not back up.	Use throttling valve to identify ideal flow conditions.	Final prototype	11/13/20		

