RECLAMATION

Managing Water in the West

Hydraulic Laboratory Technical Memorandum PAP-1104

Fish Predator Reduction using Fish Traps with Bait Attraction

2013 Laboratory Testing

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Hydraulic Investigations and Laboratory Services Group
Denver, Colorado

May 2014

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2013 Laboratory Testing

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Introduction

Testing was conducted in Reclamation's Hydraulics Laboratory to study predator fish response to odor-releasing baits. The main objective of this testing was to determine if odor-releasing baits can be used to lure predator fish into a common fish trap. Using these artificial "smelly baits" in conjunction with existing fish collection trap designs may be beneficial to reducing fish predation issues at Reclamation facilities. This report documents findings from additional laboratory testing that were recommended after previous lab tests were unsuccessful at providing reliable results (Mortensen, 2013). These additional tests (current study) were performed in a different laboratory setup that allowed more reliable results to be obtained to provide unbiased conclusions.

Experimental Setup

The test approach was designed to provide a "proof-of-concept" on whether this method is worth further investigation in a field evaluation where statistically significant results could then be obtained. Testing was performed in a large rectangular tank (138 x 32 x 30 inches) on the main floor of the Hydraulics Lab. As shown in Figure 1, the test tank was the same type and size as the holding tank where the striped bass (*Morone saxatilis*) were held to help reduce stress prior to testing. Predator fish (striped bass) were placed inside the test tank to determine if they could be lured into a fish trap that contained bait. Temperature and water quality properties were the same in both the holding and test tanks and about 5 gpm of water flowed through the test tank consistently throughout testing.

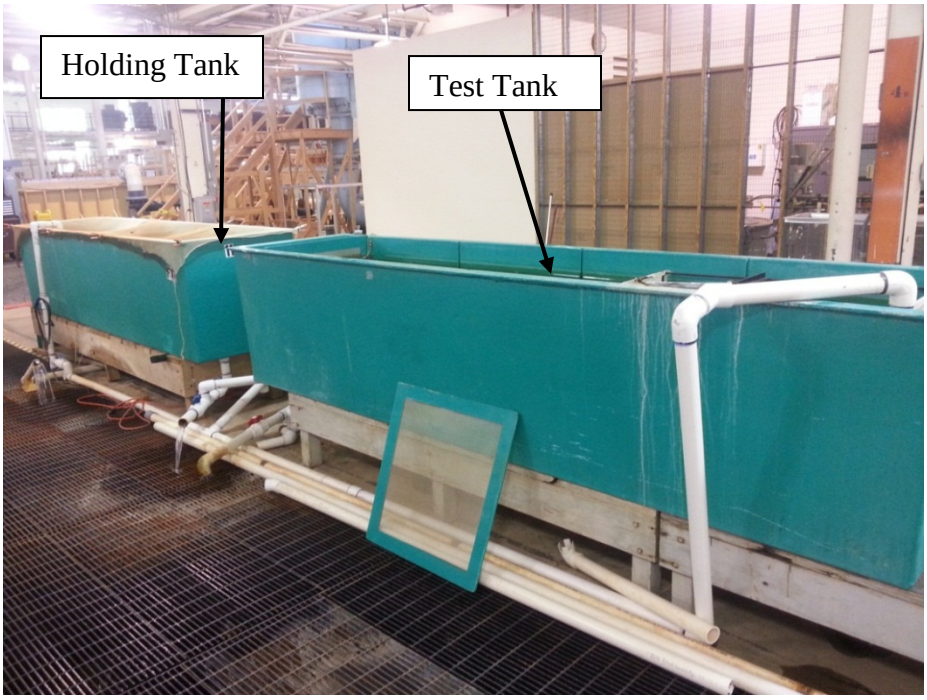

Figure 1 Rectangular fish tanks used for bait attraction testing.

Figure 2 shows the fish trap used for testing, constructed out of a simple steel frame and fine fish netting. Trap dimensions (48 x 28 x 27 inches) allowed it to fit snuggly inside the tank with only a single entrance into the trap. The converging shape of the entrance (common fish trap feature) was designed for easy entrance and difficult escape for the predator fish. Two bait holding nets were placed at the top of the entrance and back of the trap to provide both a visual and odor-releasing stimulus for the striped bass. The trap was set inside the tank at the upstream end to allow the striped bass to follow the scent of the bait upstream into to trap.

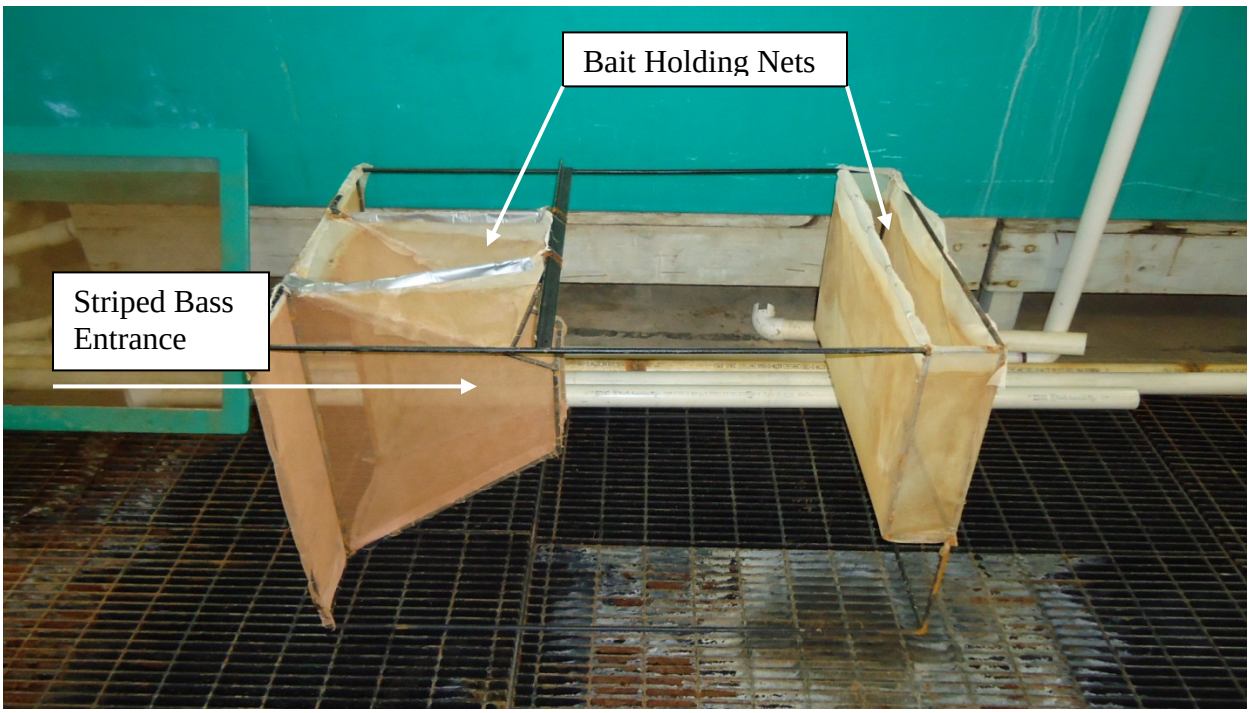

Figure 2 Fish trap set inside tank during testing. Baits were held in the holding nets upstream of the entrance where they could be both seen and smelled by the striped bass.

Striped bass ranging from 12 to 16 inches in length were imported from Reclamation's Tracy Fish Collection Facility in California and were used as the predator test species in this experiment. Two types of bait were used during testing; live Rainbow trout minnows (*Oncorhynchus mykiss*, 1-2 inches in length) and commercial bass fishing bait (Yum Wooly Junebug, purchased from the Bass Pro Shop). A typical treatment test consisted of leaving 2 or 3 striped bass in the test tank with bait in the fish trap for a minimum of 8 hrs. This provided sufficient time for the fish to acclimate to their new environment after the handling stress of being moved from the holding tank. After the allotted test time, the number of bass that entered the trap were counted and released into the holding tank. While at least 2 hours were allowed between tests to help the bait odor clear out of the test tank, it was impossible to verify the complete removal of the scent. New predator fish and bait were then set into the tank for the next test after. This process was repeated with no bait in the trap for control testing. Figure 3 shows bait and predator fish during a treatment test.

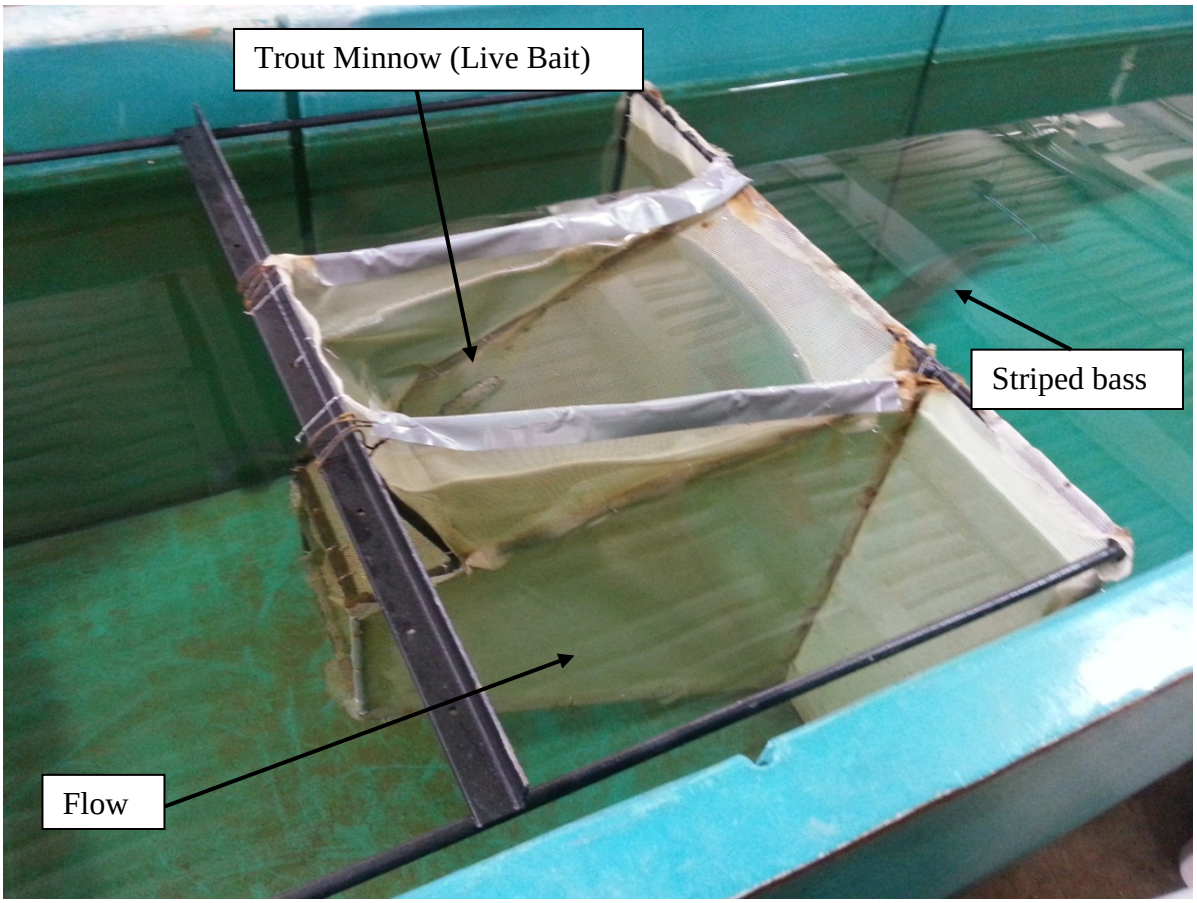

Figure 3 Striped bass near the trap entrance during a test. A trout minnow was held in the top holding net for bait during this test.

Results and Observations

Testing included 11 control tests and 16 treatment tests. Of the treatment tests, 8 were made with live bait and 8 with artificial odor-releasing bait. Test runs are documented in Table 1 which shows a log of results and observations of each test. Overall, test results showed that 24.0 percent of the control fish and 46.2 percent of the treatment fish entered the fish trap during testing. For the treatment tests, 69.6 percent of the fish exposed to live bait entered the trap while only 12.5 percent entered that were exposed to artificial bait. Control test results are displayed in Figure 5 and treatment test results are shown in Figure 6.

Figure 4 shows a sharp drop in successful treatment tests near the end of March. At that time several sucker fish (*Catostomidae*), not related to this study, were placed in a holding tank near the test holding tanks that shared the same water system. The scent of the suckers may have saturated the water in both of the striped bass test and holding tanks, biasing a few of the treatment test results with live bait. The sucker tank was moved to a different location within the hydraulics lab and the striped bass tanks were cleaned and testing was resumed in August using the artificial odor-releasing bait.

Table 1 Log of control and treatment runs made during 2013 lab testing. For test type T and C represent treatment and control tests, respectively.

Date	Test Type	Bait Type	# Test fish	# Fish in trap	Notes
3/8/2013	T	Live	5	5	
3/11/2013	T	Live	2	1	Minnow gone from top containment
3/12/2013	T	Live	2	1	Striped bass switched, large one entered trap and small one escaped
3/13/2013	C	-	2	0	
3/15/2013	T	Live	2	2	Washed out trap after test
3/18/2013	C	-	3	3	
3/19/2013	C	-	3	2	
3/21/2013	T	Live	3	3	
3/22/2013	T	Live	3	3	Bait swimming free in tank, trap and tank cleaned after test
3/23/2013	C	-	3	1	
3/25/2013	T	Live	3	1	Sucker fish placed in adjacent holding tank
3/26/2013	T	Artificial	2	0	
4/1/2013	T	Live & Artificial	2	0	Tank and trap emptied and cleaned
4/5/2013	C	-	2	0	
4/20/2013	C	-	2	0	
8/5/2013	C	-	2	0	Sucker fish holding tank moved during mid-summer
8/6/2013	T	Artificial	2	0	Inactive; swim in unison; bait only in back traps
8/7/2013	T	Artificial	2	1	One bait fish was added to the top trap; same fish as previous test
8/8/2013	C	-	2	0	Slight increase in swim activity
8/8/2013	T	Artificial	2	1	Different swim activity, not swimming in unison
8/9/2013	C	-	2	0	Fed fish at 9:30 am and waited to put fish in experimental tank
8/9/2013	T	Artificial	2	0	Fish inactive; one bait fish missing from trap w/o explanation
8/12/2013	C	-	2	0	Fish inactive
8/12/2013	T	Artificial	2	0	Different swim activity; swam in circles
8/13/2013	C	-	2	0	Cleaned out tank and trap before putting fish in
8/13/2013	T	Artificial	2	0	

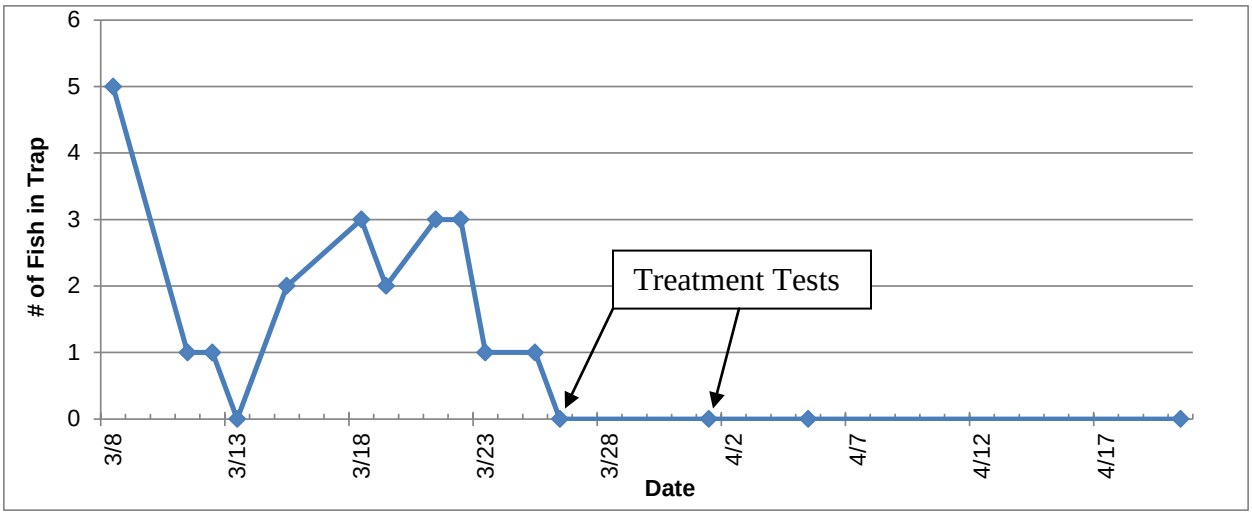

Figure 4 Number of fish that entered into the trap vs. date of test. In late March the scent in the water may have been contaminated by sucker fish (not part of this study) that were placed in a laboratory tank sharing the same water system as the test tanks.

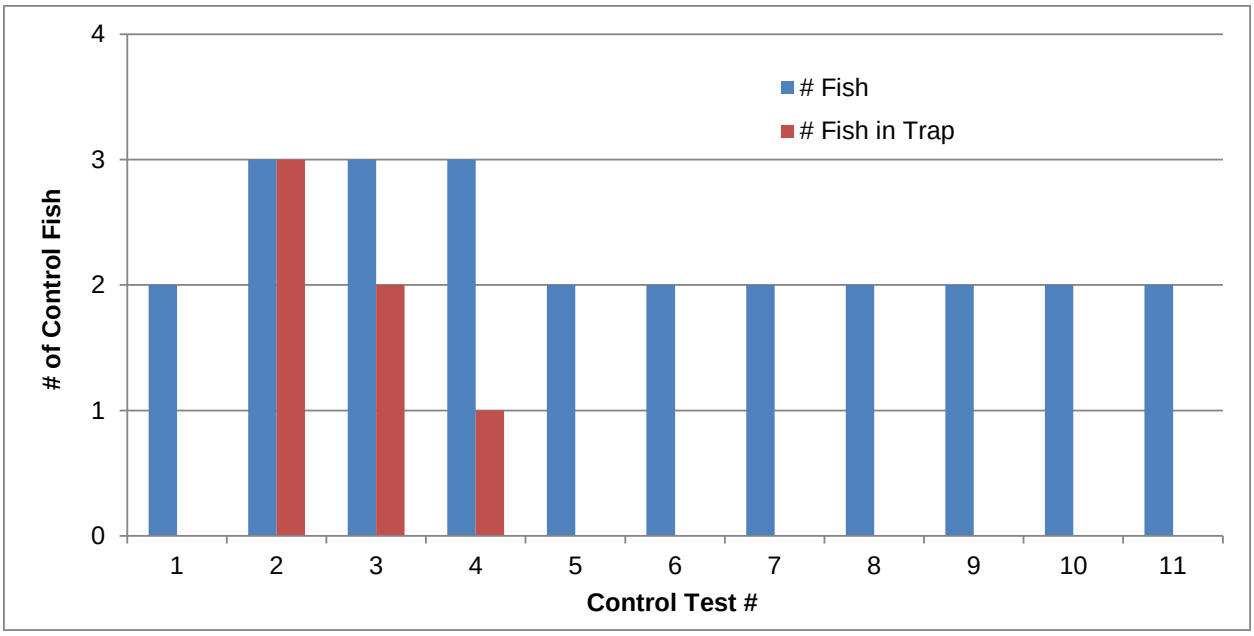

Figure 5 Comparison of control fish that entered the fish trap for all control tests.

The significant difference in treatment test results using artificial odor-releasing bait suggests that striped bass are more attracted by visual stimulus than scent (Figure 6). Anecdotal evidence from fish facilities also shows that striped bass are a visual predator. Minnows used for live bait frequently swam and moved within the holding nets of the fish trap. For the artificial bait, velocity of the tank flow was not sufficient to cause any significant movement. However, some uncertainty was added to artificial bait results by the sucker fish tank which still shared the same overall closed system of the hydraulics laboratory water supply even after it was relocated. Differences in striped bass appetite and feeding patterns from the March to August testing may have also added uncertainty to test results. Despite uncertainties, results show that live bait can be used to lure predator fish into fish traps.

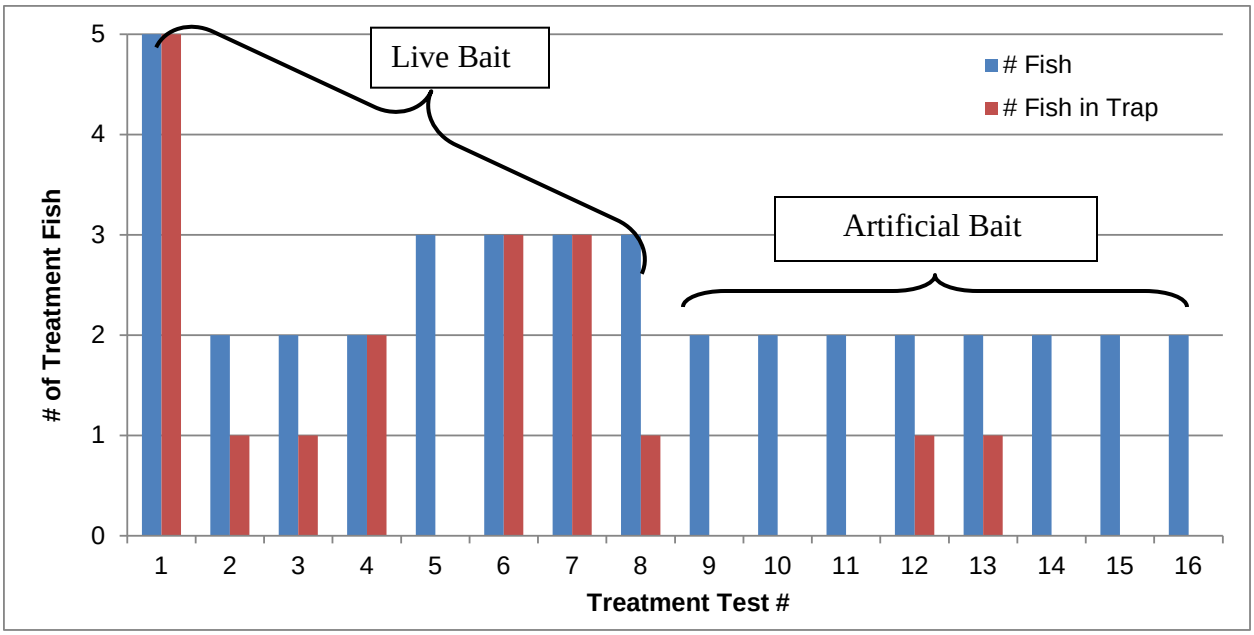

Figure 6 Comparison of treatment fish that entered the fish trap for all treatment tests. Tests 1-8 used live trout minnows as bait. Tests 9-16 used commercial artificial bass bait.

Conclusions and Recommendations

Laboratory tests showed that predator fish (striped bass) could successfully be lured into a fish trap using live bait. A fish trap with bait holding areas was used within a long rectangular fish tank to determine if striped bass could be lured in by either the scent or sight of the bait. Proof-of-concept results indicated that about 70 percent of the fish that were exposed to live bait entered the trap, while only 12.5 percent entered that were exposed to artificial bait. These were compared to control test results where 24 percent of the fish entered the trap with no bait.

Results suggest that visual baits that move will likely be effective in a field application of this approach for predator reduction and warrant a field evaluation. The next step to develop this method of predation removal would be a field test using live bait in a single fish trap of similar size and geometry. Field testing could also utilize artificial bait to remove any uncertainty of this treatment seen in laboratory testing. A field demonstration could easily be performed at a Reclamation facility with large numbers of predators to determine if this approach will be both practical and effective. It is recommended that field testing be lead and performed by fisheries biologists with engineering support for fish trap design and deployment if necessary.

References

Mortensen, J. D. (2013). *Fish Predation Reduction using Fish Traps with Bait Attraction, Progress Report, 2012 Initial Laboratory Testing.* Denver, CO: U.S. Department of the Interior, Bureau of Reclamation.