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Effects of Removing Primary Channel Adult Striped Bass on Delta Smelt Salvage Efficiency

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14. ABSTRACT
The Bureau of Reclamation's Tracy Fish Collection Facility (TFCF) operates to isolate (salvage) fish from water destined for the Bill Jones Pumping Plant, thereby reducing entrainment loss and mortality. Of particular concern, to regional biologists and managers, are the effects of TFCF operations on health and survival of delta smelt (*Hypomesus transpacificus*), a species listed as endangered under the California Endangered Species Act in 2010. Loss of fish as a result of predation, throughout multiple components of the TFCF, is one of the many factors that may have a negative effect on TFCF fish salvage efficiency. Removal of piscivorous fish is regularly completed in the TFCF secondary channel, because it can be dewatered and is easily accessed. Though there are current methods being evaluated to remove piscivores from the TFCF primary channel, a safe and efficient method that contributes to increased salvage efficiency of fish has yet to be implemented regularly. In 2007, small-scale piscivore removal efforts, using a gill net to sample ~25-35% of the TFCF primary channel were attempted. Across twelve net sets, totaling 76 min of fishing, 35 adult striped bass (mean FL = 60.3 cm) were removed from the primary channel. Before and after piscivore removal delta smelt facility efficiency mark-capture experiments indicate the piscivore removal effort had no significant effect on whole facility, primary louver, or secondary louver efficiency. Other similar research efforts conducted at the TFCF indicate removal of predators from the primary channel does result in increased facility efficiency. It is likely the lacking impact piscivore removal efforts had in the current study is a result of the inability to ensure the majority of piscivores were removed, combined with elevated facility water velocities that may have promoted rapid movement of fish through the facility.

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Tracy Fish Facility Studies
California

Effects of Removing Primary Channel Adult Striped Bass on Delta Smelt Salvage Efficiency

Tracy Technical Bulletin 2014-2

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COVER

Fish photography by René Reyes, Tracy Fish Collection Facility, Tracy, California.
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EXECUTIVE SUMMARY

The Bureau of Reclamation's Tracy Fish Collection Facility (TFCF) operates to isolate (salvage) fish from water destined for the Bill Jones Pumping Plant, thereby reducing entrainment loss and mortality. Of particular concern, to regional biologists and managers, are the effects of TFCF operations on health and survival of delta smelt (*Hypomesus transpacificus*), a species listed as endangered under the California Endangered Species Act in 2010. Loss of fish as a result of predation, throughout multiple components of the TFCF, is one of the many factors that may have a negative effect on TFCF fish salvage efficiency. Removal of piscivorous fish is regularly completed in the TFCF secondary channel, because it can be dewatered and is easily accessed. Though there are current methods being evaluated to remove piscivores from the TFCF primary channel, a safe and efficient method that contributes to increased salvage efficiency of fish has yet to be implemented regularly. In 2007, small-scale piscivore removal efforts, using a gill net to sample ~25-35% of the TFCF primary channel were attempted. Across twelve net sets, totaling 76 min of fishing, 35 adult striped bass (mean FL = 60.3 cm) were removed from the primary channel. Before and after piscivore removal delta smelt facility efficiency mark-capture experiments indicate the piscivore removal effort had no significant effect on whole facility, primary louver, or secondary louver efficiency. Other similar research efforts conducted at the TFCF indicate removal of predators from the primary channel does result in increased facility efficiency. It is likely the lacking impact piscivore removal efforts had in the current study is a result of the inability to ensure the majority of piscivores were removed, combined with elevated facility water velocities that may have promoted rapid movement of fish through the facility.

INTRODUCTION

Operations at the Bureau of Reclamation's (Reclamation) Tracy Fish Collection Facility (TFCF), in California's Sacramento-San Joaquin Delta (SSJD), function to salvage fish, preventing pump-induced mortality at the down-canal Bill Jones Pumping Plant. To promote survival, and return of healthy fish to the SSJD, the Tracy Fish Facility Improvement Program has supported significant research endeavors aimed at optimizing facility fish salvage efficiency. There are a multitude of species salvaged annually at the TFCF. However, delta smelt (*Hypomesus transpacificus*), a pelagic fish endemic to the SSJD, are of great concern as they have experienced precipitous declines in abundance, contributing to historically low population indices and a listing status of endangered under the California Endangered Species Act in 2010 (CDFG 2010).

Though there are a number of factors (e.g., bypass ratio, water velocity) that affect TFCF fish salvage efficiency (Bowen et al. 1998, Sutphin and Bridges 2008), loss of salvageable fish as a result of predation in the TFCF has historically been assumed to be a contributing factor (Orsi 1967, Liston et al. 1994, Fausch 2000). Piscivorous fish are frequently encountered in every major component of the TFCF, including holding tanks, count/haul buckets, and haul trucks (Liston et al. 2004; Figure 1). To combat predation loss, periodic predator removals are completed in the TFCF secondary channel (Sutphin et al. 2014; Figure 1). Though there are current efforts being conducted to identify safe and efficient means to remove predators from the TFCF primary channel, the large water volume and inability to dewater the channel has precluded practicing a consistent predator removal program in this part of the TFCF. The primary channel is the largest (area and volume) component of the TFCF, and, therefore, could potentially support the highest abundance of piscivorous fish, contributing to significant predation loss of salvageable fish. The primary objectives of this small-scale research effort were to evaluate the effectiveness of deploying a gill net in the primary channel to remove piscivorous fish and, using mark-capture methodology, determine if removal of piscivores in the primary effects TFCF salvage efficiency of adult delta smelt.

METHODS

Mark Bowen (former Reclamation Fish Biologist) was the project lead for experimental design and data collection efforts in 2007. All data reported in this document and used for analyses were a result of his coordination efforts with TFCF and Reclamation's Technical Service Center (Denver, CO). Tracy Fish Collection Facility operations, as managed by the Fish Diversion Workers, are conveyed in English units. Therefore, TFCF velocity data will be reported in

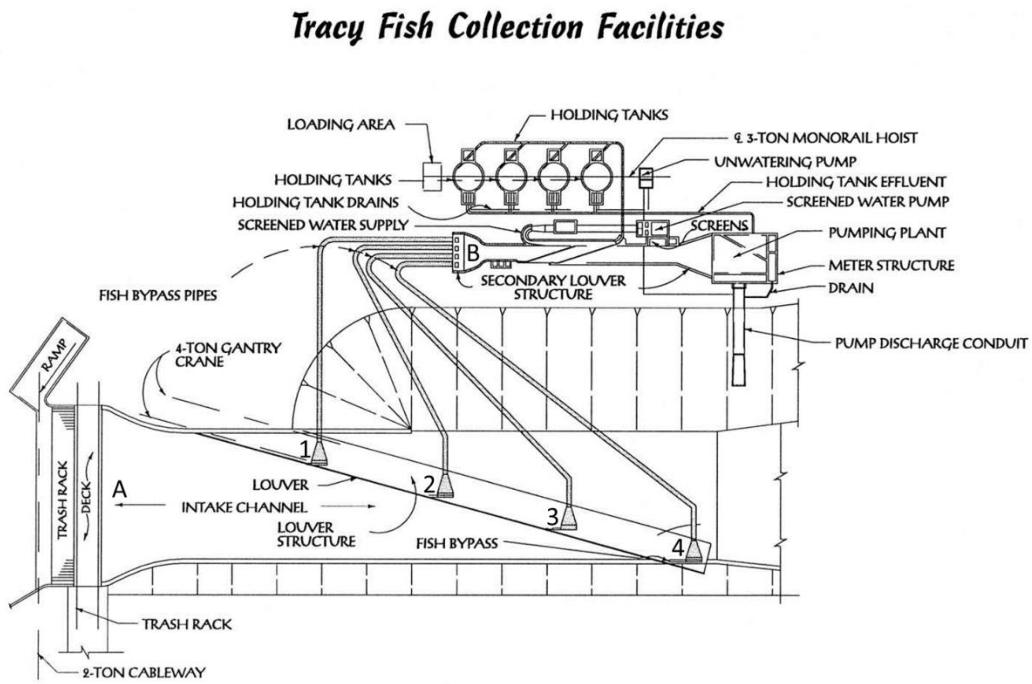

Figure 1.—Schematic of Reclamation's Tracy Fish Collection Facility (Byron, CA) depicting major facility components. Predator removal activities were completed in the Primary Channel (labeled as "Intake Channel"). For mark-capture experiments adult delta smelt were released downstream of the trashrack and primary channel deck ("A"), as well as the most upstream section of the secondary channel ("B"). Primary channel bypasses are labeled as "1", "2", "3", and "4".

English units. All other values will be reported in Metric. Supplementary descriptions of TFCF facility components, not included in this report, are available in Bowen et al. (2004).

Fish Source and Care

Adult delta smelt, cultured and supplied by University of California Davis's Fish Conservation and Culture Lab (Byron, CA), were maintained at Reclamation's Tracy Aquaculture Facility (TAF) in black cylindrical tanks, provided continuous flows of aerated SSJD water, and supplied satiation rations of a commercial fish food (BioKyowa 1000) during holding. Prior to testing, delta smelt were provided an external mark, using a photonic marking gun (Sutphin 2008; New West Technology, Santa Rosa, CA), to permit identification of each unique release group of experimental fish. Following marking procedures, smelt were provided 1–3d recovery before initiation of testing.

Predator Removal

Removal of larger piscivorous fish from the primary channel was completed by repeatedly drifting a gill net (15 m long × 6 m deep, 13.3 cm mesh) with the flow, from just downstream of the trashrack to near the entrance of bypass 3 (Figure 1). It was estimated that approximately 25 - 35% of the total primary channel was sampled during this effort. However, the majority of sampling occurred immediately behind the trashrack. To minimize effects of piscivores residing in the secondary channel on experimental results, predators were removed daily, throughout testing, from the secondary channel following methods described in Sutphin et al. (2014). Gill net mesh size (13.3 cm) was selected to capture larger fish, and permit escapement of smaller fish.

Experimental Procedure

Before predator removal mark-capture experimental replicates were conducted on November 27, and after predator removal replicates were completed November 28 – 30, 2007. Because facility hydraulics can have a significant effect on fish salvage efficiency (Bowen et al. 1998, Sutphin and Bridges 2008), efforts were made to maintain similar primary and secondary velocities, as well as similar primary and secondary bypass ratios, during both before and after replicates so the effects of removing predators from the primary channel could be isolated from these variables. Delta smelt salvage at the TFCF often coincides with salvage of Chinook salmon (CDFG 2007, 2008, 2009). Therefore, facility hydraulics were targeted to meet salmon requirements (primary bypass ratio > 1.0, secondary bypass ratio > 1.0, secondary channel mean velocity 3.0 – 3.5 ft/s; Sutphin and Bridges 2008).

For each experimental replicate, two uniquely marked groups of fish were released: 75 adult smelt were released immediately downstream of the trashrack at the most upstream end of the primary channel (location A on Figure 1), and 20 were released at the most accessible upstream end of the secondary channel (location B on Figure 1). For all replicate releases of smelt, a uniquely designed dip-net was used to permit water-to-water transfer from TAF tanks to a black 19-L bucket, after which fish were transported (< 100 m), lowered to the water surface, and gently poured from the bucket into each channel. Test fish were recovered from the holding tank or behind the secondary louver array every 20 min during an hour long experimental period. Delta smelt were recovered from holding tanks using standard TFCF holding tank sampling methodology (see Sutphin et al. 2007), and were deemed fish that were successfully salvaged. Fish were recovered downstream of the secondary louver array using a sieve net (2-mm mesh; 2.4 × 2.8 m opening), and were deemed fish that passed through the secondary louvers and were not successfully louvered (salvaged). Following capture, all hatchery-reared delta smelt were enumerated and measured for fork length (mm). Water quality data was recorded semi-continuously (every 30 min) throughout data collection using a YSI multi-probe (YSI Inc., Yellow Springs, OH) installed upstream of the trashrack on the north side of the primary channel, and these values are reported in Appendix 1.

To confirm the holding tank screen and bucket were functioning properly, and fish loss was not significant at this location, 10 uniquely marked smelt were inserted directly into the holding tank during each replicate. If $\geq$ 80% of these fish were not retained during collection, all data for that particular replicate was deemed invalid and not included in analyses.

Hydraulic Calculations

Hydraulic parameters were calculated from data collected at the TFCF during the test period. Preferably, hydraulic data was directly recorded from facility instrumentation. Due to equipment failure or calibration issues, there were occasions when hydraulic data needed to be estimated.

Water depths in the primary and secondary channels were measured with permanent ultrasonic water level sensors. Primary channel velocity was measured with a ChannelMaster H-ADCP model acoustic Doppler current profiler (ADCP) installed in the primary channel (Teledyne RD Instruments, Inc., San Diego, California). When the primary channel flow meter was not operational, the primary channel velocity was estimated. The pumping rate from the Harvey O. Banks Pumping Plant was obtained and the primary average channel velocity at the TFCF was estimated by dividing the pumping plant flow rate by the cross-sectional area of the channel (measured primary channel depth × primary channel width).

Secondary channel velocity was measured with a ChannelMaster H-ADCP installed in the secondary channel (Teledyne RD Instruments, Inc., San Diego, California). When the secondary channel flow meter was not operational, the secondary channel velocity was estimated. The secondary channel flow rate is controlled by a bank of low head velocity control (VC) pumps positioned at the downstream end of the secondary screening facility. The secondary channel discharge was estimated from VC pump ratings when the flow meter was not available. The secondary average channel velocity was calculated as the secondary channel discharge divided by the cross-sectional area of the secondary channel (measured secondary channel depth x secondary channel width).

The primary bypass ratio is defined as the ratio of primary bypass velocity (velocity at the entrance of the bypass) to the primary average channel velocity. The primary bypass intake velocity is calculated as the bypass flow (estimated as the secondary channel discharge) divided by the cross sectional area of the bypass (measured primary channel depth × bypass width). The primary bypass ratio must be greater than 1.0 to achieve facility criteria (Table 1; California State Water Resources Control Board 1978).

The secondary bypass ratio is the ratio of the secondary bypass velocity to the secondary average channel velocity. The secondary bypass intake velocity is calculated as the bypass flow (discharge in bypass line flowing to the holding tanks) divided by the cross sectional area of the bypass (measured secondary channel depth x bypass width).

TFCF Efficiency and Participation Calculations

Whole Facility Efficiency (WFE)

Whole facility efficiency quantifies the percent of fish released at the head of the primary channel that are ultimately captured in a holding tank. Fate of fish that do not make it to the holding tank can include: lost to predation, lost through primary or secondary louvers, swam out of the TFCF through the trashrack, or stayed in the TFCF during the experimental period.

$$\text{WFE} = (H/I_P) \times 100 \qquad \textbf{Eq. (1)}$$

H = Number of fish recovered from a holding tank
I_P = Number of fish released into the primary channel

Primary Louver Efficiency (PLE)

Primary louver efficiency quantifies the percentage of fish released in the primary channel that make it to the secondary channel.

$$\text{PLE} = ((H + S)/I_P) \times 100 \qquad \textbf{Eq. (2)}$$

S = Number of fish recovered in the sieve net

Secondary Louver Efficiency (SLE)

Secondary louver efficiency quantifies the percent of fish released at the most upstream section of the secondary channel that move downstream through the secondary channel that are ultimately captured in a holding tank. This value estimates how well the secondary louvers are functioning. Fish holding in the secondary channel or lost to predation are removed from the SLE because these fish did not have a chance to participate in the test. Secondary louver efficiency can also be estimated for fish released in the primary channel. The majority of this report references SLE with regards to secondary released fish. However, SLE of primary released fish is included in Appendix 2 for comparison.

$$SLE = (H/(H + S)) \times 100 \qquad \textbf{Eq. (3)}$$

Secondary Louver Participation (SLP)

The secondary louver participation calculation provides a measure of how many fish participated in the test, thereby providing the level of precision available in the SLE measurement. In addition, this measurement indicates how channel velocity influences the number of fish guided downstream after release. Since the secondary channel is a closed system, it can be assumed the percentage of fish not captured in the holding tank or sieve net were either lost to predation or took up residency in the secondary channel.

$$SLP = ((H + S)/I_s) \times 100 \qquad \textbf{Eq. (4)}$$

Is = Number of fish inserted into most upstream section of secondary channel

Secondary sieve net efficiency was not tested, but assumed to be 100% for calculations.

Statistical Analyses

The majority of data did not meet the assumptions (normality and/or equal variance) to model using parametric statistics. Therefore, non-parametric alternatives were employed. Differences in fish fork length, and facility hydraulics (primary velocity, secondary velocity, primary bypass ratio, and secondary bypass ratio) as a function treatment condition (before vs. after predator removal) was evaluated using a Mann-Whitney Rank Sum Test. Similarly, effects of the primary channel predator removal on WFE, PLE, and SLE were evaluated using a Mann-Whitney Rank Sum Test. After results on effects of predator removal were determined, a post-hoc analysis on effects of diel period (day vs. night) on WFE, PLE and SLE, averaged over treatment (before / after predator removal), using a Mann-Whitney Rank Sum Test was completed. Statistical analyses were conducted using SigmaStat 3.5 software (Systat Software Inc., Richmond, California); the significance level (α) for all analyses was set at 0.05.

RESULTS AND DISCUSSION

Piscivorous fish removed during daily secondary channel predator removal efforts are summarized in Appendix 1. Fork length (mean ± standard deviation) of delta smelt before (60.7 ± 8.0 mm) and after (59.3 ± 8.6 mm) primary predator removals were not significantly different (Mann-Whitney Rank Sum Test, P = 0.122). Hydraulic conditions during testing were maintained within a small range, and before (B) and after (A) levels for primary velocity (B = 2.51 ± 0.20 ft/s, A = 2.46 ± 0.08 ft/s, P = 0.85), secondary velocity (B = 2.89 ± 0.22 ft/s, A = 3.02 ± 0.09 ft/s, P = 0.15), primary bypass ratio (B = 1.56 ± 0.09 , A = 1.51 ± 0.09, P = 0.19), and secondary bypass ratio (B = 1.41 ± 0.12, A = 1.43 ± 0.12, P = 0.89) were not significantly different (Mann-Whitney Rank Sum Test). When averaged across treatment condition (before / after predator removal) diel period (day vs. night) had a significant effect on PLE (Mann-Whitney Rank Sum Test, P = 0.04), but not SLE (P = 0.81) or WFE (P = 0.30). Environmental and hydraulic conditions during testing are summarized in Table 1, and further detailed in Appendix 2.

During predator removals in the primary channel, the gill net was fished across twelve unique drifts, ranging in time from 1 to 19 min, between 07:35 and 10:56a, for a total sampling time of 76 minutes. This effort resulted in removal of 35 striped bass (mean FL = 60.3 cm, mean weight = 3.8 kg) totaling 130.9 kg. Because of the small area sampled, the inconsistency with netting efforts, and because the primary channel louvers were cleaned daily during testing, this technique did not prevent immigration of new piscivores into the primary channel and it was not demonstrated that the majority of predators were removed. Removing 35 large piscivorous striped bass from the primary channel had no significant effect on TFCF PLE (P = 0.92), SLE (P = 0.59) or WFE (P = 0.54) of adult delta smelt (Mann-Whitney Rank Sum Test, Figure 2). Mean delta smelt SLP before and after primary channel predator removals were 94% and 93%, respectively. Elevated SLP, and no difference in SLE before or after primary channel predator removal, was expected because piscivores were removed from the secondary channel prior to all replicate releases, and secondary velocities > 3 ft/s likely restricted most experimental fish from residing in the secondary channel for extended periods.

In contrast to the results observed in the current study, Bridges et al. (In Draft) observed a significant improvement in TFCF WFE of both delta smelt and juvenile Chinook salmon (*Oncorhynchus tshawytscha*) following removal of predators from the primary channel. Caloric needs, or food demand, for fish is a function of metabolic rate, which tends to increase with temperature (Moyle and Cech 2004). Our experimental temperatures were well below the thermal preference of striped bass (Coutant and Carroll 1980, Coutant et al. 1984), which could have contributed to reduced predation rates during data collection. However, Bridges et al. (*In Draft*) conducted their experiments in December

Table 1.—Test dates, sample size, mean (± standard deviation) environmental and hydraulic conditions during evaluation of delta smelt (*Hypomesus transpacificus*) salvage efficiency before and after removal of 35 large (mean fork length = 60.3 cm) striped bass from the Tracy Fish Collection Facility (Byron, CA) primary channel. Water quality was summarized from data collected hourly, across the entire duration of testing, from a permanent water quality monitoring station (see Craft et al. 2004 for details). Water quality recorded during each experimental replicate is reported in Appendix A.

Treatment Condition	Dates	Sample Size (Day / Night)	Temperature (°C)	Turbidity (NTU)	Primary Channel Velocity (ft/s)	Secondary Channel Velocity (ft/s)	Primary Bypass Ratio	Secondary Bypass Ratio
Before	11/27	6 (3/3)	11.9 ± 0.6	8.0 ± 3.5	2.51 ± 0.20	2.89 ± 0.22	1.56 ± 0.09	1.41 ± 0.12
After	11/28 – 11/30	12 (9/3)	11.5 ± 0.6	7.2 ± 4.3	2.46 ± 0.08	3.02 ± 0.09	1.51 ± 0.09	1.43 ± 0.12

when water temperatures were less than those reported in the current report (8.1 °C). Therefore, it is more likely the WFE improvements observed by Bridges et al. (*In Draft*) were a result of differences in sampling methodology/success, facility hydraulic conditions, and amount of additional prey, outside of experimental fish, available to piscivores in the primary channel.

Bridges et al. (*In Draft*) were able to remove more piscivorous fish (67 total), 65 of which were large (218 – 739 mm FL) striped bass, from the primary channel, their results indicate they removed the majority of the piscivores from the primary channel, and large fish were not permitted to immigrate into the primary channel during their testing period. Adult striped bass are highly piscivorous, with a significant amount of their diet consisting of smaller fish (Stevens 1966, Thomas 1967). Therefore, if the majority of adult striped bass can be removed from, and kept out of, the primary channel, improvements in PLE and WFE should be expected. Results from the current study do not provide an estimate of the proportion of piscivores removed from the primary channel, and daily cleaning of the facility primary louvers could have allowed immigration of fish into the channel. Therefore, it is possible there was still an abundance of predators residing in the primary channel following our predator removals, and removal of 35 adult striped bass was only a small portion of the total abundance of piscivores in the channel.

Primary and secondary velocities during data collection efforts by Bridges et al. (*In Draft*; primary velocity range = 0.73 – 0.91 ft/s, secondary velocity range = 2.40 – 2.59 ft/s) were lower than those recorded in the current study. It is probable elevated water velocities provide favorable conditions that promote movement of fish through the TFCF more rapidly, reducing exposure time to piscivores, and limiting predation, which contributed to no significant differences in facility efficiency rates before and after predation in the current study. As mentioned previously, it is also likely that the number prey available to piscivores in the primary channel could have had an effect on our results. Daily fish salvage (i.e., available prey) before (Nov 27 = 5274 fish) and after (Nov 28 = 3911, Nov 29 = 6540, Nov 30 = 33912) predator removals in the current study were comparable to typical 2007 salvage rates (2007 mean = 8667, range = 84 – 246348), and the ratio of prey salvaged:predators removed over the course of the study was > 100:1. Bridges et al. (*In Draft*) reported a ratio of 7:1 during delta smelt efficiency experiments, indicating a much smaller number of fish were salvaged over the course of their study. The more prey available, the more likely fish are already satiated and not eager to consume prey, and the less likely the small groups of fish we released would have been targeted for consumption.

Results reported in the current study, along with those reported by Bridges et al. (*In Draft*), suggest the proportion of predators removed, facility hydraulic conditions, and the amount of prey available likely impact the success of primary channel predator removals on TFCF delta smelt salvage efficiency. The current report summarizes a small data set covering a small range of facility hydraulic conditions. Future efforts aimed at minimizing effects of piscivores in the TFCF primary channel on fish salvage and salvage efficiency should ensure the technique employed removes the large majority of piscivores, and immigration of piscivores into the channel is not possible. Given the inability to sample the majority of the primary channel, and difficulties incurred getting the nets to fish adequately, as a result of elevated water velocities in the current study, piscivore removal efforts using the described technique would likely be optimized if employed during lower water velocities as was done by Bridges et al. (*In Draft*).

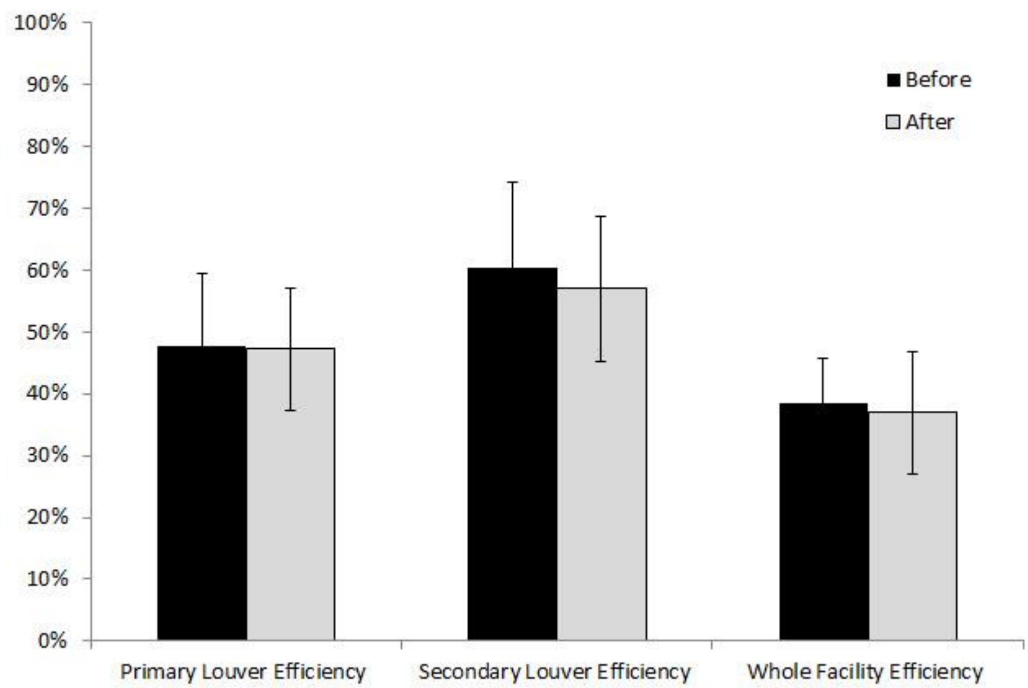

Figure 2.—Mean (± standard deviation) primary louver efficiency, secondary louver efficiency, and whole facility efficiency of adult delta smelt (*Hypomesus transpacificus*) before (black bars, n = 6) and after (grey bars, n = 12) removal of 35 large (mean fork length = 60.3 cm) striped bass from the primary channel. There was no significant difference in any facility efficiency values before or after striped bass removal (Mann-Whitney Rank Sum Test, $P > 0.05$).

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APPENDIX 1

Secondary Channel Predator Removal Data Collected During Testing

Table A1-1.—Total number, weight (kg), and size range (mm) of piscivorous fish removed from the Tracy Fish Collection Facility Secondary Channel during each day of testing

Date	Species Removed	# Removed	Total Weight (kg)	Length Range (mm)
11/27/2007	Striped Bass	2	2.8	168 – 358
	White Catfish	2	0.8	100 – 185
	Channel Catfish	2	0.2	77 – 203
	Largemouth Bass	1	0.1	128
11/28/2007	Striped Bass	4	16.3	175 – 740
	White Catfish	5	1.1	70 – 259
	Channel Catfish	2	0.4	177 – 195
11/29/2007	Striped Bass	2	11.9	230 – 690
	White Catfish	2	< 0.1	235 – 390
	Channel Catfish	1	1.3	135
11/30/2007	Striped Bass	9	7.4	182 – 499
	White Catfish	3	0.6	180 – 255

APPENDIX 2

Experimental Conditions Before and After Removal of Striped Bass from the Primary Channel

Table A2-1.—Date, time, primary and secondary channel depths (upstream locations), experimental and hydraulic conditions (primary bypass ratio = PBR, secondary bypass ratio = SBR), and subsequent primary channel (PLE), secondary channel (SLE), and whole facility efficiencies (WFE) for adult delta smelt (*Hypomesus transpacificus*) before and after removal of 35 large (mean fork length = 60.3 cm) striped bass from the Tracy Fish Collection Facility (Byron, CA) primary channel. Water temperature is reported in degrees Celsius (°C) and turbidity is reported as NTU. For ease of comparison, replicates completed after the primary channel predator removal are shaded in grey.

Month	Day	Time	Temp (°C)	NTU	Primary Channel Depth (ft)	Secondary Channel Depth (ft)	Day (D) / Night (N)	Before (B) / After (A) Predator Removal	Primary Velocity (ft/s)	Secondary Velocity (ft/s)	PBR	SBR	PLE	Secondary Efficiency (SLE) Secondary Released Fish	Secondary Efficiency (SLE) Primary Released Fish	WFE
Nov	27	12:42	12.4	6.7	NA	NA	D	B	2.47	3.07	1.50	1.43	0.59	0.79	0.89	0.52
Nov	27	13:03	12.5	6.5	NA	NA	D	B	2.5	3.07	1.49	1.56	0.49	0.41	0.76	0.37
Nov	27	13:24	12.5	4.8	NA	NA	D	B	2.51	3.03	1.45	1.53	0.64	0.65	0.60	0.39
Nov	27	18:05	12.4	8.0	19.27	6.51	N	B	2.38	2.53	1.63	1.31	0.40	0.65	0.83	0.33
Nov	27	18:25	12.3	6.5	19.14	6.4	N	B	2.89	2.89	1.66	1.27	0.36	0.65	0.89	0.32
Nov	27	18:46	12.4	6.1	19.31	6.57	N	B	2.32	2.75	1.64	1.36	0.39	0.47	0.97	0.37
Nov	28	15:21	11.3	4.7	17.54	5.1	D	A	2.53	3.08	1.42	1.43	0.45	0.50	0.71	0.32
Nov	28	15:42	11.5	4.7	17.59	5.15	D	A	2.52	3.11	1.44	1.42	0.55	0.67	0.63	0.35
Nov	28	16:01	11.6	5.2	17.89	5.25	D	A	2.51	3.04	1.44	1.42	0.56	0.40	0.67	0.37
Nov	28	19:37	12.1	6.0	18.97	6.19	N	A	2.36	2.93	1.62	1.36	0.43	0.60	0.84	0.36
Nov	28	19:56	12.1	5.0	19.09	6.34	N	A	2.33	2.85	1.64	1.26	0.39	0.53	0.83	0.32
Nov	28	20:17	12.1	4.7	19.2	6.42	N	A	2.33	2.86	1.64	1.26	0.48	0.52	0.78	0.37
Nov	29	12:39	12.0	4.3	17.42	5.14	D	A	2.53	3.05	1.42	1.51	0.28	0.62	0.81	0.23
Nov	29	13:00	11.9	4.9	17.41	5.12	D	A	2.53	3.05	1.42	1.62	0.47	0.72	0.77	0.36
Nov	29	13:21	12.1	4.7	17.49	5.17	D	A	2.52	3.09	1.45	1.63	0.37	0.47	0.68	0.25
Nov	30	13:56	11.8	7.4	18.43	5.82	D	A	2.42	3.00	1.56	1.38	0.65	0.78	0.92	0.60
Nov	30	14:18	11.9	4.4	18.39	5.7	D	A	2.43	3.09	1.58	1.41	0.52	0.42	0.79	0.41
Nov	30	14:41	11.9	4.4	18.32	5.65	D	A	2.46	3.08	1.54	1.45	0.52	0.61	0.92	0.48