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February 23, 2010

Ms. Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street, N.E.  
Washington, DC 20426

Re: The City of Holyoke Gas & Electric Department  
Holyoke Project, FERC Project No. 2004  
2009 Monitoring Report of Upstream Fish Passage, and  
Notice of Upstream Fish Passage Construction Activities Planned for 2010

Dear Ms. Bose:

The City of Holyoke Gas & Electric Department (HG&E) hereby submits its 2009 Monitoring Report of Upstream Fish Passage at the Holyoke Project and its notice of upstream fish passage construction activities planned for 2010. Specific as to this notice, HG&E hereby reports the construction activities relating to upstream fish passage facilities that are planned for 2010. This notice fulfills the annual reporting requirement under License Article 414 as to such construction plans for 2010.

The enclosed Monitoring Report of Upstream Fish Passage for 2009 is being submitted pursuant to License Article 411(d) [111 FERC ¶ 61,106 (April 19, 2005)]. On December 10, 2009, HG&E distributed a draft of this report to the Federal and State resource agencies and other stakeholders including: U.S. Fish and Wildlife Service; U.S. Department of Commerce, National Oceanic and Atmospheric Administration's National Marine Fisheries Service; Massachusetts Department of Environmental Protection; Massachusetts Division of Fisheries and Wildlife; Trout Unlimited; and the Connecticut River Watershed Council. Documentation of consultation with those agencies and stakeholders on the Report is included in Appendices B and C.

If there are any questions concerning these matters, please contact me at (413) 536-9453.

Sincerely,

Richard F. Murray Jr.  
Hydro Electric Engineer

Enclosure

Ms. Kimberly D. Bose, FERC Secretary  
FERC Project No. 2004

February 23, 2009  
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cc: John Warner, USFWS (w/ encl.)  
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MONITORING REPORT:  
UPSTREAM FISH PASSAGE AT HG&E'S HOLYOKE DAM  
FISHWAY, SPRING AND FALL, 2009

February 2010

FINAL REPORT

MONITORING REPORT:  
UPSTREAM FISH PASSAGE AT HG&E'S HOLYOKE DAM  
FISHWAY, SPRING AND FALL, 2009

Prepared for

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*Normandeau Project Number 21528.000*

February 2010

## EXECUTIVE SUMMARY

Upstream fish passage activities were conducted for the Holyoke Project (FERC Project No. 2004) at Holyoke Dam, Holyoke, MA from April 14 through July 24, 2009, and weekdays September 15 through November 15, 2009 (except September 21 - 25 when fishway attraction flows were not available due to a scheduled maintenance outage of the Holyoke Canal System), pursuant to Holyoke Gas & Electric Department's (HG&E) updated Upstream Passage Evaluation and Monitoring Plan [approved by the Federal Energy Regulatory Commission (FERC); order issued May 19, 2006 (115 FERC ¶ 62,204), Updated Plan]. The Updated Plan was submitted on December 29, 2004, and supplemented on March 17, 2006, pursuant to the comprehensive Settlement Agreement [filed in 2004 and approved by FERC in April 2005 (111 FERC ¶ 61,106) which revised the License Articles applicable to the Project (2005 License Articles)] and pursuant to the Upstream Fish Passage Plan [filed in September 2005 as required by 2005 License Article 411(a), and approved by order issued September 7, 2006 (116 FERC ¶ 62,193)]. Per Section 4.6 (d)(2)(C) of the Settlement Agreement [2005 License Article 411(c)(4)] and amended article 411 (c) and (d)] HG&E filed its final cumulative results report for studies of effectiveness of the upstream passage facilities with FERC on February 27, 2009 with the concurrence of the Cooperative Consultation Team (CCT). The report was accepted by FERC by letter dated June 11, 2009.

The report contained herein fulfills the annual reporting requirements for upstream fish passage monitoring activities in 2009 and plans for 2010 activities per Section 5.5 of the Updated Plan, that incorporated the requirements of Section 4.6(e) of the Settlement Agreement [2005 License Article 411(d)] and Condition 15 of the WQC for submittal of annual reports of the previous year's activities relative to the operation of the upstream passage facilities including the number of fish lifted relative to the target design populations for upstream fish passage as described in Condition 12 of the WQC and plans for next year's activities.

Specific objectives of the approved Updated Plan were addressed in 2009; these included:

- Monitoring upstream fish passage, spring:
  - 160,669 American shad, 18,996 sea lamprey, 671 striped bass, 68 gizzard shad, 61 Atlantic salmon, and 40 blueback herring were passed or collected in the upstream fishways in 2009.
  - 603 fish of 21 resident species (including American eel) were counted and passed upstream.
- Monitoring upstream fish passage for Atlantic Salmon and shortnose sturgeon, fall:
  - Fall 2009 passage operations done from September 15 – November 15 did not result in any Atlantic salmon or shortnose sturgeon collections.
- Shortnose sturgeon monitoring and handling:
  - No shortnose sturgeon were recorded using the fish passage facilities in spring/summer 2009. The handling and reporting protocol for shortnose sturgeon was maintained pursuant to the Shortnose Sturgeon Handling Plan as required under 2005 License Article 416(d). Daily observations for stranded shortnose sturgeon on the spillway apron yielded no occurrences of stranding on the apron, but a dead shortnose sturgeon was found on an emergent rock shelf just downstream of the spillway fish lift entrance on August 20. After examination, it was determined that there were no wounds consistent with downstream passage related collision. Additionally, bypass reach water surface level had been consistent within the prior 24 h, the period when the fish was believed to have been stranded (M. Keiffer, Conte Anadromous Fish Research, Laboratory, USGS) suggesting that stranding as a result of rapidly receding water surface elevation was not likely

- Fish trapping, sampling, and handling
  - The trap-and-haul facility continued to function well, providing over 4,000 American shad and 38 sea lamprey to state and federal agencies in 21 days of use.
  - Biological samples, including scale samples for aging analysis and samples for a UFSWS fish health survey were collected from 571 American shad.
  - Sixty one adult Atlantic salmon were collected during the 2009 spring passage season. Ten fish were tagged with a radio-transmitter and passive integrated transmitter (PIT tag) and released upstream of the project, and the remainder were transferred to the United States Fish and Wildlife Service (USFWS) for hatchery spawning.
- Monitoring of water surface elevations, attraction water volume, and gate settings pertinent to fish passage:
  - Water surface elevations, gate positions, and flows relevant to fishway entrances and approaches to entrances were monitored either by manual observation or electronic data recording via the Supervisory Control and Data Acquisition (SCADA) system.
  - Water surface elevations in the spillway (bypass reach) as measured at the Texon gauge were maintained at or above the requisite 62.85 ft (+/- 0.1 ft) National Geodetic Vertical Datum (NGVD) throughout the fish passage season as the zone-of-passage (ZOP) flow. Higher bypass reach elevations resulted from flood discharges, including modifications of run-of-river operations pursuant to 2005 License Article 405 (b)-(c).

Pursuant to 2005 License Article 411(d) and WQC Condition 15, HG&E will monitor fish passage and provide a report to the CCT by December 31, 2010, and December 31 in each subsequent year.

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## ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

°C	Degree Celsius
Bascule Gate	Hinged crest spill gate situated between the powerhouse and spillway rubber dams
B.O.	Biological Opinion
bypass reach	Holyoke Dam spillway to the confluence with the powerhouse tailrace canal
CCT	Cooperative Consultation Team
cfs	Cubic foot per second
FERC	Federal Energy Regulatory Commission
HG&E	City of Holyoke Gas and Electric Company
MADEP	Massachusetts Department of Environmental Protection
MW	Megawatt
NGVD	National Geodetic Vertical Datum
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
RD5	Rubber Dam Section Number 5
SCADA	Supervisory Control and Data Acquisition
SD	Standard deviation
SE	Standard error
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WQC	Water Quality Certification
WSE	Water Surface Elevation
ZOP	Spillway zone-of-passage

## **1.0 INTRODUCTION, PROJECT DESCRIPTION, AND METHODS**

### **1.1 License Requirements**

On December 28, 2004, the City of Holyoke Gas & Electric Department (HG&E) filed its Upstream Passage Evaluation and Monitoring Plan (Plan) for the Holyoke Project (FERC Project No. 2004) with the Federal Energy Regulatory Commission (FERC), and with the Massachusetts Department of Environmental Protection (MADEP). The Plan was submitted pursuant to Section 4.6(d) of the comprehensive Settlement Agreement [approved (111 FERC ¶ 61,106), 2005 License], 2005 License Article 411(c), and Condition 14 of the Water Quality Certification (WQC). On March 17, 2006 HG&E filed its Updated Upstream Passage Evaluation and Monitoring Plan (Updated Plan) with the FERC. The Updated Plan included enhancements requested by the Federal and state natural resource agencies and stakeholders (the Cooperative Consultation Team, CCT) and was approved by FERC order dated May 19, 2006 (115 FERC ¶ 62,204).

Per Section 4.6 (d)(2)(C) of the Settlement Agreement [2005 License Article 411(c)(4)] and amended article 411 (c) and (d)] HG&E filed it's final cumulative results report for studies of effectiveness of the upstream passage facilities with FERC on February 27, 2009, and the report was accepted by FERC by letter dated June 11, 2009.

Section 5.5 of the Updated Plan incorporates the requirements of Section 4.6(e) of the Settlement Agreement [2005 License Article 411(d)] and Condition 15 of the WQC, which require submittal of annual reports of the previous year's activities relative to the operation of the upstream passage facilities including the number of fish lifted relative to the target design populations for upstream fish passage as described in Condition 12 of the WQC and plans for next year's activities to the parties to the Settlement Agreement by December 31, and filing with FERC by February 28 each year. Reporting contained herein fulfills the annual reporting requirements for 2009 upstream fish passage monitoring activities and plans for 2010 activities.

### **1.2 Study Site**

The 42.9 megawatt (MW) Holyoke Hydroelectric Project (FERC No. 2004) is located on the Connecticut River at river mile 86 in Hampden and Hampshire counties, Massachusetts. The drainage area at Holyoke Dam is about 8,309 square miles. The main facilities of the Project are located in the City of Holyoke and the Town of South Hadley.

The Project consists of a 30-ft-high, 985-ft-long dam topped by five 3.5-ft-high inflatable rubber dam sections. A 25 ft wide Bascule Gate (Figure 1-1) is located at the southwest end of the dam between the spillway and the intake for the Hadley Falls Station. The Project impounds a 2,290-acre reservoir with a normal maximum surface elevation of 100.6 ft, National Geodetic Vertical Datum (NGVD). A three-level canal system extends through the lower areas of the City of Holyoke and provides water for industrial and hydropower generation. The Project includes six hydroelectric generation stations (five in the canal system and one at the dam) as well as upstream and downstream fish passage facilities.

The upstream fish passage facilities at the Hadley Falls station consist of two fish lifts; one fish lift serves the Hadley Falls Station tailrace (tailrace fish lift) and has a lift capacity of up to 33 cubic feet per minute. A second fish lift serves the Project's bypass reach (spillway fish lift) and has a lift capacity of 46 cubic feet per minute. Each fish lift consists of (1) an entrance, (2) a crowding basin, (3) a lift bucket, and (4) a lift elevator (Figures 1-2, 1-3). An attraction water system draws water from the First Level Canal and serves both fish lifts, distributing up to 200 cfs to the spillway fish lift entrance and 120 cfs at each of two tailrace fish lift entrances. The two fish lifts discharge into a common exit flume. A fish counting room is located between the fish lifts and the flume exit upstream of the Hadley Falls Station intake (Figure 1-4).

## **2.0 MONITORING METHODS**

### **2.1 Annual Fish Passage Counts**

Fish lift operations commenced on April 14 and continued daily except that no operations were done April 18 – 21, an early season period prior to any fish passage. Operations continued through July 24, except that no operations were done during the late season weekend of July 18 – 19. Operations continued per request of the CCT for an additional week beyond the protocol closing date, July 15, because an Atlantic salmon was collected on July 15, invoking a season extension. Fish lift personnel counted the number of each species that passed the project hourly. Additionally, a relative index of fullness of the fish lift hoppers, as described in the Updated Plan (see Appendix A, Table A-1) was used to qualify the amount of fish lifted in each operation on a scale of 0 - 5. In the fullness index, 0 = no fish lifted and 5 is representative of a heavy run period. Most lifts were indexed in real-time, but digital video recordings of lift hoppers were archived as well and those were used when real-time indexing was not possible.

Daily operations protocol included guidelines to invoke extension of the fish passage operations day during heavy run periods. When American shad in the last scheduled hourly counts were 750 or greater, fish lift hopper fullness was indexed (see Appendix 1, Table A-1) at 4 for either lift in the last operations, and lift frequency was 20 min or greater operations continued for an additional hour. If fullness was indexed at 5 for either lift in the last operations, lift frequency was increased, as appropriate, and lifting continued for an additional hour. At the end of any additional hour of lifting, the same assessment criteria were applied.

Fish lift operations were also conducted for fall run Atlantic salmon four times per day (0900 h, 1100 h, 1300 h and 1500 h) five days per week (Monday – Friday) from September 15 through November 13. Fall operations were not done from September 21 – 25 when attraction water was not available during a scheduled maintenance outage of the Holyoke Canal system. For fall operations the fish lifts were operated normally, but the buckets were lifted to the trap-and-transport level and were not raised to the exit flume level. Fish lift operators then inspected the buckets for Atlantic salmon and shortnose sturgeon. If either species were present, they were removed to the trap-and-transport tanks. The bucket was then reset to the fishing position for the next operation cycle. After the last lift of the day, the tailrace bucket was secured in the elevated position rather than in the fishing position so that an eel ramp could be set overnight for upstream eel passage monitoring.

### **2.2 Physical and Mechanical Data**

Water surface elevations (WSE), including those recorded for the Texon gauge in the bypass reach, operations of the Hadley Falls Station turbines, and rubber dam positions were recorded by the SCADA system. Total river discharge data were obtained from the USGS gauge: 01172010 at the I391 Bridge just downstream of the Project. Water temperature was recorded hourly during the fish passage operational day by fish passage monitors. Attraction water supply and distribution gate settings, Bascule Gate, and salmon gate settings were recorded routinely by fish passage monitors.

### **2.3 Fish Trapping Facilities**

The trap-and-haul and trap-gate fish trapping facilities were used to collect adult Atlantic salmon for restoration program brood-stock (Figure 1-4), to take biological samples of adult American shad, to trap shortnose sturgeon as needed, and to trap fish for research purposes.

### **2.4 Shortnose Sturgeon**

Attachment 3 of the Updated Plan, “Shortnose Sturgeon Handling Plan for Holyoke Dam” (Handling Plan) was maintained in the counting room for use by fish lift personnel. The bypass reach was monitored for the potential stranding of shortnose sturgeon.

### **3.0 2009 RESULTS**

#### **3.1 Annual Fish Passage**

##### **3.1.1 Anadromous Fish Passage**

Fish lift operations for 2009 commenced on April 14. The first anadromous fish, a blueback herring, was passed on April 22, and the first American shad was passed on April 23. Operations continued daily every other hour from 0900 – 1500 h through May 5 when the cumulative American shad passage reached 1,370. Beginning May 6 operations were done at least hourly from 0900 – 1700 h. Beginning May 15 the operational day was extended to 0800 – 1800 h. Operations were continued through 1900 h on May 20, 22, and 23 and through 2000 h on May 21 when the extended operations protocol was invoked.

During the 2009 anadromous fish passage season 160,669 American shad, 18,996 sea lamprey, 671 striped bass, 68 gizzard shad, 61 Atlantic salmon, and 40 blueback herring were collected or passed upstream. American shad passage was similar to that of the previous three years, remaining below the long-term (1975 – 2009) mean of 295,683 (Table 3-1, Figure 3-1). Atlantic salmon collections were the lowest since 2004, falling well below the long-term mean of 160. Blueback herring passage was again negligible with only 40 fish passed (long term mean = 167,983). Appendix A (Table A-2) contains a listing of common and taxonomic names of all species observed during 2009 fish passage monitoring.

Hourly passage counts of American shad were distributed throughout the day with highest hourly mean passage occurring between 1400 – 1800 h (Table 3-2, Figure 3-2). Note that the high mean passage calculated for 1900 h was biased because limited operations in that time period were done only on specific dates when passage remained high in the evening and the protocol to extend the passage day was invoked. Additionally, the high mean count for 1800 h is somewhat biased as well because the last count cycles typically occurred during that hour. More time and effort were expended during the last count cycle to clear all remaining fish from the exit flume. Substantial American shad passage (2,542) first occurred on May 6 when mean water temperature was 13.6° C. During the period of active American shad passage (encompassing the entire time period when daily passage was greater than 1% of the seasonal total), May 6 – June 13, mean water temperature ranged from 13.6 – 19.3° C and 94% of American shad passage occurred. During the period of peak passage (encompassing the time period when daily passage was greater than 4% of the seasonal total), May 15 – May 24, water temperature ranged from 14.5 – 17.9° C and 54% of American shad passage occurred (Table 3-3, Figure 3-3). Appendix A (Table A-3) includes hourly American shad count data.

##### **3.1.2 Resident Species Upstream Passage**

From April 14 – July 24, 603 fish of 21 species (including American eel) were counted and passed upstream (Table 3-4). The most common species were smallmouth bass (50% of resident fish count), American eel (14%), white sucker (12%), walleye (6%), and channel catfish (3%). Refer to Appendix A (Table A-2) of this report for taxonomic names of fish counted.

##### **3.1.3 Fall Atlantic Salmon Collection Operations**

During fall fish lift operations, no Atlantic salmon and no shortnose sturgeon were collected.

#### **3.2 Physical and Mechanical Data**

Appendix A contains tabular physical and mechanical data recordings. Table A-4 contains daily observations of Salmon Gate settings, Bascule Gate settings, attraction flow volume, and attraction flow distribution gate settings. Table A-5 contains hourly rubber dam positions. Table A-6 contains daily average water surface elevations. Table A-7 contains daily mean Hadley Falls Station generation data and total river discharge.

### **3.3 Fish Trapping Facilities**

#### Summary of trap usage

The exit flume traps were used to collect 61 Atlantic salmon for hatchery broodstock collection and radio telemetry tagging and 571 American shad for population dynamics sampling (scale samples) and USFWS fish health survey samples. Salmon trapping protocols were adhered to throughout. Ten of the trapped Atlantic salmon were tagged with radio transmitters and released upstream of the project as part of a TransCanada Deerfield River Project license requirement (Normandeau Associates, in preparation), the remainder were transferred to the United States Fish and Wildlife Service (USFWS) Cronin Fish Hatchery for spawning. Atlantic salmon biological data are available from USFWS. The trap-and-haul facility was used to collect 4,794 American shad and 38 sea lamprey. American shad were trapped and transferred to transport trucks in 51 loads on 21 days from May 18 – June 16. American shad were transported by Connecticut Department of Environmental Protection (CT DEP, 802), New Hampshire Fish and Game Department (317), USFWS (1,347), Rhode Island Department of Environmental Management (1,132) and the United States Geological Survey (USGS) Conte Anadromous Fish Laboratory (1,196, Table 2-5). Thirty-eight sea lamprey were also transported by USGS. American shad biological data, including length, weight, sex, and scale samples were collected for 571 fish on 34 dates representing 0.4% of the annual passage. Those data and samples were transferred to the CT DEP.

### **3.4 Shortnose Sturgeon**

No shortnose sturgeon were collected during 2009. The spillway pools and dam apron were examined in accordance with the handling plan and 2000 Biological Opinion (B.O.) as required for monitoring for stranding of shortnose sturgeon. A dead shortnose sturgeon was found on an emergent rock shelf just downstream of the spillway fish lift entrance on August 20. Reporting was done according to the handling plan (Figure 3-5). The fish was retrieved, examined, and salvaged by Dr. M. Kieffer (CAFRL, USGS, Figure 3-6). The fish was a 110.4 cm long (total length), 11.8 kg gravid female with an existing PIT tag. External damage consistent with downstream passage related collision was not evident. Additionally, bypass reach water surface level had been consistent for the period when the fish was believed to have been stranded (within prior 24 h) suggesting that stranding as a result of rapidly receding water surface elevation was not likely.

### **4.0 2009 ANNUAL REPORT AND 2010 CONSTRUCTION PLAN**

Annual Report: Data contained in this report comprise the annual reporting requirement specified in the Settlement Agreement, Section 4.6(e) [2005 License Article 411(d) and WQC Condition 15].

Construction Activity: No Construction activities regarding upstream fish passage facilities are planned prior to the start of the 2010 passage season. This fulfills the annual reporting requirements specified in the Settlement Agreement, Sections 4.6(e) and 4.9 [2005 License Articles 411(d) and 414].

### **5.0 2010 FISH PASSAGE MONITORING AND SAMPLING**

Fish passage and monitoring activities in 2010 will be conducted pursuant to 2005 License Article 411 and Conditions 14(d) and 15 of the WQC. Activities will include fish counting; American shad biological sampling, trapping, and loading; shortnose sturgeon handling and reporting; Atlantic salmon monitoring, trapping, and holding; and observations relative to Fish Monitoring Work as described in Condition 15(a) of the WQC. A Report of 2010 activities will be submitted to the CCT by January 31, 2011 per 2005 License Article 411(d) and Condition 15 of the WQC. HG&E will file the monitoring report with the FERC by February 28, 2011.

The revised protocol for extension of daily lifting operations during heavy run periods that extend to the end of the scheduled day will be maintained for 2010. When spilling is limited to zone-of-passage (ZOP) flows, it will be alternated daily between the full and partial settings of the Bascule Gate and RD5.

## TABLES



Table 3-1. Holyoke fish lift. Annual passage totals for Atlantic salmon, American shad, and blueback herring, with 95% confidence interval (LCL = lower confidence limit, UCL = upper confidence limit) and overall mean. Data for 1975 – 2005 from HG&E (2006); data for 2006 - 2008 from Normandeau Associates, Inc. (2009)<sup>1</sup>.

Year	Atlantic Salmon	American Shad	Blueback Herring
1975	3	110,000	1,600
1976	2	350,000	4,700
1977	7	200,000	3,300
1978	90	140,000	38,000
1979	58	260,000	40,000
1980	175	380,000	200,000
1981	529	380,000	420,000
1982	90	290,000	590,000
1983	39	530,000	450,000
1984	92	500,000	480,000
1985	310	480,000	630,000
1986	318	350,000	520,000
1987	353	270,000	360,000
1988	95	290,000	340,000
1989	109	350,000	290,000
1990	263	360,000	390,000
1991	203	520,000	410,000
1992	490	720,000	310,000
1993	198	340,000	100,000
1994	326	170,000	32,000
1995	188	190,000	110,000
1996	260	280,000	55,000
1997	199	300,000	64,000
1998	300	320,000	12,000
1999	154	190,000	2,700
2000	77	225,000	11,000
2001	40	270,000	11,000
2002	44	370,000	1,900
2003	43	280,000	1,300
2004	45	190,000	145
2005	131	116,523	534
2006	118	154,772	21
2007	102	158,807	75
2008	80	153,149	84
2009	61	160,669	40
LCL	114	248,892	96,888
MEAN	160	295,683	167,983
UCL	206	342,474	239,078

<sup>1</sup>Normandeau Associates, Inc. 2008. Evaluation and monitoring report of upstream fish passage at HG&E's Holyoke Dam fishway, spring 2008. Final Report prepared for City of Holyoke Gas and Electric Department.

Table 3-2. Holyoke fish lift, 2009. Sum, mean, and standard deviation of the mean for passage counts by hour of day of American shad, blueback herring, sea lamprey, striped bass, Atlantic salmon, and gizzard shad. Hour of day indicates time of beginning of the count cycle. Count cycles were generally one hour long.

Time		Beginning of Count Interval												
		0800 (n=26)	0900 (n=84)	1000 (n=40)	1100 (n=87)	1200 (n=42)	1300 (n=92)	1400 (n=57)	1500 (n=80)	1600 (n=48)	1700 (n=43)	1800 (n=30)	1900 (n=4)	2000 (n=1)
American Shad	Sum	5,526	12,265	10,870	15,150	13,367	17,364	16,412	17,131	21,046	18,658	10,928	1,787	165
	Mean	212.54	146.01	271.75	174.14	318.26	188.74	287.93	214.14	438.46	433.91	364.27	446.75	
	SD	347.08	288.41	292.76	260.69	305.15	283.53	416.70	351.96	495.64	463.16	386.52	366.54	
Blueback Herring	Sum	4	0	6	2	0	1	1	10	1	8	7	0	0
	Mean	0.15	0.00	0.15	0.02	0.00	0.01	0.02	0.13	0.02	0.19	0.23	0.00	
	SD	0.46	0.00	0.66	0.15	0.00	0.10	0.13	0.72	0.14	0.79	1.28	0.00	
Sea Lamprey	Sum	1,523	2,350	1,096	1,182	847	1,125	1,266	1,894	2,282	2,296	2,186	757	192
	Mean	58.58	27.98	27.40	13.59	20.17	12.23	22.21	23.68	47.54	53.40	72.87	189.25	
	SD	118.36	93.39	79.50	43.49	32.26	32.90	67.61	60.62	113.09	95.05	117.06	131.38	
Striped Bass	Sum	27	50	35	59	38	76	48	112	61	87	70	8	0
	Mean	1.04	0.60	0.88	0.68	0.90	0.83	0.84	1.40	1.27	2.02	2.33	2.00	
	SD	1.48	1.02	1.36	1.18	1.43	1.88	1.77	2.57	2.10	2.52	2.58	4.00	
Atlantic Salmon	Sum	1	1	4	8	6	7	7	8	9	5	5	0	0
	Mean	0.04	0.01	0.10	0.09	0.14	0.08	0.12	0.10	0.19	0.12	0.17	0.00	
	SD	0.20	0.11	0.30	0.42	0.35	0.31	0.33	0.30	0.49	0.32	0.53	0.00	
Gizzard Shad	Sum	3	7	9	11	8	6	1	6	9	7	1	0	0
	Mean	0.12	0.08	0.23	0.13	0.19	0.07	0.02	0.08	0.19	0.16	0.03	0.00	
	SD	0.43	0.32	0.42	0.33	0.45	0.25	0.13	0.27	0.57	0.48	0.18	0.00	

Table 3-3. Holyoke fish lift, 2009. Daily sum and cumulative (year-to-date, YTD) passage counts of American shad, blueback herring, sea lamprey, striped bass, Atlantic salmon, and gizzard shad.

Date	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Atlantic Salmon		Gizzard Shad	
	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
4/14*	0	0	0	0	0	0	0	0	0	0	0	0
4/15	0	0	0	0	0	0	0	0	0	0	0	0
4/16	0	0	0	0	0	0	0	0	0	0	0	0
4/17	0	0	0	0	0	0	0	0	0	0	0	0
4/21	0	0	0	0	0	0	0	0	0	0	0	0
4/22	0	0	1	1	0	0	0	0	0	0	0	0
4/23	1	1	0	1	0	0	0	0	0	0	0	0
4/24	0	1	0	1	0	0	0	0	0	0	0	0
4/25	7	8	0	1	0	0	0	0	0	0	0	0
4/26	4	12	0	1	0	0	0	0	0	0	1	1
4/27	6	18	0	1	2	2	0	0	0	0	0	1
4/28	67	85	0	1	6	8	0	0	0	0	0	1
4/29	62	147	0	1	5	13	0	0	0	0	0	1
4/30	31	178	0	1	8	21	0	0	0	0	0	1
5/1	49	227	1	2	5	26	0	0	1	1	0	1
5/2	222	449	0	2	17	43	0	0	2	3	1	2
5/3	211	660	0	2	12	55	0	0	0	3	1	3
5/4	496	1,156	0	2	79	134	2	2	0	3	0	3
5/5	214	1,370	0	2	14	148	0	2	0	3	0	3
5/6	2,542	3,912	1	3	596	744	1	3	2	5	0	3
5/7	3,327	7,239	0	3	272	1,016	1	4	3	8	1	4
5/8	2,897	10,136	11	14	59	1,075	1	5	0	8	9	13
5/9	2,789	12,925	1	15	309	1,384	0	5	1	9	4	17
5/10	1,453	14,378	2	17	47	1,431	2	7	0	9	3	20
5/11	519	14,897	0	17	14	1,445	1	8	0	9	1	21
5/12	2,369	17,266	0	17	45	1,490	2	10	0	9	0	21
5/13	1,799	19,065	3	20	38	1,528	5	15	0	9	1	22
5/14	2,500	21,565	0	20	9	1,537	1	16	1	10	0	22
5/15	6,567	28,132	12	32	139	1,676	1	17	0	10	0	22
5/16	8,501	36,633	0	32	145	1,821	0	17	4	14	0	22
5/17	10,736	47,369	1	33	906	2,727	3	20	3	17	0	22
5/18	3,057	50,426	0	33	334	3,061	4	24	1	18	0	22
5/19	4,248	54,674	0	33	8	3,069	1	25	0	18	0	22
5/20	9,229	63,903	0	33	221	3,290	2	27	3	21	0	22
5/21	12,871	76,774	0	33	1,611	4,901	4	31	0	21	1	23
5/22	10,314	87,088	0	33	4,972	9,873	14	45	9	30	1	24
5/23	11,659	98,747	4	37	1,588	11,461	11	56	6	36	4	28
5/24	8,601	107,348	1	38	991	12,452	25	81	7	43	7	35

Table 3-3 (continued).

Date	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Atlantic Salmon		Gizzard Shad	
	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
5/25	4,304	111,652	0	38	1,661	14,113	52	133	2	45	3	38
5/26	4,276	115,928	0	38	299	14,412	45	178	1	46	3	41
5/27	1,904	117,832	1	39	282	14,694	31	209	1	47	0	41
5/28	1,042	118,874	0	39	15	14,709	16	225	0	47	0	41
5/29	1,093	119,967	0	39	15	14,724	5	230	3	50	0	41
5/30	2,520	122,487	1	40	284	15,008	6	236	0	50	1	42
5/31	1,762	124,249	0	40	91	15,099	5	241	1	51	1	43
6/1	1,905	126,154	0	40	11	15,110	12	253	0	51	0	43
6/2	1,044	127,198	0	40	9	15,119	10	263	1	52	1	44
6/3	3,145	130,343	0	40	111	15,230	8	271	2	54	0	44
6/4	4,190	134,533	0	40	663	15,893	43	314	0	54	0	44
6/5	2,499	137,032	0	40	332	16,225	12	326	1	55	0	44
6/6	3,906	140,938	0	40	511	16,736	7	333	0	55	0	44
6/7	4,179	145,117	0	40	876	17,612	19	352	0	55	0	44
6/8	2,090	147,207	0	40	892	18,504	25	377	0	55	0	44
6/9	1,361	148,568	0	40	309	18,813	5	382	0	55	0	44
6/10	904	149,472	0	40	51	18,864	7	389	0	55	0	44
6/11	337	149,809	0	40	21	18,885	5	394	0	55	0	44
6/12	651	150,460	0	40	24	18,909	4	398	1	56	0	44
6/13	2,661	153,121	0	40	25	18,934	11	409	0	56	1	45
6/14	1,227	154,348	0	40	11	18,945	8	417	0	56	1	46
6/15	932	155,280	0	40	2	18,947	10	427	0	56	5	51
6/16	173	155,453	0	40	3	18,950	29	456	0	56	0	51
6/17	313	155,766	0	40	1	18,951	20	476	0	56	4	55
6/18	121	155,887	0	40	1	18,952	17	493	0	56	1	56
6/19	323	156,210	0	40	23	18,975	29	522	1	57	0	56
6/20	388	156,598	0	40	4	18,979	8	530	0	57	1	57
6/21	200	156,798	0	40	1	18,980	6	536	0	57	0	57
6/22	425	157,223	0	40	3	18,983	9	545	0	57	1	58
6/23	319	157,542	0	40	1	18,984	5	550	0	57	1	59
6/24	261	157,803	0	40	3	18,987	16	566	0	57	1	60
6/25	72	157,875	0	40	5	18,992	6	572	0	57	0	60
6/26	623	158,498	0	40	2	18,994	21	593	0	57	4	64
6/27	66	158,564	0	40	1	18,995	3	596	0	57	1	65
6/28	43	158,607	0	40	0	18,995	8	604	0	57	0	65
6/29	164	158,771	0	40	0	18,995	6	610	1	58	0	65
6/30	163	158,934	0	40	1	18,996	3	613	0	58	0	65
7/1	95	159,029	0	40	0	18,996	1	614	0	58	0	65
7/2	174	159,203	0	40	0	18,996	5	619	1	59	0	65
7/3	142	159,345	0	40	0	18,996	8	627	0	59	1	66

Table 3-3 (continued).

Date	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Atlantic Salmon		Gizzard Shad	
	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
7/4	99	159,444	0	40	0	18,996	7	634	0	59	0	66
7/5	102	159,546	0	40	0	18,996	9	643	0	59	0	66
7/6	20	159,566	0	40	0	18,996	1	644	0	59	0	66
7/7	111	159,677	0	40	0	18,996	5	649	0	59	1	67
7/8	112	159,789	0	40	0	18,996	2	651	0	59	1	68
7/9	46	159,835	0	40	0	18,996	0	651	0	59	0	68
7/10	44	159,879	0	40	0	18,996	2	653	0	59	0	68
7/11	203	160,082	0	40	0	18,996	2	655	0	59	0	68
7/12	267	160,349	0	40	0	18,996	4	659	0	59	0	68
7/13	46	160,395	0	40	0	18,996	0	659	0	59	0	68
7/14	20	160,415	0	40	0	18,996	5	664	1	60	0	68
7/15	61	160,476	0	40	0	18,996	2	666	1	61	0	68
7/16	53	160,529	0	40	0	18,996	2	668	0	61	0	68
7/17	55	160,584	0	40	0	18,996	0	668	0	61	0	68
7/20	23	160,607	0	40	0	18,996	0	668	0	61	0	68
7/21	7	160,614	0	40	0	18,996	0	668	0	61	0	68
7/22	13	160,627	0	40	0	18,996	3	671	0	61	0	68
7/23	20	160,647	0	40	0	18,996	0	671	0	61	0	68
7/24	22	160,669	0	40	0	18,996	0	671	0	61	0	68

Table 3-4. Holyoke fish lift 2009. Daily upstream passage counts of resident fish species, April 14 – July 27. Counts include immigrating American eel (10 elver and 75 adult sized). Refer to Appendix A of this report for taxonomic names of fish counted.

Date	Small Mouth Bass	American Eel Adult	White Sucker	Walleye	Channel Catfish	Brown Trout	Common Carp	Bluegill	Rock Bass	American Eel elver	Large Mouth Bass	Tiger Trout	Northern Pike	Brook Trout	Rainbow Trout	Brown Bullhead	Common Shiner	Spottail Shiner	White Perch	Pumpkinseed	Fall Fish
4/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/23	0	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
4/24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/25	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/26	2	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/27	4	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/28	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/29	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
4/30	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/1	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/3	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5/4	18	1	6	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
5/5	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/6	8	0	3	2	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5/7	20	1	21	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5/8	5	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/9	11	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/11	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
5/12	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/14	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5/15	1	3	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
5/16	5	6	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
5/17	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/18	2	1	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5/19	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/20	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/21	11	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/22	21	0	0	1	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
5/23	6	0	1	3	1	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 3-4 (continued).

Date	Small Mouth Bass	American Eel Ad	White Sucker	Walleye	Channel Catfish	Brown Trout	Common Carp	Bluegill	Rock Bass	American Eel elver	Large Mouth Bass	Tiger Trout	Northern Pike	Brook Trout	Rainbow Trout	Brown Bullhead	Common Shiner	Spottail Shiner	White Perch	Pumpkinseed	Fall Fish
5/24	5	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
5/25	13	1	0	3	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
5/26	5	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
5/27	1	0	0	0	0	0	1	0	2	0	0	1	1	1	0	0	0	0	1	0	0
5/28	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/29	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/30	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
5/31	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/1	2	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6/2	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
6/3	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/4	5	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/5	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
6/6	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6/7	2	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6/8	4	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6/9	3	1	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1
6/10	0	3	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/11	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
6/12	2	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6/13	0	2	0	1	2	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
6/14	0	2	0	1	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
6/15	2	1	0	4	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
6/16	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6/17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/18	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
6/19	2	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/20	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/21	4	2	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
6/22	3	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
6/23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/26	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
6/27	5	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/29	5	2	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0
6/30	15	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3-4 (continued).

Date	Small Mouth Bass	American Eel Ad	White Sucker	Walleye	Channel Catfish	Brown Trout	Common Carp	Bluegill	Rock Bass	American Eel elver	Large Mouth Bass	Tiger Trout	Northern Pike	Brook Trout	Rainbow Trout	Brown Bullhead	Common Shiner	Spottail Shiner	White Perch	Pumpkinseed	Fall Fish
7/1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
7/3	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7/4	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/5	1	5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
7/6	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
7/7	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/9	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7/10	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7/12	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/13	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/20	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7/21	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/22	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
7/24	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	302	75	70	34	20	16	16	14	11	10	8	6	5	4	4	3	1	1	1	1	1



Table 3-5. Holyoke fish lift, 2009. American shad trap and truck contributions; recipients included Connecticut Department of Environmental Protection (CT), New Hampshire Fish and Game Department (NH), Rhode Island Division of Fish and Wildlife (RI), US Fish and Wildlife Service (USFWS), and Conte Anadromous Fish Research Laboratory (CAFRL, USGS).

Date	CT	NH	RI	USFWS	USGS	Sums
5/1	-	-	-	-	531	531
5/18	77	-	-	-	-	77
5/19	78	-	180	-	100	358
5/20	75	-	160	-	-	235
5/21	-	-	160	-	-	160
5/22	-	-	-	-	65	65
5/26	160	-	160	50	-	370
5/27	55	-	152	-	-	207
5/28	140	-	-	81	-	221
5/29	-	-	-	165	80	245
6/1	73	80	-	80	200	433
6/2	144	75	-	81	-	300
6/3	-	82	160	159	-	401
6/4	-	80	160	160	100	500
6/5	-	-	-	-	50	50
6/8	-	-	-	240	-	240
6/10	-	-	-	-	70	70
6/11	-	-	-	80	-	80
6/12	-	-	-	85	-	85
6/15	-	-	-	83	-	83
6/16	-	-	-	83	-	83
Sums	802	317	1,132	1,347	1,196	4,794

## FIGURES



Figure 1-1. Holyoke Dam, Bascule Gate with Alden Weir and Rubber Dam section #5 (RD5). Rubber Dam section #4 is visible in the closed position to the right of RD5.



Figure 1-2. Holyoke fish lift, examples of components. A. tailrace east entrance (salmon gate), B. spillway fish lift crowder gate, C. Spillway fish lift hopper, full and raised nearly to exit flume elevation, D. fish lift towers viewed from downstream; the spillway lift is on the right.



Figure 1-3. Holyoke fish lift. An image of a fish lift hopper near the end of the dump. The perspective is similar to that of observers monitoring fullness.



Figure 1-4. Holyoke fish lift. Flume trap with the floor crowded upward for collection of fish. An Atlantic salmon, an American shad, and several sea lamprey were trapped in this operation.

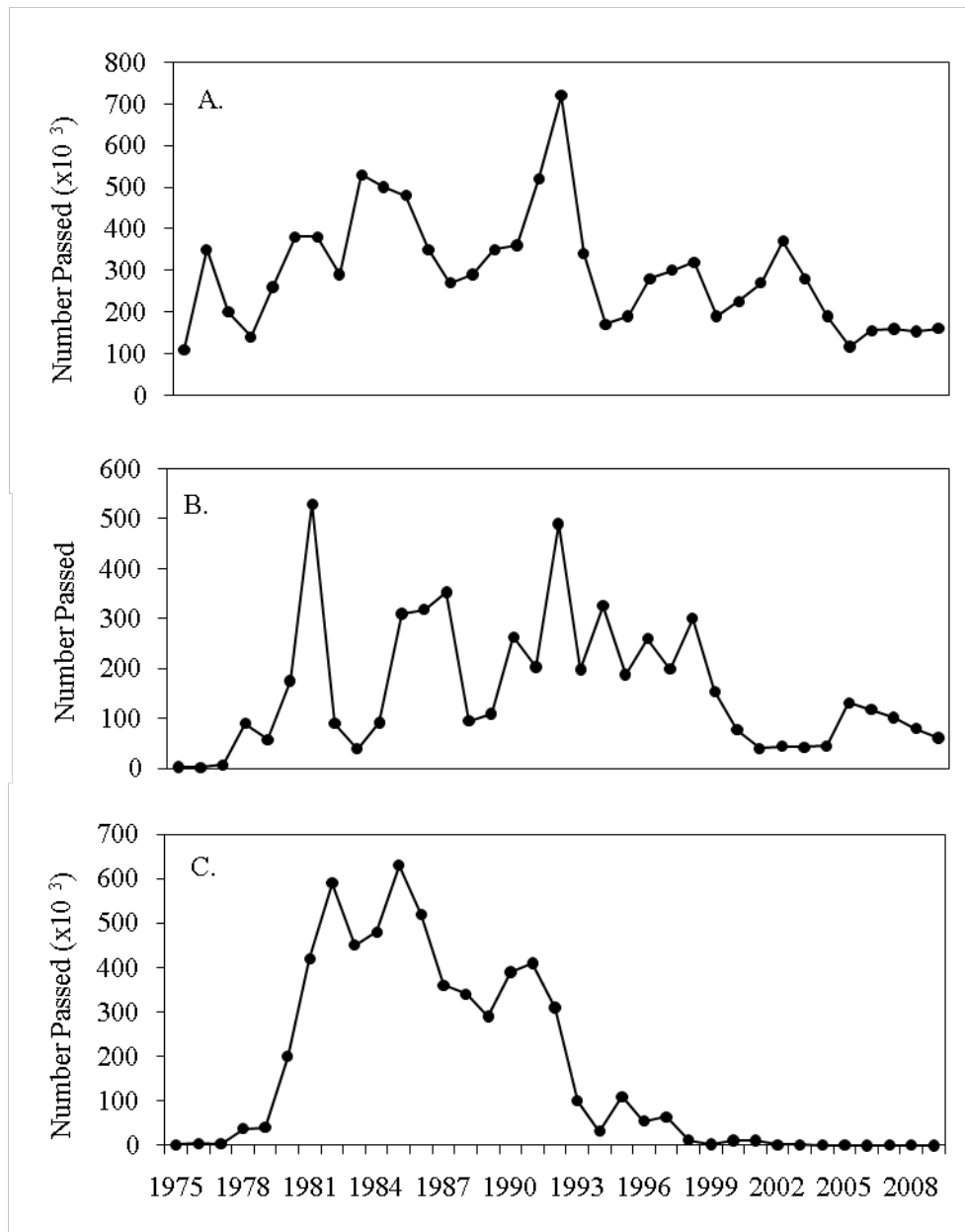


Figure 3-1. Holyoke fish lift, 1975 - 2009. Total annual passage of A. American shad, B. Atlantic salmon, and C. blueback herring. Data for 1975 – 2005 from HG&E (2006).

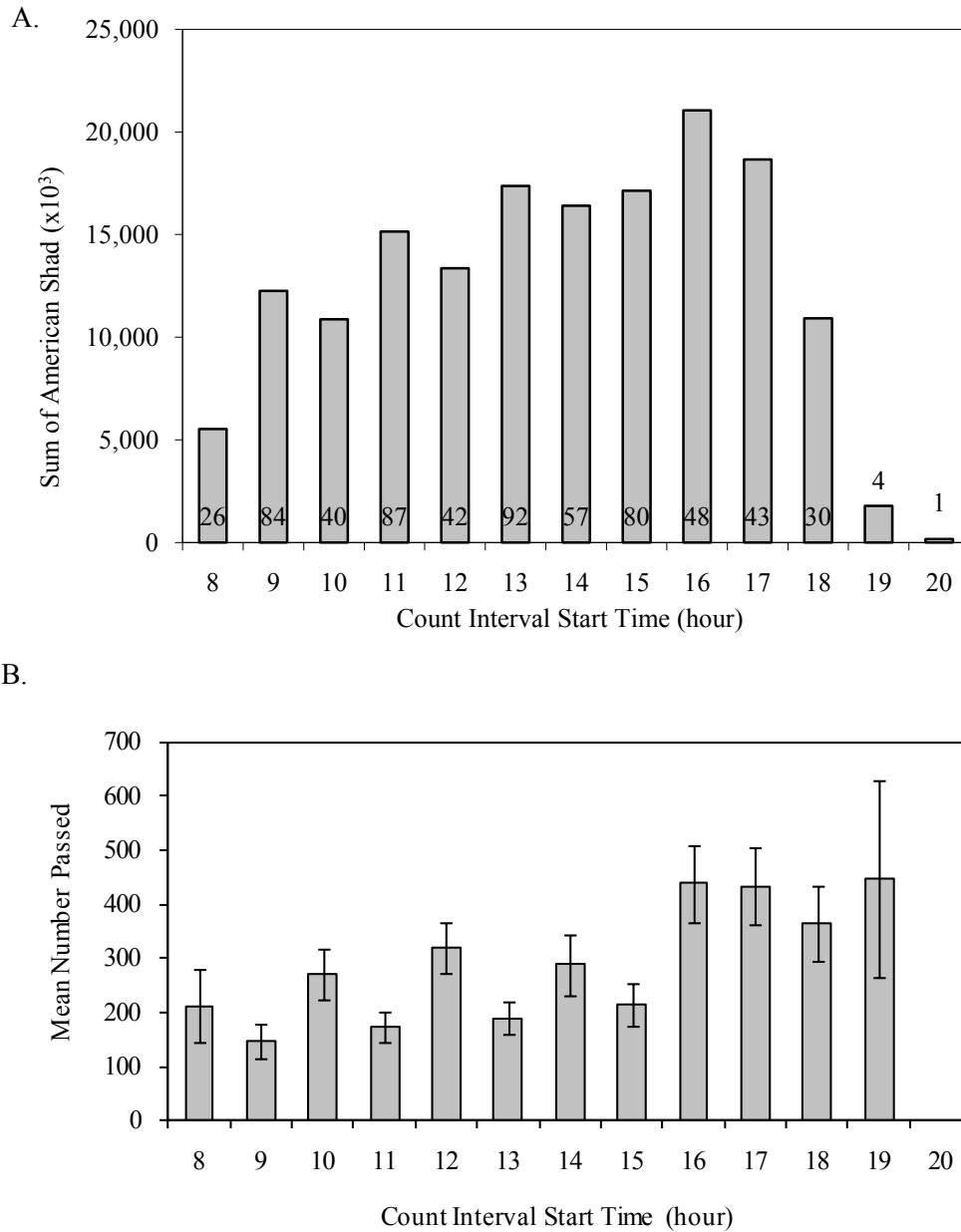
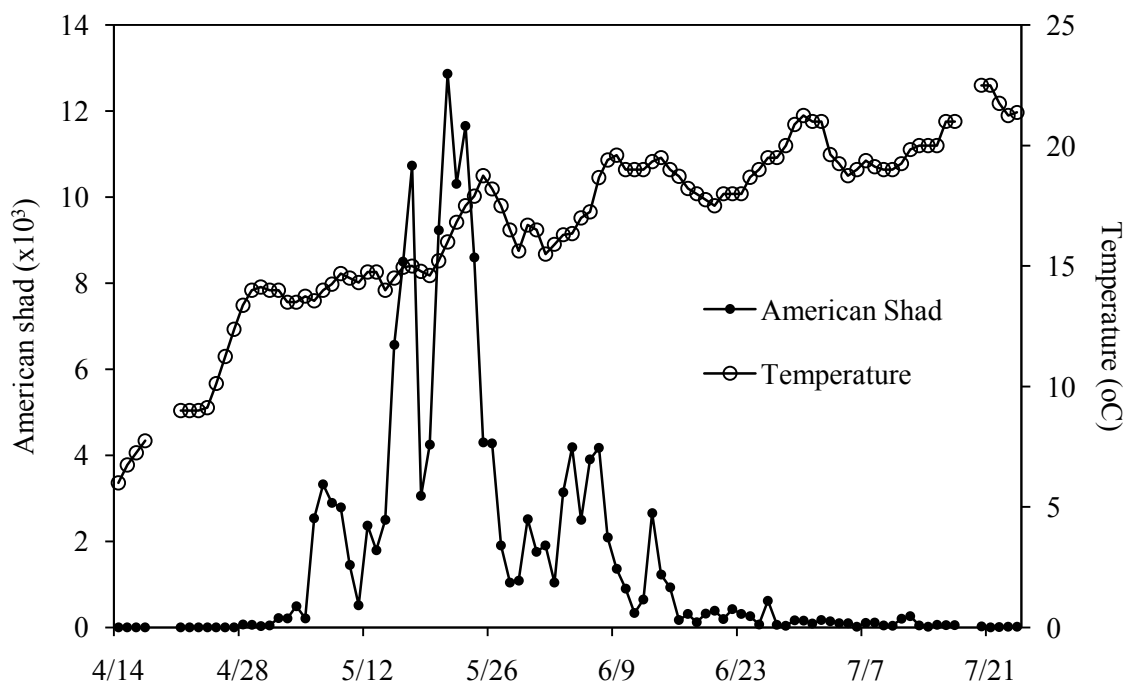


Figure 3-2. Holyoke fish lift, 2009. A. sums, and B. mean (+/- 1 SE) American shad passage counts by count interval start time (hour of day). Count intervals were generally one hour long. Number of observations is given in the column bases of panel A.

A.



B.

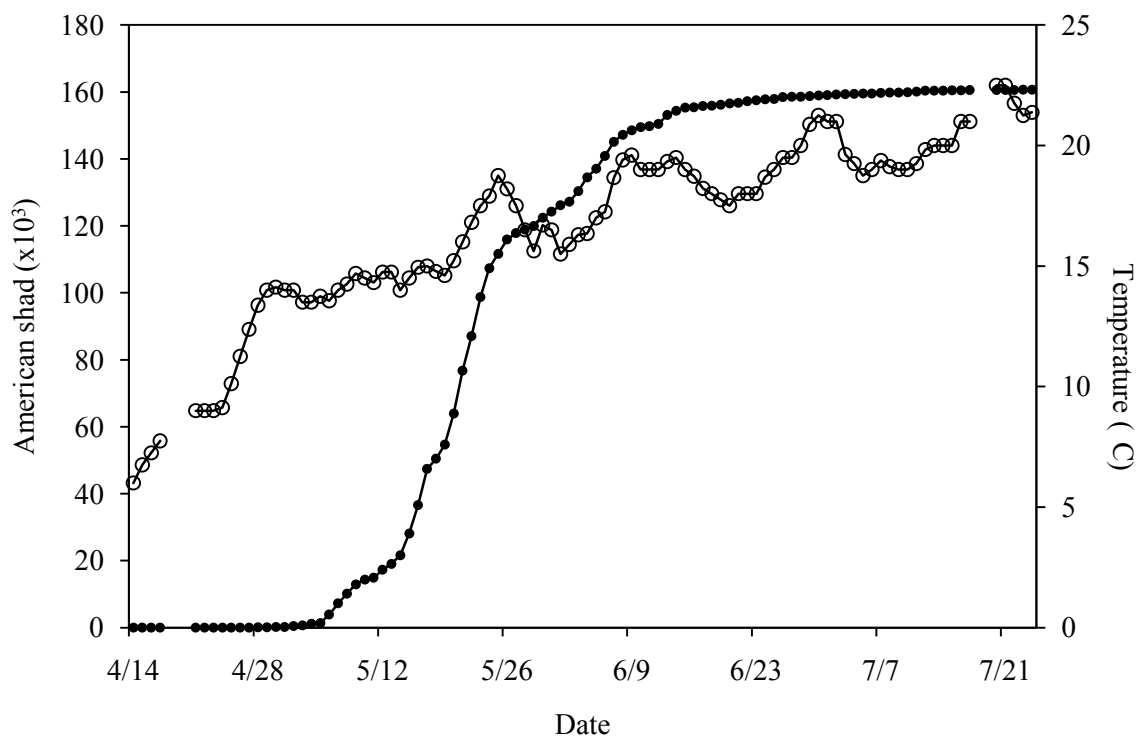


Figure 3-3. Holyoke fish lift, 2009. American shad passage: A. Daily sum of passage and daily average water temperature; B. Daily cumulative passage and daily average water temperature.

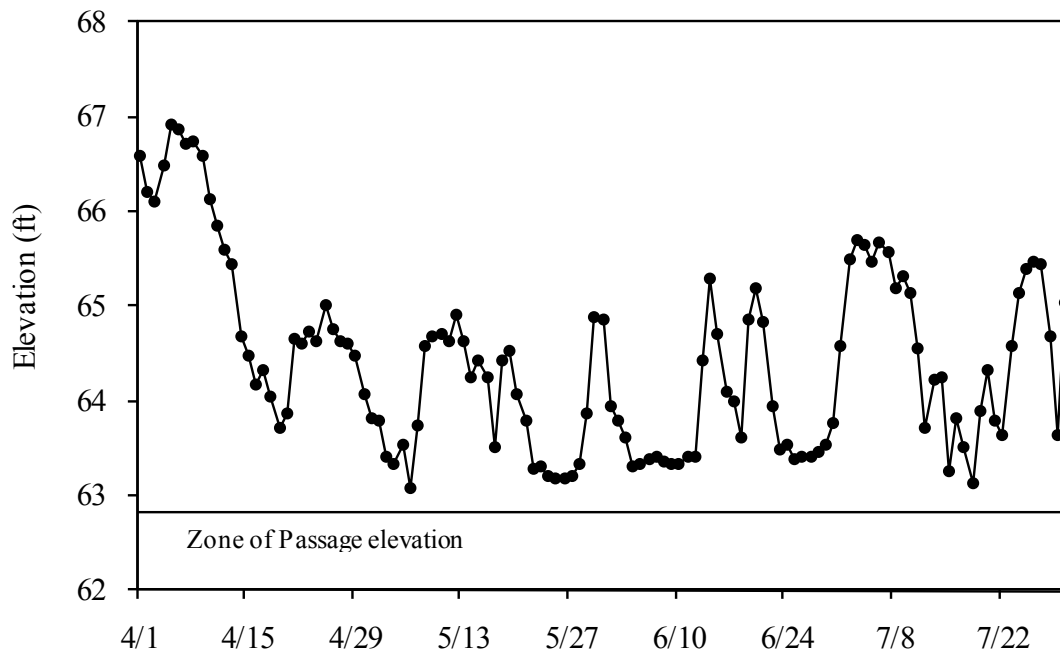


Figure 3-4. Holyoke fish lift, 2009. Daily mean water surface elevation in the Holyoke Dam spillway (at Texon gauge). Spillway elevations were maintained at or above the requisite 62.85 ft (+/- 0.1 ft) National Geodetic Vertical Datum (NGVD) throughout the fish passage season as the zone-of-passage flow pursuant to the Settlement Agreement.



Figure 3-5. Holyoke Dam, 2009. Shortnose sturgeon handling protocol reporting for a fish found dead on an emergent rock shelf downstream of the spillway fish lift entrance on August 20, 2009.

SHORTNOSE STURGEON REPORTING SHEET FOR THE HOLYOKE PROJECT

Date: 8/20/09 Time: 4:45 pm

Physical conditions

Is spill being released over the dam?  YES  NO BASCULE GATES  
What is the approximate gaged river flow? 6,800 CFS (Ex. 45,000 cfs)  
What is the approximate gaged minimum flow in the bypass reach? 62.3  
What is the approximate gaged minimum flow in the canal reach? 400 CFS  
Water temperature (°C): at surface 25.4 and/or at bottom \_\_\_\_\_

Are fishways operating (circle) YES  NO If yes, circle one or both: TAILRACE SPILLWAY

Is project generating?  YES  NO

If yes, what units are currently being operating?  UNIT1  UNIT2

Location from where species was recovered (circle): TAILRACE LIFT SPILLWAY LIFT  
DAM APRON POOLS ATTRACTION WATER STRUCTURE CANAL BYPASS  
OTHER Spillway on Rock d/s of EOL Ramp  
If fish lift, estimate condition of lift: EMPTY FEW FISH MODERATE FULL VERY FULL

Species information:

Total Length EST 36" Fork length: \_\_\_\_\_ Weight: 11.8 kg  
Condition of fish: DEAD LESS THAN 1 DAY MICAH KIEFFER TO VERIFY

Does the sturgeon have visible injuries or abrasions: YES NO  
If Yes, circle and code area of abrasions on sturgeon diagram on back side of sheet.

Was sturgeon previously tagged? YES  NO  
If tagged, what type? CARLIN PIT RADIO OTHER \_\_\_\_\_  
What is the tag number? \_\_\_\_\_

If not tagged, did you tag the fish? YES NO  
If yes, what type of tag and ID number? TYPE \_\_\_\_\_ ID# \_\_\_\_\_

Comments/other: Found @ 2:45 pm By Rich Murray Fish Retrieved  
By MICAH K. @ 4:30 pm. Pond level above dam was 102.4 Just 1 datum

Name of watch observer: \_\_\_\_\_

Observer's Signature: [Signature]

Figure 3-5 (continued).

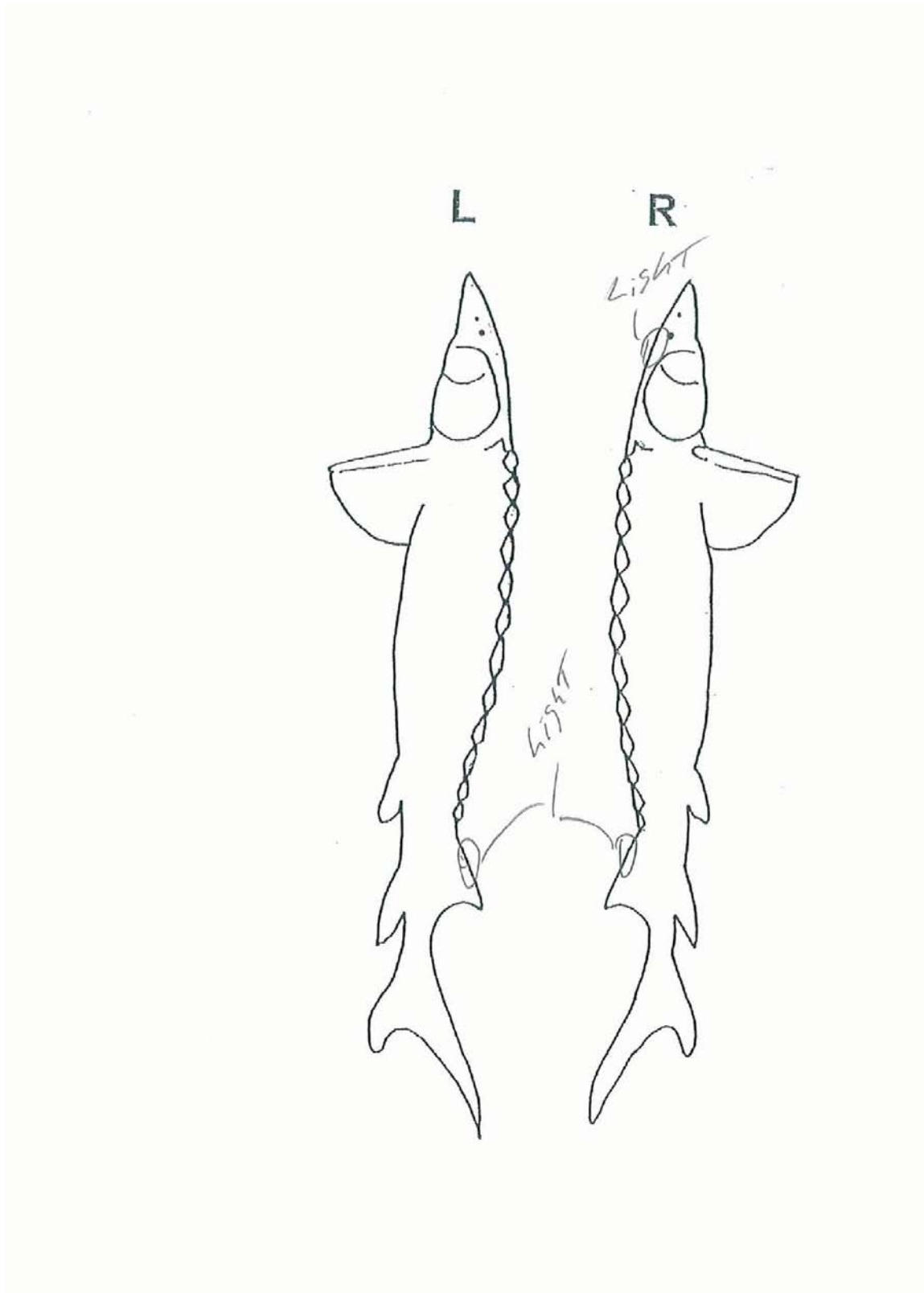


Figure 3-6. Sturgeon salvage form for a shortnose sturgeon found dead on an emergent rock shelf downstream of the spillway fish lift entrance on August 20, 2009. Retrieval of fish and reporting courtesy of M. Kieffer, Conte Anadromous Fish Research Laboratory (CAFRL, USGS).

### STURGEON SALVAGE FORM (front)

For use in documenting dead sturgeon in the wild under ESA permit no. 1614

<b>INVESTIGATORS'S CONTACT INFORMATION</b> Name: First <u>MICAH</u> Last <u>KIEFFER</u> Agency Affiliation <u>USGS</u> Email <u>micah.kieffer@usgs.gov</u> Address: <u>CAFRL, 1 Migratory way</u> <u>Turners Falls, MA 01376</u> Area code/Phone number <u>(413) 863-3817</u>		UNIQUE IDENTIFIER (Assigned by NMFS)  DATE REPORTED: Month <u>08</u> Day <u>24</u> Year 20 <u>09</u> DATE EXAMINED: Month <u>08</u> Day <u>20</u> Year 20 <u>09</u>
<b>SPECIES: (check one)</b> <input checked="" type="checkbox"/> shortnose sturgeon <input type="checkbox"/> Atlantic sturgeon <input type="checkbox"/> Unidentified <i>Acipenser</i> species Check "Unidentified" if uncertain. See reverse side of this form for aid in identification.	<b>LOCATION FOUND:</b> <input type="checkbox"/> Offshore (Atlantic or Gulf beach) <input checked="" type="checkbox"/> Inshore (bay, river, sound, inlet, etc) River/Body of Water <u>CONNECTICUT RIVER</u> City <u>Holyoke</u> State <u>MA</u> Descriptive location (be specific) <u>30m downstream of Holyoke Dam</u> <u>basculo gale. fish was on rock</u>  Latitude _____ N (Dec. Degrees) Longitude _____ W (Dec. Degrees)	
<b>CARCASS CONDITION at time examined: (check one)</b> <input checked="" type="checkbox"/> 1 = Fresh dead <input type="checkbox"/> 2 = Moderately decomposed <input type="checkbox"/> 3 = Severely decomposed <input type="checkbox"/> 4 = Dried carcass <input type="checkbox"/> 5 = Skeletal, scutes & cartilage	<b>SEX:</b> <input type="checkbox"/> Undetermined <input checked="" type="checkbox"/> Female <input type="checkbox"/> Male How was sex determined? <input type="checkbox"/> Necropsy <input type="checkbox"/> Eggs/milt present when pressed <input checked="" type="checkbox"/> Borescope	<b>MEASUREMENTS:</b> <span style="float: right;">Circle unit</span> Fork length _____ <u>100.2</u> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">cm</span> / in Total length _____ <u>110.4</u> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">cm</span> / in Length <input checked="" type="checkbox"/> actual <input type="checkbox"/> estimate Mouth width (inside lips, see reverse side) _____ cm / in Interorbital width (see reverse side) _____ cm / in Weight <input checked="" type="checkbox"/> actual <input type="checkbox"/> estimate <u>11.8</u> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">kg</span> / lb
<b>TAGS PRESENT?</b> Examined for external tags including fin clips? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Scanned for PIT tags? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Tag # <u>17500 B3C44</u> Tag Type <u>PIT</u> Location of tag on carcass <u>DORSAL FIN BASE</u>		
<b>CARCASS DISPOSITION: (check one or more)</b> <input type="checkbox"/> 1 = Left where found <input type="checkbox"/> 2 = Buried <input checked="" type="checkbox"/> 3 = Collected for necropsy/salvage <input checked="" type="checkbox"/> 4 = Frozen for later examination <input type="checkbox"/> 5 = Other (describe) _____	<b>Carcass Necropsied?</b> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Date Necropsied: _____ Necropsy Lead: _____	<b>PHOTODOCUMENTATION:</b> Photos/video taken? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Disposition of Photos/Video: <u>CAFRL ARCHIVE</u> <u>HG&amp;E ARCHIVE</u>
<b>SAMPLES COLLECTED?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No		
Sample <u>Fin clip</u>	How preserved <u>ETHANOL (100%)</u>	Disposition (person, affiliation, use) <u>CAFRL FREEZER</u> <u>MICAH KIEFFER</u>  <u>USED AS TAG MOUNTAIN</u> <u>AND EGG RETENTION STUDY</u> <u>SPECIMEN.</u>

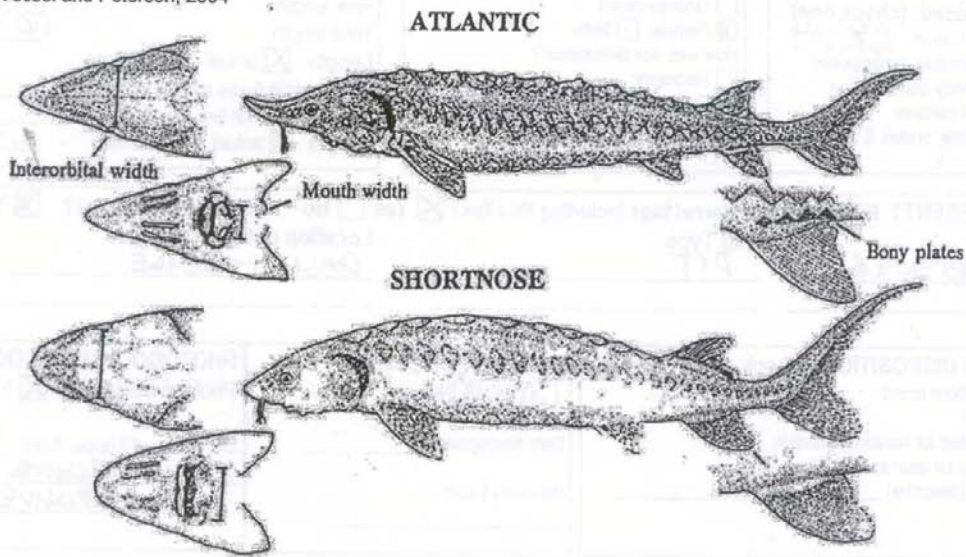
**Comments:**  
INITIAL DETECTION AND ACTIVATION OF RECOVERY EFFORT:  
RICH MURPHY, Holyoke Gas + Electric, Holyoke, MA

Figure 3-6 (continued).

Attachment B: (Back) Distinguishing Characteristics of Atlantic and Shortnose Sturgeon

Characteristic	Atlantic Sturgeon, <i>Acipenser oxyrinchus</i>	Shortnose Sturgeon, <i>Acipenser brevirostrum</i>
Maximum length	> 9 feet/ 274 cm	4 feet/ 122 cm
Mouth	Football shaped and small. Width inside lips < 55% of bony interorbital width	Wide and oval in shape. Width inside lips > 62% of bony interorbital width
*Pre-anal plates	Large paired pre-anal plates, often followed by a second pair of plates and another, larger single plate	1-3 pre-anal plates, never paired
Plates along the anal fin	Large rhombic plates found along the lateral base of the anal fin	No plates along the base of anal fin
Habitat/Range	Anadromous; spawn in freshwater but primarily lead a marine existence	Freshwater amphidromous; aside from seasonal migrations to estuary, rarely occurs in the marine environment

\* From Vecsei and Peterson, 2004



Describe any wounds / abnormalities (note tar or oil, gear or debris entanglement, propeller damage, etc.). Please note if no wounds / abnormalities are found.

Chafing on right side of skull (minimal - did not look like impact)  
other than skull chafing, fish looked unharmed.  
Full of late-stage eggs.

Data Access Policy: Upon written request, information submitted to National Marine Fisheries Service (NOAA Fisheries) on this form will be released to the requestor provided that the requestor credit the collector of the information and NOAA Fisheries. NOAA Fisheries will notify the collector that these data have been requested and the intent of their use.

Submit completed forms (within 30 days of date of investigation) to: Dana Hartley, Shortnose Sturgeon Recovery Coordinator, NOAA Fisheries Northeast Region, One Blackburn Drive, Gloucester, MA 01930  
Phone: 978-281-9300 x6514; Fax: 978-281-9394; E-Mail [Dana.Hartley@noaa.gov](mailto:Dana.Hartley@noaa.gov)

## APPENDIX A

### SUPPLEMENTARY TABLES

Table A-1. Fish lift hopper fullness index.

Fullness Index	Criteria
0	No shad observed
1	Shad present, no accumulation at exit gate as hopper emptied
2	Shad accumulated at exit gate, but covered not more than approximately half of the hopper floor as hopper emptied.
3	Hopper appeared to contain a substantial number of shad but much of the hopper floor was visible before hopper emptied; once most water was gone shad covered most of the hopper floor.
4	Hopper more crowded but some floor was visible before hopper emptied; once most water was gone, multiple layers of shad covered most of the hopper floor.
5	Hopper crowded, nearly all of the hopper floor obscured by fish before hopper emptied; multiple layers of shad covered the hopper floor; emptying process lasts longer.

Table A-2. List of common and taxonomic names of fish species counted in fish passage efforts at Holyoke Dam during the anadromous fish passage season, 2009.

Common Name	Class	Order	Family	Genus	Species	Authority (date)
Sea Lamprey	Cephalaspidomorphi	Petromyzontiformes	Petromyzontidae	<i>Petromyzon</i>	<i>marinus</i>	Linnaeus 1758
American Eel		Anguilliformes	Anguillidae	<i>Anguilla</i>	<i>rostrata</i>	Lesueur 1817
Blueback Herring		Clupeiformes	Clupeidae	<i>Alosa</i>	<i>aestivalis</i>	Mitchill 1814
American Shad				<i>Alosa</i>	<i>sapidissima</i>	Wilson 1811
Gizzard Shad				<i>Dorosoma</i>	<i>cepedianum</i>	Lesueur 1818
Common Carp		Cypriniformes	Cyprinidae	<i>Cyprinus</i>	<i>carpio</i>	Linnaeus 1758
Spottail Shiner				<i>Notropis</i>	<i>hudsonius</i>	Clinton 1824
Common Shiner				<i>Luxilus</i>	<i>cornutus</i>	Mitchill 1817
Fallfish				<i>Semotilus</i>	<i>corporalis</i>	Mitchill 1817
White Sucker			Catostomidae	<i>Catostomus</i>	<i>commersonii</i>	Lacepède 1803
Channel Catfish		Siluriformes	Ictaluridae	<i>Ictalurus</i>	<i>punctatus</i>	Rafinesque 1818
Northern Pike		Esociformes	Esocidae	<i>Esox</i>	<i>lucius</i>	Linnaeus 1758
Rainbow Trout		Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>mykiss</i>	Walbaum 1792
Atlantic Salmon				<i>Salmo</i>	<i>salar</i>	Linnaeus 1758
Brown Trout*				<i>Salmo</i>	<i>trutta</i>	Linnaeus 1758
Brook Trout*				<i>Salvelinus</i>	<i>fontinalis</i>	Mitchill 1814

Table A-2 (continued).

Common Name	Class	Order	Family	Genus	Species	Authority (date)
White Perch	Actinopterygii	Perciformes	Moronidae	<i>Morone</i>	<i>americana</i>	Gmelin 1789
Striped Bass				<i>Morone</i>	<i>saxatilis</i>	Walbaum 1792
Rock Bass			Centrarchidae	<i>Ambloplites</i>	<i>rupestris</i>	Rafinesque 1817
Pumpkinseed				<i>Lepomis</i>	<i>gibbosus</i>	Linnaeus 1758
Bluegill					<i>macrochirus</i>	Rafinesque 1819
Smallmouth Bass				<i>Micropterus</i>	<i>dolomieu</i>	Lacepède 1802
Largemouth Bass				<i>Micropterus</i>	<i>salmoides</i>	Lacepède 1802
Black Crappie				<i>Pomoxis</i>	<i>nigromaculatus</i>	Lesueur 1829
Yellow Perch			Percidae	<i>Perca</i>	<i>flavescens</i>	Mitchill 1814
Walleye				<i>Sander</i>	<i>vitreus</i>	Mitchill 1818

\*Tiger Trout, a hybrid of brook trout and brown trout, were also counted.



Table A-3. Holyoke fish lift, 2009. Hourly American shad upstream passage counts with daily and cumulative totals.

Date	Count Cycle (hour of day)*													Sum	YTD
	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20+		
4/14	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/15	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/16	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/17	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/18	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/19	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/20	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/21	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/22	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
4/23	-	0	-	0	-	1	-	0	-	-	-	-	-	1	1
4/24	-	0	-	0	-	0	-	0	-	-	-	-	-	-	1
4/25	-	0	-	0	-	2	-	5	-	-	-	-	-	7	8
4/26	-	1	-	2	-	0	-	1	-	-	-	-	-	4	12
4/27	-	0	-	4	-	1	-	1	-	-	-	-	-	6	18
4/28	-	3	-	19	-	28	-	17	-	-	-	-	-	67	85
4/29	-	12	-	16	-	20	-	14	-	-	-	-	-	62	147
4/30	-	6	-	8	-	11	6	-	-	-	-	-	-	31	178
5/1	-	14	-	8	-	15	12	-	-	-	-	-	-	49	227
5/2	-	60	-	28	-	62	72	-	-	-	-	-	-	222	449
5/3	-	33	-	86	-	69	23	-	-	-	-	-	-	211	660
5/4	-	38	-	161	-	201	96	-	-	-	-	-	-	496	1,156

Table A-3 (continued).

Date	Count Cycle (hour of day)*													Sum	YTD
	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20+		
5/5	-	25	-	19	-	122	48	-	-	-	-	-	-	214	1,370
5/6	-	541	0	864	0	332	297	207	119	182	-	-	-	2,542	3,912
5/7	-	93	131	137	431	765	127	560	646	437	-	-	-	3,327	7,239
5/8	-	900	189	348	593	308	109	68	276	106	-	-	-	2,897	10,136
5/9	-	144	136	511	527	539	421	118	141	252	-	-	-	2,789	12,925
5/10	-	1	-	324	257	216	-	359	166	130	-	-	-	1,453	14,378
5/11	-	2	-	-	102	117	0	203	45	50	-	-	-	519	14,897
5/12	-	164	452	518	208	557	-	58	345	67	-	-	-	2,369	17,266
5/13	-	-	94	252	139	434	230	56	104	490	-	-	-	1,799	19,065
5/14	-	-	-	-	-	86	107	541	1,126	640	-	-	-	2,500	21,565
5/15	-	578	792	416	342	768	856	367	1,192	929	327	-	-	6,567	28,132
5/16	915	669	387	539	848	130	1,410	1,391	1,061	1,001	621	-	-	8,972	37,104
5/17	1,247	931	459	507	777	766	1,906	1,618	1,065	989	876 <sup>1</sup>	-	-	11,141	48,245
5/18	-	32	208	252	270	406	215	410	561	503	402	-	-	3,259	51,504
5/19	-	95	304	237	402	458	329	382	881	484	327	-	-	3,899	55,403
5/20	-	1,380	596	386	-	1,327	883	1,245	1,692	1,120	564	198	-	9,391	64,794
5/21	154	1,111	462	858	886	841	1,203	1,720	2,131	2,036	1,725	977	165	14,269	79,063
5/22	805	390	1,131	1,168	558	1,010	1,205	147	1,406	1,523	1,536	407	-	11,286	90,349
5/23	419	1,076	1,069	687	1,347	1,107	880	334	1,106	1,704	766	205	-	10,700	101,049
5/24	757	618	573	929	860	632	671	376	1,114	535	434	-	-	7,499	108,548
5/25	349	414	268	618	401	483	386	167	333	119	242	-	-	3,780	112,328
5/26	330	-	502	345	709	694	372	-	665	225	211	-	-	4,053	116,381

Table A-3 (continued).

Date	Count Cycle (hour of day)*													Sum	YTD
	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20+		
5/27	-	-	-	-	-	492	-	387	401	382	101	-	-	1,763	118,144
5/28	-	-	-	-	-	-	220	389	-	222	176	-	-	1,007	119,151
5/29	-	-	-	-	-	-	278	-	450	264	203	-	-	1,195	120,346
5/30	-	166	-	439	326	223	87	432	417	254	128	-	-	2,472	122,818
5/31	-	297	177	126	274	109	-	-	20	556	356	-	-	1,915	124,733
6/1	118	120	80	188	154	178	384	342	164	49	94	-	-	1,871	126,604
6/2	-	-	-	218	-	109	-	128	91	142	63	-	-	751	127,355
6/3	-	-	756	740	644	321	272	116	-	202	113	-	-	3,164	130,519
6/4	-	138	393	249	106	731	1,146	607	237	520	137	-	-	4,264	134,783
6/5	-	1	-	463	79	-	590	507	500	246	373	-	-	2,759	137,542
6/6	-	-	535	684	230	383	426	545	435	531	167	-	-	3,936	141,478
6/7	358	336	237	524	270	381	280	496	450	474	344	-	-	4,150	145,628
6/8	0	255	165	161	201	158	97	248	305	333	214	-	-	2,137	147,765
6/9	0	0	0	0	376	177	186	110	24	144	152	-	-	1,169	148,934
6/10	-	-	70	-	-	228	-	242	-	150	177	-	-	867	149,801
6/11	1	-	-	-	80	-	-	59	-	45	99	-	-	284	150,085
6/12	-	-	-	-	-	80	-	146	177	71	-	-	-	474	150,559
6/13	-	694	265	-	303	192	187	212	422	287	-	-	-	2,562	153,121
6/14	-	-	-	-	-	-	-	866	149	212	-	-	-	1,227	154,348
6/15	8	96	71	93	251	118	83	74	117	21	-	-	-	932	155,280
6/16	0	11	0	2	0	84	29	15	16	16	-	-	-	173	155,453
6/17	3	16	12	49	49	43	38	35	53	15	-	-	-	313	155,766

Table A-3 (continued).

Date	Count Cycle (hour of day)*													Sum	YTD
	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20+		
6/18	8	12	6	19	14	15	11	12	24	-	-	-	-	121	155,887
6/19	4	23	28	32	29	15	21	44	127	-	-	-	-	323	156,210
6/20	15	69	31	50	48	37	49	33	56	-	-	-	-	388	156,598
6/21	13	24	16	25	28	16	14	22	42	-	-	-	-	200	156,798
6/22	0	111	36	66	49	16	36	33	78	-	-	-	-	425	157,223
6/23	10	3	16	9	99	15	19	57	91	-	-	-	-	319	157,542
6/24	7	43	48	46	34	27	15	19	22	-	-	-	-	261	157,803
6/25	0	13	13	23	5	11	4	3	0	-	-	-	-	72	157,875
6/26	5	127	162	48	61	84	76	57	3	-	-	-	-	623	158,498
6/27	-	19	-	16	-	19	-	12	-	-	-	-	-	66	158,564
6/28	-	10	-	12	-	6	-	15	-	-	-	-	-	43	158,607
6/29	-	34	-	57	-	36	-	37	-	-	-	-	-	164	158,771
6/30	-	29	-	49	-	49	-	36	-	-	-	-	-	163	158,934
7/1	-	13	-	29	-	22	-	31	-	-	-	-	-	95	159,029
7/2	-	44	-	48	-	46	-	36	-	-	-	-	-	174	159,203
7/3	-	31	-	49	-	41	-	21	-	-	-	-	-	142	159,345
7/4	-	14	-	25	-	34	-	26	-	-	-	-	-	99	159,444
7/5	-	9	-	38	-	32	-	23	-	-	-	-	-	102	159,546
7/6	-	0	-	1	-	17	-	2	-	-	-	-	-	20	159,566
7/7	-	0	-	29	-	64	-	18	-	-	-	-	-	111	159,677
7/8	-	9	-	50	-	32	-	21	-	-	-	-	-	112	159,789
7/9	-	8	-	17	-	14	-	7	-	-	-	-	-	46	159,835

Table A-3 (continued).

Date	Count Cycle (hour of day)*													Sum	YTD
	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20+		
7/10	-	2	-	17	-	12	-	13	-	-	-	-	-	44	159,879
7/11	-	5	-	32	-	51	-	115	-	-	-	-	-	203	160,082
7/12	-	81	-	96	-	48	-	42	-	-	-	-	-	267	160,349
7/13	-	6	-	15	-	22	-	3	-	-	-	-	-	46	160,395
7/14	-	0	-	3	-	11	-	6	-	-	-	-	-	20	160,415
7/15	-	22	-	17	-	10	-	12	-	-	-	-	-	61	160,476
7/16	-	11	-	6	-	10	-	26	-	-	-	-	-	53	160,529
7/17	-	13	-	15	-	12	-	15	-	-	-	-	-	55	160,584
7/18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160,584
7/19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160,584
7/20	-	6	-	10	-	7	-	0	-	-	-	-	-	23	160,607
7/21	-	2	-	1	-	4	-	0	-	-	-	-	-	7	160,614
7/22	-	0	-	7	-	2	-	4	-	-	-	-	-	13	160,627
7/23	-	7	-	7	-	3	-	3	-	-	-	-	-	20	160,647
7/24	-	4	-	3	-	9	-	6	-	-	-	-	-	22	160,669

\* Count periods during the early season (through May 6) and late season (July 1 – 11) were done based on two hour lift cycles and are included here as hour that the period began.

<sup>1</sup> Count includes estimate of 200 fish in remaining in flume.

Table A-4. Holyoke Dam and fish lift, 2009. Daily observations of the tailrace fish lift east entrance gate (Salmon Gate) setting (% open), attraction water supply gate opening (inches open for both gates), total attraction flow (cfs), and attraction flow distribution (% open) for distribution gates 3-5. Gate 3 diverts flow to the spillway fish lift entrance; Gate 4 to the tailrace fish lift bucket / channel; and Gate 5 to the spillway fish lift bucket / channel.

Date	Salmon Gate Opening (%)	Attraction Water Supply (in)	Attraction Water (cfs)	Bascule Gate	Attraction Water Distribution Gate Positions (%)		
					Gate 3	Gate 4	Gate 5
4/14	0	.	.	Open	.	.	.
4/15	0	.	.	Open	.	.	.
4/16	0	.	.	Open	.	.	.
4/17	0	15	294	Open	.	.	.
4/18 - 4/20, no lifting				Open			
4/21	0	12	236	Open	.	.	.
4/22	0	.	.	Open	.	.	.
4/23	0	.	.	Open	.	.	.
4/24	0	12	236	Open	24	94	20
4/25	0	13	256	Open	24	94	20
4/26	0	13	256	Open	24	94	20
4/27	0	15	294	Open	.	.	.
4/28	0	15	294	Open	.	.	.
4/29	10	15	294	Open	25	94	20
4/30	15	15	294	Open	24	94	20
5/1	25	15	294	Open	24	94	20
5/2	.	15	294	Open	24	94	20
5/3	.	15	294	Open	24	94	20
5/4	50	15	294	Open	24	94	20
5/5	32	15	294	Open	24	94	24
5/6	100	15	294	*	24	94	24
5/7	10	15	294	Open	24	94	24
5/8	0	15	294	Open	24	94	24
5/9	0	15	294	Open	24	94	20
5/10	0	15	294	Open	24	94	20
5/11	0	15	294	Open	24	94	20
5/12	0	15	294	Open	24	94	24
5/13	0	15	294	Open	24	94	20
5/14	0	15	294	Partial	24	94	20
5/15	0	15	294	Open	24	94	20

Table A-3 (continued).

Date	Salmon Gate Opening (%)	Attraction Water Supply (in)	Attraction Water (cfs)	Bascule Gate	Attraction Water Distribution Gate Positions (%)		
					Gate 3	Gate 4	Gate 5
5/16	0	15	294	Open	24	94	20
5/17	0	15	294	Open	24	94	20
5/18	.	15	294	Open	24	93	20
5/19	0	15	294	Open	24	93	20
5/20	.	15	294	Open	24	93	20
5/21	25, 50, 0	15	294	Open	24	93	20
5/22	100	15	294	Partial	24	94	24
5/23	.	15	294	Open	24	94	24
5/24	60, 100	15	294	Open	24	94	24
5/25	variable	15	294	Open	24	94	24
5/26	100	15	294	Partial	24	90	24
5/27	100	15	294	Partial	24	90	24
5/28	variable	15	294	Partial	24	90	20
5/29	.	15	294	Partial	24	90	20
5/30	0	15	294	Open	24	90	20
5/31	0	15	294	Open	24	90	24
6/1	0	15	294	Open	24	90	20
6/2	25	15	294	Partial	24	90	20
6/3	40	15	294	Open	24	90	20
6/4	variable	15	294	Open	24	90	20
6/5	variable	15	294	Open	24	90	20
6/6	100, 85	15	294	Partial	24	90	20
6/7	100	15	294	Open	24	90	20
6/8	100	15	294	Open	24	90	20
6/9	100	15	294	Partial	24	90	20
6/10	100	15	294	Open	25	60	26
6/11	.	15	294	Partial	25	60	26
6/12	.	15	294	Open	.	.	.
6/13	0	15	294	Open	.	80	25
6/14	100	15	294	Open	.	80	25
6/15	0	15	294	Open	50	80	25
6/16	0	15	294	Partial	35	80	25.
6/17	.	15	294	Open	50	80	40
6/18	25	15	294	Partial	30	80	20
6/19	.	15	294	Open	.	.	.
6/20	100	15	294	Open	.	90	24

Table A-3 (continued).

Date	Salmon Gate Opening (%)	Attraction Water Supply (in)	Attraction Water (cfs)	Bascule Gate	Attraction Water Distribution Gate Positions (%)		
					Gate 3	Gate 4	Gate 5
6/21	100	15	294	Open	.	24	90
6/22	0, 20	15	294	Open	35	80	33
6/23	25	15	294	Open	35	80	20
6/24	25, 70	15	294	Open	50	80	33
6/25	.	15	294	Open	35	80	20
6/26	.	15	294	Partial	50	80	33
6/27	.	15	294	Open	.	90	24
6/28	.	15	294	Open	.	90	24
6/29	5	15	294	Open	.	.	.
6/30	5	15	294	Partial	.	80	33
7/1	0	15	294	Open	.	.	.
7/2	0	15	294	Open	.	.	.
7/3	0	15	294	Open	.	.	.
7/4	0	15	294	Open	.	.	.
7/5	0	15	294	Open	30	80	21
7/6	0	15	294	Open	.	.	.
7/7	0	15	294	Open	.	.	.
7/8	0	15	294	Open	.	.	.
7/9	0	15	294	Open	.	.	.
7/10	0	15	294	Open	.	.	.
7/11	0, 50	15	294	Open	.	.	.
7/12	0, 50	15	294	Open	.	90	24
7/13	100	15	294	Open	.	.	.
7/14	0	15	294	Open	.	.	.
7/15	57.5	15	294	Open	.	.	.
7/16	57.5, 85	15	294	Open	.	.	.
7/17	100	15	294	Open	.	.	.
7/18 - 7/18, no lifting					.	.	.
7/20	100	15	294	Open	.	.	.
7/21	100	15	294	Open	.	.	.
7/22	100	15	294	Open	.	.	.
7/23	100	15	294	Open	.	.	.
7/24	100	15	294	Open	.	.	.
7/25	100	15	294	Open	.	.	.
7/26	100	15	294	Open	.	.	.

\* Alden-NU weir installation



Table A-5. Holyoke Dam, 2009. Hourly rubber dam positions. Five positions are represented in each cell to indicate the setting of rubber dam sections 1-5 reading from left to right. Rubber Dam Section # 5 is closest to the fish lift entrance. O = open, / = partially open, X = closed.

Date	Hour of Day											
	8	9	10	11	12	13	14	15	16	17	18	19
4/21									OXXXO	OXXXO	OXXXO	OXXXO
4/22	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/23	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/24	OXXX/	OXXXO	OXXXO	XXXOO	XXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/25	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/26	OXXXO	XXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/27	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/28	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/29	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
4/30	OXXXO	OXXXO	OXXXO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO
5/1	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
5/2	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
5/3	XXXXX	XXXXX	XXX/	XXX/	XXX/	XXX/	XXX/	XXX/	XXX/	XXX/	XXX/	XXX/
5/4	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
5/5	XXXX/	XXXXO	XXXXO	XXXXX	XXXXX	XXX/	XXX/	XXX/	XXX/	XXXXX	XXXXX	XXXXX
5/6*	XXXXX	OXXXO	OXXXO	OXXX/	OXXXO	OXXXO	OXXXO	OXXXO	XXX/	XXX/	XXXXX	XXXXX
5/7	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	OXXXO	OXXXO	OXXX/	OXXXO
5/8	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/9	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/10	XXOOO	XXOOO	XXOOO	XXOOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO
5/11	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/12	OXXXO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO
5/13	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/14	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXXO	XXXXO	XXXXO	OXXXO
5/15	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/16	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/17	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXX/
5/18	OXXXO	OXXXO	OXXXO	XXXOO	XXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/19	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
5/20	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
5/21	XXXXO	OXXXO	OXXXO	OXXXO	OXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO

Table A-5 (continued).

Date	Hour of Day											
	8	9	10	11	12	13	14	15	16	17	18	19
5/22	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/
5/23	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/
5/24	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/
5/25	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/
5/26	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/
5/27	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
5/28	XXXXO	XXXX/	XXXX/	XXXX/	XXXXX	XXXX/	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
5/29	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
5/30	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
5/31	OXXO	OXXO	OXXO	OXXO	OXXO	XXO	XXO	XXO	XXO	XXO	XXXX	OXXO
6/1	OXXO	OXXO	OXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/2	OXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/3	XXXXO	XXXXO	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXX/	XXXXO	XXXXO
6/4	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/5	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/6	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/7	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/8	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/9	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/10	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/11	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/12	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/13	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
6/14	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
6/15	OXXO	OXXO	XOXX	XXXXO	XXXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
6/16	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
6/17	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/18	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/19	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX
6/20	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX
6/21	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX	OXXX
6/22	OXXX	OXXX	OXXX	OXXX	OXXX	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/23	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO

Table A-5 (continued).

Date	Hour of Day											
	8	9	10	11	12	13	14	15	16	17	18	19
6/24	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/25	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/26	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/27	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/28	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/29	OXXO	OXXO	OXXO	OXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
6/30	OXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
7/1	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO
7/2	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/3	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/4	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/5	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/6	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/7	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/8	OOOOO	OOOOO	XOOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	XXOOO	OXOOO	OXOOO	OXOOO
7/9	OXOOO	OXOOO	OXOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO	OOOOO
7/10	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO	XOOOO
7/11	OXXOO	OXXOO	OXXOO	OXXOO	OXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXO
7/12	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO	XXXXO
7/13	OXXOO	OXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO	XXXOO
7/14	OXXOO	OXXOO	OXXOO	OXXOO	XXXOO	XXXOO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
7/15	XXXXO	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
7/16	OXOXO	OXOXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	XXXXO	XXXXO
7/17	OXXXO	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX/	XXXXX/	XXXXX	XXXXX/	XXXXX/
7/18	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
7/19	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	OXXXX	XXXXX	XXXXX
7/20	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO	OXXXO
7/21	OXXXO	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
7/22	XXXXO	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX/
7/23	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO
7/24	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO	OXXO

<sup>1</sup> NU-Alden weir installation into Bascule Gate slot

Table A-6. Holyoke Dam and fish lift, 2009. Daily average water surface elevations calculated from hourly data collected by the SCADA system for: Hadley head pond, fish lift exit flume, fish lift attraction water distribution center, inside of the spillway and tailrace fish lift entrances and outside of the tailrace entrances, and the spillway at the Texon Building. Means and 95% confidence limits are included at the bottom of the table.

Date	Pond	Flume	Dist. Center	Water Surface Elevation			
				Spillway Fish Lift	Tailrace Fish Lift		
				Inside	Inside	Outside	Texon
4/1	105.67	98.83	69.06	72.06	60.05	59.59	66.59
4/2	104.78	98.83	69.05	72.08	58.67	58.53	66.21
4/3	104.53	98.84	69.06	72.10	58.20	58.12	66.10
4/4	105.53	98.84	69.06	72.14	59.91	59.42	66.49
4/5	106.58	98.83	69.06	72.06	61.74	59.65	66.91
4/6	106.44	98.83	69.06	72.07	61.51	59.65	66.87
4/7	106.08	98.83	69.06	72.06	60.91	59.65	66.71
4/8	106.18	98.83	69.06	72.07	61.02	59.65	66.74
4/9	105.67	98.84	69.06	72.06	60.23	59.59	66.59
4/10	104.54	98.83	69.06	72.09	58.28	58.19	66.13
4/11	103.79	98.83	69.06	72.07	57.28	57.23	65.86
4/12	102.94	98.84	69.05	72.07	56.07	56.07	65.61
4/13	102.88	100.95	69.36	70.76	55.27	55.39	65.45
4/14	102.95	102.91	69.51	68.84	54.57	54.75	64.68
4/15	102.84	103.11	69.67	68.99	54.48	54.63	64.48
4/16	102.83	103.21	69.53	67.90	54.01	54.18	64.18
4/17	103.18	103.49	69.99	67.81	54.02	54.27	64.34
4/18	103.00	102.79	69.05	67.42	53.68	53.79	64.04
4/19	102.80	102.59	69.05	67.36	53.60	53.69	63.71
4/20	103.05	102.83	69.05	67.32	53.63	53.70	63.86
4/21	103.45	103.04	69.50	68.36	49.97	54.53	64.65
4/22	103.27	103.37	69.98	68.68	.	54.67	64.60
4/23	103.09	103.31	69.70	69.11	.	54.50	64.73
4/24	103.01	103.17	69.07	70.14	.	54.90	64.64
4/25	102.85	102.90	69.38	70.60	.	55.37	65.00
4/26	102.97	103.09	69.31	70.31	.	55.13	64.77
4/27	103.08	103.25	69.47	70.53	.	55.03	64.62
4/28	103.07	103.34	69.55	68.96	.	54.51	64.60
4/29	102.95	102.99	69.46	68.46	.	54.31	64.49
4/30	103.06	103.05	69.39	67.97	.	53.94	64.06
5/1	103.06	103.09	69.42	67.87	.	53.95	63.83
5/2	102.98	103.13	69.49	67.97	.	53.99	63.80
5/3	102.05	102.17	69.11	67.75	.	53.32	63.41

Table A-6 (continued).

Date	Pond	Flume	Dist. Center	Water Surface Elevation			
				Spillway Fish Lift Inside	Tailrace Fish Lift		
					Inside	Outside	Texon
5/4	102.69	102.82	69.37	67.66	.	53.36	63.33
5/5	102.81	102.86	69.43	67.71	.	53.79	63.55
5/6	102.42	102.69	69.63	67.16	.	52.66	63.09
5/7	103.08	103.19	69.65	68.34	.	53.85	63.73
5/8	103.07	102.99	69.72	71.14	.	54.71	64.58
5/9	103.24	102.84	69.79	71.68	.	54.84	64.69
5/10	102.81	102.34	69.77	71.70	.	55.03	64.71
5/11	103.21	102.75	69.77	71.89	.	54.87	64.63
5/12	102.99	102.69	69.82	71.92	.	55.25	64.92
5/13	103.16	102.57	69.79	71.80	.	54.97	64.64
5/14	102.83	102.57	69.73	70.66	.	54.44	64.24
5/15	103.26	103.09	69.70	69.40	.	54.29	64.42
5/16	103.06	102.93	69.85	69.22	.	54.23	64.25
5/17	102.56	102.52	69.80	68.75	.	53.78	63.50
5/18	103.26	102.95	69.85	70.14	.	54.27	64.43
5/19	103.31	103.01	69.67	69.99	.	54.47	64.53
5/20	103.10	102.84	69.76	69.04	.	54.15	64.08
5/21	102.80	102.72	69.63	68.83	.	53.47	63.79
5/22	102.29	102.00	69.70	68.20	.	52.19	63.29
5/23	102.53	102.18	69.77	68.43	.	52.85	63.32
5/24	102.42	102.32	69.63	68.13	.	52.66	63.20
5/25	102.49	102.41	69.67	68.17	.	52.36	63.17
5/26	102.47	102.42	69.59	68.23	.	51.49	63.19
5/27	102.39	102.35	69.70	68.34	.	49.78	63.21
5/28	102.43	102.34	69.77	68.37	.	.	63.34
5/29	103.00	102.84	69.66	68.74	.	.	63.86
5/30	103.29	103.02	69.79	70.28	.	.	64.89
5/31	103.23	103.18	69.83	70.29	.	.	64.85
6/1	103.06	102.98	69.54	69.02	.	.	63.95
6/2	102.80	102.94	69.65	68.71	.	.	63.78
6/3	102.43	102.55	69.65	68.44	.	.	63.61
6/4	102.10	101.91	69.69	68.24	.	.	63.32
6/5	102.31	101.94	69.63	68.42	.	.	63.34
6/6	102.54	102.42	69.68	68.51	.	.	63.38
6/7	102.60	101.97	69.70	68.57	.	.	63.40
6/8	102.53	102.52	69.66	68.52	.	.	63.36
6/9	102.47	102.37	69.71	68.44	.	.	63.33

Table A-6 (continued).

Date	Pond	Flume	Dist. Center	Water Surface Elevation			Texon
				Spillway Fish Lift	Tailrace Fish Lift		
					Inside	Outside	
6/10	102.41	102.47	69.77	68.53	.	.	63.34
6/11	102.45	102.48	69.65	68.60	.	.	63.41
6/12	102.45	102.06	69.50	68.48	.	.	63.40
6/13	103.25	102.84	69.56	69.26	.	.	64.42
6/14	103.16	103.06	69.52	69.63	.	.	65.29
6/15	103.17	103.14	69.48	69.32	.	.	64.72
6/16	102.94	103.01	69.61	68.81	.	.	64.11
6/17	103.05	103.09	69.57	68.91	.	.	64.00
6/18	102.58	102.66	69.52	68.58	.	.	63.61
6/19	102.77	102.55	69.62	70.19	.	.	64.86
6/20	103.09	102.73	69.41	70.92	.	.	65.19
6/21	102.78	102.61	69.60	70.25	.	.	64.84
6/22	102.69	102.57	69.48	69.00	.	.	63.95
6/23	102.57	102.67	69.59	68.53	.	.	63.48
6/24	102.47	102.44	69.49	68.49	.	.	63.53
6/25	102.47	102.29	69.09	68.28	.	.	63.39
6/26	102.52	102.50	69.13	68.35	.	.	63.40
6/27	102.42	102.39	69.12	68.34	.	.	63.40
6/28	102.77	102.70	69.42	68.62	.	.	63.45
6/29	102.74	102.69	69.44	68.63	.	.	63.54
6/30	102.92	103.00	69.40	68.81	.	.	63.76
7/1	103.01	102.87	69.50	70.96	.	.	64.57
7/2	102.98	102.75	69.55	71.90	.	.	65.50
7/3	103.21	102.80	69.56	71.96	.	.	65.69
7/4	103.12	102.76	69.55	71.94	.	.	65.66
7/5	102.48	102.26	69.60	71.65	.	.	65.46
7/6	103.18	102.37	69.39	71.91	.	.	65.67
7/7	102.85	102.33	69.39	71.75	.	.	65.57
7/8	102.66	102.32	69.50	71.75	.	.	65.18
7/9	102.80	102.39	69.61	71.85	.	.	65.32
7/10	102.48	102.05	69.51	71.62	.	.	65.14
7/11	102.50	102.44	69.47	70.41	.	.	64.55
7/12	102.21	102.27	69.41	68.77	.	.	63.71
7/13	102.64	102.48	69.48	70.28	.	.	64.22
7/14	102.69	102.74	69.42	70.07	.	.	64.26
7/15	102.29	102.50	69.40	67.93	.	.	63.25
7/16	102.63	102.38	69.44	68.52	.	.	63.82

Table A-6 (continued).

Date	Pond	Flume	Dist. Center	Water Surface Elevation			Texon
				Spillway Fish Lift Inside	Tailrace Fish Lift Inside      Outside		
7/17	102.30	102.09	69.44	68.06	.	.	63.51
7/18	102.42	102.18	69.05	67.16	.	.	63.12
7/19	102.91	102.56	69.06	67.66	.	.	63.89
7/20	103.09	102.66	69.45	69.05	.	.	64.32
7/21	102.93	102.73	69.36	68.36	.	.	63.78
7/22	102.70	102.19	69.44	68.30	.	.	63.63
7/23	102.88	102.06	69.45	69.38	.	.	64.58
7/24	102.70	101.95	69.51	69.98	.	.	65.14
7/25	102.52	101.92	69.05	70.71	.	.	65.40
7/26	102.40	101.93	69.04	71.63	.	.	65.46
7/27	102.34	99.72	69.04	71.59	.	.	65.45
7/28	102.51	98.77	69.04	70.46	.	.	64.67
7/29	102.54	98.78	69.04	65.50	.	.	63.65
7/30	103.01	98.77	69.04	66.58	.	.	65.03
7/31	104.34	98.81	69.04	72.65	.	.	66.09
LCL	102.90	101.87	69.41	69.29	54.88	54.43	64.25
Mean	103.06	102.11	69.46	69.57	56.51	55.01	64.43
UCL	103.22	102.35	69.50	69.86	58.15	55.59	64.60

Table A-7. Hadley Falls Station, 2009. Daily minimum, maximum, mean, and standard deviation of generation by Hadley Falls hydroelectric units #1 and #2, and total river discharge as recorded by USGS gauge #01172010 at I-391 bridge, Holyoke, MA. Overall means and 95% confidence intervals (LCL, UCL) are included at the bottom of the table.

Date	Unit #1 Generation (MW)				Unit #2 Generation (MW)				Total River Discharge (cfs)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
4/1	0	16	14	3.10	0	13	11	2.57	52,700	61,700	56,656	2,968.60
4/2	15	16	15	0.15	12	13	12	0.35	45,800	52,900	48,111	2,054.67
4/3	0	16	15	3.17	0	13	12	2.67	43,800	48,900	46,088	1,374.98
4/4	15	15	15	0.16	11	13	12	0.40	48,900	63,400	56,058	4,046.28
4/5	0	15	14	3.03	0	12	11	2.44	63,500	68,200	66,724	1,166.17
4/6	14	15	15	0.26	0	12	11	2.43	62,700	68,200	65,435	1,795.31
4/7	15	15	15	0.15	12	13	12	0.38	60,100	64,100	62,109	1,186.24
4/8	0	15	14	3.07	0	13	12	2.47	61,800	64,200	62,765	619.50
4/9	0	16	15	3.12	0	13	12	2.55	52,200	63,000	57,819	3,266.94
4/10	0	16	15	3.20	0	13	12	3.67	45,000	51,800	47,181	2,100.29
4/11	15	16	16	0.13	13	13	13	0.11	37,800	45,200	40,806	2,326.63
4/12	15	16	16	0.33	1	14	13	2.53	28,900	37,900	33,381	2,472.30
4/13	0	16	15	3.25	13	15	14	0.28	26,500	29,500	28,629	854.94
4/14	15	17	16	0.62	13	14	14	0.22	20,500	28,500	23,658	2,826.96
4/15	15	17	16	0.39	14	14	14	0.15	20,500	23,200	22,230	765.18
4/16	0	17	16	3.36	14	15	14	0.28	18,900	22,100	19,791	1,057.31
4/17	16	17	17	7.71	14	15	14	6.62	19,000	20,300	19,529	342.41
4/18	0	17	16	3.40	0	15	14	2.95	17,700	19,100	18,599	282.65
4/19	16	17	17	0.16	14	15	14	0.16	17,400	18,500	17,900	353.93
4/20	17	17	17	0.07	14	14	14	0.06	17,300	19,200	17,923	481.33
4/21	16	17	16	0.29	14	15	14	0.22	19,300	25,700	22,298	2,106.98
4/22	16	17	16	0.19	14	14	14	0.15	22,000	25,900	23,668	1,430.46
4/23	0	17	14	5.52	0	15	14	2.89	21,900	25,700	23,597	1,181.65
4/24	16	17	16	0.29	14	15	14	0.30	21,700	29,500	25,099	2,763.69
4/25	16	16	16	0.20	13	14	14	0.21	27,500	29,500	28,283	616.21
4/26	16	16	16	0.24	13	14	14	0.28	24,700	29,000	26,595	1,570.81
4/27	16	17	16	0.14	14	14	14	0.13	24,100	26,800	25,434	890.51
4/28	16	17	16	0.21	14	15	14	0.27	20,300	24,500	21,954	1,274.11
4/29	16	17	16	0.23	14	15	14	0.20	19,300	22,200	20,624	1,121.72
4/30	0	17	16	3.39	0	15	14	2.95	18,100	19,500	18,845	447.18
5/1	16	17	16	0.25	14	15	15	0.10	17,600	18,300	17,858	155.37
5/2	16	17	17	0.16	14	15	14	0.15	17,100	18,500	17,698	487.09
5/3	5	17	14	3.55	14	15	14	0.24	12,600	17,600	15,130	1,997.95
5/4	11	17	15	2.01	14	15	14	0.20	12,400	17,500	14,335	1,622.47
5/5	16	17	17	0.17	14	15	14	0.19	14,400	18,100	16,974	933.72
5/6	0	16	10	5.19	0	15	13	4.96	10,200	14,800	13,254	1,191.01



Table A-7 (continued).

Date	Unit #1 Generation (MW)				Unit #2 Generation (MW)				Total River Discharge (cfs)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
5/7	16	17	16	0.11	14	15	15	0.16	14,800	21,300	17,566	1,862.59
5/8	16	16	16	0.15	14	15	14	0.29	21,400	25,000	23,766	951.77
5/9	0	16	14	5.46	0	15	14	2.90	21,700	26,500	24,366	1,209.33
5/10	16	16	16	0.19	14	14	14	0.19	22,900	26,600	25,096	1,232.96
5/11	5	16	16	2.24	0	14	14	2.90	22,300	27,100	24,840	1,587.48
5/12	15	16	16	0.34	13	14	14	0.32	24,900	28,700	27,049	989.95
5/13	9	17	16	1.59	0	14	14	2.90	23,900	25,600	25,111	387.94
5/14	16	17	16	0.23	10	15	14	0.85	19,500	23,800	21,410	1,416.73
5/15	16	17	17	0.15	14	15	14	0.12	18,800	19,900	19,568	174.41
5/16	16	17	16	0.14	14	15	14	0.10	17,500	20,000	18,855	798.14
5/17	15	17	16	0.60	14	15	14	0.13	14,600	17,600	15,831	947.83
5/18	0	17	15	4.71	0	15	13	4.06	16,100	23,300	19,391	2,161.34
5/19	16	17	17	0.20	14	15	14	0.25	20,000	23,300	20,909	1,080.36
5/20	16	17	17	0.19	14	15	14	0.14	16,700	20,200	18,247	1,234.41
5/21	0	17	12	6.72	14	15	15	0.33	13,000	17,400	15,921	1,239.18
5/22	5	17	13	4.24	0	15	6	7.33	7,580	13,400	10,531	1,563.24
5/23	6	17	12	3.99	14	15	15	0.26	9,330	11,700	10,508	700.56
5/24	5	16	10	4.24	12	15	14	0.93	8,450	11,000	9,891	776.99
5/25	5	13	9	2.46	14	15	15	0.23	8,230	9,490	9,033	304.01
5/26	5	17	8	4.42	0	15	9	7.54	6,320	8,280	7,655	663.05
5/27	0	12	6	4.09	0	16	13	5.12	6,210	9,160	7,916	986.87
5/28	9	17	13	2.93	14	15	15	0.29	9,190	11,500	10,577	641.58
5/29	14	17	16	0.76	14	15	14	0.17	11,100	18,500	15,146	2,611.11
5/30	16	17	16	0.24	14	15	14	0.17	18,500	25,300	22,176	2,179.75
5/31	16	16	16	0.19	13	14	14	0.22	19,500	25,400	22,831	2,121.09
6/1	16	17	16	0.22	14	15	14	0.32	16,000	19,500	17,369	1,285.41
6/2	0	17	16	3.36	14	15	15	0.19	15,400	17,400	16,402	618.31
6/3	15	17	16	0.73	14	15	14	0.14	13,300	17,100	15,203	1,248.19
6/4	5	16	12	3.12	0	15	13	4.92	10,100	13,100	11,307	647.63
6/5	0	17	9	4.53	0	16	13	4.21	6,940	10,900	9,367	1,044.32
6/6	5	13	9	3.42	0	0	0	0.01	4,500	7,100	6,189	731.02
6/7	0	13	9	4.61	0	0	0	0.01	3,830	6,530	5,488	898.82
6/8	5	15	9	3.18	0	15	4	7.05	5,630	7,970	6,708	758.11
6/9	5	16	8	3.83	0	15	4	7.03	5,380	7,550	6,357	771.99
6/10	0	17	8	4.82	0	15	4	6.60	4,580	8,950	6,365	1,318.20
6/11	0	15	6	5.60	0	16	10	7.23	6,580	9,100	7,403	608.77
6/12	8	17	12	3.07	14	15	15	0.30	8,600	13,300	10,901	1,137.00
6/13	16	17	17	0.22	14	15	15	0.19	13,300	21,000	17,659	2,039.69
6/14	16	16	16	0.12	14	15	14	0.12	21,000	24,900	23,589	1,204.72

Table A-7 (continued).

Date	Unit #1 Generation (MW)				Unit #2 Generation (MW)				Total River Discharge (cfs)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
6/15	16	17	16	0.19	14	15	14	0.20	19,500	24,600	21,584	2,136.17
6/16	16	17	16	0.12	14	15	15	0.17	17,500	19,500	18,302	615.41
6/17	16	17	17	0.13	14	15	15	0.15	16,600	18,700	17,640	721.13
6/18	15	17	16	0.63	14	15	14	0.19	15,700	17,600	16,492	545.54
6/19	15	17	16	0.46	0	15	13	2.89	16,800	32,700	24,509	5,371.54
6/20	15	16	16	0.32	14	14	14	0.33	24,900	33,000	28,214	2,845.33
6/21	16	16	16	0.13	14	14	14	0.13	22,600	24,800	23,096	575.81
6/22	16	17	16	0.27	14	15	14	0.19	16,700	23,000	18,838	2,196.52
6/23	16	17	16	0.22	14	15	15	0.16	15,200	16,800	15,850	598.77
6/24	10	17	15	2.20	14	15	15	0.20	11,600	15,500	13,391	1,285.80
6/25	5	16	12	4.71	14	15	15	0.39	9,610	12,800	11,213	950.60
6/26	5	17	13	3.96	14	15	15	0.28	9,910	12,400	11,338	736.81
6/27	12	16	14	1.85	14	15	15	0.18	10,700	12,000	11,278	402.15
6/28	16	16	16	0.15	14	15	15	0.15	11,900	12,600	12,249	203.65
6/29	15	16	16	0.27	14	15	15	0.16	11,100	13,400	12,797	506.27
6/30	16	17	16	0.25	14	15	15	0.19	13,400	16,900	15,248	756.58
7/1	0	17	15	3.31	0	15	14	2.93	17,000	27,800	21,239	2,830.93
7/2	15	16	15	0.19	13	14	14	0.22	28,000	33,500	31,359	1,196.27
7/3	15	15	15	0.17	13	14	13	0.11	32,700	35,700	33,831	711.60
7/4	15	16	15	0.36	13	14	13	0.25	30,700	36,600	33,682	2,249.12
7/5	0	16	15	3.15	0	14	13	2.75	27,200	30,800	28,941	1,312.58
7/6	15	16	15	0.12	13	14	14	0.19	28,900	36,400	32,582	2,172.80
7/7	0	16	14	5.23	13	14	14	0.16	28,500	36,300	31,230	2,613.37
7/8	15	16	16	0.23	13	14	14	0.24	26,400	28,900	27,684	851.42
7/9	15	16	16	0.21	14	14	14	0.16	28,400	29,900	29,044	421.23
7/10	15	16	16	0.18	14	14	14	0.14	24,700	28,600	26,456	1,351.94
7/11	15	17	16	0.29	14	15	14	0.27	18,600	25,200	21,304	2,161.57
7/12	15	16	16	0.45	14	15	14	0.20	15,200	19,400	16,781	1,321.19
7/13	16	17	16	0.23	14	15	14	0.18	16,400	21,000	18,852	1,285.38
7/14	16	16	16	0.19	14	15	14	0.18	16,600	21,500	19,564	1,757.04
7/15	6	17	15	2.86	14	15	15	0.23	13,100	16,600	14,719	1,055.54
7/16	16	17	16	0.21	0	15	4	6.76	12,300	16,200	14,046	1,218.88
7/17	12	17	16	1.47	0	0	0	0.00	9,730	13,400	11,467	1,408.89
7/18	5	17	12	4.61	0	0	0	0.00	7,970	11,200	9,495	963.45
7/19	16	17	17	0.25	0	0	0	0.01	11,200	12,700	12,207	256.39
7/20	17	17	17	0.14	0	0	0	0.02	12,700	14,200	13,750	362.45
7/21	16	17	17	0.18	0	0	0	0.00	11,900	13,700	12,763	635.98
7/22	16	17	17	0.18	0	0	0	0.00	12,000	13,600	12,725	518.70

Table A-7 (continued).

Date	Unit #1 Generation (MW)				Unit #2 Generation (MW)				Total River Discharge (cfs)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
7/23	16	17	17	0.22	0	0	0	0.00	13,700	17,100	15,425	931.78
7/24	16	17	16	0.19	0	0	0	0.00	17,200	24,100	20,863	1,651.68
7/25	15	17	16	0.42	0	0	0	0.00	22,700	28,500	25,383	1,878.00
7/26	15	16	16	0.29	0	0	0	0.00	24,500	28,600	26,702	1,505.08
7/27	16	16	16	0.14	0	0	0	0.00	25,200	25,900	25,568	204.42
7/28	0	17	14	6.24	0	0	0	0.01	15,600	25,600	19,660	3,526.52
7/29	17	17	17	0.23	0	0	0	0.00	12,800	18,100	14,425	1,921.84
7/30	16	18	16	0.53	0	0	0	0.00	13,700	37,500	23,058	7,115.54
7/31	0	16	15	3.19	0	0	0	0.00	37,900	43,700	41,690	1,109.43
LCL			14.4				10.6				19,889.7	
Mean			14.8				11.5				22,180.9	
UCL			15.3				12.4				24,472.1	

Table A-8. Holyoke fish lift, 2009. Hopper Fullness Indices for the Spillway and Tailrace fish lifts. Lifts indexed from archived video are denoted with '\*', all others were indexed in real-time.

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
4/13/2009	13:00	0		4/13/2009	13:20	0	
4/14/2009	9:00	0		4/14/2009	11:00	0	
4/14/2009	11:00	0		4/14/2009	13:00	0	
4/14/2009	13:00	0		4/14/2009	14:20	0	
4/14/2009	14:15	0		4/15/2009	8:45	0	
4/15/2009	9:00	0		4/15/2009	9:00	0	
4/15/2009	11:00	0		4/15/2009	11:00	0	
4/15/2009	13:00	0		4/15/2009	13:00	0	
4/15/2009	14:15	0		4/15/2009	14:20	0	
4/16/2009	9:05	0		4/16/2009	9:00	0	
4/16/2009	11:05	0		4/16/2009	11:00	0	
4/16/2009	13:00	0		4/16/2009	13:05	0	
4/16/2009	14:15	0		4/16/2009	14:20	0	
4/17/2009	9:05	0		4/17/2009	9:00	0	
4/17/2009	11:00	0		4/17/2009	11:15	0	
4/17/2009	13:00	0		4/17/2009	13:05	0	
4/17/2009	14:10	0		4/17/2009	14:15	0	
4/21/2009	9:05	0		4/21/2009	9:00	0	
4/21/2009	11:10	0		4/21/2009	11:00	0	
4/21/2009	13:05	0		4/21/2009	12:47	1	
4/21/2009	14:05	0		4/21/2009	14:00	0	
4/22/2009	9:05	0		4/22/2009	9:00	0	
4/22/2009	11:10	0		4/22/2009	11:00	0	
4/22/2009	13:05	0		4/22/2009	13:00	1	
4/22/2009	14:15	0		4/22/2009	14:20	0	
4/23/2009	9:05	0		4/23/2009	9:00	0	
4/23/2009	11:05	0		4/23/2009	11:00	0	
4/23/2009	13:06	0		4/23/2009	12:50	0	
4/23/2009	14:10	0		4/23/2009	14:15	1	
4/24/2009	9:00	0		4/24/2009	9:05	0	
4/24/2009	11:00	0		4/24/2009	11:05	0	
4/24/2009	13:05	0		4/24/2009	13:00	0	
4/24/2009	14:05	0		4/24/2009	14:00	0	
4/25/2009	9:05	0		4/25/2009	9:00	0	
4/25/2009	11:05	0		4/25/2009	11:00	0	
4/25/2009	13:05	1		4/25/2009	13:00	1	
4/25/2009	15:05	1		4/25/2009	15:00	0	
4/26/2009	9:05	1		4/26/2009	9:00	1	
4/26/2009	11:05	1		4/26/2009	11:00	1	
4/26/2009	13:05	0		4/26/2009	13:00	0	
4/26/2009	15:05	0		4/26/2009	15:00	1	
4/27/2009	9:00	0		4/27/2009	9:00	0	
4/27/2009	11:00	1		4/27/2009	11:00	1	
4/27/2009	13:05	0		4/27/2009	13:00	1	
4/27/2009	15:05	0		4/27/2009	15:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
4/28/2009	9:00	1		4/28/2009	9:00	0	
4/28/2009	11:05	1		4/28/2009	11:00	1	
4/28/2009	13:05	1		4/28/2009	13:00	1	
4/28/2009	15:05	1		4/28/2009	15:00	1	
4/29/2009	9:00	0		4/29/2009	9:45	1	
4/29/2009	11:00	1		4/29/2009	11:00	1	
4/29/2009	13:00	1		4/29/2009	13:00	1	
4/29/2009	15:00	1		4/29/2009	15:00	1	
4/30/2009	9:05	1		4/30/2009	9:10	1	
4/30/2009	11:05	1		4/30/2009	10:00	0	
4/30/2009	13:05	1		4/30/2009	11:00	0	
4/30/2009	14:25	1		4/30/2009	13:00	1	
5/1/2009	9:05	1		4/30/2009	14:20	1	
5/1/2009	11:05	1		5/1/2009	9:00	0	
5/1/2009	13:05	1		5/1/2009	11:00	1	
5/1/2009	14:25	1		5/1/2009	13:00	1	
5/2/2009	9:05	1		5/1/2009	14:20	1	
5/2/2009	11:05	1		5/2/2009	9:00	1	
5/2/2009	13:05	1		5/2/2009	11:15	1	
5/2/2009	14:20	1		5/2/2009	13:00	1	
5/3/2009	9:05	1		5/2/2009	14:15	1	
5/3/2009	11:05	1		5/3/2009	9:00	1	
5/3/2009	13:05	1		5/3/2009	11:00	1	
5/3/2009	14:30	1		5/3/2009	13:00	1	
5/4/2009	9:05	1		5/3/2009	14:25	1	
5/4/2009	11:05	1		5/4/2009	9:00	1	
5/4/2009	13:05	1		5/4/2009	11:00	1	
5/4/2009	14:25	1		5/4/2009	13:00	1	
5/5/2009	9:05	1		5/4/2009	14:20	1	
5/5/2009	11:05	1		5/5/2009	9:00	1	
5/5/2009	13:05	1		5/5/2009	11:00	1	
5/5/2009	14:30	1		5/5/2009	13:00	1	
5/6/2009	9:05	5		5/5/2009	14:45	1	
5/6/2009	9:30	0		5/6/2009	9:00	1	
5/6/2009	10:05	3		5/6/2009	10:00	1	
5/6/2009	10:40	3		5/6/2009	11:00	2	
5/6/2009	11:05	2		5/6/2009	12:00	1	
5/6/2009	12:30	2		5/6/2009	13:00	1	
5/6/2009	13:30	0		5/6/2009	14:00	0	
5/6/2009	14:30	2		5/6/2009	15:00	0	
5/6/2009	15:30	2		5/6/2009	16:00	0	*
5/6/2009	16:29	1	*	5/7/2009	9:00	1	
5/6/2009	17:02	1	*	5/7/2009	10:00	1	
5/7/2009	9:05	2		5/7/2009	11:00	1	
5/7/2009	9:30	1		5/7/2009	12:00	3	*
5/7/2009	10:30	1		5/7/2009	13:00	4	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/7/2009	11:30	1		5/7/2009	14:00	3	
5/7/2009	12:29	1	*	5/7/2009	15:00	2	
5/7/2009	13:30	1		5/7/2009	16:00	4	
5/7/2009	14:30	2		5/7/2009	17:00	3	
5/7/2009	15:30	2		5/8/2009	9:05	5	
5/7/2009	16:30	3		5/8/2009	9:30	1	
5/7/2009	17:00	1		5/8/2009	10:30	1	
5/8/2009	9:00	1		5/8/2009	11:30	2	
5/8/2009	10:00	1		5/8/2009	12:30	1	
5/8/2009	11:00	2		5/8/2009	13:40	1	
5/8/2009	12:00	4		5/8/2009	14:30	1	
5/8/2009	13:00	2	*	5/8/2009	15:30	1.5	
5/8/2009	14:00	1		5/8/2009	16:30	1	
5/8/2009	15:00	1		5/8/2009	17:00	1	
5/8/2009	16:00	1		5/9/2009	9:00	1.5	
5/8/2009	17:00	1		5/9/2009	9:30	1.5	
5/9/2009	9:00	1		5/9/2009	10:30	1.5	
5/9/2009	10:00	1		5/9/2009	11:30	5	
5/9/2009	11:00	1		5/9/2009	12:30	4.5	
5/9/2009	12:00	1		5/9/2009	13:30	3.5	
5/9/2009	13:00	2.5		5/9/2009	14:30	3.5	
5/9/2009	14:00	2.5		5/9/2009	15:30	1	
5/9/2009	15:00	1		5/9/2009	16:30	1	
5/9/2009	16:00	2		5/9/2009	17:00	1	
5/9/2009	17:00	2		5/10/2009	9:00	1	
5/10/2009	9:05	1		5/10/2009	9:30	1	
5/10/2009	10:00	1		5/10/2009	10:30	1	
5/10/2009	11:00	2		5/10/2009	11:30	1	
5/10/2009	12:00	1		5/10/2009	13:30	1	
5/10/2009	13:00	1		5/10/2009	14:30	1	
5/10/2009	14:00	1.5		5/10/2009	15:30	1	
5/10/2009	15:00	1.5		5/10/2009	16:30	1	
5/10/2009	16:00	1		5/10/2009	17:00	1	
5/10/2009	17:05	1		5/10/2009			
5/11/2009	9:03	1		5/11/2009	9:00	0	
5/11/2009	10:05	1		5/11/2009	10:00	0	
5/11/2009	11:05	1		5/11/2009	11:00	1	
5/11/2009	12:05	1		5/11/2009	12:00	1	
5/11/2009	13:05	1		5/11/2009	13:00	1	
5/11/2009	14:05	1.5		5/11/2009	14:00	1	
5/11/2009	15:05	1		5/11/2009	15:00	1	
5/12/2009	9:15	3		5/11/2009	16:00	1	
5/12/2009	10:05	3		5/11/2009	17:00	1	
5/12/2009	11:10	3		5/12/2009	9:00	1	
5/12/2009	12:05	3		5/12/2009	10:00	1	
5/12/2009	13:05	3		5/12/2009	11:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/12/2009	14:05	1		5/12/2009	12:00	1	
5/12/2009	15:05	2		5/12/2009	13:00	1	
5/12/2009	16:05	2		5/12/2009	14:00	1	
5/12/2009	17:05	1		5/12/2009	15:00	1	
5/13/2009	9:05	1		5/12/2009	16:00	1	
5/13/2009	9:30	1		5/12/2009	17:00	1	
5/13/2009	10:30	1.5		5/13/2009	8:06	0	*
5/13/2009	10:30	1.5		5/13/2009	9:00	1	
5/13/2009	11:30	3		5/13/2009	10:00	1	
5/13/2009	12:30	1		5/13/2009	11:00	1	
5/13/2009	13:30	4		5/13/2009	11:00	1	
5/13/2009	14:30	2		5/13/2009	12:00	1	
5/13/2009	15:30	1		5/13/2009	13:00	1	
5/13/2009	16:30	2.5		5/13/2009	14:00	1	
5/13/2009	17:00	2		5/13/2009	15:00	1	
5/14/2009	9:00	1		5/13/2009	16:00	1	
5/14/2009	9:35	1		5/13/2009	17:02	1	
5/14/2009	10:35	1		5/14/2009	9:02	1	
5/14/2009	11:30	1		5/14/2009	10:05	1	
5/14/2009	12:30	1.5		5/14/2009	11:00	1	
5/14/2009	13:30	2		5/14/2009	12:00	1	
5/14/2009	14:30	2		5/14/2009	13:00	1	
5/14/2009	15:30	5		5/14/2009	14:00	1	
5/14/2009	16:00	4.5		5/14/2009	15:00	1	
5/14/2009	16:30	4		5/14/2009	16:03	1	
5/14/2009	17:00	4		5/14/2009	17:00	1	
5/15/2009	9:00	5		5/15/2009	9:02	1	
5/15/2009	9:30	4.5		5/15/2009	10:02	1	
5/15/2009	10:00	4.5		5/15/2009	11:02	1	
5/15/2009	10:30	4		5/15/2009	12:02	1	
5/15/2009	11:00	3		5/15/2009	13:02	1	
5/15/2009	11:30	4		5/15/2009	14:02	1	
5/15/2009	12:00	3		5/15/2009	15:02	1	
5/15/2009	12:30	4		5/15/2009	16:02	1	
5/15/2009	13:00	3.5		5/15/2009	17:02	1	
5/15/2009	14:00	4.5		5/15/2009	18:02	1	
5/15/2009	14:30	4		5/16/2009	8:02	2.5	
5/15/2009	15:00	4		5/16/2009	9:02	2.5	
5/15/2009	15:30	4		5/16/2009	10:02	1.5	
5/15/2009	16:00	5		5/16/2009	11:02	1	
5/15/2009	16:30	4		5/16/2009	12:05	1	
5/15/2009	17:00	4		5/16/2009	13:02	1.5	
5/15/2009	17:30	5		5/16/2009	14:02	1.5	
5/15/2009	18:00	3		5/16/2009	15:02	1	
5/16/2009	8:00	4.5		5/16/2009	16:02	1.5	
5/16/2009	8:30	4		5/16/2009	17:02	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/16/2009	9:00	3.5		5/16/2009	18:02	1.5	
5/16/2009	9:30	3.5		5/17/2009	8:01	1.5	
5/16/2009	10:00	2.5		5/17/2009	9:01	3.5	
5/16/2009	10:30	3		5/17/2009	10:01	3.5	
5/16/2009	11:00	1.5		5/17/2009	11:01	3.5	
5/16/2009	11:30	2.5		5/17/2009	12:01	3.5	
5/16/2009	12:00	2		5/17/2009	13:00	3	
5/16/2009	12:30	2.5		5/17/2009	14:01	5	
5/16/2009	13:00	2.5		5/17/2009	15:01	4.5	
5/16/2009	13:30	4		5/17/2009	16:01	4.5	
5/16/2009	14:00	3		5/17/2009	17:01	4.5	
5/16/2009	14:30	5		5/17/2009	18:01	4	
5/16/2009	15:00	5		5/18/2009	9:01	1.5	
5/16/2009	15:30	4.5		5/18/2009	10:01	2	
5/16/2009	16:00	4.5		5/18/2009	11:01	2.5	
5/16/2009	16:30	5		5/18/2009	12:01	3	
5/16/2009	17:00	5		5/18/2009	13:01	2	
5/16/2009	17:30	4.5		5/18/2009	14:00	2	
5/16/2009	18:00	4		5/18/2009	15:00	2	
5/17/2009	8:00	5		5/18/2009	16:01	2	
5/17/2009	8:30	4		5/18/2009	17:01	2	
5/17/2009	9:00	3		5/18/2009	18:01	1.5	
5/17/2009	9:30	3.5		5/19/2009	8:31	1	
5/17/2009	10:00	3.5		5/19/2009	9:30	1	
5/17/2009	10:30	2.5		5/19/2009	10:30	1	
5/17/2009	11:00	3.5		5/19/2009	11:30	1	
5/17/2009	11:30	3		5/19/2009	12:30	1	
5/17/2009	12:00	3.5		5/19/2009	13:30	1	
5/17/2009	12:30	3		5/19/2009	14:31	1	
5/17/2009	13:30	3.5		5/19/2009	15:30	1	
5/17/2009	14:00	4.5		5/19/2009	16:30	1	
5/17/2009	14:30	5		5/19/2009	17:31	1	
5/17/2009	15:00	4.5		5/19/2009	18:01	1	
5/17/2009	15:30	4.5		5/20/2009	9:01	5	
5/17/2009	16:00	3.5		5/20/2009	10:00	1	
5/17/2009	16:30	4		5/20/2009	11:00	1.5	
5/17/2009	17:00	3		5/20/2009	12:01	1.5	
5/17/2009	17:30	4		5/20/2009	13:00	1	*
5/17/2009	18:00	2.5		5/20/2009	14:00	1	*
5/18/2009	9:00	1		5/20/2009	15:00	1	*
5/18/2009	10:00	1		5/20/2009	16:00	1.5	
5/18/2009	11:00	0		5/20/2009	17:00	1	*
5/18/2009	12:00	2		5/20/2009	18:00	1	*
5/18/2009	13:00	3		5/20/2009	19:01	2	
5/18/2009	14:00	2		5/21/2009	8:01	1	
5/18/2009	15:00	2		5/21/2009	9:01	4.5	



Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/18/2009	16:00	4		5/21/2009	10:01		
5/18/2009	17:00	2		5/21/2009	11:01	3	
5/18/2009	18:00	2		5/21/2009	12:01	3	
5/19/2009	8:30	1		5/21/2009	13:01	3.5	
5/19/2009	9:15	4		5/21/2009	14:01	3	
5/19/2009	10:00	3	*	5/21/2009	15:01	2.5	
5/19/2009	10:45	3		5/21/2009	16:01	2.5	
5/19/2009	11:30	2		5/21/2009	17:01	2.5	
5/19/2009	12:15	3.5		5/21/2009	18:01	4	
5/19/2009	13:00	3.5		5/21/2009	19:01	1	
5/19/2009	13:45	4		5/21/2009	20:01	1	
5/19/2009	14:30	2.5		5/22/2009	8:15	1	
5/19/2009	15:15	3.5		5/22/2009	9:05	3	
5/19/2009	16:00	5		5/22/2009	10:00	5	
5/19/2009	16:45	4		5/22/2009	10:30	5	*
5/19/2009	17:30	4		5/22/2009	11:00	4	
5/19/2009	18:00	3		5/22/2009	11:30	3	
5/20/2009	9:00	2		5/22/2009	12:00	4	
5/20/2009	9:30	5		5/22/2009	12:30	5	*
5/20/2009	9:50	2		5/22/2009	13:00	2	
5/20/2009	10:10	1		5/22/2009	13:30	2	
5/20/2009	10:30	2		5/22/2009	14:00	3	
5/20/2009	10:50	2		5/22/2009	14:30	3	*
5/20/2009	11:10	2		5/22/2009	15:00	3	
5/20/2009	11:40	3		5/22/2009	15:30	4	*
5/20/2009	12:00	2		5/22/2009	16:00	5	
5/20/2009	13:00	5	*	5/22/2009	16:30	5	*
5/20/2009	13:30	5	*	5/22/2009	17:00	5	*
5/20/2009	14:00	5	*	5/22/2009	17:20	5	*
5/20/2009	14:50	5	*	5/22/2009	17:40	5	*
5/20/2009	15:20	5	*	5/22/2009	18:00	5	*
5/20/2009	15:50	5		5/22/2009	18:15	4	*
5/20/2009	16:30	4.5		5/22/2009	18:30	4	*
5/20/2009	16:50	5	*	5/22/2009	18:45	3	*
5/20/2009	17:10	3	*	5/22/2009	19:00	1	*
5/20/2009	17:30	3	*	5/22/2009	19:15	1	*
5/20/2009	18:00	5	*	5/22/2009	19:30	0	*
5/20/2009	18:30	4	*	5/23/2009	8:30	5	
5/20/2009	19:00	3		5/23/2009	9:00	4	
5/21/2009	8:00	1		5/23/2009	9:30	5	
5/21/2009	8:30	3		5/23/2009	9:50	3	
5/21/2009	9:00	3		5/23/2009	10:10	3	
5/21/2009	9:30	3		5/23/2009	10:30	3	
5/21/2009	10:00	2.5		5/23/2009	10:50	3	
5/21/2009	10:30	2		5/23/2009	11:10	2	
5/21/2009	11:00	2.5		5/23/2009	11:30	2	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/21/2009	11:30	2		5/23/2009	12:12	5	*
5/21/2009	12:08	4	*	5/23/2009	12:30	2	*
5/21/2009	12:15	3		5/23/2009	12:50	4	*
5/21/2009	12:30	3.5		5/23/2009	13:11	3	*
5/21/2009	13:00	3		5/23/2009	13:30	3	*
5/21/2009	13:30	4		5/23/2009	13:50	3	*
5/21/2009	14:00	5		5/23/2009	14:10	2	*
5/21/2009	14:25	5		5/23/2009	14:30	1	*
5/21/2009	14:45	3		5/23/2009	15:00	3	*
5/21/2009	14:45	4	*	5/23/2009	15:30	3	
5/21/2009	15:00	4		5/23/2009	15:30	4	*
5/21/2009	15:15	3		5/23/2009	16:00	2	
5/21/2009	15:30	5		5/23/2009	16:30	4	
5/21/2009	15:45	4.5		5/23/2009	17:00	5	*
5/21/2009	16:00	4.5		5/23/2009	17:20	5	*
5/21/2009	16:15	4.5		5/23/2009	17:40	5	*
5/21/2009	16:30	4.5		5/23/2009	18:00	2	
5/21/2009	16:45	4.5		5/23/2009	18:20	3	*
5/21/2009	17:00	5		5/23/2009	19:00	2	*
5/21/2009	17:15	4.5		5/24/2009	8:00	4	
5/21/2009	17:30	4.5		5/24/2009	8:30	5	
5/21/2009	17:45	4.5		5/24/2009	9:00	4	
5/21/2009	18:00	3.5		5/24/2009	9:30	4	
5/21/2009	18:15	4.5		5/24/2009	10:00	4	
5/21/2009	18:30	4.5		5/24/2009	10:30	4	
5/21/2009	18:45	4.5		5/24/2009	11:00	3	*
5/21/2009	19:00	4.5		5/24/2009	11:30	4	*
5/21/2009	19:15	4		5/24/2009	12:00	4	*
5/21/2009	19:30	3.5		5/24/2009	12:30	3	*
5/21/2009	19:45	3		5/24/2009	13:00	5	
5/21/2009	20:00	2.5		5/24/2009	13:30	3	
5/22/2009	8:15	5		5/24/2009	14:00	4	*
5/22/2009	8:43	3		5/24/2009	14:30	3	
5/22/2009	9:00	2		5/24/2009	15:00	4	*
5/22/2009	9:30	2		5/24/2009	15:30	5	*
5/22/2009	10:00	3	*	5/24/2009	16:00	5	*
5/22/2009	10:30	3	*	5/24/2009	16:30	4	
5/22/2009	11:00	2		5/24/2009	16:30	4	*
5/22/2009	11:30	4		5/24/2009	17:00	3	
5/22/2009	12:00	4		5/24/2009	17:30	4	
5/22/2009	12:30	3	*	5/24/2009	18:00	3	
5/22/2009	13:00	5		5/24/2009	18:30	3	*
5/22/2009	13:30	4		5/25/2009	8:00	2	
5/22/2009	14:00	3		5/25/2009	8:30	3	
5/22/2009	14:30	3		5/25/2009	9:00	2	
5/22/2009	15:00	3		5/25/2009	9:30	4	*

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/22/2009	15:30	3	*	5/25/2009	10:00	2	
5/22/2009	16:00	2		5/25/2009	10:30	3	
5/22/2009	16:30	3	*	5/25/2009	11:00	2	
5/22/2009	17:00	1	*	5/25/2009	11:30	2	
5/22/2009	17:40	3	*	5/25/2009	12:00	2	
5/22/2009	18:10	1	*	5/25/2009	12:30	3	
5/22/2009	18:30	1	*	5/25/2009	13:00	2	
5/22/2009	18:45	1	*	5/25/2009	13:30	2	
5/22/2009	19:00	1	*	5/25/2009	13:30	2	
5/22/2009	19:30	2	*	5/25/2009	14:00	2	
5/23/2009	8:30	2		5/25/2009	14:30	2	
5/23/2009	9:00	2		5/25/2009	15:00	1	
5/23/2009	9:30	2		5/25/2009	15:30	1	
5/23/2009	10:00	2		5/25/2009	16:00	1	
5/23/2009	10:30	2		5/25/2009	17:00	1	
5/23/2009	11:00	2		5/26/2009	8:30	2.5	
5/23/2009	11:30	3		5/26/2009	9:00	3	
5/23/2009	12:00	3	*	5/26/2009	9:30	2	
5/23/2009	12:30	4	*	5/26/2009	10:00	2	
5/23/2009	13:00	3	*	5/26/2009	10:30	3	
5/23/2009	13:30	3	*	5/26/2009	11:00	3	
5/23/2009	14:00	4	*	5/26/2009	11:30	3	
5/23/2009	14:30	4	*	5/26/2009	12:00	4	
5/23/2009	15:00	3	*	5/26/2009	12:31	3	
5/23/2009	15:30	1		5/26/2009	13:00	3	
5/23/2009	16:00	1		5/26/2009	13:31	3.5	
5/23/2009	16:30	3		5/26/2009	14:00	3	
5/23/2009	17:00	4	*	5/26/2009	14:31	3	
5/23/2009	17:30	4	*	5/26/2009	15:00	3	
5/23/2009	18:00	1		5/26/2009	15:31	2.5	
5/23/2009	18:20	1	*	5/26/2009	16:00	2.5	
5/23/2009	19:00	2	*	5/26/2009	16:31	2	
5/24/2009	8:00	2		5/26/2009	17:00	1	*
5/24/2009	8:30	2		5/26/2009	17:31	2	
5/24/2009	9:00	2		5/26/2009	18:01	1	
5/24/2009	9:30	2		5/27/2009	8:01	1	
5/24/2009	10:00	2		5/27/2009	8:30	1	
5/24/2009	10:30	2		5/27/2009	9:01	1	
5/24/2009	11:00	2	*	5/27/2009	9:30	1	
5/24/2009	11:30	3	*	5/27/2009	10:30	1	
5/24/2009	12:00	3	*	5/27/2009	11:30	1	
5/24/2009	12:30	4	*	5/27/2009	12:30	1	
5/24/2009	13:00	1		5/27/2009	13:30	2	
5/24/2009	13:30	2		5/27/2009	14:30	2	
5/24/2009	14:00	1	*	5/27/2009	15:30	3	
5/24/2009	14:30	1		5/27/2009	16:30	3	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/24/2009	15:00	1	*	5/27/2009	17:30	1	
5/24/2009	15:30	1	*	5/27/2009	18:01	1	
5/24/2009	16:00	1	*	5/28/2009	8:16	1	
5/24/2009	16:30	1		5/28/2009	9:00	1	
5/24/2009	17:00	1		5/28/2009	10:00	1	
5/24/2009	18:00	2		5/28/2009	11:00	1	
5/25/2009	8:00	2		5/28/2009	12:00	1	
5/25/2009	8:30	2		5/28/2009	13:00	1	
5/25/2009	9:00	1		5/28/2009	14:00	1	
5/25/2009	9:30	3	*	5/28/2009	15:00	2	
5/25/2009	10:30	2		5/28/2009	16:00	1	
5/25/2009	11:30	2		5/28/2009	17:00	1.5	
5/25/2009	12:30	2		5/28/2009	18:00	1	
5/25/2009	13:30	1		5/29/2009	9:01	1	
5/25/2009	14:30	1		5/29/2009	9:30	1	
5/25/2009	15:30	1		5/29/2009	10:30	1	
5/25/2009	16:30	2	*	5/29/2009	11:30	1	
5/25/2009	17:00	1	*	5/29/2009	12:30	1	
5/25/2009	18:00	0	*	5/29/2009	13:30	1	
5/26/2009	8:30	1		5/29/2009	14:30	1	
5/26/2009	9:30	1		5/29/2009	15:30	1	
5/26/2009	10:30	1		5/29/2009	16:30	1	
5/26/2009	11:30	1		5/29/2009	17:30	1	
5/26/2009	12:30	3		5/30/2009	8:01	1.5	
5/26/2009	13:30	2.5		5/30/2009	9:01	1	
5/26/2009	14:30	1.5		5/30/2009	10:00	1	
5/26/2009	15:30	1.5		5/30/2009	11:00	1	
5/26/2009	16:30	2		5/30/2009	12:00	1	
5/26/2009	17:30	1		5/30/2009	13:00	1	
5/26/2009	18:00	1		5/30/2009	14:00	1	
5/27/2009	8:00	1		5/30/2009	15:00	1	
5/27/2009	9:00	1		5/30/2009	16:00	1	
5/27/2009	10:00	1		5/30/2009	17:01	1	
5/27/2009	11:00	1		5/30/2009	18:01	1	
5/27/2009	12:00	1		5/31/2009	8:01	1.5	
5/27/2009	13:00	1		5/31/2009	9:01	1.5	
5/27/2009	14:00	1		5/31/2009	10:00	1	
5/27/2009	15:00	2		5/31/2009	11:00	1	
5/27/2009	16:00	1		5/31/2009	12:00	1	
5/27/2009	17:00	1		5/31/2009	13:00	1	
5/27/2009	18:00	1		5/31/2009	14:00	0.5	
5/28/2009	8:15	1		5/31/2009	15:00	1	
5/28/2009	9:30	1		5/31/2009	16:00	1	
5/28/2009	10:30	1		5/31/2009	17:00	2	
5/28/2009	11:30	1		5/31/2009	18:01	1	
5/28/2009	12:30	1		6/1/2009	8:01	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
5/28/2009	13:30	1		6/1/2009	9:00	1	
5/28/2009	14:30	1		6/1/2009	10:00	0	
5/28/2009	15:30	2		6/1/2009	11:01	1	
5/28/2009	16:30	2		6/1/2009	12:00	1	
5/28/2009	17:30	1		6/1/2009	13:00	0	
5/29/2009	9:00	1		6/1/2009	14:00	1	
5/29/2009	10:00	1		6/1/2009	15:00	1	
5/29/2009	11:00	1		6/1/2009	16:00	1	
5/29/2009	12:00	1		6/1/2009	17:00	1	
5/29/2009	13:00	1		6/1/2009	18:00	0	
5/29/2009	14:00	1		6/2/2009	8:00	1	
5/29/2009	15:00	1.5		6/2/2009	9:00	1	
5/29/2009	16:00	2		6/2/2009	10:00	1	
5/29/2009	17:00	1.5		6/2/2009	11:00	1	
5/29/2009	18:00	2		6/2/2009	12:00	1	
5/30/2009	8:00	1		6/2/2009	13:00	1	
5/30/2009	9:00	2.5		6/2/2009	14:00	1	
5/30/2009	9:30	2.5		6/2/2009	15:00	1	
5/30/2009	10:30	1.5		6/2/2009	16:00	1	
5/30/2009	11:30	4		6/2/2009	17:00	0	
5/30/2009	12:30	3		6/2/2009	18:00	1	
5/30/2009	13:30	3		6/3/2009	8:00	1	
5/30/2009	14:30	3		6/3/2009	9:30	1	
5/30/2009	15:30	3		6/3/2009	10:30	1	
5/30/2009	16:30	3		6/3/2009	11:30	1	
5/30/2009	17:00	2		6/3/2009	12:30	1	
5/30/2009	17:30	1.5		6/3/2009	13:30	1	
5/30/2009	18:00	1		6/3/2009	14:30	1	
5/31/2009	8:00	1		6/3/2009	15:30	1	
5/31/2009	9:00	1.5		6/3/2009	16:30	2	
5/31/2009	9:30	1.5		6/3/2009	18:00	1	
5/31/2009	10:30	2		6/4/2009	8:00	1	
5/31/2009	11:30	1		6/4/2009	9:30	2	
5/31/2009	12:30	1		6/4/2009	10:30	1	
5/31/2009	13:30	1		6/4/2009	11:30	1	
5/31/2009	14:30	1		6/4/2009	12:30	3	
5/31/2009	15:30	1		6/4/2009	13:30	4	
5/31/2009	16:30	2		6/4/2009	14:30	3	
5/31/2009	17:00	3	*	6/4/2009	15:30	3	
5/31/2009	17:30	3		6/4/2009	16:30	2	
5/31/2009	18:00	1.5		6/4/2009	17:30	2	
6/1/2009	8:00	1.5		6/5/2009	8:00	1	
6/1/2009	9:00	3		6/5/2009	9:00	1	
6/1/2009	10:00	1		6/5/2009	9:30	1	
6/1/2009	11:00	3		6/5/2009	10:30	2	
6/1/2009	12:00	1		6/5/2009	11:30	3.5	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/1/2009	13:00	1		6/5/2009	12:30	3.5	
6/1/2009	14:00	3		6/5/2009	13:30	4	
6/1/2009	15:00	2		6/5/2009	14:30	4	
6/1/2009	16:00	1		6/5/2009	15:30	4	
6/1/2009	17:00	1		6/5/2009	16:30	4	
6/1/2009	18:00	1		6/5/2009	17:30	3	
6/2/2009	8:00	1		6/5/2009	18:00	1	
6/2/2009	9:00	1		6/6/2009	8:00	0	
6/2/2009	10:00	1		6/6/2009	9:00	1	
6/2/2009	11:00	1		6/6/2009	10:00	1.5	
6/2/2009	12:00	1		6/6/2009	10:30	1	*
6/2/2009	13:00	1		6/6/2009	11:00	1	
6/2/2009	14:00	1		6/6/2009	11:30	1	
6/2/2009	15:00	1		6/6/2009	12:05	1	
6/2/2009	16:00	1		6/6/2009	13:00	1	
6/2/2009	17:00	1		6/6/2009	14:00	1	
6/2/2009	18:00	1		6/6/2009	15:00	1	
6/3/2009	8:00	2		6/6/2009	16:00	2	
6/3/2009	9:00	2		6/6/2009	17:00	1	
6/3/2009	10:00	3.5		6/6/2009	18:00	1	
6/3/2009	11:00	4.5		6/7/2009	8:00	1	
6/3/2009	11:30	2		6/7/2009	9:00	1	
6/3/2009	12:00	3		6/7/2009	10:00	1	
6/3/2009	12:30	3		6/7/2009	11:00	1.5	
6/3/2009	13:00	1		6/7/2009	12:00	1	
6/3/2009	13:30	1		6/7/2009	13:00	1.5	
6/3/2009	14:00	1		6/7/2009	14:00	2.5	
6/3/2009	15:00	1		6/7/2009	15:00	2.5	
6/3/2009	16:00	2		6/7/2009	16:00	1.5	
6/3/2009	17:00	2		6/7/2009	17:00	1	
6/3/2009	18:00	1		6/7/2009	18:00	1	
6/4/2009	8:00	1		6/8/2009	8:00	1	
6/4/2009	9:00	2		6/8/2009	8:00	0	
6/4/2009	10:00	2		6/8/2009	9:00	1	
6/4/2009	11:00	2		6/8/2009	9:00	0	
6/4/2009	12:00	2		6/8/2009	10:00	1	
6/4/2009	13:00	2		6/8/2009	10:00	1	
6/4/2009	13:45	2		6/8/2009	11:00	1	
6/4/2009	14:00	1		6/8/2009	11:00	2	
6/4/2009	15:00	2		6/8/2009	12:00	1	
6/4/2009	16:00	1		6/8/2009	12:00	1	
6/4/2009	17:00	1		6/8/2009	13:00	1	
6/4/2009	18:00	2		6/8/2009	13:00	2	
6/5/2009	8:00	1		6/8/2009	14:00	1	
6/5/2009	9:00	1		6/8/2009	14:00	1	
6/5/2009	10:00	1		6/8/2009	15:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/5/2009	11:00	1		6/8/2009	15:00	1	
6/5/2009	12:00	2		6/8/2009	16:00	1	
6/5/2009	13:00	1		6/8/2009	16:00	1	
6/5/2009	14:00	1.5		6/8/2009	17:00	1	
6/5/2009	15:00	2		6/8/2009	17:00	1	
6/5/2009	16:00	2		6/8/2009	18:00	1	
6/5/2009	17:00	1.5		6/8/2009	18:00	1	
6/5/2009	18:00	2		6/9/2009	8:00	0	
6/6/2009	8:00	1		6/9/2009	9:00	0	
6/6/2009	9:00	2		6/9/2009	10:00	1	
6/6/2009	9:30	2.5		6/9/2009	11:00	2	
6/6/2009	10:30	4.5		6/9/2009	12:00	1	
6/6/2009	11:00	3.5		6/9/2009	13:00	2	
6/6/2009	11:30	2		6/9/2009	14:00	1	
6/6/2009	12:00	2		6/9/2009	15:00	1	
6/6/2009	12:30	2		6/9/2009	16:00	1	
6/6/2009	13:00	3		6/9/2009	17:00	1	
6/6/2009	13:30	3		6/9/2009	18:00	1	
6/6/2009	14:00	2.5		6/10/2009	8:00	0	
6/6/2009	14:30	3	*	6/10/2009	9:00	1	
6/6/2009	15:00	2		6/10/2009	10:00	1	
6/6/2009	15:30	2		6/10/2009	11:00	1	
6/6/2009	16:30	3		6/10/2009	12:00	1	
6/6/2009	17:30	3		6/10/2009	13:00	1	
6/7/2009	8:00	4.5		6/10/2009	14:00	1	
6/7/2009	8:30	4		6/10/2009	15:00	1	
6/7/2009	9:00	4.5		6/10/2009	16:00	1	
6/7/2009	9:30	3		6/10/2009	17:00	1	
6/7/2009	10:00	2.5		6/10/2009	18:00	1	
6/7/2009	10:30	2.5		6/11/2009	8:00	0	
6/7/2009	11:00	1.5		6/11/2009	9:00	0	
6/7/2009	11:30	3		6/11/2009	9:30	1	
6/7/2009	12:00	3		6/11/2009	10:30	1	
6/7/2009	12:30	3		6/11/2009	11:30	1	
6/7/2009	13:00	3		6/11/2009	12:30	0	
6/7/2009	13:30	2.5		6/11/2009	13:30	0	
6/7/2009	14:00	3		6/11/2009	14:30	1	
6/7/2009	14:30	2.5		6/11/2009	15:30	1	
6/7/2009	15:00	3		6/11/2009	16:30	1	
6/7/2009	15:30	3		6/11/2009	18:00	1	
6/7/2009	16:00	3		6/12/2009	8:00	1	
6/7/2009	16:30	3.5		6/12/2009	9:00	1	
6/7/2009	17:00	3		6/12/2009	10:00	1	
6/7/2009	17:30	4		6/12/2009	10:45	1	
6/7/2009	18:00	2.5		6/12/2009	11:15	1	
6/8/2009	8:00	1		6/12/2009	12:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/8/2009	8:00	1		6/12/2009	13:00	1	
6/8/2009	9:00	2		6/12/2009	14:00	1	
6/8/2009	9:00	1		6/12/2009	15:00	1	
6/8/2009	10:00	2		6/12/2009	16:00	1	
6/8/2009	10:00	1		6/12/2009	17:00	1	
6/8/2009	11:00	2		6/13/2009	8:00	1	
6/8/2009	11:00	1		6/13/2009	9:00	1	
6/8/2009	12:00	2		6/13/2009	10:00	1	*
6/8/2009	12:00	1		6/13/2009	11:45	1	*
6/8/2009	13:00	1		6/13/2009	12:00	1	
6/8/2009	13:00	1		6/13/2009	13:00	1	
6/8/2009	14:00	1		6/13/2009	14:00	1	
6/8/2009	14:00	1		6/13/2009	15:00	1	
6/8/2009	15:00	2		6/13/2009	16:00	1	
6/8/2009	15:00	1		6/13/2009	17:00	1	
6/8/2009	16:00	2		6/14/2009	8:00	0	
6/8/2009	16:00	1		6/14/2009	9:00	1	
6/8/2009	17:00	1		6/14/2009	10:00	1	
6/8/2009	17:00	1		6/14/2009	11:00	1	
6/8/2009	18:00	2		6/14/2009	12:00	1	
6/8/2009	18:00	1		6/14/2009	13:00	1	
6/8/2009	18:00	5	*	6/14/2009	14:00	1	
6/9/2009	8:00	1		6/14/2009	15:00	1	
6/9/2009	9:00	1		6/14/2009	16:00	1	
6/9/2009	10:00	1		6/14/2009	17:00	1	
6/9/2009	11:00	1		6/15/2009	8:00	1	
6/9/2009	12:00	1		6/15/2009	9:00	1	
6/9/2009	13:00	1		6/15/2009	10:00	1	
6/9/2009	14:00	1		6/15/2009	11:00	1	
6/9/2009	15:00	1		6/15/2009	12:00	1	
6/9/2009	16:00	1		6/15/2009	13:00	1	
6/9/2009	17:00	1		6/15/2009	14:00	0	
6/9/2009	18:00	1		6/15/2009	15:00	1	
6/10/2009	8:00	1		6/15/2009	16:00	1	
6/10/2009	9:30	1		6/15/2009	17:00	1	
6/10/2009	10:30	1		6/16/2009	8:00	0	
6/10/2009	11:30	1		6/16/2009	9:00	1	
6/10/2009	12:30	1		6/16/2009	10:00	1	
6/10/2009	13:30	1		6/16/2009	11:00	0	
6/10/2009	14:30	1		6/16/2009	12:00	0	
6/10/2009	15:30	1		6/16/2009	13:00	0	
6/10/2009	16:30	1		6/16/2009	14:00	1	
6/10/2009	17:30	1		6/16/2009	15:00	1	
6/11/2009	8:00	1		6/16/2009	16:00	1	
6/11/2009	9:00	1		6/16/2009	17:00	1	
6/11/2009	10:00	1		6/17/2009	8:00	0	



Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/11/2009	11:00	1		6/17/2009	9:00	1	
6/11/2009	12:00	1		6/17/2009	10:00	1	
6/11/2009	13:00	1		6/17/2009	11:00	1	
6/11/2009	14:00	1		6/17/2009	12:00	1	
6/11/2009	15:00	1		6/17/2009	13:00	1	
6/11/2009	16:00	1		6/17/2009	14:00	1	
6/11/2009	17:00	1	*	6/17/2009	15:00	1	
6/11/2009	18:00	1		6/17/2009	16:00	1	
6/12/2009	8:00	1		6/17/2009	17:00	1	
6/12/2009	9:30	1		6/18/2009	8:00	1	
6/12/2009	10:30	1		6/18/2009	9:00	0	
6/12/2009	11:00	1		6/18/2009	10:00	1	
6/12/2009	11:30	1		6/18/2009	11:00	1	
6/12/2009	12:30	1		6/18/2009	12:00	1	
6/12/2009	13:30	1		6/18/2009	13:00	1	
6/12/2009	14:30	1		6/18/2009	14:00	1	
6/12/2009	15:30	1		6/18/2009	15:00	1	
6/12/2009	16:30	1		6/18/2009	16:00	1	
6/13/2009	8:00	2		6/19/2009	8:00	1	
6/13/2009	9:00	4.5		6/19/2009	9:00	1	
6/13/2009	9:30	4		6/19/2009	10:00	1	
6/13/2009	10:00	3		6/19/2009	11:00	1	
6/13/2009	10:30	3		6/19/2009	12:00	1	
6/13/2009	11:00	3		6/19/2009	13:00	1	
6/13/2009	11:30	2.5		6/19/2009	14:00	1	
6/13/2009	12:00	2		6/19/2009	15:00	1	
6/13/2009	12:30	2		6/19/2009	16:00	1	
6/13/2009	13:00	2		6/20/2009	8:00	1	
6/13/2009	13:30	2		6/20/2009	9:00	1	
6/13/2009	14:00	2		6/20/2009	10:00	1	
6/13/2009	14:30	1.5		6/20/2009	11:00	1	
6/13/2009	15:00	2		6/20/2009	12:00	1	
6/13/2009	15:30	2		6/20/2009	13:00	1	
6/13/2009	16:00	2		6/20/2009	14:00	1	
6/13/2009	16:30	2		6/20/2009	15:00	1	
6/13/2009	17:00	2		6/20/2009	16:00	1	
6/14/2009	8:00	1		6/21/2009	8:00	1	
6/14/2009	9:00	1		6/21/2009	9:00	1	
6/14/2009	9:30	1.5		6/21/2009	10:00	1	
6/14/2009	10:30	1		6/21/2009	11:00	1	
6/14/2009	11:30	2		6/21/2009	12:00	1	
6/14/2009	12:30	1		6/21/2009	13:00	1	
6/14/2009	13:30	1.5		6/21/2009	14:00	1	
6/14/2009	14:30	1		6/21/2009	15:00	1	
6/14/2009	15:30	1		6/21/2009	16:00	1	
6/14/2009	16:30	1		6/22/2009	8:00	0	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/15/2009	8:00	0		6/22/2009	9:00	1	
6/15/2009	9:00	1		6/22/2009	10:00	1	
6/15/2009	10:00	1		6/22/2009	11:00	0	
6/15/2009	11:00	1		6/22/2009	12:00	1	
6/15/2009	12:00	2		6/22/2009	13:00	1	
6/15/2009	13:00	1		6/22/2009	14:00	1	
6/15/2009	14:00	1		6/22/2009	15:00	0	
6/15/2009	15:00	1		6/22/2009	16:00	1	
6/15/2009	16:00	1		6/23/2009	8:00	0	
6/15/2009	17:00	1		6/23/2009	9:00	0	
6/16/2009	8:00	1		6/23/2009	10:15	0	
6/16/2009	9:00	1		6/23/2009	12:00	1	
6/16/2009	10:00	1		6/23/2009	13:00	0	
6/16/2009	11:00	1		6/23/2009	15:00		*
6/16/2009	12:00	1		6/23/2009	15:25		*
6/16/2009	13:00	1		6/23/2009	16:00	1	
6/16/2009	14:00	1		6/23/2009	16:11	1	*
6/16/2009	15:00	1		6/23/2009	17:00	1	*
6/16/2009	16:00	1		6/24/2009	8:15	0	
6/16/2009	17:00	1		6/24/2009	9:15	0	
6/17/2009	8:00	1		6/24/2009	10:00	1	
6/17/2009	9:00	1		6/24/2009	11:15	1	
6/17/2009	10:00	1		6/24/2009	12:15	1	
6/17/2009	11:00	1		6/24/2009	13:15	1	
6/17/2009	12:00	1		6/24/2009	14:15	1	
6/17/2009	13:00	1		6/24/2009	15:00	1	
6/17/2009	14:00	1		6/24/2009	16:00	1	
6/17/2009	15:00	1		6/25/2009	8:25	0	
6/17/2009	16:00	1		6/25/2009	9:25	1	
6/17/2009	17:00	1		6/25/2009	10:25	1	
6/18/2009	8:00	1		6/25/2009	11:25	1	
6/18/2009	9:00	1		6/25/2009	12:25	1	
6/18/2009	10:00	1		6/25/2009	13:25	1	
6/18/2009	11:00	1		6/25/2009	14:25	0	
6/18/2009	12:00	1		6/25/2009	15:25	0	
6/18/2009	13:00	1		6/26/2009	8:00	0	
6/18/2009	14:00	1		6/26/2009	9:00	1.5	
6/18/2009	15:00	1		6/26/2009	10:00	1.5	
6/18/2009	16:00	1		6/26/2009	11:00	1	
6/19/2009	8:00	1		6/26/2009	12:00	1	
6/19/2009	9:00	1		6/26/2009	13:00	1	
6/19/2009	10:00	1		6/26/2009	14:00	1	
6/19/2009	11:00	1		6/26/2009	15:00	1	
6/19/2009	12:00	1		6/27/2009	9:00	1	
6/19/2009	13:00	1		6/27/2009	11:00	1	
6/19/2009	14:00	1		6/27/2009	13:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/19/2009	15:00	1		6/27/2009	15:00	1	
6/19/2009	16:00	1		6/28/2009	9:00	1	
6/20/2009	8:00	0		6/28/2009	11:00	1	
6/20/2009	9:00	1		6/28/2009	13:00	0	
6/20/2009	10:00	1		6/28/2009	15:00	1	
6/20/2009	11:00	1		6/29/2009	9:00	1	
6/20/2009	12:00	1		6/29/2009	11:00	1	
6/20/2009	13:00	1		6/29/2009	11:13	1	
6/20/2009	14:00	1		6/29/2009	11:18	1	
6/20/2009	15:00	1		6/29/2009	13:00	1	
6/20/2009	16:00	1		6/29/2009	15:00	1	
6/21/2009	8:00	1		6/30/2009	8:00	1	*
6/21/2009	9:00	1		6/30/2009	9:00	0	
6/21/2009	10:00	1		6/30/2009	11:00	1	
6/21/2009	11:00	1		6/30/2009	13:00	1	
6/21/2009	12:00	1		6/30/2009	15:00	1	
6/21/2009	13:00	1		7/1/2009	9:00	1	
6/21/2009	14:00	1		7/1/2009	11:00	1	
6/21/2009	15:00	1		7/1/2009	13:00	1	
6/21/2009	16:00	1		7/1/2009	15:00	1	
6/22/2009	8:00	0		7/2/2009	9:00	1	
6/22/2009	9:00	2		7/2/2009	11:00	1	
6/22/2009	10:00	1		7/2/2009	13:00	1	
6/22/2009	11:00	1		7/2/2009	15:00	1	
6/22/2009	12:00	1		7/3/2009	9:00	1	
6/22/2009	13:00	1		7/3/2009	11:00	1	
6/22/2009	14:00	1		7/3/2009	13:00	1	
6/22/2009	15:00	1		7/3/2009	15:00	1	
6/22/2009	16:00	1		7/4/2009	9:00	1	
6/23/2009	8:00	1		7/4/2009	11:00	1	
6/23/2009	9:00	1		7/4/2009	13:00	1	
6/23/2009	10:00	1		7/4/2009	15:00	1	
6/23/2009	11:00	1		7/5/2009	9:00	1	
6/23/2009	12:00	1		7/5/2009	11:00	1	
6/23/2009	13:00	1		7/5/2009	13:00	1	
6/23/2009	14:00	1		7/5/2009	15:00	1	
6/23/2009	15:00	1		7/6/2009	9:00	0	
6/23/2009	16:00	1		7/6/2009	11:00	1	
6/24/2009	8:15	1		7/6/2009	13:00	1	
6/24/2009	9:15	1		7/6/2009	15:00	1	
6/24/2009	10:15	1		7/7/2009	9:00	1	
6/24/2009	11:15	1		7/7/2009	11:00	1	
6/24/2009	12:15	1		7/7/2009	13:00	1	
6/24/2009	13:15	1		7/7/2009	15:00	1	
6/24/2009	14:15	1		7/8/2009	9:00	1	
6/24/2009	15:00	1		7/8/2009	11:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
6/24/2009	16:00	1		7/8/2009	13:00	1	
6/25/2009	8:00	0	*	7/8/2009	15:00	1	
6/25/2009	8:25	0		7/9/2009	9:00	1	
6/25/2009	9:25	1		7/9/2009	11:00	1	
6/25/2009	10:25	1		7/9/2009	13:00	1	
6/25/2009	11:25	1		7/9/2009	15:00	1	
6/25/2009	12:25	1		7/10/2009	9:00	0	
6/25/2009	13:25	1		7/10/2009	11:00	1	
6/25/2009	14:25	1		7/10/2009	13:00	1	
6/25/2009	15:25	1		7/10/2009	15:00	1	
6/26/2009	8:00	1		7/11/2009	9:05	1	
6/26/2009	9:00	1		7/11/2009	11:05	1	
6/26/2009	10:00	1		7/11/2009	13:05	1	
6/26/2009	11:00	1		7/11/2009	15:05	1	
6/26/2009	12:00	1		7/12/2009	9:05	1	
6/26/2009	13:00	1		7/12/2009	11:05	1	
6/26/2009	14:00	1		7/12/2009	13:05	0	
6/26/2009	15:00	1		7/12/2009	15:00	1	
6/26/2009	16:00	1		7/13/2009	9:00	1	
6/27/2009	9:00	1		7/13/2009	11:00	1	
6/27/2009	11:00	1		7/13/2009	13:00	0	
6/27/2009	13:00	1		7/13/2009	15:00	0	
6/27/2009	15:00	1		7/14/2009	9:00	0	
6/28/2009	9:00	1		7/14/2009	11:00	1	
6/28/2009	11:00	1		7/14/2009	13:00	1	
6/28/2009	13:00	1		7/14/2009	15:00	1	
6/28/2009	15:00	1		7/15/2009	9:00	1	
6/29/2009	9:00	1		7/15/2009	11:00	1	
6/29/2009	11:00	1		7/15/2009	13:00	1	
6/29/2009	13:00	1		7/15/2009	15:00	1	
6/29/2009	15:00	1		7/16/2009	9:00	1	
6/30/2009	9:00	1		7/16/2009	11:00	1	
6/30/2009	11:00	1		7/16/2009	13:00	0	
6/30/2009	13:00	1		7/16/2009	15:00	1	
6/30/2009	15:00	1		7/17/2009	9:00	1	
7/1/2009	9:00	1		7/17/2009	11:00	1	
7/1/2009	11:00	1		7/17/2009	13:00	1	
7/1/2009	13:00	1		7/17/2009	15:30	0	
7/1/2009	15:00	0		7/18/2009	9:00	0	*
7/2/2009	9:00	1		7/18/2009	15:03	0	*
7/2/2009	11:00	1		7/20/2009	9:00	1	
7/2/2009	13:00	1		7/20/2009	11:55	1	
7/2/2009	15:00	1		7/20/2009	13:00	1	
7/3/2009	9:00	1		7/20/2009	15:00	0	
7/3/2009	11:00	1		7/21/2009	9:00	1	
7/3/2009	13:00	1		7/21/2009	11:00	1	

Table A-8 (continued).

Spillway Fish Lift				Tailrace Fish Lift			
Date	Time	Fullness	Video	Lift Date	Time	Fullness	Video
7/3/2009	15:00	1		7/21/2009	13:00	1	
7/4/2009	9:00	0		7/21/2009	15:00	0	
7/4/2009	11:00	0		7/22/2009	9:00	0	
7/4/2009	13:00	1		7/22/2009	11:00	1	
7/4/2009	15:00	1		7/22/2009	13:00	1	
7/5/2009	9:00	1		7/22/2009	15:00	1	
7/5/2009	11:00	1		7/23/2009	9:00	1	
7/5/2009	13:00	1		7/23/2009	11:00	1	
7/5/2009	15:00	1		7/23/2009	13:00	0	
7/6/2009	9:00	0		7/23/2009	15:00	1	
7/6/2009	11:00	1		7/24/2009	9:00	1	
7/6/2009	13:00	1		7/24/2009	11:00	1	
7/6/2009	15:00	1		7/24/2009	13:00	0	
7/7/2009	9:00	1		7/24/2009	15:00	0	
7/7/2009	11:00	1					
7/7/2009	13:00	1					
7/7/2009	15:00	1					
7/8/2009	9:00	1					
7/8/2009	11:00	1					
7/8/2009	13:00	1					
7/8/2009	15:00	1					
7/9/2009	9:00	0					
7/9/2009	11:00	1					
7/9/2009	13:00	1					
7/9/2009	15:00	1					
7/10/2009	9:00	1					
7/10/2009	11:00	1					
7/10/2009	13:00	1					
7/10/2009	15:00	1					
7/11/2009	9:00	1					
7/11/2009	11:00	1					
7/11/2009	13:00	1					
7/11/2009	15:00	2					
7/12/2009	9:00	1					
7/12/2009	11:00	1					
7/12/2009	13:00	1					
7/12/2009	15:00	1					
7/13/2009	9:00	0					
7/13/2009	11:00	1					
7/13/2009	13:00	1					
7/13/2009	15:00	1					
7/14/2009	9:00	0					
7/14/2009	11:00	1					
7/14/2009	13:00	1					

Table A-8 (continued).

Spillway Fish Lift			
Date	Time	Fullness	Video
7/14/2009	15:00	1	
7/15/2009	9:00	1	
7/15/2009	11:00	1	
7/15/2009	13:00	1	
7/15/2009	15:00	1	
7/16/2009	9:00	1	
7/16/2009	11:00	1	
7/16/2009	13:00	1	
7/16/2009	15:00	1	
7/17/2009	9:00	1	
7/17/2009	11:00	1	
7/17/2009	13:00	1	
7/17/2009	15:20	1	
7/20/2009	9:00	1	
7/20/2009	11:55	1	
7/20/2009	13:00	1	
7/20/2009	15:00	0	
7/21/2009	9:00	0	
7/21/2009	11:00	0	
7/21/2009	13:00	1	
7/21/2009	15:00	0	
7/22/2009	9:00	0	
7/22/2009	11:00	1	
7/22/2009	13:00	1	
7/22/2009	15:00	1	
7/23/2009	9:00	1	
7/23/2009	11:00	1	
7/23/2009	13:00	1	
7/23/2009	15:00	1	
7/24/2009	9:00	1	
7/24/2009	11:00	1	
7/24/2009	13:00	1	
7/24/2009	15:00	1	

## **APPENDIX B**

# **HG&E'S RESPONSE TO AGENCY AND STAKEHOLDERS SPECIFIC COMMENTS ON THE DRAFT REPORT, DISTRIBUTED DECEMBER 10, 2009**

### Response to Comments

Specific comments are presented in Courier New, 10 pt font.

Responses to specific comments are presented in Times New Roman, 11 pt. font.

Comments received are included as Appendix C of this report.

Comment submitted by Caleb Slater, MADFW, in an email dated 11 January, 2010

The one comment I have relates to extended lifting hours. It appears that there were several days when the last lifts' shad numbers exceeded the trigger (750 fish), but no additional lifts were made (May 24 and May 25). I also think a trigger of 500 shad might be more reasonable (a 500 fish trigger would only have added two or three days of extended lifts in 2009). I think the lower trigger number makes sense when you look at how compressed the shad run is. In fact 51% of the total run passed in just 8 days between May 16 and May 24th and the lifts did not operate extra hours on May 23rd or 24th (12% of the entire run passed on these days; 18,000 shad).

As reported in errata for the Agency Review Draft distributed 14 January, 2010 in response to this comment:

A tabular error was made that affected Table 3-3, Appendix Table A-3, and Figure 3-3. Multiple entries for hourly American shad passage during the 1800-1900 h count period recorded on May 16 and 17 were not summed by date, and instead following entries shifted down on the table to the next date resulting in erroneous records for subsequent days in the 1800-1900 time period and erroneous calculations of daily totals. In particular, this may have affected reviewer's analysis of lift day extension protocol during the week of May. The corrected tables are included in the Final Report.



Comment submitted by Don Pugh, Trout Unlimited, in an email dated January 23, 2010

1) Describe how fullness index is determined for each lift and is there a record for each lift.

The fullness index was referenced in Section 2.1 and referred to Appendix 1, Table A-1 which contains definitions of the classified index of fullness. There is a record of hopper fullness for each lift, but those were not included in the draft report because there were more than 1,600 records. The complete record of hopper fullness is included in the Final Report as Appendix A, Table A-8.

#### Section 2.1 Revision

Additionally, a relative index of fullness of the fish lift hoppers, as described in the Updated Plan (see Appendix A, Table A-1) was used to qualify the amount of fish lifted in each operation on a scale of 0 - 5. In the fullness index, 0 = no fish lifted and 5 is representative of a heavy run period. Most lifts were indexed in real-time, but digital video recordings of lift hoppers were archived as well and those were used when real-time indexing was not possible.

2) The altering of bascule and rubber dam 5 seem irregular for the primary shad passage season. From May 4 to June 26 (the next to last partial opening) when most of the shad passed the bascule gate was fully open 40 days and partially open 13 days. This does not seem to alternate as I had hoped. The protocol for 2010 (and presumably for 2009) calls for alternation when only ZOP flows are being spilled. This seems unduly restrictive for altering the bascule position. A count of hours from May 4 to June 26 shows that 70.3% of the time either - only rubber dam #5 or rubber dams 1 and 5 were open. Under both of these conditions it seems that the difference in flows between the bascule gate being fully open or partially open could be discerned by shad. Alternating of bascule opening should occur when rubber dams 5 and 1 and 5 are open rather than being restricted to only ZOP flows.

The protocol to alternate partial and full opening of the Bascule Gate and Rubber Dam 5 was developed over several years and applies specifically to Zone-of-Passage flows. Generally, when Rubber Dam 1 and 5 are both open, the Bascule Gate also must be fully open to accommodate the volume of inflows. A protocol to partially open the Bascule Gate when Rubber Dam 1 and 5 are both open would often result in opening of Rubber Dam 4.

Comment submitted by Andrea Donlon, CRWC, in an email dated January 27, 2010

1. Section 2.1 explains the daily operations protocol for extending fish passage operations on heavy run periods. By having a requirement that all three criteria be met (750 shad, hopper fullness index at least a 4, AND lift frequency 20 minutes), there are some days that the lift could have kept going but didn't. For example, looking at Table A-3, on May 24, 1,536 shad passed between 18 and 19 hours, but the lift did not operate the next hour. The next day, 766 shad passed at the same time, and the lift did not operate the next hour. In early June, the shad passage slowed to a few thousand a day, so the numbers weren't as high, but there are several days that the last lift of the day (18-19) had among the highest numbers of fish, but another hour was not triggered. We recommend that the trigger number of shad be lowered, and there be some days that all three criteria not have to be met to trigger additional hours.

Please see response to comments submitted by Caleb Slater, MADFW contained herein regarding errors in Table 3-3 that would have affected the interpretation.

2. Based on Table 3-2, it seems that sea lamprey passage numbers are highest late in the day. But the lift triggers are only geared towards shad. We recommend that there be lift triggers established for lamprey.

HG&E does not intend to establish extension of lift day triggers for sea lamprey at this time.

3. Section 3.2 references several tables, but should include a discussion as to any observations about fish passage numbers and flows, power generation, and rubber dam positions.

Data contained in tables referenced in Section 3.2 are reported pursuant to requirements of the 401 Water Quality Certificate. There was no intent to analyze those data in this report.

**APPENDIX C**  
**AGENCY AND STAKEHOLDERS COMMENTS ON THE DRAFT REPORT,**  
**DISTRIBUTED DECEMBER 10, 2009**

**From:** [Steve Leach](#)  
**To:** [Steve Leach](#)  
**Subject:** FW: 2009 Upstream Fishway Monitoring Report  
**Date:** Thursday, February 04, 2010 9:13:39 PM

---

----- Forwarded by Richard Murray/Hydro/HG&E on 01/27/2010 03:04 PM -----

John\_Warner@fws.gov  
To Richard Murray <rmurray@hged.com>  
01/27/2010 02:12 PM  
cc  
Subject Re: 2009 Upstream Fishway Monitoring Report

Rich -- We have no time due to workload to review this report and therefore defer comments to the other consulting parties - jw \_\_\_\_\_

John P. Warner, Energy/Hydropower Coordinator New England Field Office, U.S. Fish and Wildlife Service  
70 Commercial Street, Suite 300 Concord, NH 03301  
(603) 223-2541 - ext.15  
(603) 223-0104 - FAX

[www.fws.gov.northeast/newenglandfieldoffice](http://www.fws.gov.northeast/newenglandfieldoffice)  
Inactive hide details for Richard Murray <rmurray@hged.com>Richard Murray <rmurray@hged.com>

**From:** [Julie Crocker](#)  
**To:** [Richard Murray](#)  
**Cc:** [adonlon@ctriver.org](mailto:adonlon@ctriver.org); [Steve Leach](#)  
**Subject:** Re: Fw: 2009 Upstream Fishway Monitoring Report  
**Date:** Thursday, February 18, 2010 2:57:08 PM  
**Attachments:** [Julie\\_Crocker.vcf](#)

---

Hi Rich -

NMFS has no comments on the report.

Julie

Richard Murray wrote:

> Good Morning,  
>  
> We need to file this report with FERC at the end of the week and wanted to  
> know if you had any comments.  
>  
> If you have any questions please feel free to give me a call or an e-mail.  
>  
> Thanks,  
>  
> Rich

> ----- Forwarded by Richard Murray/Hydro/HG&E on 01/27/2010 09:10 AM -----

> Richard  
> Murray/Hydro/HG&E  
> To  
> 12/10/2009 09:37 AM John\_Warner@fws.gov,  
> caleb.slater@state.ma.us,  
> robert.kubit@state.ma.us,  
> Pasquale.Scida@noaa.gov,  
> don\_pugh@usgs.gov,  
> adonlon@ctriver.org,  
> julie.crocker@noaa.gov,  
> al.blott@verizon.net,  
> Ben\_Rizzo@fws.gov,  
> Jessica.Pruden@Noaa.gov  
> cc  
> Paul Ducheny/Hydro/HG&E@HG&E,  
> "Nancy J. Skancke"  
> <njskancke@grse-law.com>,  
> sleach@normandeau.com  
> Subject  
> 2009 Upstream Fishway Monitoring  
> Report

**From:** [Kubit, Robert \(DEP\)](#)  
**To:** [Richard Murray](#); [John\\_Warner@fws.gov](mailto:John_Warner@fws.gov); [Slater, Caleb \(FWE \)](#); [Pasquale.Scida@noaa.gov](mailto:Pasquale.Scida@noaa.gov); [don\\_pugh@usgs.gov](mailto:don_pugh@usgs.gov); [adonlon@ctriver.org](mailto:adonlon@ctriver.org); [julie.crocker@noaa.gov](mailto:julie.crocker@noaa.gov); [al.blott@verizon.net](mailto:al.blott@verizon.net); [Ben\\_Rizzo@fws.gov](mailto:Ben_Rizzo@fws.gov); [Jessica.Pruden@Noaa.gov](mailto:Jessica.Pruden@Noaa.gov)  
**Cc:** [Paul Ducheney](#); [Nancy J. Skancke](#); [Steve Leach](#)  
**Subject:** RE: 2009 Upstream Fishway Monitoring Report  
**Date:** Monday, January 11, 2010 2:35:55 PM

---

Hi Rich,

The MassDEP has reviewed and concurs with the 2009 Upstream Fishway Monitoring Report. The MassDEP supports any additional comments forthcoming from the MADFW.

Bob

Robert Kubit  
MassDEP  
Division of Watershed Management  
627 Main Street  
Worcester MA 01608  
Telephone: (508) 767-2854  
Email: [robert.kubit@state.ma.us](mailto:robert.kubit@state.ma.us)  
Fax: (508) 791-4131

-----Original Message-----

From: Richard Murray [<mailto:rmurray@hged.com>]  
Sent: Thursday, December 10, 2009 9:38 AM  
To: [John\\_Warner@fws.gov](mailto:John_Warner@fws.gov); Slater, Caleb (FWE ); Kubit, Robert (DEP); [Pasquale.Scida@noaa.gov](mailto:Pasquale.Scida@noaa.gov); [don\\_pugh@usgs.gov](mailto:don_pugh@usgs.gov); [adonlon@ctriver.org](mailto:adonlon@ctriver.org); [julie.crocker@noaa.gov](mailto:julie.crocker@noaa.gov); [al.blott@verizon.net](mailto:al.blott@verizon.net); [Ben\\_Rizzo@fws.gov](mailto:Ben_Rizzo@fws.gov); [Jessica.Pruden@Noaa.gov](mailto:Jessica.Pruden@Noaa.gov)  
Cc: Paul Ducheney; Nancy J. Skancke; [sleach@normandeau.com](mailto:sleach@normandeau.com)  
Subject: 2009 Upstream Fishway Monitoring Report

Good Morning,

The City of Holyoke Gas & Electric Department (HG&E) hereby provides for your review a copy of the 2009 Upstream Fishway Monitoring Report.

Please provide your concurrence or comments by Monday January 11th, 2010.

If there are any questions concerning this matter, please contact me at 413-536-9453 or by e-mail.

Thanks,

Rich

Rich Murray  
City of Holyoke Gas & Electric Dept.  
1 Canal Street  
Holyoke, MA 01040  
(413) 536-9453  
(413) 536-9412 fax

**From:** [Steve Leach](#)  
**To:** [Steve Leach](#)  
**Subject:** FW: Holyoke upstream passage report  
**Date:** Thursday, February 04, 2010 9:22:53 PM

---

----- Forwarded by Richard Murray/Hydro/HG&E on 01/11/2010 11:43 AM -----

"Slater, Caleb (FWE)" <Caleb.Slater@state.ma.us>  
To "Richard Murray" <rmurray@hged.com>  
cc <John\_Warner@fws.gov>, "Andrea Donlon" <adonlon@ctriver.org>, "Don Pugh"  
<don.pugh@yahoo.com> Subject Holyoke upstream  
passage report  
01/11/2010 11:37 AM

Rich,

I have looked through the "Monitoring Report: Upstream Fish Passage at HG&E's Holyoke Dam Fishway, Spring and Fall, 2009" that you sent out for comment last month.

It appears to be complete.

The one comment I have relates to extended lifting hours. It appears that there were several days when the last lifts' shad numbers exceeded the trigger (750 fish), but no additional lifts were made (May 24 and May 25). I also think a trigger of 500 shad might be more reasonable (a 500 fish trigger would only have added two or three days of extended lifts in 2009). I think the lower trigger number makes sense when you look at how compressed the shad run is. In fact 51% of the total run passed in just 8 days between May 16 and May 24th and the lifts did not operate extra hours on May 23rd or 24th (12% of the entire run passed on these days; 18,000 shad).

Thanks,

Caleb

Caleb Slater, Ph.D.  
Anadromous Fish project Leader  
MA Division of Fisheries and Wildlife  
508.389.6331  
508.389.7890 fax

**From:** [Steve Leach](#)  
**To:** [Steve Leach](#)  
**Subject:** FW: Upstream passage report  
**Date:** Tuesday, January 26, 2010 9:53:41 AM

---

**From:** Richard Murray [mailto:rmurray@hged.com]  
**Sent:** Saturday, January 23, 2010 10:38 PM  
**To:** Steve Leach  
**Subject:** Fw: Upstream passage report

-----Forwarded by Richard Murray/Hydro/HG&E on 01/23/2010 10:36PM -----

To: RMurray@hged.com  
From: Donald Pugh <dpugh@usgs.gov>  
Date: 01/23/2010 01:48PM  
cc: John\_Warner@fws.gov, caleb.slater@state.ma.us, adonlon@ctriver.org,  
alan.blott@noaa.gov, Ben\_Rizzo@fws.gov  
Subject: Upstream passage report

Rich,

A couple of comments on the draft 2009 Upstream Report:

1) Describe how fullness index is determined for each lift and is there a record for each lift.

2) The altering of bascule and rubber dam 5 seem irregular for the primary shad passage season. From May 4 to June 26 (the next to last partial opening) when most of the shad passed the bascule gate was fully open 40 days and partially open 13 days. This does not seem to alternate as I had hoped. The protocol for 2010 (and presumably for 2009) calls for alternation when only ZOP flows are being spilled. This seems unduly restrictive for altering the bascule position. A count of hours from May 4 to June 26 shows that 70.3% of the time either - only rubber dam #5 or rubber dams 1 and 5 were open. Under both of these conditions it seems that the difference in flows between the bascule gate being fully open or partially open could be discerned by shad. Alternating of bascule opening should occur when rubber dams 5 and 1 and 5 are open rather than being restricted to only ZOP flows.

Thanks for the opportunity to comment.

Don





## CONNECTICUT RIVER WATERSHED COUNCIL

*The River Connects Us*

15 Bank Row, Greenfield, MA 01301

January 11, 2010

Paul Duchenev  
Superintendent – Hydro  
Holyoke Gas and Electric Department  
99 Suffolk Street  
Holyoke, MA 01040-5082

**Re: Monitoring Report: Upstream Fish Passage at HG&E's Holyoke Dam Fishway, Spring and Fall, 2009**

Dear Paul,

I have reviewed the agency review draft of *Monitoring Report: Upstream Fish Passage at HG&E's Holyoke Dam Fishway, Spring and Fall 2009*, dated November 2009 and prepared for HG&E by Normandeau Associates. Annual reports and plans for following year's activities are required under the Settlement Agreement and the 401 Water Quality Certificate. My comments on behalf of the Connecticut River Watershed Council (CRWC) follow.

1. Section 2.1 explains the daily operations protocol for extending fish passage operations on heavy run periods. By having a requirement that all three criteria be met (750 shad, hopper fullness index at least a 4, AND lift frequency 20 minutes), there are some days that the lift could have kept going but didn't. For example, looking at Table A-3, on May 24, 1,536 shad passed between 18 and 19 hours, but the lift did not operate the next hour. The next day, 766 shad passed at the same time, and the lift did not operate the next hour. In early June, the shad passage slowed to a few thousand a day, so the numbers weren't as high, but there are several days that the last lift of the day (18-19) had among the highest numbers of fish, but another hour was not triggered. We recommend that the trigger number of shad be lowered, and there be some days that all three criteria not have to be met to trigger additional hours.
2. Based on Table 3-2, it seems that sea lamprey passage numbers are highest late in the day. But the lift triggers are only geared towards shad. We recommend that there be lift triggers established for lamprey.
3. Section 3.2 references several tables, but should include a discussion as to any observations about fish passage numbers and flows, power generation, and rubber dam positions.

Thank you for the opportunity to review the report and provide comments.

Sincerely,

Andrea F. Donlon, M.S.  
River Steward