Relicensing Study 3.3.6

IMPACT OF PROJECT OPERATIONS ON SHAD SPAWNING, SPAWNING HABITAT AND EGG DEPOSITION IN THE AREA OF THE NORTHFIELD MOUNTAIN AND TURNERS FALLS PROJECTS

Initial Study Report Summary

Northfield Mountain Pumped Storage Project (No. 2485)

and Turners Falls Hydroelectric Project (No. 1889)

Prepared for:

FirstLight™

GDF SUEZ

Prepared by:

Kleinschmidt

GOMEZ AND SULLIVAN ENGINEERS

SEPTEMBER 2014

1.1 Study Summary and Consultation Record to Date

The purpose of Study No. 3.3.6 is to gather data to determine whether project operations affect shad spawning in the Project area. American shad (shad), migrate into the Connecticut River to spawn, reaching Project waters in late April or early to mid- May. Much of the river downstream of Cabot Station is suitable for shad spawning, and the reach of the Connecticut River including the Deerfield River confluence is thought to be particularly productive spawning habitat.

Specifically, the shad spawning study will:

- Determine areas utilized by shad for spawning by conducting night-time visual and aural observation of spawning activity;
- Identify and define those areas geospatially, and obtain data on physical habitat conditions affected by project operations (e.g., water depth, velocity, discharge, substrate, exposure and inundation of habitats);
- Collect information in order to assess project operation effects on observed spawning activity, under a range of permitted or proposed project operation conditions;
- Quantify effects (e.g., water velocity, depths, inundation, exposure of habitats) of project operation on identified spawning areas for a range of conditions, over the complete period of spawning activity; and
- Verify spawning activity as measured by night-time spawning/splash surveys in areas of spawning activity, and downstream of these areas, to gather data to determine project operation effects (location extent of exposure from changing water levels and flows and on associated habitats from project operations).

On August 14, 2013 FirstLight filed its Revised Study Plan (RSP) with the Federal Energy Regulatory Commission (FERC).

On December 2, 2013, NMFS filed a letter (Appendix A) with FERC expressing concern about the study's potential to adversely affect shortnose sturgeon, an endangered species under the Endangered Species Act (ESA). The NMFS letter stated that if possible, the study *"should be designed or modified to avoid effects to shortnose sturgeon; however, if such modification is not possible, Section 7 consultation is necessary".*

On January 28, 2014, FirstLight filed a letter (Appendix A) with FERC responding to NMFS's concern. FirstLight proposed to replace the shad collection efforts with enhanced visual observations and splash counts of shad spawning to avoid adverse effects to shortnose sturgeon

On February 21, 2014, the Federal Energy Regulatory Commission's (FERC) issued its Study Plan Determination Letter (SPDL). In it, FirstLight was required to *"consult with NMFS, FWS, MADFW and Commission staff on an amendment to the revised study plan that would seek to avoid all effects to shortnose sturgeon and provide sufficient information. Following consultation, FirstLight should file with the Commission for approval, an amended study plan for study 3.3.6 when it files its Initial Study Report in September 2014".* (page B-45 of February 21, 2014 SPDL).

On June 3, 2014, FirstLight met with FERC (via phone), National Marine Fisheries Service (NMFS) (via phone), United States Fish and Wildlife Service (USFWS), Massachusetts Division of Fish and Wildlife (MADFW), The Nature Conservancy (TNC), and Connecticut River Watershed Council (CRWC) to discuss the study. At this meeting, USFWS provided FirstLight with four potential modifications to

Study Nos. 3.3.6 study plan with the goal of not adversely affecting endangered shortnose sturgeon. The four modifications were:

1. Avoid towing nets within 2-km of the Montague reach between Rock Dam (river km 194) and the railroad bridge (rkm 192; now a bike path, located immediately downstream of the Deerfield River mouth- see Figure 1), a hydrographically turbulent reach where the greatest concentration of larval migrants would occur within;
2. Avoid sampling in shallower water (< 2 m);
3. Use floats attached to nets to make sure towed nets remain at the chosen depths near the surface.
4. Require that egg samples be screened for the presence of shortnose sturgeon before the next sampling effort is made. If shortnose sturgeon eggs, embryos, or larvae, are detected during screening of ichthyoplankton tows, all sampling should cease and NMFS will be contacted immediately. NMFS will then work with First Light to determine how to proceed.

On July 3, 2014, FirstLight sent NMFS a letter (Appendix A) with proposed modifications to Study No. 3.3.6.

On July 14, 2014, NMFS provided an email (Appendix A) to FirstLight recommending that FirstLight submit a letter describing the final proposed study, analyzing the effects of the proposed study on shortnose sturgeon, and determining whether the proposal would ill adversely affect shortnose sturgeon. If FirstLight determined that the proposed study is not likely to adversely affect shortnose sturgeon (i.e., that all effects will be insignificant and discountable and FirstLight does not anticipate any capture or collection), NMFS advised FirstLight to request NMFS's concurrence with that determination.

On August 6, 2014 FirstLight discussed the study further with NMFS. On August 25, 2014, FirstLight sent NMFS and other agencies a letter (Appendix A) indicating that, after thorough consideration of the proposed study modifications, it was unable to make a determination that the study is not likely to adversely affect shortnose sturgeon. In its letter, FirstLight stated that based on past studies, it expects to capture sturgeon egg larvae if ichthyoplankton nets are deployed. As such, FirstLight proposed to conduct the study as set forth in its January 28, 2014 letter, with no shad egg collection efforts. Instead, FirstLight proposed (see Appendix B) to replace shad collection efforts with enhanced visual observations and splash counts below Turners Falls Dam. Ross (1993) has quantified spawning of adult American shad by counting spawning splashes over 5-min intervals. Splashing events were verified to be spawning American shad through direct observations. Ross (1993) concluded that that this technique was valid and useful to quantify spawning activity for this species. Collection of eggs downstream of the spawning sites will not confirm that spawning occurred, as eggs drift downstream and there is no assurance that the collected eggs were just spawned. However, FirstLight has agreed to collect eggs as described upstream in the Impoundment as this area is beyond the range of the shortnose sturgeon. FirstLight therefore believes that visual observations and splash counts of shad spawning, which will have no impact to shortnose sturgeon, will fulfill the goals and objectives of the study.

1.2 Study Progress Summary

Task 1: Development of a Detailed Study Design

An amended study plan was developed based on the consultation described above. See Appendix B.

Task 2: Examination of Known Spawning Areas Downstream of Turners Falls Dam

To be conducted in 2015.

Task 3: Identification of Spawning Areas Upstream of Turners Falls Dam

To be conducted in 2015.

Task 4: Examination of Identified Spawning Areas Upstream of Turners Falls Dam

To be conducted in 2015.

Task 5: Data Analysis and Reporting

A final report will be completed in March 2016 per FERC's SPDL.

1.3 Variances from Study Plan and Schedule

To date, there are no variances from the study plan

1.4 Remaining Activities

The study will be conducted in 2015 and the report will be completed by March 2016.

Appendix A
Correspondence Log

ORIGINAL

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

NOV 22 2013

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

P-2485

RE: Supplemental Comments on Firstlight's Proposed Study Plan dated June 28, 2013 for Turners Falls (P-1889) and Northfield Mountain Pumped Storage (P-2485)

Dear Ms. Bose:

We submitted comments on Firstlight's June 28, 2013, Study Plan in letters filed with you on July 15, 2013 and August 28, 2013. In our July 15 letter, we indicated that a consultation, pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended, may be necessary to consider effects of the *Fish Assemblage Assessment* (P-1889 Study 3.3.11) on endangered shortnose sturgeon. We recommended that the study be modified to eliminate the potential for effects or that FERC initiate formal consultation pursuant to section 7 with us. In recent conversations with Firstlight, we have become aware of the potential for additional studies to adversely affect shortnose sturgeon including study 3.3.6 *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects* and study 3.6.3 *Whitewater Boating Evaluation* (Revised Study Plan for the Turners Falls Hydroelectric Project (P-1889) and Northfield Mountain Pumped Storage Project (P-2485)). If possible, these studies should be designed or modified to avoid effects to shortnose sturgeon; however, if such modification is not possible, section 7 consultation is necessary.

Section 7(a)(2) of the ESA, states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Any discretionary federal action that may affect a listed species must undergo Section 7 consultation. It is our understanding that the approval of study plans is a discretionary action taken by FERC that is subject to section 7 consultation. As the lead Federal agency, you must initiate section 7 consultation with us on any action that may affect listed species. If you determine that the studies are "not likely to adversely affect" any listed species (i.e., when direct or indirect effects of the proposed project or its interdependent and/or interrelated actions on listed species are expected to be discountable, insignificant or completely beneficial), you should submit this determination to us in writing, along with a justification, and request our concurrence. If we concur with this determination, we will reply in a letter that will convey the concurrence, thus completing Section 7 consultation. If you determine that a study or

studies are "likely to adversely affect" any listed species (i.e., if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effects are not: discountable, insignificant, or beneficial) or we do not concur with your "not likely to adversely affect" determination, formal Section 7 consultation, resulting in the issuance of a Biological Opinion with an appropriate Incidental Take Statement, may be required. Any effects that amount to the take of a listed species (defined by the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct") are not discountable, insignificant or entirely beneficial. Therefore, if any take, including non-lethal capture and release and/or exposure to electric current during electrofishing, is anticipated, formal consultation is required. My staff is available to discuss the effects of the proposed studies on shortnose sturgeon and assist you and Firstlight in determining the likely effects of the proposed studies. If you have designated Firstlight as your non-Federal representative for purposes of informal section 7 consultation, you must indicate this in writing to us. In that event, Firstlight, representing FERC, would be able to request our concurrence for any "not likely to adversely affect" determinations. However, if formal consultation is necessary, the request must come from FERC.

This letter supplements the comments filed by us in July and August 2013; the comments presented in those letters regarding our Federal Power Act authorities as well as impacts to other NMFS trust resources remain valid. If you have any questions or need additional information, please contact Jessica Pruden in our Protected Resources Division (Jessica.Pruden@noaa.gov or 978-282-8482).

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

EC: Crocker, F/NER3
McDavitt, F/NER4

File Code: Sec 7 FERC Turners Falls Relicensing

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John S. Howard
Director FERC Hydro Compliance
Chief Dam Safety Engineer

January 28, 2014

VIA ELECTRONIC FILING

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

Re: FirstLight Hydro Generating Company, FERC Project Nos. 2485-063 and 1889-081
Response to National Marine Fisheries Service Supplemental Comments on Study Plan

Dear Secretary Bose:

On December 2, 2013, the National Marine Fisheries Service (NMFS) filed a letter with the Federal Energy Regulatory Commission (FERC or Commission) containing supplemental comments on FirstLight Hydro Generating Company's (FirstLight) study plan for relicensing the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485). NMFS's comments expressed concern that three of FirstLight's study plans; Study Plan 3.3.6, *Impact of Project Operations on Shad Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects*; Study Plan 3.3.11, *Fish Assemblage Assessment*, and Study Plan 3.6.3; *Whitewater Boating Evaluation*—had the potential to adversely affect shortnose sturgeon, an endangered species under the Endangered Species Act. NMFS therefore suggested that these studies should be designed or modified to avoid effects to shortnose sturgeon. The purpose of this letter is to respond to NMFS's comments on two of these study plans, Study Plans 3.3.6 and 3.3.11, to enable the Commission's Director of the Office of Energy Projects to issue a study plan determination that directs FirstLight to implement studies that will avoid potential effects to shortnose sturgeon.[1]

Study Plan 3.3.6, *Impact of Project Operations on Shad Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects*

Study Plan 3.3.6 addresses requests by resource agencies to determine if Turners Falls Project operations affect shad spawning, by conducting night time surveys to document shad spawning. The agencies requested that following this documentation, FirstLight observe spawning activity under a range of

[1] FirstLight has already addressed NMFS's concerns on the third study plan, Study Plan 3.6.3, *Whitewater Boating Evaluation*, in its modified revised study plan filed on January 13, 2014, by proposing to conduct the evaluation outside of the April 15 – June 22 shortnose sturgeon spawning and rearing period.

operating conditions. FirstLight's revised study plan for Study Plan 3.3.6 includes these parts of the study as requested, during the May – June shad spawning time period.

The agencies also requested that shad egg collections be conducted in areas of spawning activity to further determine if spawning has occurred. It has been documented that shortnose sturgeon spawn in the vicinity of the Cabot Station tailrace (Kieffer and Kynard 2012). Kieffer and Kynard (2012) have documented a spawning period of 5-17 days during the same 26 day period each year (April 27-May 22). Early life history stages (eggs and larvae) are present in the project area for 20 to 30 days after spawning (Kynard et al. 2012a). So the period when shortnose sturgeon eggs and larvae are present overlaps with the proposed sampling period for shad egg collection. Consequently, the collection of shad eggs may have the potential to impact shortnose sturgeon, and NMFS recommended in its December 2 letter that the study be revised.

To address this potential concern, FirstLight proposes to replace shad egg collection efforts, which studies have shown are duplicative of visual observations of shad spawning, with enhanced visual observations and splash counts. Ross (1993) has quantified spawning of adult American shad by counting spawning splashes over 5-min intervals. Splashing events were verified to be spawning American shad through direct observations. Ross (1993) concluded that that this technique was valid and useful to quantify spawning activity for this species. FirstLight therefore believes that visual observations and splash counts of shad spawning, which will have no impact to shortnose sturgeon, will fulfill the goals and objectives of the study.

Study Plan 3.3.11, *Fish Assemblage Assessment*

Study Plan 3.3.11 addresses regulatory agency requests to characterize the fish assemblage above and below the Turners Falls Dam. Although the study is not targeting shortnose sturgeon, NMFS has pointed out that non-targeted sampling in certain areas may have the potential to affect shortnose sturgeon, whose historic upstream range on the Connecticut River is Turners Falls. While sampling as proposed can occur in the Turners Falls impoundment because this is beyond the range of shortnose sturgeon, sampling efforts below Turners Falls Dam may need to be modified to avoid potential impacts to shortnose sturgeon.

In its comments dated July 15 on proposed Study Plan 3.3.11, NMFS recommended the study be modified to eliminate the potential for effects on shortnose sturgeon. Specifically, NMFS recommended that: (1) no electrofishing occur in the reach of the Connecticut River below the Deerfield River (which NMFS refers to as Transect 6); and (2) a seasonal restriction be placed on sampling in the bypass reach (which NMFS refers to as Transect 5) to ensure that no electrofishing is carried out when shortnose sturgeon may be present (April 15 – June 30).

In its revised study plan, FirstLight noted that the geographic scope of the study was being reviewed by NMFS, and that the potential impact on shortnose sturgeon may result in modifying the geographic area. FirstLight therefore agreed not to perform any electrofishing in the bypass reach from April 15 – June 30.

While NMFS did not provide any additional comments on FirstLight's revised study plan for Study 3.3.11, FirstLight believes that additional modifications to the plan may be necessary to avoid potential impacts to shortnose sturgeon in both the bypass reach and the reach of the river below the Turners Falls Dam. To avoid any potential impacts to sturgeon, FirstLight proposes to conduct all sampling in the bypass reach after June 30, and in the reach below the Deerfield River, FirstLight proposes to use both existing data and the data it obtains in the Turners Falls Impoundment.

A 2009 electrofishing survey of the area below Turners Falls Dam downstream to the Route 116 Bridge was conducted as part of a larger Environmental Protection Agency effort to sample the entire Connecticut River from Lake Francis to the freshwater extent of the tidal estuary. Sampling occurred at three 1-km stations in the bypass reach and eight 1-km stations between the bypass reach and the Route 116 Bridge in Sunderland (Figure 1). The species composition and relative abundance (Table 1) is typical of fish assemblages described for inland fishes of Massachusetts (Hartel et al. 2002). FirstLight believes that these recent data, coupled with the data FirstLight will obtain in the Turners Falls Impoundment will provide sufficient information on species composition and relative abundance in the Project area to accomplish the study's goals and objectives.

If you have any questions regarding this filing, please feel free to contact me.

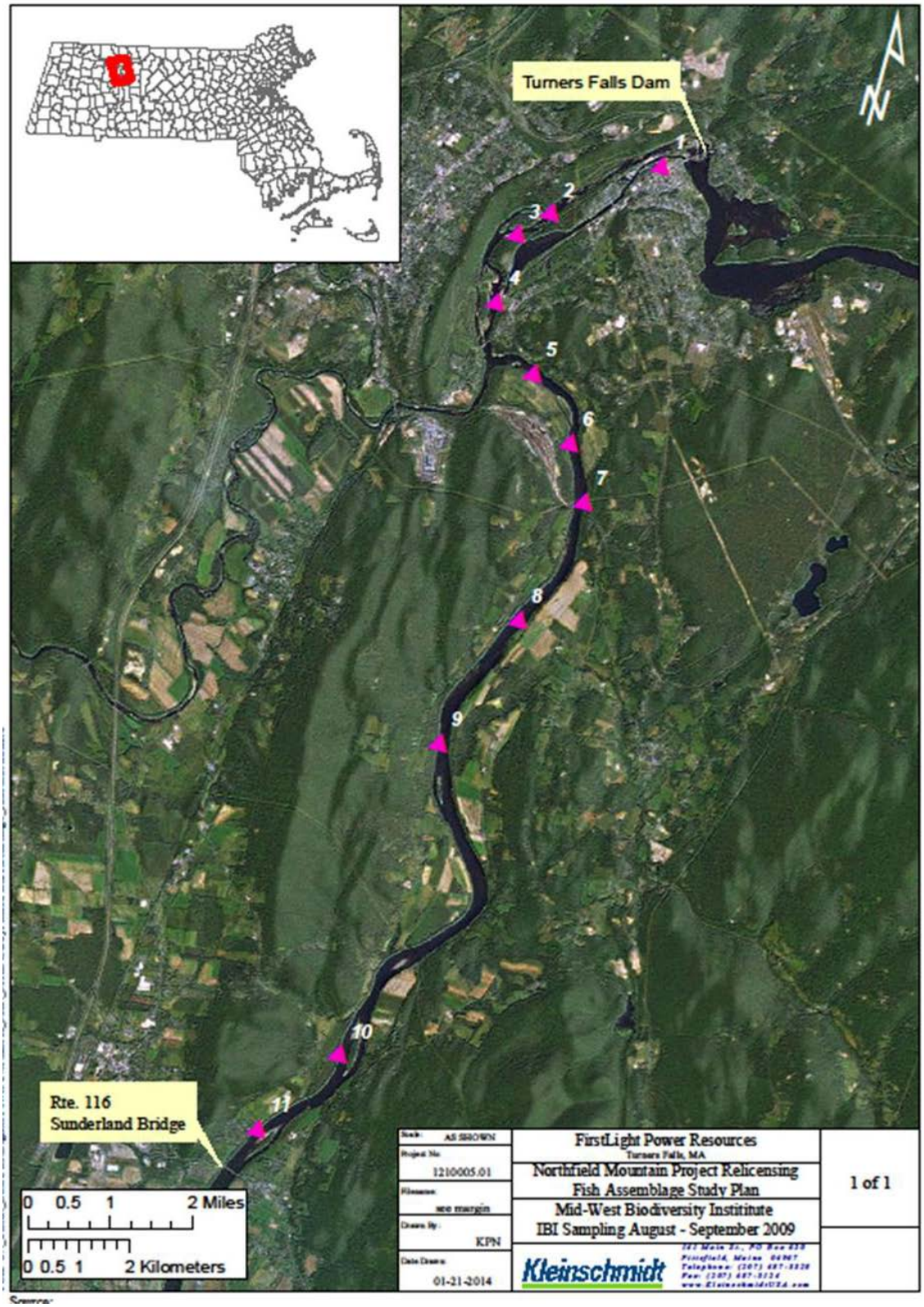
Sincerely,

John Howard

Table 1. Fish collected at eleven 1 km sample sites on the Connecticut River below the Turners Falls Dam to the Route 116 Bridge in Sunderland MA by electrofishing (2009).

	Stations											
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**
Date Sampled (2009)	**8/31**	**9/28**	**8/15**	**8/16**	**8/16**	**9/2**	**8/16**	**10/5**	**8/17**	**8/17**	**8/17**	
American eel	13	12	5	14	0	0	3	2	29	0	0	**78**
American shad	0	0	0	7	7	6	0	0	0	1	25	**46**
Atlantic salmon	0	8	0	1	0	0	0	0	0	0	1	**10**
Black crappie	0	0	0	0	1	0	0	0	0	0	0	**1**
Bluegill	15	0	3	5	7	8	8	0	12	14	9	**81**
Brown trout	1	0	0	0	0	0	2	0	0	0	0	**3**
Chain pickerel	0	0	0	0	0	1	0	1	0	0	0	**2**
Channel catfish	0	0	0	0	0	0	1	0	0	0	0	**1**
Common carp	1	0	0	2	0	0	0	0	0	0	0	**3**
Common shiner	0	0	0	4	0	0	0	0	0	0	0	**4**
Fallfish	0	0	14	4	29	150	10	10	99	128	8	**452**
Largemouth bass	0	0	0	0	2	0	0	0	0	4	0	**6**
Longnose dace	11	0	1	0	0	0	0	0	0	0	0	**12**
Northern pike	0	0	1	0	1	0	0	1	0	2	0	**5**
Pumpkinseed	0	0	1	0	0	0	0	0	2	0	0	**3**
Rock bass	2	3	8	1	3	3	4	0	12	0	0	**36**
Sea lamprey	14	1	1	0	0	0	0	2	3	0	2	**23**
Smallmouth bass	85	56	70	42	45	46	81	19	12	33	25	**514**
Spottail shiner	13	0	133	0	9	354	0	8	53	10	0	**580**
Tessellated darter	17	0	8	3	1	2	1	4	1	0	0	**37**
Walleye	0	0	0	0	0	0	1	0	0	0	0	**1**
White sucker	6	5	9	5	4	23	9	3	1	4	2	**71**
Yellow perch	1	1	3	0	0	2	1	2	1	7	5	**23**
Total	**179**	**86**	**257**	**88**	**109**	**595**	**121**	**52**	**225**	**203**	**77**	**1992**
Sampling effort (Seconds)	**9272**	**3356**	**4856**	**3298**	**3495**	**6360**	**4415**	**6578**	**3708**	**3595**	**3441**	**52374**

Figure 1: Locations of fish collection sites on the Connecticut River below the Turners Falls Dam to the Route 116 Bridge in Sunderland MA by electrofishing (2009).



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Kynard, B., M. Kieffer, E. Parker, D. Pugh and B.E. Kynard. 2012b. Lifetime Movements by Connecticut River Shortnose Sturgeon. Chapter 9 *in* Life history and behavior of Connecticut River shortnose sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

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Normandeau Associates, Inc. (NAI), Inc. 2008. Shortnose sturgeon emigration approach and downstream passage routes at the Holyoke Project, 2007. Final Report.

Normandeau Associates, Inc. (NAI) 2009. Shortnose sturgeon emigration approach and downstream passage routes at the Holyoke Project, 2008. Final Report.

Ross, R.M., Backman, T.W.W. & Bennett, R.M. (1993). *Evaluation of habitat suitability index models for riverine life stages of American shad, with proposed models for pre-migratory juveniles* (Biological Report 14. U. S. DOI). Washington, D.C.: U. S. Fish and Wildlife Service.

July 3, 2014

Ms. Jessica Pruden
Northeast Regional Shortnose Sturgeon Recovery Coordinator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930

Re: FirstLight, Relicensing of the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485), Study No. 3.3.6- *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Project*.

Dear Ms. Pruden

FirstLight Hydro Generating Company (FirstLight) is currently in the process of relicensing its Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485) with the Federal Energy Regulatory Commission (FERC). On August 14, 2013 FirstLight filed its Revised Study Plan (RSP). The purpose of this letter is to submit proposed modifications to Study No. 3.3.6 *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Project* so as to avoid potential effects to federally endangered shortnose sturgeon known to occur in the area below Cabot Station[1].

Background

Study No. 3.3.6 addressed requests by resource agencies to evaluate any potential impacts of the Turners Falls Hydroelectric Project on shad spawning. As part of the study, FirstLight proposed to conduct shad egg collections in areas of spawning activity to further determine if spawning had occurred. One of these areas is in the vicinity of Cabot Station where shortnose sturgeon are documented to spawn at the same time when shad egg collection would occur. Consequently, the collection of shad eggs may have the potential to impact federally listed shortnose sturgeon due to potentially collecting shortnose sturgeon larvae.

John S. Howard
Director FERC Compliance
Chief Dam Safety Engineer

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[1] Cabot Station and Station No. 1 are two developments that comprise the Turners Falls Hydroelectric Project.

On December 2, 2013, the National Marine Fisheries Service (NMFS) filed a letter with FERC stating "*In recent conversations with FirstLight, we have come aware of the potential for additional studies to adversely affect shortnose sturgeon including study 3.3.6 Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Project and study 3.6.3 Whitewater Boating Evaluation. If possible, these studies should be designed or modified to avoid effects to shortnose sturgeon; however, if such modification is not possible, section 7 consultation is necessary.*

On January 28, 2014, FirstLight filed a letter with FERC responding to the NMFS's December 2, 2013 letter. To address NMFS's concern regarding potential impacts to shortnose sturgeon due to shad egg collection, FirstLight proposed to replace shad egg collection efforts with enhanced visual observations and splash counts.

On February 21, 2014 FERC issued its second Study Plan Determination Letter (SPDL) which addressed Study No. 3.3.6. In the SPDL, FERC stated the following relative to Study No. 3.3.6 "*consult with NMFS, FWS, MADFW and Commission staff on an amendment to the revised study plan that would seek to avoid all effects to shortnose sturgeon and provide sufficient information. Following consultation, FirstLight should file with the Commission for approval, an amended study plan for study 3.3.6 when it files its Initial Study Report in September 2014*" (page B-45 of February 21, 2014 SPDL).

As requested by FERC, on June 3, 2014, FirstLight held a meeting[2] with FERC, NMFS, United States Fish and Wildlife Service (USFWS), Massachusetts Division of Fisheries and Wildlife (MADFW), Connecticut River Watershed Council (CRWC) and The Nature Conservancy (TNC) to discuss Study No. 3.3.6 and other studies.

Proposed Modifications to Study No. 3.3.6

At the June 3, 2014 meeting, the regulatory agencies indicated that in addition to splash counts, they would like shad eggs to be collected. The regulatory agencies had discussed the issue with Micah Kieffer of the United States Geological Survey's (USGS) Conte Lab, who has spent decades studying shortnose sturgeon spawning in the vicinity of Cabot Station. Mr. Kieffer provided the regulatory agencies with suggested modifications to the field data collection work that he felt would limit potential impacts to shortnose sturgeon. Those proposed modifications were provided to FirstLight at the June 3, 2014 meeting and included the following:

1. Avoid towing nets within 2-km of the Montague reach between Rock Dam (river km 194) and the railroad bridge (rkm 192; now a bike path, located immediately downstream of the Deerfield River mouth- see Figure 1) where the greatest concentration of larval migrates would occur within a hydrographically turbulent reach;
2. Avoid sampling in shallower water (< 2 m);
3. Use floats attached to nets to make sure towed nets remain at the chosen depths near the surface.
4. Require that egg samples be screened for the presence of shortnose sturgeon before the next sampling effort is made.

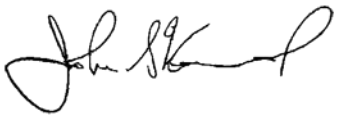
FirstLight is willing to incorporate modifications 1-3 above in the study plan to be filed in September 2014. Processing eggs samples, as proposed by modification 4, is time consuming; May and June are periods of high detritus and dense plankton concentrations in the Connecticut River, and ichthyoplankton

[2] FERC and NMFS participated via telephone.

samples must be examined with the aid of a dissecting microscope. Accordingly, obtaining and screening egg samples is not possible while FirstLight conducts the initial night time reconnaissance surveys to document shad spawning. FirstLight is willing, however, to conduct limited plankton sampling following this documentation, as part of its observations of spawning activity under a range of operating conditions. Specifically, FirstLight proposes to conduct two plankton samples per week, before and after a flow change, to evaluate whether shad spawning is occurring. FirstLight believes that this sampling and screening will fulfill the goals and objectives of the shad spawning study, while also addressing concerns about potential impacts to shortnose sturgeon.

Thank you for your consideration of this proposed modification. Please respond to confirm that these proposed modifications to the shad spawning study will address your concerns about the study's potential impacts to shortnose sturgeon.

Sincerely,



John Howard

Cc: John Warner, USFWS (via email)
Melissa Grader, USFWS (via email)
Ken Hogan, FERC (via email)
Caleb Slater, MADFW (via email)

Attachment: Figure 1

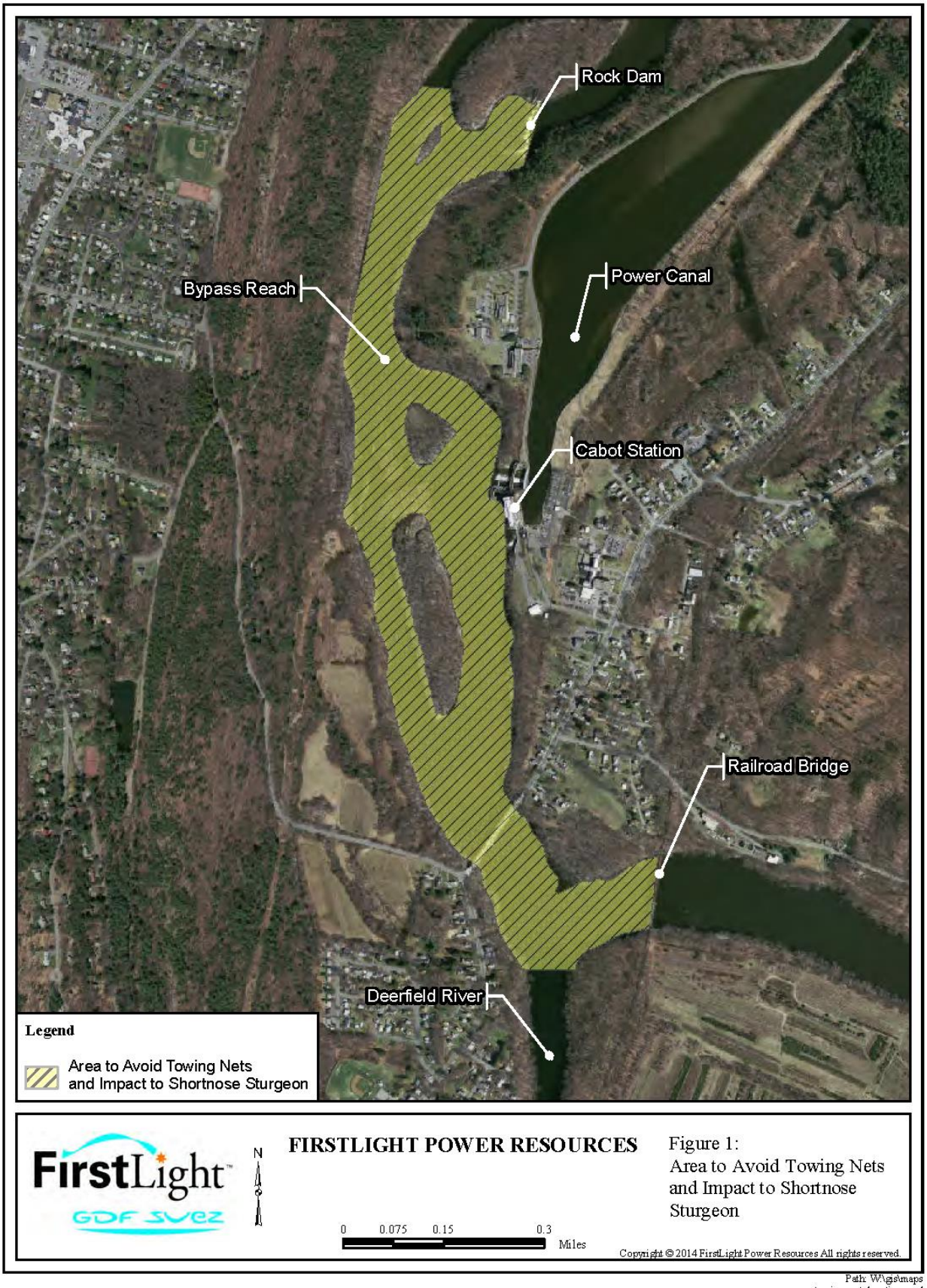


Figure 1:
Area to Avoid Towing Nets and Impact to Shortnose Sturgeon

Path: W:\gis\maps
o_towing_net_location.mxd

Mark Wamser

From: Howard, John <John.Howard@gdfsuezna.com>
Sent: Monday, July 14, 2014 10:55 AM
To: 'Julia Wood'
Cc: Mark Wamser - Gomez and Sullivan Engineers, P.C. (mwamser@gomezandsullivan.com)
Subject: FW: Re:

Julia, FYI, John

From: Jessica Pruden - NOAA Federal [mailto:jessica.pruden@noaa.gov]
Sent: Monday, July 14, 2014 10:52 AM
To: Howard, John
Cc: Chris Tomichek; Kimberly Damon-Randall - NOAA Federal; Kenneth Hogan; Julie Crocker - NOAA Federal; Mark Wamser
Subject: Re:

John,
Thank you for your letter outlining the proposed modifications that will be incorporated into study *3.3.6 Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of Northfield Mountain and Turners Falls Project.* We are comfortable with modifications 1-3 being incorporated into the final study plan. We also understand the difficultly of screening every sample and are comfortable with the proposed screening approach outlined in your letter. However, the following requirement should also be incorporated into the proposed sampling and screening approach: *If shortnose sturgeon eggs, embroys, or larvae, are detected during screening of ickthyo-plankton tows, all sampling should cease and NMFS should be contacted immediately. NMFS will then work with First Light to determine how to proceed.*

Once First Light is confident that the proposed study, with the modifications and requirements outlined above, are acceptable to the other agencies, we would recommend ESA section 7 consultation. Given that First Light has been designated as the non-federal representative by FERC, you may submit a letter, as FERC's representative, describing the final proposed study, an analysis of the effects of the proposed action on shortnose sturgeon, and determination as to whether the proposed action will adversely affect shortnose sturgeon. If you determine that the proposed study is not likely to adversely affect shortnose sturgeon (i.e., that all effects will be insignificant and discountable and you do not anticipate any capture or collection), you should request our concurrence with that determination. Once we receive this letter, NMFS will make a determination as to whether we concur with First Lights determination.

We understand that a separate working group is developing an alternative proposed approach for study *3.3.11 Fish Assemblage Assessment.* We would strongly recommend that if possible, First Light include a description of the final proposed approach, an analysis of the effects on shortnose sturgeon, and determination on whether the action will adversely affect shortnose sturgeon in the same letter we reference above. This will likely ensure greater efficiency in terms of a timely response from NMFS.

We are comfortable engaging in early consultation, which would allow First Light and NMFS to consult as soon as First Light is confident that both studies are acceptable to all of the interested agencies. Consultation does not need to wait until the Final Study Plan Determination has been made by FERC. Please let us know if you have any questions about any of this information.

Thank you,

Jessica Pruden

On Thu, Jul 3, 2014 at 10:56 AM, Chris Tomichek <Chris.Tomichek@kleinschmidtgroup.com> wrote:

Good Morning

Attached is a letter that FirstLight put in the mail to NMFS this morning that includes proposed modifications to Study Plan 3.3.6 - *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Project* to avoid potential impacts to shortnose sturgeon larvae as discussed at the June 3, 2014 meeting.

Regards,

Chris

Chris Tomichek

Senior Manager

Fisheries and Aquatic Resources

Office: 860.767.5069

www.KleinschmidtGroup.com

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Jessica Pruden
Shortnose Sturgeon Recovery Coordinator and Tribal Liaison for the Greater Atlantic Region
NOAA Fisheries
55 Great Republic Drive
Gloucester, MA 01930
Work 978-282-8482
E-Mail Jessica.Pruden@noaa.gov
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August 25, 2014

VIA EMAIL

Jessica Pruden, National Marine Fisheries Service
John Warner, US Fish & Wildlife Service
Melissa Grader, US Fish & Wildlife Service
Caleb Slater, Massachusetts Department of Fish & Wildlife
Ken Hogan, Federal Energy Regulatory Commission

Re: FirstLight Hydro Generating Company, Relicensing of the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485), Study No. 3.3.6 - *Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Project.*

Dear All:

FirstLight is preparing a revision to relicensing Study No. 3.3.6, *Impact of Project Operations on Shad Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects*. After FirstLight filed its Revised Study Plan (RSP) on August 14, 2013, the National Marine Fisheries Service (NMFS) expressed concern that the shad egg collection efforts proposed in the study had the potential to adversely affect shortnose sturgeon. FirstLight responded to NMFS's concerns in a January 28, 2014 letter in which FirstLight proposed to replace the shad collection efforts with enhanced visual observations and splash counts of shad spawning, which would have no impact to shortnose sturgeon. The United States Fish and Wildlife Service (USFWS) subsequently indicated that alternative study plan modifications may be feasible to allow for shad egg collection while minimizing effects to shortnose sturgeon. The Federal Energy Regulatory Commission (FERC) therefore recommended, in its study plan determination issued on February 21, 2014, that FirstLight consult with NMFS, USFWS, Massachusetts Division of Fish and Wildlife (MDFW), and FERC staff on an amendment to the RSP that "would seek to avoid all effects to shortnose sturgeon."

At FirstLight's June 3, 2014 consultation meeting, USFWS and NMFS offered suggested modifications to FirstLight's field data collection that they felt would limit potential impacts to shortnose sturgeon. These included:

1. Avoiding towing nets within 2-km of the Montague reach between Rock Dam (river km 194) and the railroad bridge (rkm 192; located immediately downstream of the Deerfield River mouth),

John S. Howard
Director FERC Compliance
Chief Dam Safety Engineer

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E-mail: john.howard@gdfsuezna.com

where the greatest concentration of larval migrates would occur within a hydrographically turbulent reach;
2. Avoiding sampling in shallower water (< 2 m);
3. Using floats attached to nets to make sure towed nets remain at the chosen depths near the surface; and
4. Screening egg samples for the presence of shortnose sturgeon before the next sampling effort is made, and if shortnose sturgeon eggs, embryos, or larvae, are detected during screening of ichthyoplankton tows, ceasing all sampling and contacting NMFS immediately.

FirstLight initially felt such modifications could minimize potential impacts to shortnose sturgeon. However, in a July 14, 2014 email, NMFS indicated that FirstLight should conduct an analysis of the study, and in particular the sampling effort with the suggested modifications, on shortnose sturgeon. NMFS stated that "if [FirstLight] determine[s] that the proposed study is not likely to adversely affect shortnose sturgeon (i.e., that all effects will be insignificant and discountable and you do not anticipate any capture or collection), you should request our concurrence with that determination."

After careful consideration of the proposed study modifications, FirstLight is unable to make a determination that the study is not likely to adversely affect shortnose sturgeon. In fact, for the reasons discussed below, FirstLight anticipates that it would capture and collect shortnose sturgeon larvae if it conducts shad egg sampling below Cabot Station, with or without the suggested modifications to the egg sampling effort.

Shortnose sturgeon spawning is well documented in the Connecticut River. The United States Geological Survey's (USGS) Conte Lab researchers have conducted studies concluding that there is only one spawning site in the Connecticut River, at Montague below Cabot Station and at the Rock Dam at approximately river km 192 (Kynard et al. 2012). The Montague site was verified as a spawning area based on successful capture of sturgeon eggs and larvae in 1993, 1994, and 1995, that were 190 times the number of fertilized eggs and 10 times the number of embryos found at the downstream Holyoke site (Vinogradov 1997). Based on available information, shortnose sturgeon larvae generally rear at, or just downstream from, spawning grounds (Kieffer and Kynard 2012).

However, shortnose sturgeon larvae have been collected much farther downstream, including at river km 120 on May 25, 2005 (Kleinschmidt 2008) and at river km 68 on May 3, 2006 (Kleinschmidt 2006). These shortnose sturgeon larvae were collected as part of general ichthyoplankton studies that filtered 100 m^3 of water (6 minute tow). The larvae collected at river km 120 occurred where river depths averaged about 2-m and 0.6-m diameter plankton nets were towed close to the surface. The two larvae captured at river km 68 occurred where river depths averaged about 3-m and a 1-m diameter plankton net was towed close to the surface.

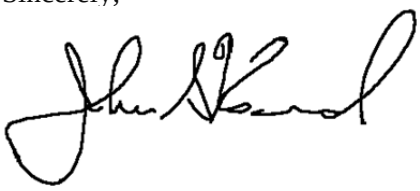
NMFS has prohibited sampling much further downstream of the Montague spawning site, without appropriate take protections in place, because of potential adverse impacts to shortnose sturgeon. In 2007, the United States Environmental Protection Agency (USEPA) requested that FirstLight sample ichthyoplankton at river km 148 as part of an assessment of the Mt. Tom Generating Station. NMFS was concerned that some shortnose sturgeon larvae may drift downstream from the Montague spawning grounds and be captured in ichthyoplankton nets in May and June. Thus, FirstLight did not conduct the requested sampling.

Based on the past collections of shortnose sturgeon larvae at river kms 120 and 68, as well as NMFS's previous analysis that shortnose sturgeon larvae may be collected 44 river kilometers downstream of the Montague spawning and rearing grounds, FirstLight expects that capture and collection of shortnose sturgeon larvae may be likely to occur if it deploys ichthyoplankton nets as requested for Study No. 3.3.6

just downstream of river km 192 in May and June. For these reasons, FirstLight proposes to conduct the study as set forth in its January 28, 2014 letter, with no shad egg collection efforts. Instead, FirstLight will propose in its modified study plan, to be filed with the upcoming Initial Study Report, to replace shad collection efforts—which studies have shown are duplicative of visual observations of shad spawning—with enhanced visual observations and splash counts. FirstLight believes that this will fulfill the goals and objectives of the study without impacting shortnose sturgeon.

If you have any questions, please feel free to call me.

Sincerely,



John Howard

cc: Andrea Donlon, Connecticut River Watershed Council, via email
Katie Kennedy, The Nature Conservancy, via email
Karl Meyer, Environmental Scientist, via email
Don Pugh, Trout Unlimited, via email

Attachment: Literature Cited

Literature Cited

Kieffer, M.. Kynard, B.2012. Spawning and Non-spawning Migrations, Spawning, and the Effect of River Regulation on Spawning Success of Connecticut River Shortnose Sturgeon Chapter 3 *in* Life history and behavior of Connecticut River Shortnose Sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Kleinschmidt Associates. 2006. Entrainment Report. Prepared for Connecticut Resources Recovery Authority. November 2006. 27 pp plus appendices.

Kleinschmidt Associates. 2008. Annual Progress Report. Prepared for CEEMI. February 2008. 34 pp plus appendices.

Kynard, B., M. Kieffer, M. Horgan, B.E. Kynard, M. Burlingame and P. Vinogradov.2012. Seasonal Movements among River Reaches, Migration Strategies and Population Structure of the Divided Connecticut River Shortnose Sturgeon Population: The Effect of Holyoke Dam. Chapter 1 *in* Life history and behavior of Connecticut River Shortnose Sturgeon and other sturgeons. B. Kynard, P. Bronzi, and H. Rosenthal Editors. World Sturgeon Conservation Society: Special Publication #4. Norderstedt, Germany.

Vinogradov, P. 1997. The impact of Holyoke Dam on shortnose sturgeon, *Acipenser brevirostrum*,spawning and migration. Master's thesis, Dept, Natuiral Resources Conser. Univ. of Massachusetts, Amherst,MA pp. 39

Appendix B
Modified Study Plan

3.3.6 Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects (Updated)

General Description of Proposed Study

The following stakeholders requested studies to investigate the impact of project operations on shad spawning, spawning habitat and egg deposition within the project boundary: USFWS, MADFW, NHFGD, NHDES, CTRWC, NOAA, the Town of Gill, TU, and VTDEC. Section 4.4.5 of the PAD identifies several migratory species of fish that seasonally occur in the aquatic habitat within the Project boundary. One such species, the American shad (shad), migrate into the Connecticut River to spawn, reaching Project waters in late April or early to mid- May. Much of the river downstream of Cabot Station is suitable for shad spawning, and the reach of the Connecticut River including the Deerfield River confluence is thought to be particularly productive spawning habitat. The study described herein will gather data to determine the effects of operational changes and subsequent flow/water level fluctuations on spawning shad in the project area.

Study Goals and Objectives (18 CFR § 5.11(d)(1))

Determine if project operations (under the permitted and proposed operational ranges) affect shad spawning site use and availability, spawning habitat quantity and quality, and spawning activity in the river reaches that extends from the base of Vernon Dam to the Route 116 Bridge in Sunderland.

Specifically, the shad spawning study will:

- Determine areas utilized by shad for spawning by conducting night-time visual and aural observation of spawning activity;
- Identify and define those areas geospatially, and obtain data on physical habitat conditions affected by project operations (e.g., water depth, velocity, discharge, substrate, exposure and inundation of habitats);
- Collect information in order to assess project operation effects on observed spawning activity, under a range of permitted or proposed project operation conditions;
- Quantify effects (e.g., water velocity, depths, inundation, exposure of habitats) of project operation on identified spawning areas for a range of conditions, over the complete period of spawning activity; and
- Verify spawning activity as measured by night-time spawning/splash surveys in areas of spawning activity, and downstream of these areas, to gather data to determine project operation effects (location extent of exposure from changing water levels and flows and on associated habitats from project operations).

Resource Management Goals of Agencies/Tribes with Jurisdiction over Resource (18 CFR § 5.11(d)(2))

The CRASC was established by Congress in 1983 (and reauthorized in 2002 for another 20 years) through the Connecticut River Atlantic Salmon Compact (Public Law 98-138).

CRASC developed *A Management Plan for American Shad in the Connecticut River Basin* in 1992. Management Objectives in the plan include the following:

- Achieve and sustain an adult population of 1.5 to 2 million individuals entering the mouth of the Connecticut River annually.
- Achieve annual passage of 40% to 60% of the spawning run (based on a 5-year running average) at each successive upstream barrier on the Connecticut River mainstem.

The Atlantic States Marine Fisheries Commission, Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management), approved in 2010, aims to maximize the number of juvenile recruits emigrating from freshwater stock complexes through the following objectives:

- To mitigate hydrological changes from dams, consider operational changes such as turbine venting, aerating reservoirs upstream of hydroelectric plants, aerating flows downstream, and adjusting in-stream flows.
- Natural river discharge should be taken into account when instream flow alterations are being made to a river (flow regulation) because river flow plays an important role in the migration of diadromous fish.
- Ensure that decisions on river flow allocation (e.g., irrigation, evaporative loss, out of basin water transport, hydroelectric operations) take into account instream flow needs for American shad migration, spawning, and nursery use, and minimize deviation from natural flow regimes.
- When considering options for restoring alosine habitat, include study of impacts and possible alteration of dam-related operations, to enhance river habitat.

The resource agencies' goals related to aquatic natural resources include:

- Protect, enhance, or restore, diverse high quality habitat necessary to sustain healthy aquatic and riparian plant and animal communities.
- Provide an instream flow regime that meets the life history requirements of resident fish and wildlife (including invertebrates such as freshwater mussels) throughout the area impacted by Project operations.
- Minimize the potential negative effects of project operation on water quality and aquatic habitat, and mitigate for loss or degradation.
- Conserve, enhance, and restore natural communities, habitats, and species and the ecological processes that sustain them.
- Provide a diversity of fish- and wildlife-based activities and opportunities that allow the safe and ethical viewing, regulated harvesting, and utilization of fish, plant and wildlife resources consistent with the North American model of fish and wildlife conservation.
- Ensure that PME measures are commensurate with Project effects and help meet regional fish and wildlife objectives for the basin.
- Conserve, protect, and enhance the habitats for fish, wildlife, and plants that continue to be affected by the Turners Falls Project.

The resource agencies' goal specific to American shad is:

- Minimize current and potential negative project operation effects on American shad spawning and recruitment.

The agency requests are intended to facilitate the collection of information necessary to conduct effects analyses and to develop reasonable and prudent conservation measures, and PME measures pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. §1531 *et seq*.), the Fish and Wildlife Coordination Act, as amended (16 U.S.C. §661 *et seq*.), Silvio O. Conte National Fish and Wildlife Refuge Act (P.L. 102-212; H.R.794), the Federal Power Act (16 U.S.C. §791a, *et seq*.), the Atlantic States Marine Fisheries Compact (P.L. 539, 77th Congress, as amended by P.L. 721, 81st Congress), and the Atlantic Coastal Fisheries Cooperative Management Act (16 U.S.C. 5107).

Existing Information and Need for Additional Information (18 CFR § 5.11(d)(3))

Since the construction of the first fish lift facility at Holyoke Dam in 1967, American shad have had access to spawning and rearing habitat upstream from Holyoke Dam. A number of improvements to the Holyoke fishway have occurred since that time. The number of shad lifted at Holyoke reached 721,764 in 1992 and the overall Connecticut River shad population exceeded 1.6 million shad in that year (CRASC 1992). In most years, however, the shad population has not reached CRASC management plan objectives. Likewise the number of shad passing Turners Falls Dam has not met the CRASC objective.

In preparation of the PAD, fisheries data were compiled on the shad resources in the Connecticut River; the data can be found in section 4.4.5 of the PAD. American shad seasonally migrate into the Connecticut River in the spring, late March or April, to spawn; typically reaching Project waters by late April to mid-May when river flow is generally declining from the spring peak. Shad passage has been monitored at the Holyoke Dam (Figure 4.4.5-1 of the PAD) and these counts provide a comprehensive record of the number of shad that have access to Project waters. Population number and passage numbers past Holyoke have declined from the 1992 peak described above, with average Holyoke passage numbers over the last ten years of 211,850. However, shad numbers have been on the rise since 2005 with over 490,000 shad passing Holyoke Dam in 2012.

American shad typically spawn in water ranging from 3 to 18 ft in depth, in run or glide habitat (FirstLight, 2012). Shad typically spawn at night, with males reaching spawning areas prior to females (Greene et al., 2009). Daytime spawning has been documented on overcast days or in turbid water when light intensity is somewhat diminished (Greene et al., 2009). Females are broadcast spawners, preferring to release their eggs in the water column over coarse substrates including cobble, gravel and sand (Greene et al., 2009 and FirstLight, 2012). American shad are highly fecund and spawn repeatedly as they move up river (Greene et al., 2009). The act of spawning can be conspicuous and vigorous, with spawning individuals breaking the surface.

Most (~77%) of the 30 mile reach below Cabot Station consists of *run* mesohabitat type with coarse substrates; presence of glide habitat areas are negligible (FirstLight, 2012a). Though habitat suitable for shad spawning is abundant in the 30 mile reach downstream of Cabot Station, the area of the Connecticut River, in the vicinity of the Deerfield River confluence, is thought to be particularly productive. The location of American shad spawning in the Connecticut River between Holyoke Dam and Turners Falls Dam was identified in previous studies by Layzer (1974) and Kuzmeskus (1977). The documented spawning locations from Cabot Station downstream to the Route 116 Bridge are shown in Figure 3.3.1-4.

The upstream extent of this range is in close proximity to Cabot Station and experiences flow changes resulting from Station operation.

In 2012, FirstLight conducted studies in the late spring and summer to examine habitat conditions downstream of the Turners Falls Dam. The study documented that in low flow conditions Cabot Station project operations produced fluctuations in water level elevations that can range over 4 feet in magnitude (daily operation) at the USGS Montague Gage Station, to lower values of 2 to 3 feet at the Route 116 Bridge, Sunderland, MA (PAD).

Project Nexus (18 CFR § 5.11(d)(4))

For the purposes of this study plan the Study Area includes the Connecticut River: downstream from Cabot Station to the upper extent of the Holyoke impoundment (specifically, the Route 116 Bridge in Sunderland); in the bypass reach between Turners Falls Dam and Cabot Station, and in the Turners Falls impoundment.

Shad spawning is likely influenced by river flow, among other environmental factors such as water temperature. Flow fluctuations may impact shad spawning activity by altering current velocities and water depth at the spawning sites. Effects on spawning behavior could include suspension of spawning activity, poor fertilization, flushing of eggs into unsuitable habitat due to higher peaking discharges, eggs dropping out into unsuitable substrate and being covered by sediment and/or eggs becoming stranded on dewatered shoal areas as peak flows subside.

While several shad spawning and egg deposition studies were conducted in the 1970s, that research was aimed at assessing the potential impact of developing a nuclear power station in the Montague Plains section of the Connecticut River. There are no known studies of the relationship between spawning behavior, habitat use, and egg deposition and Turners Falls and Northfield Project operations Continued Project operation and maintenance activities could, through the manipulation of flow, affect American shad that utilize the project area for spawning. The Agencies are concerned that peaking operations may be altering spawning behavior and contributing to the failure of the Connecticut River shad population to meet management targets. This study will provide information regarding the availability and location of shad spawning habitat and the effect on spawning activity of flow changes caused by Project operation.

Methodology (18 CFR § 5.11(b)(1), (d)(5)-(6))

FirstLight will investigate shad spawning within the study area to determine how operations at Cabot Station and Northfield may affect shad spawning behavior. The investigation will include a review of existing information relative to shad spawning in the Connecticut River and a visual and aural survey of the study area to locate spawning areas and evaluate the effect of Project operations on spawning.

The field studies will examine known spawning areas downstream of the Turners Falls Project (to the Route 116 Bridge), although the plankton-net sampling of eggs will be restricted to above Turners Falls Dam where the sampling will not affect shortnose sturgeon eggs and larvae. No previous studies have attempted to locate spawning areas upstream of Turners Falls Dam. Additionally, the field effort will include surveying the impoundment (up to the Vernon Dam) for evidence of shad spawning.

Field study locations will be determined by review of existing information, results of the IFIM study (Study No. 3.3.1) and hydraulic modeling; therefore, FirstLight will consult with Stakeholders to review results of Task 1, as outlined under the Study Schedule section below.

Task 1: Development of a Detailed Study Design

As a first step, historic data pertaining to Cabot Station discharge and flow data was collected to provide the basis for determining typical flow regimes during the study period. Operational data from the previous eight years of generation was reviewed to determine how the station has historically operated during the shad spawning season. Historical data from the USGS gage located on the Connecticut River in the City of Montague (USGS 01170500) and the Deerfield River (USGS 01170000) near the town of West Deerfield, Massachusetts was reviewed in conjunction with station operation data. It is important to determine the magnitude of flow and corresponding water level fluctuation in the Connecticut River below Cabot Station when flows exceed the hydraulic capacity of the Turners Falls Project. Similarly, it will be important to determine the same when flows are within the hydraulic capacity of the Turners Falls Project. The frequency of changes and rate of flow changes will also be reviewed.

FirstLight is developing a hydraulic model of the Connecticut River from the Turners Falls Dam to the Holyoke Dam- see Study No. 3.2.2 *Hydraulic Studies of Turners Falls Impoundment, Bypass Reach, and below Cabot Station*. The hydraulic model developed for the reach between Turners Falls Dam and Holyoke Dam will be used to further inform this study. More specifically, the hydraulic model will simulate water elevations in this reach under the historic flow ranges during the spawning season. Flow data will be obtained from the Montague USGS gage. The model will be run in an unsteady mode to simulate the peaking operations of the Turners Falls Project during the spawning season. The intent of the modeling is to understand the relationship between the magnitudes of water level fluctuations due to peaking operations. The hydraulic model and previous water level data collected at Route 116 Bridge and at Rainbow Beach may also place bounds on the geographic extent of the study. For example, peaking operations may have a greater impact on the magnitude of water level fluctuations closer to Cabot Station than further downstream. Based on the water level monitoring conducted at the USGS gage in Montague, Route 116 Bridge and at Rainbow Beach, the magnitude of water level fluctuation decreases and attenuates further downstream. The results of the hydraulic model will also provide an indication of areas that potentially become dewatered under certain operational scenarios.

Further, counts of shad passed at the Holyoke Dam and Turners Falls will be tracked to pinpoint the most effective timing of field surveys. Concurrent adult shad telemetry studies may also provide insight as to the location of spawning shad.

Task 2: Examination of Known Spawning Areas Downstream of Turners Falls Dam

Field surveys will be conducted in two phases at night primarily by boat or from shore during periods of anticipated spawning; timing and flow regimes will be based on information collected in Task 1; Phase 1 will identify locations where shad are actively spawning, and information will be collected to evaluate project effects in Phase 2. In the study area, spawning typically occurs between early May to mid-June, when water temperatures reach 13-18ºC (Collette and Klein-MacPhee, 2002). Field surveys of spawning activity will commence during this period (approximately early May) or after a minimum of 10,000 shad have passed the Holyoke Project. The level of effort will be dependent on the density of spawning shad within the study area, with initial surveys to be conducted twice weekly and will be increased to three times per week during peak spawning..

Surveys conducted below Turners Falls Dam will investigate all the historical spawning locations downstream to the Route 116 Bridge (Layzer, 1974; Kuzmeskus, 1977). However since this work was

conducted over 35 years ago, it is probable that spawning sites have changed so we will also survey the area, down to the Route 116 Bridge, for radio tagged fish that may be spawning as well as previously undocumented spawning sites.

Phase 1 of the surveys will employ methods described by Ross et al. (1993). Adult spawning shad will be observed and quantified by counting spawning splashes over 15-minute intervals between sunset and 01:00 hours. Once splashes have been observed for a 15-minute interval, the survey crew will progress to the next known spawning area for observations. The amount of time spent at each spawning area will be subjectively determined by the field survey crew, but will be such that all of the known spawning areas are observed between sunset and 01:00 hrs. Sampling will be conducted to ensure the results are not bias by visiting the same site at the same time of day every time.

Spot lights will be used to verify that such splashes were made by spawning American shad. The species and number of fish observed and their behavior will be recorded. We assume that, though every splash may not represent actual spawning and every spawning may not be accompanied by a splash, the level of surface activity is strongly correlated with actual spawning (Ross et al., 1993). Other parameters to be measured during observed spawning events include; spawn timing and location (GPS); water temperature, dissolved oxygen (DO), pH, conductivity, turbidity, depth and surface velocity; and predominant substrate type. All data will be recorded on a dedicated data sheet. The data sheet will include aerial reference images and/or maps of the study area to document the relative position of observed spawning shad and provide the information necessary to estimate the total area used for spawning as well as an index of spawning activity. The data collected in the field will be correlated to Cabot Station discharge and river flow as a function of time.

In Phase 2, the impacts of flow fluctuation on spawning shad will be investigated during the peak spawning period at locations identified in Phase 1 These areas will be targeted for observations during periods of discharge fluctuation at Cabot Station. Prior to, during, and after flow changes, data (including splash observations, water quality parameters, depth, surface velocity, predominant substrate type, and location) will be collected to provide a baseline of shad spawning rate. FirstLight will then manipulate discharge at Cabot Station to investigate impacts to spawning. Shad spawning rate will be investigated over a range of expected seasonal flow fluctuations based on historic discharge data at Cabot Station. Several discharge manipulations will be investigated but will begin with the most extreme fluctuations scenarios. Baseline spawning rate and behavior will be compared to those observed during periods of flow manipulation to investigate potential impacts to spawning.

Task 3: Identification of Spawning Areas Upstream of Turners Falls Dam

Less is known about spawning locations upstream of the Turners Falls Dam; and the study described herein should provide insight on spawning locations upstream within the study area (to the Vernon Dam). As such, upstream surveys will target areas of suitable aquatic habitat for shad spawning based on HSI curves. The methodology for these surveys will focus on identifying spawning areas via splash surveys consistent with Phase 1 of Task 1. Sampling will begin after 2,500 shad pass the Gatehouse ladder.

Task 4: Examination of Identified Spawning Areas Upstream of Turners Falls Dam

Further investigation of spawning areas identified upstream of the Turners Falls Dam (to the Vernon Dam) in Task 3 will be performed with methodology consistent to that utilized for Phase 2 of Task 2. As discussed above, a review of the previous ten years of Project operational data will allow for the determination of appropriate operating scenarios for which sampling will occur. In addition, based on the

results of Phase 1 of the spawning survey, ichthyoplankton nets will be deployed downstream of spawning areas during operational changes to determine if shad eggs are present and viable above the Turners Falls Dam. A 1-meter -long ichthyoplankton net 500 micron mesh or smaller will be towed for 10 minutes, the net will be retrieved and the contents preserved for subsequent analysis and identification of shad eggs. Identification of shad eggs will be in accordance with existing literature and will rely on methods of Ross and Bennet (1993) for distinction from white sucker eggs.

Task 5: Data Analysis and Reporting

Information collected during this study will be compiled and presented in a report, which will include a map of the study area depicting the locations of observed spawning shad; materials and methods; results; a discussion of observed spawning behaviors; and, if applicable, impacts due to operational changes.

Level of Effort and Cost (18 CFR § 5.11(d)(6))

FirstLight believes the proposed level of effort will adequately assess the potential effects of continued Projects operations on spawning shad and their habitat within the study area. One year of the study is anticipated to cost between $70,000 and $90,000. Should a second year of study be required, year two cost is anticipated to be between $50,000 and $60,000.

Study Schedule (18 CFR § 5.11(b)(2) and (c))

Due to the iterative nature of the study tasks that need to occur prior to field investigations, FirstLight proposes to utilize an ongoing consultation process with Stakeholders. This will provide Stakeholders with an opportunity to review results of Task 1 and to provide input on specific known and likely spawning locations to be visited in the field. The following study and consultation steps/estimated timeframes will be the following:

- FirstLight to conduct Task 1 – October 2014 through December 2014 (it is anticipated that results of hydraulic modeling and IFIM study will be compiled in the fall 2014 timeframe sufficient to be considered under this task to identify operating regimes under which field studies will be conducted)
- Distribute results of Task 1 and proposed locations for field investigation of known and anticipated spawning locations – January 2015
- Hold meeting with Stakeholders to review desktop analysis and reach consensus on field study locations – February – March 2015

Conduct field studies of spawning locations during the 2015 spawning season, May through June. The exact timing of the field survey will depend on a variety of seasonal and site specific factors but water temperature is the primary factor that triggers spawning. Other factors include photoperiod, water flow and velocity, and turbidity. The timing of the survey will be further refined using information obtained from shad passage data collected downstream at the Holyoke Project fish lift and Turners Falls Project fish ladders. Further, information collected during concurrent shad migration investigations may also provide insight to the locations and timing of spawning.

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