Relicensing Study 3.3.11

FISH ASSEMBLAGE ASSESSMENT

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 this study is to characterize the fish assemblage above and below the Turners Falls Project. The National Marine Fisheries Service (NMFS) has pointed out that 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 in the RSP can occur in the Turners Falls Impoundment because this is beyond the range of shortnose sturgeon, sampling efforts below Turners Falls Dam will be modified from the RSP, as discussed below, to avoid potential impacts to shortnose sturgeon.

Correspondence

On June 28, 2013, FirstLight filed its *Updated* Proposed Study Plan (PSP) with the Federal Energy Regulatory Commission (FERC).

On July 15, 2013, NMFS filed a letter with the FERC commenting on the *Update*d PSP. In NMFS's letter, it recommended that Study No. 3.3.11 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).

On August 14, 2013, FirstLight filed its Revised Study Plan (RSP) with FERC incorporating NMFS's recommendations.

On January 28, 2014, FirstLight filed a letter (Appendix A) with FERC noting 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 Turners Falls Dam. To avoid any potential impacts to sturgeon, FirstLight proposed to conduct all sampling in the bypass reach after June 30, and in the reach below the Deerfield River, FirstLight proposed to use both existing data and the data it obtains in the Turners Falls Impoundment.

On February 21, 2014, FERC in its second Study Plan Determination Letter (SPDL) stated the following: "*The revised study plan, as proposed [in August 2013] may result in effects on shortnose sturgeon. FirstLight's proposal to amend the revised study plan would eliminate this concern. However, we recognize that the resource management agencies with jurisdictional responsibilities have not had an opportunity to consult with FirstLight or comment on the proposed amendment to this study. As a result, we recommend that FirstLight consult with the 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 needed by the jurisdictional agencies and the Commission for their needs. Following consultation, FirstLight should file with the Commission for approval, an amended study plan for study 3.3.11 when it files its Initial Study Report in September 2014. The amended study plan should document FirstLight's consultation efforts, consider comments received, and if recommendations are not adopted, provide FirstLight's reasons based on project-specific information*".

On June 3, 2014, FirstLight had a meeting with FERC, NMFS, 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 potential alternatives to the study revisions proposed by FirstLight on January 28.

On July 14, 2014, NMFS emailed FirstLight (Appendix A) recommending that FirstLight determine whether the final study it proposes will adversely affect shortnose sturgeon.

On September 9, 2014, USFWS emailed FirstLight and NMFS (Appendix A) its understanding of the status of Study 3.3.11 and attached a revised fish assemblage study plan. Note that FirstLight is filing a modified study plan (Appendix B) but does not address the USFWS's revised study plan (attached to the September 9, 2014 email).

At this juncture, FirstLight proposes to adopt the changes to the RSP it set forth in its January 28, 2014 letter, which will avoid potential impacts to the species. Specifically, FirstLight will conduct all sampling in the bypass reach after June 30, and in the reach below the Deerfield River, FirstLight will use both existing data and the data it obtains in the Turners Falls Impoundment to characterize the fish assemblage in this reach.

Reporting

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

1.2 Study Progress Summary

An amended study plan was developed based on the consultation described above (see Appendix B). Note that FirstLight's amended study plan does not address the modified study plan provided to FirstLight by the USFWS on September 9, 2014.

1.3 Variances from Study Plan and Schedule

To date, there have been no variances from this study.

1.4 Remaining Activities

- Conduct the field study in 2015.
- Complete report.

Appendix A
Correspondence Log

ORIGINAL

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
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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.

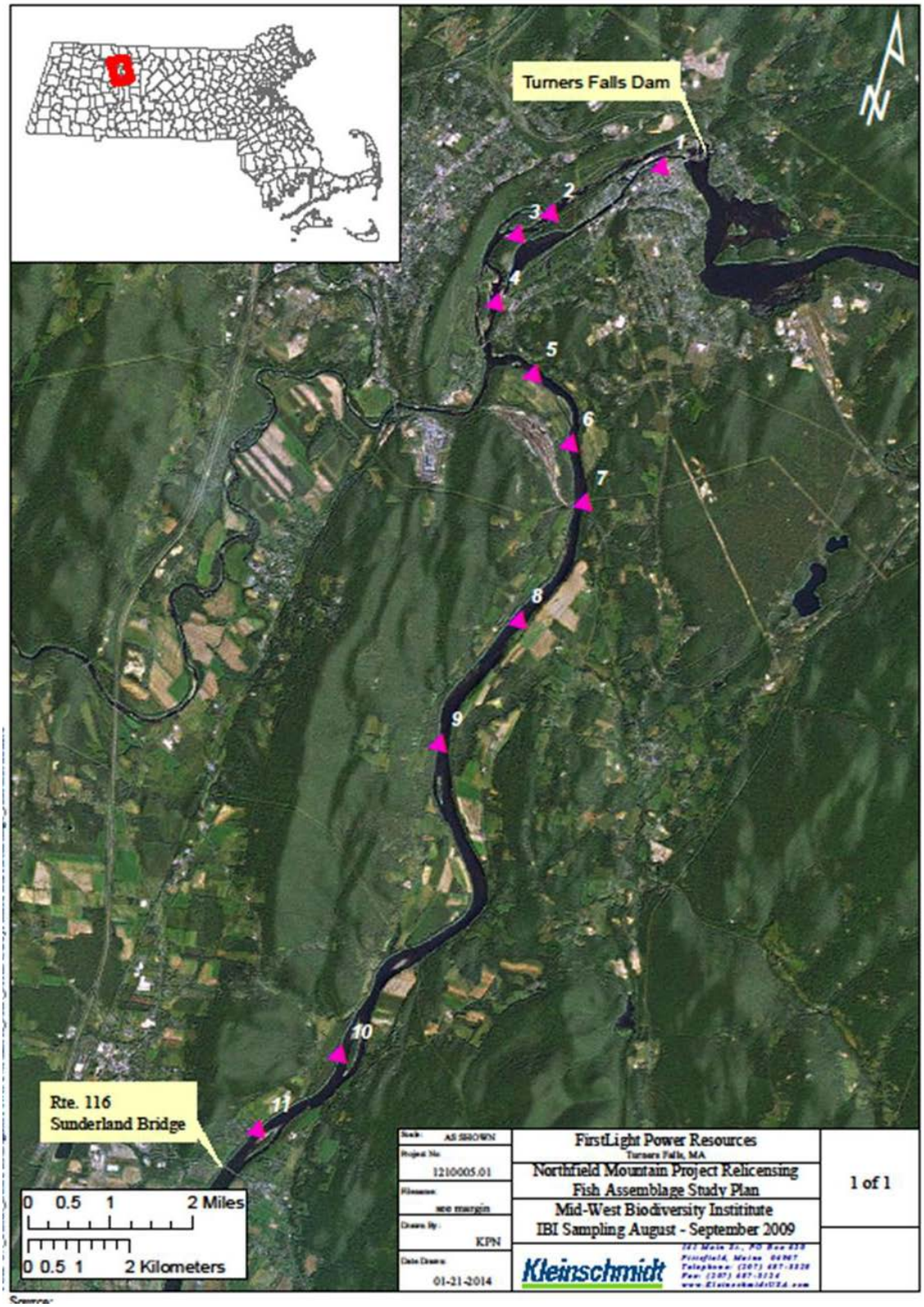
Sincerely,

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, B.E. Kynard, M. Burlingame and P. Vinogradov. 2012a. Demography, Movements, Spawning habitat, and Spawning Success of Adult Connecticut River Shortnose Sturgeon Migrating to Holyoke Dam. Chapter 2 *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) 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.

Mark Wamser

From: Jessica Pruden - NOAA Federal <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

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Jessica Pruden
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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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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.

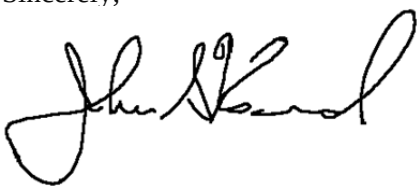
NMFS has prohibited sampling much further downstream of the Montague spawning site, without appropriate take protections in place, because of potential adverse impacts to shortnose sturgeon. In 2007, the United States Environmental Protection Agency (USEPA) requested that FirstLight sample ichthyoplankton 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

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Appendix A

Study Plan 3.3.11 Correspondence from USFWS

From: Grader, Melissa [mailto:melissa_grader@fws.gov]
Sent: Tuesday, September 09, 2014 3:35 PM
To: Howard, John; Pruden, Jessica
Cc: kkennedy@tnc.org; John Warner; Ken Sprankle; Andrea Donlon; Slater, Caleb (MISC); Mark Wamser; Stira, Robert; William McDavitt - NOAA Affiliate; John Baummer; william.connelly@ferc.gov; Stephen.Kartalia@ferc.gov; Nicholas Ettema; Don Pugh; Julie Crocker - NOAA Federal
Subject: Re: Northfield Turners Falls Study Plan Consultation 6 3 14 Meeting Minutes

Hi John and Jess,

This is to follow up on the issue of how to address fish assemblage sampling downstream of Turners Falls Dam. I believe this is how things were left:

1. FL in its RSP proposed to not sample downstream of Cabot, due to concerns with potentially capturing shortnose sturgeon (SNS).

2. In its February 21, 2014 Study Plan Determination, FERC required FirstLight to consult with the Service, NMFS, MA DFW 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 needed by the jurisdictional agencies and the Commission for their needs."

3. On June 6, 2014 FL held a meeting with stakeholders to discuss possible ways to avoid interactions with SNS. With respect to the bypass reach, FL proposed to sample after June 30th. For the reach below Cabot Station, FL proposed to use existing data and data it obtains in the Turners Falls headpond to characterize the fish assemblage. Details of the full discussion are contained in the meeting minutes provided by FL.

4. A revised study plan was to have been sent to stakeholders for review and comment prior to filing it with the ISR this month. To date, FL has not submitted any revised plans to the stakeholders for review.

5. Subsequent to the June 6, 2014 meeting, the Service consulted with NMFS and reviewed relevant literature to determine if there were suitable non-invasive sampling techniques that could be used to characterize the fish assemblage in the reach below Cabot Station. Based on those consultations and deliberations, we herein provide proposed amendments to Study Plan 3.3.11 (attached). We believe the proposed changes will eliminate SNS concerns and provide the information needed by the agencies.

In short, the Service recommends that visual observations be used downstream of Cabot as well as in other riverine reaches. We believe that NMFS has stated this is an acceptable sampling method that would not require ESA consultation. Jess, would you please confirm/clarify what, if anything would be required at this point ? Based on our proposed amendments, would FL need to submit anything (informal or otherwise) to NMFS?

We are available to discuss the proposed changes if you think that would be beneficial.

Regards,

Melissa

USFWS Proposed Study Plan:

3.3.11 Fish Assemblage Assessment

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

The study area includes the Connecticut River from Vernon Dam to the Route 116 Bridge in Sunderland. The study will employ a stratified-random sampling design. The study area will be divided into strata based on mesohabitat type. Proposed sampling methods include daytime boat electrofishing, nighttime boat electrofishing, gill nets, seine nets, and visual observation. Sampling will be performed during the early summer (June) and again in the fall (September).

The stratified random sampling design will randomly assign sampling stations within particular mesohabitat types in proportion to their linear habitat distance. Thus for mesohabitat types having a larger proportion of linear mesohabitat, more random sites will be assigned. A stratified random sample will capture key population characteristics that are proportional to the overall Connecticut River fish assemblage. Furthermore, stratified random sampling performs as well or better than simple random sampling and results in substantial improvement in precision when variation within strata (mesohabitat type) is less than variation among strata (Hansen, Beard and Hayes 2007). In stratified random sampling, an estimate for the whole population is obtained by weighting estimates from each stratum by the fraction of the whole population contained in each stratum. It is important to note that stratified random sampling requires that the entire sampling frame be divided into strata before sampling begins (Hanson, Beard and Hayes 2007). Multiple methods of fish capture will be used in each stratum, except in the riverine reach below Cabot Station where only visual observation methods will be used to avoid impacts to shortnose sturgeon. Selected locations within each station will be sampled either by day and night-time boat electrofishing (shoreline and littoral habitat), gill nets (deeper, benthic areas), seine net (wadeable shoreline and littoral habitat), and visual observation (shoreline, littoral, or benthic habitat) during the early summer and again in the fall. The exact number of sampling locations will be dependent on the weighted stratification of the study area by mesohabitat but it is anticipated that at least 18 stations will be sampled during each sampling event.

Stakeholders requested an additional spring sampling. FirstLight is not proposing to sample during the spring for the following reasons: 1) Anadromous fish will be available for capture

during the proposed early summer collection. 2) The fall collection will occur when young-of-the-year (age-0+) fish had grown to sizes such that they were readily susceptible to capture using various sampling gears. 3) All species of fish that are found within the study area should be readily captured during the early summer and fall sampling events that FirstLight proposes. 4) FirstLight is proposing to conduct a comprehensive survey of the nesting fish in the littoral zone during the spring which will provide information on the occurrence, distribution, and relative abundance of these fish species.

Task 1: Sampling Location Selection

During this assessment, a stratified-random sampling design will be utilized to provide unbiased and precise fish assemblage data. The proposed design incorporates general river morphology along with mesohabitat through the use of strata and sub-strata. To accomplish this, the underlying strata allow for delineation of the study area spatially, based on locations where changes in river morphology occur. For all areas downstream of Cabot Station to the Route 116 Bridge, mesohabitat sub-strata were derived from surveys performed during 2012. Alternatively, the bypass reach contains the greatest diversity of mesohabitats, but each mesohabitat segment is relatively small; thus, random stations will be selected from shoreline, deep water, and tailwater habitats such that a representative sample from multiple habitats will be collected. Sub-strata in the Turners Falls Impoundment will be derived from bathymetry data, because the impoundment contains areas with relatively deep water.

Due to inherent variability of flows, water levels, and likely fish movements within the study area, different sampling locations will be selected for each sampling event; this statistically valid practice will avoid bias. Prior to field sampling, stations to be sampled will be selected to ensure all mesohabitat types are adequately represented. Mesohabitat types include:

- **Riffle:** shallow, moderate velocity, turbulent, high gradient, moderate to large substrates (cobble/gravel)

- **Rapid:** shallow, moderate to high velocity, turbulent, chutes and eddies present, high gradient, large substrates or bedrock

- **Run:** moderately deep to deep, well defined non-turbulent laminar flow, low to moderate velocity, well defined thalweg, typically concave stream geometry, varying substrates, gentle slope

- **Glide:** moderately shallow, well defined non-turbulent laminar flow, low velocity, well defined thalweg, typically flat stream geometry, typically finer substrates, transitional from pool

- **Pool:** deep, low velocity, well defined hydraulic control at outlet

- **Backwater:** varying depth, minimal or no velocity, long backwatered reaches

- **Impounded:** varying depth, low velocity influenced by the presence of a dam

- **Nearshore/Shallow**: less than 8ft in depth
- **Mid-Channel**
- **Deep water:** depths greater than 20ft

Alternative sampling locations will also be identified by mesohabitat in case a selected sampling station is inaccessible.

Task 2: Fish Capture

FirstLight anticipates using a variety of techniques to sample the various habitat types within the study area, including day and nighttime boat electrofishing, gill netting, seining, and visual observation as described below. The type of gear utilized will be largely dictated by habitat type, with visual observation methods used at riverine sampling stations. In addition to biological data, supporting data will also be collected for each sample site including: location (GPS), sampling gear type, sampling effort, mesohabitat type, average depth, average velocity, river flow, water temperature, turbidity, predominant substrate, time of day, day of year, presence of cover, and proportion of vegetation cover. All data will be recorded on dedicated data sheets. Upon return from the FGS, data sheets will be review for quality assurance and archived.

The MADFW has recommended that sampling include the use of eel pots. Boat electrofishing is effective at collecting eel within the littoral habitat and will therefore be adequately represented within the sampled fish assemblage. The sampling effectiveness of collecting eel in the Connecticut River was demonstrated by Yoder (unpublished data 2009) whom found that the American eel was the most abundant species collected using boat electrofishing methods in the Connecticut River below the Holyoke Dam. The VANR has recommended the use of a benthic trawl; however, FirstLight proposes to use gill nets to sample deeper sections of the river.

Boat Electrofishing

Due to the presence of spawning and juvenile surgeon in the bypass reach during the spring, no electrofishing will be performed in this stratum from April 15 – June 30 as suggested by the NMFS.

Boat electrofishing will occur during the daytime and night. All electrofishing transects will be standardized by time (500 seconds fished) such that a catch per unit effort (CPUE) may be calculated. Boat electrofishing can effectively sample fish from most near-shore littoral habitats present within the Connecticut River (typically 10 feet deep or less).

Electrofishing will be accomplished with the use of a 16-ft jonboat rigged with a pulsed-DC Smith-Root GPP 5.0 electrofisher with the capacity to adjust the pulse rates between 30 - 120 pulses/second and vary voltage to accommodate ambient conductivity. The electrode array includes an array of cathodes suspended from the bow to a depth of approximately six feet to project the electric field into both the shoreline epibenthic zone, as well as the upper water column. The anode array is suspended from the bow on an adjustable boom. Both anodes and cathodes will be configured to optimize the electric field under ambient low conductivity conditions. A smaller vessel capable of negotiating riffles and shoals, similarly rigged with a 2.5

GPP unit may be deployed for sampling in the shallower riverine habitats. This smaller boat will consist of a 14 ft inflatable Sea-Eagle raft with retractable anodes and side-mounted cathodes.

Electrofishing will be conducted in a downstream manner, following standardized methods developed specifically for large river quantitative electrofishing surveys (MBI, 2002, Yoder and Kulik, 2003). The start point, end point, and boat track for each sampling station will be geo-referenced using a handheld Garmin GPS (or similar device) and transposed to corresponding USGS topographic mapping software program (Terrain Navigator).

All stunned fish will be collected with ¼-inch mesh dip nets and deposited into a live-well filled with aerated ambient river water. At the conclusion of each sample, all captured fish will be identified to species, classified as adult, juvenile or Young-of-Year (YOY), enumerated, weighed, measured for total length, and then released. If large numbers (n > 25) of small fish (YOY fish or cyprinids less than 100 mm) are captured, they will be grouped by size class, enumerated, and batch-weighed with length measurements only taken from one large and one small representative specimen within each group. Fish that are not able to be identified in the FGS, such as small cyprinids, will be brought back to the lab for identification.

Gill Netting

For sampling deeper habitat sub-strata (Depth 12-25 feet; Depth 25-40 feet; Depth > 40 feet), where electrofishing will not be effective, sampling will be conducted with experimental gill nets consistent with standardized methods for fish capture from rivers (Bonar, Hubert, & Willis, 2009). The nets will be 12-foot feet high by 100-foot in length and will be constructed of 4 to 5 panels of increasing mesh size (e.g., 1.5, 2, 2.5, 3, 3.5-inch stretched mesh) to accommodate collection of the various sized fish in the project waters.

The nets will be deployed to maximize capture area where water depths are greater than net height. Nets will be set in selected locations and allowed to fish for 4 hours prior to retrieval.

The exact locations of each net set will be recorded using a handheld Garmin Vista HCx GPS (or similar device) and the time of deployment and retrieval will also be recorded. Fish processing will occur as described above for electrofishing.

Seining

In shallow shoreline locations where boat access may not be feasible sampling will be performed via seining with a 100-ft long, 6-ft deep, 1/4-inch mesh bag seine net.

Seine samples will be collected by extending the net parallel to shore and then pulling the upstream end of the net into the water and in a downstream direction for a 180 degree sweep while the opposite end of the net is held in place (Bonar, Hubert, & Willis, 2009). The start point and end point for each sweep will be geo-referenced using a handheld Garmin Vista HCx GPS (or similar device) and transposed to corresponding USGS topographic mapping software program (Terrain Navigator). Total fish catch will be processed following each haul in the same manner as described above for electrofishing and gill netting.

Visual Observation

Direct visual observation is a simple, versatile, cost-effective, and proven method for collecting fish assemblage data that is also nonintrusive, making it an ideal technique in rivers occupied by threatened or endangered species (e.g., shortnose sturgeon) that could be disturbed or injured by other methods such as electrofishing (Bonar et al. 2009; Thurow et al. 2013). Visual observation was used in the recently completed Maryland darter survey as part of the relicensing of the Conowingo Project on the Susquehanna River (RSP 3.10, 2013).Visual observation surveys will be conducted in the riverine portions of the study area. Below Cabot Station, this will be the only sampling method employed (due to the presence of the endangered shortnose sturgeon in this reach). In both the bypass reach and the riverine reach below Vernon Dam, visual observation will be used in addition to the other gear types, to validate the technique as well as collect data that could be used to calibrate the visual observation-only data collected below Cabot Station (i.e., to assess whether visual observations may have missed certain species and/or sizes of fish).

Methods should follow those described in Bonar et al. (2009) and Thurow et al. (2013). All visual observations will occur during daylight hours with optimum light conditions (e.g., 10:00 am to 5:00 pm). Visual observation is an effective fish sampling technique in a variety of habitats, but may be impeded by high velocities. If measured velocities are > 1.5 m/s, sampling should be delayed if possible; if not possible, an alternative sampling method should be employed. Visual observation is also highly dependent upon water transparency and turbidity. Before sampling, visibility distance will be measured using a Secchi disk or similar method (see Bonar et al. 2009:153). Visual observation methods should only be used when visibilities are 2 m or greater. If low visibilities are due to a recent rain event or other temporary disturbance, sampling should be postponed to a later date; if low visibilities are the result of chronic turbidity, an alternative sampling method should be employed.

Visual observation surveys will be conducted using snorkeling, SCUBA diving, or hookah diving (see Thurow et al. 2013 for detailed methods) along multiple transects (or lanes) parallel with the current, as described in Thurow et al. (2013). Snorkeling will be limited to the shallower areas of banks and bars, whereas SCUBA and hookah diving methods may be used at most depths. At greater depths, handheld underwater lights may be necessary to improve visibility. Because observers moving upstream are less likely to disturb fish, observers should enter the water downstream and proceed slowly upstream (using a supporting stick or rod if necessary). If conditions do not permit a downstream entry, observers will float downstream with the current while limiting motion as much as possible (Thurow et al. 2013). The location and time of beginning and end points will be recorded for each transect.

For each fish observed, species and estimated length should be recorded. If a large school of fish is encountered, all species observed should be recorded; average number and length of fish in the school should be estimated. Any uncertainty regarding species identification should also be noted. See Bonar et al. (2009) for methods to estimate fish length underwater and Thurow et al. (2013) for methods of underwater data recording.

Visual observation transects will be standardized by observation time and area sampled. Area sampled will be equivalent to (length of transect) * (2*visibility distance).

Task 3: Data Analysis and Reporting

All data will be standardized by effort expended (seconds of electrofishing, net-hours, observation hours, and number of seine hauls for electrofishing, gill netting, visual observation, and seining respectively). Catch per unit effort (CPUE) and standard errors will be calculated for each species, station, and sampling technique. Data will also be separated into groups by size and a CPUE per size group will be calculated. Values of CPUE for each segment and gear type will be calculated as the sum of catch from all samples within a station divided by the sum effort expended within that station. The Shannon-Weiner index of diversity, which is a function of species richness and evenness, will also be calculated.

Information collected during this study will be compiled and presented in a final report. The report will include tabular data summarizing length, weight, and size class of fish captured, a map of the study area to depict the location of sample stations, and overall results including occurrence, distribution and relative abundance. Comparisons will be made with historical records. Results will be described in relation to studies described in study plans 3.3.14 – *Aquatic Habitat Mapping of the Turners Falls Impoundment* and 3.3.13 – *Impacts of the Turners Falls Project and Northfield Mountain Project on Littoral Zone Fish Habitat and Spawning Habitat*. Raw data will be provided to stakeholders in digital format upon request.

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

FirstLight believes the proposed level of effort will adequately address the objectives by documenting fish species occurrence, distribution and abundance within the project area along spatial and temporal gradients. FirstLight estimates the cost of this study to be $75,000 to $85,000.

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

The study described herein is scheduled to be conducted in the early summer and fall of 2014, with Task 1 occurring prior to field studies. Because the study effort will be ongoing when the Initial Study Report is due to Stakeholders in September 2014, FirstLight proposes to provide Stakeholders with a study report supplement to summarize results in February 2015.

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Appendix B
Modified Study Plan

3.3.11 Fish Assemblage Assessment

General Description of Proposed Study

In the study request letter from the FERC, a baseline fisheries population study was requested. The request included sampling within the Turners Falls Impoundment, tailwater areas, the bypassed reach, and downstream riverine corridors via electrofishing surveys. The FERC also requested targeted eel sampling of upstream and downstream migrating American eel. Targeted eel sampling will be conducted as part of *Study No. 3.3.4 – Evaluate Upstream Passage of American Eel at the Turners Falls Project* and silver-phase eel abundance and migration will be evaluated in *Study No. 3.3.5– Evaluate Downstream Passage of Eel*; thus, additional targeted eel sampling is not being proposed for this study.

In their study request letters, USFWS, MADFW, NHFGD, CRWC, Town of Gill, TNC, TU, VANR each requested a fish assemblage assessment to determine the occurrence, distribution, and relative abundance of fish species within the project areas and to compare study results to historical records. They requested a comprehensive assessment of fish assemblages, employing multiple gear types to randomly sample a variety of habitats throughout the study area during spring, summer, and fall as part of a robust sampling design. The proposed study will include multiple sampling methods within a statistically rigorous and comprehensive stratified-random design similar to what has been used successfully on large rivers a high degree of spatial heterogeneity.

MADFW further requested that the study include state-listed fish species as well as host fish species of the dwarf wedgemussel (*Alasmidonta heterodon*), federally- and state-listed as "Endangered"; the yellow lampmussel (*Lampsilis cariosa)* state-listed as "Endangered"; and the Eastern pondmussel (*Ligumia nasuta*), state-listed as "Special Concern." MADFW requested that the study should assess the occurrence and abundance of mussel larvae on resident host fish. FirstLight is not proposing to evaluate mussel larvae on host fish because the relationships are already well understood (Table 3.3.11-1); the level of effort proposed will provide data on the distribution and relative abundance of state-listed fish species and host fish species.

The Pre-Application Document (PAD) for the Turners Falls Project and Northfield Mountain Projects identifies 22 species of fish that occur in the aquatic habitat within the Project boundary. The study described herein will document fish species occurrence, distribution and relative abundance within the Turners Falls Project and Northfield Mountain Project areas. FirstLight believes that the level of effort will provide baseline fish assemblage data and that the overall sampling design will provide useful data that can be used to inform other proposed studies.

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

The goal of this study is to provide baseline information pertaining to the fish assemblage structure within the study area. Specific objectives include to:

- Document species occurrence, distribution, and relative abundance of resident and diadromous fish within the project area along spatial and temporal gradients.
- Describe the distribution of resident and diadromous fish species within reaches of the river and in relationship to habitat.
- Compare historical records of fish species occurrence in the project area to results of this study.

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

The MADFW, NHFGD and the VTFWD each have, as a mission, the protection and conservation of fish and their habitats. Riverine fish species are an important component of the river's ecology and are the basis for the sport fishery. Furthermore, several of the states' Species of Greatest Conservation Need (SGCN) have been documented in the project area.

The conservation and protection of species state-listed as Endangered, Threatened, or of Special Concern under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) is an important objective of the Natural Heritage & Endangered Species Program of the MADFW. State-listed species and their habitats are protected pursuant to the MESA and its implementing regulations (321 CMR 10.00), as well as the rare wildlife species provisions of the Massachusetts Wetlands Protection Act (WPA) (310 CMR 10.59). The Division seeks to accomplish the resource goals and regulatory requirements of the MESA in order to:

- Ensure that PME measures are commensurate with Turners Falls Project and Northfield Mountain Project affects and meet MESA requirements for the Turners Falls Projects and Northfield Mountain Project.
- Conserve, protect, and enhance the habitats for state-listed species that will be affected by Turners Falls Project and Northfield Mountain Project operations.

The agencies requests are intended to facilitate the collection of information necessary to conduct impact analyses and develop reasonable conservation, PME measures pursuant to the Fish and Wildlife Coordination Act, as amended (16 U.S.C. §661 *et seq*.), the Federal Power Act (16 U.S.C. §791a, *et seq*.), the Clean Water Act (33 U.S.C. §1251 *et seq*.), the MESA, and the WPA. Specific to state-listed fish and mussel species, the Divisions goals are to:

- Protect, enhance, or restore diverse high quality aquatic habitats in the Connecticut River watershed and mitigate for the loss or degradation of these habitats.
- Minimize current and potentially negative effects of Turners Falls Project and Northfield Mountain Project operations on state-listed species and their habitats.

Determining species occurrence, distribution, and abundance of fish species will better clarify what species occur in the project area both spatially and temporally relative to habitats which may be affected by operation of the Turners Falls Project and Northfield Mountain Project. This information will better inform results from other study requests that will be examining the effects of operations of the Turners Falls Project and Northfield Mountain Project on various aquatic habitats, water quality, and other related concerns such as entrainment concerns at the Northfield Mountain Project. This information will be used to make recommendations and provide full consideration for all species, including those that might not otherwise be known to occur in the project area and impacts that may affect their population status through direct or indirect effects of the Turners Falls Project and Northfield Mountain Project.

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

A study of resident fish species in the Turners Falls Impoundment was conducted by the Commonwealth of Massachusetts from 1971 to 1975. Eight stations in the impoundment were sampled every other week from April through October with electrofishing equipment (MDF&G, 1978). Because many changes have occurred throughout the watershed during the last four decades, these data may not be an accurate representation of the current fish assemblage.

In 2008 the impoundment was surveyed via electrofishing; this survey, conducted by Midwest Biodiversity Institute (MBI), was part of a larger United States Environmental Protection Agency (USEPA) effort to sample the entire Connecticut River from its headwaters at Lake Francis to the freshwater extent of the tidal estuary (Yoder et al., 2009). The 2008 survey did not have the same goals and objectives as this study; thus, data collected is not sufficient to assess the abundance, occurrence, or distribution of fish within the study area or in relation to project operations. Neither study employed the use of alternative gear types; while electrofishing is considered to an effective method for capturing fish in littoral areas of flowing water, capture probabilities are typically lower for small fish or those lacking swim bladders. It is also not effective at capturing fish from deep water unless modified. A total of 22 fish species was identified in the project area based on historical data, but several species reported to occur within the project area were not documented, including Northern pike, burbot, Eastern silvery minnow, and channel catfish.

As referenced in the PAD, Section 4.4, two state-listed fish species are known to occur in the Connecticut River, including the Eastern silvery minnow (*Hybognathus regius*) and burbot (*Lota lota*), both of which are state-listed as "Special Concern." Currently, there are only two known populations of the Eastern silvery minnow in Massachusetts, both located in the Connecticut River. Burbot are also rare in Massachusetts, with only a few individuals having been collected in the Connecticut River watershed.

The tessellated darter is one of only three fish species in the Upper Connecticut River that serve as hosts for the glochidia of dwarf wedgemussel, the others being the slimy sculpin (*Cottus cognatus*) and the Atlantic salmon (*Salmo salar*) (Nedeau, 2008). Tessellated darters are a relatively sedentary benthic insectivorous fish with small home ranges and short, fast bursts of speed.

Based on data collected by Yoder (2009), sampling at 4-5 transects distributed throughout the Turners Falls Impoundment was sufficient to capture most but not all species detectable by electrofishing the shoreline of the impoundment (Figure 3.3.11-1).

A 2009 electrofishing survey of the area below Turners Falls Dam downstream to the end of the Project area was conducted as part of a larger EPA 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 3.3.11-2). The species composition and relative abundance (Table 3.3.11-2) is typical of fish assemblages described for inland fishes of Massachusetts (Hartel et al. 2002).

Project Nexus (18 CFR § 5.11(d)(4))

Operation of the Turners Falls Project and Northfield Mountain Project has the potential to directly affect fish populations, biological interactions, and habitat quantity and quality. For example, headpond and tailwater water level fluctuations could dewater spawning areas, which could limit the productivity of certain fish species through direct impacts to their spawning success, ultimately resulting in alterations to fish assemblage structure. An understanding of the current fish assemblage is needed in order to examine potential effects. Determining species distribution and abundance will clarify what species occur in the Turners Falls Project and Northfield Mountain Project areas, spatially and temporally, relative to habitats that may be affected.

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

The study area includes the Connecticut River from Vernon Dam to the Turners Falls Bypass Reach. The Bypass reach will not be sampled until after June 30 and the area below the Bypass reach to the Rt 116 Bridge in Sunderland will be evaluated using existing data (Table 3.3.11-2) and results from the

Impoundment survey. The study will employ a stratified-random sampling design. The study area will be divided into strata based on mesohabitat type. Proposed sampling methods include daytime boat electrofishing, nighttime boat electrofishing, gill nets, and seine nets. Sampling will be performed during the early summer (June) and again in the fall (September).

The stratified random sampling design will randomly assign sampling stations within particular mesohabitat types in proportion to their linear habitat distance. Thus for mesohabitat types having a larger proportion of linear mesohabitat, more random sites will be assigned. A stratified random sample will capture key population characteristics that are proportional to the overall Connecticut River fish assemblage. Furthermore, stratified random sampling performs as well or better than simple random sampling and results in substantial improvement in precision when variation within strata (mesohabitat type) is less than variation among strata (Hansen, Beard and Hayes 2007). In stratified random sampling, an estimate for the whole population is obtained by weighting estimates from each stratum by the fraction of the whole population contained in each stratum. It is important to note that stratified random sampling requires that the entire sampling frame be divided into strata before sampling begins (Hanson, Beard and Hayes 2007). Multiple methods of fish capture will be used in each stratum. Selected locations within each station will be sampled either by day and night-time boat electrofishing (shoreline and littoral habitat), gill nets (deeper, benthic areas), and seine net (wadeable shoreline and littoral habitat) during the early summer and again in the fall. The exact number of sampling locations will be dependent on the weighted stratification of the study area by mesohabitat but it is anticipated that at least 18 stations will be sampled during each sampling event.

Stakeholders requested an additional spring sampling. FirstLight is not proposing to sample during the spring for the following reasons: 1) Anadromous fish will be available for capture during the proposed early summer collection. 2) The fall collection will occur when young-of-the-year (age-0+) fish had grown to sizes such that they were readily susceptible to capture using various sampling gears. 3) All species of fish that are found within the study area should be readily captured during the early summer and fall sampling events that FirstLight proposes. 4) FirstLight is proposing to conduct a comprehensive survey of the nesting fish in the littoral zone during the spring which will provide information on the occurrence, distribution, and relative abundance of these fish species.

Task 1: Sampling Location Selection

During this assessment, a stratified-random sampling design will be utilized to provide unbiased and precise fish assemblage data. The proposed design incorporates general river morphology along with mesohabitat through the use of strata and sub-strata. To accomplish this, the underlying strata allow for delineation of the study area spatially, based on locations where changes in river morphology occur. The bypass reach contains the greatest diversity of mesohabitats, but each mesohabitat segment is relatively small; thus, random stations will be selected from shoreline, deep water, and tailwater habitats such that a representative sample from multiple habitats will be collected. Sub-strata in the Turners Falls Impoundment will be derived from bathymetry data, because the impoundment contains areas with relatively deep water.

Due to inherent variability of flows, water levels, and likely fish movements within the study area, different sampling locations will be selected for each sampling event; this statistically valid practice will avoid bias. Prior to field sampling, stations to be sampled will be selected to ensure all mesohabitat types are adequately represented. Mesohabitat types include;

- **Riffle:** shallow, moderate velocity, turbulent, high gradient, moderate to large substrates (cobble/gravel)

- **Rapid:** shallow, moderate to high velocity, turbulent, chutes and eddies present, high gradient, large substrates or bedrock

- **Run:** moderately deep to deep, well defined non-turbulent laminar flow, low to moderate velocity, well defined thalweg, typically concave stream geometry, varying substrates, gentle slope

- **Glide:** moderately shallow, well defined non-turbulent laminar flow, low velocity, well defined thalweg, typically flat stream geometry, typically finer substrates, transitional from pool

- **Pool:** deep, low velocity, well defined hydraulic control at outlet

- **Backwater:** varying depth, minimal or no velocity, long backwatered reaches

- **Impounded:** varying depth, low velocity influenced by the presence of a dam

    - **Nearshore/Shallow**: less than 8ft in depth

    - **Mid-Channel**

    - **Deep water:** depths greater than 20ft

Alternative sampling locations will also be identified by mesohabitat in case a selected sampling station is inaccessible.

Task 2: Fish Capture

FirstLight anticipates using a variety of techniques to sample the various habitat types within the study area, including day and nighttime boat electrofishing, gill netting, and seining as described below. The type of gear utilized will be dictated by habitat type. In addition to biological data, supporting data will also be collected for each sample site including: location (GPS), sampling gear type, sampling effort, mesohabitat type, average depth, average velocity, river flow, water temperature, turbidity, predominant substrate, time of day, day of year, presence of cover, and proportion of vegetation cover. All data will be recorded on dedicated data sheets. Upon return from the FGS, data sheets will be review for quality assurance and archived.

The MADFW has recommended that sampling include the use of eel pots. Boat electrofishing is effective at collecting eel within the littoral habitat and will therefore be adequately represented within the sampled fish assemblage. The sampling effectiveness of collecting eel in the Connecticut River was demonstrated by Yoder (unpublished data 2009) whom found that the American eel was the most abundant species collected using boat electrofishing methods in the Connecticut River below the Holyoke Dam. The VANR has recommended the use of a benthic trawl; however, FirstLight proposes to use gill nets to sample deeper sections of the river.

Boat Electrofishing

Due to the presence of spawning and juvenile surgeon in the bypass reach during the spring, no electrofishing will be performed in this stratum from April 15 – June 30 as recommended by the NMFS.

Boat electrofishing will occur during the daytime and night. All electrofishing transects will be standardized by time (500 seconds fished) such that a catch per unit effort (CPUE) may be calculated.

Boat electrofishing can effectively sample fish from most near-shore littoral habitats present within the Connecticut River (typically 10 feet deep or less).

Electrofishing will be accomplished with the use of a 16-ft jonboat rigged with a pulsed-DC Smith-Root GPP 5.0 electrofisher with the capacity to adjust the pulse rates between 30 - 120 pulses/second and vary voltage to accommodate ambient conductivity. The electrode array includes an array of cathodes suspended from the bow to a depth of approximately six feet to project the electric field into both the shoreline epibenthic zone, as well as the upper water column. The anode array is suspended from the bow on an adjustable boom. Both anodes and cathodes will be configured to optimize the electric field under ambient low conductivity conditions. A smaller vessel capable of negotiating riffles and shoals, similarly rigged with a 2.5 GPP unit may be deployed for sampling in the shallower riverine habitats. This smaller boat will consist of a 14 ft inflatable Sea-Eagle raft with retractable anodes and side-mounted cathodes.

Electrofishing will be conducted in a downstream manner, following standardized methods developed specifically for large river quantitative electrofishing surveys (MBI, 2002, Yoder and Kulik, 2003). The start point, end point, and boat track for each sampling station will be geo-referenced using a handheld Garmin GPS (or similar device) and transposed to corresponding USGS topographic mapping software program (Terrain Navigator).

All stunned fish will be collected with ¼-inch mesh dip nets and deposited into a live-well filled with aerated ambient river water. At the conclusion of each sample, all captured fish will be identified to species, classified as adult, juvenile or Young-of-Year (YOY), enumerated, weighed, measured for total length, and then released. If large numbers (n > 25) of small fish (YOY fish or cyprinids less than 100 mm) are captured, they will be grouped by size class, enumerated, and batch-weighed with length measurements only taken from one large and one small representative specimen within each group. Fish that are not able to be identified in the FGS, such as small cyprinids, will be brought back to the lab for identification.

Gill Netting

For sampling deeper habitat sub-strata (Depth 12-25 feet; Depth 25-40 feet; Depth > 40 feet), where electrofishing will not be effective, sampling will be conducted with experimental gill nets consistent with standardized methods for fish capture from rivers (Bonar, Hubert, & Willis, 2009). The nets will be 12-foot feet high by 100-foot in length and will be constructed of 4 to 5 panels of increasing mesh size (e.g., 1.5, 2, 2.5, 3, 3.5-inch stretched mesh) to accommodate collection of the various sized fish in the project waters.

The nets will be deployed to maximize capture area where water depths are greater than net height. Nets will be set in selected locations and allowed to fish for 4 hours prior to retrieval.

The exact locations of each net set will be recorded using a handheld Garmin Vista HCx GPS (or similar device) and the time of deployment and retrieval will also be recorded. Fish processing will occur as described above for electrofishing.

Seining

In shallow shoreline locations where boat access may not be feasible sampling will be performed via seining with a 100-ft long, 6-ft deep, 1/4-inch mesh bag seine net.

Seine samples will be collected by extending the net parallel to shore and then pulling the upstream end of the net into the water and in a downstream direction for a 180 degree sweep while the opposite end of the

net is held in place (Bonar, Hubert, & Willis, 2009). The start point and end point for each sweep will be geo-referenced using a handheld Garmin Vista HCx GPS (or similar device) and transposed to corresponding USGS topographic mapping software program (Terrain Navigator). Total fish catch will be processed following each haul in the same manner as described above for electrofishing and gill netting.

Task 3: Data Analysis and Reporting

All data will be standardized by effort expended (seconds of electrofishing, net-hours, and number of seine hauls for electrofishing, gill netting, and seining respectively). Catch per unit effort (CPUE) and standard errors will be calculated for each species, station, and sampling technique. Data will also be separated into groups by size and a CPUE per size group will be calculated. Values of CPUE for each segment and gear type will be calculated as the sum of catch from all samples within a station divided by the sum effort expended within that station. The Shannon-Weiner index of diversity, which is a function of species richness and evenness, will also be calculated.

Information collected during this study will be compiled and presented in a final report. The report will include tabular data summarizing length, weight, and size class of fish captured, a map of the study area to depict the location of sample stations, and overall results including occurrence, distribution and relative abundance. Comparisons will be made with historical records. Results will be described in relation to studies described in study plans *3.3.14 – Aquatic Habitat Mapping of the Turners Falls Impoundment* and *3.3.13 – Impacts of the Turners Falls Project and Northfield Mountain Project on Littoral Zone Fish Habitat and Spawning Habitat*. Raw data will be provided to stakeholders in digital format upon request.

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

FirstLight believes the proposed level of effort will adequately address the objectives by documenting fish species occurrence, distribution and abundance within the project area along spatial and temporal gradients. FirstLight estimates the cost of this study to be $75,000 to $85,000.

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

The study described herein is scheduled to be conducted in the early summer and fall of 2015, with Task 1 occurring prior to field studies. FirstLight proposes to provide Stakeholders with a study report supplement to summarize results in the first quarter of 2016.

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Table 3.3.11-1: Freshwater mussel and glochicial host fish relationships.

Freshwater Mussel	**Connecticut River Glochidial Host Fish**
Dwarf Wedgemussel	Tessellated darter, slimy sculpin, juvenile and parr Atlantic salmon
Yellow Lampmussel	White perch, yellow perch; banded killifish, chain pickerel, white sucker, smallmouth bass, and largemouth bass
Eastern Pondmussel	Unknown; reported to parasitize centrarchids (sunfishes and bass) as well as banded killifish

Table 3.3.11-2. 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**

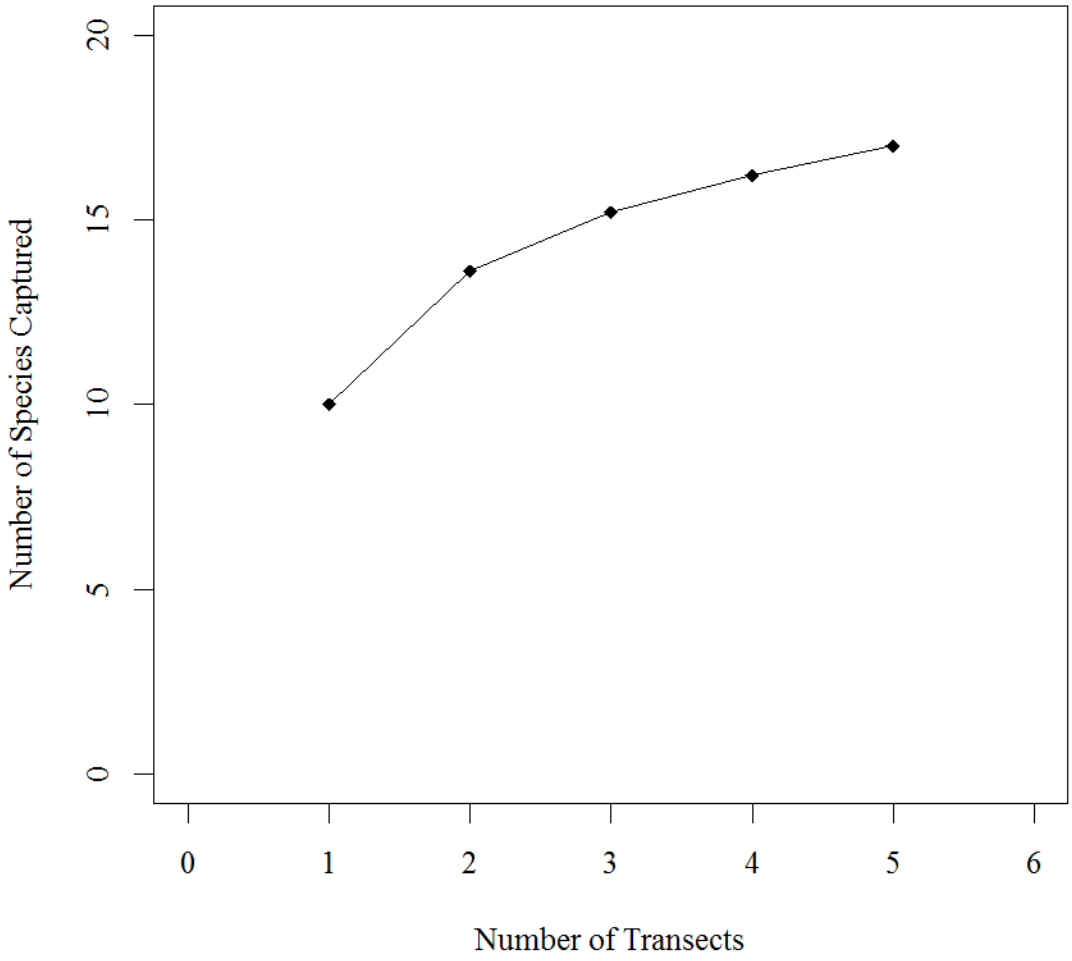

Figure 3.3.11-1: Species-accumulation curve derived from Yoder (2009) boat electrofishing data within the Turners Falls Impoundment

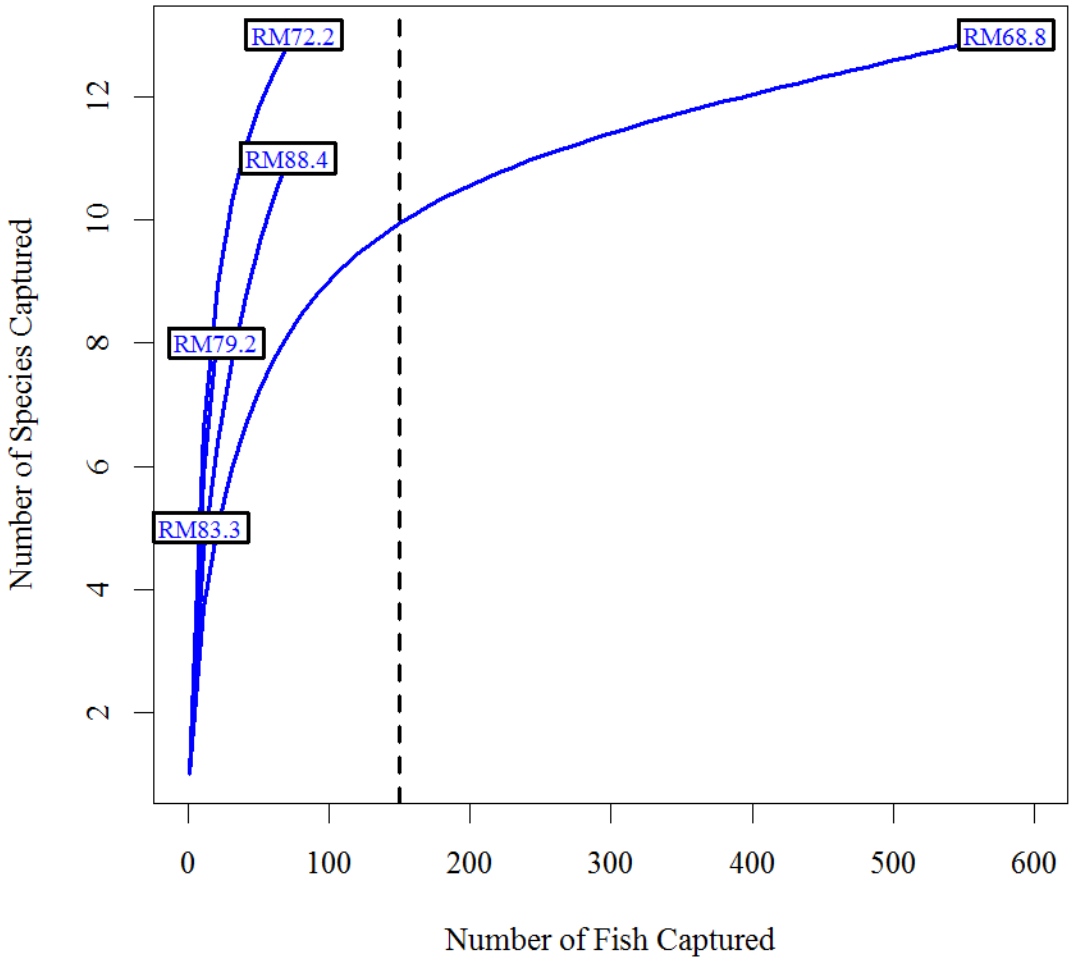

Figure 3.3.11-2: Rarefaction curves derived from each transect sampled by Yoder (2009). Labels indicate locations (River Mile) within the Turners Falls Impoundment where fish were sampled. The dashed vertical line indicates the proposed minimum sample size (n = 150 fish) per reach sampled.