Monthly Pile Driving Summary and Underwater Noise Monitoring Results

Pile Driving Period: June 15, 2014 - July 12, 2014
Revised September 12, 2014 to include results of underwater noise monitoring received this period
DOC Reference: TA_FHWA_03053_RPT_ENV

Summary:

No sturgeon were observed to have been severely injured or killed as a result of underwater noise from pile driving during this reporting period. This conclusion was reached based on the results of sturgeon monitoring by observers on the barge and vessel-based sturgeon monitoring conducted downstream of the piles being driven.

Based on an analysis using both empirical and modeled data, recoverable injuries caused by exposure to sub-lethal levels of underwater noise could not have been sustained by more than one sturgeon during this reporting period. This conclusion was reached by considering:

- the time required to drive each pile;
- the underwater area that experienced noise levels higher than a level that could potentially result in recoverable injury to the sturgeon (206 dB re 1 µPa peak sound pressure level); and
- the possible number of sturgeon that could have been in that area (number of gill nets x sturgeon encounter rate).

The potential number of sturgeon likely to have experienced recoverable injuries (described as "sturgeon take") is reported as the probability of a fish being affected by exposure to underwater noise from pile driving, as shown in the table below. If the sturgeon take is listed as 1, then 1 sturgeon was potentially exposed to recoverable noise levels. If sturgeon take is less than 1, then it is less likely that 1 sturgeon was affected. As shown at the bottom right of the table below, the sturgeon take for this reporting period was 0.62 sturgeon (that is, less than 1 sturgeon), which is less than the 1.16 sturgeon that was anticipated based on the NMFS Biological Opinion (NMFS BO).

Introduction:

As required under the NMFS BO, dated April 2014, Reasonable & Prudent Measures #4 and #5 and Term & Condition #9, underwater noise resulting from pile installation must be monitored. The following is a summary of the installation and underwater noise monitoring of permanent and trestle piles for the time period beginning June 15, 2014 through July 12, 2014.

As required under this condition, an estimate of sturgeon take for piles driven during the most recent 30-day monitoring period is included. The sturgeon take estimate has been calculated using the times required to drive each pile (impact hammer only) and an estimate of the diameter of the 206 dB peak SPL isopleth, which has been measured for a representative number of the piles installed during this time period. For piles that were not monitored for underwater noise, the size of the isopleth was conservatively assumed to be equivalent to the largest isopleth measured for piles driven at the same pier (or other representative piles at

nearby piers). The take estimate has been compared to that listed for the same piles in Table 10 of the NMFS BO to ensure that sturgeon take is not being exceeded. Sturgeon take summarized in Table 10 applies to both shortnose and Atlantic sturgeon (i.e., it is anticipated that 37 of each species will be exposed to underwater noise equal to 206 dB re 1µ Pa SPL_{peak} during pile driving.

Pile Installation and Underwater Noise Monitoring:

During the 30-day period from June 15 through July 12, 2014, 116 piles were driven (100 production piles and 16 trestle piles). Of these, [redacted] piles were driven at [redacted] at the Main Span, [redacted] piles were driven at [redacted] eastbound (EB) and westbound (WB), [redacted] on the Rockland approach, and [redacted] piles driven at [redacted]. In addition, [redacted] trestle piles were driven with an impact hammer to support the Rockland work platform. These piles correspond to those driven during weeks 22 through 26 in Table 10[1] of the NMFS BO.

Unlike most piles, which have required only one day of impact pile driving, sixteen of the piles driven at [redacted] during this period required two days of impact pile driving. This was because the vibratory hammer was not sufficient to drive the pile through the glacial till layer. In order to accomplish this, it was necessary to use the impact hammer on the first day, when impact hammering would not otherwise be used. The second day of impact pile-driving was necessary to finish driving the pile, as is standard procedure for all pile driving. Despite the need to use the impact hammer on two days for these piles, only [redacted] of the [redacted] piles driven at [redacted] exceeded the 0.33-hour drive time (0.37 to 0.49 hours) and many of the piles were well under the anticipated time. On average, the drive time was below the anticipated 0.33 hours at this pier (i.e., 0.27 hours).

Anticipated Sturgeon Take from Table 10 of the NMFS BO

For the purposes of tracking take associated with the subset of piles from the groups of piles shown in Table 10 (i.e., Anticipated Sturgeon Take), total take for each time period was divided by the number of piles scheduled to be driven during the time period. To calculate anticipated sturgeon take per pile from Table 10, the anticipated take of 1 sturgeon for piles in the group containing [redacted] was divided by the [redacted] piles for this group and 3 sturgeon at [redacted], and the Rockland trestle were divided by the [redacted] piles for that group, which resulted in an estimate of 0.01 sturgeon per pile in the case of both groups.

Based on these values:

- the anticipated take from Table 10 for the [redacted] piles driven from June 15 through July 12 was 1.16 sturgeon, which was calculated as:

  0.01 sturgeon per pile multiplied by [redacted] piles.

[1] Anticipated take was calculated in Table 10 of the NMFS BO as the product of the number of piles, number of hours to drive a pile, number of gill nets to span the 206 dB peak SPL isopleth, and the sturgeon encounter rate of 0.033 sturgeon per net per hour.

- the cumulative take[1] associated with the [redacted] piles driven to date (which includes trestle piles, test piles, and production piles as anticipated in Table 10 of the NMFS BO) is the sum of the anticipated take values for all [redacted] piles, or 16.77 sturgeon.

Calculated Sturgeon Take for this reporting period

Following the same method used to estimate incidental sturgeon take for Table 10, the product of pile driving time, number of gill nets to span the width of the 206 dB isopleth, and sturgeon encounter rate of 0.033 sturgeon per net per hour was used to calculate sturgeon take for the piles driven during this reporting period (i.e., Calculated Sturgeon Take). For previous piles that have been monitored for underwater noise, the diameter of the 206 dB peak SPL isopleth was measured based on the maximum peak SPL recorded during pile driving. For the unmonitored piles, the maximum recorded isopleth diameter was assigned based on noise monitoring from the test pile program or from noise monitoring of piles at each pier. Actual pile driving times for each of the piles were used in the calculations.

During this reporting period, none of the [redacted] piles exceeded the maximum allowable pile driving time of 1.0 hour per pile; impact pile-driving times for [redacted] piles were routinely shorter than anticipated (i.e., approximately 0.23 hours, on average, and no longer than 0.42 hours). No underwater noise monitoring was conducted for these piles and the diameter of the isopleth for the 206-dB SPL_{peak} was assumed to be 60 feet for piles driven at [redacted], which was the maximum observed isopleth size for monitored piles at [redacted].

For [redacted] piles driven at [redacted] along the Rockland approach, pile-driving times ranged from 0.47 to 0.75 hours and averaged 0.59 hours each to install. Thirty-two of the [redacted] piles were above the anticipated time of 0.5 hours. Piles driven along the Rockland approach, which includes [redacted], have routinely required 35 to 45 minutes to drive, which exceeds the estimate of 30 minutes. Although these drive times are up to 50% longer than anticipated, the Calculated Sturgeon Take for this reporting period is still well below the Anticipated Sturgeon Take reported in Table 10 of the NMFS BO. None of the [redacted] piles were monitored by TZC/JASCO for underwater noise during this reporting period.

Drive times for [redacted] piles installed at [redacted] along the Westchester approach ranged from 0.10 to 0.49 hours and averaged 0.24 hours each to install. Four of the [redacted] piles were above the anticipated time of 0.33 hours; these drive times ranged from 0.37 to 0.49 hours. None of the [redacted] piles were monitored by TZC/JASCO for underwater noise during this reporting period.

Drive times for [redacted] piles installed at the Rockland trestle averaged 0.11 hours per pile and only exceeded the anticipated 0.17 hours per pile for 2 of the [redacted] piles, which required 0.22 and 0.23 hours to drive. None of the trestle piles were monitored by TZC/JASCO for underwater noise.

[1] In previous Monthly Reports, trestle piles and test piles driven prior to January 17, 2014 were not included in the cumulative take estimate. Therefore, this estimate has been updated to include these piles so as to be consistent with Table 10 in the NMFS BO and now reflects the 10 sturgeon that were exempted in the BO dated April 2, 2014.

Based on the recorded pile-driving times and isopleth widths:

- the incidental sturgeon take for the [redacted] piles driven during the 30-day period from June 15 through July 12 was calculated as 0.62 sturgeon, which is less than the estimate of 1.16 sturgeon for the same [redacted] piles listed in Table 10,
- the cumulative incidental take for the [redacted] piles driven to date (which includes trestle piles, test piles, and production piles as anticipated in Table 10 of the NMFS BO) was calculated as 4.45 sturgeon, which is less than the anticipated take of 16.77 sturgeon for the same [redacted] piles in Table 10.

Despite the longer than anticipated pile-driving times for [redacted] piles at piers along the Rockland approach (i.e., [redacted]), the pile-driving times for the other piles installed during this period were considerably less than anticipated. This resulted in a total observed sturgeon take for all piles that was less than the anticipated take for piles driven during the current reporting period. Therefore, incidental take for sturgeon was not exceeded during the most recent 30-day reporting period for pile driving, nor has the cumulative sturgeon take been exceeded for all piles driven to date.

Report Period: 06/15/2014 to 07/12/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 9 of the NMFS BO (hrs/pile)	Average width of isopleth for 206-dB peak SPL (feet)	Maximum width of isopleth for 206-dB peak SPL (feet)	Number of gill nets to span the 206-dB peak SPL isopleth	Sturgeon encounter rate (fish/net/ hour)	Sturgeon take
6/16/2014	2014	25		0.12	0.17	Not measured	77	0.6	0.033	0.002
6/16/2014	2014	25		0.1	0.17	Not measured	77	0.6	0.033	0.002
6/16/2014	2014	25		0.13	0.33	Not measured	77	0.6	0.033	0.003
6/16/2014	2014	25		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/16/2014	2014	25		0.12	0.17	Not measured	77	0.6	0.033	0.002
6/16/2014	2014	25		0.12	0.17	Not measured	77	0.6	0.033	0.002
6/16/2014	2014	25		0.08	0.17	Not measured	77	0.6	0.033	0.002
6/16/2014	2014	25		0.05	0.17	Not measured	77	0.6	0.033	0.001
6/16/2014	2014	25		0.53	0.5	Not measured	56[a]	0.4	0.033	0.008
6/16/2014	2014	25		0.57	0.5	Not measured	56[a]	0.4	0.033	0.008
6/17/2014	2014	25		0.53	0.5	Not measured	56[a]	0.4	0.033	0.008
6/17/2014	2014	25		0.5	0.5	Not measured	56[a]	0.4	0.033	0.007
6/17/2014	2014	25		0.68	0.5	Not measured	56[a]	0.4	0.033	0.010
6/17/2014	2014	25		0.42	1	Not measured	60	0.5	0.033	0.007
6/17/2014	2014	25		0.32	1	Not measured	60	0.5	0.033	0.005
6/17/2014	2014	25		0.33	1	Not measured	60	0.5	0.033	0.005
6/17/2014	2014	25		0.18	1	Not measured	60	0.5	0.033	0.003
6/17/2014	2014	25		0.22	1	Not measured	60	0.5	0.033	0.003
6/17/2014	2014	25		0.33	1	Not measured	60	0.5	0.033	0.005
6/18/2014	2014	25		0.18	0.33	Not measured	77	0.6	0.033	0.004
6/18/2014	2014	25		0.08	0.17	Not measured	77	0.6	0.033	0.002
6/18/2014	2014	25		0.03	0.17	Not measured	77	0.6	0.033	0.001
6/19/2014	2014	25		0.38	0.33	Not measured	77	0.6	0.033	0.008
6/19/2014	2014	25		0.22	0.17	Not measured	77	0.6	0.033	0.004
6/19/2014	2014	25		0.05	0.17	Not measured	77	0.6	0.033	0.001
6/19/2014	2014	25		0.2	0.33	Not measured	77	0.6	0.033	0.004
6/19/2014	2014	25		0.17	0.17	Not measured	77	0.6	0.033	0.003
6/19/2014	2014	25		0.18	0.33	Not measured	77	0.6	0.033	0.004
6/19/2014	2014	25		0.13	0.17	Not measured	77	0.6	0.033	0.003

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6/19/2014	2014	25		0.4	0.33	Not measured	77	0.6	0.033	0.008
6/19/2014	2014	25		0.47	0.5	Not measured	56[a]	0.4	0.033	0.007
6/19/2014	2014	25		0.5	0.5	Not measured	56[a]	0.4	0.033	0.007
6/19/2014	2014	25		0.5	0.5	Not measured	56[a]	0.4	0.033	0.007
6/19/2014	2014	25		0.47	0.5	Not measured	56[a]	0.4	0.033	0.007
6/19/2014	2014	25		0.55	0.5	Not measured	56[a]	0.4	0.033	0.008
6/23/2014	2014	26		0.23	0.17	Not measured	77	0.6	0.033	0.005
6/23/2014	2014	26		0.08	0.17	Not measured	77	0.6	0.033	0.002
6/23/2014	2014	26		0.12	0.17	Not measured	77	0.6	0.033	0.002
6/23/2014	2014	26		0.08	0.17	Not measured	77	0.6	0.033	0.002
6/23/2014	2014	26		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
6/23/2014	2014	26		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
6/23/2014	2014	26		0.67	0.5	Not measured	54[b]	0.4	0.033	0.010
6/23/2014	2014	26		0.67	0.5	Not measured	54[b]	0.4	0.033	0.010
6/23/2014	2014	26		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
6/23/2014	2014	26		0.6	0.5	Not measured	54[b]	0.4	0.033	0.009
6/24/2014	2014	26		0.07	0.33	Not measured	77	0.6	0.033	0.001
6/24/2014	2014	26		0.07	0.33	Not measured	77	0.6	0.033	0.001
6/24/2014	2014	26		0.03	0.33	Not measured	77	0.6	0.033	0.001
6/24/2014	2014	26		0.08	0.33	Not measured	77	0.6	0.033	0.002
6/24/2014	2014	26		0.07	0.33	Not measured	77	0.6	0.033	0.001
6/24/2014	2014	26		0.03	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.28	0.33	Not measured	77	0.6	0.033	0.006
6/25/2014	2014	26		0.03	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.03	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.07	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001

Report Period: 06/15/2014 to 07/12/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 9 of the NMFS BO (hrs/pile)	Average width of isopleth for 206-dB peak SPL (feet)	Maximum width of isopleth for 206-dB peak SPL (feet)	Number of gill nets to span the 206-dB peak SPL isopleth	Sturgeon encounter rate (fish/net/ hour)	Sturgeon take
6/25/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/25/2014	2014	26		0.18	0.33	Not measured	77	0.6	0.033	0.004
6/25/2014	2014	26		0.02	0.33	Not measured	77	0.6	0.033	0.000
6/25/2014	2014	26		0.22	0.33	Not measured	77	0.6	0.033	0.004
6/25/2014	2014	26		0.23	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.27	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.25	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.07	0.33	Not measured	77	0.6	0.033	0.001
6/26/2014	2014	26		0.05	0.33	Not measured	77	0.6	0.033	0.001
6/26/2014	2014	26		0.13	0.33	Not measured	77	0.6	0.033	0.003
6/26/2014	2014	26		0.15	0.33	Not measured	77	0.6	0.033	0.003
6/26/2014	2014	26		0.25	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.25	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.25	0.33	Not measured	77	0.6	0.033	0.005
6/26/2014	2014	26		0.2	0.33	Not measured	77	0.6	0.033	0.004
6/26/2014	2014	26		0.3	0.33	Not measured	77	0.6	0.033	0.006
6/26/2014	2014	26		0.3	0.33	Not measured	77	0.6	0.033	0.006
6/26/2014	2014	26		0.2	0.33	Not measured	77	0.6	0.033	0.004
6/26/2014	2014	26		0.22	1	Not measured	60	0.5	0.033	0.003
6/26/2014	2014	26		0.18	1	Not measured	60	0.5	0.033	0.003
6/26/2014	2014	26		0.18	1	Not measured	60	0.5	0.033	0.003
6/26/2014	2014	26		0.22	1	Not measured	60	0.5	0.033	0.003
6/26/2014	2014	26		0.18	1	Not measured	60	0.5	0.033	0.003
6/26/2014	2014	26		0.23	1	Not measured	60	0.5	0.033	0.004
6/27/2014	2014	26		0.58	0.5	Not measured	54[b]	0.4	0.033	0.008
6/27/2014	2014	26		0.68	0.5	Not measured	54[b]	0.4	0.033	0.010
6/30/2014	2014	27		0.65	0.5	Not measured	54[b]	0.4	0.033	0.009
6/30/2014	2014	27		0.75	0.5	Not measured	54[b]	0.4	0.033	0.011

Report Period: 06/15/2014 to 07/12/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 9 of the NMFS BO (hrs/pile)	Average width of isopleth for 206-dB peak SPL (feet)	Maximum width of isopleth for 206-dB peak SPL (feet)	Number of gill nets to span the 206-dB peak SPL isopleth	Sturgeon encounter rate (fish/net/ hour)	Sturgeon take
6/30/2014	2014	27		0.68	0.5	Not measured	54[b]	0.4	0.033	0.010
6/30/2014	2014	27		0.52	0.5	Not measured	54[b]	0.4	0.033	0.007
6/30/2014	2014	27		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
7/1/2014	2014	27		0.5	0.5	Not measured	32	0.3	0.033	0.004
7/1/2014	2014	27		0.7	0.5	Not measured	32	0.3	0.033	0.006
7/1/2014	2014	27		0.55	0.5	Not measured	32	0.3	0.033	0.005
7/1/2014	2014	27		0.55	0.5	Not measured	32	0.3	0.033	0.005
7/1/2014	2014	27		0.53	0.5	Not measured	32	0.3	0.033	0.004
7/7/2014	2014	28		0.12	0.33	Not measured	77	0.6	0.033	0.002
7/7/2014	2014	28		0.33	0.33	Not measured	77	0.6	0.033	0.007
7/7/2014	2014	28		0.17	0.33	Not measured	77	0.6	0.033	0.003
7/7/2014	2014	28		0.13	0.33	Not measured	77	0.6	0.033	0.003
7/7/2014	2014	28		0.13	0.33	Not measured	77	0.6	0.033	0.003
7/7/2014	2014	28		0.12	0.33	Not measured	77	0.6	0.033	0.002
7/7/2014	2014	28		0.13	0.33	Not measured	77	0.6	0.033	0.003
7/7/2014	2014	28		0.2	0.33	Not measured	77	0.6	0.033	0.004
7/7/2014	2014	28		0.22	0.33	Not measured	77	0.6	0.033	0.004
7/7/2014	2014	28		0.23	0.33	Not measured	77	0.6	0.033	0.005
7/7/2014	2014	28		0.25	0.33	Not measured	77	0.6	0.033	0.005
7/7/2014	2014	28		0.33	0.33	Not measured	77	0.6	0.033	0.007
7/7/2014	2014	28		0.27	0.33	Not measured	77	0.6	0.033	0.005
7/7/2014	2014	28		0.28	0.33	Not measured	77	0.6	0.033	0.006
7/7/2014	2014	28		0.25	0.33	Not measured	77	0.6	0.033	0.005
7/7/2014	2014	28		0.65	0.5	Not measured	54[b]	0.4	0.033	0.009
7/7/2014	2014	28		0.6	0.5	Not measured	54[b]	0.4	0.033	0.009
7/7/2014	2014	28		0.58	0.5	Not measured	54[b]	0.4	0.033	0.008
7/7/2014	2014	28		0.57	0.5	Not measured	54[b]	0.4	0.033	0.008
7/7/2014	2014	28		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
7/8/2014	2014	28		0.23	0.33	Not measured	77	0.6	0.033	0.005

Report Period: 06/15/2014 to 07/12/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 9 of the NMFS BO (hrs/pile)	Average width of isopleth for 206-dB peak SPL (feet)	Maximum width of isopleth for 206-dB peak SPL (feet)	Number of gill nets to span the 206-dB peak SPL isopleth	Sturgeon encounter rate (fish/net/ hour)	Sturgeon take
7/8/2014	2014	28		0.17	0.33	Not measured	77	0.6	0.033	0.003
7/8/2014	2014	28		0.15	0.33	Not measured	77	0.6	0.033	0.003
7/8/2014	2014	28		0.1	0.33	Not measured	77	0.6	0.033	0.002
7/8/2014	2014	28		0.18	0.33	Not measured	77	0.6	0.033	0.004
7/8/2014	2014	28		0.2	1	Not measured	60	0.5	0.033	0.003
7/8/2014	2014	28		0.17	1	Not measured	60	0.5	0.033	0.003
7/9/2014	2014	28		0.23	0.33	Not measured	77	0.6	0.033	0.005
7/9/2014	2014	28		0.28	0.33	Not measured	77	0.6	0.033	0.006
7/9/2014	2014	28		0.18	1	Not measured	60	0.5	0.033	0.003
7/9/2014	2014	28		0.18	1	Not measured	60	0.5	0.033	0.003
7/9/2014	2014	28		0.2	1	Not measured	60	0.5	0.033	0.003
7/9/2014	2014	28		0.22	1	Not measured	60	0.5	0.033	0.003
7/11/2014	2014	28		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
7/11/2014	2014	28		0.55	0.5	Not measured	54[b]	0.4	0.033	0.008
7/11/2014	2014	28		0.57	0.5	Not measured	54[b]	0.4	0.033	0.008
7/11/2014	2014	28		0.62	0.5	Not measured	54[b]	0.4	0.033	0.009
7/11/2014	2014	28		0.57	0.5	Not measured	54[b]	0.4	0.033	0.008
Monthly sturgeon take (Calculated based on pile-driving data/Anticipated from Table 10 of the April 2014 NMFS BO)										**0.62/1.16**
Cumulative sturgeon take to date (Calculated based on pile-driving data/Anticipated from Table 10 of the April 2014 NMFS BO)										**4.45/16.77**

[a] Isopleth widths were revised based on the results of underwater noise monitoring at Piers 5EB and 5WB received from TZC following submission of this report.

[b] Isopleth widths were revised based on the results of underwater noise monitoring at Pier 11EB received from TZC following submission of this report.