Monthly Pile Driving Summary and Underwater Noise Monitoring Results

Pile Driving Period: September 7, 2014 – October 4, 2014
DOC Reference: TA_FHWA_07335_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 0.36 sturgeon (that is, less than 1 sturgeon), which is less than the 3.29 sturgeon that was anticipated based on the NMFS Biological Opinion (NMFS BO).

Introduction:

As required under the NMFS BO, dated September 23, 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 September 7, 2014 through October 4, 2014.

As required under this condition, an estimate of sturgeon take for piles driven during the most recent monthly 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 12

of the NMFS BO to ensure that sturgeon take is not being exceeded. Sturgeon take summarized in Table 12 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 monthly period from September 7 through October 4, 2014, [redacted] piles were driven (all of them were production 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]. These piles correspond to those driven during weeks 26 through 42 in Table 12[1] of the NMFS BO.

Anticipated Sturgeon Take from Table 12 of the NMFS BO

For the purposes of tracking take associated with the subset of piles from the groups of piles shown in Table 12 (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 12, the anticipated take of 1 sturgeon for piles in the group containing [redacted] was divided by [redacted] piles for this group which resulted in an estimate of 0.1 sturgeon per pile for this groups. Similarly, 1 sturgeon for piles in the group containing [redacted] was divided by the [redacted] piles in this group, which resulted in an estimate of 0.02 sturgeon per pile for this group. Lastly, 1 sturgeon for piles in the group containing [redacted] was divided by the [redacted] piles for this group, 1 sturgeon for piles in the group containing [redacted] was divided by the [redacted] piles for this group, and 3 sturgeon at [redacted] were divided by the [redacted] piles for that group. The result was an estimate of 0.01 sturgeon per pile for all piles driven in these groups.

Based on these values:

- the anticipated take from Table 12 for the [redacted] piles driven from September 7 through October 4 was 3.29 sturgeon, which was calculated as the sum of:
  - 0.01 sturgeon per pile multiplied by [redacted] piles,
  - 0.02 sturgeon per pile multiplied by [redacted] piles,
  - 0.1 sturgeon per pile multiplied by [redacted] piles,
- the cumulative take associated with the [redacted] piles driven to date (which includes trestle piles, test piles, and production piles as anticipated in Table 12 of the NMFS BO) is the sum of the anticipated take values for all [redacted] piles, or 22.41 sturgeon.

Calculated Sturgeon Take for this reporting period

Following the same method used to estimate incidental sturgeon take for Table 12, 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

[1] Anticipated take was calculated in Table 12 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.

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 piles exceeded the maximum allowable pile driving time of 1.0 hour per pile; impact pile-driving times for piles were routinely shorter than anticipated (i.e., approximately 0.20 hours, on average, and no longer than 0.32 hours). Underwater noise monitoring was conducted for piles at . The maximum peak SPL isopleth measured during monitoring was 48 feet. This value was used to calculate sturgeon take for piles at . For piles at , the diameter of the isopleth for the 206-dB SPL_{peak} was estimated based on the largest measured isopleth at Pier 33 and used to calculate sturgeon take for these piles.

For of the piles driven at along the Rockland approach, pile-driving times ranged from 0.17 to 0.55 hours to install. Twelve of the piles exceeded the anticipated time of 0.5 hours, but on average piles driven this reporting period required 0.41 hours of impact pile driving. Nine of the twelve drive times that were greater than anticipated were only slightly greater and did not exceed 0.55 hours. The other three piles required 0.63 to 0.90 hours to drive. Although several of these drive times were greater than anticipated, the overall average time to install piles during this reporting period was less than anticipated in the NMFS BO. Moreover, the Calculated Sturgeon Take for this reporting period is still well below the Anticipated Sturgeon Take reported in Table 12 of the NMFS BO. Seven of the piles at were monitored by TZC/JASCO for underwater noise during this reporting period. The largest measured peak SPL isopleth of 27 feet was used to calculate sturgeon take for pile at . Previous noise monitoring results for were used to approximate the peak SPL isopleth for .

Drive times for the piles installed at along the Rockland landing ranged from 0.02 to 0.17 hours and averaged 0.08 hours each to install, which is less than the anticipated time of 0.33 hours. None of the piles were monitored by TZC/JASCO for underwater noise during this reporting period.

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

- the incidental sturgeon take for the piles driven during the monthly period from September 7 through October 4 was calculated as 0.36 sturgeon, which is less than the estimate of 3.29 sturgeon for the same piles listed in Table 12,
- the cumulative incidental take for the piles driven to date (which includes trestle piles, test piles, and production piles as anticipated in Table 12 of the NMFS BO) was calculated as 6.01 sturgeon, which is less than the anticipated take of 22.41 sturgeon for the same piles in Table 12.

Despite the longer than anticipated pile-driving times for several of the piles at piers along the Rockland approach , 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 monthly reporting period for pile driving, nor has the cumulative sturgeon take been exceeded for all piles driven to date.

Report Period: 09/07/2014 to 10/04/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 12 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
9/8/2014	2014	37		0.53	0.5	Not measured	54	0.4	0.033	0.008
9/8/2014	2014	37		0.55	0.5	Not measured	54	0.4	0.033	0.008
9/9/2014	2014	37		0.53	0.5	Not measured	54	0.4	0.033	0.008
9/9/2014	2014	37		0.53	0.5	Not measured	54	0.4	0.033	0.008
9/9/2014	2014	37		0.28	0.5	27	27	0.2	0.033	0.002
9/9/2014	2014	37		0.22	0.5	24	27	0.2	0.033	0.002
9/9/2014	2014	37		0.25	0.5	22	27	0.2	0.033	0.002
9/9/2014	2014	37		0.20	0.5	22	27	0.2	0.033	0.001
9/9/2014	2014	37		0.22	0.5	13	27	0.2	0.033	0.002
9/9/2014	2014	37		0.25	0.5	17	27	0.2	0.033	0.002
9/9/2014	2014	37		0.25	0.5	19	27	0.2	0.033	0.002
9/10/2014	2014	37		0.32	1	44	48	0.4	0.033	0.004
9/10/2014	2014	37		0.07	1	Not measured	48	0.4	0.033	0.001
9/11/2014	2014	37		0.52	0.5	Not measured	54	0.4	0.033	0.007
9/11/2014	2014	37		0.63	0.5	Not measured	54	0.4	0.033	0.009
9/11/2014	2014	37		0.48	0.5	Not measured	54	0.4	0.033	0.007
9/11/2014	2014	37		0.50	0.5	Not measured	54	0.4	0.033	0.007
9/11/2014	2014	37		0.50	0.5	Not measured	54	0.4	0.033	0.007
9/11/2014	2014	37		0.22	1	Not measured	48	0.4	0.033	0.003
9/11/2014	2014	37		0.02	1	Not measured	48	0.4	0.033	<0.001
9/11/2014	2014	37		0.22	1	48	48	0.4	0.033	0.003
9/11/2014	2014	37		0.17	1	31	48	0.4	0.033	0.002
9/11/2014	2014	37		0.15	1	Not measured	48	0.4	0.033	0.002
9/11/2014	2014	37		0.27	1	Not measured	48	0.4	0.033	0.003
9/15/2014	2014	38		0.27	0.5	Not measured	27	0.2	0.033	0.002
9/15/2014	2014	38		0.22	0.5	Not measured	27	0.2	0.033	0.002
9/15/2014	2014	38		0.22	0.5	Not measured	27	0.2	0.033	0.002
9/15/2014	2014	38		0.25	0.5	Not measured	27	0.2	0.033	0.002
9/15/2014	2014	38		0.22	0.5	Not measured	27	0.2	0.033	0.002

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9/15/2014	2014	38		0.25	0.5	Not measured	27	0.2	0.033	0.002
9/15/2014	2014	38		0.25	0.5	Not measured	27	0.2	0.033	0.002
9/16/2014	2014	38		0.22	1	Not measured	48	0.4	0.033	0.003
9/17/2014	2014	38		0.42	0.5	Not measured	27	0.2	0.033	0.003
9/18/2014	2014	38		0.07	0.5	Not measured	27	0.2	0.033	<0.001
9/18/2014	2014	38		0.43	0.5	Not measured	27	0.2	0.033	0.003
9/18/2014	2014	38		0.37	0.5	Not measured	27	0.2	0.033	0.003
9/18/2014	2014	38		0.40	0.5	Not measured	27	0.2	0.033	0.003
9/18/2014	2014	38		0.35	0.5	Not measured	27	0.2	0.033	0.002
9/18/2014	2014	38		0.43	0.5	Not measured	27	0.2	0.033	0.003
9/18/2014	2014	38		0.42	0.5	Not measured	27	0.2	0.033	0.003
9/19/2014	2014	38		0.55	0.5	Not measured	35	0.3	0.033	0.005
9/19/2014	2014	38		0.48	0.5	Not measured	35	0.3	0.033	0.004
9/19/2014	2014	38		0.47	0.5	Not measured	35	0.3	0.033	0.004
9/19/2014	2014	38		0.47	0.5	Not measured	35	0.3	0.033	0.004
9/19/2014	2014	38		0.18	1	Not measured	48	0.4	0.033	0.002
9/19/2014	2014	38		0.20	1	Not measured	48	0.4	0.033	0.003
9/19/2014	2014	38		0.23	1	Not measured	48	0.4	0.033	0.003
9/19/2014	2014	38		0.18	1	Not measured	48	0.4	0.033	0.002
9/22/2014	2014	39		0.50	0.5	Not measured	35	0.3	0.033	0.005
9/22/2014	2014	39		0.17	0.5	Not measured	27	0.2	0.033	0.001
9/22/2014	2014	39		0.27	0.5	Not measured	27	0.2	0.033	0.002
9/22/2014	2014	39		0.17	0.5	Not measured	27	0.2	0.033	0.001
9/22/2014	2014	39		0.27	0.5	Not measured	27	0.2	0.033	0.002
9/23/2014	2014	39		0.02	0.33	Not measured	77	0.6	0.033	<0.001
9/23/2014	2014	39		0.77	0.5	Not measured	27	0.2	0.033	0.005
9/23/2014	2014	39		0.37	0.5	Not measured	27	0.2	0.033	0.003
9/23/2014	2014	39		0.52	0.5	Not measured	27	0.2	0.033	0.004
9/23/2014	2014	39		0.35	0.5	Not measured	27	0.2	0.033	0.002

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9/23/2014	2014	39		0.22	1	Not measured	9	0.1	0.033	0.001
9/24/2014	2014	39		0.08	0.33	Not measured	77	0.6	0.033	0.002
9/24/2014	2014	39		0.05	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.07	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.03	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.08	0.33	Not measured	77	0.6	0.033	0.002
9/24/2014	2014	39		0.05	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.12	0.33	Not measured	77	0.6	0.033	0.002
9/24/2014	2014	39		0.07	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.05	0.33	Not measured	77	0.6	0.033	0.001
9/24/2014	2014	39		0.12	0.33	Not measured	77	0.6	0.033	0.002
9/24/2014	2014	39		0.38	0.5	Not measured	27	0.2	0.033	0.003
9/24/2014	2014	39		0.30	0.5	Not measured	27	0.2	0.033	0.002
9/24/2014	2014	39		0.43	0.5	Not measured	35	0.3	0.033	0.004
9/24/2014	2014	39		0.42	0.5	Not measured	35	0.3	0.033	0.004
9/24/2014	2014	39		0.50	0.5	Not measured	35	0.3	0.033	0.005
9/24/2014	2014	39		0.45	0.5	Not measured	27	0.2	0.033	0.003
9/24/2014	2014	39		0.48	0.5	Not measured	35	0.3	0.033	0.004
9/24/2014	2014	39		0.02	0.5	Not measured	27	0.2	0.033	<0.001
9/24/2014	2014	39		0.48	0.5	Not measured	35	0.3	0.033	0.004
9/24/2014	2014	39		0.25	1	Not measured	9	0.1	0.033	0.001
9/24/2014	2014	39		0.27	1	Not measured	9	0.1	0.033	0.001
9/24/2014	2014	39		0.18	1	Not measured	9	0.1	0.033	<0.001
9/24/2014	2014	39		0.20	1	Not measured	9	0.1	0.033	<0.001
9/24/2014	2014	39		0.20	1	Not measured	9	0.1	0.033	<0.001
9/25/2014	2014	39		0.32	0.5	Not measured	27	0.2	0.033	0.002
9/25/2014	2014	39		0.50	0.5	Not measured	27	0.2	0.033	0.004
9/25/2014	2014	39		0.37	0.5	Not measured	27	0.2	0.033	0.003
9/25/2014	2014	39		0.37	0.5	Not measured	27	0.2	0.033	0.003

Report Period: 09/07/2014 to 10/04/2014

Date	Year	Week		Net Impact Pile Driving Duration (hrs/pile)	Pile driving time from Table 12 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
9/26/2014	2014	39		0.07	0.33	Not measured	77	0.6	0.033	0.001
9/26/2014	2014	39		0.03	0.33	Not measured	77	0.6	0.033	0.001
9/26/2014	2014	39		0.05	0.33	Not measured	77	0.6	0.033	0.001
9/26/2014	2014	39		0.25	0.5	Not measured	27	0.2	0.033	0.002
9/26/2014	2014	39		0.22	0.5	Not measured	27	0.2	0.033	0.002
9/26/2014	2014	39		0.23	0.5	Not measured	27	0.2	0.033	0.002
9/26/2014	2014	39		0.17	0.5	Not measured	27	0.2	0.033	0.001
9/26/2014	2014	39		0.18	1	Not measured	9	0.1	0.033	<0.001
9/26/2014	2014	39		0.18	1	Not measured	9	0.1	0.033	<0.001
9/26/2014	2014	39		0.20	1	Not measured	9	0.1	0.033	<0.001
9/26/2014	2014	39		0.20	1	Not measured	9	0.1	0.033	<0.001
9/30/2014	2014	40		0.32	0.5	Not measured	27	0.2	0.033	0.002
9/30/2014	2014	40		0.42	0.5	Not measured	27	0.2	0.033	0.003
9/30/2014	2014	40		0.45	0.5	Not measured	27	0.2	0.033	0.003
9/30/2014	2014	40		0.90	0.5	Not measured	27	0.2	0.033	0.006
9/30/2014	2014	40		0.23	1	Not measured	9	0.1	0.033	0.001
9/30/2014	2014	40		0.22	1	Not measured	9	0.1	0.033	0.001
9/30/2014	2014	40		0.13	1	Not measured	9	0.1	0.033	<0.001
9/30/2014	2014	40		0.17	1	Not measured	9	0.1	0.033	<0.001
9/30/2014	2014	40		0.17	1	Not measured	9	0.1	0.033	<0.001
9/30/2014	2014	40		0.17	1	Not measured	9	0.1	0.033	<0.001
10/1/2014	2014	40		0.53	0.5	Not measured	35	0.3	0.033	0.005
10/1/2014	2014	40		0.45	0.5	Not measured	35	0.3	0.033	0.004
10/1/2014	2014	40		0.53	0.5	Not measured	35	0.3	0.033	0.005
10/1/2014	2014	40		0.47	0.5	Not measured	35	0.3	0.033	0.004
10/1/2014	2014	40		0.50	0.5	Not measured	35	0.3	0.033	0.005
10/1/2014	2014	40		0.50	0.5	Not measured	35	0.3	0.033	0.005
10/1/2014	2014	40		0.45	0.5	Not measured	35	0.3	0.033	0.004
10/1/2014	2014	40		0.13	1	Not measured	9	0.1	0.033	<0.001

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10/1/2014	2014	40		0.15	1	Not measured	9	0.1	0.033	<0.001
10/1/2014	2014	40		0.12	1	Not measured	9	0.1	0.033	<0.001
10/1/2014	2014	40		0.18	1	Not measured	9	0.1	0.033	<0.001
10/3/2014	2014	40		0.10	0.33	Not measured	77	0.6	0.033	0.002
10/3/2014	2014	40		0.08	0.33	Not measured	77	0.6	0.033	0.002
10/3/2014	2014	40		0.10	0.33	Not measured	77	0.6	0.033	0.002
10/3/2014	2014	40		0.05	0.33	Not measured	77	0.6	0.033	0.001
10/3/2014	2014	40		0.03	0.33	Not measured	77	0.6	0.033	0.001
10/3/2014	2014	40		0.07	0.33	Not measured	77	0.6	0.033	0.001
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10/3/2014	2014	40		0.10	0.33	Not measured	77	0.6	0.033	0.002
10/3/2014	2014	40		0.03	0.33	Not measured	77	0.6	0.033	0.001
10/3/2014	2014	40		0.17	0.33	Not measured	77	0.6	0.033	0.003
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10/3/2014	2014	40		0.50	0.5	Not measured	35	0.3	0.033	0.005
10/3/2014	2014	40		0.45	0.5	Not measured	35	0.3	0.033	0.004
10/3/2014	2014	40		0.43	0.5	Not measured	35	0.3	0.033	0.004
10/3/2014	2014	40		0.50	0.5	Not measured	35	0.3	0.033	0.005
10/3/2014	2014	40		0.47	0.5	Not measured	35	0.3	0.033	0.004
10/3/2014	2014	40		0.50	0.5	Not measured	35	0.3	0.033	0.005
10/3/2014	2014	40		0.47	0.5	Not measured	35	0.3	0.033	0.004
Monthly sturgeon take (Calculated based on pile-driving data/Anticipated from Table 12 of the September 2014 NMFS BO)										**0.36/3.29**
Cumulative sturgeon take to date (Calculated based on pile-driving data/Anticipated from Table 12 of the September 2014 NMFS BO)										**6.01/22.41**