

Welcome to an Introduction to NMFS's Multispecies Pile Driving Calculator. This PowerPoint is designed to be a basic tutorial on how to use this optional Tool. You may advance through these slides at your own pace.



Before you get started:



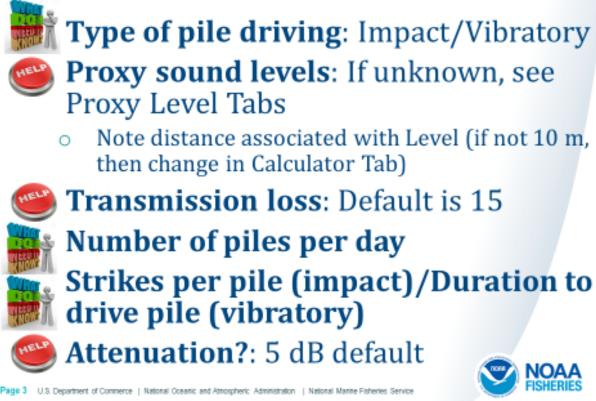
NOTE: Different Regions may have different requirements, please check with the appropriate Regional/HQ staff before using this tool.

 This Tool was primarily designed for coastal pile driving activities
 Please read Instructions Tab
 Use of this Tool is <u>optional</u>
 Make sure you are using the most recent version of Tool

NOTE: This optional tool provides a means to estimates distances associated with various NMFS thresholds (i.e., interim, as well as more formalized) Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of this Calculator

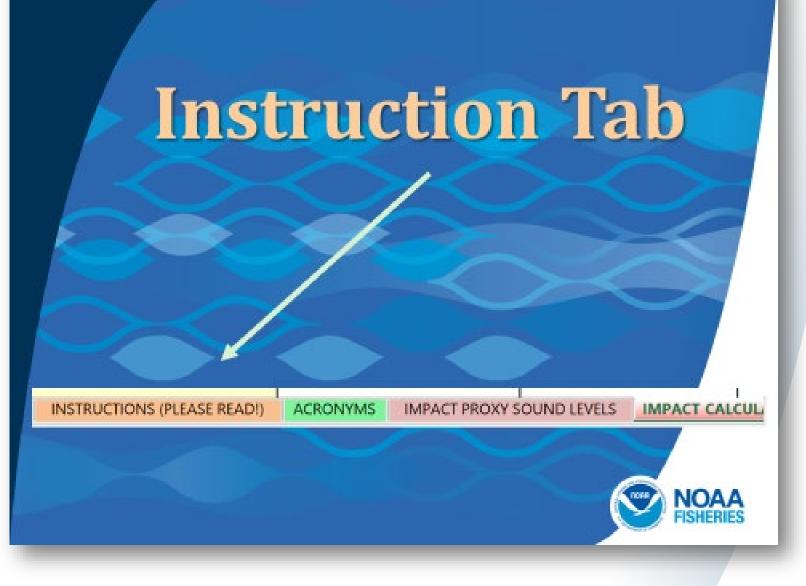
Before you start, there are a few items of note, including that different Regions may have different requirements, please check with the appropriate Regional/HQ staff before using this tool. 1) This Tool was primarily designed for coastal pile driving activities, 2) Reading the Instruction Tab is recommended, and 3) Use of this Tool is optional. If you have more accurate means of estimating isopleths, please do so. Finally, this Tool provides a means to estimate distances associated with various NMFS thresholds. Mitigation and monitoring requirements associated with a MMPA or an ESA consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of this Tool.

Basic Information Needs



ndaa,

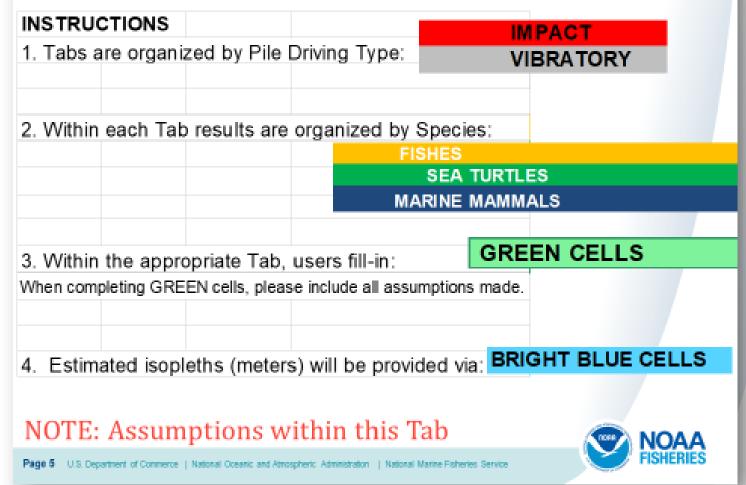
There are some basic pieces of information needed to use this Tool. First, one must know what type of pile driving activity they are doing, either impact or vibratory. Proxy sound levels are also needed, but if unknown, NMFS provides help by the Tool having a Tab with surrogate levels. Note: Most proxy levels are specified at 10 m from the pile. If this distance is different from 10 m, this needs to be changed in the Calculator Tab. Transmission loss is needed, but NMFS provides help via a default value of 15 (practical spreading), if unknown. This default may be changed if transmission loss data are available. One must know the number of piles per day and either strikes per pile for impact pile driving or duration (minutes) to drive a pile using vibratory pile driving. NMFS suggests using a best estimate based on previous experience. If a bubble curtain or other attenuation device is being used, NMFS provides help via recommending a -5 dB default, unless better information is available



There are eight Tabs in this tool. Let's start with the Instruction Tab, which you can access using the toolbar found at the bottom of the Tool.

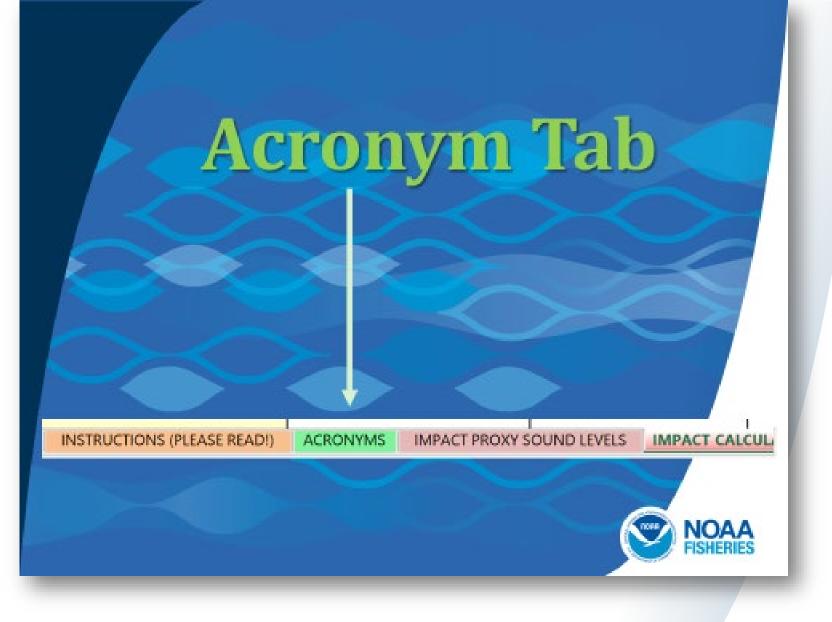






The Instruction Tab provides instructions and a general overview of other tabs within the Tool. Tabs are organized by pile driving type: either impact (red) or vibratory (gray). Within each Tab, results are organized by species (fishes, sea turtles, or marine mammals). Within each Tab, the user provides information via green cells with output (isopleths in meters) provided in bright blue cells. Additionally in this Tab, note the various Assumptions listed. This Tab also includes a Contact for technical questions or suggestions, proxy sound level references, and threshold references.





The Acronym Tab can be accessed using the toolbar found at the bottom of the Tool.



Acronym Tab

| A | B | C | D | E | F |
|------|--------------------|----------------|--------------|------------|--------------|
| ACRO | YMS | | | | |
| FHWG | Fisheries H | lydroacous | tic Working | g Group | |
| 8 | grams | | | | |
| h | hour | | | | |
| HF | high-frequ | ency cetaci | ean | | |
| LF | low-freque | ncy cetace | an | | |
| m | meters | | | | |
| MF | mid-freque | ency cetace | an | | |
| MM | marine ma | mmals | | | |
| MMPA | Marine Ma | immal Prot | ection Act | | |
| NMFS | National M | larine Fishe | eries Servic | e | |
| NOAA | National O | ceanic and | Atmosphe | ric Admini | stration |
| PK. | peak sound | d pressure | level | | |
| PTS | permanent | t threshold | shift | | |
| PW | phocid pin | niped (und | lerwater) | | |
| ow | otariid pini | niped (und | erwater) | | |
| RMS | root-mean | -square so | und pressu | ire level | |
| SEL | sound exp | osure level | | | |
| | DOM: THE OWNER | na in the name | C DOMEST | | 18.8.0° 18.8 |

For definitions of common terms in this Tool see:

https://media.fisheries.noaa.gov/dammigration/tech memo acoustic guidance (20) (pdf) 508.pdf



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The Acronym Tab provides various acronyms used throughout the Tool. It also provides a link to definitions of common terms used in the Tool.



Test Drive/Demo: Updated Tool



Examples:

A. Impact pile driving

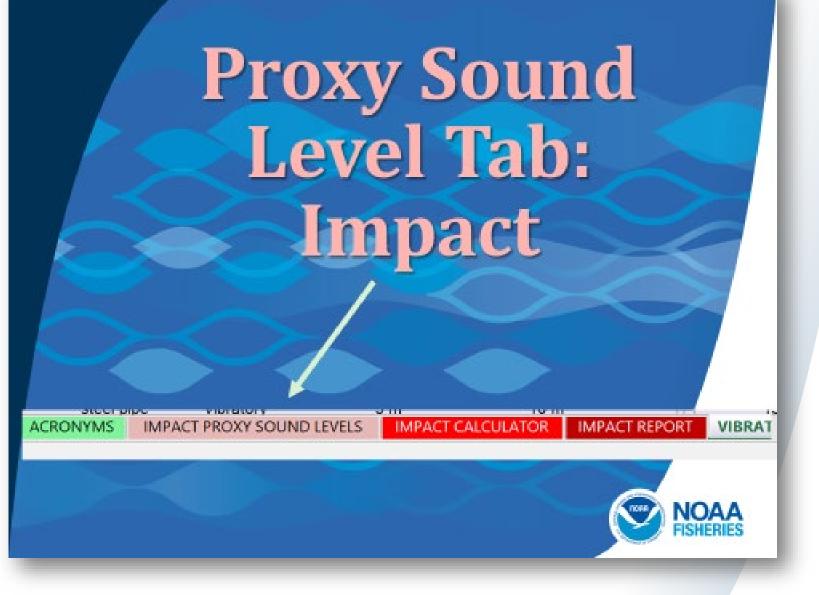
- 36" steel pipe, 3 piles, 1000 strikes/pile, with bubble curtain
- B. Vibratory pile driving
 - o 36" steel pipe, 3 piles, 30 minutes





Today, we will be walking through two examples, starting with an impact pile driving example (36" steel pipe piles, 3 piles per day, 1000 strikes/pile, with a bubble curtain).





Let's demonstrate the Proxy Sound Level Tab for impact pile driving. Again, this Tab can be accessed using the toolbar found at the bottom of the Tool.



Proxy Sound Level Tab: Impact

1. Tab is sortable



- 2. Note: Pile size, Material, Water depth, & Comments
- 3. If exact pile size/material is not listed: Consult NMFS or use next largest size
- 4. Copy from Tab & then paste directly in Calculator Tab (paste as Value 123)

NOTE: Measurement Distance from Pile if not 10 m, then value will need to be updated in Calculator Tab



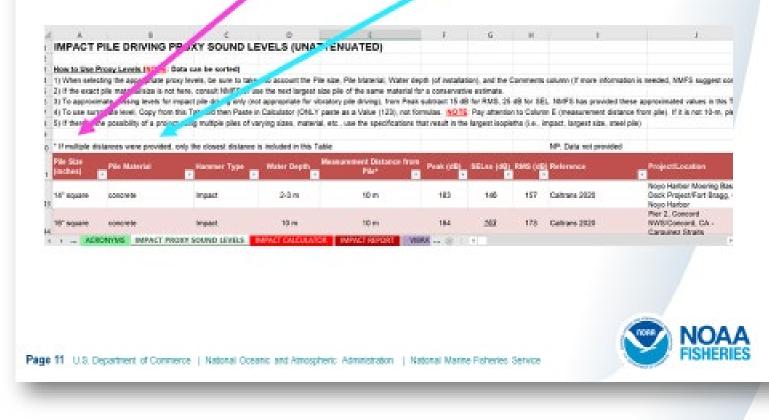
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Note the various assumptions listed at the top of this Tab. This Tab is sortable by various pile features (size, material, etc.). Note the complete row of information provided for each pile, including water depth, location, reference, and comments. Please pick the proxy that is most applicable to your activity. If the exact pile size or material is not listed, consult NMFS or use next largest size. Copy the information from this Tab and then paste directly in the corresponding Calculator Tab (paste as a Value, 123). Note: If the measurement distance from the pile is not 10 m, then this value will need to be updated in Calculator Tab. If you have specific information on sound levels for your pile size/material, then it is not necessary to rely on a proxy.



Proxy Sound Level Tab: Impact

To use this Tab, it makes sense to sort data by appropriate <u>pile size</u> and <u>pile material</u>.



To use the Proxy Sound Level Tab, it makes sense to sort data by appropriate pile size (hot pink arrow) and pile material (turquoise arrow).



Proxy Sound Level Tab: Impact

| Pile Size | Pile Material |
|----------------------------------|-----------------------------------|
| 36" pile | Steel pipe |
| ĝį Sort A to Z | 1 Sort A to Z |
| L Sort Z to A | ≩↓ Sart Z to A |
| Sort by Color + | Soly by Color |
| The Stor Filter From 'File Stor' | Clear Filter From "Pile Material" |
| Either by Color | Fifter by Color * |
| Test Elters * | Text Eliters · |
| Search P | Search P |
| - 24' square A | Casted to calculate |
| - 30° square (Type I) | All and a second second |
| | isteep pipe |
| | |
| OK Cancel | OK Cancel |

Here is a closer look at sorting columns, specifically Column A for pile size and Column B for pile material. In this example, we are interested in available data for 36" steel pipe piles.

Pa



Proxy Sound Level Tab: Impact Results of Sort



| Pile Size | Pile Material | Hammer Type | Water Depth | Measurement Distance from Pile* | Peak 👻 | 8ELss | RM8 | Reference |
|-----------|---------------|-------------|-------------|------------------------------------|--------|-------|-----|---------------|
| 36" | steel pipe | Impact | 10 m | 10 m | 210 | 183 | 193 | Caltrans 2015 |
| 36" | steel pipe | Impact | <5 m | 10 m | 208 | 180 | 190 | Caltrans 2016 |
| 36" | steel pipe | Impact | NA. | 10 m | 210 | 183 | 193 | Caltrans 2020 |
| | | | | | | | | |

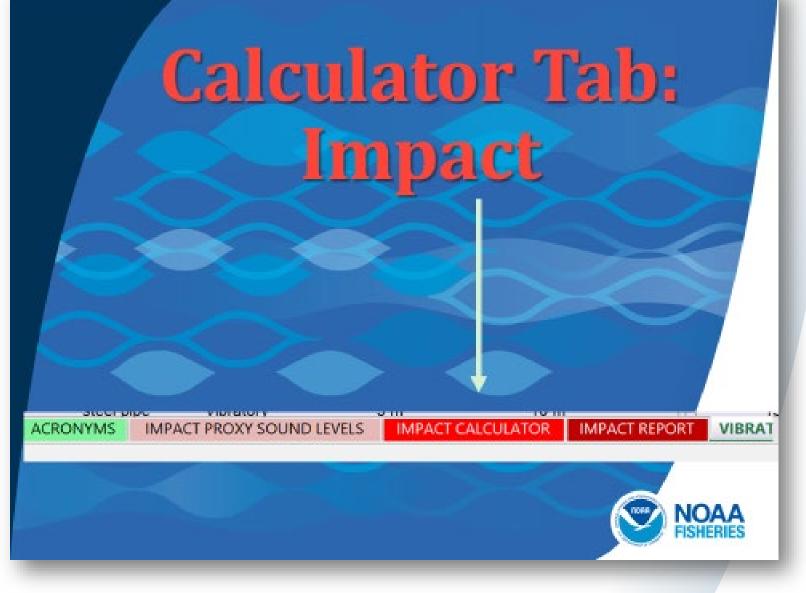
- Red box indicates proxy sound levels for 36" steel pipe pile
- 2. Check water depth & other factors (location, notes)
- For this example: All three choices are generic examples (no specified location)
- 4. Will choose 3rd row choice, since depth unknown
 - Copy values of all 3 metrics (Peak, SEL_{ss}, & RMS) for this row



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Once data are sorted (by pile size and material), three potential choices for proxy levels are provided (see red box). To choose the most appropriate of the three, check water depth and other factors, such as location, notes, etc. to decide which most closely resembles your situation. For this example, all three choices are generic examples (no specified location). Since for this example, water depth is unknown, we will choose the 3rd row as the most appropriate proxy level. Once chosen, copy values in all three metrics (Peak, SEL_{ss}, and RMS) for this proxy. Note: Pay attention to the measurement distance from the pile if it is anything other than 10 m.





Let's take a look at the Calculator Tab for impact pile driving. This Tab can be accessed using the toolbar found at the bottom of the Tool.



KEY

User Provided Information

Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.

OUTPUT: Resultant Isopleth (cannot be altered by user)

Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user



This slide illustrates the Key at the top of the Calculator Tab. Green cells are for user provided information. Note that default values are in bold italics turquoise font. These default values may be changed by the user if project-specific information is available. Yellow cells represent preset NMFS provided information and cannot be altered by the user. NMFS thresholds/default weighting values are in bold red. Bright blue cells represent outputs of the Tool or resultant isopleths based on user provided information and cannot be altered by the user. Finally, gray cells represent automatically calculated values based on user provided information (only weighting adjustment (-dB) values can be altered by the user and are found in the last row of the Tool). Please see Advanced Features later in this presentation for more information on adjusting these values.



| | Astomatically Calculat | ad Yeless Based on User Pro | ided Information (only | r waig | |
|--|------------------------|--|--|----------|------|
| TEP 1: GENERAL PROJECT I | RECEIMATION | | | | |
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| | | | | | |
| ROJECT/SOURCE | | | | | |
| FORMATION (size, meterial, | | | | | |
| unders, pile strikes, sto.) | | | | | |
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| TEP 2: QUANTITATIVE PROJ | ECT-SPECIFIC INFO | RMATION | | | |
| TEP 2: QUANTITATIVE PROJ | ECT-SPECIFIC INFO | ORMATION METRICS | | ±1 | |
| TEP 2: QUANTITATIVE PROJ | ECT-SPECIFIC INFO | | 888 | - | |
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| nationented Single strike level 35) (see Prosp Level Tak dar maartie wiker, Garr, OBLT Parte | | METRICS | nMS | - | Step |
| extransted Single stribe level 1831 Geo Prusy Lovel Tek Kur | | METRICS | пм: 0 | | Step |
| nottenented Single stribe level 80) (zwo Prane Level Tek der smegete wehrer, Gager, 680. F. Parte einer (1933, ant farmeler) Heannied Single stribe level 1837 (calcolution dawn | Peak | METRICS 301.00 | | | Step |
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| extransited Single statike level (5) (see Prens Level Teb day magning others, Carp, 600.7 Parts- draw (1015, and Jarmalac) (1016, 1017, 1017, 1018 | Pesk D M | METRICS SELare 0 Attensation accured | 0 30 0 | | Step |
| extremented Single strike level 85) (see Prop Level Tek der renegte wehre, Gary, MILT Parte des (1933), ant (seeder) Resented Single strike level 1971 (seidenteine des 1971 (sei | Pesk D M | METRICS SELes 0 10 Attenuation accumed (s.g., bubble certain) | 0 N ⁰ N ¹ N ¹ Second second | | Step |
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| nottenneted Single strike level 55) (see Prop Level Tek her remote without, Gapp, ORLT Parke due (1935, est formales) tenneted Single strike level 1971 (seidestation does 1976-Ci strike strike level 1976-Ci strike strike tek het pie an dackte check date rememission leve constant 1975 occumented 19 34 enknown) under of piles per dag (her timete based on previous specieus) | Pesk D M | METRICS SELes 0 10 Attenuation accumed (s.g., bubble certain) | 0 N ⁰ N ¹ N ¹ Second second | | Step |
| nottenneted Single strike level 55) (see Prop Level Tek her remote without, Gapp, ORLT Parke due (1935, est formales) tenneted Single strike level 1971 (seidestation does 1976-Ci strike strike level 1976-Ci strike strike tek het pie an dackte check date rememission leve constant 1975 occumented 19 34 enknown) under of piles per dag (her timete based on previous specieus) | Pesk D M | METRICS SELes 0 10 Attenuation accumed (s.g., bubble certain) | 0 N ⁰ N ¹ N ¹ Second second | | Step |

This slide illustrates the first two steps of the Impact Calculator Tab. Step 1 outlined in hot pink, where a user will enter qualitative project-specific information and Step 2 outlined in turquoise, where the user will enter quantitative project-specific information. We will go into more detail on both these steps in the next slides.



Step 1: General Project Information



| STEP 1: GENERAL PROJECT INFORM | MATION | | |
|--|---------------|---------------------------------|--------|
| PROJECT TITLE and CONTACT | Example title | Notes (Please include all assum | ptons) |
| PROJECT/SOURCE INFORMATION (size, type, number; pile strikes, etc.) | | other information | |

NOTE: Please include any assumptions, including if relying upon proxy sound levels.

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Step 1 in the Calculator Tab is where the user provides general project information, such as project title and contact; source information such as pile size material, strikes per pile; and any other assumptions or notes, including if proxy levels were used or if any type of attenuation is assumed.



Step 2: Quantitative Project-Specific Information

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

| STEP 2 GOAN THAT THE PRODECTS | | METRICS | |
|--|-------|--|---|
| | Peak | SELss | RMS |
| Unattenuated Single strike level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas) | | | |
| Attenuated Single strike level (dB)* (calculation done automatically) | 0 | 0 | 0 |
| Distance associated with single strike level (meters); Typically, 10-m but please double check data being used | 10 | 10 | 10 |
| Transmission loss constant (NMFS recommends: 15 if unknown) | 15 | | |
| Number of piles per day (best estimate based on previous experience) | | Attenuation assumed (e.g., bubble curtain) (enter positive number) | 0 |
| Number of strikes per pile (best estimate based on previous experience) | | | NMFS recommends 5 dB as default, if attenuation used |
| Number of strikes per day | 0 | | |
| Cumulative SEL at measured distance | #NUMI | | |
| | | | |

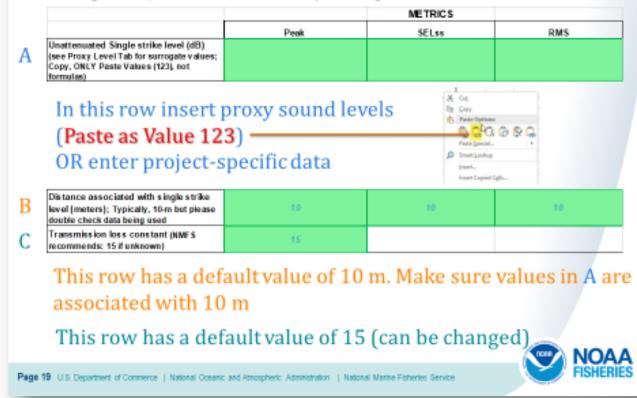
NOTE: Default values already included in *italic turquoise* (can be changed)

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Step 2 is where quantitative project-specific information is entered, such as levels, distance associated with level, transmission loss, number of piles per day, number of strikes per pile, and attenuation assumed. Default values (italics, turquoise) are provided for distance associated with level and transmission loss. Please confirm these defaults are applicable. If not, they may be modified. Gray cells represent automatically calculated values based on user provided information (and cannot be changed in Step 2). The next slides go into more detail on Step 2 inputs.



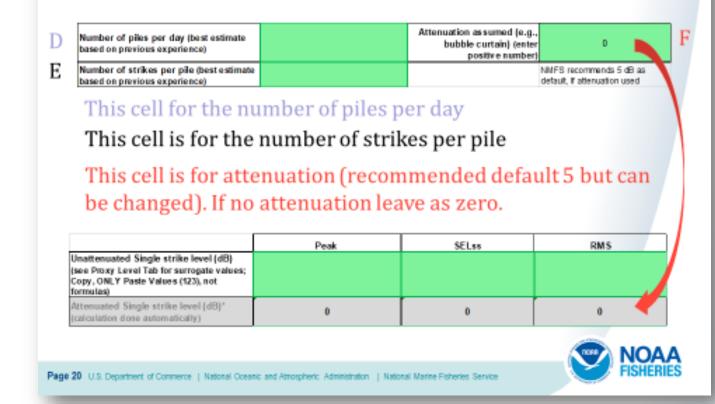
Step 2: Quantitative Project-Specific Information



Let's take a closer look at some of the specific cells in Step 2 (labeled by row letter). Row A represents the unattenuated levels in three various metrics (Peak, SEL_{ss}, and RMS). Here a user may enter project-specific levels, if available or enter surrogate levels from the Proxy Level Tab. If values are copied from the Proxy Level Tab, paste them in Row A as a value (see red arrow). Row B represents the distance associated with the previously entered levels. The default value is 10-m, but one should ensure this is correct. This value may be changed if the default is not correct. Row C represents transmission loss. The default value is 15 and is recommended if this value is unknown. If site-specific transmission loss is available, it may be used here instead of the default.



Step 2: Quantitative Project-Specific Information



Two additional rows are in Step 2. Cell D represents the number of piles per day based on best estimate from previous experience. Cell F represents attenuation, if being used. If it is unclear the appropriate decibel reduction associated with the attenuation method used, NMFS recommends a default of 5 dB. Please only enter positive numbers in this cell. If nothing is being used, please leave value as zero. Whatever attenuation is used will be reflected automatically in the attenuated levels (subtracted off levels entered on previous slide), as shown in the gray cells being illustrated by the red arrow. This will be illustrated further in the next slide. Finally, Cell E represents the number of strikes per pile based on best estimate from previous experience.



Step 2: Quantitative Project-Specific Information

| | | METRICS | |
|--|------|--|-------|
| | Peak | SELss | RMS |
| Unattenuated Single strike level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas) | 210 | 183 | 193 |
| Attenuated Single strike level (dB)* Lakulation done automatically) | 205 | 178 | 188 |
| Distance associated with single strike level (meters): Typically, 10-m but please double check data being used | 10 | 10 | 10 |
| Transmission loss constant (NMFS recommends: 15 if unknown) | 15 | | |
| Number of piles per day (best estimate based on previous experience) | | Attenuation assumed (e.g., bubble curtain) (enter positive number) | ر 🕑 ר |
| | | | |

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This illustrates all the green cells in Step 2. In this example, a bubble curtain is being used but attenuation is unknown. Thus, the NMFS suggested default value of 5 dB is being used (red circle; always enter a positive number). This attenuation is automatically subtracted from the unattenuated values entered previously, as illustrated in the gray cells. These attenuated values are used for calculating resulting isopleths, which will be illustrated next.



Step 2: Quantitative Project-Specific Information Fully entered values

| STEP 2: QUANTITATIVE PROJECT-SI | PECIFIC INFORMATION | | |
|--|---------------------|--|--|
| | | METRICS | |
| | Peak | SELss | RMS |
| Unattenuated Single strike level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas) | 210 | 183 | 193 |
| Attenuated Single strike level (dB)* (calculation done automatically) | 205 | 178 | 188 |
| Distance associated with single strike level (meters); Typically, 10-m but please double check data being used | 10 | 10 | 10 |
| Transmission loss constant (NMFS recommends: 15 if unknown) | 15 | | |
| Number of piles per day (best estimate based on previous experience) | 3 | Attenuation assumed (e.g., bubble curtain) (enter positive number) | 5 |
| Number of strikes per pile (best estimate based on previous experience) | 1000 | | NIVES recommends 5 dB as default, if attenuation used |
| Number of strikes per day | 3000 | | |
| Cumulative SEL at measured distance | 213 | | |
| | | | and the second s |

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This slide illustrates all the values entered in Step 2 for our specific example.



Resultant Isopleths (by taxa)

| PISHES | OWSET OF | PHISICAL | IN Shrachald | BERATION. | | | |
|----------------------------------|--|---------------------------|--|--|--|-------------|------|
| | Park (PR) | FRESHWAL | Theorem 1 and 1 | ELECTRON DE LE CARTERINE | | | |
| | Threehold Lift | Finh & A | Fished a | Threaded 1000 | | | |
| | 215 | 112 | | | | | |
| | 1 | 600 | 716 | 1445 | | | |
| haddler anneste fer degle skille | 81 - 198 - North and a summary of the same | ningang (Kilinakan Kalal) | • | | | | |
| STA TURILLS | Distance (motors) | an alteratural d | | 1 | | | |
| 240 199 1992 | PTS ORSET | 10.10222600 | BENATION | | | | |
| | Paul (PR) Threadadd (40) | DEL Thread-In the | BHI Threadedd 1891 | | | | |
| | IN INCOMENTATION OF THE OWNER OF T | and and a second state | 101 | | | | |
| | | | 21 | | | | |
| | • | - | | | | | |
| MAINE MANNALS | | Distance (metane) | to three hold | | | | |
| | | | PTS GESET | | | | |
| Rearing Group | LP Colonnas PTS Peak IPTI Threadadd 1000 | Threshold 1981 | BP Colourus PTS Pauli IPEI Threadald MBI | PW Final and PTS Peak IEEE Threadable MBI | WW Planny of PTS Peak INCI Threadedd 1484 | | |
| | 210 | 210 | 212 | 218 | 191 | | |
| | 1 | | | 1 | | | |
| | LF Coloress PTS SIS | HP Columna PTS | BF Column PTS | Por Pinniged PTS | AN Planty of PTS | | |
| I | The subsidie Light | SEL Threadedd Mill | SEL Threaded is 1411 | SEL Threehold MRI | 183 Threadadd 1481 | | |
| | 164 | | 1,901 | 515 | | | |
| | | | 4.000 | | - | | |
| | | | Marine Manu | nal Hearing Group | | | |
| | BEHAVIOR | | Low-despency (LF) | ortaorana bairea whaira ortaorana: dolphina, | | | |
| | UNS Threaded [db] | | | d whairs, bottlesses whairs | | | |
| | | | High-bequeuxy (HI) |) ortoceane: tetre delphian, orpheledgrachid; | | | |
| ALL MARINE MANIMALS | F18 | | Learnerflamhas crucier - | h L, autois | | | |
| | | | Phonid pinnipeds (P | | | | |
| | | | Conseq brands as it | PUT the loss and the reals | | | |
| | | | | | | | |
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| | | | | | | | IIAJ |
| LE Deserver de Comme | and the second concerns | and the sector to the | and the second sec | Under Chieven Court | | V 🥌 / HISH | ERIE |
| 1.5. Department, of Comm | erce National Uceanic | and Attrospheric: Adm | instation National | varine Hishenes, Servic | 0 | Ser . India | |

After quantitative project-specific information is entered in Step 2 of the Calculator, resultant isopleths (bright blue cells) are produced by taxa.



Resultant Isopleths (by taxa)



| RESULTANT ISOPLETHS! | ¹ Impulsive sounds have dual metric three | | | |
|---|--|-------------------|------------------|----------------|
| | Hetric producing largest isopleth should | the used. | | |
| FISHE S | | Distance (meters) | to threshold | |
| | ONSET OF | PHYSICAL | INJURY | BEHAVIOR |
| and the second se | Peak (PK) | SEL | Threshold (dB)** | RMS |
| | Threshold (dB) | Fish ≥ 2 g | Fish < 2 g | Threshold (dB) |
| | 206 | 187 | 183 | 150 |
| | 9 | 522 | 736 | 3415 |
| 1774 and 111 and 111 and 110 and 110 and 110 and 110 and 110 | 2 | | 736 | 341 |

**This calculation accounts for single strike SEL < 158 dB do not accountiate to cause injury (Effective Quiet).</p>

| SEA TURTLES | Distance (meters) | | |
|-------------|--------------------------|-----------------------------------|--------------------|
| | PTS ONSET | BEHAVIOR | |
| | Peak (PK) Threshold (dB) | SEL _{oue} Threshold (dB) | RMS Threshold (dB) |
| | 232 | 204 | 175 |
| | 0 | 38 | 74 |

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This slide illustrates the Resultant Isopleths (bright blue cells) for fishes and sea turtles based on the various taxa-specific acoustic thresholds.



Resultant Isopleths (by taxa) cont'd



"Impulsive sounds have dual metri othresholds for injury (SEL_{con} & PK). Metric producing largest isoplath should be used.

| MARINE MAMMULS | | Distance (meters) | to threshold | | |
|--------------------|---|--|--|---|---|
| | | | PTS ON SET | | |
| Hearing Group | LF Cetacean PTS Peak (PR) Threshold (dB) | MF Cetaceae Peak (PN) Threshold (dB) | HF Cetaoran PT S Peak (PN) Threshold (dB) | PW Proviped PTS Peak (PK) Thresheld (dB) | OW Pinniped PTS Peak (PK) Threshold (dB) |
| | 219 | 239 | 202 | 215 | 212 |
| | 4 | 0 | | 4 | |
| | LP Cetatoren PT 5 SELaam Threshold (d.B) | MF Cetecean PT 5 SELaw Threshold (dB) | HF Cetace an PT 5 SELam Threshold (45) | FW Pinniped PT 5-St Law Threshold (dB) | OW Planiped PTS-SCLear Threshold (d3) |
| | 143 | 185 | 155 | 186 | 203 |
| | 964 | 34 | 1,148 | 616 | 38 |
| | | | | | |
| | BEHAMOR | | | | |
| | RMS Threshold (dB) | | | | |
| | 190 | | | | |
| ALL MARINE MAMMALS | 736 | | | | |



This slide illustrates the Resultant Isopleths (bright blue cells) for marine mammals based on the various hearing group-specific acoustic thresholds.





Let's demonstrate the Impact pile driving Report Tab. This Tab can be accessed using the toolbar found at the bottom of the Tool.



Report Tab: Impact

of OTHER INFO or NOTES and out-off, please probable to be mattern elsewhered

OTHER INFO

NOTES

Attenuette

BEHAVIOR

h agéada

H15

PMPinniged QMPinnigeda

10

Summarizes user inputs and resulting isopleths

PRINT IN LANDSCRIPE TO CAPTURE ENTIRE SCREEN.

EM5

NULRY In ealers

Fabric 2 g

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IF Colsciences

1.140

MPACT PILE DRIVING REPORT

PEAK.

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15

ONSETOF

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SEA TURILLES

MARINE MAANAN S

LF Cotecnes

ALL MM

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DUE SEAL

医脑静脉 法没有

Peak leopisth Silling leopisth PMS leopisth

MC Calaborates

10

PTS ONSET

PROJECT INFORMATION.

Transmission loss constant Number of piles per day

Number of strikes per pile. Number of strikes per day

vel immers/

changed Single strike level (d.)

Distance essectated with single strike.

Canadative SEL at received distance RESULTANT ISOPLETHS

SOPLE HS (motors)

ISOR FTHS (make

PTS OVSET (Post is uploth, motors PTS OVSET (SEL_{con} is uploth, motors

Belayior (RMS is spleth, motor



Fits on one sheet (landscape)

 If other info/notes get cut off, please include elsewhere





The Report Tab summarizes the inputs and outputs provided in the Calculator Tab. The information in this Tab is designed to fit in a single sheet (landscape view). If other information or notes get cut-off from the what was provided in the Calculator Tab, please provide this information elsewhere.



Test Drive/Demo: Updated Tool

Examples:

A. Impact pile driving

 36" steel pipe, 3 piles, 1000 strikes/pile, with bubble curtain

B. Vibratory pile driving

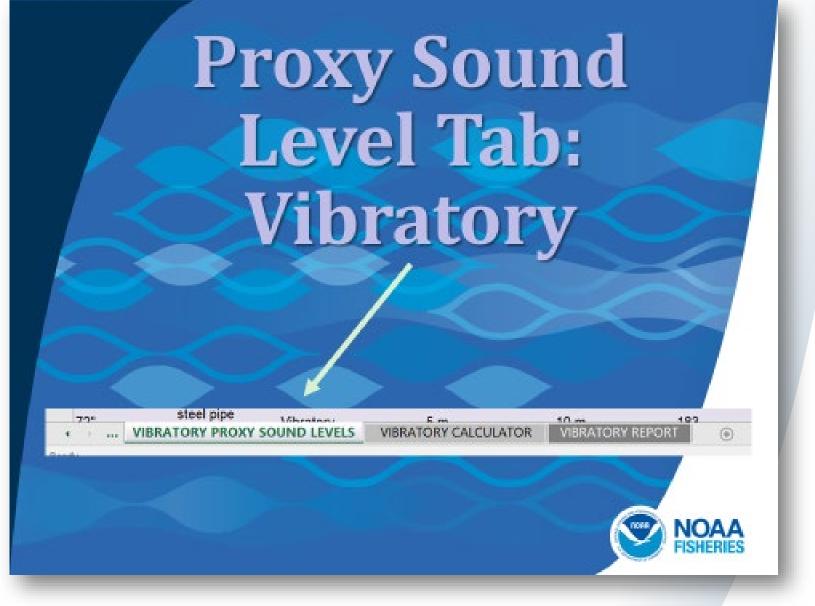
o 36" steel pipe, 3 piles, 30 minutes





Now, I will begin our second example: Vibratory pile driving (36" steel pipe pile, 3 piles per day, and time to drive a pile is 30 minutes)





Let's demonstrate the Proxy Sound Level Tab for vibratory pile driving. This Tab can be accessed using the toolbar found at the bottom of the Tool.



Proxy Sound Level Tab: Vibratory

- 1. Tab is sortable
- 2. Note: Pile size, Material, Water depth, & Comments
- 3. If exact pile size/material is not listed: Consult NMFS or use next largest size
- 4. Copy from Tab & then paste directly in Calculator Tab (paste as Value 123)

NOTE: Measurement Distance from Pile if not 10 m, then value will need to be updated in Calculator Tab



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Note the various assumptions listed at the top of this Tab. This Tab is sortable by various pile features (size, material, etc.). Note complete row of information provided for each pile, including water depth, location, reference, and comments. Please pick the proxy that is most applicable to your activity. If the exact pile size or material is not listed, consult NMFS or use next largest size. Copy the information from this Tab and then paste directly in the corresponding Calculator Tab (paste as a Value, 123). Note: If measurement distance from pile is not 10 m, then this value will need to be updated in Calculator Tab. If you have specific information on sound levels for your pile size/material, then it is not necessary to rely on a proxy.



Proxy Sound Level Tab: Vibratory

To use this Tab, it makes sense to sort data by appropriate <u>pile size</u> and <u>pile material</u>

VIBRATORY PILE DRIVING ROXY SOUND LEVELS (JNATTENUATED)

How to Use Proze Levels (NO 12 Data can be sorted)

1) When selecting the appropriate proxy levels, be sure to this who account the Pile size. Pile Material, Water depth (of installation), and the Comments column (if more information is needed, HMPS suggest con 2) If the exact pile material can be not here, consult WMC or use the next largest size pile of the same material for a conservative estimate

4) To use surport evel. Copy from this 1 and they Paste in Calculator (CMLY paste as a Value (123), not formulas. NOTE: Pay attention to Column E (measurement distance from pile). If it is not 10-m, piles if there is the specifications that result in the largest isopleths 0.m. impact, largest skie, steel pile).

| Pile Size (inches) | Pile Material | Hammer Type | Water Depth | Measurement Distance from Piler | Part (cfb) | RMS (48) | Reference | Project/Lecation | - Nobe | |
|-----------------------|-----------------------------|---------------|-------------|------------------------------------|------------|----------|-----------------|------------------|--------------------|--|
| 12" | steel Miple | Vibratory . | 45.00 | 10.00 | 705 | 150 | Calibrate 2015 | NA. | Genetic example | |
| 12" | steel pipe | Werstory | -45 mi | 10 m | 171 | 152 | California 2015 | NA. | Generic example | |
| 38" | stivel pipe (hoted) | Veralory | 6 m | 10 m | -165 | 170 | Calibans 2015 | RA. | Oeneric example | |
| 34" | AZ steel sheet (typical) | Veralley | 15 m | 10 m | .178 | 160 | Caltrans 2016 | NA. | Generic example | |
| in . | AZ steel sheet | A Revenue of | 45.00 | 44.00 | | +64 | Andrews Caller | | Presente promotion | |
| 1 K | MINOT CALCULATOR | IMPACT REPORT | VIBUATORY | PROOF SOUND LEVELS | VERATORY | CALC | 8 1 - | | | |

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To use the Proxy Sound Level Tab, it makes sense to sort data by appropriate pile size (hot pink arrow) and pile material (turquoise arrow).



Proxy Sound Level Tab: Vibratory

| 36" pile | Steel pipe |
|--|--|
| ↓ Sort A to Z | 1 Sort A to Z |
| Sgrt Z to A | ▲ Sort Z to A Sort In Color |
| Sort by Color • | Sort by Color • |
| Quar Filter From "Ple Size" Filter by Color | The by Color |
| Text Elters + 2 | Test Ethen |
| Search P | Search C |
| - 24" A | Gelect All |
| 24" AZ | Sector Se |
| · · · · · · · · · · · · · · · · · · · | |
| | |

Here is a closer look at sorting columns, specifically Column A for pile size and Column B for pile material. In this example, we are interested in available data for 36" steel pipe piles. Since this is a more a generic assessment, we will choose steel pipe "typical" vs. "loudest."

P



Proxy Sound Level Tab: Impact Results of Sort



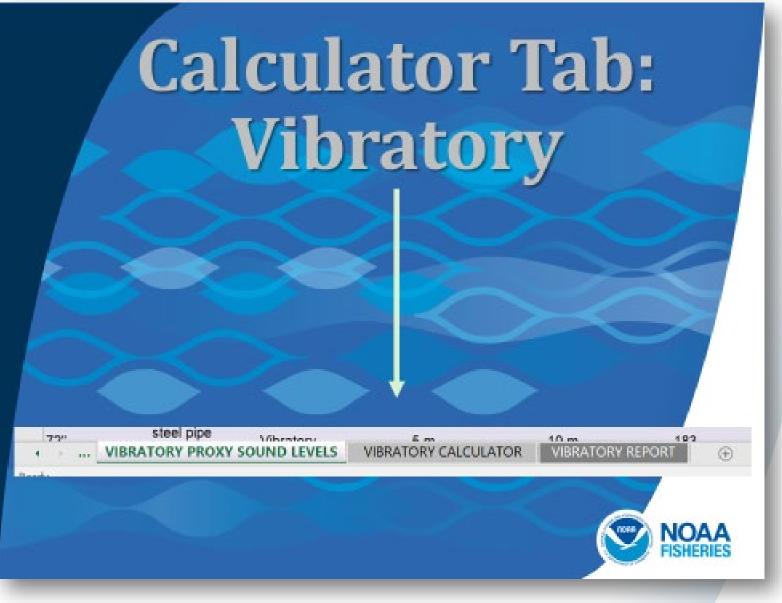
| Pile Size | Pile Material | ar Hammer Type | Water Dept | Measurement Distance from Pile* | Peek 🙀 | RMS 💡 | Reference | * |
|-----------|-------------------------|----------------|------------|------------------------------------|--------|-------|---------------|---|
| 36* | steel pipe (typical) | Vibratory | 5 m | 10 m | 180 | 170 | Caltrans 2015 | |

- Red box indicates proxy sound levels for 36" steel pipe pile
- 2. Check water depth & other factors (location, notes)
- 3. For this example: There is only one value provided
- 4. Copy only RMS value for this row (Don't need Peak!)

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Once data are sorted (by pile size and material), one potential choices for proxy levels is provided (see red box). Since this is the only choice, it used as the appropriate proxy level. Once chosen, copy values in only the RMS metric for this proxy (Peak is provided but not needed, which is why this column has gray text). Note: Pay attention to the measurement distance from the pile if it is anything other than 10 m.





Let's take a look at the Calculator Tab for vibratory pile driving. This Tab can be accessed using the toolbar found at the bottom of the Tool.



Calculator Tab: Vibratory

KEY

User Provided Information

Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.

OUTPUT: Resultant Isopleth (cannot be altered by user)

Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user



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This slide illustrates the Key at the top of the Calculator Tab. Green cells are for user provided information. Note that default values are in bold italics turquoise font. These default values may be changed by the user if project-specific information is available. Yellow cells represent preset NMFS provided information and cannot be altered by the user. NMFS thresholds/default weighting values are in bold red. Bright blue cells represent outputs of the Tool or resultant isopleths based on user provided information and cannot be altered by the user. Finally, gray cells represent automatically calculated values based on user provided information (only weighting adjustment (-dB) values can be altered by the user and are found in the last row of the Tool). Please see Advanced Features later in this presentation for more information on adjusting these values.



Calculator Tab: Vibratory

| STEP 1: GENERAL PROJECT INFORM | ALION | | | |
|---|------------------|--|--|--------|
| NO JECT TITLE and CONTACT | Casangko Alda | | Notes-place include all assum | Step 1 |
| RD JECT/SOURCE INFORMATION (arm.) adealal, number, duration to drive plie. 40.) | | | eans information | |
| | | | | |
| STEP 2: QUANTITATIVE PROJECT-S | CETIC MPORMATION | | \ | |
| | METRIC | | | |
| 1 secSD. = RAS Anatternanted Sound Pressure Level dB) (see Woop Level Tableto surrogate silver: Copy046.2' Paste Velues (103), not consum | MMIS (NOT Peak) | Sea Turtle Default WFA | (WFA in H1z) Marine Mannual Detaut WFA (kHa) | Step 2 |
| itternuzted Sound Pressure Level (dB)* calculation done automatically) | 9 | 0.15 | 2.5 | |
| Setance acception with council recours level measurement (metero); 'princily, 10-m but please double check sit bring und | | | | |
| constni esion kess constant (NMP s economendo : 15 il unknown) | 16 | | | |
| tamber of piles per day (textertmate used on previous experience) | | Atternation (e.g., bubble curtain) genter poetive number | 0 | |
| Denetice to drive a single pile (minutes) peet estimate based on previous a parteros) | | | | |
| | | | | |

This slide illustrates the first two steps of the Vibratory Calculator Tab. Step 1 outlined in hot pink, where a user will enter qualitative project-specific information and Step 2 outlined in turquoise, where the user will enter quantitative project-specific information. We will go into more detail on both these steps in the next slides.



Step 1: General Project Information



| STEP | 1: GENERAL PROJECT INFOR | MATION | | |
|-------|--|---------------|---------------------------------|----------|
| PROJE | CT TITLE and CONTACT | Exomple title | Notes (Please include all assur | nptions) |
| | CT/SOURCE INFORMATION (size, amber, pile strikes, etc.) | | other information | |
| | OTTEN | 1 1 | 1 12 26 1 | |

NOTE: Please include any assumptions, including if relying upon proxy sound levels.

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Step 1 in the Calculator Tab is where the user provides general project information, such as project title and contact; source information such as pile size material, duration to drive a pile; and any other assumptions or notes, including if proxy levels were used or if any type of attenuation is assumed.



Step 2: Quantitative Project-Specific Information

| | METRIC | | |
|---|--------|--|------------------------------------|
| 1 sec SEL = RMS | RMS | WEIGHTING | (WFA in kHz) |
| Unattenuated Sound Pressure Level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas) | | Sea Turtle Default WFA (kitz) | Marine Mammal Default WF. (kHz) |
| Attenuated Sound Pressure Level (dB)* (calculation done automatically) | 0 | 0.16 | 2.5 |
| Distance associated with sound | | | |
| pressure level measurement (meters); Typically, 10-m but please double check data being used | 70 | | |
| Transmission loss constant (NMFS recommends: 15 if unknown) | 15 | | |
| Number of piles per day (best estimate based on previous experience) | | Attenuation (e.g., bubble curtain) (enter positive number) | 0 |
| Duration to drive a single pile (minutes) (best estimate based on previous experience) | | | |
| Duration of Sound Production within a day (seconds) | 0 | Cumulative SEL at measured distance (dB) | #NUM |
| 10 Log (duration of sound production) | #NUM! | | |

NOTE: Default values already included in *italic turquoise* (can be changed)

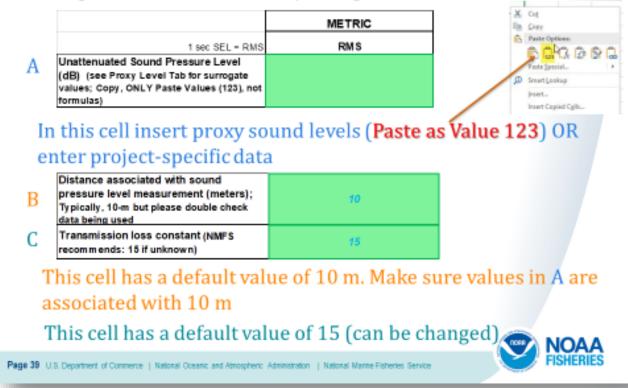
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Step 2 is where quantitative project-specific information is entered, such as levels, distance associated with level, transmission loss, number of piles per day, duration to drive a pile, and attenuation assumed. Default values (italics, turquoise) are provided for distance associated with level and transmission loss. Please confirm these defaults are applicable. If not, they may be modified. Gray cells represent automatically calculated values based on user provided information (and cannot be changed in Step 2). The next slides go into more detail on Step 2 inputs.



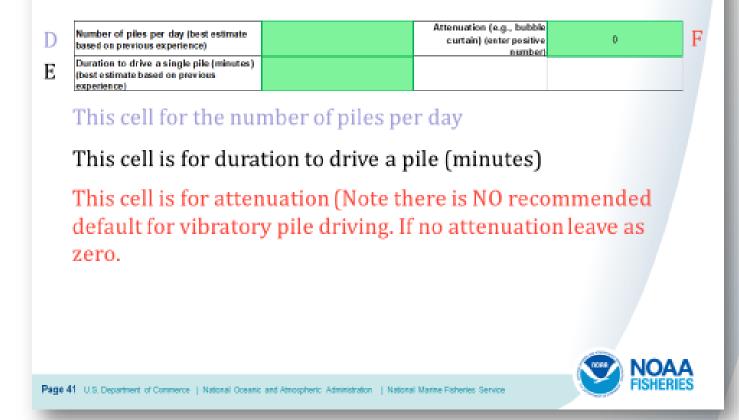


Step 2: Quantitative Project-Specific Information



Let's take a closer look at some of the specific cells in Step 2 (labeled by row letter). Row A represents the unattenuated levels in the RMS metric. Here a user may enter project-specific level, if available or enter surrogate level from the Proxy Level Tab. If a value is copied from the Proxy Level Tab, paste it in Row A as a value (see red arrow). Row B represents the distance associated with the previously entered level. The default value is 10-m, but one should ensure this is correct. This value may be changed if the default is not correct. Row C represents transmission loss. The default value is 15 and is recommended if this value is unknown. If site-specific transmission loss is available, it may be used here instead of the default.

Step 2: Quantitative Project-Specific Information



Two additional rows are in Step 2. Cell D represents the number of piles per day based on best estimate from previous experience. Cell F represents attenuation, if being used. Please only enter positive numbers in this cell. If nothing is being used, please leave value as zero. Whatever attenuation is used will be reflected automatically in the attenuated levels (subtracted off levels entered on previous slide). Finally, Cell E represents the duration to drive a pile (minutes) based on best estimate from previous experience.

Calculator Tab: Impact

Step 2: Quantitative Project-Specific Information Fully entered values

| | METRIC | | |
|--|--------|---|------------------------------------|
| 1 sec SEL = RMS | RMS | WEIGHTING | (WFA in kHz) |
| Jnattenuated Sound Pressure Level dB) (see Proxy Level Tab for surrogate ratues; Copy, ONLY Paste Values (123), not formulas) | 170 | Sea Turtle Default WFA (kHz) | Marine Mammal Default WFA (kHz) |
| Attenuated Sound Pressure Level (dB) ^e calculation done automatically) | 170 | 0.16 | 2.5 |
| Distance associated with sound pressure level measurement (meters); Typically, 10-m but please double check lata being used | 10 | | |
| Fransmission loss constant (NMFS ecommends: 15 if unknown) | 15 | | |
| Number of piles per day (best estimate pased on previous experience) | 3 | Attenuation (e.g., bubble curtain) (enterpositive number) | 0 |
| Duration to drive a single pile (minutes) best estimate based on previous experience) | 30 | | |
| Duration of Sound Production within a day (seconds) | 5400 | Cumulative SEL at measured distance (dB) | 207.32 |
| 10 Log (duration of sound production) | 37.32 | | |

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This slide illustrates all the values entered in Step 2 for our specific example. Note in this example, there is no attenuation (0), so the unattenuated and attenuated RMS level is identical (170 dB).



Resultant Isopleths (by taxa)

| RESULTANT ISOPLETHS | | | | | |
|--|---------------------------------------|---------------------------------------|---|---------------------------|---------------------------------------|
| FISHES | tance (meters) to thresh | old | | | |
| far vite stary pile driving, and the basis of the former of the second stary of the se | BEHAVIOR | | | | |
| | RMS Threshold (dB) | | | | |
| | 150 | | | | |
| | 28 | | | | |
| | | | | | |
| SEA TUBILES | Distance (meters) PTS ONSET | BEHAVIOR | | | |
| SEA TURILES | PTS UNSET | | | | |
| | 1.485 | RMS Threshold (dB) | | | |
| | 224 | 175 | | | |
| | 1 | 5 | | | |
| | | | | | |
| MARINE MAMMALS | | Dist | ance (meters) to three | hald | |
| | | | PTS ONSET | | |
| Hearing Group | LF Cetaceas PTS SEL Threshold (dB) | MF Catacase PTS SEL Threehold (dB) | NF Cotocese PTS SEL Theorhold (dB) | PW Pissiped PTS 901 | OW Pissiped PTS SEL Threshold (dB) |
| | 199 | 198 | 113 | 201 | 819 |
| | 96 | 8 | 59 | 22 | 2 |
| | | | | | |
| | BEHAVIOR | | Marine Manunal | | |
| | RMS Threehold (dB) | | Low-frequency (LF) cet Mid-frequency (MF) cet | | |
| | 120 | | toothed wholes, bested with High-frequency (HIP) or | hales, bottlesione wholes | |
| ALL MARINE MAMMALO | 21,344 | | prospoinen, Kigit, sitter dolp | shine, explosioshynethid. | |
| | | | Laportyniai carige & L Physid pinnineds (PW) | | |
| VEIGHTING FUNCTION CALC | ULATIONS | | Otarial pinnipeds (0%) | | |
| A COMPANY OF A REAL PROPERTY OF A COMPANY | NAMES OF TAXABLE PARTY. | | | | |

After quantitative project-specific information is entered in Step 2 of the Calculator, resultant isopleths (bright blue cells) are produced by taxa.



Calculator Tab: Impact

Resultant Isopleths (by taxa)



| FISHES | Distance (meters) to threshold | | |
|--|---|--------------------|-----|
| For vibratory pile driving, only behavioral thresholds exist for fishes | BEHAVIOR | | |
| | RMS Threshold (dB) | | |
| 3 | 150 | | |
| | 215 | | |
| | | | |
| | Distance (meters) | to threshold | 1 |
| SEA TURTLES | PTS ONSET | BEHAVIOR | |
| | PTS SEL _{com} Threshold (dB) | RMS Threshold (dB) | |
| | 220 | 175 | |
| A STATE OF THE OWNER | 1 | 5 | V. |
| | | | 10 |
| U.S. Department of Commerce National Oceanic and Atr | rospheric Administration National Marine Fisheries Se | enice 💽 Fl | SHI |
| | | | |

This slide illustrates the Resultant Isopleths (bright blue cells) for fishes and sea turtles based on the various taxa-specific acoustic thresholds.



Calculator Tab: Impact

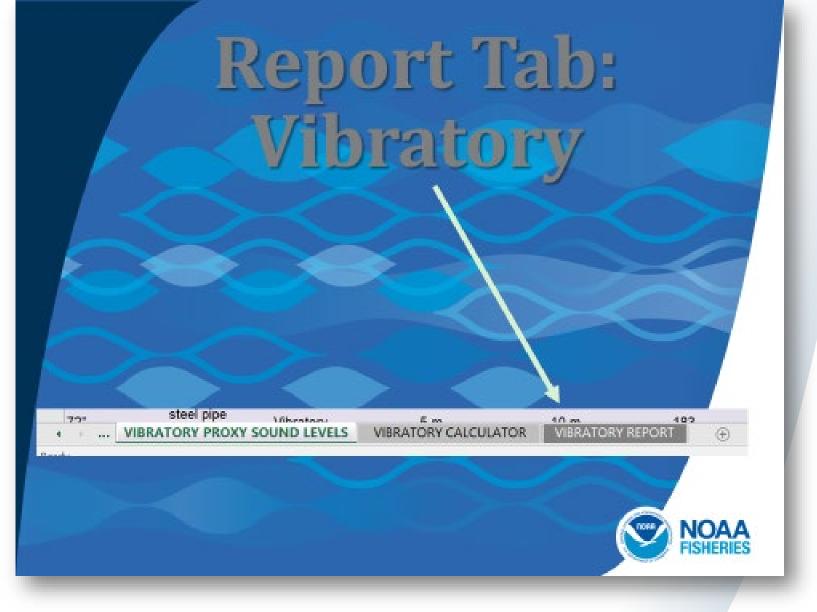
Resultant Isopleths (by taxa) cont'd



| MARINE MAMMALS | | | istance (meters) to threahol | d | |
|-------------------------------------|--|---|--|--|--------------------------|
| | | | PTSONSET | | |
| Hearing Group | LF Cetacean PTS SELoan Threshold (46) | MF Cotacean PTS SELam Threshold (dB) | HF Cetacean PT 5 SEL _{am} Threshold (dB) | PW Pinniped PTS SEL _{con} Threshold (dB) | OW Pleniped PT 5 SEL |
| | 199 | 198 | 173 | 201 | 219 |
| | 26 | а | 53 | 22 | 2 |
| | | | | | |
| | BEHAVIOR | | | | |
| | RMS Threshold (dB) | | | | |
| | 129 | | | | |
| ALL MARINE MAMMALS | 21,564 | | | | |
| | | | | | - |
| Page 45 U.S. Department of Commerce | National Oceanic and Atnosph | veric Administration Nation | al Marine Fisheries Service | | NOAA FISHERIES |

This slide illustrates the Resultant Isopleths (bright blue cells) for marine mammals based on the various hearing group-specific acoustic thresholds.



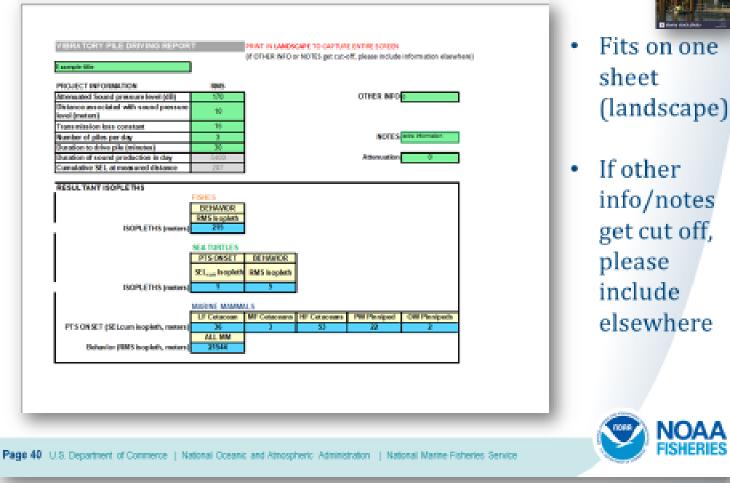


Let's demonstrate the Vibratory pile driving Report Tab. This Tab can be accessed using the toolbar found at the bottom of the Tool.



Report Tab: Vibratory

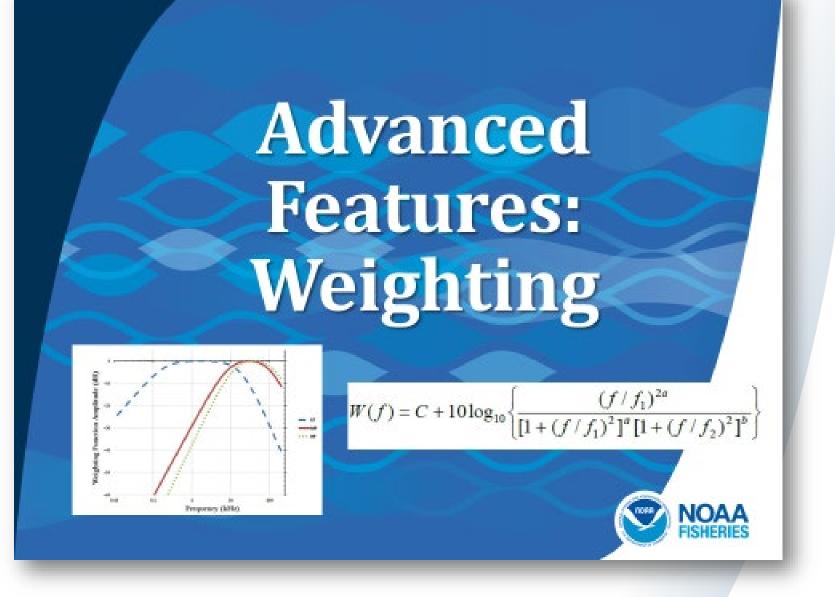
Summarizes user inputs and resulting isopleths



The Report Tab summarizes the inputs and outputs provided in the Calculator Tab. The information in this Tab is designed to fit in a single sheet (landscape view). If other information or notes get cut-off from the what was provided in the Calculator Tab, please provide this information elsewhere.







The final slides cover an advanced feature, specifically incorporating weighting based on the pile driving spectrum, if available. This feature is optional.



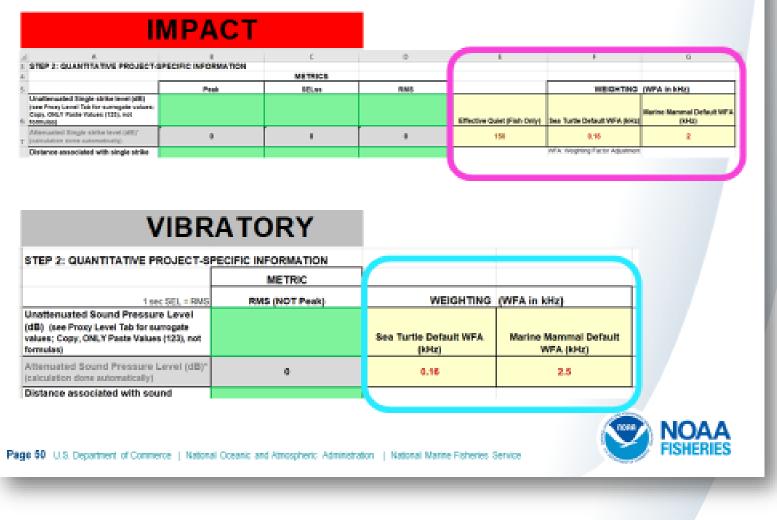
Tool automatically provided default weighting for PTS threshold (SEL_{cum} metric) for **marine mammals & sea turtles** (none for **fishes**)

| | WEIGHTING | (WFA in kHz) |
|--|---|------------------------------------|
| IMPACT | | Marine Mammal Default WFA |
| | 0.16 | 2 |
| | WEIGHTING | |
| | WEIGHTING | (WFA in kHz) |
| VIBRATORY | Sea Turtle Default WFA (kHz) | Marine Mammal Default WF/ (kHz) |
| | 0.16 | 2.5 |
| Page 42 U.S. Department of Commerce National Oceanic and Atmospheric A | dministration National Marine Fisheries Service | . 🔊 🕅 |

This Tool automatically provides default weighting for PTS thresholds in the SEL_{cum} metric for both marine mammals and sea turtles. Note auditory weighting functions are not available for fishes. These defaults are illustrated in the yellow boxes and bold red text on this slide and within the Tool on the Calculator Tabs. Note that they are different for marine mammals depending on whether the activity is impact or vibratory pile driving.

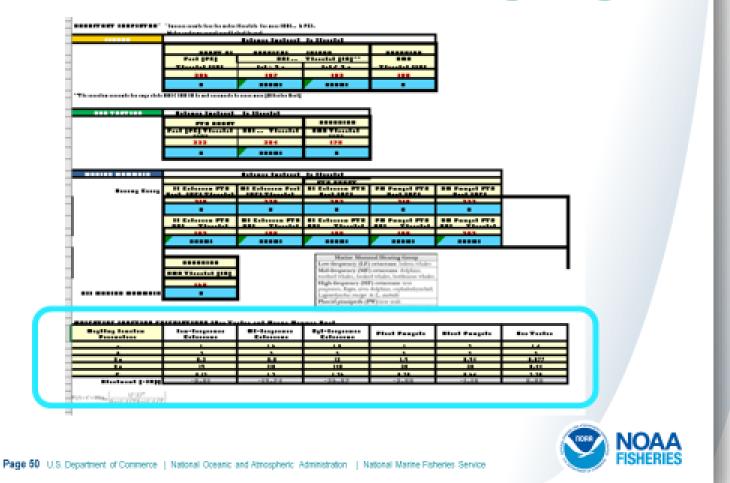


RIES



This slide simply illustrates that the default weighting is provided in Step 2 of both the Impact (outlined in hot pink) and Vibratory (outlined in turquoise) Calculator tabs.





If a spectrum is available for your particular pile size, material, and location. Default weighting may be adjusted at the bottom of the Calculator Tab, as illustrated by the turquoise box. For pile driving, it is particularly important to pay attention if the spectrum available is for an attenuated or an unattenuated pile and that the available spectrum matches your particular activity. Note, NMFS cautions using spectrum associated with bubble curtains, unless the exact same bubble curtain/settings is proposed for the specific project. The user should also note if a spectrum is being used and the associated details in Step 1.



However, if the spectrum is available for the pile material/size, then these data can be used to override default weighting via gray cells below:

| Weighting Function Parameters | Los-Frequency Cetaceans | Mid-Frequency Cataceans | High-Frequency Cetaceans | Phonid Pinnipeds | Otariki Pimipede | Sea Turties |
|-------------------------------|-------------------------|-------------------------|--------------------------|------------------|------------------|-------------|
| 1 | 1 | 1.6 | 1.2 | 1 | 2 | 14 |
| 6 | 1 | 1 | 2 | 2 | 2 | 2 |
| | 0.2 | 8.9 | 12 | 19 | 0.94 | 0.077 |
| <u> </u> | 0.13 | 12 | 1.30 | 0.75 | 0.04 | 5.95 |
| Adjustment (-d51 | -6.01 | -19.34 | -66.87 | -2.01 | -1.15 | 0.00 |
| Continue 2 | .2 (SPECTRU | UM (MULTIP | LE FREOUEN | (CIES) TO OV | ERRIDE WE | IGHTING |

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Spectrum data would be specifically entered in the gray cells, as illustrated by the red arrow. Inputs should always be negative numbers and are based on the difference between the unweighted SEL level and the marine mammal or sea turtle weighting function. For specific instructions on how to override default weighting, please see the Manual for the Optional User Spreadsheet Tool (marine mammals) found at the web site on this slide.



SHEHIES

Thanks for Viewing!



Thanks for viewing this presentation. If you have technical questions or suggestions to improve this Tool, please feel free to contact the person listed on this slide or if you have project-specific questions, please contact your Headquarter or Regional analyst.