

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:**



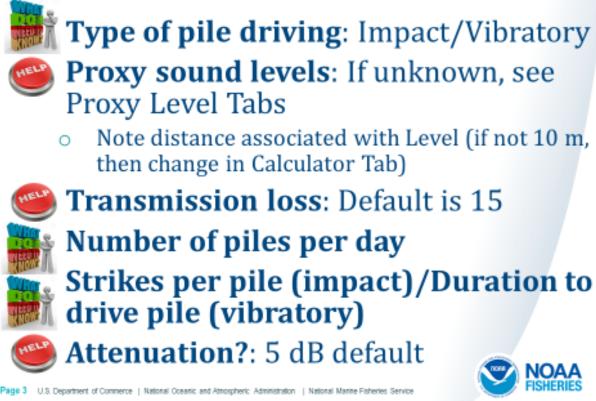
NOTE: Different Regions may have different requirements, please check with the appropriate Regional/HQ staff before using this tool.

 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

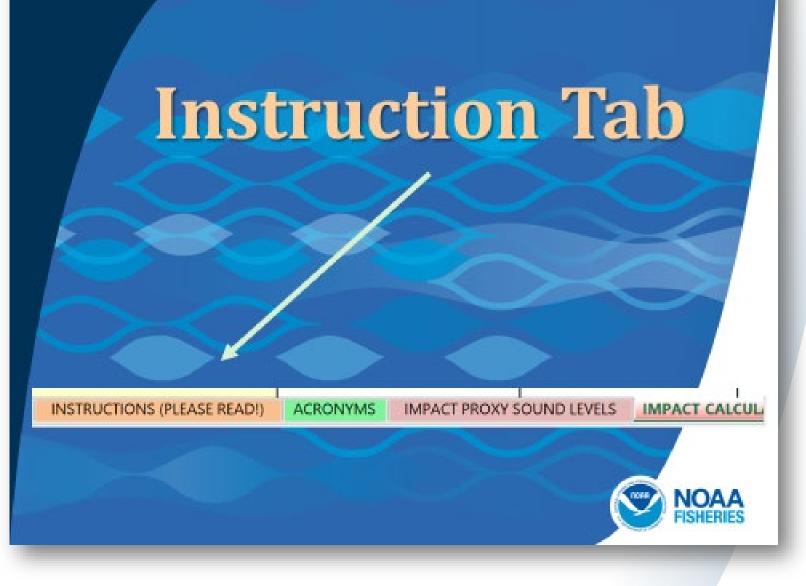
Before you start, there are a few items of note, including that different Regions may have different requirements, please check with the appropriate Regional/HQ staff before using this tool. 1) This Tool was primarily designed for coastal pile driving activities, 2) Reading the Instruction Tab is recommended, 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**



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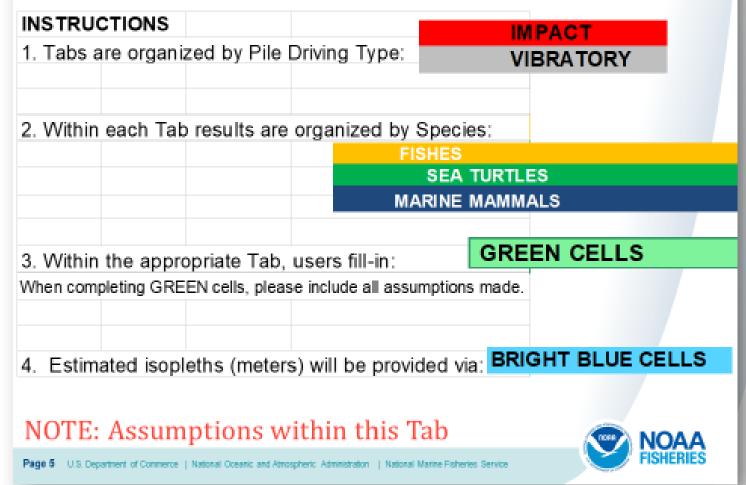
There are some basic pieces of information needed to use this Tool. First, one must know what type of pile driving activity they are doing, either impact or vibratory. Proxy sound levels are also needed, but if unknown, NMFS provides help by the Tool having a Tab with surrogate levels. Note: Most proxy 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.

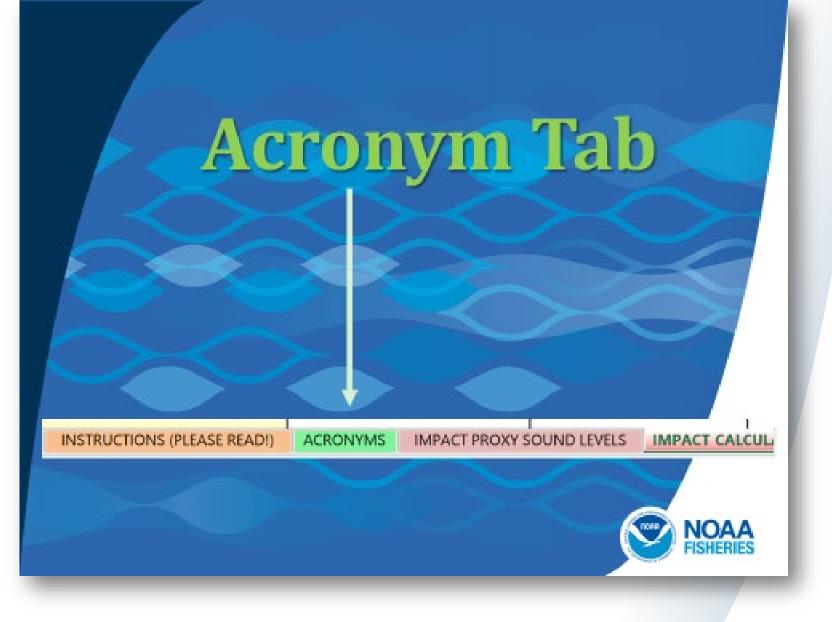






The Instruction Tab provides instructions and a general overview of other tabs within the Tool. Tabs are organized by pile driving type: either impact (red) or vibratory (gray). Within each Tab, results are organized by species (fishes, sea turtles, or marine mammals). Within each Tab, the user provides 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	<b>Fisheries H</b>	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

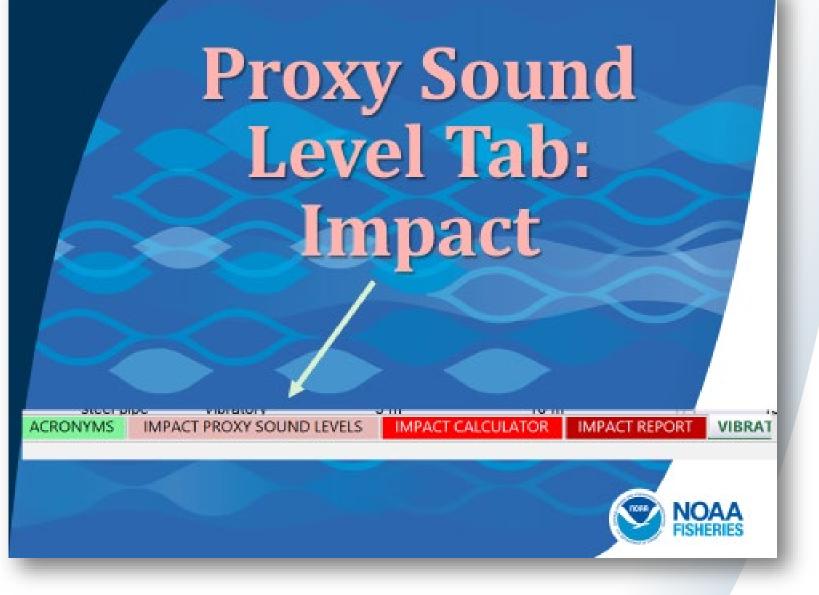
- 36" steel pipe, 3 piles, 1000 strikes/pile, with bubble curtain
- B. Vibratory pile driving
  - o 36" steel pipe, 3 piles, 30 minutes





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



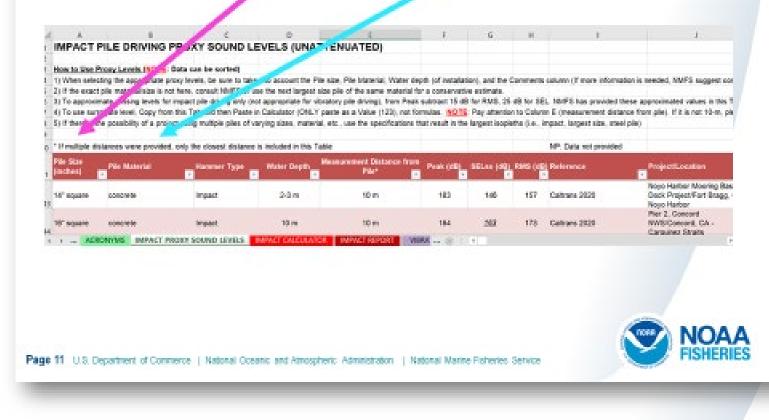
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Note the various assumptions listed at the top of this Tab. This Tab is sortable by various pile features (size, material, etc.). Note the complete row of information provided for each pile, including water depth, location, reference, and comments. 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

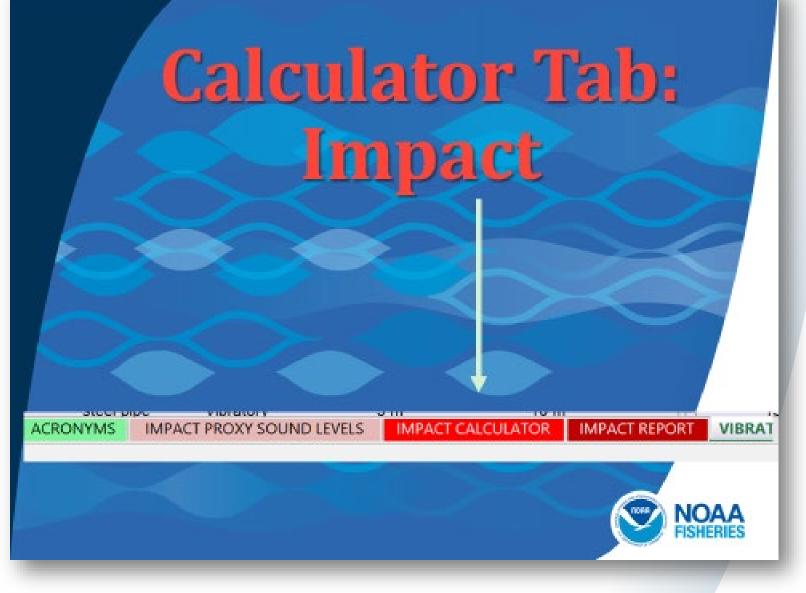
- Red box indicates proxy sound levels for 36" steel pipe pile
- 2. Check water depth & other factors (location, notes)
- For this example: All three choices are generic examples (no specified location)
- 4. Will choose 3<sup>rd</sup> row choice, since depth unknown
  - Copy values of all 3 metrics (Peak, SEL<sub>ss</sub>, & 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 3<sup>rd</sup> row as the most appropriate proxy level. Once chosen, copy values in all three metrics (Peak, SEL<sub>ss</sub>, 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.



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ROJECT TITLE and CONTACT					Step
					occp
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			andere gestander fan		
ROJECT/SOURCE					
FORMATION (size, meterial,					
unders, pile strikes, sto.)					
				<u> </u>	
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TEP 2: QUANTITATIVE PROJ	ECT-SPECIFIC INFO	RMATION			
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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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wattenwated Single stribe level 48) (see Proop Level Teb day proopsis address Capy, ORLT Parts day (103), and dawader) treasanted Single perits level 48)" (coloristic days 1976-1 addressed with pagts risk land (actors); Typicalis, th	Pesk D	METRICS SEL::	•	-	Step
nottennoted Single stelle level 45) (see Prome Level Tek das rengels velvar, Capy, GHLT Parts das (131), and generaled treasmeted Single strike level 18)" (setentarian dass 18540), billocosted with Inegle ricks level (meters); Tasisaile, th but ple are duckle check data renemicsion loss constant HMS recommender (6 21 subment)	Pesk D M	METRICS SEL::	•		Step
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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



<b>STEP 1: GENERAL PROJECT INFORM</b>	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		

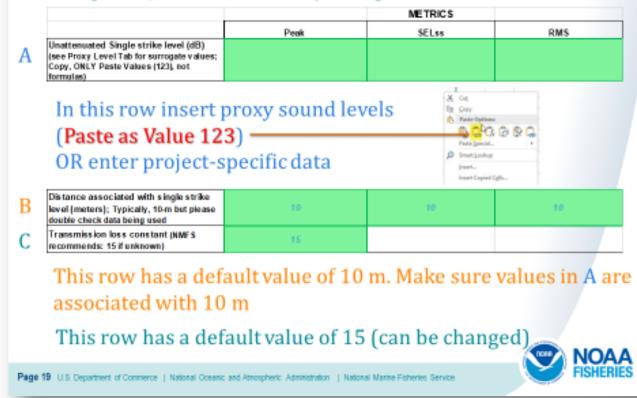
# NOTE: Default values already included in *italic turquoise* (can be changed)

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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.



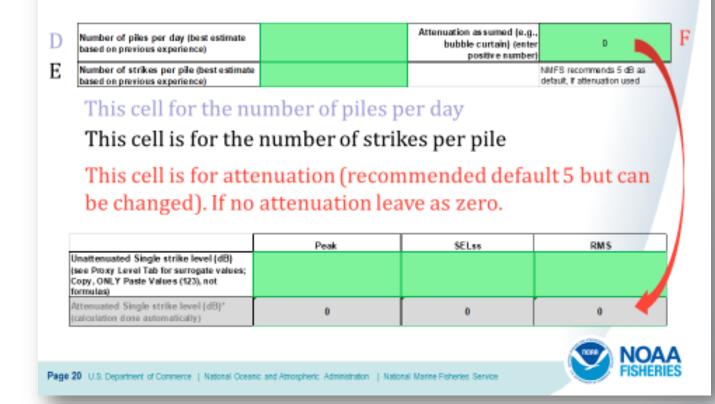
#### Step 2: Quantitative Project-Specific Information



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<sub>ss</sub>, 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.			
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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		
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			Marine Manu	nal Hearing Group			
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			High-bequeuxy (HI)	) ortoceane: tetre delphian, orpheledgrachid;			
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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!	<sup>1</sup> 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 <sub>oue</sub> 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<sub>con</sub> & 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.

181

15

ONSETOF

kopieta

SEA TURILLES

MARINE MAANAN S

LF Cotecnes

ALL MM

Siles.

110

101

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<sub>con</sub> 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

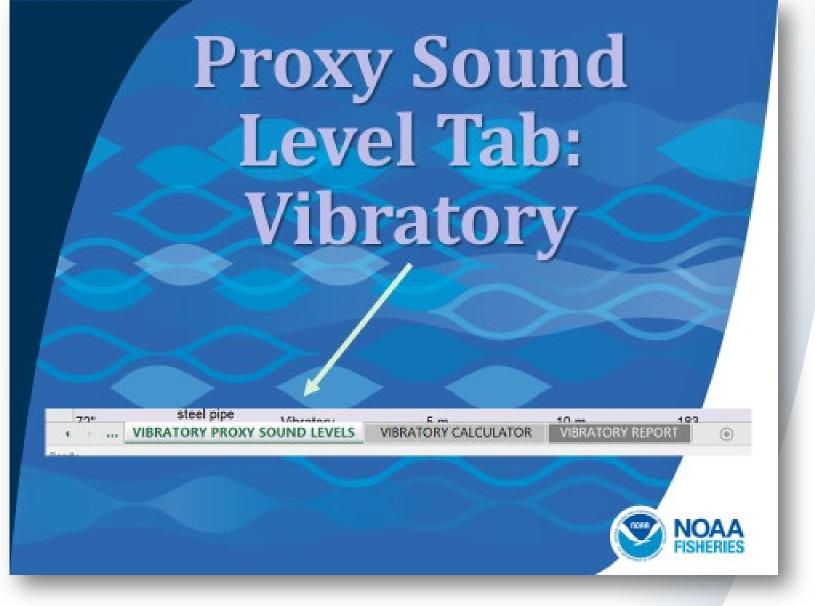
o 36" steel pipe, 3 piles, 30 minutes





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



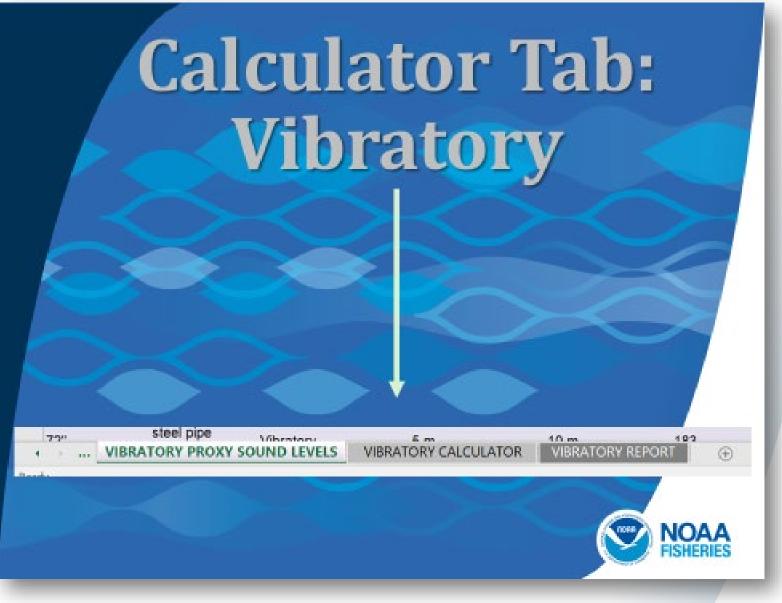
Pile Size	Pile Material	ar Hammer Type	Water Dept	Measurement Distance from Pile*	Peek 🙀	RMS 💡	Reference	*
36*	steel pipe (typical)	Vibratory	5 m	10 m	180	170	Caltrans 2015	

- 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)

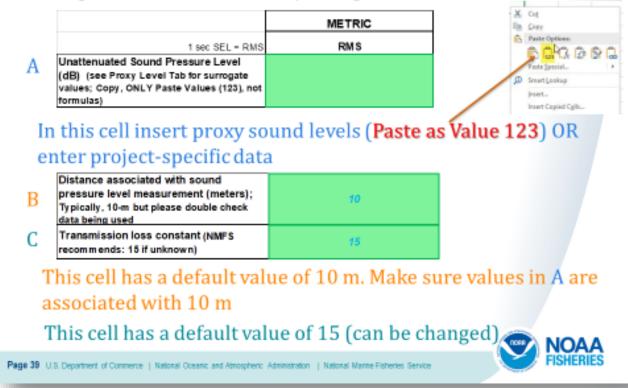
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Step 2 is where quantitative project-specific information is entered, such as levels, distance associated with level, transmission loss, number of piles per day, duration to drive a pile, and attenuation assumed. Default values (italics, turquoise) 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.



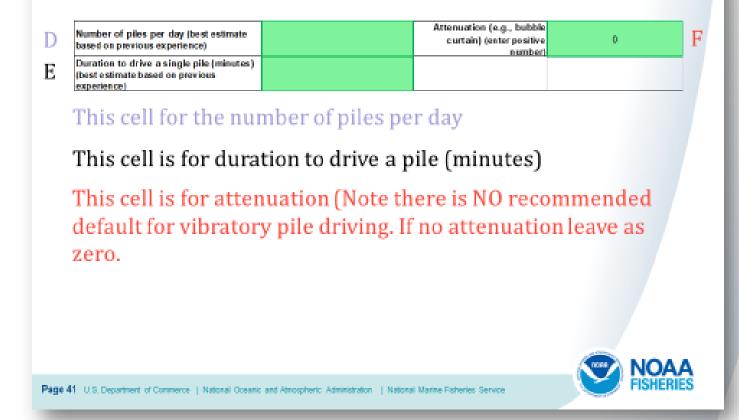


#### Step 2: Quantitative Project-Specific Information



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) <sup>e</sup> 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 <sub>com</sub> 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**

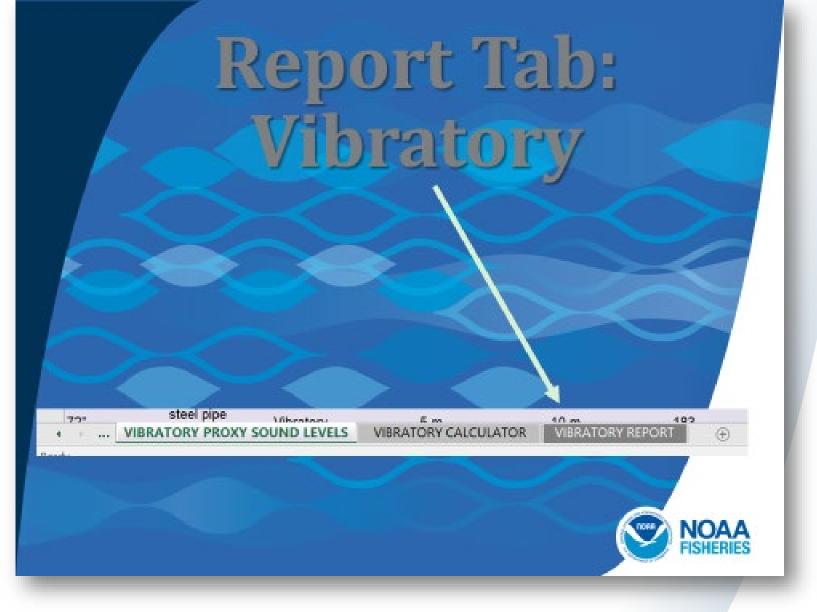
Resultant Isopleths (by taxa) cont'd



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 <sub>am</sub> Threshold (dB)	PW Pinniped PTS SEL <sub>con</sub> 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				
					-
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This slide illustrates the Resultant Isopleths (bright blue cells) for marine mammals based on the various hearing group-specific acoustic thresholds.



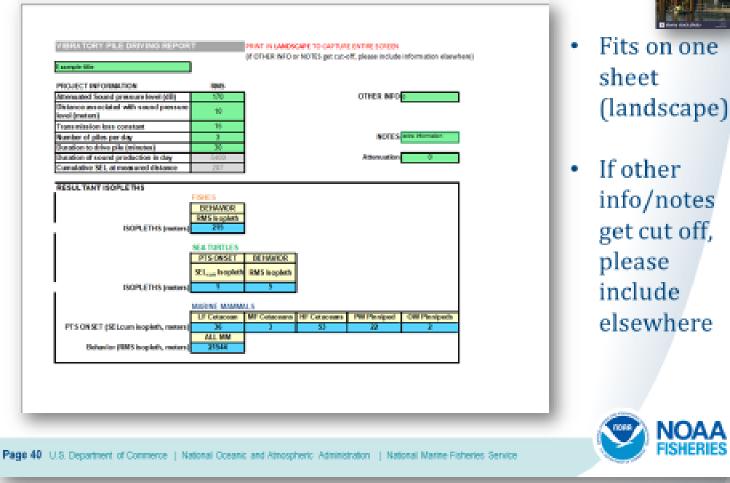


Let's demonstrate the Vibratory pile driving Report Tab. This Tab can be accessed using the toolbar found at the bottom of the Tool.



# **Report Tab: Vibratory**

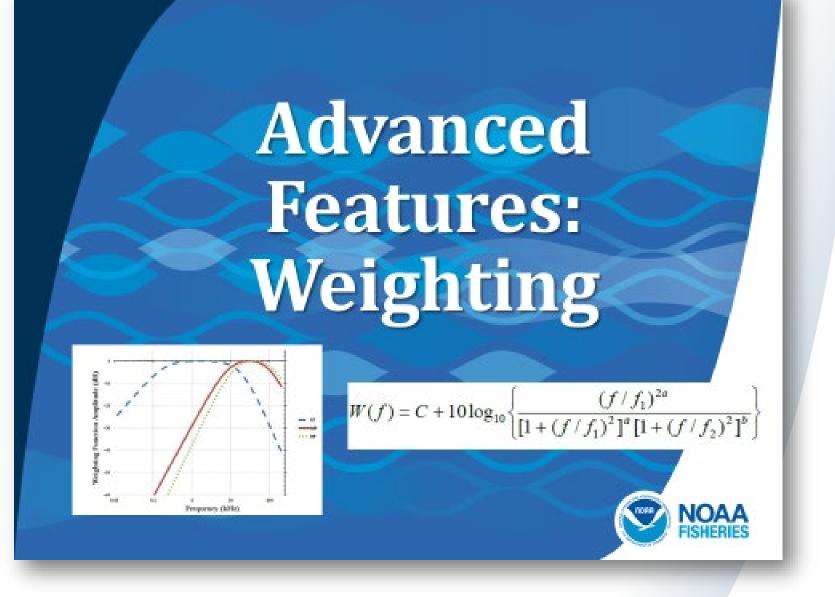
#### Summarizes user inputs and resulting isopleths



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.



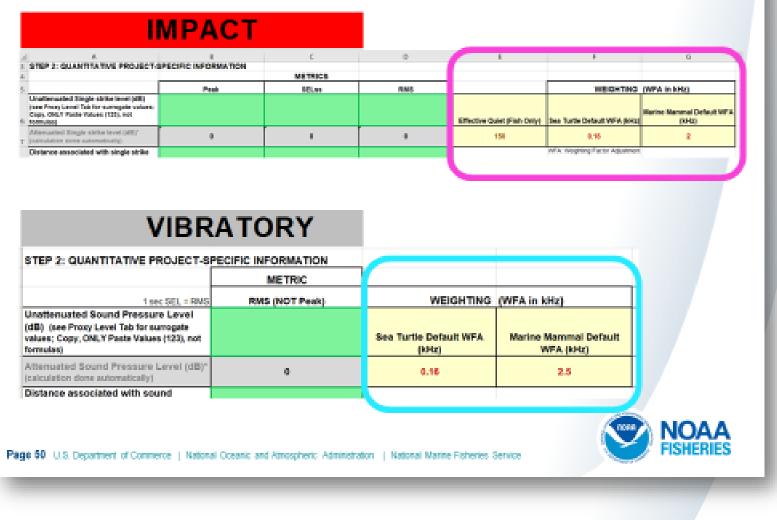
Tool automatically provided default weighting for PTS threshold (SEL<sub>cum</sub> metric) for **marine mammals & sea turtles** (none for **fishes**)

	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.

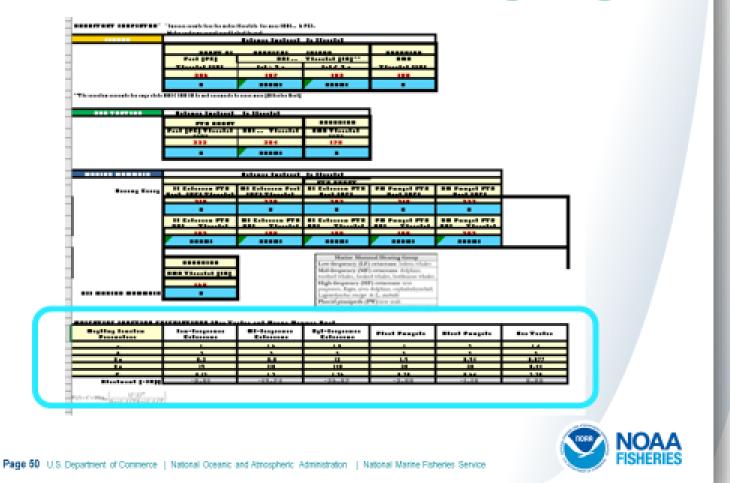


RIES



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	<b>ERRIDE WE</b>	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.