

NGSS & Common Core Standards	Lesson Title	Materials
<ul style="list-style-type: none"> <li>• <b>SL.8.4:</b> Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence and sound valid reasoning.</li> <li>• <b>MP.2:</b> Reason abstractly and quantitatively.</li> <li>• <b>SC.5.N.2.1-</b> Recognize and explain that science is grounded in empirical observations that are testable; explanations must always be linked with evidence.</li> <li>• <b>MS.PS.3.1:</b> Construct and interpret graphical displays of data to describe relationships.</li> <li>• <b>SC.5.L.17.1</b> - Compare and contrast different ways animals can communicate and what factors could influence their ability to communicate effectively.</li> </ul>	<h2 style="text-align: center;">MAKING MUSIC WITH MARINE MAMMALS</h2>	<ul style="list-style-type: none"> <li>• Notepad and pencil</li> <li>• Ability to view Powerpoint</li> <li>• Headphones</li> <li>• YouTube</li> <li>• The ability to to play music (speakers, stereo, etc.)</li> <li>• Microphone for audio recording</li> <li>• Flipgrid WinS Topic page               <ul style="list-style-type: none"> <li>• Ability to download audio clips from the dolphin spectrograms</li> <li>• <a href="https://flipgrid.com/winstem">https://flipgrid.com/winstem</a></li> </ul> </li> <li>• <a href="https://listeningtowaves.com/sound-exploration">https://listeningtowaves.com/sound-exploration</a></li> </ul>
<h3 style="text-align: center;">Vocabulary</h3>	<h3 style="text-align: center;">Warmup Questions</h3>	
<ul style="list-style-type: none"> <li>• <b>Hydrophones;</b></li> <li>• <b>Environmental Monitoring; P.A.L.S.;</b></li> <li>• <b>Signature Whistle;</b></li> <li>• <b>Acoustic Monitoring;</b></li> <li>• <b>Cetaceans; Citizen Science;</b></li> <li>• <b>Anthropogenic Sound;</b></li> <li>• <b>Spectrogram; Noise Pollution</b></li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Why</b> do you think animals sing or talk to each other?</li> <li>2. <b>What</b> do you think they're saying to each other?</li> <li>3. <b>How</b> do scientists study animal communications? <b>What</b> tools do you think they use?</li> <li>4. <b>What</b> can scientists learn from studying animal calls and communications?</li> <li>5. <b>What</b> animals have you heard "singing?" Make a list below:</li> </ol>	

Activity Instructions	
<p><b>1. Recognizing which individual dolphin has which signature whistle is an important part of Dr. Katie McHugh's research. Help Katie match the dolphin with their signature whistle:</b></p> <ol style="list-style-type: none"> <li><b>1. Let's learn how to see sound! Go to the Women in STEM Flipgrid Topic page at <a href="https://flipgrid.com/winstem">https://flipgrid.com/winstem</a> and listen to the mother-calf whistle exchange. Can you tell when the sounds are high and low based on the shape of the spectrogram? (Fig.1)</b></li> <li><b>2. Now that you can match sounds to spectrograms, test your skills! Listen to three dolphin audio recordings and match them to the signature whistle spectrogram. (Fig.2)</b></li> </ol> <p><b>2. Now that you're an expert at listening to dolphin signature whistles, it's time to make your own! Go to the website, <i>Listening to Waves</i>, scroll down to the bottom of the webpage and create your own signature whistle using their <i>spectrogram</i>.</b></p> <ol style="list-style-type: none"> <li><b>1. <a href="https://listeningtowaves.com/sound-exploration">https://listeningtowaves.com/sound-exploration</a></b></li> <li><b>2. A <i>spectrogram</i> allows you to see all the frequencies that combine to produce a sound.</b></li> </ol> <p><b>3. Record another signature whistle, but this time have music playing in the background. Make observations about how well you could hear your signature whistle over the background music.</b></p> <ol style="list-style-type: none"> <li><b>1. Is it hard to hear your signature whistle over the background noise? Did the website pick up more of the background noise or more of your signature whistle?</b></li> <li><b>2. Now try this experiment again, but this time gradually turn up the music while you continue to call your signature whistle. What did you notice?</b></li> </ol>	
What did we learn?	Why am I learning this?
<p><b>Animal Communication:</b></p> <ul style="list-style-type: none"> <li>A signature whistle is a learned, individually distinctive whistle in a bottlenose dolphin's acoustic repertoire that gives the identity of the whistle owner.</li> <li>The whistles are identified and studied in the wild or in human care by researchers using hydrophones.</li> <li>Cetaceans in particular, appear to "sing" together, matching one another's tempo and producing calls in-sync, to foster cooperation and social dynamics.</li> </ul>	<ul style="list-style-type: none"> <li><b>Discover</b> how the world around you works.</li> <li>Provide <b>inspiration</b> for a career in science.</li> <li><b>Compare</b> the requirements of STEM professions.</li> <li><b>Understand</b> you could be the next scientist to solve unknowns!</li> </ul>
	<p><b>Share Your Skills</b></p> <ul style="list-style-type: none"> <li><b>Share</b> with a friend or family member what you learned about animal communication, what they're saying when they sing, and some of the challenges they face because the more we share, the more we care! <b>Show</b> your friends and family the dolphin images and spectrograms on the WinS Flipgrid Topic page.</li> <li><b>Connect</b> with us on Flipgrid (<a href="https://flipgrid.com/seatrek">https://flipgrid.com/seatrek</a>) to share your findings or submit any questions! Share with us your signature whistles!</li> </ul>

**Real world applications?**

1. Now that you understand the importance of animal communication, explain a “signature whistle.” What is a comparable feature to humans?
2. Why is a dolphin having a “name” such a unique adaptation? How does it help contribute to their social dynamics?
3. What is a Passive Acoustic Listening Station?
  1. What is the importance of P.A.L.S.?
  2. How can background noise interfere with the P.A.L.S. data?
  3. How can background noise interfere with the dolphins communicating?
  4. What are scientists, like Dr. Katie McHugh, learning from using them?
4. What do you think might interfere with animals communicating? How can you help?

**Observation Notes**

**FREE ZOOM WEBINAR**

# WOMEN IN STEM

PROGRAM FOR 5TH-9TH GRADES



**25-FEB-21** ► **DR. KATIE McHUGH**  
MAKING MUSIC WITH MARINE MAMMALS

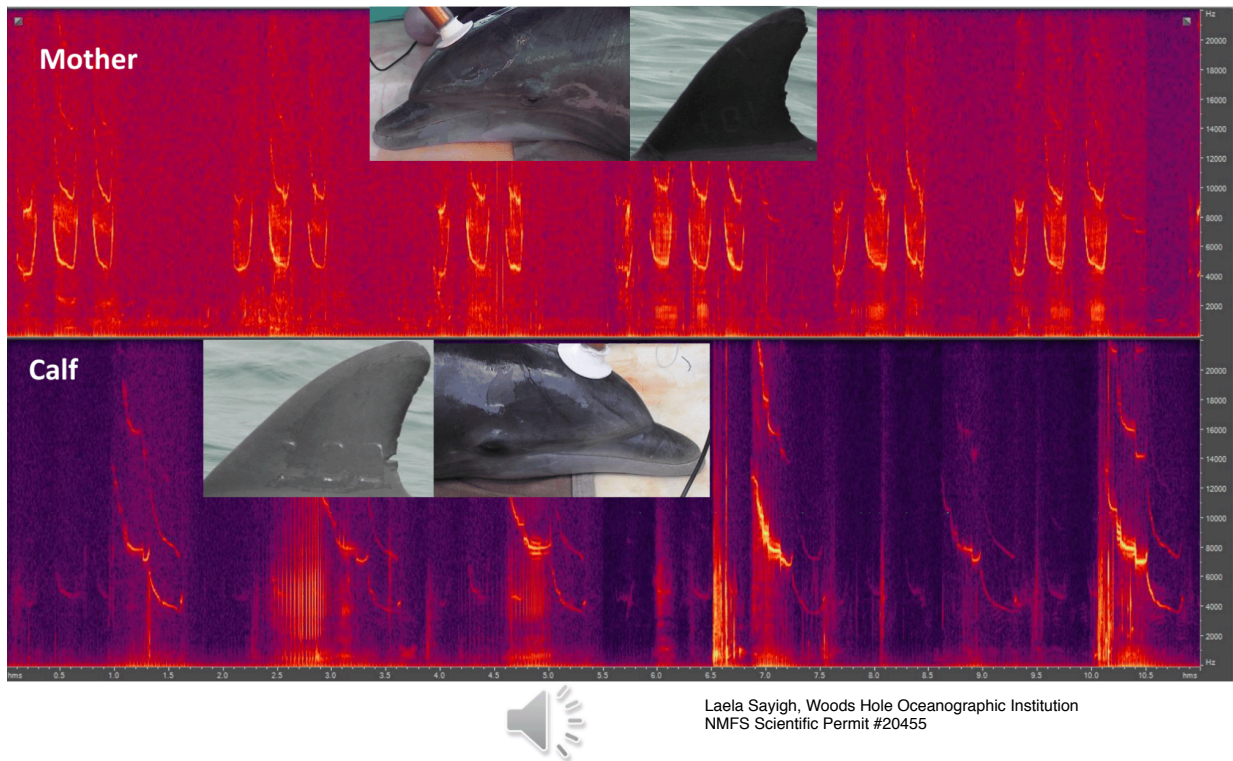
**Chicago Zoological Society**  
*Sarasota Dolphin Research Program*

**MOTE** MARINE LABORATORY  
& AQUARIUM

**MOTE.ORG/EVENTS/DETAILS/WINS**  
FUNDING PROVIDED BY MOTE SCIENTIFIC FOUNDATION

Te:

## Mother-calf whistle exchange Mother F181 (29 yrs) and Calf F230 (2 yrs), recorded in 2004

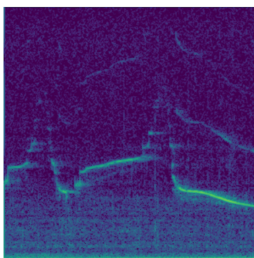


Above: Fig. 1 // Below Fig. 2

Austin Anderson, New College of Florida  
Laela Sayigh, Woods Hole Oceanographic Institution  
NMFS Scientific Permit #20455

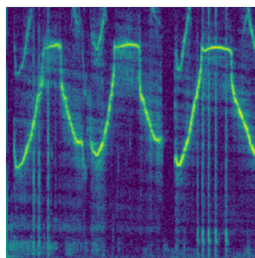
## Match the Sounds to the Spectrograms

A



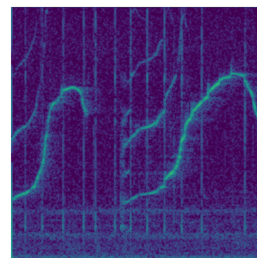
1

B



2

C



3