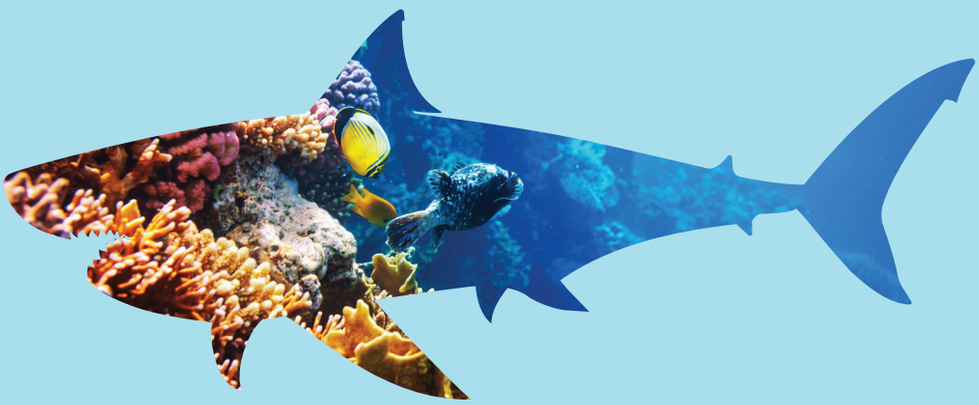
Hot Science

Rethink the Shark



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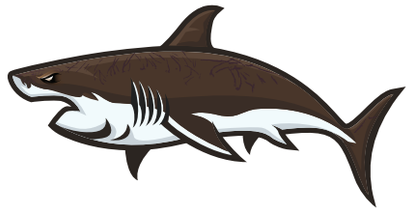


About Sharks

Sharks are always on the move in the vast oceans. To study these enigmatic creatures, Dr. Greg Stunz and his team use satellites to track each time a shark surfaces. Once equipped with the tags, information on the animal's location is shared with satellites orbiting thousands of miles above Earth. But how exactly do these trackers work? One technique that scientists can use to track an animal's position from space uses a phenomenon known as the Doppler Effect.

Your Challenge

Recreate the Doppler Effect and discover how shark tracking works! On your phone or tablet, go to the following link:

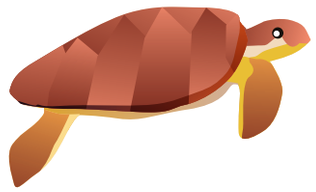
https://youtu.be/Bh2YppyFY3E

Play the video. Make sure your sound is on relatively high. At ear level, quickly spin your phone in a circle as shown:

1 Do you notice a change in the sound while you spin the phone?

Now, try spinning the phone very slowly. What happens?

The pitch is changing! This is not because of the position of the noise. You're experiencing the Doppler Effect! It's a result of the phone's motion.

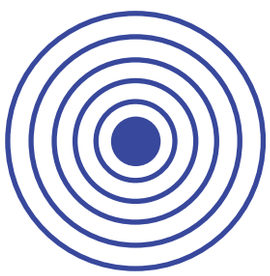


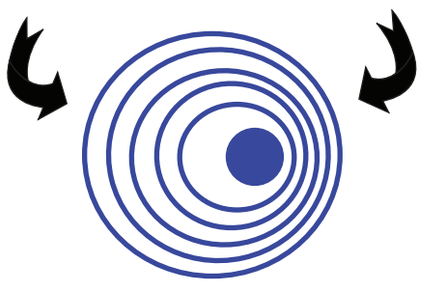
Doppler Effect

What is the Doppler Effect?

Waves more spread out = Lower Frequency

Waves bunched up = higher frequency





When something emitting waves, such as the sound waves from your cell phone, is not moving, the waves are the same distance apart, or frequency, in all directions. Like ripples in a pond, as shown in the image above.

When the object producing the sound waves is moving, the waves on the side of the object's direction bunch up and become a higher frequency. At the same time the waves on the opposite side become more spaced out or a lower frequency.

In soundwaves, a higher frequency means we hear a higher pitch and a lower frequency means we hear a lower pitch. This is why the pitch of the noise was changing as you spun it around. The sound was a higher frequency when the phone was traveling towards your ear and a lower frequency when it was traveling away from your ear! This is illustrated by the drawing of sound waves in the diagram next page:

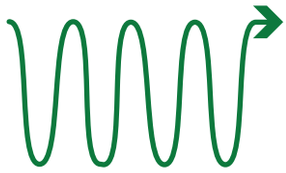
Shark Tracking

So how does this tell scientists where a shark is? Well, the tracking tags placed on the shark emit a signal, a wave with a known frequency. This signal is received by the satellite. Depending on the satellite's position, the signal received will appear different when the satellite is moving closer to or further away from the shark.

Satellite in orbit moving towards shark

As the satellite approaches the location of the shark, the wave emitted by the shark's tracker becomes scrunched. The frequency appears higher than the original frequency.

Original soundwave



Soundwave reflected from shark's tracker is higher in frequency than the original frequency

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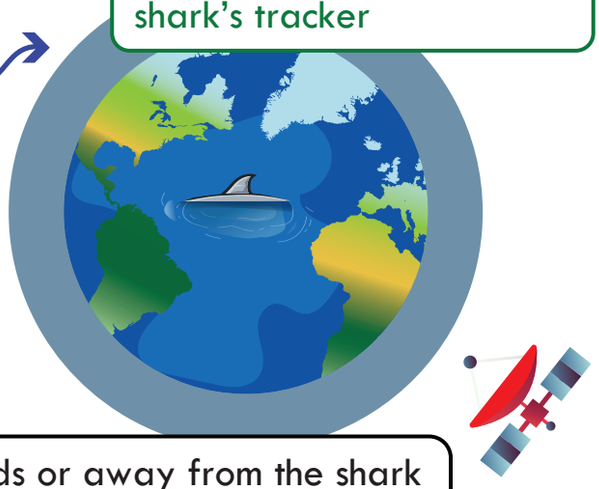
Shark Tracking

Original soundwave

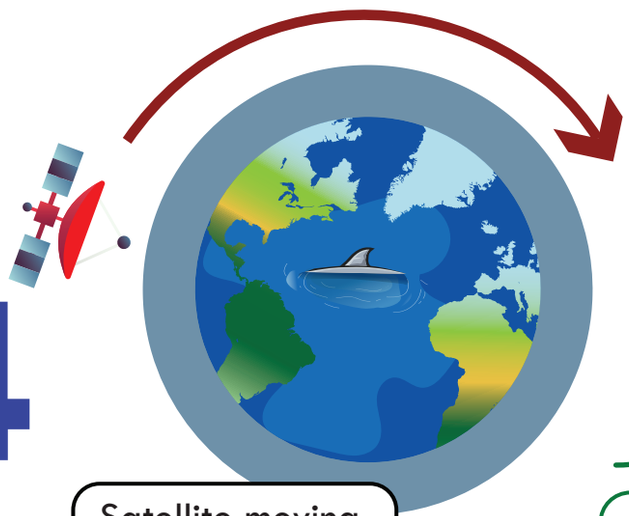
Soundwave reflected from shark's tracker

When the satellite is in the same location as the shark, the frequency is the same. The satellite in orbit is at the closest point to the shark.



Satellite is not moving towards or away from the shark

When the satellite is moving away from the shark, the wave appears stretched out. This frequency is lower than the original frequency



Satellite moving away from shark

Original soundwave

Reflected frequency is lower than the original frequency

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Shark Tracking

By comparing the received frequency to the original frequency, scientists collect data that provides clues to the shark's location. Combined with computer software and some additional calculations, this data allows scientists to track sharks across the entire ocean!

Now that you know how the tracking tags work, go track some sharks by following the link.

https://www.ocearch.org/tracker/

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TEKS used in this activity
Mathematics, Grade 6: 1A; 1D; 1G
Science, Grade 6: 2A, 2E
Science, Grade 8: 8C
Physics, High School: 8D