Go With the Flow
Docent Presentation 2: Penguin Feather

Intro for Presenter
This presentation uses the fictional, but not impossible, story of a penguin feather being found by a beach clean up crew in San Francisco to introduce the concept of deep thermal ocean currents and to model using real scientific data to make a prediction. You will set up the story of the penguin feather and encourage initial predictions. Next, you will introduce the concept of thermally driven ocean currents with a demonstration. Using the ocean conveyor belt data set, and the wind-driven currents data set, visitors will refine their predictions. Finally, a possible path for the penguin feather will be revealed.

Learning Objectives
- Visitors will understand that some ocean currents are caused by temperature differences
- Visitors will use thermal and wind-driven ocean currents datasets on the SOS to determine whether or not the penguin feather could have reached California.

Estimated Time
20 minutes

Playlist
- *Penguin Feather: Title*
- *Penguin Feather: Introduction PIP*
- *Penguin Feather: Convection Currents*
- *Penguin Feather: Surface Currents*
- *Penguin Feather: All Currents*
- *Penguin Feather: Feathers and Both Currents*
- *Global Circulation*
- *Go With the Flow: Credits*

Acknowledgement:
Adpated from material original originally appearing in Halverson, C., Beals, K. and Strang, C. (2001) *Ocean Currents: Marine Science Activities for Grades 5-8.* The Lawrence Hall of Scence, University of California, Berkeley.

Hands-on Demonstration:
Materials Needed:
- A table near the SOS with a table lamp or some sort of directed light source to highlight the surface of the table.
- Clear plastic or glass pan or bin

- Water to fill pan 3-4 full
- Two vials of food coloring in different colors
- 1-2 rock “islands” to fit in the pan, or upside down cups
- A cup of ice

Setting Up:
- Get a cup of ice
- Fill up the pan of water and place the rock islands
- Have the cup of ice and the food coloring ready to go near the pan of water.
- Leave table light off until read to begin demo

Overview of Directions: (Step by Step worked into the presentation script)
In this activity, you will be demonstrating how convection can create currents in the ocean. You will first add one food coloring drop to the water and watch what happens with no temperature differential. Then, you will add the ice to the pan and another drop of food coloring. The temperature differential will set up a current that moves the food coloring around the pan. The presentation will relate this demo to the large ocean currents powered by the difference in temperature at the equator and the poles.

Presentation Script

1. Title and Introduction
Load: Penguin Feather: Title.

Presenter: Welcome to _____. My name is _____. Today, we’ll be working together to solve the mystery of the Ocean Beach, California penguin feather using scientific data and our Science on a Sphere. Science on a Sphere was developed by the National Oceanic and Atmospheric Administration. The image you see is projected from four projectors around the room.

Presenter points towards the projection towers.

Presenter: The sphere its self is a six-foot diameter carbon fiber sphere.

Pause here for any questions about the SOS.

Presenter: And now, let’s get started with the mystery of the Ocean Beach Penguin feather.

2. Introduction to Penguin Feather Mystery

Load Penguin Feather: Intro PIP clip

Clip narration: (Audio track included, don’t need to read)
*Voice 1***:** Ewww! Look at that shoe! I wonder how long it’s been floating around out there!

Voice 2: Okay everyone, thanks for all your help out there today. Let's all bring the bags back up to the beach and sort the trash from the recyclables.
Voice 1: Hey, I found these feathers on the beach. You study birds. Can you tell me what species of birds these feathers are from?
Voice 2: Hmmm... well most of these are sea gull feathers, but this one is kind of interesting. It looks to me like a penguin feather.
Voice 1: A penguin feather on a California beach? How could that be?

Presenter: What do you think? What is your initial guess about whether or not it is possible for an emperor penguin feather from Antarctica to reach California?

Presenter picks a few volunteers from the audience to share what they think and why. If possible, use any mention of ocean currents as a factor to transition to the next point.

3. Hands on Demonstration

Presenter: One of the factors that has an impact on what will happen to anything that falls into the ocean are the currents in the ocean – the movement of water from one place to another. Join me over here at the demonstration table to find out more about what causes ocean currents.

Turn on the light on the demonstration table.

Presenter: The pan represents the ocean, and the rocks represent continents. What do you think will happen if we put a drop of food coloring in the water right now?

Ask visitors to share their ideas. Have a volunteer put a drop of food coloring into the water.

Presenter: What do you notice? *(pause for comments)* Nothing seems to really be happening. But, what would happen if I added ice to the pan?

Add ice cubes to the pan of water. Add another drop of food coloring. Encourage visitors to watch and describe what is happening.

Presenter: What do you notice about how the water is moving? What happens when the water reaches one of the rocks?

Give visitors a chance to share ideas. Ask follow up questions as appropriate for clarification.

Presenter: In the pan, cold melted water from the ice cube is denser (has more water packed into a smaller space) than the warmer water in the pan. It sinks and moves along the bottom where it eventually warms up and rises to the surface. Let's move back to the sphere now and see how this related to what is happening in the ocean.

T*urn off demo table light, move back to SOS.*

4. Ocean Conveyor Belt – Deep Ocean Convection Currents
Load Penguin Feather: Convection Currents

Presenter: Just like the pan of water, the oceans of the earth are not evenly heated. The poles are colder than the equator. The cold water of the poles is denser, and sinks to the bottom of the ocean and starts to move towards the equator. This creates large-scale deep currents. These currents are responsible for moving large amounts of water from one part of the world to another. Take a look at the data set. Does it seem that these thermal currents could carry the penguin feather to ocean beach?

Pause and give visitors a chance to share their thinking.

5. Wind-driven Surface Currents

Presenter: Differences in water temperature are not the only things that cause ocean currents. Wind blowing across the surface creates surface currents that would catch our penguin feather if it were to "upwell" or get caught in an updraft of warm water and come to the surface.

Load Penguin Feather: Surface Currents

Presenter: Here are some of the major wind-driven currents. Does that change your thinking about whether or not a penguin feather could end up in Ocean Beach?

6. Both sets of currents together

Presenter: Let's look at both sets of currents together.

Load Penguin Feather: All Currents.

Pause to give visitors a chance to examine the dataset. Give visitors a chance to share their ideas. Encourage visitors to expand their answers from just a yes or no to include their reasoning. You can hand a laser pointer to the visitors to have them show you what they think will happen if you chose.

7. Penguin Feather – Reveal

Presenter: Okay, ready to see one possible solution?

Load: Penguin Feather: Feather and Both Currents animation.
Congratulate/commiserate with visitors about the results of their prediction vs what actually happened.

Presenter: So, it is possible that a penguin feather might be brought all the way from Antarctica to San Francisco in the ocean currents. However, it takes a really long time for that to happen, on the order of several hundred years. Possible, but perhaps unlikely.

However, it brings up an interesting point. Could an object placed in the ocean end up anywhere if it stays in the ocean long enough?

8. Global Circulation

Load: Global Circulation. Pause the animation.

Presenter: Scientists have run simulations to see what happens when you add an object to the ocean. This is important in thinking about what happens to pollution that gets added to the ocean. Is it contained to one area? Does it spread? How far will it spread? Here's a sample particle added to the Pacific Ocean. Let's run the simulation and see where it ends up.

Start the animation. Encourage visitors to share what they are noticing about how the particle moves through the ocean.

Presenter: As you can see, if we let the simulation run long enough, our pollutant moves throughout all the worlds oceans. In fact, the idea that there are seven seas, or a number of different oceans is really a misnomer. All oceans are connected, and thus anything that happens to the ocean in one part of the world can affect the ocean in other places.

Pause for visitor questions and comments

9. Credits

Load: Go With the Flow: Credits

Presenter: Thanks for helping me solve the mystery of the penguin feather! The Science on a Sphere will resume its regular programming momentarily. I'll be over here by the demonstration table to answer any further questions you may have.

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