Marine Mammal Strandings

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Summary

Using marine mammal stranding data, students will create a model to document the location of strandings on the Oregon coast. The data will be coded to include anthropogenic (human) reasons for strandings which will lead the students to look for patterns and develop future research questions. Students will map 40 data points of ten different marine mammals stranded along the Oregon coast between 2013 and 2017.

*[TAGS: marine mammal strandings, graphing, claim-evidence-reasoning]*

Key Concepts

* Analyze data to determine a scientist’s next investigative steps using argumentative scientific reasoning.

Objectives

* Use observations and inference skills to explore data
* Plot, analyze and interpret data
* Identify patterns and trends within a data set
* Engage in argument from evidence using the CER rubric

Materials

* Access to YouTube® video
* Transparency paper
* White paper
* Colored pens
* [Map of Oregon coast](https://docs.google.com/document/d/1LAZJ3Pr1E39JbkxtuGAOtk3CJ8ubwgnr0cgfPav-EvU/edit)
* Marine Mammal stranding data sheet
* [Student Worksheet for CER Summative Assessment](https://docs.google.com/document/d/1BnwdEkk9Z6bUvFe8rcQafi1EirKRdjvExLiuYAaZBAk/edit)

 (using a CER template implies understanding of the claim evidence reasoning process)

* Spreadsheet Data Includes: Teacher Data Set (with KEY); Student-ready Data Set; Raw Data Set
* Lab Activity Sheet – This lab allows students to explore and analyze *Level A Data* for Marine Mammal Strandings along the Oregon coast. Level A Data includes: Species Identification, Location of Stranding (latitude/longitude), Age, Sex, Status of animal (live, dead, fresh, decomposed), Signs of Human Interaction (entanglement, ship strike, gunshot), and Presence of Tags/Brands. Level A Data is available on the Raw Data Set but has been simplified for the Student-ready Data Sets.

Procedure

Using the Five E Model of instruction students will...

**ENGAGE:** Show the video of a stranded sperm whale on the Faroe Islands

[Sperm Whale Explosion](https://www.youtube.com/watch?v=7X0hq0ug9q4)

1. Discussion to include key points from the narration of the video including species;
	1. where it was found,
	2. was there discussion on why the individual died?
2. Using key terminology, introduce students to:
	1. marine mammals
	2. strandings
	3. necropsy
	4. evidence
	5. human interactions including, but not limited to entanglements, pinnipeds, cetaceans.

**EXPLORE:** Students will explore a data set collected and provided by Mr. Jim Rice; Oregon State University Marine Mammal Institute. (see resource section).

1. Provide students with either an electronic or hard copy of the stranding data (see resources).
2. Give students a few minutes to look at the data and make observations and list any questions they may have.
3. Discuss their observations and questions using the following questions to guide the discussion;
	1. What type of data is included in this document?
	2. What species of animals do you see listed?
	3. What is a genus and a species?
	4. What is meant by human interaction?
	5. What do you think CBD means? HUMAN INTERACTIONS (CBD\* )
		1. \*CBD, Can not be determined, no data available (no data listed as to the cause of the stranding, could be physiological such as a bacterial infection or harmful algae bloom)
	6. What range of dates are included?
	7. What do you think observation status means?
4. If you are using the electronic version of the spreadsheet be sure to show students how to sort and filter, be sure they are comfortable with this because they will need to use the filters to create a model of the data.

**EXPLAIN:** Using guided discovery students will develop a two part **model** (using overhead transparencies) of pinniped and cetacean strandings along the Oregon coast from 2013 - 2017.

1. Break students into four groups.
2. Give each group access to the [Marine Mammal Stranding Data](https://docs.google.com/spreadsheets/d/1et_oCabLUzOEPzZrjhNNNgEoxqO5qnpBWbnkuuj32oM/edit#gid=338139765) (electronic).
3. Within the groups, students will make a two-part model documenting the marine mammal strandings:
	1. First ask the students to plot all 40 strandings on the[Map of the Oregon Coast](https://docs.google.com/document/d/1LAZJ3Pr1E39JbkxtuGAOtk3CJ8ubwgnr0cgfPav-EvU/edit). The students should create a key for distinguishing the different species of stranded marine mammals.
	2. The second part of the model will use an overhead transparency. Assign one of the following categories to each of the four groups and have them use the transparency to make the specific strandings. this will narrow down why the organisms became stranded.
		1. Fishery interactions (entangled in nets)
		2. Boat collision (hit by a sea going vessel)
		3. Gunshot (individual has a gunshot wound)
		4. Other human interactions ( floating debris)

**ELABORATE:** Placing one complete data transparency under the document camera have each team successively place their transparency sheet on top (the one with the fewer data points) and explain their subset of data: fishery interaction, boat collision, gunshot wounds, other human interactions and CBD.

During the presentation the students should elaborate on any observations and inferences on:

* different species
* visible patterns, including location patterns
* What is the data telling the scientist?

 ✅for understanding: Students should show evidence of accurate mapping skills and the ability to aggregate the accurate data, use informal formative assessment based on the four aforementioned criteria.

**At the completion of this section students will have an understanding that collecting data is only the first segment in a series of steps necessary to decode scientific meaning. Many times initial data needs additional sources of information to be combined in order to complement a claim or hypothesis. Scientists then will look at multiple variables to ascertain why an event has occurred. When looking at unusual mortality events in coastal ecosystems scientists might also look at sea surface temperature, ocean currents, pH, or even salinity to see if there is a correlation to stranding events.**

 **EVALUATE:** Using the claim, evidence and reasoning rubric [Claim, Evidence, Reasoning (CER) Rubric](https://docs.google.com/document/d/1_qunCvluo3o5NMP3YANoGArb62v_BHQPdCIzuwOXFxk/edit) students will write a one to three paragraph summative summary that shows evidence of being able to analyze data to determine a scientist’s next investigative steps using argumentative scientific reasoning.

Assessment

* **Formative assessments**—✅ - located in “elaboration” phase
* **Summative assessments**: Claim, evidence and reasoning (CER) worksheet
* For more information: <https://facultyinnovate.utexas.edu/teaching/check-learning/methods>
* Summative Assessment Rubric
	+ [Claim, Evidence, Reasoning (CER) Rubric](https://docs.google.com/document/d/1_qunCvluo3o5NMP3YANoGArb62v_BHQPdCIzuwOXFxk/edit)

Additional Resources

* [Marine Mammal Stranding Data](https://docs.google.com/spreadsheets/d/1et_oCabLUzOEPzZrjhNNNgEoxqO5qnpBWbnkuuj32oM/edit#gid=338139765) (electronic version)
	+ If you need a hard copy of the data print in landscape fit to width from the google data sheet
* [Recent Strandings Map](https://batchgeo.com/map/78d1aa7533d6ac9be58ab35110255ce5) (web link)

Extensions or Adaptations

Use the summary on the Guadalupe Fur Seal in California and develop a discussion on trends in data and what this data shows as an unusual mortality event and discuss why there was such a change in 2015.

[2015-2018 Guadalupe Fur Seal Unusual Mortality Event in California](https://www.fisheries.noaa.gov/national/marine-life-distress/2015-2018-guadalupe-fur-seal-unusual-mortality-event-california)

[Guadalupe Fur Seal (Arctocephalus townsendi)](http://www.nmfs.noaa.gov/pr/species/mammals/seals/guadalupe-fur-seal.html)

**To develop prior knowledge using an addition EARTH Resource**

[Stranded...How You Can Help](https://docs.google.com/document/d/11Z9QQGux8Gie7GoZ59YYCttjyuO6kHCGf-Lpb04bqcY/edit)

**LAB ACTIVITY: Marine Mammal Stranding Investigation – West Coast Data**

This lab allows students to explore and analyze *Level A Data* for Marine Mammal Strandings along the Oregon coast. Level A Data includes: Species Identification, Location of Stranding (latitude/longitude), Age, Sex, Status of animal (live, dead, fresh, decomposed), Signs of Human Interaction (entanglement, ship strike, gunshot), and Presence of Tags/Brands.

(NOTE: The West Coast Data was revised in accordance with the following):

1. CND (Cannot Be Determined) Data was omitted from this activity. CND data included 3503 recorded strandings.

2. Yes/Y (Stranding Cause Determined) was the only West Coast Data included in this activity. Yes/Y data included 514 recorded strandings.

Useful Websites:

* <https://www.mbari.org/wp-content/uploads/2018/05/June2018MBARI.pdf> (EARTH 2018 PPT presented by Jim Rice, Coordinator, Oregon Marine Mammal Stranding Network Marine Mammal Institute, Oregon State University)
* <https://docs.google.com/spreadsheets/d/1gRs4F37aSQeDcdkUfIwOjSKRVvBMee-G9_vc4eFfhkY/edit#gid=604398715> (Raw Data for Oregon Marine Mammal Strandings, 2008 – 2017)
* <https://mmi.oregonstate.edu/ommsn> (Oregon Marine Mammal Stranding Network website)
* <http://www.nmfs.noaa.gov/pr/sars/species.htm#pinnipeds> (NOAA Marine Mammal Stock Assessment Reports (SARs) by Species/Stock)
* <https://www.mbari.org/wp-content/uploads/2018/05/44.3-Warlicketal.pdf> - Article: Spatio Temporal Characterization of Pinniped Strandings and Human Interaction Cases in the Pacific Northwest, 1991-2016 (Amanda J. Warlick, Deborah A. Duffield, Dyanna M. Lambourn, Steven J. Jeffries, James M. Rice, Joseph K. Gaydos, Jessica L. Huggins, John Calambokidis, Lesanna L. Lahner, Jennifer Olson, Erin D’Agnese, Victoria Souze, Alysha Elsby, and Stephanie A. Norman)
* <https://ptmsc.org/programs/investigate/citizen-science/marine-mammal-stranding-network-and-necropsy-program/local-marine-mammals> (Species images and information for West Coast marine mammals)

**KEY FOR MARINE MAMMAL SPECIES:**

* Baird’s beaked whale – Beradius bairdii
* Blue whale – Balaenoptera musculus
* Bottlenose dolphin – Tursiops truncatus
* California sea lion – Zalophus californianus
* Common dolphin – Delphinus delphis
* Culvier’s beaked whale – Ziphius cavirostris
* Dall’s porpoise – Phoconoides dalli
* Fin whale – Balaenoptera physalus
* Gray whale – Eschrichtius robustus
* Guadalupe fur seal – Arctocephalus townsendi
* Harbor porpoise – Phocoena phocoena
* Harbor seal – Phoca vitulina
* Humpback whale – Megaptera novaeangliae
* Killer whale – Orcinus orca
* Long-beaked common dolphin – Delphinus capensis
* Minke whale – Balaenoptera acutorostrata
* Northern elephant seal – Mirounga angustirostris
* Northern fur seal – Callorhinus ursinus
* Northern right whale dolphin – Lissodelphis borealis
* Pacific white-sided dolphin – Lagenorhynchus obliquidens
* Pantropical spotted dolphin – Stenella attenuata
* Pygmy sperm whale – Kogis breviceps
* Risso’s dolphin – Grampus griseus
* Sea otter – Enhydra lutris
* Sperm whale – Physeter macrocephalus
* Stejneger’s beaked whale – Mesoplodon stejnegeri
* Steller sea lion – Eumetopias jubatus
* Striped dolphin – Stenella coeruleoalba

**LAB ACTIVITY: Marine Mammal Stranding Investigation – West Coast Data**

**QUESTION**: What is the most common cause of marine mammal strandings?

**HYPOTHESIS**:

**TEST YOUR HYPOTHESIS**:

**MATERIALS/PROCEDURES**:

Part I: All Recorded Data

1. Open the “All Recorded Data” spreadsheet and save to your folder.
2. Enter formulas to calculate the “Total Interactions” and “Percentage by Interactions” columns.
3. Enter formulas to calculate the “Total Interactions by Species” and Percentage of Interactions by Species” columns.
4. Generate “GRAPHS 1 – 5” Using the “All Recorded Data” spreadsheet.

Part II. Top 5 Species Data

1. Open the “Top 5 Species Data” spreadsheet and save to your folder.
2. Enter formulas to calculate the “Total Species” and “Percentage by Species” columns.
3. Enter formulas to calculate the “Total Interactions by Species” and Percentage of Interaction by Species” columns.
4. Generate “GRAPHS 6 – 7” Using the “Top 5 Species Data” spreadsheet.

**DATA COLLECTION**: *(Copy and Paste your completed spreadsheets below.)*

* TABLE 1 - “All Recorded Data”
* TABLE 2 - “Top 5 Species Data”

**DATA ANALYSIS:** (Copy and Paste your completed graphs below.)

**All Species Recorded**

GRAPH 1 – Human Interactions by All Species Recorded

GRAPH 2 – Fisheries Interactions by All Species Recorded

GRAPH 3 – Boat Collisions by All Species Recorded

GRAPH 4 – Gunshots by All Species Recorded

GRAPH 5 – Other Human Interactions by All Species Recorded

**Top 5 Species Recorded**

GRAPH 6 – Top 5 Species Interacting with Humans

GRAPH 7 – Most Common Interactions in Top 5 Marine Mammal

**CONCLUSION:**

(Complete sentences should be used to construct a paragraph addressing the following: 1. Readdress the lab

question; 2. Readdress your hypothesis; 3. Use these key terms to summarize your findings: (

**LAB ACTIVITY KEY: Marine Mammal Stranding Investigation – West Coast Data**

**QUESTION**: What is the most common cause of marine mammal strandings?

**HYPOTHESIS**: (A complete sentence should be constructed to address the lab question.)

**TEST YOUR HYPOTHESIS**:

**MATERIALS/PROCEDURES**:

Part I: All Recorded Data

1. Open the “All Recorded Data” spreadsheet and save to your folder.
2. Enter formulas to calculate the “Total Interactions” and “Percentage by Interactions” columns.
3. Enter formulas to calculate the “Total Interactions by Species” and Percentage of Interactions by Species” columns.
4. Generate “GRAPHS 1 – 5” Using the “All Recorded Data” spreadsheet.

Part II. Top 5 Species Data

1. Open the “Top 5 Species Data” spreadsheet and save to your folder.
2. Enter formulas to calculate the “Total Species” and “Percentage by Species” columns.
3. Enter formulas to calculate the “Total Interactions by Species” and Percentage of Interaction by Species” columns.
4. Generate “GRAPHS 6 – 7” Using the “Top 5 Species Data” spreadsheet.

**DATA COLLECTION**: *(Copy and Paste your completed spreadsheets below.)*

* TABLE 1 - “All Recorded Data”

|  |  |
| --- | --- |
| **Human Interactions by Species with Data** |   |
| **COMMON NAME** | **FISHERY INTERACTION** | **BOAT COLLISION** | **GUN SHOT** | **OTHER HUMAN INTERACTION** | **Totals (N=514)** | **Percentage by Species** |
| California Sea Lion | 37 | 12 | 114 | 64 | 227 | 0.44 |
| Gray Whale | 10 | 1 | 0 | 0 | 11 | 0.02 |
| Guadalupe Fur Seal | 11 | 0 | 0 | 3 | 14 | 0.03 |
| Harbor Porpoise | 40 | 3 | 0 | 0 | 43 | 0.08 |
| Harbor Seal | 10 | 3 | 43 | 23 | 79 | 0.15 |
| Humpback Whale | 6 | 1 | 0 | 0 | 7 | 0.01 |
| North.Elephant Seal | 3 | 0 | 3 | 2 | 8 | 0.02 |
| North.Fur Seal | 16 | 0 | 0 | 2 | 18 | 0.04 |
| Pacific White-sided Dolphin | 1 | 0 | 0 | 0 | 1 | 0.00 |
| Risso's Dolphin | 1 | 0 | 0 | 0 | 1 | 0.00 |
| Sperm Whale | 0 | 0 | 0 | 2 | 2 | 0.00 |
| Steller Sea Lion | 21 | 3 | 66 | 9 | 99 | 0.19 |
| Striped Dolphin | 4 | 0 | 0 | 0 | 4 | 0.01 |
| **TOTAL Interactions** | 160 | 23 | 226 | 105 |  |   |
| Percentage By Interaction | 0.31 | 0.04 | 0.44 | 0.20 |   |   |

* TABLE 2 - “Top 5 Species Data”

|  |  |
| --- | --- |
| **TOP 5 Species Interactions** |  |
| **COMMON NAME** | **FISHERY INTERACTION** | **BOAT COLLISION** | **GUN SHOT** | **OTHER HUMAN INTERACTION** | **Totals (N=466)** | **Percentage by Species** |
| California Sea Lion | 37 | 12 | 114 | 64 | 227 | 0.44 |
| Harbor Porpoise | 40 | 3 | 0 | 0 | 43 | 0.08 |
| Harbor Seal | 10 | 3 | 43 | 23 | 79 | 0.15 |
| North.Fur Seal | 16 | 0 | 0 | 2 | 18 | 0.04 |
| Steller Sea Lion | 21 | 3 | 66 | 9 | 99 | 0.19 |
| **TOTAL By Interaction** | 124 | 21 | 223 | 98 |   |   |
| Percentage By Interaction | 0.24 | 0.04 | 0.43 | 0.19 |  |  |

**DATA ANALYSIS:** (Copy and Paste your completed graphs below.)

**All Species Recorded**

GRAPH 1 – Human Interactions by All Species Recorded

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**Top 5 Species Recorded**

GRAPH 6 – Top 5 Species Interacting with Humans

GRAPH 7 – Most Common Interactions in Top 5 Marine Mammal

**CONCLUSION:**

(Complete sentences should be used to construct a paragraph addressing the following:

 1. Readdress the lab question.

 2. Readdress your hypothesis.

 3. Use these key terms to summarize your findings: (