

# Baseline Module – Money Analogy

**Title of lesson:** Shifting Baselines Conceptual Introduction

**Length of lesson:** 50 min

**Course Title:** Science

**Grade level:** 6, 7, 8

**TEKS addressed:** <http://www.tea.state.tx.us/rules/tac/chapter112/index.html>

**§112.22. Science, Grade 6.**

(2C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(4B) identify patterns in collected information using percent, average, range, and frequency;

**§112.23. Science, Grade 7.**

(2C) organize, analyze, make inferences, and predict trends from direct and indirect evidence; (82C)\*

(2E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data; (82E)\*

(3A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information; (83A)\*

(4B) collect and analyze information to recognize patterns such as rates of change;

(14C) make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources;

**§112.24. Science, Grade 8.**

(4B) extrapolate from collected information to make predictions;

(14B) analyze how natural or human events may have contributed to the extinction of some species;

(14C) describe how human activities have modified soil, water, and air quality;

\* Uses same TEKS in 8th

**Source of the lesson:**

1) Dr. Jeremy Jackson's "Brave New Ocean" lecture presentation for the Environmental Science Institute at the University of Texas at Austin;

<http://www.esi.utexas.edu/outreach/lectures.html>

2) Shifting Baselines website: <http://shiftingbaselines.org/index.php>

**The Lesson:**

**I. Overview**

The concept of a baseline is widely applicable to the study of ecosystems. The term baseline refers to the "original," undisturbed state of a system. Any deviation from this state is called a shift in the baseline. Marine environments are such, that their baselines can be significantly degraded, or downshifted, over time with very little notice by the scientific community or society at large. This leads to the acceptance of a degraded state as the natural state of a system. It is important for students to keep the idea of baselines in mind when interpreting environmental information from various sources.

Furthermore, it is vital that students understand the impact of human activities in causing baselines to shift. This lesson introduces baselines by way of analogy to the universally accessible topic of money.

**II. Performance or learner outcomes**

**Students will be able to:**

1) Define what a baseline is

- 2) Give an example of a baseline in nature
- 3) Demonstrate how a baseline changes
- 4) Explain why the appropriate choice of baseline is so important
- 5) Discuss why an accurate baseline might be difficult to find in nature

### **III. Resources, materials and supplies needed:**

Computer with projector for viewing online videos – recommended but optional  
Plastic replicas of coins in various denominations - quarter and dimes at least  
3x5 cards – or slips of paper  
Plastic 5-10 sandwich baggies

### **IV. Supplementary materials, handouts**

Sea Turtle graphic handout – 1/student  
Graph template handout or graph paper – 1/group  
Time vs. money table handout – 1/group

### **VIII. Preparation:**

Make several sets of coins in plastic baggies and note the value of each set – correlate value with image  
Number cards beginning at 1900 and incrementing up by 10 through 2000

### Five-E Organization

Teacher Does	Probing Questions	Anticipated Student Responses
<p><b>Engage:</b></p> <p>Introduce topic of money.</p> <p><b>Time: 5 minutes</b></p>	<p>Does anyone know what a savings account in a bank is?</p> <p>How about a piggy bank?</p> <p>Would you rather have a lot of money or only a little bit?</p>	<p>That's where people keep their money.</p> <p>Same</p> <p>A lot.</p>
<p><b>Explore:</b></p> <p>Divide class into groups of 10.</p> <p>Distribute cards, data table templates and graph templates.</p> <p>Instruct students to put their name on their card. The cards should be numbered as follows: one student starts with 1900; each subsequent student increments up by 10 – 1910, 1920, 1930....up through 2000.  <b>Note: Save time by numbering card sets in advance.</b></p> <p>Give the 1900 member of each group a prepared set of coin replicas and the data table template. Have them record the total amount on the data table, remove 1-2 coins, do the subtraction on the data table and pass it to the next student (1910) who should repeat the process until all students have a coin and the table is complete. Each student should note the value of the coin set they received, the value of the coin/s they took and the value they passed along on their cards – this will be turned in for individual accountability.</p> <p>Assign a group recorder (a confident math student) to follow the coin set and ensure the table is filled out correctly. This provides a check, and a complete data set for the graphing exercise.</p> <p>Once the data table is complete, it should be returned to the 1900</p>	<p>If you remove a dime or a quarter from a large set of coins, will you notice the difference?</p> <p>If you share a piggy bank with someone else, and you each take money out sometimes, how can you be sure how much is in it?</p> <p>Imagine that your great-great-grandparents started with a piggy bank in 1900 and passed it down through your family until it reached you. Along the way, each person took a little bit of money out of it, but no one added back to it.            How would you know how much money was there when it started?</p> <p>When you pass it on to your kids, would you like give them a lot of money, or a little?</p>	<p>No.            Maybe, if you count them all before and after the coin is taken.</p> <p>You would have to know how much you started with and tell each other how much you took out each time.</p> <p>Go back and ask them how much they took.</p> <p>It would be impossible, because those people are not here anymore.</p> <p>Guess.</p> <p>Why would it matter?  <b>Note: This is a probable response and constitutes a good segue into the baseline concept.</b></p> <p>A lot.</p>

<p>member who will place the point for their year's value on the graph template. It will then be passed to each consecutive member who will repeat the process and connect a line from the previous point.</p> <p>Graph axis should be labeled as follows: Horizontal axis – 1900, 1910, 1920, etc. (time in decades) Vertical axis – value of money in the bag.</p> <p><b>Note: Save time by pre-labeling axis.</b></p> <p><b>Note: Correlating coin set values with turtle graphic below can be helpful in transferring the analogy.</b></p> <p><b>The data table eases calculations and provides a complete data set for the groups to graph with.</b></p> <p><b>Possible math mistakes on data table can be used to exemplify difficulty with reporting baselines.</b></p> <p><b>Time: 20 minutes</b></p>	<p>Do you think it would matter much to your kids if you take out 10-15 cents before you pass it to them?</p> <p>Now think of the coin set you just passed around. If you only had the number on your card, and not the table or graph, would you know that there was more money in the bank in 1960 than in 2000?</p> <p>If you asked your parents or grandparents how much money was in the piggy bank when they had it, would it be the same value that you have?</p> <p>Would it be more or less? Why?</p>	<p>No.</p> <p>No.</p> <p>No.</p> <p>More. Because each person took some out.</p>
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<p><b>Explain:</b></p> <p>Instruct groups to look at the completed graphs.</p> <p>Call on individuals to explain what their group found.</p> <p>Ask their group members to elaborate if needed.</p> <p><b>Time: 5 min</b></p>	<p>Look at the numbers on your table and graph: Is there a big difference between each number and the one next to it? What about between the first number and the last one?</p> <p>Does taking 20 cents matter more when you have 3 dollars or when you have 80 cents?</p> <p>What happens to the line as time goes by?</p> <p>What does the shape of the graph mean?</p> <p>If people keep taking coins out, what will the graph look like in 2010, 2020, etc.</p>	<p>No. Not a lot – 10-20 cents.</p> <p>It is a much bigger difference than between each one – 2 or 3 dollars.</p> <p>It is the same amount, but it matters more when there is less money.</p> <p>It starts high and goes down.</p> <p>The value is decreasing.</p> <p>It will keep going down until there are no more coins – zero.</p>
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<p><b>Extend:</b></p> <p>Introduce baseline concept.</p> <p>The amount of money in the bank when you got it – the value on your card – could be called the baseline amount. The baseline is how much you started with.</p> <p>The true baseline for the coin exercise was the beginning value in 1900. But if you only knew the value from your card, you might think that was the baseline. The change in the money value between the years on each person’s card can be called a shift in baseline. The idea of shifting baselines can be used for things in the natural world too.</p> <p>Project attached image of turtle population change. And/or distribute handouts of image. Ask class to study it. Explain it.</p> <p>If they do not draw the analogy given in the third column, elaborate it for them.</p>	<p>What happens to the baseline in the graphing exercise we just did?</p> <p>Is your baseline the same as your parents and grandparents?</p> <p>Can anyone think of an example Of shifting baselines in the in the natural world?</p> <p>The historic values on the image might represent numbers of turtles from around 1900. Think about the coin exercise we just did. What would the whole group of green circles represent?</p> <p>What would the smaller group of yellow circles represent?</p>	<p>It goes down.</p> <p>No. It’s lower.</p> <p>Answers will vary depending on grade and class.</p> <p>The total number of sea turtles from 1900 – like the original value of coins in the bank. The number of sea turtles now – like the value of the coins in the</p>
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<p>Cross off a few circles on the overhead and relate that to removal of coins from the bag for 1900-1910. Repeat it for 1910-1920, and so forth until all the green circles are marked off – leaving only the yellow.</p> <p>Play “Pristine” video (4 min) included on this CD-ROM or at: <a href="http://shiftingbaselines.org/videos/index.html">http://shiftingbaselines.org/videos/index.html</a></p> <p><b>Time: 15 minutes</b></p>	<p>What does the size of each circle mean?</p> <p>What does this mean for the turtles?</p> <p>Why are the turtles disappearing?</p> <p>What is a baseline?</p> <p>What is an example of a baseline in nature?</p> <p>Can a baseline change? How?</p> <p>Why is the idea of baseline important?</p> <p>Is it easy to find a true baseline in the ocean?</p>	<p>bank now. It’s the number of turtles at each place – like the value of each individual coin; big ones are more - like quarters, and small ones are less – like dimes.</p> <p>Someday there won’t be any more turtles.</p> <p>People.</p> <p>The way things were before anything was taken.</p> <p>Turtle populations.</p> <p>Yes. It can go up or down without anyone noticing.</p> <p>If you don’t know how things were originally, you won’t know that they are worse now.</p> <p>No, because no one was keeping track before – like our data table.</p>
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<p><b>Evaluate:</b> Have students complete question post evaluation.</p> <p><b>Time: 5 minutes</b></p>		
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## **Post Evaluation Questions for Baseline/Money Analogy**

1) Explain what a baseline is?

2) Explain how a baseline can change?

3) Give an example of a baseline in nature?

4) Why is the idea of baseline important - explain?

5) Is it easy to find a true baseline in the ocean - explain?

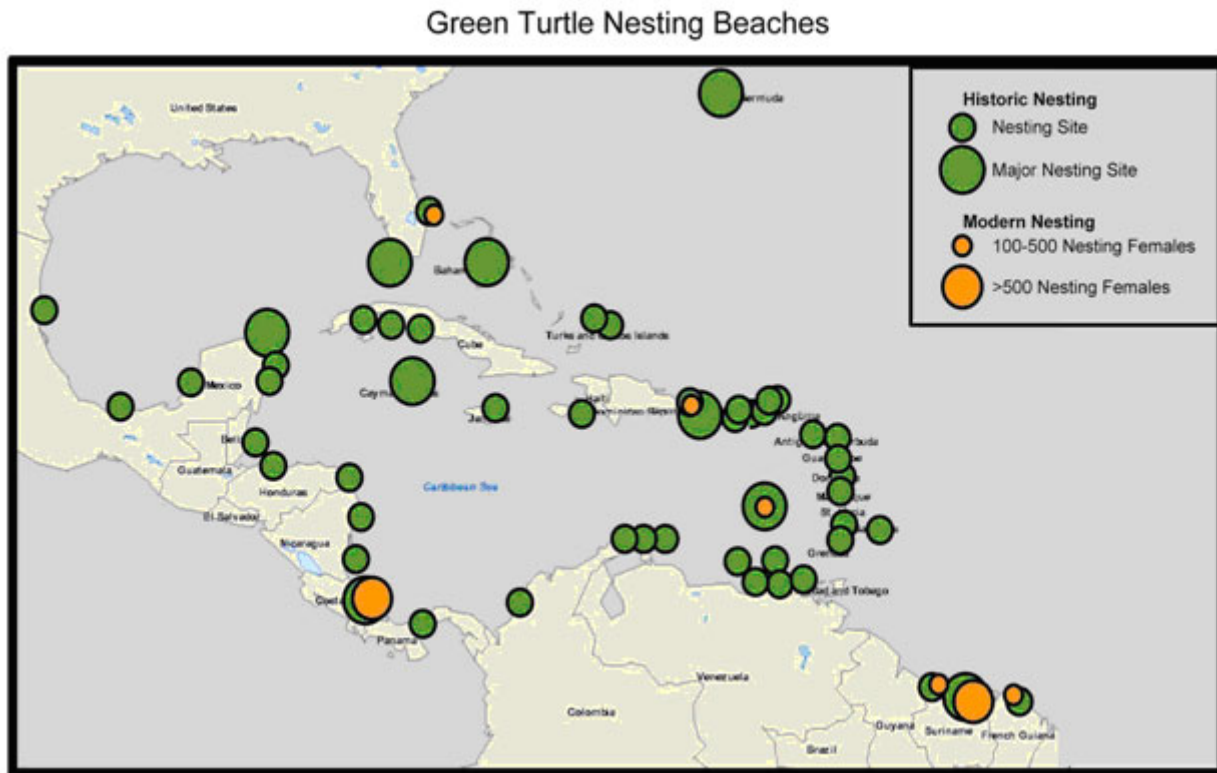
**Data Table for Baseline/Money Analogy**

Time (year)	Value (dollars or cents)	Notes
1900		Original amount – Graph 1
-		Subtract amount taken out
1910		New amount – graph 2
-		Subtract
1920		New amount – graph 3
-		Subtract
1930		New amount – graph 4
-		Subtract
1940		New amount – graph 5
-		Subtract
1950		New amount – graph 6
-		Subtract
1960		New amount – graph 7
-		Subtract
1970		New amount – graph 8
-		Subtract
1980		New amount – graph 9
-		Subtract
1990		New amount – graph 10
-		Subtract
2000		Final amount - graph 11





Graphic for Extend portion of lesson



This graph comes from a paper Dr. Jeremy Jackson and his students have in review at the journal *Frontiers in Ecology*: McClenachan, L., Jackson, J. B. C., and Newman, M. J. H. Conservation implications of historic sea turtle nesting beach loss.

The data come from analysis of 161 historic sources ranging from archeological evidence, explorers' and pirates accounts (e.g., Columbus, William Dampier), early naturalists, shipping and customs records, and archival documents. The green circles represent historic nesting beaches (think 1492) and the orange circles the present, but the scales are different between the times. Large green circles represent nesting populations in the millions (Grand Cayman calculated to be 6.5 million based on 17<sup>th</sup>-18<sup>th</sup> century hunting data in Dr. Jackson's 1997 paper titled "Reefs since Columbus" published in the journal *Coral Reefs*). Small green circles represent "minor beaches" thought to have about 10% the abundance of "major beaches." From all the sources the scientists calculated an abundance of roughly 90 (30-150) million green turtles in 1492 compared to perhaps 100,000 today. That was much more biomass than all the bison in North America before the arrival of horses and the rifle. The orange circles (same size to be visible) represent very small populations as shown in the legend.