Lesson 1
Current Trends

How has the ocean contributed to or reacted from global climate change throughout the Earth’s history?

Lesson 2
Timeline Clothesline

How have large scale climate changes affected the local place where you live?

Lesson 3
Changes Close to Home

East Coast MARE
Marine Activities, Resources and Education
August 7, 2008
The Polar Seas/Climate Change
(Blue title indicates lessons to start within Year 1)
A class period = 40 minutes

Informational Articles
Use to distribute to students or for teacher’s background knowledge.

Apples and Oceans
Hands on Discovery 1-2 Class periods

Mapping the Sea Floor
1-2 Class Periods

Exhausts & Exhalations
1-2 Class periods

Glaciers & Global Warming
1-2 Class periods

Family Production of CO2
1-2 Class periods

Density Currents in a Model Ocean
1-2 Class periods

Changes Close to Home
Hands on Discovery 1 Class period
http://forces.si.edu/
Smithsonian Forces of Change Lessons

Timeline Clothesline
Hands on Discovery 1 Class period
(found in Climate Change Backpack Guide)

Cold As Ice?
3 Class periods

Salty Dog
1 Class Period

Density Currents in a Model Ocean
1-2 Class periods

Current Trends
Hands on Discovery 2-3 Class periods
(found in GEMS Guide)

Please go to the next page

A Class Action Whale
3-4 Class periods.

The Longest Migration
LAL Lesson 1-2 Class periods

Krill-A Whale of a Game
(Ancillary activity)

Ecoscenario: Oil Spill
1-2 Class periods Role-play

Get the Connection!
1-2 Class periods

Staying Alive!
1-2 Class periods

From Pole to Pump
1-2 Class periods

END

p. 1

p. 2
**Lesson Overview**
There are 2 sessions to Current Trends. The first session, students will complete station 1 and 2. In the second session, students will complete station 3 and make a poster describing how what they have learned connects to actual currents.

**Lesson Rationale**
Current Trends is a lesson that will demonstrate, at the students’ own pace, how water temperature and salinity drive ocean currents. By the end of this lesson students may be able to connect what they’ve discovered to weather and current patterns on a larger scale, across the globe.

**Teacher’s Notes**
This lesson is a student-centered lesson wherein the class will be rotating through 3 stations which include three different experiments involving water currents. It should take 2 class periods, but allow for a third class to conclude and discuss results.

**Key Concept:**
Salinity and temperature differences create masses of water with different densities. Gravity causes more dense water to sink below less dense water. As a result, the less dense water rises.

**Time Required:**
2-3 class periods

**My Notes**
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<tr>
<th>Subject Area</th>
<th>Interdisciplinary Connection</th>
<th>Resources</th>
<th>Going Further</th>
<th>NJCCCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>• Temperature measurement</td>
<td>• Tornado tubes (2)</td>
<td>Make your own hydrometers</td>
<td>Standard 5.1 (Scientific Process) A.1, A.2, A.3, A.4, B.1, B.3, C.1, C.2</td>
</tr>
<tr>
<td></td>
<td>• Density/Salinity</td>
<td>• Kosher salt</td>
<td>Test unknown samples for</td>
<td>Standard 5.6 (Chemistry) A.1, A.2</td>
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<td></td>
<td>• Movement</td>
<td>• Food coloring(at least 2 dark colors, no yellow)</td>
<td>density/salinity</td>
<td>Standard 5.7 (Physics) A.2, B.1, B.3</td>
</tr>
<tr>
<td></td>
<td>• Scientific process</td>
<td>• Clear water bottles, straight side</td>
<td></td>
<td>Standard 5.8 (Earth Science) B.1</td>
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<td></td>
<td>• Recording data</td>
<td>• Yogurt lids (4)</td>
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<td></td>
<td>• Observation</td>
<td>• Plastic lunch trays</td>
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<td>• Prediction</td>
<td>• Chart paper</td>
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<td>• Lab Safety</td>
<td>• Markers</td>
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<td></td>
<td>• Mass</td>
<td>• Inflatable globes</td>
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<td>• Styrofoam cups</td>
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<td>• 6qt(large) plastic rectangular container</td>
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<td>• 20 marbles</td>
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<td>• Push pins</td>
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<td>• White paper (computer or copy)</td>
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<td>• Tablespoon measure</td>
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<td></td>
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<td>• White dish towels</td>
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<tr>
<td>Language Arts</td>
<td>Group discussion</td>
<td></td>
<td></td>
<td>Standard 3.1 (Reading) A.1, F.1, H.1</td>
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<tr>
<td>Literacy</td>
<td>Recording ideas/brainstorming</td>
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<td></td>
<td>Standard 3.2 (Writing) C.1, C.8, D.1, D.8</td>
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<td></td>
<td>Reasoning</td>
<td></td>
<td></td>
<td>Standard 3.3 (Speaking) A.2, A.4, A.7, B.4, C.1, C.1, D.1, D.2, D.6, D.8</td>
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<td></td>
<td>Sharing/publishing results</td>
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<td>Standard 3.4 (Listening) A.1, A.2, A.3, B.7</td>
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<td>NJCCCS</td>
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| Mathematics      | Measurement  
Volume  
Data collection  
Temperature                                                                 |                                                                           |                                                                               | Standard 4.1  
(Numerals & Numeric Process)  
A.3  
Standard 4.2  
(Geometry & Measurement)  
D.4  
Standard 4.5  
(Mathematical Process)  
C.3 | | |
| Social Studies   | Map/Globe skills  
Geography  
Bodies of water identification  
Projection of where they might find real-life examples of the currents they created in the lab |                                                                           |                                                                               | Standard 6.1  
(Social Studies Skills)  
A.5  
Standard 6.3(World History)  
D.1  
Standard 6.6(Geography)  
A.5, B.4, C.2, C.3, C.5 | | |
| Visual Arts      | Presentation of posters  
Layout and design of posters                                                                 |                                                                           |                                                                               | Standard 1.2  
(Creation & Performance)  
D.1 | | |
| Technology       |                                                                                             |                                                                           |                                                                               | Use online resources for surface temperature maps to further these activities. | | |
| World Language   |                                                                                             |                                                                           |                                                                               | This lesson is another one that could be taught entirely in Spanish or another World Language  
Include: Colors, volume(measurements), time, following directions, responding to | Standard 7.1  
(Communication)  
A.1, A.3, A.5, B.1, B.3, C.1, C.2, C.3  
Standard 7.2(Culture)  
A.2 | |
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<td>questions, describing experiments using proper vocabulary. Students could discuss the exploration of the New World from the perspective of the Portuguese and Spanish explorers(first views of the Amazon plume)</td>
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<tr>
<td>Career Education &amp; Consumer,</td>
<td>Group Discussion</td>
<td></td>
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<td>Standard 9.2(Consumer, Family and Life</td>
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<tr>
<td>Family &amp; Life Skills</td>
<td>Teamwork</td>
<td></td>
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<td>Skills) A.1, B.2, C.1, C.2, C.3, C.4, C.5, C.6, F.1</td>
</tr>
<tr>
<td>Physical Education</td>
<td>Group Discussion</td>
<td></td>
<td>Have students model the movement of the different types of water by moving around the room.</td>
<td>Standard 2.2 (Integrated Skills) A.4, E.1, E.3</td>
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<tr>
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<td>Teamwork</td>
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**Timeline Clothesline**

Polar Seas (Grade 8)

**Lesson Overview**
Students will stretch the Timeline Clothesline across the classroom. Then they will break up into groups, or as a class, be given different cards that have an event written on one side and an approximate date on the other. They will be asked to place their event on the timeline. This will be repeated 4 times, representing the Earth’s history.

**Lesson Rationale**
The idea of climate change occurs over enormous time scales that are often difficult to conceptualize. This lesson addresses the vast scope of climate study and will help students come to the realization that the Earth has a natural climate variability.

**Teacher’s Notes**
Timeline Clothesline could be completed in as little as 20 minutes but there is approximately 1 hour minimum preparation time to become familiar with the materials. Also, be sure to have a lot of space to stretch the rope “timeline” out—moving desks, or performing the lesson in a larger room or outdoors is a good alternative.

*This lesson is from the Climate Change Backpack, published by the New England Science Center Collaborative.

**Key Concept:**
Students gain a perspective of how the Earth has evolved since its beginning including:
1. How and when our atmosphere formed.
2. How our atmosphere changed over time due to interconnected geological, biological, hydrologic, and atmospheric processes.

**Time Required:**
1 class period
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</thead>
</table>
| Science          | • Modeling a timeline  
• Earth science  
• Photosynthesis  
• Environmental Change | Timeline cards  
Clothes line  
15 clothes pins(spring type) |                                                                                      | Standard 5.1  
(Scientific Process)  
B.2, B.3  
Standard 5.2  
(Science and Society)  
A.1, A.3, B.1, B.2  
Standard 5.3  
(Mathematical Application)  
A.1, C.1  
Standard 5.5(Life Science)  
A.1, B.2  
Standard 5.6(Chemistry)  
A.1  
Standard 5.8(Earth Science)  
B.1, C.1  
Standard 5.10  
(Environmental Studies)  
B.1                                                                 |                                                                             |
| Language Arts    | • Fact gathering  
• Group discussion                                                                 | Debate: Are humans really to blame for the recent climate change or is this another stage in a larger Earth cycle? |                                                                                      | Standard 3.1(Reading)  
A.1, F.1, F.2  
Standard 3.3(Speaking)  
A.2, A.4, A.7, B.4, D.6, D.8  
Standard 3.4(Listening)  
A.2                                                                 |                                                                             |
| Literacy         |                                                                                                  |                                  |                                                                                      | Standard 4.1  
(Numbers & Numerical Operations)  
A.2, A.3, C.2  
Standard 4.4(Data Analysis)  
C.3  
Standard 4.5  
(Mathematical Process)  
B.1, B.2, C.3, C.4, D.2, E.1                                                                 |                                                                             |
<table>
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<th>NJCCCS</th>
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</thead>
<tbody>
<tr>
<td>Social Studies</td>
<td>• World (Earth) History&lt;br&gt;• Governments established&lt;br&gt;• Early Humans&lt;br&gt;• Hunting &amp; Gathering</td>
<td>Group discussion&lt;br&gt;Debate(See above LAL)</td>
<td></td>
<td>Standard 6.1 (Social Studies Skills)&lt;br&gt;A.1, A.2, A.4, A.5, A.9, A.11&lt;br&gt;Standard 6.2(Civics)&lt;br&gt;E.8&lt;br&gt;Standard 6.3(World History)&lt;br&gt;A.1, A.2, B.5, B.10, B.11&lt;br&gt;Standard 6.5(Economics)&lt;br&gt;B.1, B.3&lt;br&gt;Standard 6.6(Geography)&lt;br&gt;B.2, C.3, C.4, C.5, E.1, E.2</td>
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<tr>
<td>Visual Arts</td>
<td>Visual representation of different eras via different colored information cards</td>
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<td>Technology</td>
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<td>Use online resources to follow up on any interesting information points from clothesline</td>
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<tr>
<td>World Language</td>
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<tr>
<td>Career Education &amp; Consumer, Family &amp; Life Skills</td>
<td>• Group discussion&lt;br&gt;• Teamwork&lt;br&gt;• Leadership skills</td>
<td></td>
<td></td>
<td>Standard 9.2(Consumer, Family &amp; Life Skills)&lt;br&gt;A.1, C.1, C.2, C.3, C.4, C.5, C.6</td>
</tr>
<tr>
<td>Physical Education</td>
<td>• Group discussion&lt;br&gt;• Teamwork&lt;br&gt;• Leadership skills</td>
<td>Physically demonstrate the idea of 1/100th using the playground (measure out 100ft on the ground and compare it to 1 foot) Create a game that demonstrates the idea of photosynthesis</td>
<td>Standard 2.2 (Integrated Skills)&lt;br&gt;E.1</td>
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</table>
Lesson Overview
Students use interview techniques to explore perceptions about local climate change amount long-time residents of their community. Students then compare the results of their interviews to 30-year local temperature and precipitation records.

Lesson Rationale
Students may not recognize that weather and climate have changed over the last 50 years or so. This experience will help them recognize that our climate, not just our immediate weather, is undergoing long-term changes.

Teacher’s Notes
This lesson is a great way for students to get in touch with older community members. You might want to schedule a class trip to a community center where some students could survey some people in the community about the weather and climate in the not-so-distant past.

*This lesson is from the Smithsonian. http://forces.si.edu/arctic/05_00_00.html

My Notes

Key Concepts:
- Demonstrate appropriate use of tools and techniques to gather, analyze and interpret data.
- Compile and summarize community survey results on local climate change.
- Communicate results of their investigations.
- Use a climate database.
- Explain the difference b/w weather and climate

Time Required:
- 3-4 Class periods over the course of several weeks.
- 1-2 Weeks for students to conduct surveys.
- 1 class period for and optional extension activity.
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<tbody>
<tr>
<td>Science</td>
<td>• Climate</td>
<td>• Internet Access</td>
<td>Have students retrieve 30 year average annual temperatures and precipitation records from various cities around the world. (incl. Arctic cities)</td>
<td>Standard 5.1 (Scientific Process) A.1, A.2, b.1, B.3 Standard 5.2 (Science &amp; Society) A.1 Standard 5.3 (Mathematic Application) C.1, D.1, D.2, D.4 Standard 5.8(Earth Science) A, B.1</td>
</tr>
<tr>
<td></td>
<td>• Weather</td>
<td>• Activity sheets B, C &amp; D</td>
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<td></td>
<td>• Meteorological maps</td>
<td>• Overhead projector</td>
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<td></td>
<td>• Observation</td>
<td>• Transparency of fig 2.1</td>
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<td></td>
<td>• Data Collection</td>
<td>• Graph paper</td>
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<td></td>
<td>• Precipitation</td>
<td>• Interviewees who have lived in the area for more than two or three decades.</td>
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<tr>
<td>Language Arts</td>
<td>• Gathering information</td>
<td>• Students can generate a contact letter to reach out to local community groups for interviewees.</td>
<td></td>
<td>Standard 3.1(Reading) F.1 Standard 3.2(Writing) B.1, B.3, C.1, C.6, C.7, C.8, D.1, D.2, D.6, D.8, D.10 Standard 3.3(Speaking) A.2, A.7, B.1, B.2, B.3, B.4, C.1, C.2, C.3, C.4, D.1, D.2, D.3, D.4, D.8 Standard 3.4(Listening) A.1, A.2, A.3, B.5, B.6, B.7 Standard 3.5(Viewing &amp; Media Literacy) C.3</td>
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<tr>
<td>Literacy</td>
<td>• Survey</td>
<td>• Students can generate a “thank you” letter after the activity, sharing their findings.</td>
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<td></td>
<td>• Group Discussion</td>
<td>• Publish their findings in a pamphlet or PowerPoint presentation.</td>
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<td>• Students can create persuasive writing pieces using the findings of their surveys as support.</td>
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<td>Mathematics</td>
<td>• Temperature</td>
<td>Graph results using a computer program(ex. MS Excel)</td>
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<td>Standard 4.1(Number &amp; Numeric Process) B.1 Standard 4.4(Data Analysis), Probability &amp; Discrete Math A.1, A.2, A.4, C.3 Standard 4.5 (Mathematic Process) A.1, A.2, B.1, B.2, C.3, F.1, F.2, F.6</td>
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<td>• Mean</td>
<td>• Multiplication</td>
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<td>• Multiplication</td>
<td>• Division</td>
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<td>• Division</td>
<td>• Data Analysis</td>
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| Social Studies   | • Weather patterns          |                                                                            | Standard 6.1 (Social Studies Skills)  
A.1, A.2, A.3, A.5, A.6, A.7, A.8, A.9, A.11  
Standard 6.2(Civics)  
E.8, E.10  
Standard 6.4 (US & NJ History)  
A  
Standard 6.6(Geography)  
A.1, A.2, B.2, C.3, C.4, C.5, D.8, E.1                                                                 |                                                                                                                                                                                                           |
|                  | • Map skills                |                                                                            |                                                                                                                                                                                                           |
|                  | • Climate Change            |                                                                            |                                                                                                                                                                                                           |
|                  | • Effect of humans on climate change |                                                                            |                                                                                                                                                                                                           |
| Visual Arts      | • Graphic Design & Layout   | Students may use their graphic arts knowledge and experience in publishing their results as mentioned above in LAL. | Standard 1.2(Creation & Performance)  
D.1, D.2, D.3                                                                                                                                                                                                  |
| Technology       |                              | Students may find other web-based resources to complete this activity or an extension. | Standard 8.1(Computer & Information Literacy)  
A.5, A.7, A.8, A.11, B.4, B.6, B.7                                                                 |                                                                                                                                                                                                           |
| World Language   |                              |                                                                            | Standard 7.1 (Communication)  
A.3, A.4, A.5, B.1, B.2, B.3, B.4, C.1  
Standard 7.2(Culture)  
A.2, B.1, B.5                                                                 |                                                                                                                                                                                                           |
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<tr>
<td>Career Education &amp; Consumer, Family &amp; Life Skills</td>
<td>• Group Discussion • Teamwork • Leadership skills</td>
<td>long time and use that info to compare to current data in that city/region of that country.</td>
<td>Standard 9.2(Consumer, Family &amp; Life Skills) A.1, C.1, C.2, C.3, C.4, C.5, C.6</td>
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<tr>
<td>Physical Education</td>
<td>• Group discussion • Teamwork • Leadership skills</td>
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<td>Standard 2.2 (Integrated Skills) E.1</td>
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