Marine Debris and Me

A Web-Accessible Marine Debris Curriculum

Created by Matthew Brim
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Help Soda Can Dan clean up our oceans!

The purpose of the curriculum is to provide basic knowledge and understanding of marine debris and its hazardous impact on the marine and coastal ecosystems as well as human health and safety. The primary goal of the curriculum is to provide activities which help students understand the impact of their actions on the marine environment and themselves.

The curriculum will provide several hands-on activities and graphing opportunities using Microsoft Excel. The activities and graphing exercises may be modified for other grade levels.

Grade Level: 4 – 8

Georgia Performance Standards
4th grade: S4CS1; S4CS4; S4CS5; S4CS8;
5th grade: S5CS1; S5CS2; S5CS4; S5CS5; S5CS8
6th grade: S6CS1 a; S6CS3; S6CS6 c; S6CS9 c
7th grade: S7CS1 a; S7CS3 a,b,c,d; S7CS4 c
8th grade: S8CS1 a; S8CS3 a,b,c; S8CS6 b,c

National Science Education Standards
Science in Personal and Social Perspectives
Content Standard F: populations, resources, and environments and natural hazards

Ocean Literacy Principles
Essential Principles 2, 4, 5, 6

Key Concepts
- Marine Debris
- Watershed
- Coastal and Marine Health Hazards
- Human Health Hazards

Background Information

What is marine debris?

Ocean health is essential to the well being of all life on the planet including our own (Ocean Conservancy 2007). Oceans provide critical habitats for countless marine organisms. These organisms require specific environmental conditions to survive. **Marine debris** has adverse impacts on coastal and marine ecosystems. According to the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program,

"marine debris is any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes" (NOAA Marine Debris Program- http://marinedebris.noaa.gov/marinedebris101//mdinfo.html). Marine environments can only tolerate so much debris before it negatively impacts the natural functions of surrounding ecosystems.

What are the sources of marine debris?

The general sources of marine debris are people and their actions on land and water.

Land–based sources of marine debris are the result of human activities that occur on land. Land-based debris includes any debris inland or in a coastal region which may make it into the marine environment via storm drains, rivers, and other waterways. According to the Ocean Conservancy, the majority of marine debris is generated from land-based sources such as fast food consumption, beachgoers, picnics, sports and recreation, as well as litter washed from streets, parking lots, and storm drains (2007 International Coastal Cleanup Report).

Ocean-based sources of marine debris are the result of human activities that occur in the ocean. Ocean-based debris includes anything that is deliberately or negligently disposed in the ocean. Examples of ocean-based sources are merchant shipping, cruise lines, offshore oil and gas platforms, drilling rigs, and natural events such as a hurricane. Oceans are collection points for land- and ocean-based debris via **gyres**. A gyre is made of ocean currents and atmospheric winds which create a net current cycle in the middle of the ocean. The North Pacific Gyre holds land- and ocean-based debris for many years.

Child playing in the waves with cargo ship behind. Photo courtesy of Mare Timmons.

An estimated 80% of marine debris comes from land-based sources and 20% from ocean-based sources (U.S. Department of Commerce 1999). According to The National Marine Debris Monitoring Program (NMDMP), 49% of marine debris items found along beaches were land-based, 18% were ocean-based, and 33% were general source debris meaning those debris items were undetermined as either land- or ocean-based debris (Sheavly 2007).

Debris enters the marine environment mainly due to human influence. Once the debris has entered a **watershed**, it may eventually make its way into the waterways leading to a large body of water such as an ocean. A watershed is an area of land from which water drains downstream (via rivers, streams, etc.). A watershed connects inland communities to the coastal and marine environments. For example, a piece of trash thrown in an Atlanta street may travel through a storm drain into a nearby river where it could harm wildlife and/or make the habitat look degraded.

What impact does marine debris have on the environment, human health, and the global economy?

Environmental Health Impacts

The **environmental health impacts** due to marine debris are numerous. Marine debris can pose harm to wildlife. For example, a plastic bag floating in the ocean resembling a sea jelly may be accidentally consumed by a sea turtle and block its digestive tract resulting in death from gastrointestinal blockage. According to the 2007 ICC Report, "81 birds, 63 fish, 49 invertebrates, 30 mammals, 11 reptiles, and one amphibian were found entangled in debris during the cleanup." Marine debris has injured or killed at least 267 species world-wide, primarily through ingestion and entanglement (California Coastal Commission 2006). Another environmental health impact involves synthetic polymers, more commonly known as plastics, which degrade at a slow rate in the ocean because of the colder temperatures (Moore 2008). Plastic marine debris can leach harmful chemicals into the marine environment such as PCBs and DDT.

An example of marine debris which becomes a **coastal and marine health hazard** is monofilament fishing line. Fishing line can entangle many marine organisms. For example, a black skimmer (*Rynchops niger*) which skims the water surface to catch fish for food, may encounter floating fishing line during feeding. Studies have shown that marine debris items decompose at different rates in the ocean (see marine debris illustration on page 4). Once debris enters our waterways and marine environment, it may take certain objects up to 600 years to completely decompose during which the odds of debris coming in contact with wildlife are high.

Black skimmer (*Rynchops niger)* entangled in fishing line. Courtesy of John Crawford.

Fishing line recycling post next to Moon River, GA.

Balloon shaped like sea jelly (dangerous when consumed by sea turtles). Courtesy of Lauren Jensen.

Human Health and Safety Impacts

Littering on land or at sea contributes to marine debris impacts. Marine debris is not only an environmental problem, but one that affects human health and safety. Aesthetically, marine debris is an eyesore for tourists and those who live on the coast. A sharp marine debris object is an example of a **human health hazard**. Imagine yourself walking down the beach with the sun at your back and crashing waves echoing in the background and THEN you feel a sharp pain in the bottom of your foot. You just stepped on a piece of glass that washed onto shore or someone left on the beach. Marine debris *can* directly affect you!

Broken glass in beach sand

Marine debris can contaminate the waterways we enjoy for recreation (see *Marine Debris from Land and Sea* link). Toxins from plastics and other debris can create chemicals which are harmful to humans. Certain marine debris types such as fishing line or nets entangled in boat props can cause harm to humans operating watercraft.

Economic Impacts

Marine debris can have devastating economic impacts. It is difficult to accurately estimate the overall economic impact of marine debris, but specific cases are available as examples of potential economic impacts. Marine debris negatively impacts tourism, fish catch revenues, loss of fishing gear, damaged vessels, and human injuries.

Marine debris can impact tourism through losses of revenue due to beach closures and costly cleanups. The aesthetic value of the beach can be negatively impacted with marine debris on the beach. Environmental contamination near beaches negatively impacts tourism. In New Jersey the loss in tourism in 1988 was estimated to be between $706 million and $2,977 million (in 2008 US$) as a result of medical debris wash-ups (Ofiara and Brown 1999).

The loss of fishing gear including crab pots, monofilament fishing line, and commercial fishing nets can negatively impact the commercial fishing industry. For example, an estimated 200,000 pounds of Dungeness crab (*Cancer magister*) are killed in abandoned crab pots every year in Puget Sound, an amount worth approximately $335,000 commercially.

Economic losses can result from vessel damage or entanglement. For example, in 1992 Japan estimated their fishing industry spent US$4.1 billion in boat repairs resulting from damage caused by marine debris (Proceedings of the International Marine Debris Conference, 2000).

What are possible solutions to the marine debris problem?

Marine debris causes negative impacts to environmental and human health, and to the economy. For environmental management experts and regulators the marine debris problem is a local, national, and international issue. Experts continually draw on new ideas to develop and implement strategic plans for (1) prevention, (2) response, and future (3) research and development. Unifying efforts in prevention, response, and research and development provides the best chance to manage and potentially reduce the problem. A recent plan of action created by the Interagency Marine Debris Coordinating Committee intends "to reduce, mitigate, prevent, and control the harmful effects of marine debris" (Interagency Report 2008).

(1) Prevention of Marine Debris Impacts

Public Awareness and Education

Providing the general public with the information regarding marine debris is essential in the effort to decrease the problem and possible environmental and human health impacts. This curriculum is one of many tools developed in an effort to inform young people about marine debris.

Legislation Improvement

Currently, legislation such as the Marine Debris Research, Prevention and Reduction Act and the Marine Protection, Research, and Sanctuaries Act of 1972 helps enforce legal dumping guidelines and cleanup beaches along our coastline. Like other environmental legislation, marine debris legislation must be strictly enacted and enforced to properly maintain our beaches and coastal marine ecosystems.

(2) Responses to Marine Debris Impacts

Coastal Cleanups

The Ocean Conservancy's Annual International Coastal Cleanup (ICC) is one of the largest coastal cleanups in the world. The non-profit organization coordinates cleanups in coastal regions on six continents. In 2007, more than 378,000 volunteers took part in the ICC removing more than six million pounds of debris from 33,000 miles of coastline—approximately 182 pounds of trash per mile (2007 International Coastal Cleanup Report).

The United States ICC leads the world in clean up and pounds of debris removed from the beaches. In the United States, 190,196 people removed approximately 3,949,580 pounds of debris over 10,110 miles of shoreline (2007 International Coastal Cleanup Report).

Georgia Littering Enforcement

Litter is defined as misplaced, abandoned, or discarded waste (Litter Enforcement Training for the State of Georgia). The most common marine debris items in coastal cleanups and during roadside cleanups are cigarette butts (2007 International Coastal Cleanup Report and Georgia 2006 Visible Litter Survey). In the state of Georgia, littering is illegal and strongly enforced. Anyone in Georgia caught littering could be required to pay a fine up to $1,000 and could receive more serious violations (Litter Enforcement Training for the State of Georgia). Georgia taxpayers spend millions of dollars every year to cleanup the litter in Georgia. The Georgia Department of Transportation has spent $14 million in litter cleanups in 2006 (Litter Enforcement Training for the State of Georgia).

In 2006, 66.3% of littering in Georgia was negligent (passive) and 33.7% was deliberate (Georgia 2006 Visible Litter Survey). The most persistent deliberate litterers tend to be individuals 11-24 years of age while negligent litterers are more evenly distributed among the age groups ranging from <11 – 55+ years old (Georgia 2006 Visible Litter Survey). Littering is a problem throughout the U.S. and legal enforcement is an essential tool in preventing further problems.

(3) Research and Development

One of the most important solutions to the marine debris challenge is increased funding for research and development (R&D). R&D provides the opportunity for researchers, educators, and other marine and coastal science professionals to evaluate and analyze the general and specific impacts of marine debris. It is also a resource for forecasting the marine debris impacts on global health of land and sea.

According to the 2008 Interagency Report, research must focus on the impact of persistent materials on the marine environment and the development of new technologies for prevention and removal. Marine debris research has not yet been able to provide a sufficiently comprehensive description of sources, movement, or impacts of marine debris. Better development technologies including biodegradable materials, sewer and stormwater drains, and debris location and removal equipment may help reduce introduction and persistence of marine debris.

Unified Effort and Support

A combination of these three solution categories may make for an effective marine debris solution program. Unifying coordination between federal, state, and local governments as well as private organizations allows for proper use of available resources to address marine debris issues (Interagency Report 2008).

Using Outdoor Activities to Understand Marine Debris Issues

***NOTE**: Pose the question to the students from the beginning: What is marine debris and how does it affect you?*

The following activities will provide students with a better understanding of marine debris and encourage critically thinking about its environmental, human health, and economic consequences.

Activity 1: Marine Debris Identification and Discussion

Grade: 4 – 8

Number of students: 15-20

Objectives: Students will...

- critically think about marine debris, its origins, impacts, and how it may affect their own lives
- learn marine debris negative impacts on the environment, human health, and economy through teacher-student dialog

Materials:

- medium to large beach ball, markers, paper, Velcro, pictures of marine debris items or impacts (materials based on game: whistle or stereo)

Beach ball with marine debris images for discussion

Beach ball with marine debris image attached by Velcro

Time Required: 30 minutes prep; 10-20 minutes to play

Procedure:

Place Velcro pictures of different marine debris objects or impacts on a beach ball. With class standing in a circle, the teacher tosses the beach ball to a student. The teacher asks the student about the object directly in front of him/her after the catch (recommended questions below). The student removes the picture just discussed so none of the pictures

are discussed more than once. When the questioning is finished the student chooses another student and tosses it to him/her followed by the same teacher-student dialog. This process will continue until every student has had the opportunity to discuss a picture. Be prepared to have extra pictures for the ball so that each student has there own picture.

OR

Use a stereo with music or a whistle to start and stop the activity. Using a whistle the teacher blows once to start and twice to stop. Using the Velcro beach ball and by standing in a circle, a student tosses the ball to another student once the music begins. As the time progresses students THROW and CATCH the ball in an appropriate way. ***NOTE:*** **(1) The students may not drop the ball. If so, they are out. (2) The students may not "spike" the ball at another student. If so, they are out. (3)The students may not throw the ball to another student directly to their left or right.** When the music stops the student with the beach ball must identify the picture directly in front of them. The teacher asks the student questions about the marine debris object while all other students listen. The student removes the picture (attached by Velcro), throws the ball when the music begins, and crosses his/her arms over his/her chest remaining in the circle. Students with crossed arms stay in the circle to make it more difficult for the remaining students to throw the ball to another student. The crossed armed students stay to hear the answers to questions about the different marine debris pictures. The game is over when all pictures are talked about or a student is left alone with the beach ball.

Recommended teacher questions:

- What object do you have?
- Can the object be considered marine debris?
- Why or why not? (most objects should be marine debris)
- What is a possible source of this object? Is the object from a land- or ocean-based source?
- What marine or terrestrial organisms could be harmed by this object?
- How many years does it take for the object to decompose in the ocean? (see *Marine Debris Land to Sea* link)
- What could you do to prevent this object from becoming marine debris?

Activity 2: Debris' Path to Break Down

Grade: 4 – 8

Number of students: 20-30

Objectives: Students will...

- understand the numerous impacts marine debris has on environmental, human, and economic health through critical thinking and reflection

Materials:

- Large playing space
- Marine debris object tags
- Interaction runner tags
- Hula Hops (optional)
- Four corner field cones
- ENERGIZED KIDS!!!!!

Interaction Runner Tag (Ex. Boat)

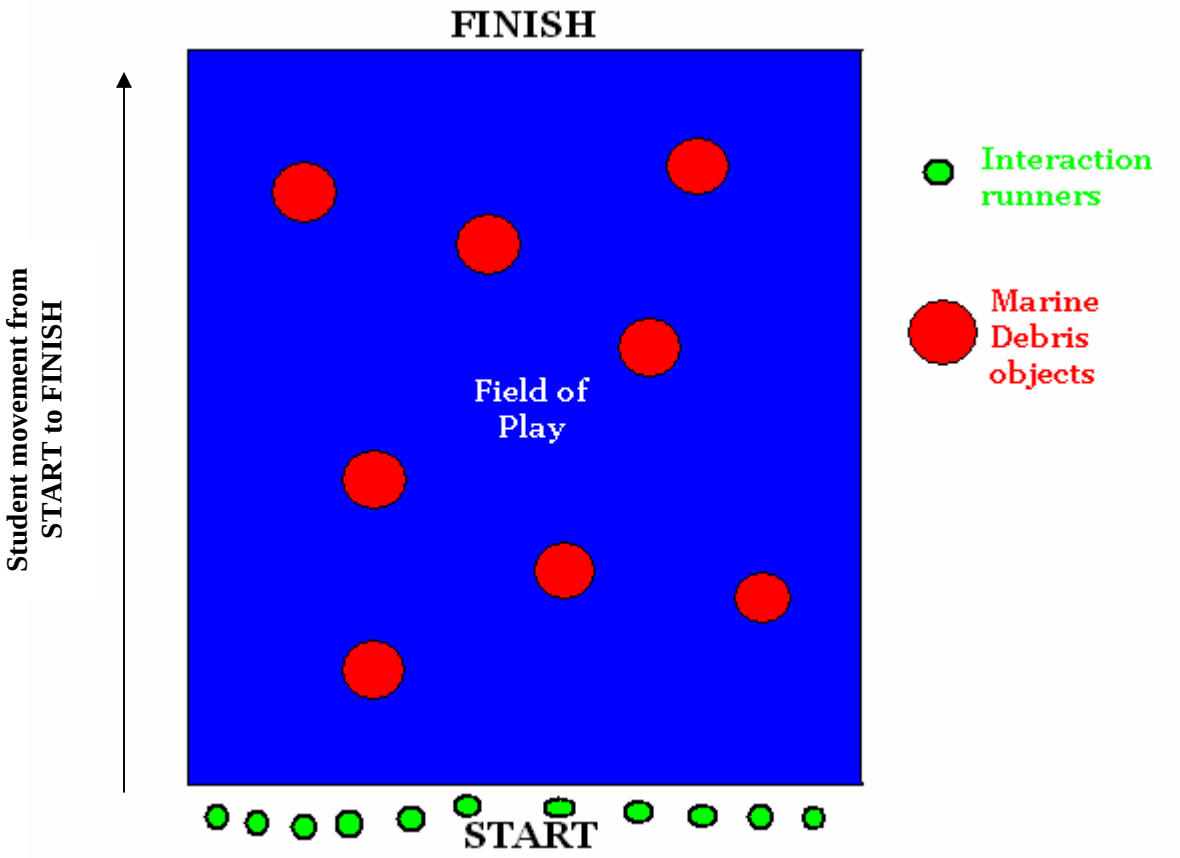
Marine Debris Object Tag (Ex: Monofilament Fishing Line)

Time Required: 30 minutes prep; 15-30 minutes to play

Procedure:

Identify students as either a marine debris object or an interaction runner. The field of play represents the ocean where marine debris objects come in contact with marine life and manmade obstructions resulting in negative environmental and human health impacts. With a group of 30 students, there are 10 taggers and 20 runners. Each student plays an active part in the game.

To play the game, the interaction runners must run from the starting line to the finish line without being tagged by the marine debris objects. Tagged students sit off the field of play. The game continues until one or no runners are left. At the end, the teacher asks how the marine debris objects negatively interact with interaction runners representing specific marine life or manmade obstructions. Play multiple rounds to increase the chances of various marine debris objects coming in contact with different interaction runners.



Marine Debris objects:
Plastic bottle, aluminum can, plastic grocery bag, glass bottle, monofilament fishing line, disposable diaper, apple core, newspaper, plywood, wool socks, hat, foamed plastic cup, plastic beverage holder, cotton gloves, cardboard box, waxed milk carton, and cotton rope

Interaction runners:
Sea turtle, boat, black skimmer (coastal bird), human health, fish, beach, whale

Recommended teacher questions:

- What may result from the contact between marine debris objects and interaction runners?
- How can the students help prevent marine debris items from coming in contact with the specific interaction runners?
- How could the marine debris item affect **me**?

Activity 3: Marine Debris Timeline

This game is modified from *Marine Debris: Cleanup and Timeline* created by Lauren Jensen and Dodie Sanders (2008).

Grade: 4 – 8

Number of Students: 20-30

Objectives: Students will...

- better understand the long decomposition process of different marine debris

Materials:

- Approximately 12 feet of rope
- 10 marine debris time tags (list below)
- 10 actual marine debris items (list below)

Time Required: 20 min prep; 10 minutes to play

Procedure:

Attach each of the ten marine debris time tags to the 20-foot rope in order of its decomposition rate in the ocean (see *Marine Debris from Land and Sea* link). The rope represents 600 years of decomposition time.

Students divide into teams of 3 students with each marine debris item represented in a group. With the marine debris tags flipped over (no description visible), the students place the marine debris item by the tag they believe represents the full decomposition time for the assigned item.

The teacher discusses the decomposition factors of each marine debris object. The teacher will reveal the correct decomposition time for each object beginning at 0 years and finishing at 600 years using the illustration as reference.

Students identifying the amount of time it takes certain marine debris items to decompose in the ocean. Photo courtesy of Lauren Jensen and Dodie Sanders.

10 marine debris time tags (in order of decomposition time):

1. Newspaper = 6 weeks
2. Cardboard box = 2 months
3. Cigarette butts = 1-5 years
4. Plastic grocery bag = 1-20 years
5. Foamed buoy = 50 years
6. Aluminum can = 200 years
7. Plastic beverage holder = 400 years
8. Plastic bottle = 450 years
9. Monofilament fishing line = 600 years
10. Glass bottle = undetermined

Using Graphing Tools and Methods to Understand Marine Debris Issues

NOTE: Graphing exercise examples completed in Microsoft Excel 2007

Graphing Exercise 1: Schoolyard Debris Study

Grade: 4- 8

Time Required: 30 minutes prep; 1-1.5 hours to conduct study

Objectives: Students will...

- investigate debris abundance by collecting debris in a schoolyard or park
- incorporate and learn the scientific inquiry
- cleanup their local park or schoolyard

Materials: Common marine debris items, quadrats made of PVC pipe (Hula Hoops can be used in place of PVC quadrats), string, or another measurable material (example below), pencils, something to write on, *#1 Data Sheet for Graphing: Schoolyard Debris Study*, gloves, trash bags or buckets for collecting

Example quadrat with dimensions of 50cm x 50 cm.

Procedure:

(1) Take a short trip to the local park or walk around the school grounds and/or pick up trash. ***CAUTION:*** Objects being picked up may include glass or other sharp objects. Take the necessary precautions to ensure student safety. Gloves are recommended.

(2) After collection, place trash in an open space outside. The teacher places quadrats (50 x 50 cm) randomly on top of the trash. With a class of 32 students, split the class into 8 groups of 4. Each group uses the *#1 Data Sheet for Graphing: Schoolyard Debris Study* to record the number of each type of debris found (Link: *(1) Data Collection Sheets 1 and 2*). The students place the recorded

data in a Microsoft Excel spreadsheet (Link: *(2) Spreadsheet and Graphing Example 1 and 2*). Using the spreadsheet template, place data for your group in the spreadsheet with the teacher's help. Once every group has submitted their data the teacher supervises the students as they create a bar graph including the class data. The bar graph should represent each group's data to evaluate the differences in debris objects found among the class.

A pie chart is good visual representation of overall class data. Using the same template spreadsheet create a pie chart of the percentage of each debris object found. Take the total number of each debris type found and place it in a new chart. In the "percentage of each debris object type" column, calculate each debris object percentage by taking the total number of each debris, dividing it by the grand total of debris objects found, and multiplying by 100. Click on the example spreadsheet cells and view the example formula. Once each percentage is calculated take the sum of all the percentages to check your work (total percentage for all debris types should equal 100). Highlight the "percentage of total number of debris" column and create a pie chart.

(3) With the bar graph and pie chart created a good comparison to real beach cleanup data is essential. Open link *(3) North Carolina Big Sweep Beach Cleanup Data* to view 2007 data. With the teacher's help students make the comparison of their data represented in the bar graph to the North Carolina beach cleanup data. The comparison at a larger scale is critical in the full understanding of the impact of marine debris on our beaches.

Reflection questions include:

Summary of Procedure:

1. Collect trash at local school or park
2. Teacher places trash randomly outside classroom
3. Place quadrats randomly in area with trash (must be same dimensions for each quadrat)
4. Identify and record debris type on data collection sheet. *(1) Data Collection Sheets 1 and 2*
5. Insert data from *#1 Data Sheet: Schoolyard Debris Study* into example spreadsheet via Microsoft Excel
6. Create a bar graph for each group's total number of debris objects and a pie chart for the percentages of total debris found. *(2) Spreadsheet and Graphing Example 1 and 2*
7. Compare to historic beach cleanup data: *(3) North Carolina Big Sweep Beach Cleanup Data*
8. Follow up questions

Follow-up questions:

1. What was the most abundant marine debris object found in our study versus the North Carolina beach cleanup?

2. What other debris items included in the North Carolina beach cleanup could harm wildlife and humans?
3. How would our plastic bags contribute to the larger problem?
4. What was the most common trash object?
5. What was the least common trash object?
6. Did you find any balls? If so, what kind and how might they impact the marine environment?
7. What unusual objects were collected?
8. How might these objects get to the marine environment?

Graphing Exercise 2: Homeward Bound: An Observational Study

Grade: 4 - 8

Time Required: 10 minutes prep; 1-2 hours to collect data, insert in spreadsheet, create graphs, and state conclusions

Objectives: Students will...

- identify debris, and record debris type and number using data collection sheet
- enter data into computer spreadsheet
- create graphs
- cleanup debris in local community

Materials: #2 Data Sheet for Graphing: Homeward Bound, pencils

Procedure:

1. Observe and record debris found in your neighborhood
2. Pick up debris and dispose of properly
3. Record debris found on the #2 Data Sheet for Graphing: Homeward Bound (*(1) Data Collection Sheets 1 and 2)*
4. Data collection and recording (procedure 1-3) one day a week for a one month
5. Place the class data in #2 Graphing Homeward Bound spreadsheet (*(2) Spreadsheet and Graphing Example 1 and 2*)
6. Calculate the percentage of debris found for each day and the total percentage for all debris found on Days 1-4 (click on cells to see formula).
7. Create a pie chart for the total percentage of debris items found on Day 1-4 (yellow highlighted column).
8. Using the pie chart, draw conclusions about the sources of the debris and where it could end up.

CAUTION: Objects being picked up may include glass or other sharp objects. Extreme care and gloves are strongly recommended for students.

Follow up questions:

1. What was the most common trash object?
2. What was the least common trash object?
3. Did you find any balls? If so, what kind and how might they impact the marine environment?
4. What unusual objects were collected?
5. How might these objects get to the marine environment?

References

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Ocean Conservancy. 2007 International Coastal Cleanup Report. 11 Dec. 2008. *http://www.oceanconservancy.org/site/DocServer/ICC_AR07.pdf?docID=3741*

Ocean Literacy Principles
http://coexploration.org/oceanliteracy/documents/OceanLitChart.pdf

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Related organizations:

Clean Coast
COSEE Southeast
Friends of Sapelo National Estuarine Research Reserve
National Oceanic and Atmospheric Administration
North Carolina Big Sweep
Ocean Conservancy's National Marine Debris Monitoring Program
Sapelo Island National Estuarine Research Reserve
South Carolina Department of Health and Environmental Control
South Carolina Sea Grant
State of Georgia Office of Environmental Management

¤ *Soda Can Dan* is an original illustration created by the UGA Marine Extension Service staff for the *Marine Debris and Me* curriculum.

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Evaluation of this curriculum

1. Did you use this curriculum?
2. Was it simple to use?
3. Would you use it again?
4. Would you recommend it to someone else?
5. Do you have any suggestions?

Please send comments to mared@uga.edu. Thank you!

#1 Data Sheet for Graphing: *Schoolyard Debris Study*

Reminder: Data should be recorded in pencil.

Name: _____ **Date:** _____

Group #: __ **Location:** _____ **Teacher:** _____

Debris Type	**Number of Debris Objects per quadrat**	**Description of certain, unique objects**
Plastic Bottle		
Plastic Bag		
Paper		
Candy Wrapper		
Rope		
Other		
Unknown		
Total		**N/A**

In a field study, why do we want to record the data in pencil?

Why do we use multiple quadrats instead of counting all the debris in the sample?

Does your debris quadrat represent: (a) a portion of, or (b) the entire area? Why or why not?

Can you think of any scientific study that would require you to take samples in quadrats instead of measuring every sample? In scientific field studies, what restrictions might not allow a scientist to measure all organisms, units, or samples?

Why do we want to know what debris objects we collected?

#2 Data Sheet for Graphing: *Homeward Bound*

Reminder: Data should be recorded in pencil.

Name: _____ **Date:** _____

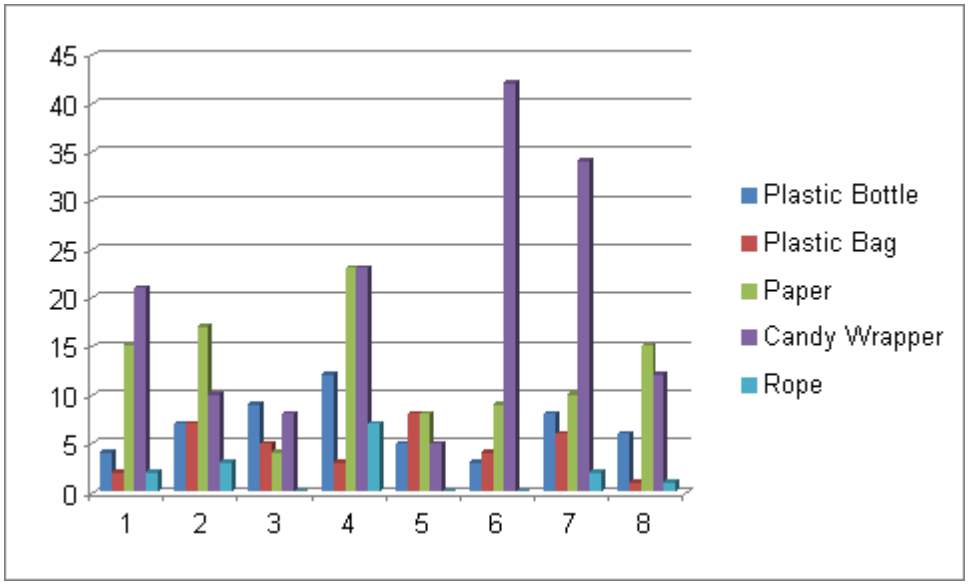
Location: _____ **Teacher:** _____

Debris Type	**Number of Debris Items**	**Description**
Plastic Bottle		
Plastic Bag		
Paper		
Candy Wrapper		
Cigarette Butt		
Rope or String		
Glass		
Aluminum Can		
Foam cup		
Paper cup		
Clothing (any type)		
Drink Straw		
To-Go Drink Lid		
Other:		
Other:		
Other:		
Total		**N/A**

(2) Spreadsheet and Graphing Example 1 and 2

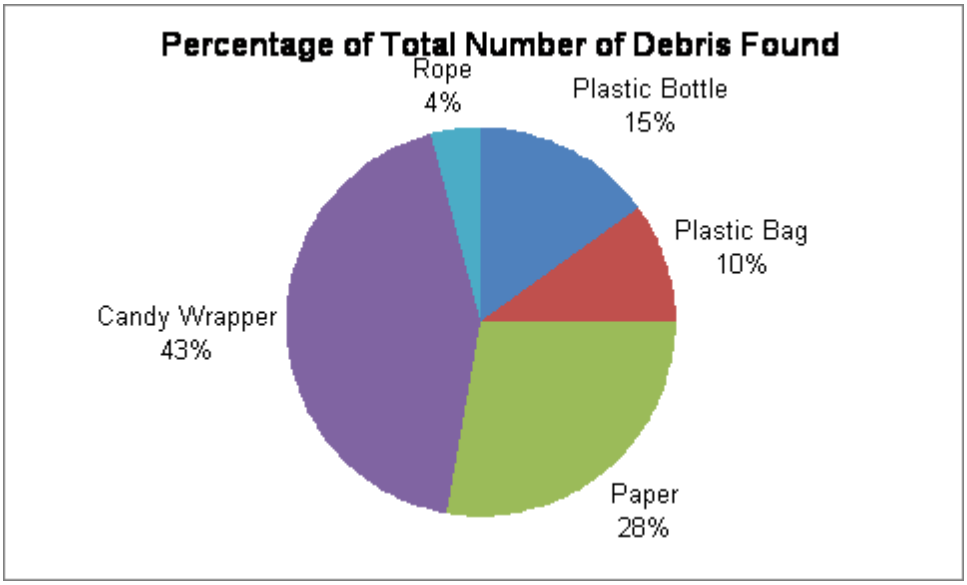
IMPORTANT NOTE: not real data

Group #	Plastic Bottle	Plastic Bag	Paper	Candy Wrapper	Rope
1	4	2	15	21	2
2	7	7	17	10	3
3	9	5	4	8	0
4	12	3	23	23	7
5	5	8	8	5	0
6	3	4	9	42	0
7	8	6	10	34	2
8	6	1	15	12	1
Total debris objects	54	36	101	155	15



Percentage of Each Debris Object Type

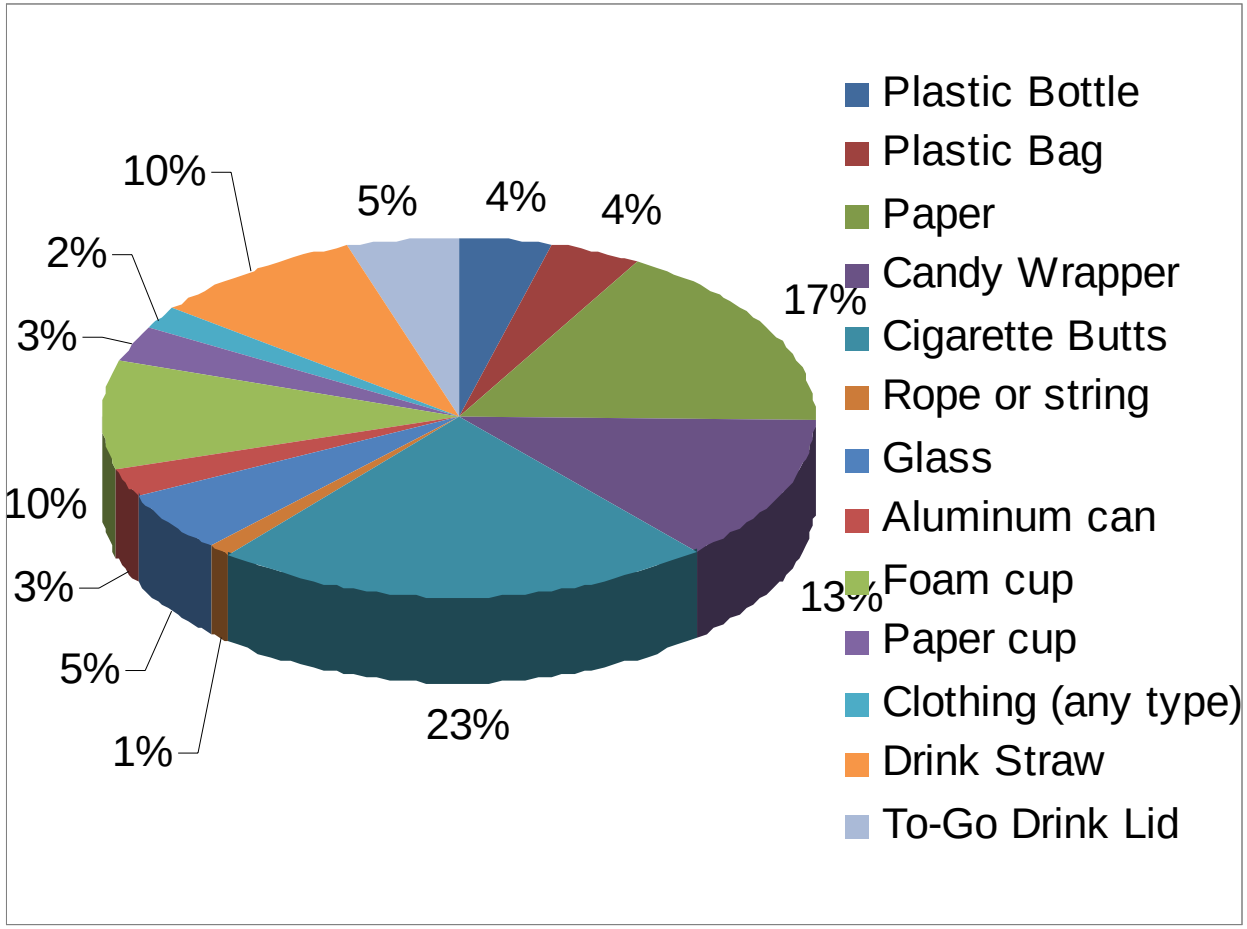
Debris Type	Number of Debris Type	Percentage of Total Number of Debris
Plastic Bottle	54	15
Plastic Bag	36	10
Paper	101	28
Candy Wrapper	155	43
Rope	15	4
Total Debris Number	361	100



(2) Spreadsheet and Graphing Example 1 and 2

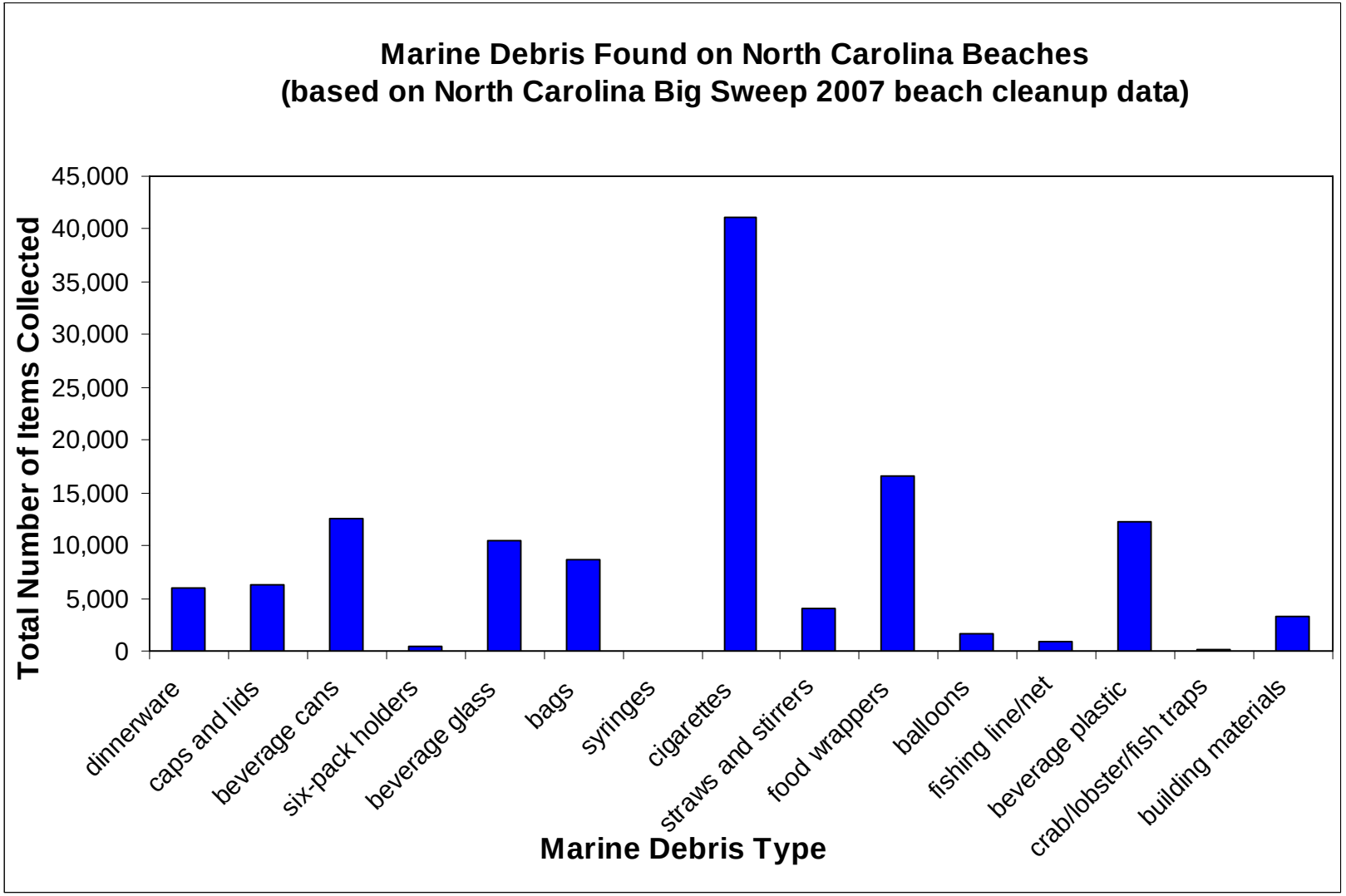
IMPORTANT NOTE: not real data

	DAY 1		DAY 2		DAY 3		DAY 4			
Debris Type	**Number of Debris Items Found**	**Percentage of Total Debris Found**	**Number of Debris Items Found**	**Percentage of Total Debris Found**	**Number of Debris Items Found**	**Percentage of Total Debris Found**	**Number of Debris Items Found**	**Percentage of Total Debris Found**	**Total Number of Debris Found Day 1-4**	**Percentage of Debris Found Day 1-4**
Plastic Bottle	6	4	10	10	4	2	12	9	32	4
Plastic Bag	3	2	3	1	23	11	3	10	32	4
Paper	29	17	63	4	23	23	19	36	134	17
Candy Wrapper	22	13	34	3	22	11	22	48	100	13
Cigarette Butts	41	24	41	6	56	12	41	62	179	23
Rope or string	2	1	1	67	0	0	6	29	9	1
Glass	14	8	8	4	5	57	15	10	42	5
Aluminum can	8	5	6	89	3	1	4	5	21	3
Foam cup	2	1	19	3	34	34	21	0	76	10
Paper cup	9	5	8	54	5	89	3	34	25	3
Clothing (any type)	4	2	2	12	6	3	3	56	15	2
Drink Straw	12	7	15	34	23	54	27	7	77	10
To-Go Drink Lid	17	10	10	5	3	1	8	4	38	5
Total	169	100	220	100	207	100	184	100	780	100


Plastic Bottle
Plastic Bag
Paper
Candy Wrapper
Cigarette Butts
Rope or string
Glass
Aluminum can
Foam cup
Paper cup
Clothing (any type)
Drink Straw
To-Go Drink Lid
4%
4%
17%
13%
23%
1%
5%
3%
10%
3%
2%
10%
5%

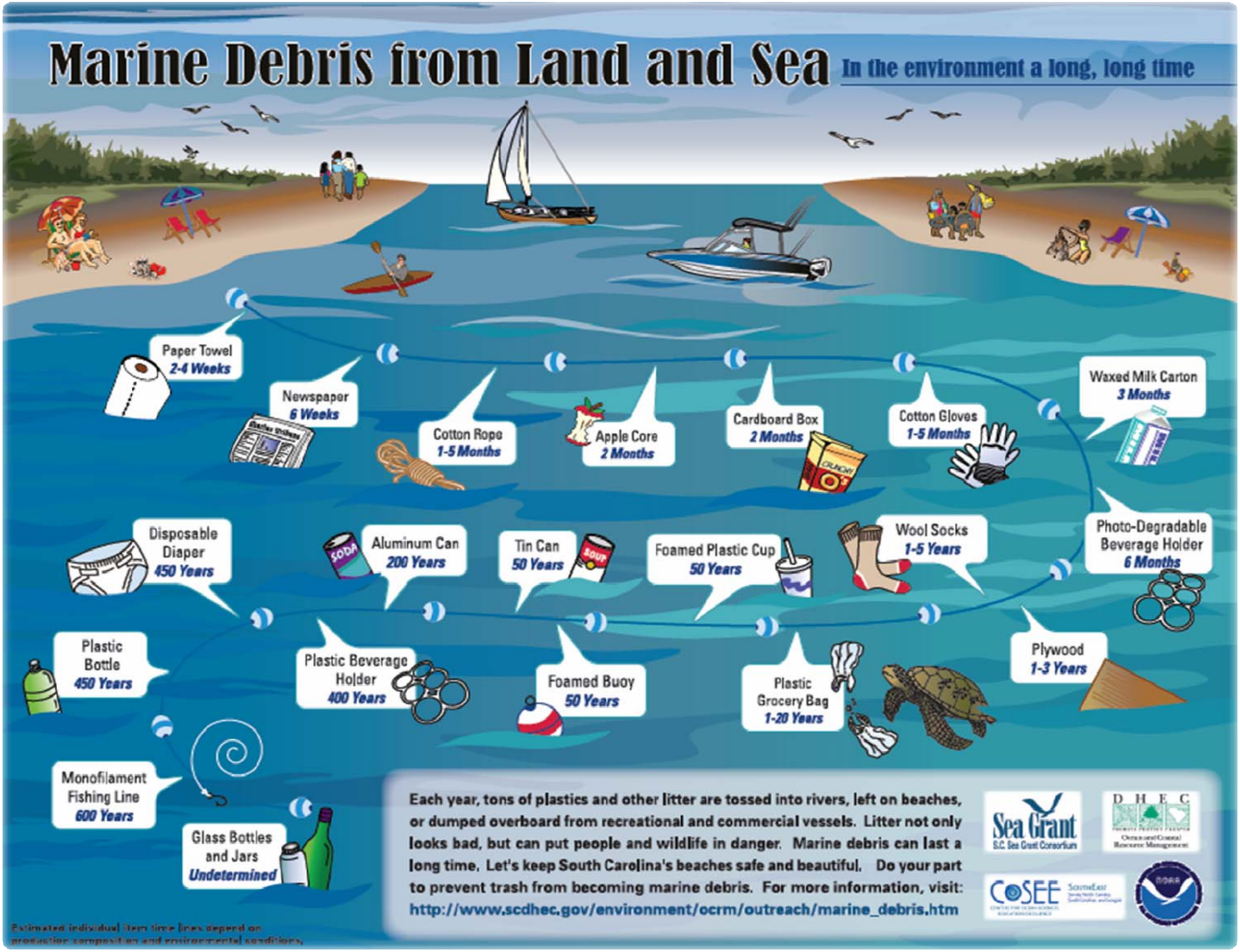
North Carolina Big Sweep Beach Cleanup Data

Number of Items	Type of Marine Debris
6,017	dinnerware
6,284	caps and lids
12,583	beverage cans
450	six-pack holders
10,414	beverage glass
8,617	bags
16	syringes
41,078	cigarettes
4,107	straws and stirrers
16,604	food wrappers
1,630	balloons
897	fishing line/net
12,255	beverage plastic
93	crab/lobster/fish traps
3,358	building materials
124403	Total # of items


Marine Debris Found on North Carolina Beaches
(based on North Carolina Big Sweep 2007 beach cleanup data)
Total Number of Items Collected
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
dinnerware
caps and lids
beverage cans
six-pack holders
beverage glass
bags
syringes
cigarettes
straws and stirrers
food wrappers
balloons
fishing line/net
beverage plastic
crab/lobster/fish traps
building materials
Marine Debris Type

Marine Debris from Land and Sea

In the environment a long, long time



Each year, tons of plastics and other litter are tossed into rivers, left on beaches, or dumped overboard from recreational and commercial vessels. Litter not only looks bad, but can put people and wildlife in danger. Marine debris can last a long time. Let's keep South Carolina's beaches safe and beautiful. Do your part to prevent trash from becoming marine debris. For more information, visit: http://www.scdhec.gov/environment/ocrm/outreach/marine_debris.htm

Sea Grant
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Estimated individual item time lines depend on production composition and environmental conditions.