# Growth: Humans & Surf Clams

## Materials

**For the leader:**

Projector

Whiteboard to project data graph onto

White paper & markers

**For the activity:**

Copy of data table

Copy of map

Class graphing paper

## Overview

Scientists studying ecology ask broad questions about how the patterns and behaviors of animals through space and time and the environmental factors that influence the distribution and abundance of individuals. Therefore for fisheries ecologists, some major questions when understanding a population are: what is the maximum age of individuals within the population, what is the maximum and typical size that individuals grow to, and how quickly do individuals in the population reach these maximum age and sizes. These data provide ecologists with an understanding of how organisms grow in their environments over time, which leads to a better understanding of the abundance of individuals within a population. Answers to questions about size and age of individual animals, as well as for the entire population, have important implications for understanding population dynamics, managing fisheries, and protecting marine and aquatic systems.

Atlantic surf clams (*Spisula solidissima*) can live up to about 35 years and are found in the western North Atlantic from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. They're most abundant on Georges Bank, the south shore of Long Island, New Jersey, and the Delmarva Peninsula. The surf clam fishery is one of New Jersey's most valuable fisheries. More than 80% of the total Mid-Atlantic and New England area catch of surf clams are landed in New Jersey. However, over the last decade, the stocks of New Jersey surf clams, along with those of within the mid-Atlantic region, including in southern Virginia and the Delmarva Peninsula have dramatically declined.

One theory for the decline of the surf clam population is that the water is getting warmer in the mid-Atlantic. This increase in temperature may be causing mortality in larger surf clams and recruitment failure (a decrease in larval survival causing decreases in the population). In addition, growth rates depend on water temperature - southern surf clam populations in warmer water grow more slowly than the more northern populations. Another impact of the warmer waters is a gradual shift in the distribution of surf clams to the north. Recent federal surf clam stock assessments indicate that nearly 50% of the stock was located off Georges Bank in 2008 whereas only 5% of the stock was located there in 1986.

Students will first plot the age vs. length data for their families to become comfortable with graphing. Then the students will plot age vs. length data for surf clams from off of New Jersey. Finally, students will compare growth curves for humans and surf clams to think about how different animals grow over time.

**Motivating Questions: How do animals grow over time? Are growth curves similar or different between people and surf clams?**

## Take Home Message

Doctors and scientists collect information about the size of individuals at certain times (ages) to learn about the health of the individual in comparison to an average animal of the population.

| | |
|---|---|
| **Engage**: Lead the students in a discussion about what they know about how humans grow over time. | 15-30 minutes |
| **Explore**: As a class, plot how surf clams grow over time. | 20-40 minutes |

| | |
|---|---|
| **Make Sense**: Compare the plots of human growth and surf clam growth. What can we learn about how animals grow from these examples? | 10-20 minutes |
| **Total:** | **45-120 minutes** |

## Audience

Early elementary school students (K-4th grade).

## New Jersey Core Curriculum Content Standards - Science

| Grade | Content Statement | CPI# |
|---|---|---|
| 2 | Living organisms: grow and develop in a predictable manner. | 5.3.2.A.1 |
| 4 | Living organisms: grow and develop in a predictable manner. | 5.3.4.A.1 |
| 4 | Building and refining models and explanations requires generation and evaluation of evidence. | 5.1.4.B.1 |
| 4 | Tools and technology are used to gather, analyze, and communicate results. | 5.1.4.B.2 |
| 4 | Evidence is used to construct and defend arguments. | 5.1.4.B.3 |

## Preparation (15 minutes)

1. For homework the night before, have your students record the age (years) and height (inches) of all of their family members.
2. Draw a chart on the board for the students to fill in the height and age of their family members as they walk into class.
3. Write the motivating question on the board:

   **How do animals grow over time? Are growth curves similar or different between people and surf clams?**

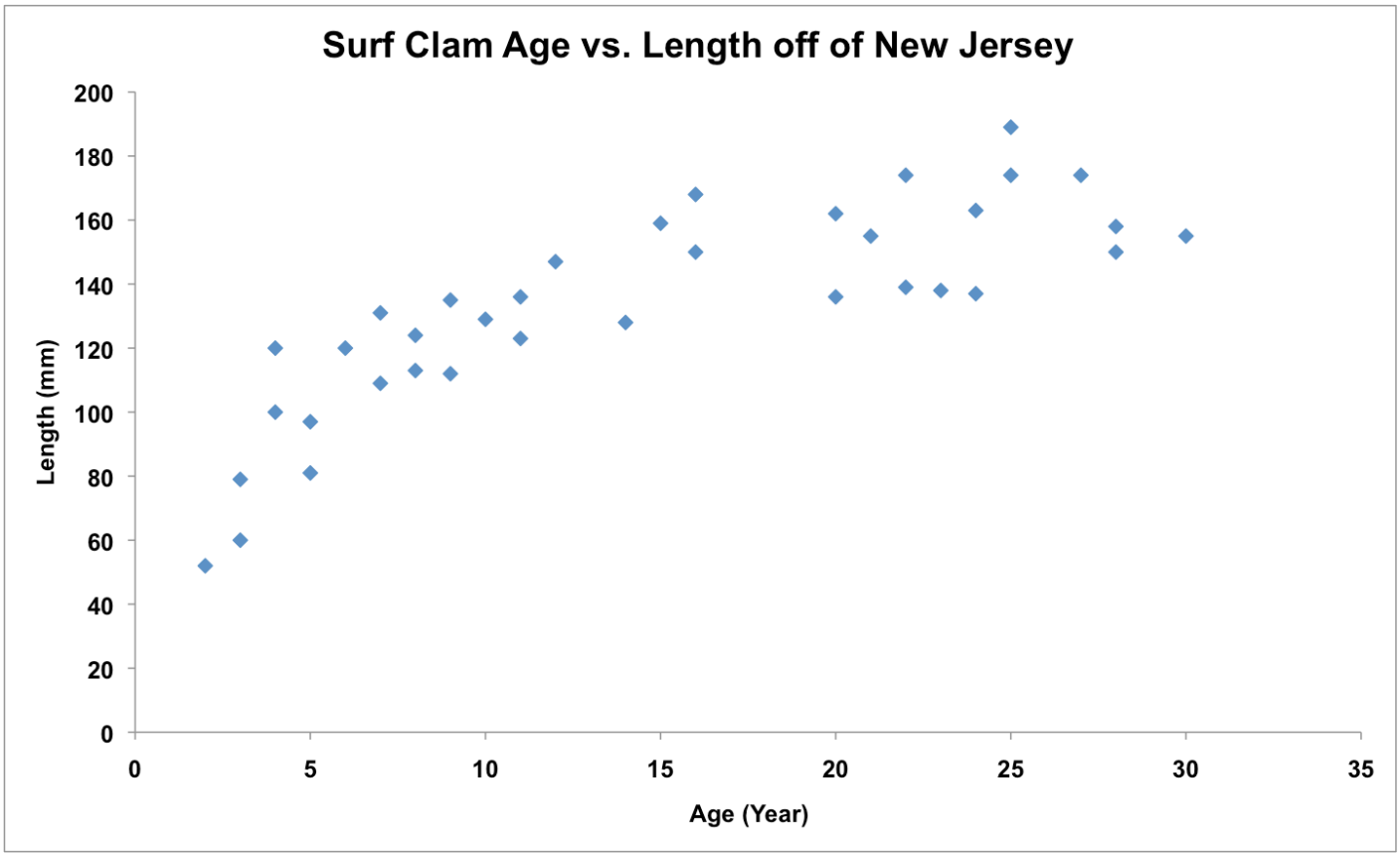
4. Project the map of where the surf clam data was collected (at the end of this document).
5. Draw out a blank graph with Age (Year) on the x-axis and Length (mm) on the y-axis on the board.
6. Draw out the data table with the Age (Year) and Length (mm) data on the board.

| Age (Year) | Length (mm) |
|---|---|
| 2 | 52 |
| 2 | 52 |
| 3 | 79 |
| 3 | 60 |
| 4 | 120 |
| 4 | 100 |
| 5 | 97 |
| 5 | 81 |
| 6 | 120 |
| 6 | 120 |
| 7 | 131 |
| 7 | 109 |
| 8 | 124 |
| 8 | 113 |
| 9 | 112 |

| | |
|---|---|
| 9 | 135 |
| 10 | 129 |
| 10 | 129 |
| 11 | 136 |
| 11 | 123 |
| 12 | 147 |
| 12 | 147 |
| 14 | 128 |
| 14 | 128 |
| 15 | 159 |
| 15 | 159 |
| 16 | 168 |
| 16 | 150 |
| 20 | 162 |
| 20 | 136 |
| 21 | 155 |

| | |
|---|---|
| 21 | 155 |
| 22 | 174 |
| 22 | 139 |
| 23 | 138 |
| 23 | 138 |
| 24 | 163 |
| 24 | 137 |
| 25 | 189 |
| 25 | 174 |
| 27 | 174 |
| 27 | 174 |
| 28 | 150 |
| 28 | 158 |
| 30 | 155 |
| 30 | 155 |

7. Make a graph of the actual surf clam data on the board, but make sure it is hidden from the students.




## Engage (15-30 minutes)

1. Lead the students in a discussion about what doctors can learn about how old people get. Be accepting of all responses from the students.

**Q. Why do doctors collect data about our height and age? What are doctors trying to learn about us when they collect this information?**

2. Explain to the students that doctors use age and size information to learn about how people grow over time and to make sure we are healthy. To do this, doctors collect information from many people at many times (ages), this is what their doctor does when they go for their annual physical. They will now get the chance to take a closer look at how humans grow over time.
3. Have the students look at the data table they created about their family members, as they added their data when they walked into class. As a group, plot the data of each family member on the board.
4. Once the plot is complete, have the students look for patterns in the data. If they get stuck, ask them does the height of people change as they get older? Do people get taller or shorter the older they get? As the students are commenting on the relationship, keep a list of their statements on the board.
5. Once the conversation slows, ask the students: what about other animals? Can we ask a dog, tree, or clam how old it is? Be accepting of all answers, as this is a brainstorming session. Then ask the students:

**Q. Why do scientists age animals? What questions are scientists trying to answer when they collect data about the age and size of animals?**

6. Inform the students that they will be marine biologists studying surf clams for the day. They will soon learn about how surf clams grow, but first lead them in a discussion about shellfish and surf clams. (Note – It would helpful to have images of different types of shellfish and clams for them to look at.)

**Q. What do you know about shellfish? What do you know about surf clams? What do they need to survive? Where do they live?**

7. After a minute or two, and depending on what the students already know, share some information with them that you feel they need to know to understand the activity of the day or that you want them to know about shellfish/clams in general.

## Explore (20-40 minutes)

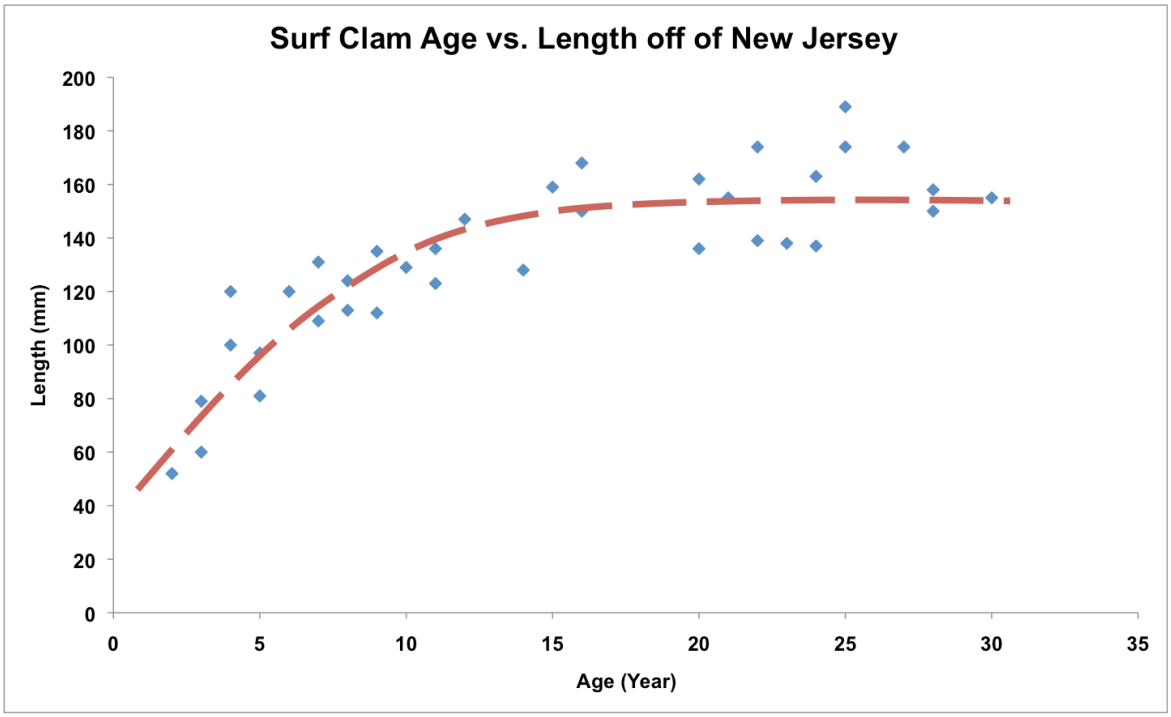
1. Explain to the students that fisheries scientists collect surf clams off of New Jersey every year to gather information about their size, age, and health. Point out to the students where the samples were collected (and other fun landmarks in the mid-Atlantic) on the map.
2. As a class make a graph of the age and size data for the surf clams from off of New Jersey on the board. (Note – Engage the students as much as possible in the graphing activity, have them draw the dots or use white paper and have them place stickers for each data point. It may help to assign students specific rows from the data table to individually plot on the class graph.)
3. Once the graph is complete, have the students talk with a partner to answer:

**Q. What patterns can you observe in the data?**

**Q. How old to surf clams get?**

**Q. How big do surf clams get?**

4. After a few minutes, have the students come back together and share as a class their observations. Make sure to have the students support their statements of the patterns and trends by stating what evidence they are using.
5. As the conversation is winding, down explain to them that scientists use a model and these data to make a growth curve line (show them the graph with the predicted growth curve line) to show the average growth curve of surf clams in the population.




6. Have the students work in small groups (2 partner pairs) and discuss:

**Q. Is there a relationship between age and size of Atlantic surf clams off of New Jersey?**

7. After a few minutes bring the students back together as a class to have them share with one another what they talked about as the relationship between age and length of surf clams. Make sure to have the students support their statements of the patterns and trends by stating what evidence they are using. As the students are commenting on the relationships, keep a list of their statements on the board. Make sure the students understand, by the end, that the growth curve line helps scientists understand how surf clams grow and that this is the same concept as the growth curve for people that doctors use.

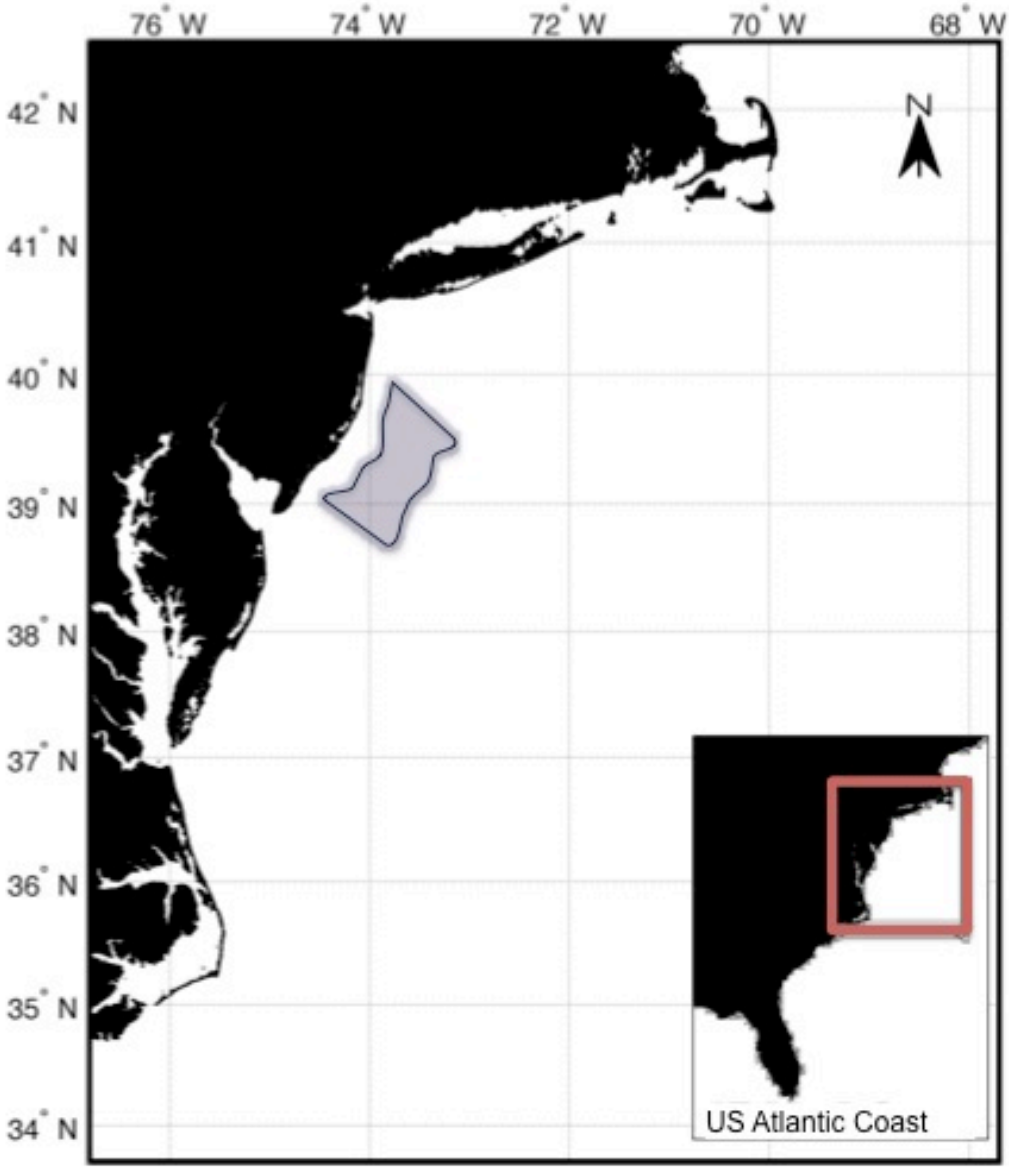
## Make Sense (10-20 minutes)

1. Tell the students that we are going to interpret and analyze all of the data (humans and surf clams) as a class.
2. With a partner have the students compare the data. Have them look at the two plots (human growth and surf clam growth) and think of the similarities and differences between the growth curves of humans and surf clams.
3. After a few minutes have the students report out what patterns and/or relationships they observed in the two datasets. Make sure to have the students support their statements of the patterns and/or relationships by stating what evidence they are using.
4. Help the students see the:
    a. Similarities:
        i. As both humans and surf clams get older (age increases) they get bigger (length increases).
        ii. However, this is not a linear relationship (1:1) and that the relationship (slope) changes as the surf clams get older, just like in humans, until it eventually levels off.
    b. Differences:
        i. The maximum age of surf clams is younger than humans (only 35 years old).
        ii. The maximum size/length of surf clams is smaller than humans (only 189 mm ~7.5 in).
5. Once the discussion slows down, point to the motivating questions and ask:

**Q. How do animals grow over time? Are growth curves similar or different between people and surf clams?**

6. Ask students to share their ideas about the questions with the entire class. Be accepting of all responses from the students. This is your opportunity to make sure the students understand the "take home message".
7. Ask if the students have any final questions about the activity, graphing, or relationship between age and size of animals.

# Surf Clam Sampling Map




Sampling stratum (area) of surf clams off of New Jersey from NOAA Fisheries Federal Stock Assessment Surveys.