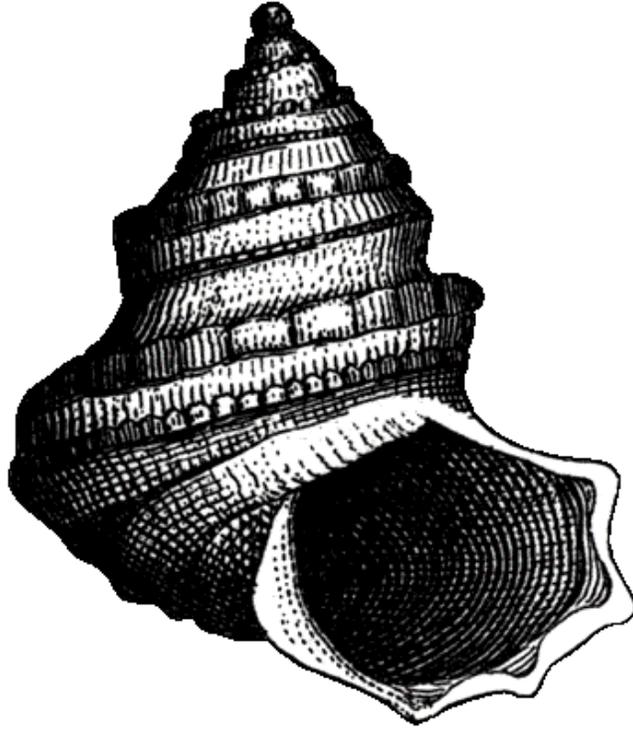


Comparison of Shell Sizes to Weights using the metric system



*“Bringing Marine Science
into the classroom”*

*An Activity developed through the
Marine Academy of Technology
and Environmental Science (MATES)*



MATES is a program of the Ocean County Vocational Technical School System

Bringing Marine Science into the Classroom

Comparison of Shell Size to Weights by using the Metric System

This activity is designed for upper elementary through middle school. It includes basic shell identification, measurements, and graphing skills.

Next Generation Standards:

Science (Middle School): MS-LS1-5 Connection MS-LS2.A

Disciplinary: LS1.B

Mathematics: 6.SP.A.2, 6.SP.B.4

Items Needed:

For the classroom consisting of three students as designated per teacher or at home each student could use...

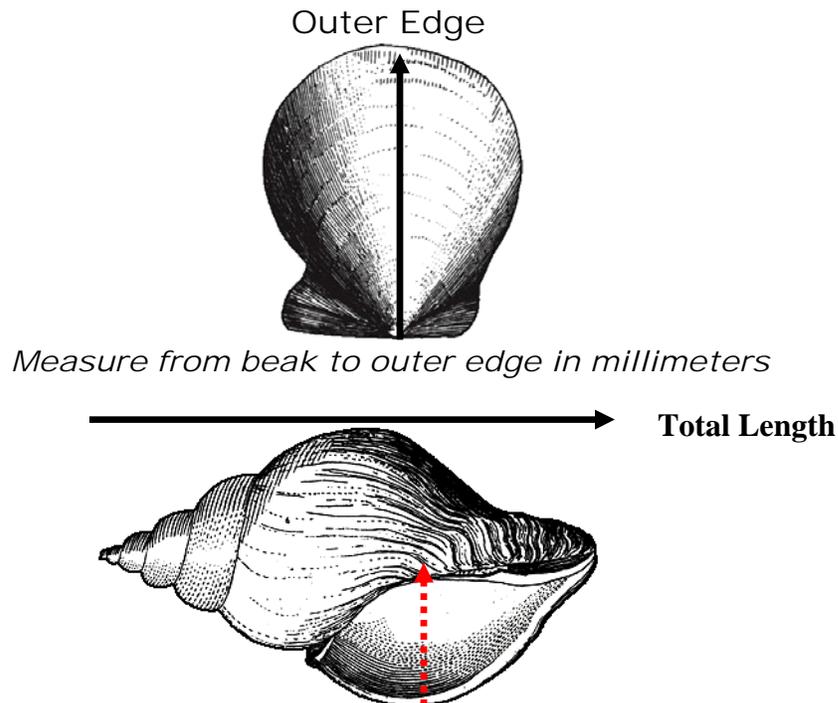
- Shells; either knobbed and channeled whelks, but Surf clams, northern quahogs, etc., could be substituted
- Balance; triple Beam Recommended, but any will do (kitchen scales)
- Ruler with millimeter measurements
- Pencils and chalk or wax pencils
- Recording sheet for data could be copied
- Graph paper or use of computer with graphing program (i.e., Excel or Google Sheets)



Comparison of Shell Type

Instructions:

1. Obtain all materials and explain to students that they will be measuring shells as explained in the attached shell measurement sheet. Each shell type has varying measurement techniques.
2. Have students mark the individual shells for measurement using chalk or wax pencil to number them to eliminate mistakes.
3. Review measurement technique using millimeters to conduct measurements.
4. After a measurement is taken, the shell should be weighed in grams.
5. All data should be logged including shell type, measurement and weight (grams) on the data sheet provided in the activity.
6. Have students log their data on a computer graphing program or use a traditional graph with size on the x - axis and weight in grams on the y - axis. Depending on the types of shells used, each shell type could be graphed using the same graph.
7. Have students clean-up and return all laboratory equipment and shells back to the area designated.



Whelk's could also be measured by using operculum opening

Comparison of Shell Type

Applications for Teachers and Resources:

Enclosed are basic fact sheets on selected shell species found in the New Jersey area. This lesson could be used in middle and high schools. At the high school level, students could graph multiple shell types including both knobbed and channeled whelks. Students could analyze their graphs, which show a linear pattern, and explain the differences in both types based upon their characteristics. Using the factual information sheets on the knobbed and channeled whelks, students can hypothesize about specific habitat.

Using a single graph, two similar classes of shell types, or more, could be graphed. Common shells belong to the Phylum Mollusca, divided into single shells or the class Gastropoda (i.e. whelks, snails, and limpets); or the class Pelecypoda including the Bivalves (i.e. clams, oysters, scallops and arks). When conducting this activity, please compare similar classes. Using the Gastropods, it is better to compare operculum opening (see first attachment), because there are so many variations in whelk lengths due to breakage. Opercular openings are not affected as much. When measuring bivalves, it is important to measure the distance between the beak and outer edge.

It is recommended that students mark their shells prior to measurements to eliminate confusion. It is also recommended that students categorize the shells into groups so that they measure the same shell types first, then the second type.

Shells could be obtained from collections on the beach, especially surf clams, local seafood markets may be able to help, and other marine education agencies, schools, and colleges are usually glad to assist.

References used in this lesson:

- *Peterson's Guide to Seashells*
- *NJ Marine Sciences Consortium Publication (Enclosures)*
- *Shell Dichotomous Key identification by Donald Dorfman, Monmouth University*



Resources and References (Updated 2020)

Atlantic City Aquarium <https://www.aquarium.com/animals/channeled-whelk-knobbed-whelk/>

Barnegat Bay Partnership (on-line electronic guide)
<https://www.barnegatbaypartnership.org/species/>

Barnegat Bay Shellfish LLC <http://Barnegatbayshellfish.org>

Chesapeake Bay Program
https://www.chesapeakebay.net/S=0/fieldguide/critter/knobbed_whelk

Traditional Resources:

Peterson's Field Guides. Gosner's Guide to the Atlantic Seashore ISBN#0-618-00209-X

National Audubon Society Field Guide to North American Seashells ISBN#0-394-51913-2

Peterson's Field Guides. Shells of the Atlantic & Gulf Coasts & the West Indies ISBN#0-395-69779-4

Surf Clam

(*Spisula solidissima*)



History: This clam is considered a bivalve (2 shells) in the Family Mactridae. It is the most common shell type that is found on mid-Atlantic coastal beaches. It is commercially an important clam species off our coast used for the seafood industry.

Habitat: Surf clams are found in sub-tidal waters near shore (sometimes in lower intertidal waters) and in water depths up to 100 feet. They are filter feeders, thus water quality is a key for their survival. They range from Labrador to South Carolina,

Description: The adult shell approximately 8 inches long, with visible markings and grooves based upon their growth years. Their exterior colors are tan to white with deeper colored markings on their grooves. They possess lateral teeth on the inside part of their hinge on either side of their umbo (beak). They also have two distinct markings where their two major adductor muscles help to keep the valves (shells) closed.

Reproduction: The life cycle of the surf clam includes a pelagic larval phase. As a juvenile, it becomes a seedling, relatively sedentary benthic and remains that way through its adult phases. Hard clams begin their adult lives as males, often become females with greater maturity, and require individuals of both sexes for reproduction. Clams develop functional male gonads during the first or second year of life.

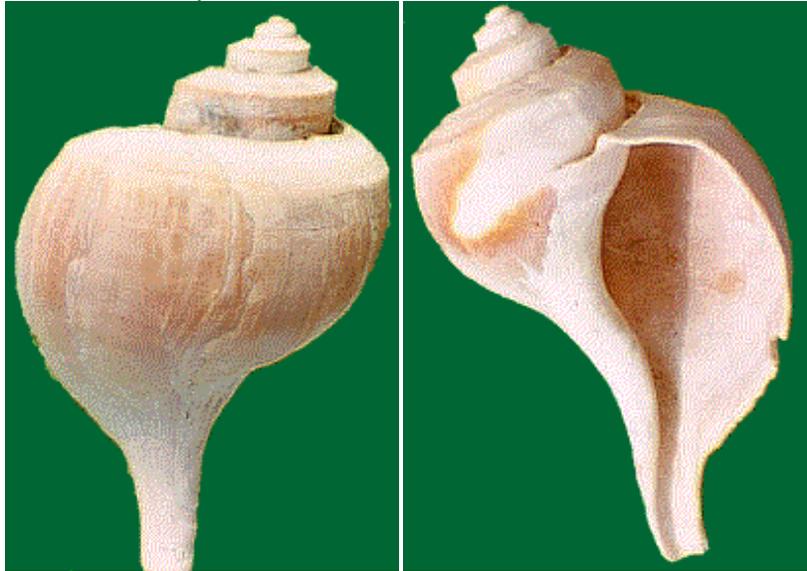
Spawning cycles are affected mainly by water temperature and the availability of food, and thus vary according to latitude. Spawning often occurs in "pulses" and may continue for months, but usually there are one or more distinct spawning peaks. Individuals may release as many as 60 million eggs during one season.*

Feeding: Surf clams are filter feeders using their siphons to pull water through their gills and digestive systems. Large phytoplankton blooms can be visibly detected by examining the stomach and gills of surf clams.

**Thanks to the Chesapeake Bay Foundation for the Reproduction Facts*

The Channeled Whelk

(*Busycon canaliculatum*)



History: It is one of fourteen recognized species of the subfamily Subfamily Bucyconinae (Finlay and Marwick, 1937), and the Family Melongenidae. They have flourished in the Atlantic Ocean approximately 30 million years.

Habitat: Channeled whelk range from Cape Cod to Florida. They can inhabit bays and estuaries, but could be found as deep as 60 feet. They bury themselves in the sand as far as 8 – 9 inches.

Description: The adult shell approximately 7 inches long, contains channeled sutures. Adults have square-shouldered whorls (a whorl is each spiral of the shell). Their exterior colors can vary from a dark grey to white, to tan with dark brown streaks. Their interior can also vary in coloration depending on the location of the whelk.

Reproduction: Whelks are separate sexes with females thought to be larger than males. They reach maturity in 3 -5 years, twice per year in the southern states they mate in estuaries. In the more temperate northern states, they mate once per year. The female remains in the estuary to deposit eggs, a string of 30- 100 fertilized egg capsules. Each capsule could contain up to 100 whelks. The length of the egg string could exceed one foot. The pattern on each capsule is rough and edged unlike their immediate relative the knobbed whelk. Eggs hatch up to one year depending upon the temperature of the system.

Feeding: Channeled Whelk feed on other bivalves as strong predators. They use their shell's lip to pry valves apart. They locate their prey with their proboscis and use a radula to scrape their prey during feeding. One they open the other valves (shells), they insert their proboscis into their prey and begin feeding.

The Knobbed Whelk

(*Busycon carica*)



History: It is one of fourteen recognized species of the subfamily Subfamily Bucyconinae (Finlay and Marwick, 1937), and the Family Melongenidae. They have flourished in the Atlantic Ocean approximately 30 million years.

Habitat: Knobbed whelk range from Cape Cod to Florida. They can inhabit bays and estuaries, but could be found as deep as 100 feet. They bury themselves in the sand as far as 8 – 9 inches.

Description: The adult shell approximately 10 inches long, contains large beads (tubercles), which resemble knobs. Their opening on the opposite side of the knobs contains a long siphonal canal. Their exterior colors can vary from a dark grey to white, to tan with dark brown streaks. Their interior can also vary in coloration depending on the location of the whelk.

Reproduction: Whelks are separate sexes with females thought to be larger than males. They reach maturity in 3 -5 years, twice per year in the southern states they mate in estuaries. In the more temperate northern states, they mate once per year. The female remains in the estuary to deposit eggs, a string of 100 fertilized egg capsules. The length of the egg string could exceed one foot. The pattern on each capsule is smooth. Eggs hatch up to one year depending upon the temperature of the system.

Feeding: Knobbed Whelk feed on other bivalves as strong predators. They use their shell's lip to pry valves apart. Once they open the other valves (shells), they insert their proboscis into their prey and begin feeding.

The Knobbed Whelk shell (valve) is considered New Jersey's State Shell