AUGUST
BOATS:
HYDRODYNAMICS

TAKE-AND-MAKE SUPPLIES
- 5 nails
- 4 toothpicks
- 2 foam craft squares
- 1 cork
- 1 piece of aluminum foil

OTHER SUPPLIES
- Water
- Sink or bucket to test the boat
  (Water should be at least 2-3" deep)
DEFINING THE TERMS

AERODYNAMICS
The study of how air moves around an object.

HYDRODYNAMICS
The study of how water moves around an object.

BALLAST
Weight in the bottom of the hull that helps keep the boat stabilized and stay balanced.

KEEL
The wing or fin that extends along the center line of the hull (bottom of the boat) downward. It runs from the bow (front) of the boat to the stern (back).
Stand on one foot and lean to the side. How far can you lean before you fall over?

Now, get on your hands and knees and lean to the side. How far can you lean over before you fall?

When is it easier to balance: when you stand on one foot or when you are on your hands and knees?

Hopefully, you noticed that it is easier for you to balance, or avoid falling over, when you are low to the ground - on your hands and knees. The same idea applies to boats! They need a low center of gravity/mass to stay upright and avoid capsizing, or falling over.
You can move the center of mass of an object by adding weight.

- When you add weight to the top, the center of mass will shift up.
- When you add weight to the side, the center of mass will shift to that side.
- When you add weight to the bottom, the center of mass will shift down.

The more weight you add to one of these areas, the more the center of mass shifts. For a boat to have a low center of gravity, its weight must be concentrated toward the bottom of the boat, not the top.

This is what the ballast does - it creates a counter-weight to the mast and helps keep it upright. The higher the mast or the bigger the sail, the heavier the ballast needs to be. BUT if the ballast is too heavy, the boat will sink! In sailboats, the ballast is usually part of the keel.
The ballast keeps the boat upright. The *keel*, or centerboard, helps it move forward. If a boat did not have a keel, then it would go in the direction of the wind or currents.

**EXTRA CHALLENGE: CHANGE THE SAIL**

Change the size of the sail: use the remaining piece of craft foam to make a sail (1.5" x 3"). What happens? Can you add more weight (more nails) to the ballast? What happens?
LOOKING FOR MORE?
Stop by the Bala Cynwyd Junior Room to check out books about boats, submarines, and more!

**NON-FICTION**

*Boats, Ships, Submarines, and Other Floating Machines*
by Ian Graham

*Into the Wind: Sailboats Then and Now*
by Steven Otfinoski

*Ships and Submarines*
by Ian Graham

*Amazing Boats*
by Margarette Lincoln

*Cargo Ships*
by Jason Cooper

*Sailboats*
by Jason Cooper

*Ships*
by Philip Wilkinson

*Boat*
by Eric Kentley
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FICTION

The True Confessions of Charlotte Doyle
by Avi

Carry On, Mr. Bowditch
by Jean Lee Latham

The Left-Handed Fate
by Kate Milford

The Great Wide Sea
by M. H. Herlong

Compass South
by Hope Larson

Turn of the Tide
by Rosanne Parry

Call it Courage
by Armstrong Sperry

Windcatcher
by Avi