

# 5

## CHAPTER

# How Sails Work

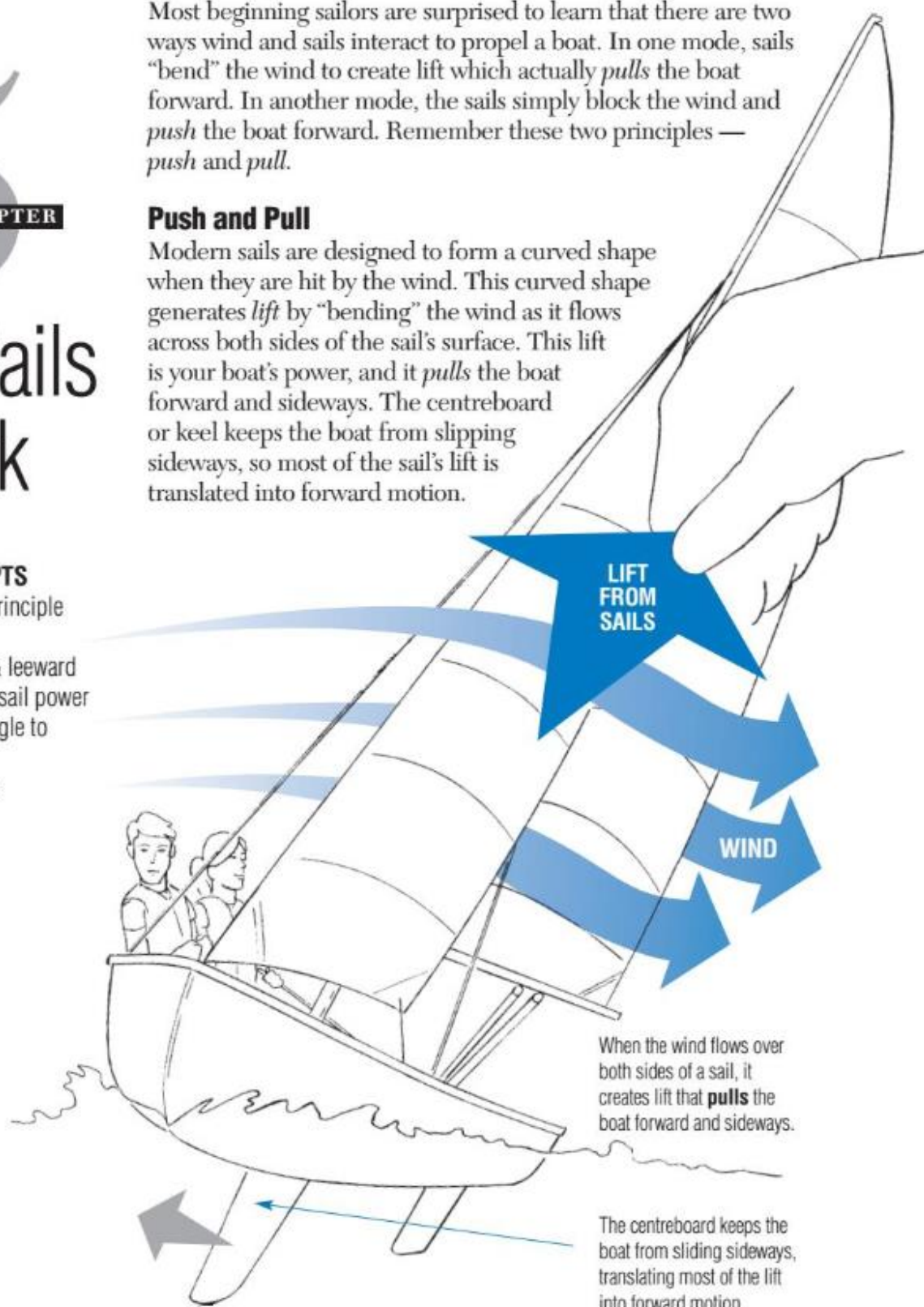
### KEY CONCEPTS

- Push-pull principle
- Lift
- Windward & leeward
- Controlling sail power
- Constant angle to the wind
- Sail telltales

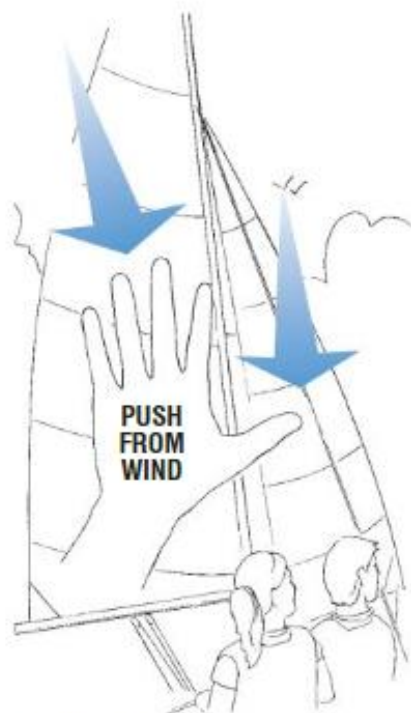
Most beginning sailors are surprised to learn that there are two ways wind and sails interact to propel a boat. In one mode, sails “bend” the wind to create lift which actually *pulls* the boat forward. In another mode, the sails simply block the wind and *push* the boat forward. Remember these two principles — *push* and *pull*.

### Push and Pull

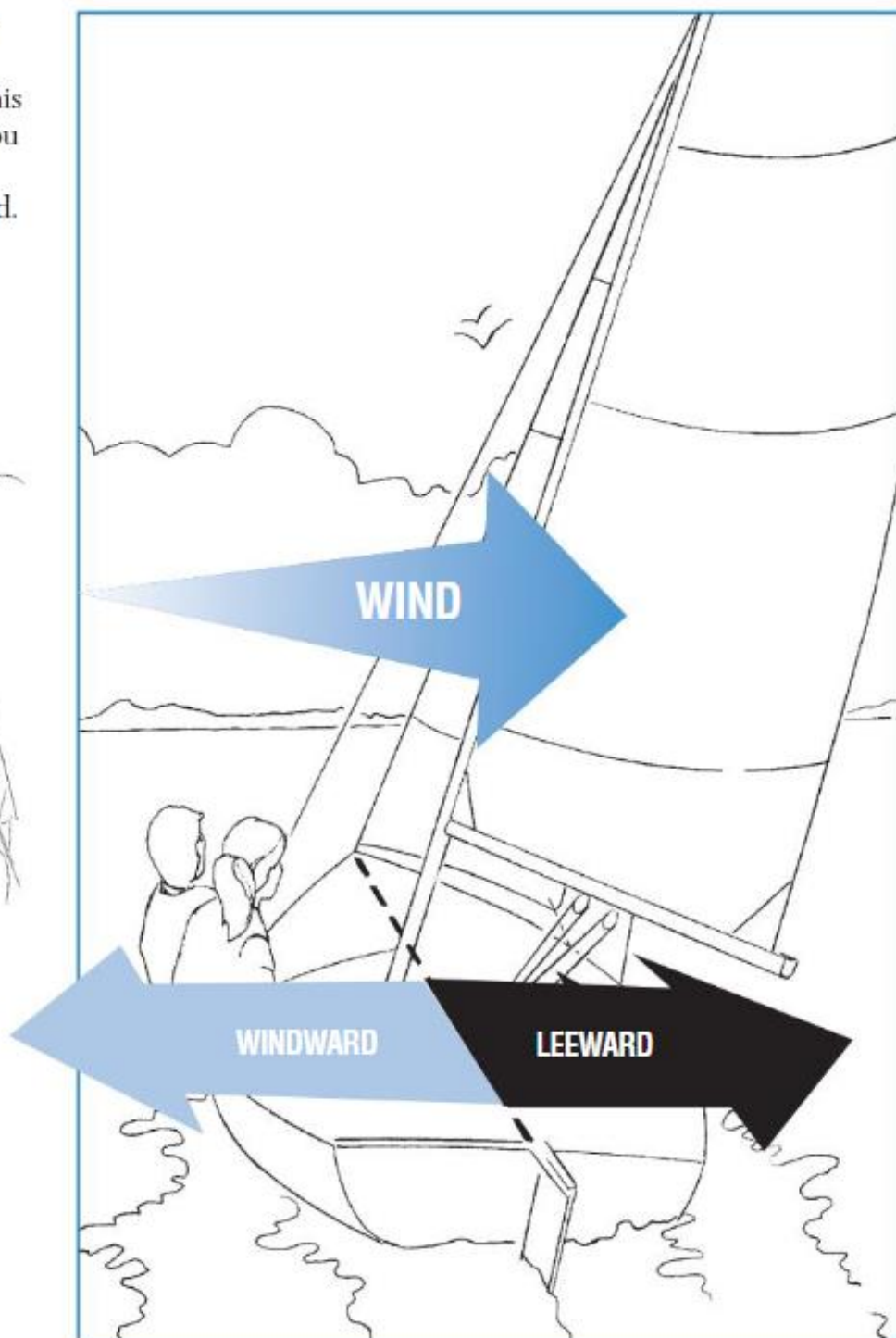
Modern sails are designed to form a curved shape when they are hit by the wind. This curved shape generates *lift* by “bending” the wind as it flows across both sides of the sail’s surface. This lift is your boat’s power, and it *pulls* the boat forward and sideways. The centreboard or keel keeps the boat from slipping sideways, so most of the sail’s lift is translated into forward motion.



Other times the sail simply blocks the wind, which *pushes* the boat forward. This is typically the case when you are sailing with the wind coming from directly behind.



When the wind comes from behind, it **pushes** against the sail and moves the boat forward.



### Windward and Leeward

To help describe this push-pull principle better, we need to introduce two key sailing terms...*windward* and *leeward*. Windward refers to the direction that is toward the wind source. Leeward is the direction away from the wind source. The windward side of a boat is the side the wind blows over first. Leeward is the side it blows over last. Windward and leeward can describe the sides of a boat: "Please move to the windward side," or relative position: "Let's sail to leeward of that boat."

## Controlling Sail Power

The amount of power (pull) your sails produce — and hence your speed — can be controlled by altering the air flow over the sails. Maximum power is obtained when the air flows smoothly across both the windward *and* leeward side of the sail. If the air flow is turbulent, the sail will develop less power and your boat will slow down.

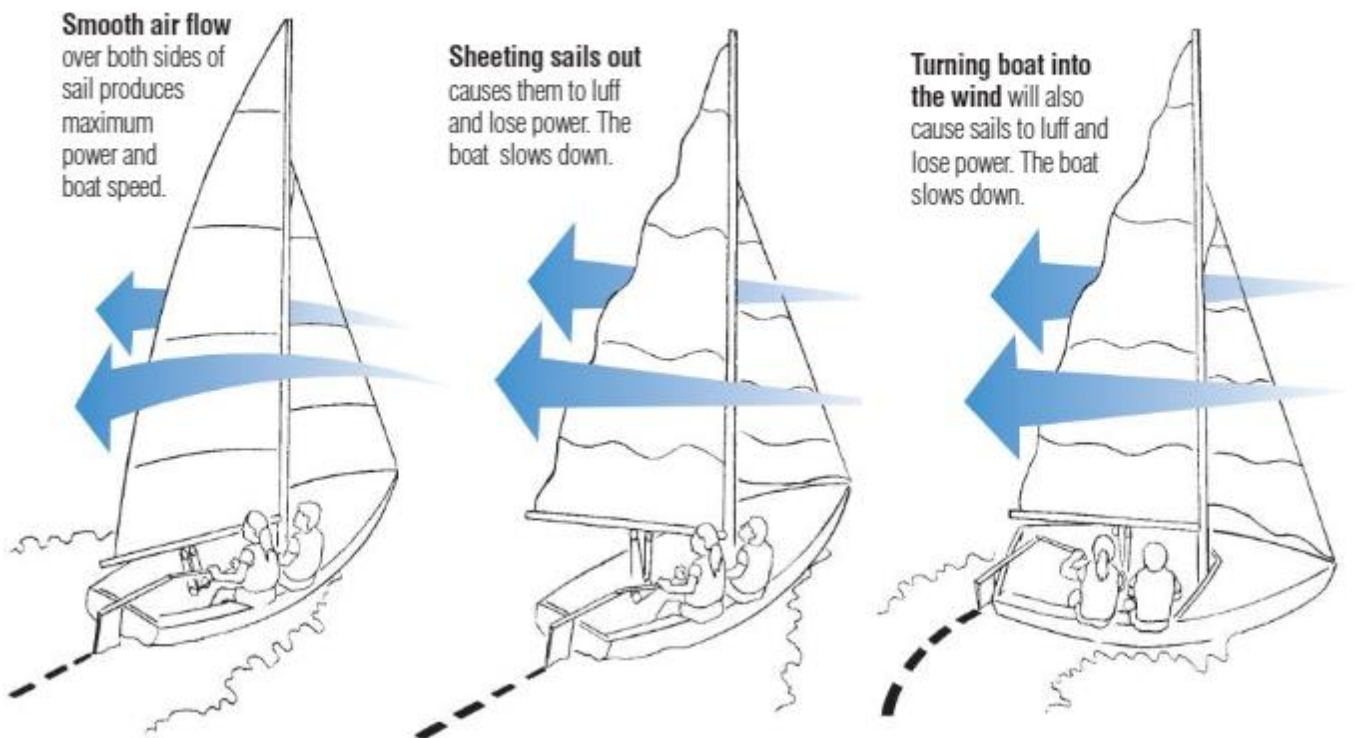
When the sail is flapping in the wind like a flag, it develops no power at all. This is called *luffing*. Luffing is a normal part of sailing and can be used to reduce boat speed or to stop the boat. A luffing sail can make a lot of noise in a fresh breeze, but don't be alarmed — it's a natural part of sailing.

For maximum power, you need to adjust the sail so that it has the optimum angle to the wind. Adjusting the angle of the sails to the wind can be done two ways.

1. **Using the sheets** to change the angle of the sails relative to the wind. This is called *sail trim*.
2. **Changing the direction of the boat**, which changes the angle of wind relative to the sails.

## Depowering Your Sails

Pulling in or letting out the main sheet or jib sheet is called *sheeting*. Pulling in the sails is called *sheeting in*. Letting the





sails out is called *sheeting out*. Sailors sometimes refer to sheeting in as *trimming* and to sheeting out as *easing*. When sheeting for maximum speed, the sail will keep a *constant angle to the wind*. This constant angle is controlled by steering and sheeting the sails.

## Using Sail Telltales

*Telltails* are often used to “show” the invisible wind flow over the sails. They are made of yarn, thread, or any other lightweight material that blows easily in the wind. They are normally placed on the forward one-third of the jib and near the centre of the mainsail. Some sailors place a telltale on the *leech* (back edge) of the sail to show the air flow as it leaves the sail’s surface.

Telltails show whether the air flow along the sails is smooth or turbulent. When a telltale is flowing parallel to the water, the wind flow is smooth. When the telltails bounce around and flutter erratically, the air flow is turbulent. While telltails are very helpful, don’t get too wrapped up in them. Remember to “keep your head out of the boat”, constantly observing changes in the wind direction and strength by looking at the water around you and checking how other boats are doing.

## Quick Review

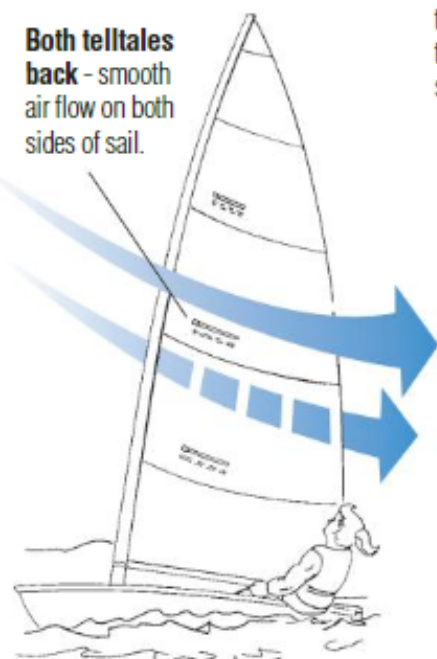
- Describe the difference between the “push” and “pull” mode when sailing. (answer on p.23-24)
- Define the terms *windward* and *leeward*. (answer on p.23)
- Describe two ways to depower your sails and slow your boat down. (answer on p.24)
- Describe how telltails work. (answer on p.25)

## Try it out...

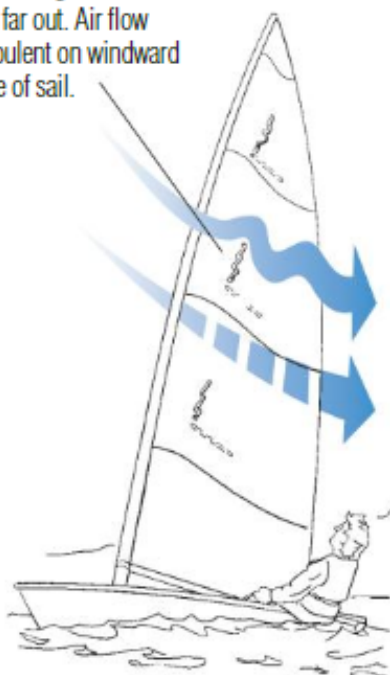
- While sailing with the tiller centred, ease and trim your sails and notice how the boat decelerates and accelerates. Next, sail with the sails sheeted properly and steer slowly toward the wind and then away from the wind, noticing how the boat decelerates and accelerates. This exercise demonstrates how you can control your boat speed by adjusting your sail’s trim or by steering.

## Using Telltales

**Both telltales back** - smooth air flow on both sides of sail.



**Windward telltale fluttering** - sail sheeted too far out. Air flow turbulent on windward side of sail.



**Leeward telltale fluttering** - sail sheeted in too tight. Air flow turbulent on leeward side of sail.

