

## TABLE OF CONTENTS

Introduction	2
Theory	3
Terms	4
Parts of the boat	6
Points of sail	7
Wind	8
Apparent wind and true wind	9
Reaching	10
Running	11
Sailing close hauled	12
Slowing and stopping	13
Tacking	14
Gybing	15
Practice	16
Weather helm	17
Steering	18
Picking up a mooring	20
Docking	21
Rules of the road	22
Finding your way	24
Weather	26
Boat gear	27
Personal gear	28
Cruising	29
Racing	29
Tendersailing	29
Courses and resources	30

Text and illustrations by Brad Dellenbaugh, edited by Amy Ulrich

## INTRODUCTION

Sailing is for all kinds of people—cruisers, racers, adventurers, poets—and for people who just like the feeling of the wind in their face and the sound of water going by. But before you can enjoy the satisfaction that comes from steering a boat around a harbor by yourself, it's important that you understand the basic principles of sailing.

We have collected what we think you

ought to know, about how a sailboat works and about how you can make it work for you. About the "rules of the road" when you're sailing or racing around other boats. About safety—how to keep from capsizing, how to stay warm and dry. About what equipment you'll need. About where you can learn to sail, from community sailing programs to formal lessons. Now it's up to you. We'll see you on the water.

—Patience Wales, Editor, SAIL.

Brad Dellenbaugh is an offshore sailing coach at the U.S. Naval Academy, as well as a freelance artist and writer. An active one-design racer on the national and world level, Brad also teaches clinics and seminars to sailors of all ages.

## THEORY

You don't need to know much about how a piston engine works in order to drive a car. You get in, turn on the engine, shift into gear, step on the gas, and off you go.

In a sailboat, though, you play a far more active role in harnessing the energy that propels you forward. You can get stuck in "neutral," with no wind in your sails—or you can even capsize—so it's important to have a basic understanding of how a sailboat works.

It's easy to see how a boat can sail when it's going in the same direction as the wind; the sails catch the wind and push the boat forward. But how does a boat make progress sailing across the wind or even toward the wind? Why doesn't a sailboat always get blown along with the wind?

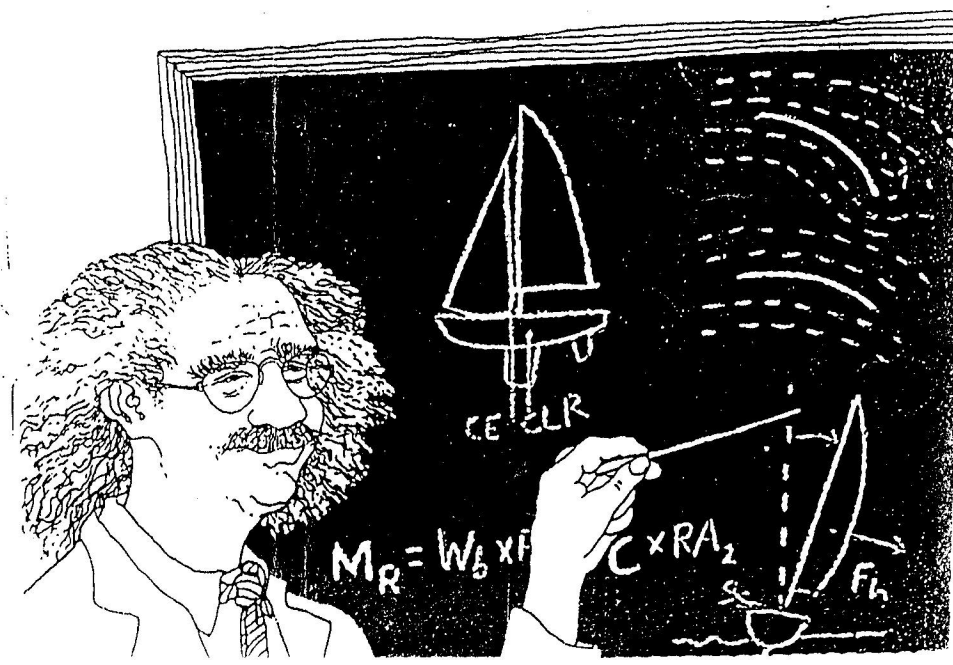
Very simply, the forces of the wind on the sails (aerodynamics) and the water on the underwater parts of the boat (hydrodynamics) combine to propel the boat through the water. The wind blows across

the sails, creating aerodynamic lift, like an airplane wing. The lift contains a sideways force and a small forward force.

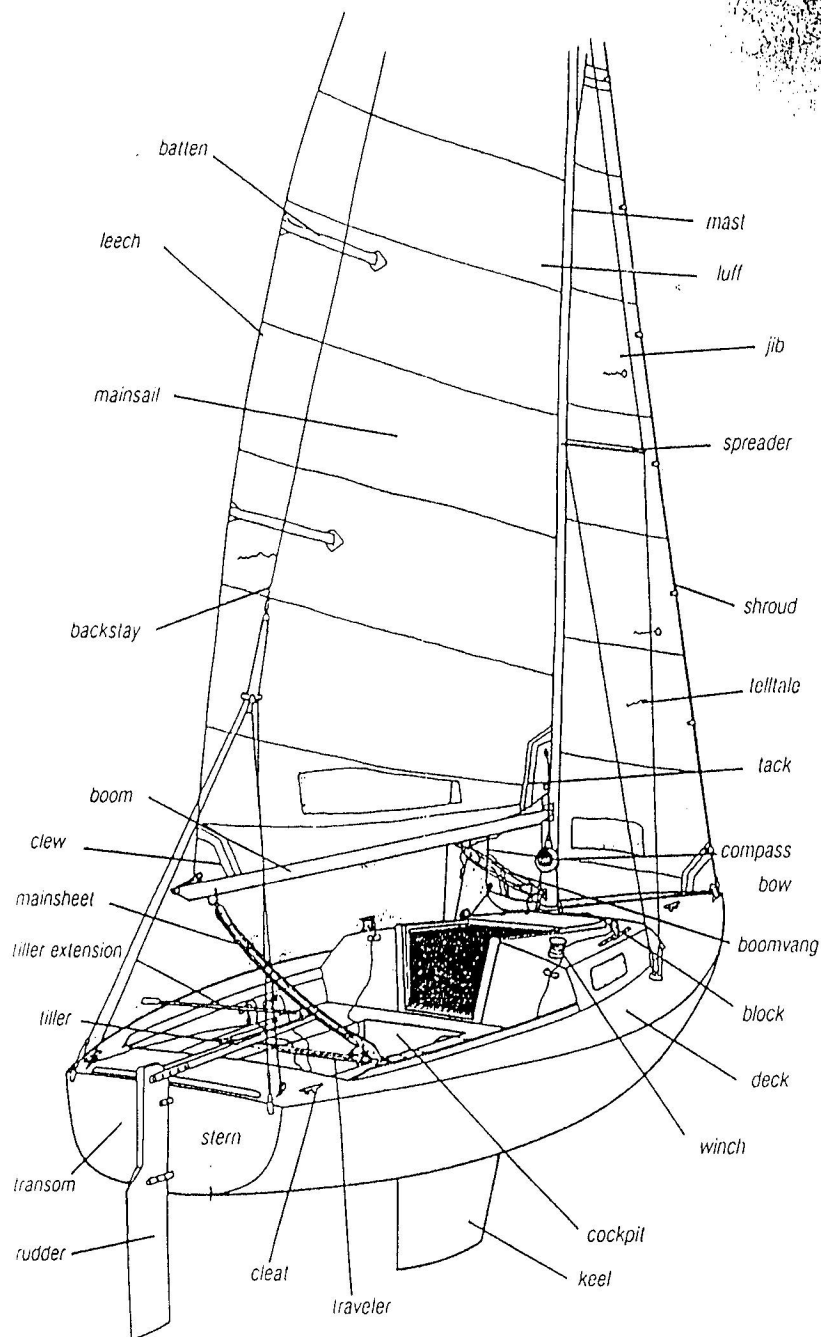
Trimming the sails efficiently produces the most forward force and the least resistance.

A sailboat would slide sideways with the wind if it did not have a **centerboard** or **keel** underneath the hull. The flow of water over the underwater surfaces creates lift, too—a sideways force countering the force of the wind. The combination of these forces pushes the boat forward.

Form stability and ballast keep a sailboat from tipping over sideways (capsizing). Keelboats have a heavy concentration of weight, usually lead, in their keels. As the boat heels, the weight of the keel pulls back down. Since centerboard boats don't have heavy keels, the crew must use their weight to counteract the heeling forces. If you get too far out of position, you risk a capsize.



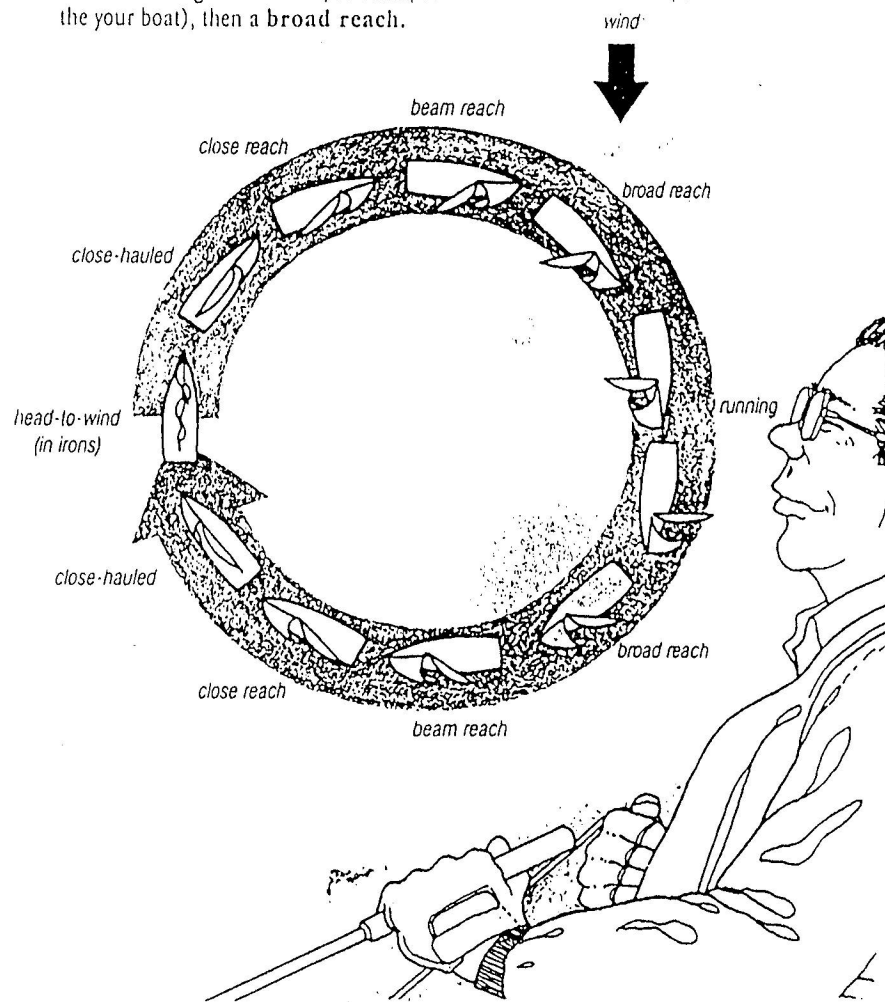
## PARTS OF THE BOAT



## POINTS OF SAIL

The angle of sail is the difference between the direction your boat is heading and the direction of the wind. Different angles of sail, called points of sail, change as your boat changes course, and the sails must be adjusted to harness the wind as efficiently as possible. When sailing as close to the wind as possible, with the sails trimmed in all the way, you are **close-hauled** or **beating**. As you bear off, steering away from the wind, you will **ease** your sails as you sail onto a **close reach**, then a **beam reach** (where the wind is blowing over the side, or beam, of the your boat), then a **broad reach**.

When you are sailing directly away from the wind, you are sailing on a **run** with your sails eased all the way out. If you continue to turn, you will **gybe**, so that you are on a run with your sails on the opposite side of the boat. As you gradually head up, turning toward the wind, you will need to trim your sails to keep them from **luffing** (flapping in the wind) as you sail onto a **broad reach**, then a **beam reach**, close reach, and finally back up to close-hauled.



## TERMS

The language of sailing is like a foreign language, because sailing has its own vocabulary. Learning sailing terms will help you understand what's going on on your boat and allow you to communicate with other sailors.

### ■ General terms

**Aft**—Toward the stern, or back, of the boat  
**Apparent wind**—The result of wind direction modified by the boat's forward movement  
**Crew**—The person (or people) who assists the helmsman by trimming the sails  
**Ease**—Let out, as in "ease the sheets or sails"  
**Forward**—Toward the front of the boat  
**Helmsman**—The person who steers the boat  
**Knot**—A measure of wind or boat speed: 1 nautical mile (6060.2 feet) per hour  
**Leeward**—The side of the boat that the boom is on. Also, away from the wind or downwind  
**One-design**—Any boat built to conform to rules so that it is identical to all others in the same racing class  
**Port side**—The left side of the boat when you're facing forward  
**Port tack**—When the wind blows over the port side of the boat and the boom is on the starboard side  
**To port**—To the left  
**Starboard side**—The right side of the boat when you're facing forward  
**Starboard tack**—When the wind blows over the starboard side of the boat and the boom is on the port side  
**To starboard**—To the right  
**Trim**—Pull in, as in "trim the sails"  
**True wind**—The wind strength or direction felt when the boat is stationary  
**Windward**—The side of the boat opposite the side the boom is on; also, toward the wind or upwind (a "windward" boat is toward the wind from the "leeward" boat)

### ■ When you're sailing

**Beam reach**—The point of sail at which the boat is sailing at a 90-degree angle to the wind  
**Bear off**—To alter the boat's course away from the wind  
**Broad reach**—The point of sail at which the boat is sailing away from the wind but not straight downwind  
**Close-hauled (or beating)**—The point of sail at which the boat is sailing as close to the wind as possible  
**Close reach**—The point of sail at which the boat is sailing toward the wind but not close-hauled  
**Course**—The direction you are sailing according to compass or wind angle  
**Draft**—The vertical distance, or depth, measured from the waterline to the lowest point of the boat  
**Gybing**—Turning the stern of the boat through the wind with the sails changing the side they fill on  
**Head-to-wind**—The point at which the boat is aimed straight into the wind with the sails luffing; when you pass through head-to-wind, you are tacking  
**Head up**—To alter course toward the wind  
**Heel**—The angle at which a boat leans over when sailing  
**Helm**—A boat's steering apparatus; also a measure of balance between hull and sails indicated by steering effort  
**In "irons"**—Stuck head-to-wind with sails luffing and no steerage  
**In the lee**—To leeward of a wind-blocking object, as "In the lee" of the island (for a protected anchorage)  
**Leave it to port/starboard**—To pass an object on your left/right side  
**Luffing**—Sails flogging in the wind  
**Run**—The point of sail at which the wind is directly behind the boat

**Tacking**—Turning the bow of the boat through the wind with the sails changing the side they fill on

### ■ Sails

**Genoa**—A large jib that overlaps the mainsail  
**Jib**—The forward sail attached to the forestay  
**Mainsail**—The primary sail attached to the mast and boom; the "main"  
**Spinnaker**—A large, light sail used for sailing downwind

### ■ Parts of sails

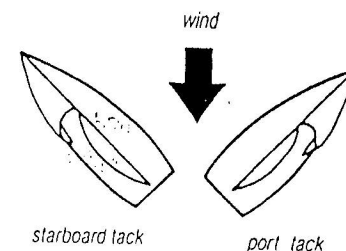
**Batten**—A strip of stiff material (usually fiberglass) inserted into a sail pocket to shape its leech  
**Clew**—The aft bottom corner. Sheets attach to the clew of a jib or spinnaker; the outhaul attaches to the clew of the main  
**Foot**—The bottom edge  
**Head**—The top corner of the sail to which the halyard attaches  
**Leech**—The aft edge  
**Luff**—The front edge  
**Tack**—The forward bottom corner of the sail

### ■ Sail controls

**Boomvang**—Connects the boom and mast and controls the main's leech tension by preventing or permitting the boom to rise  
**Cunningham**—Attaches just above the tack of the main and helps control the main's luff tension  
**Downhaul**—Attaches to the boom by the mast and tightens the luff by pulling the boom down  
**Halyard**—A line or wire used to raise or lower sails by connecting to the head of the sail  
**Leads**—Blocks or other fittings that control the angle of a trimmed sheet  
**Outhaul**—Attaches to the clew of the main and adjusts the main's foot tension  
**Sheet**—A line used to trim or ease sails

### ■ Parts of boat

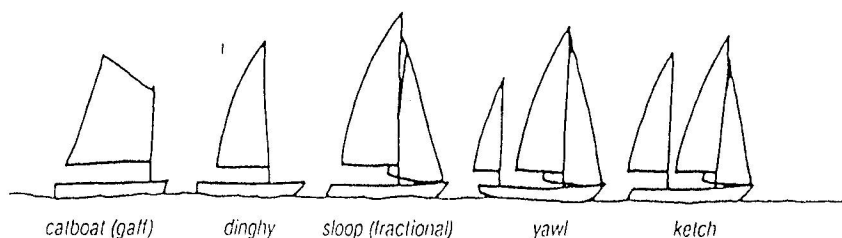
**Block**—The nautical term for a pulley  
**Boom**—A horizontal pole that attaches to the mast and is used to extend the foot of the mainsail  
**Bow**—The forward part of a boat  
**Centerboard**—A pivoting plate used to balance a boat and lessen leeway  
**Cleat**—A fastening around or in which lines can be secured  
**Hull**—The primary structural body of a vessel,

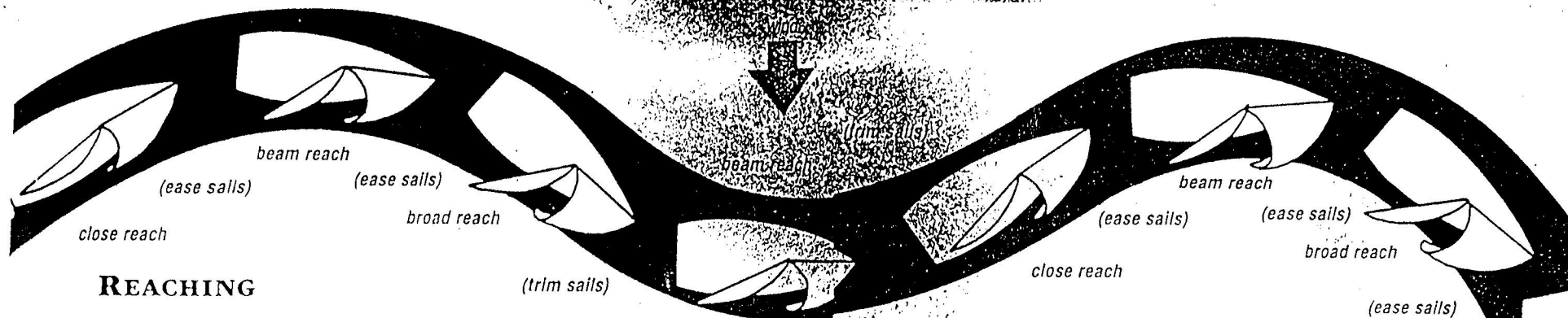


not including superstructure, masts or rigging  
**Keel**—A boat's fixed underwater part used to prevent sideways drift and provide stability  
**Line**—Any piece of rope on a boat  
**Mast**—A pole placed vertically on a boat used to support sails  
**Painter**—A line attached to a small boat's bow used to tie it to a dock or another boat  
**Rudder**—A boat's movable underwater steering board  
**Shackle**—A metal fitting commonly used to connect sails and halyards  
**Shrouds and stays**—Wires that hold the mast upright (the front one is the forestay)  
**Spreader**—Struts attached to the mast to increase the holding power of the shrouds  
**Stern**—A boat's afterpart  
**Tiller**—A wooden or metal "stick" used to turn the rudder  
**Wheel**—A steering apparatus  
**Winch**—A metal drum-shaped object around which lines are wrapped to make trimming them easier  
**Transom**—A boat's afterpart that is square to its centerline

### ■ Types of boats and rigs

**Catboat**—A single-masted boat with only one sail and no headsails  
**Dinghy**—A small racing sailboat; also a small boat used as a tender  
**Fractional rig**—A sailboat rig whose forestay goes partway up the mast  
**Gaff rig**—A rig with a pole that extends the head of a four-sided, fore-and-aft mainsail  
**Ketch**—A two-masted, fore-and-aft rigged boat with the mizzenmast stepped forward of the rudder  
**Sloop**—A single-masted boat with only one headsail  
**Yawl**—A two-masted fore-and-aft rigged boat with the smaller mizzenmast stepped behind the rudder





## REACHING

The easiest point of sail, and often the fastest, is the reach. Start off with the wind blowing across your boat. As a general rule for trimming sails, ease the **sheet** of each sail out until the **luff** (or front edge) of the sail begins to luff (thus the name). Trim it in until the sail just stops luffing. The goal is to keep the sail trimmed so that it is eased as far as possible without luffing.

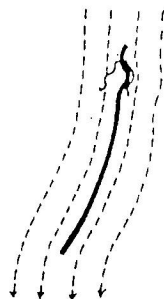
Begin sailing on a reach by picking a distant point to aim for. Experiment with steering, gradually heading up and bearing off, while you adjust the sails for your course. Sail a serpentine course from a close reach down to a broad reach and back. As you bear off you should ease the

sails, and as you head up, trim the sails.

### ■ Trimming sails using telltales

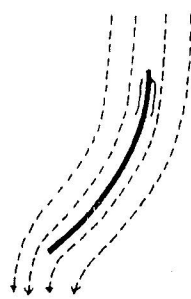
Telltales are pieces of yarn or nylon sailcloth attached near the luff of the sail, one on each side, to help you trim the sail. Your goal is to have both telltales flowing straight **aft**. When the sail is trimmed too tight, the **leeward** telltale will jump around because the air is stalled on that side of the sail. This tells you to ease the sail or turn the boat closer to the wind. When the sail is eased too far, the **windward** telltale will jump, and the luff of the sail will begin to bubble. Trim in the sail or bear off.

Too eased



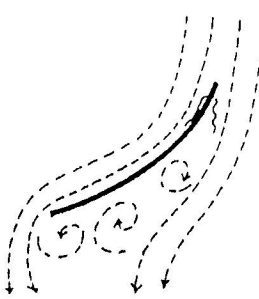
Wind hits the back of the sail, causing the luff of the sail to bubble. The windward telltale will jump erratically

Just right



Wind flows evenly on both sides of the sail. Both telltales flow smoothly back

Too tight



The sail is stalled, with no flow on the back side of the sail. The leeward telltale, desperate for air, will jump erratically

## RUNNING

Running with the wind is perhaps the most relaxing point of sail. Since the wind is not blowing across the boat, there is no sideways (or heeling) force. As you bear off from a beam reach to a run, you ease out the sheets so the sails catch as much wind as possible to push you along.

On a run, the **boom** will be close to a 90-degree angle to the boat, and the **main**-sail will block the wind to the **jib**. You can get more wind by flying the jib wing-and-wing, with the jib pulled to the side opposite the main. Here's how: Hold the jibsheet out to windward, by hand on a small boat or with a whisker pole on a larger boat. The jib fills with wind, and you're off.

If your boat has a centerboard, you'll want it raised when you're running. When you are running straight with the wind, you don't need any help from the centerboard to keep from sliding sideways, but a little board helps reduce side-to-side rocking. As you bear off, begin to raise the centerboard—approximately one-third on a beam reach and up to two-thirds on a run. Lower the centerboard before you head up.

**Caution!** Beware of the unexpected gybe; it can be dangerous. Always be aware of the boat's angle to the wind. When the jib will not fill with wind, or when you are wing-and-wing, an accidental gybe is possible. Don't bear off further than straight downwind unless you plan to gybe. If you're in doubt, head up toward a broad reach.

(ease sails)

run

(jib to windward)

wing-and-wing

by the lee

look out!

## SAILING CLOSE-HAULED (BEATING)

A boat can't sail directly into the wind, but it can sail toward the wind, as close as about 45 degrees off the wind's direction. As you turn toward the wind from a beam reach to a close reach to close-hauled, you must gradually trim your sails to keep them from luffing. Once the sails are trimmed in all the way, your steering keeps them from luffing. Steering as close to the wind as possible with your sails fully trimmed but not luffing will allow you to progress most efficiently in the direction of the wind.

Sailing close-hauled is perhaps the most difficult point of sail. When reaching or running, you simply point your boat in the direction you want to sail and adjust the sails to maximize their efficiency. But since the wind is not always from a steady direction, you now need to adjust your course rather than the sails.



With the sails trimmed in all the way, head up slowly toward the wind until the luff of the jib (or the luff of the mainsail, if you have only one sail) just begins to luff. Then bear off slightly, steering away from the wind (tiller away from the sails) until the sail just stops luffing. Sailing the boat with the luff of the jib on the verge of luffing will keep you in the close-hauled "groove."

A common mistake is to bear off too far away from the wind with your sails still trimmed for a close-hauled course. While your sails will appear to be full of wind, they will actually be stalled, with little airflow over the back side of the sails. Use the telltales on the luff of your sails as early-warning signals. When the telltale on the leeward (or back) side of the sail starts jumping around, it's telling you it's stalled and that you must either head up or ease the sail.

## SLOWING AND STOPPING

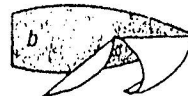
It's very important to know how to control the speed of your boat for docking, picking up a mooring, sailing in traffic, and recovering a crew overboard. There are many different techniques; here are a few of them.



the boom out to leeward to "back" the main, and the boat will stop

(d) Make sharp "S" turns to slow the boat. You can combine this with luffing the jib or overtrimming the sails

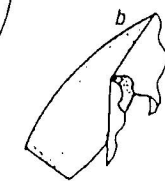
(a) Slowly head up into the wind, allowing both sails to luff and your



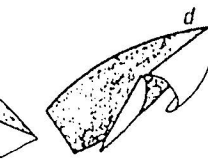
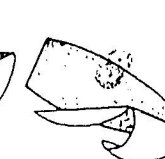
momentum to drop. You can drop your jib when making an approach

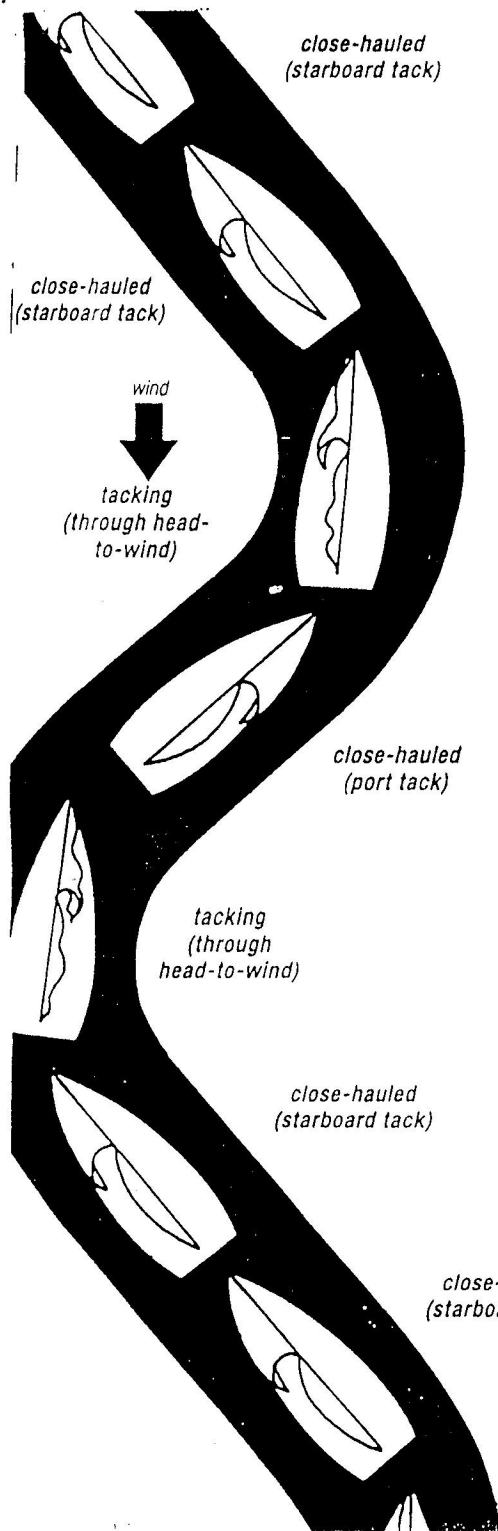
(b) Stay on a close-hauled course, but let your sails luff to slow the boat. This way makes it easy to accelerate if you need to

(c) Stay on a close-hauled course, luffing the sails to slow down. Push



(e) Bear off to sail on a broad reach or run while trimming the main in tightly. You can also overtrim the jib or trim it to windward. You cannot stop your boat when sailing below a close reach unless you drop your sails. Never try to make a landing downwind without dropping your sails and approaching very slowly.





## TACKING

Tacking is the process of turning the boat's bow through the wind from an angle at which the sails are full on one tack to one at which they are full on the other tack.

When your destination is directly upwind, you can't just head straight there. Instead, you have to zigzag by sailing close-hauled on one tack, then tacking to sail close-hauled on the other tack. By sailing back and forth as close to the wind as possible, you'll make the quickest progress into the wind.

Tacking has three parts: (1) turning the bow through the wind; (2) trimming the jib on the new leeward side; and (3) moving the crew to the new windward side. Before you do anything, though, check that you have a clear path for the tack and that the crew is ready. The helmsman says, "Ready about." The crew, when they're ready, respond, "Ready." If they're not ready, they should answer with a clear "No!"

Begin the tack by pushing the tiller (or turning the wheel), slowly at first, then more rapidly, so the bow heads toward and then passes through the wind. The crew releases the jibsheet just as the wind begins to fill on the "back" side of the jib, then trims the jib on the new leeward side with the new leeward jibsheet. If your weight is needed for balance, you should cross the boat during the tack. Slow down your turn as the boat approaches a close-hauled course on the new tack, and straighten the course when the sails are filled.

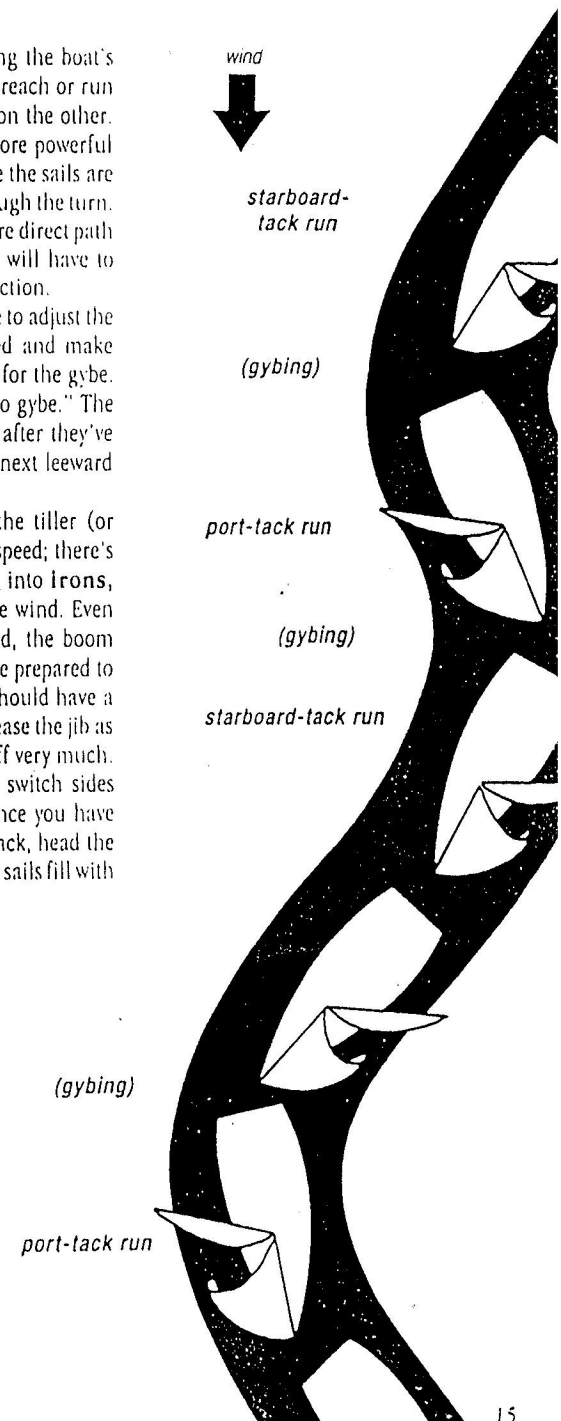
## GYBING

Gybing is the process of turning the boat's stern through the wind from a reach or run on one tack to a reach or run on the other.

Gybing is often a faster and more powerful maneuver than tacking because the sails are full of wind and do not luff through the turn. You can sail downwind on a more direct path than you can upwind, but you will have to gybe if you want to change direction.

As with tacking, you will have to adjust the jib when the gybe is completed and make sure that you have a clear path for the gybe. The helmsman says, "Prepare to gybe." The crew should respond, "Ready" after they've prepared for their move to the next leeward side.

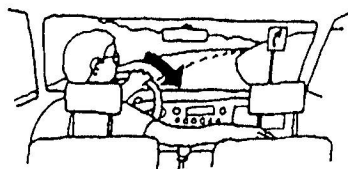
Begin the gybe by pulling the tiller (or turning the wheel) at an even speed; there's no need to worry about getting into irons, as you're sailing away from the wind. Even in a moderate amount of wind, the boom will cross the boat quickly, so be prepared to duck out of its way. The crew should have a hand on the jibsheet to trim or ease the jib as necessary, although it won't luff very much. Both skipper and crew should switch sides after the gybe is completed. Once you have turned the boat onto the new tack, head the boat downwind enough that the sails fill with wind.



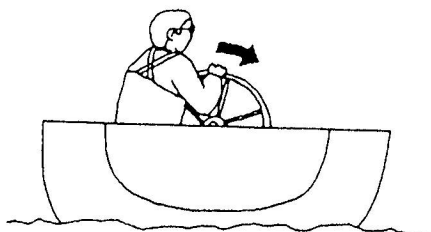
## STEERING

To steer a sailboat, you use the tiller or wheel to turn the rudder to direct the flow of water passing over its surfaces—which turns the boat. Just as a car won't turn when it's parked, a sailboat must be moving in order for its rudder to be effective.

Steering with a wheel is just like turning a car. You turn the wheel in the direction you want the



boat to turn. When you steer with a tiller, though, the boat turns in the direction opposite to the way you move the tiller.



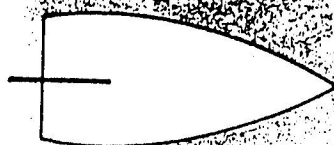
Using the rudder alone will cause excess drag in the water, slowing the boat or even stalling out the flow of water and causing a loss of steerage. The most efficient way to steer is to use a combination of the rudder, body weight, and sail trim to turn the boat.

Moving your weight to one side of the boat helps to turn the boat in the opposite direction. The sails also help with steering. When you ease the main, the boat will tend to bear off, and when you trim the main, the boat will tend to head up. The opposite is true with the jib; trimming the jib helps the boat bear off, and easing the jib helps the boat head up.



### STEERING WITH A TILLER

Move the tiller opposite to the way you want the bow to turn



**BEARING OFF** (or heading off) is turning away from the wind

Pull the tiller to windward to bear off



**HEADING UP** is turning toward the wind

Push the tiller to leeward to head up



### STEERING WITH WEIGHT

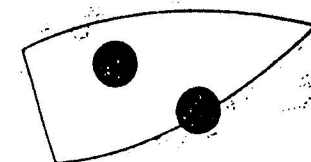
Move your weight in and out to help balance or turn the boat



Moving body weight to windward will help the boat bear off

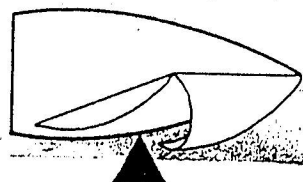


Moving weight to leeward will help the boat head up

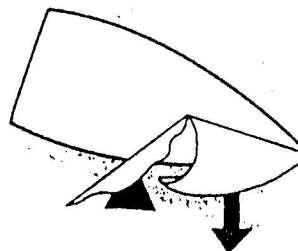


### STEERING WITH SAILS

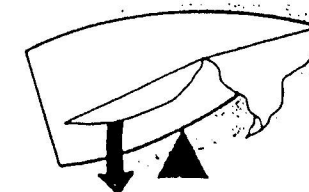
The center of the underwater surfaces acts as a fulcrum around which sail trim will pivot the boat



Ease the main and/or trim the jib to help the boat bear off



Trim the main and/or ease the jib to help the boat head up



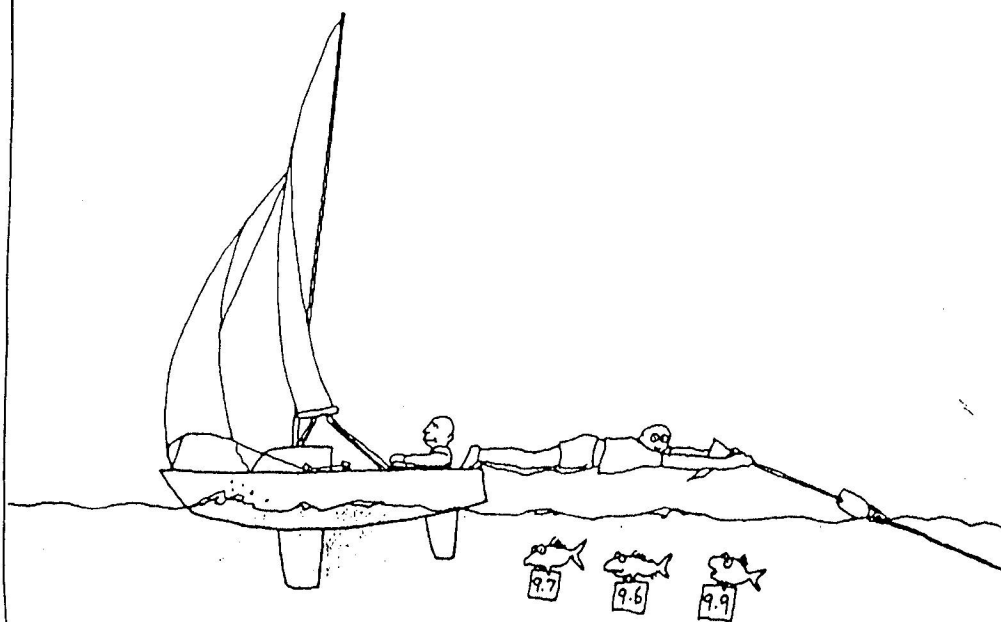
## PICKING UP A MOORING

No matter how much you like to sail, you'll eventually have to stop sailing and put the boat away. Many boats are left on moorings, and getting them there can be challenging yet satisfying.

Practice sailing to a mooring in light winds—about 5 knots—to start. The key to sailing to a mooring is momentum. You first want to learn how far your boat will coast before it stops. As the day is winding down and your sail is coming to an end, drop and secure the jib. Steer your boat onto a close-hauled course in an area clear of boats, docks, and other obstructions. (Some boats do not sail well on a close-hauled course without their jibs. If this is the case with your boat, drop the main before the jib.) Then let the mainsail luff, and see how far your boat coasts before it stops moving. Once the boat

has just about stopped, trim in the sail and start sailing again. Do this several times.

Once you have a good feel for the distance your boat needs to coast to a stop, find a mooring with as few other boats around it as possible. Approach the mooring on a close-hauled course if possible. When you think you can coast to the mooring, let the mainsail luff and coast. If you've judged the distance correctly, your boat will be just about stopped when you reach the mooring, and your crew can easily pick up the mooring pennant. If you find that you won't reach the mooring, trim the mainsail a little for speed. If you're going too fast, leave the sheets eased and push and pull the tiller back and forth. The S-turns you'll do will slow the boat down, and you can resume your course to the mooring.



*When the wind is at an angle to the dock, land with your bow toward the wind.*

## DOCKING

Always approach a dock slowly and in control of your speed. To get a smooth landing, approach the dock from the downwind side, landing with your bow as close to the wind as possible. Have your docklines tied on and coiled and a fender ready to place where needed.

The safest approach is from a close-hauled to a close-reaching course. Luff your

sails to slow down. If you need more speed, simply trim your sails back in, get the speed you need, and then let the sails luff again. If you're coming in too fast, circle around to try again. You can also brake your speed by backing the main.

Don't try to stop a rapid approach by sticking out an arm or leg. Use a fender to cushion the blow if you can't circle around.

*When you must approach from the upwind side of a dock, don't try to land with your sails up. You won't be able to slow down enough for a safe landing. Position your boat directly upwind of the dock, and lower the mainsail. Approach the dock slowly using the jib; luff it when necessary to slow, and drop it shortly before docking. Let the wind slowly push you to the dock.*

## WIND

Wind is the movement of air from areas of high pressure to areas of low pressure. While air is made up of gases, in many ways it behaves like a liquid. It flows over and around obstructions, seeking the path of least resistance. Wind will blow more strongly out of valleys and will be almost nonexistent on the leeward side of a high hill.

The wind is rarely perfectly steady. Depending on the surfaces it passes over, the stability or instability of the air, weather systems, and even the effects of other boats, the wind is constantly changing in both strength and direction.

The wind itself is invisible, but its effects are not. When you're sailing, it's important to be aware of the strength and direction of the wind in order to harness its energy efficiently and sail safely.

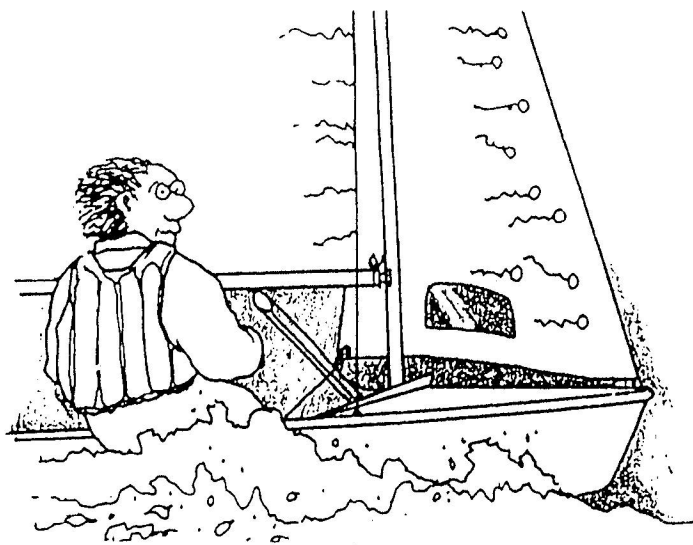
There are many ways to tell the direction of the wind. Wind blowing across water causes friction on the surface, forming small ripples perpendicular to the direction of the wind. (Larger waves are caused by the longer-term effects of

the wind and current.) Learning to determine the wind's direction by looking at the water's surface takes much practice, but it's the most accurate method. Other helpful indicators are flags, smoke, and other sailboats.

There are a couple of simple tools that can help you find the direction of the apparent wind. Telltales are lengths of yarn or strips of nylon tied to the shrouds and backstay. A masthead fly, with a wind arrow, goes at the top of the mast and points into the wind.

You can also use your sails to find wind direction. When you ease your sails, they will luff and line up with the wind. Gradually turn your boat toward the wind; you'll be straight **head-to-wind** when the sails are luffing on the boat's centerline.

One telling indicator of wind strength is when whitecaps (white tufts on the waves) just begin to form. This occurs at around 12 to 14 **knots**, a point at which many small boats begin to get less stable. Inexperienced sailors shouldn't be out alone when there are whitecaps.



## APPARENT WIND AND TRUE WIND

**True wind** is the wind strength and direction you'd feel if your boat were standing still. **Apparent wind** is the combination of the true wind and the wind caused by your boat's movement (boat-speed wind).

Imagine sticking your hand out of a parked car and feeling a light cross-wind. As the car accelerates, you will gradually feel more and more wind coming from the front of the car even though the "true

wind" is from a 90-degree angle. The same phenomenon occurs when you're sailing. An anchored boat might feel 10 knots from the north, while a boat sailing will feel the apparent wind more toward its bow. A boat sailing close-hauled toward the wind will feel a much stronger apparent wind than a boat sailing on a broad reach, even though they are in the same true wind.

*The apparent wind is the wind a boat actually sails in. Its direction is shown by the telltales or masthead fly. The apparent wind and the true wind are the same only when the boat is stopped*

