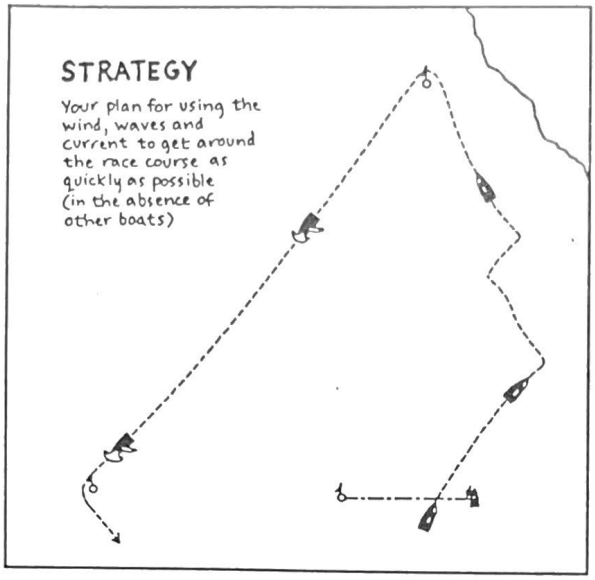

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Strategy is a plan you develop for how to get around the race course as quickly as possible, in the absence of other boats (Figure 1). Think of your strategic plan as the course you would sail if you were on a time trial all by yourself. When going upwind, your strategic plan must include such factors as wind shifts and differences in wind velocity, current and waves.

It is very important to use your strategy as a guide while you are racing. Just as a football coach wouldn't begin a game without a well-conceived game plan, a sailor should not start a race without a general strategic plan. Without strategy to guide you, race decisions will be made on the spur of the moment and may not contribute to your best overall effort.

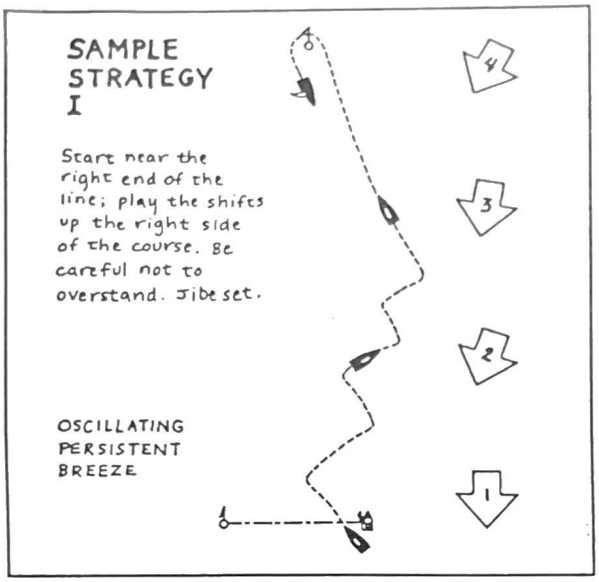
Your strategic plan

A strategic plan is based on many factors, including weather forecasts, current charts and your own observations.

You will get around the course as fast as possible if you follow a well-thought-out strategic plan. This is especially true in heavy traffic, when the temptation is to make decisions on the spur of the moment.

The best way to develop a strategy is to check the weather predictions before you go out on the water. Then add in your own observations of your particular race area.

Predictions There are many ways to get weather predictions. Newspaper, radio and television forecasts are good for general frontal and air mass movements, but they are very weak on local



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weather. A better source are the NOAA continuous weather broadcasts. These are quite specific and updated every two or three hours; listen particularly for wind directions and velocities at different points around your sailing area.

The most accurate weather information comes from airports. If you have an airport nearby, you can often get good information on wind speed and direction, visibility, cloud layers, etc. With all these sources, look for clues that will help you understand the wind during your race.

Observation The great weakness of institutional weather predictions is their inaccuracy for local areas. That's why your strategy must depend on your own observations of what is happening on the race course. Get out to your starting area as early as possible — preferably an hour before the start. Spend your time sailing around the course area, watching the wind velocity and direction, looking at current on buoys, etc.

As you approach starting time, begin to put together all your predictions and observations to develop a strategy for the race. It's a good idea to involve all your crewmembers in this process. By the ten-minute gun, you should have a specific plan for at least the first windward leg.

A sample strategy might go as follows (Figure 2): *The breeze is oscillating, but also shifting slowly to the right. Therefore we will start the race fairly close to the committee boat. We'll play the shifts up the beat, all the time working to the right. At the mark we'll do a jibe-set.* It's as simple as that.

Of course, you may get half way up the beat and discover that the wind is actually shifting to the left, not to the right. This is a new observation, and you should change your strategy accordingly. Stick to your current plan as much as possible, but don't be afraid to change when it is obviously not working.

Understanding the wind

If you want to sail smart, you have to understand how the wind works. After all, the wind makes a sailboat go, and it plays a very important part in the outcome of almost every race. The breeze you race in is actually composed of several different influences:

1) *gradient wind* — caused by large weather systems;
2) *thermal wind* — caused by local heating; and
3) *geographic wind* — caused by steering of local topography.

On the race course, your basic prob-

lem is identifying the make-up of the sailing wind. If you can determine the relative strengths and directions of the components, it will help you predict what the wind will do during the race.

For instance, suppose you are sailing in a moderate thermal breeze in the middle of the day, and the sky is clouding over with stratus. The clouds, which result from a large weather system, are robbing the thermal of its fuel (the sun). You can predict that the thermal will weaken and the gradient and geographic influences will grow stronger. Let's look at these factors a little more closely.

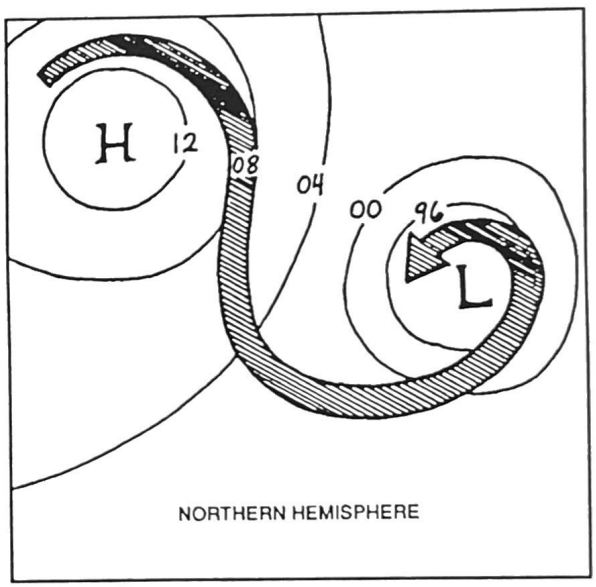
Gradient wind

The gradient wind is the breeze that's caused by large-scale weather systems. In the Northern Hemisphere, the gradient wind flows clockwise around centers of high pressure (usually fair weather) and counter-clockwise around centers of low pressure (usually bad weather).

Simply speaking, air flows from high-pressure to low-pressure areas (Figure 3). Wind velocity is determined by the rate of pressure change; i.e. by the distance between isobars on a weather chart. The closer the isobars, the stronger the wind (it's similar to contour lines on a land map—the closer the lines, the steeper the grade).

The direction and speed of gradient winds stay relatively constant throughout the duration (several hours) of most races. The major exception is when a "front" is approaching. A front is the boundary line between two large masses of air. When you have a front to your west, expect a major change in the wind.

Warm front Warm fronts bring a change from cool, dry conditions to wet, warm conditions. The signs of a warm front extend many miles and hours in advance of the front line (Figure 4), so you will have ample warning. The winds ahead of the front are generally from the east quadrant and veer to the south-southwest with the passage of the front. Their velocity is not severe. In general, the passage of a warm front is a gradual and stable event.



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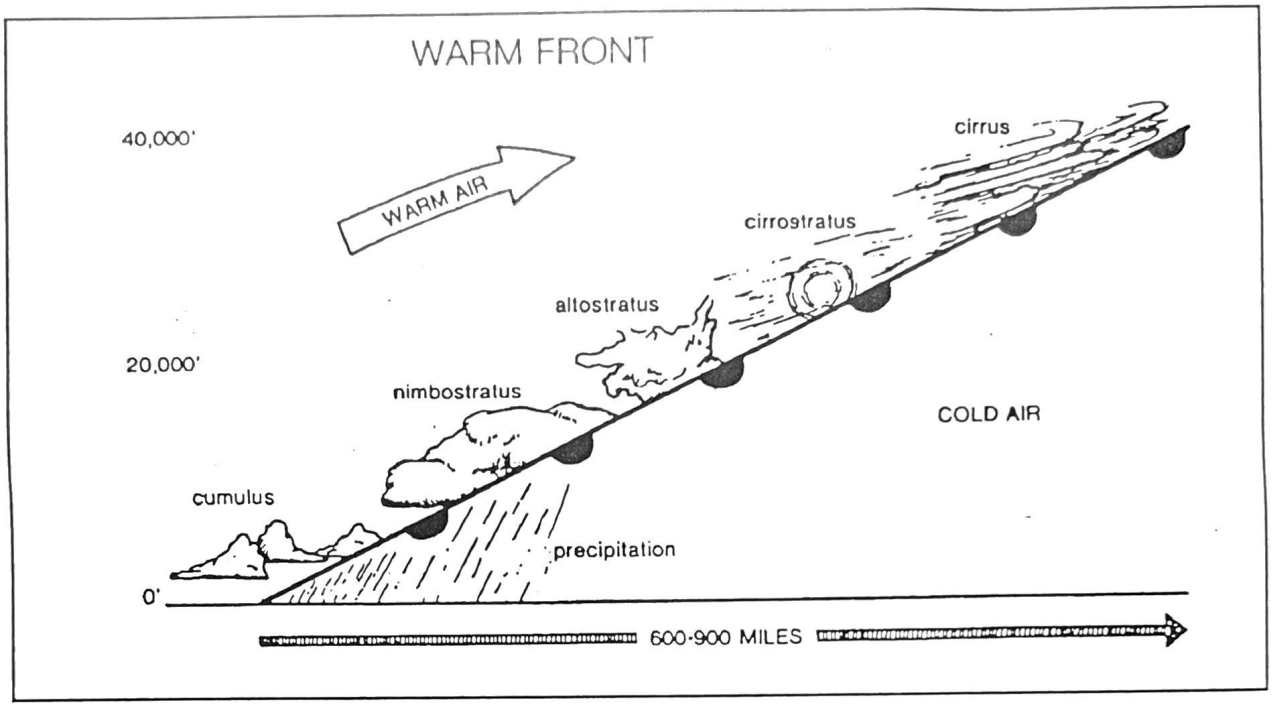
Cold front A cold front is faster-moving and more violent than a warm front, and it comes without much visible warning (Figure 5). The front line is marked by active and growing cumulonimbus clouds, thunderstorms and squall lines. The winds ahead of the cold front blow from the southwest. As the front passes, the winds shift abruptly to the northwest. The winds along the front are violent and squally; behind it they are puffy and shifty.



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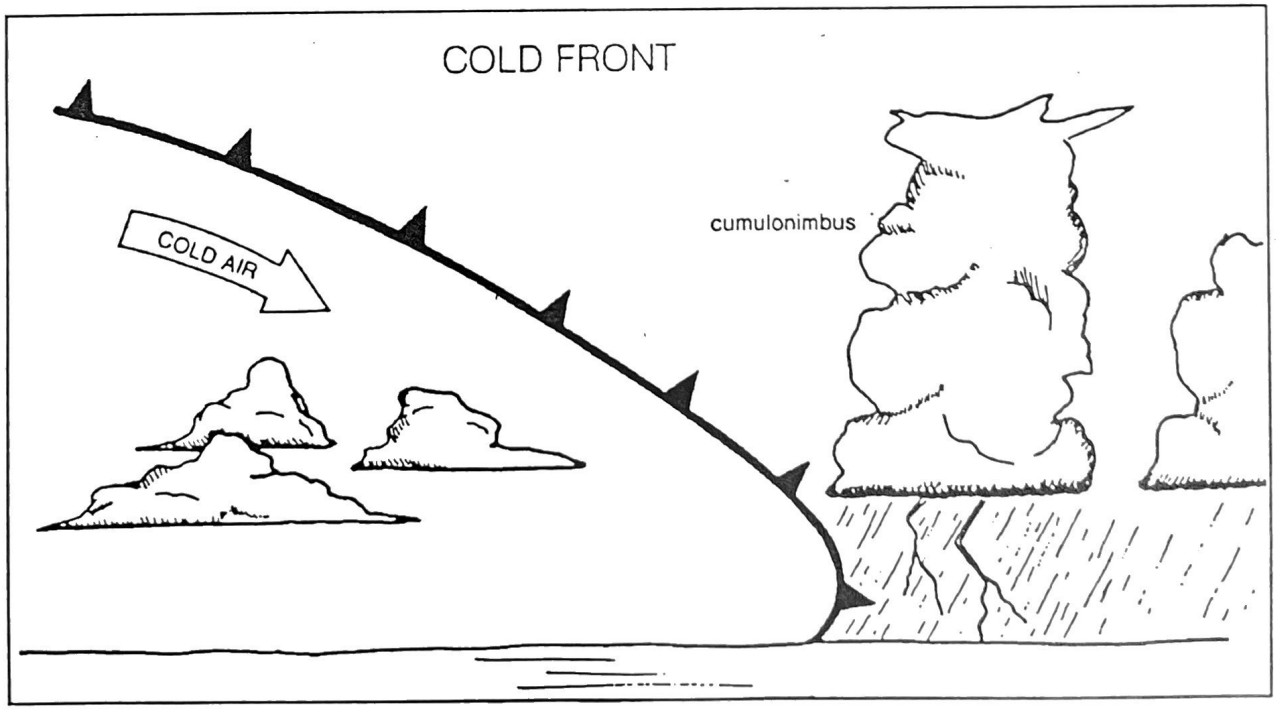
Sectional view of a warm front. Movement is from left to right. The vertical scale is greatly exaggerated. A system of overriding clouds defines the frontal line and gives the stationary observer 12-36 hours warning.



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Sectional view of a cold front, moving from left to right. This front moves relatively quickly, and the only warning may be a line of cumulonimbus clouds to the west.

Right after a front passes through, the gradient winds will be quite strong. They push down to the surface and dominate the local winds. As time passes, however, the gradient winds weaken and give way to thermal effects.

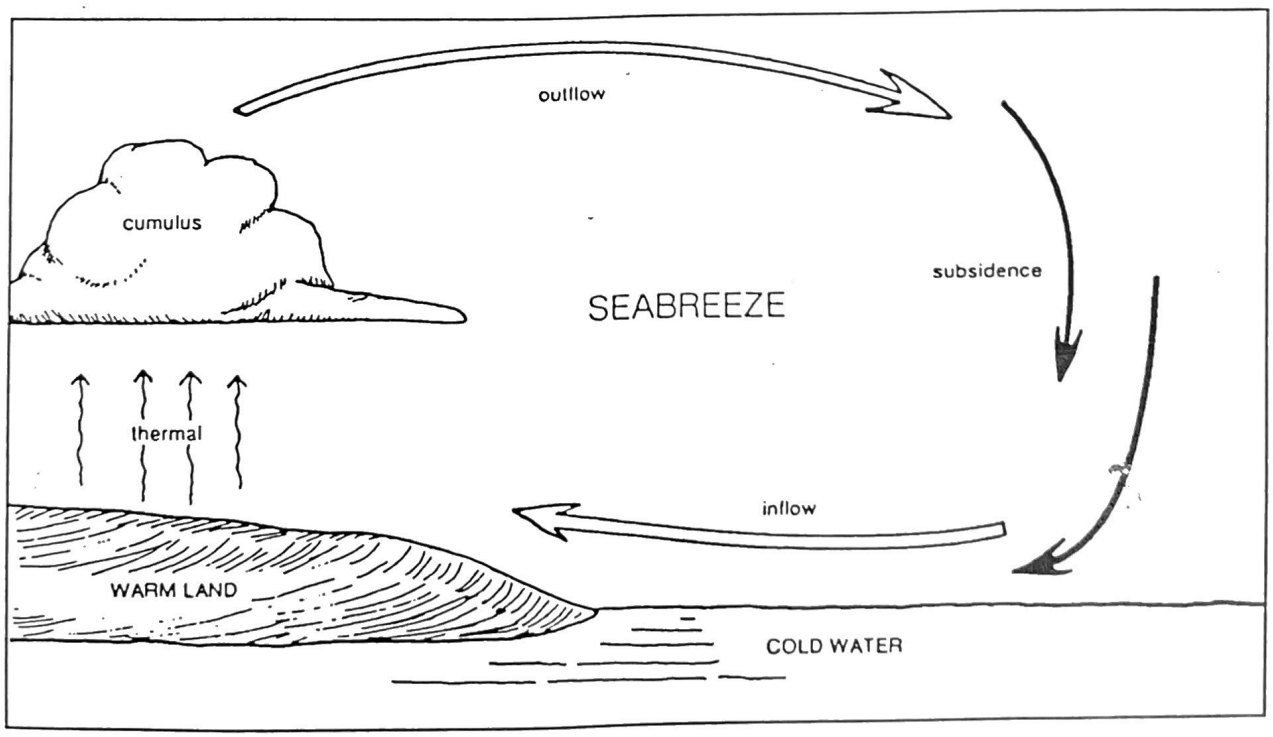
Thermal wind

A sea breeze is caused by a "thermal" — a rising column of hot air over sun-heated land (Figure 6). As the air rises, it is replaced by cooler, moist air from the water, which is in turn heated by the land and uplifted. This moist air condenses into cumulus clouds over the land.

A sea breeze typically fills in first offshore, and then moves toward land as a mini-front with a clearly discernible breeze line. A seabreeze will develop faster and blow stronger when all (or most) of the following conditions are met: hot day, cool water, little cloud cover and a gradient breeze blowing in the seabreeze direction.

Once the sea breeze is established, it will tend to shift to the right (in the Northern Hemisphere) because of the Coriolis effect. A seabreeze may move about 5 degrees per hour, and it will typically have small oscillations of 5 to 10 degrees. So, when the seabreeze is building, look for a persistent veering shift. That's why you generally want to play the right side of the course (or the left side in the Southern Hemisphere).

Late in the afternoon, however, as the sun begins to sink and surface heating is reduced, the veering stos and the breeze fades. The same thing happens when you have a building cloud cover.



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Sectional view of mature sea breeze circulation. The thermal is fed by the heat of the sun. A large temperature differential between land and water will help to establish and strengthen the sea breeze.

7

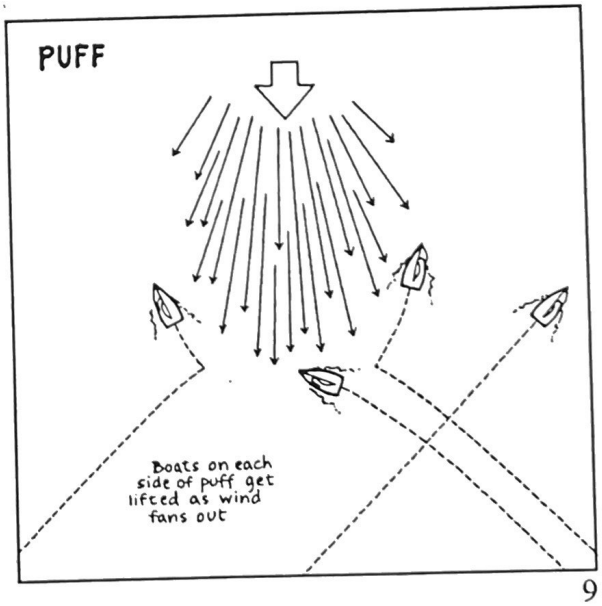
8

Geographic wind

Besides gradient pressures and thermal effects, another influence on wind is geography. Moving air is a fluid, and it behaves a lot like moving water. It basically follows the path of least resistance: down a river valley, along the long axis of a lake, between buildings, over islands, etc. When you understand how the wind behaves around your local topography, you will have a strategic advantage.

Geographic shift If you have a choice between a tack that takes you toward open water or one that takes you toward land, the latter option usually pays off. The reason is that the wind typically blows more perpendicularly off the shore (Figure 7).

The wind velocity often changes near the shore as well. Sometimes, such as with a gradient breeze, you'll find less wind in the lee of the shore. In other conditions, however, such as a thermal,



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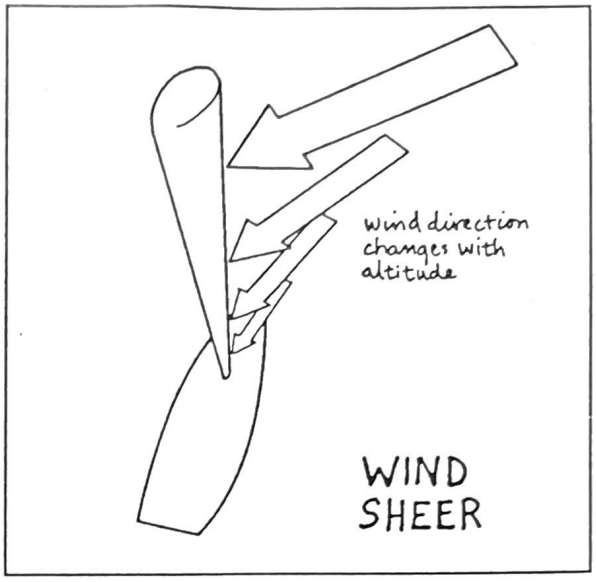
you may actually find stronger wind closer to shore.

Offshore breeze If you've ever sailed on the Charles River in Boston, near the Chicago shoreline, or along the San Francisco cityfront, you know about lulls and puffs around buildings. The same

thing happens when you are sailing to leeward of trees, islands or any other kind of obstruction (Figure 8). The closer you get to a windward shore, the more squirrelly the wind is likely to be.

The nature of puffs Most puffs, especially those associated with shifty high pressure winds, tend to fan out as they move downwind (Figure 9). This means that if a puff is crossing your bow, you will probably get headed; if it's crossing just behind, you will get lifted. In puffy conditions, don't try to follow other boats; you must sail your own race in the breeze you have.



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Wind patterns

When you combine all the different causes of wind we just talked about, you'll end up with a sailing wind that may follow several different patterns:

Oscillating Oscillating (or phasing) breezes shift back and forth, sort of like a pendulum, around an average wind direction. Likely causes are:

Vertically unstable air – Oftentimes, the strong upper altitude wind blows in a slightly different direction than the weaker surface wind. Mixing brings high altitude shifts and gusts down to the surface.

Thermal conditions – Cumulus clouds are caused by thermals and indicate unstable conditions.

Offshore breezes – Wind that has passed over sun-warmed land is likely to have oscillating shifts. Also, any wind blowing through trees or buildings will be shifty, especially close to the shore.

Persistent A persistently shifting breeze gradually swings in one direction over a period of time. Likely causes are:

Frontal passage – It could also be due to movement of a weather system.

Development or decay of a sea breeze – A building or dying thermal will often shift generally in one direction.

Geographic shift – For example, a shoreline can cause more and more of a shift as you get closer to it.

Wind sheer is a very good telltale sign of an impending persistent shift (Figure 10). Sheer is a change in wind direction at increased altitudes off the water. You can notice sheer on your instruments, or by differences in trim or speed from tack to tack. For example, if your boat feels fast on starboard tack and sluggish on port, the wind is probably sheered to the right aloft.

In general, if the wind aloft is sheered, you can expect a subsequent, similar shift in the wind at water level. The more sheer you have, the sooner the expected shift will come and the greater

PRE-RACE RECORDINGS

Port	Starboard
355	265
345	250
356	262
344	255
358	270
350	256
002	268
348	245
355	260
346	252
355	265

A. Oscillating

Port	Starboard
245	155
245	158
250	160
252	158
255	162
253	162
255	165
260	168
265	170
265	170
268	172

B. Persistent

11

that shift will be.

Oscillating persistent An oscillating persistent breeze shifts back and forth, but unlike an oscillating breeze, the average wind reading slowly shifts in one direction like a persistent shift. This is caused by a combination of the above factors.

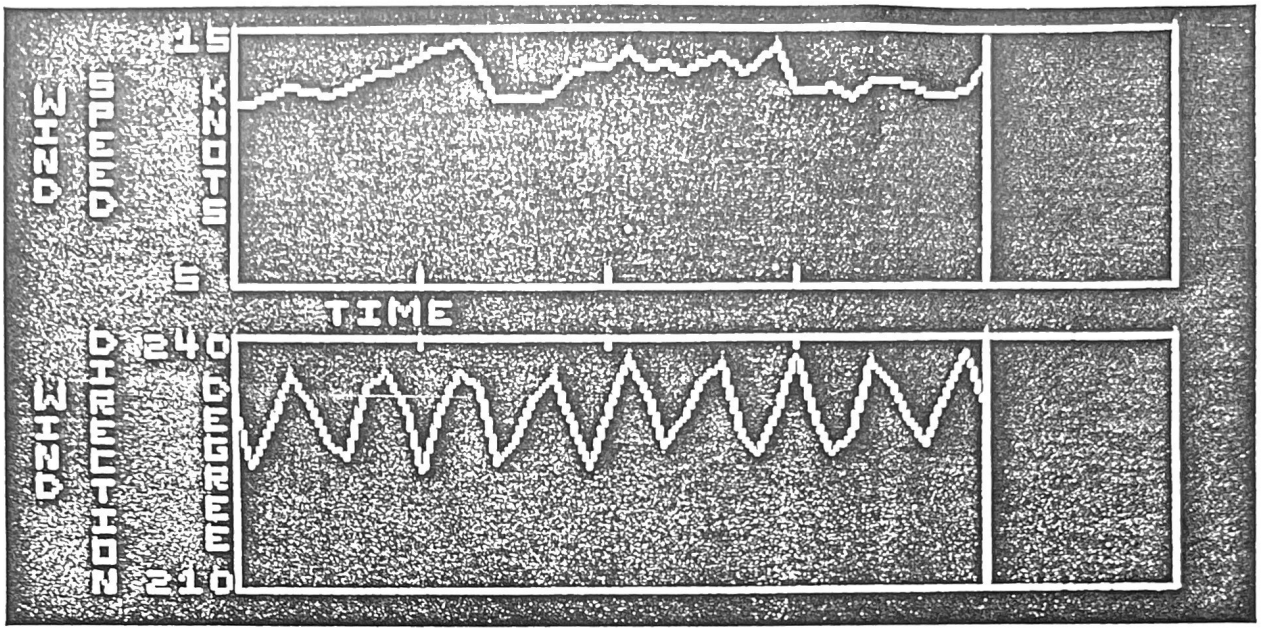
Recording the shifts

The best way to identify wind patterns is to spend a good deal of time sailing around your course area before the start. Most top sailors suggest going out an hour early, because this is the amount of time you'll need to detect some shifts.

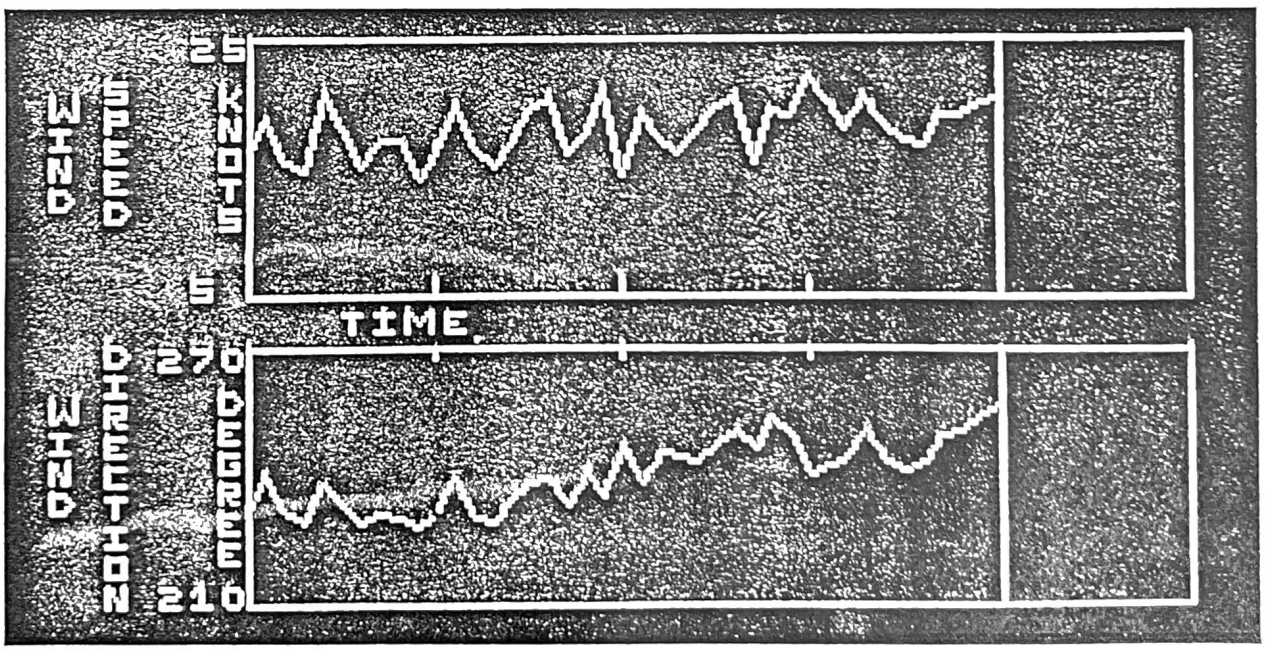
Your object during this hour is to record wind data that will describe the wind. We suggest spending a good bit of time on each tack and recording your closehauled heading every minute or two (using a grease pencil on the deck).

This "two number" method (port and starboard tack heading) is better than shooting head-to-wind because it can be used (and added to) during the race. Having your numbers on starboard tack is especially important for knowing whether you are lifted or headed when you come off the starting line.

After an hour of preparation, you will have developed a list of compass headings (Figure 11) to help you classify the shift pattern:



OSCILLATING *An oscillating breeze shifts back and forth, like a pendulum. The graph above (from the Sailing Simulator) plots wind direction and velocity for an hour. In the wind direction graph, peaks are shifts to the right, while valleys are shifts to the left. The wind velocity here is fairly constant, though there are some small puffs that seem to be coming generally from the right.* 12A



PERSISTENT *A persistent breeze shifts in one direction over time. In the example plotted here, the wind starts at about 240 degrees and slowly shifts (veers) to the right. After an hour, the wind is about 255. Because the wind is oscillating in addition to veering, we'd call this an oscillating persistent breeze.* 12B

.Oscillating (Figures 11A and 12A) The numbers swing between upper and lower limits. Average the limits for each tack to get your "median" heading; this number will be very important for your upwind strategy. If the wind has been swinging back and forth for an hour, you can assume this will continue for the near future.

Persistent (Figure 11B) The numbers on each tack gradually become greater or smaller. It's logical to expect this trend to continue for the near future as well.

Oscillating/persistent (Figure 12B) You have highs and lows on each tack, but your limits and medians gradually change in one direction over time.

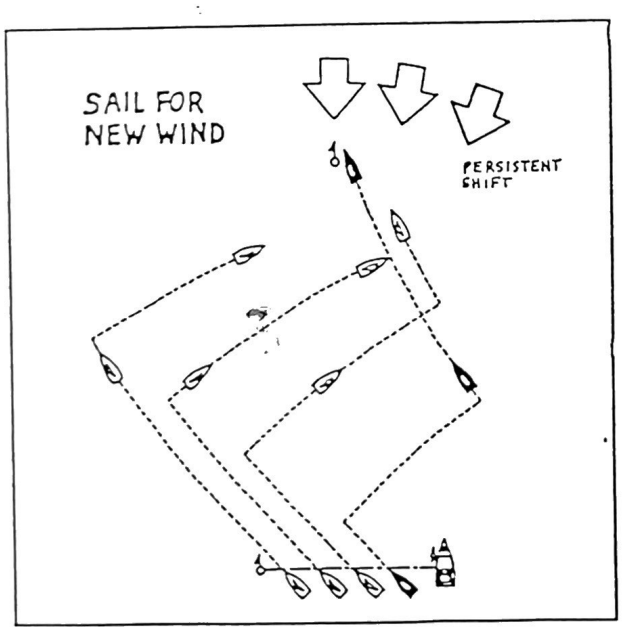
The good thing about the "two-number" system is that you can continue to use and modify this information after the start. In fact, this is something you *should* do. When you notice a new lower or upper limit on each tack, write it on your list. You may have to modify your medians during the race as well.

Determining the "favored" side

It's not always easy to figure out which side of the windward leg is going to be favored. In fact, it often seems like a complete mystery. Yet, time after time, the best sailors come out ahead because they were in the right place at the right time. How do they do it?

There are many factors that influence your decision about where to go on the beat. To develop a sound strategy, you must consider the relative importance of the following factors in your particular situation:

Wind direction Changes in the direction of the wind generally have more of an impact on strategy than any other factor. As we've seen in the Basics chapter, even a small windshift changes the ladder rungs and can produce large gains or losses.



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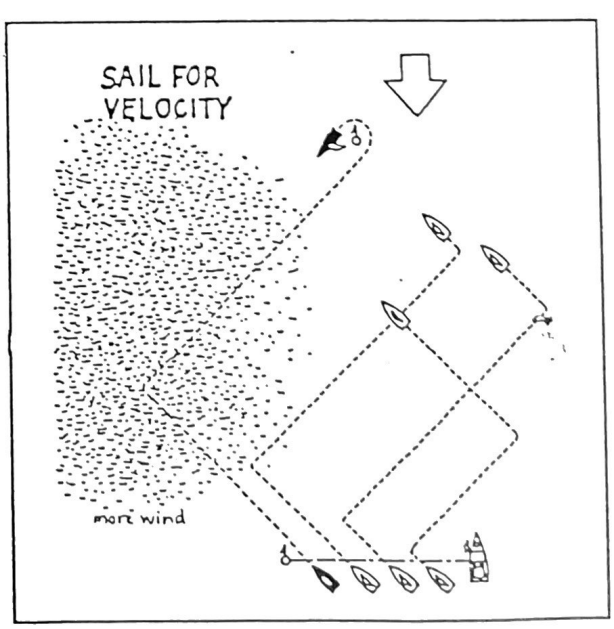

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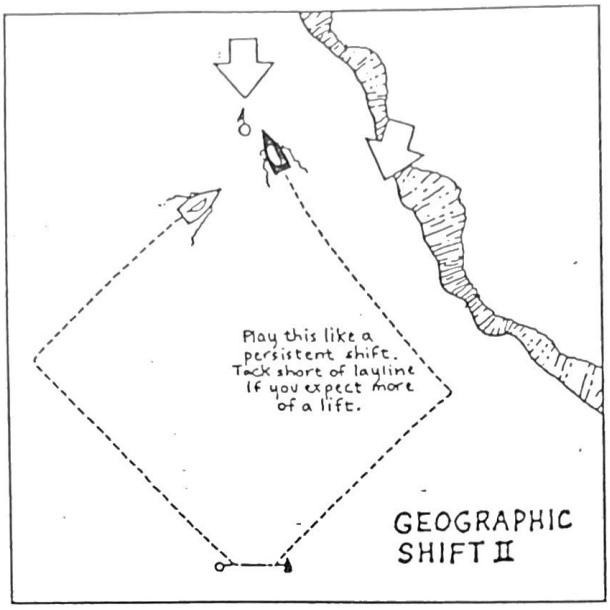

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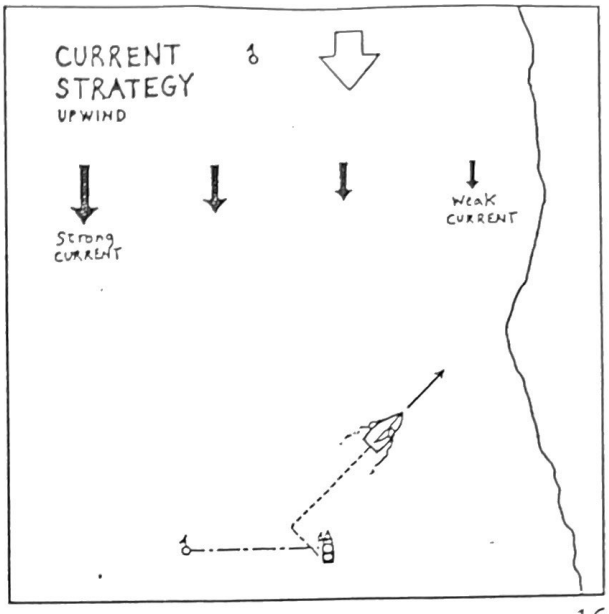

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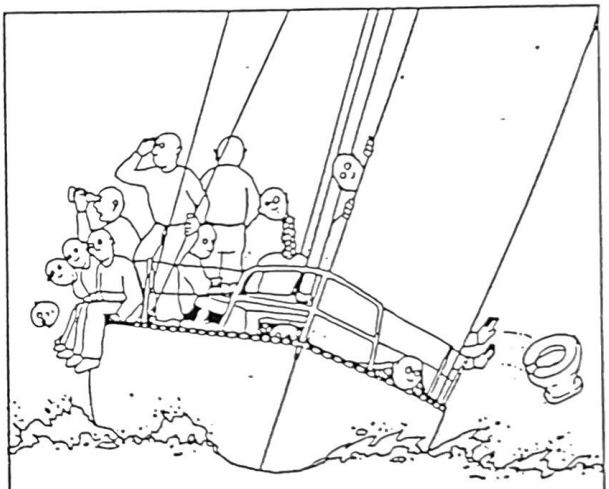
When the wind is oscillating, the "favored side" is often the middle (more on this later). But when you have any kind of persistent shift, you should sail toward the side that's closer to the expected wind direction (Figure 13). If you expect a persistent veer, for example, tack onto port after the start and get to the right side.

The sooner you get to the new wind direction, the more you will gain on the fleet. Be careful not to overstand, however, since the shift will gradually move the laylines to the mark. To reduce risks when you are far from the mark, tack well below the layline and make your final approach from closer.

Wind velocity Another way you can benefit from the wind is by sailing in more velocity. Often one side of the course will have more wind than the other. You can test for this by sailing to both sides of the course before the start. Or sometimes you can see different wind



Keep your head out of the boat.

When racing, it's easy to get your head stuck in the boat. Telltales, sail trim, instruments, the compass . . . there are so many things to keep track of. But you can't forget the big picture. You must keep your eyes out of the boat to see wind on the water, the location of marks and the position of other boats. If you have a hard time looking around and steering at the same time, ask other people on the boat to help be your eyes.

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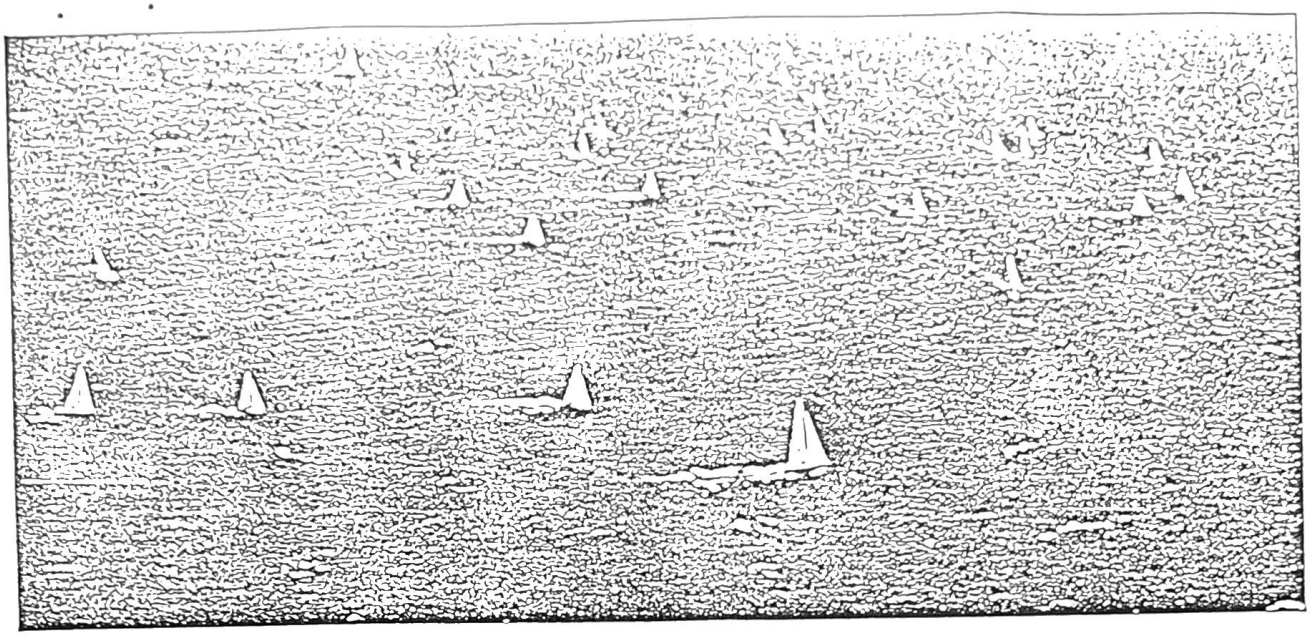


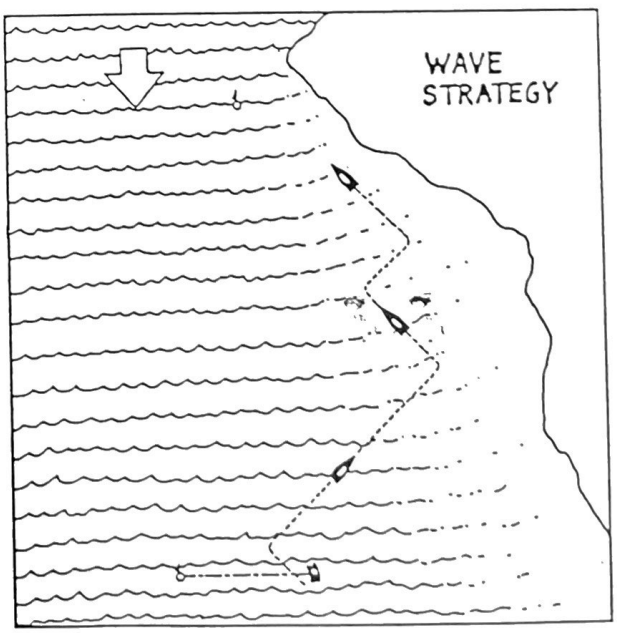
Figuring out the favored side of the course is not always an easy thing to do. You have to consider potential changes in wind direction, wind velocity, current and waves. If you're not sure which way to go, stay close to the middle until you see one side start to pay off; then head that direction quickly.

velocities on the water by standing in your boat near the starting line. When you do note a difference in velocity across the course, it almost always pays to sail to the side with more wind (Figure 14).

Geography Geographic wind effects are another factor that affect your choice of a favored side. The wind usually blows more perpendicularly off the shore, and you can take advantage of this by sailing toward land (Figure 15). Treat this like a persistent shift. Be careful, however, of changes (often decreases) in wind velocity as you get closer to the shore.

Current If the current varies across the course, you must consider this in your strategy. In simple terms, head for the area with the least adverse, or the most favorable, current (Figure 16). We'll discuss this much more in the chapter on current.

Waves Sometimes waves will play an important part in your strategy. If you have a chance to sail in smoother water upwind, head for that side (Figure 18). You have to be careful, though,



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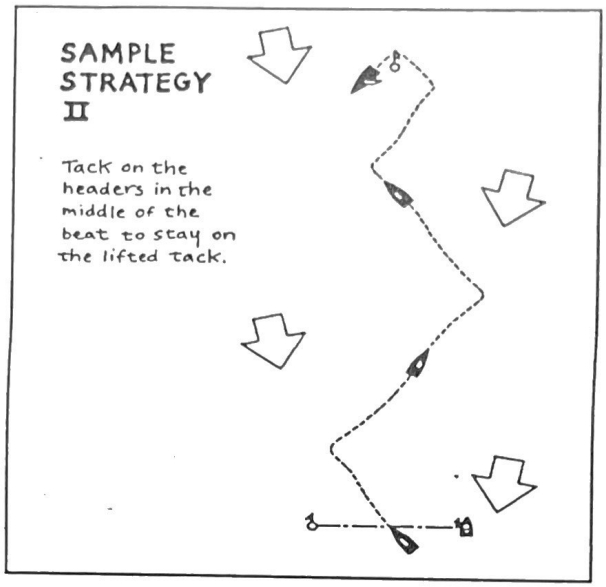

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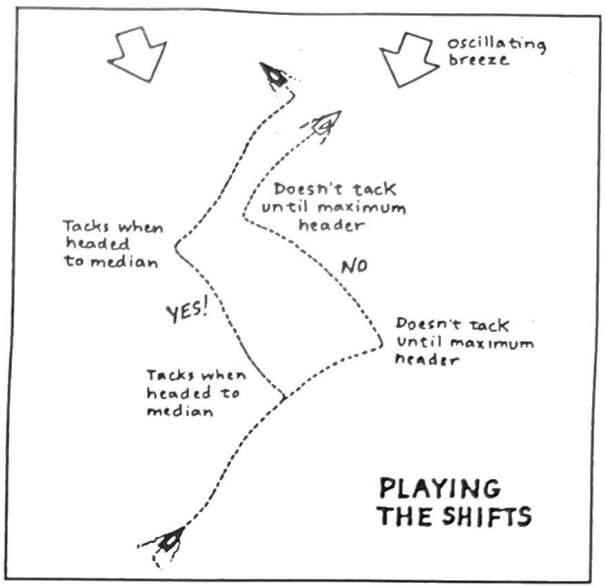

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because smooth water often indicates less wind or more adverse current. In places like San Francisco Bay, where an ebb current runs against the prevailing seabreeze, it actually pays to stay in the biggest waves because this is where the current runs strongest in your favor.

Position on the course Where you are in relation to the windward mark will influence your choice of tacks. If you are close to the starboard layline, for example, then the "favored direction" for you would be to go left (unless you have a very good reason to go to the layline). If other factors are equal, the "favored tack" is the one that takes you toward the rhumbline, or the middle of the course.

How to play an oscillating breeze

Success in shifty air is an art as much as a science. If you play the beat correctly, the rewards are great; but if you get out of phase, the frustration level can be high. That's why we've devoted a whole section to this particular strategy.

When the breeze is shifting, you must always know where the wind is at any particular moment (i.e. left phase, right phase or somewhere in between). This is the basis for all strategic moves. There are a couple of ways to detect shifts. The first, and most popular, is by watching your compass. Since you have recorded the high, median and low numbers for each tack, you should always know, by looking at the compass, whether you are lifted or headed.

A second method is to watch for shifts on the fleet. Often, small shifts show up more clearly on the fleet than on the compass. If the boats on your weather hip start pointing toward your stern, for example, you know you're being headed.

Basic strategy When sailing upwind, you want to tack on the headers so you sail on the lifted tack as much as possible. This will take you most directly toward the mark (Figure 19).

In general, stay near the middle of the other boats and the middle of the course. The closer you get to the laylines, or the fringes of the fleet, the less able you will be to play each shift to the fullest. One exception to this is light air, when boats in the middle often have less breeze and lose to boats on both sides.

As you sail into a header, the timing of your tack is important. Be sure you are using the up-down system explained in the first chapter. In other words, your crewmembers describe your heading relative to the median; e.g. "Up 5" or "Down 10."

The correct strategy is to tack when you are headed to the median. If you are "Up 10" and then you get headed five degrees, you are still "Up 5." Don't tack yet. Wait until your heading is "Median."

Don't delay your tack until you are "Down 10," however. If you wait until you are maximum headed (i.e. the wind is all the way to one extreme), you will look good temporarily, but in the long run you will lose to the boat(s) that tacked on the median (Figure 20).

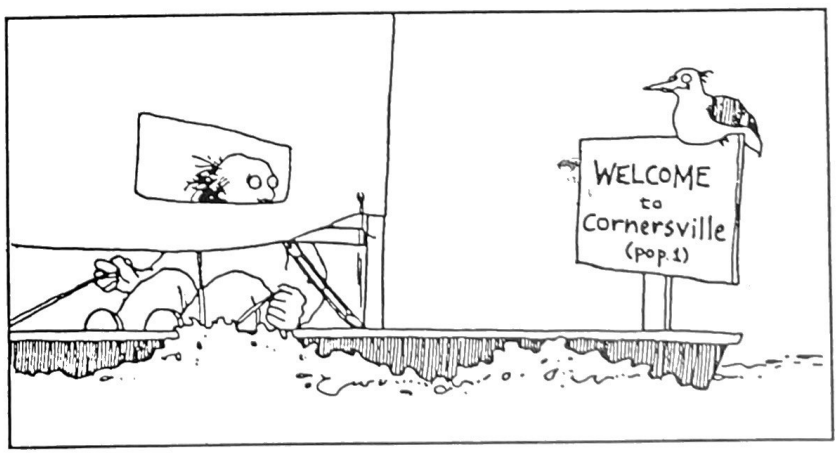
Ideally, the crewmember calling your compass numbers should sound like this: "(Port tack)...median...up 5...up 10...up 5...median...ready about...down 5...tack! (Starboard tack)...up 5...up 10...up 5...median...ready about...down 5...tack!" and so on. Notice that you should almost always be reading "up" numbers, and only momentarily read down numbers just before you tack. Also, half the time you are being lifted and half the time you are being headed.

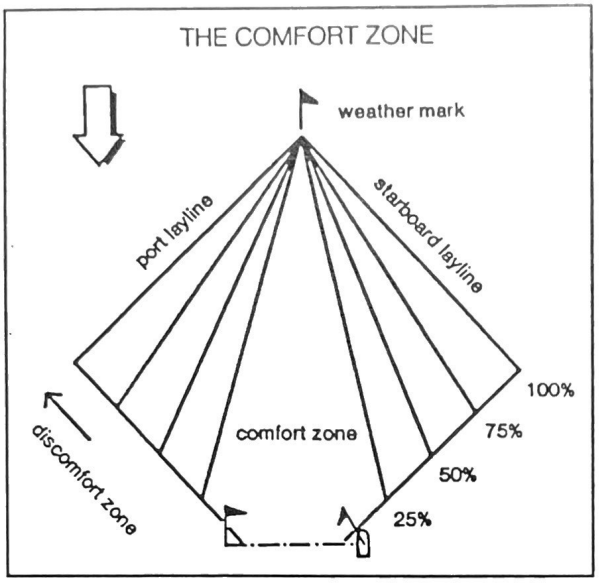
Rules of thumb There are a few guidelines you can always use for sailing in shifty winds. First, you don't have to tack immediately when you get a header. It's usually better to sail a little farther into the shift. This way you avoid sailing out of the shift on the other tack, and you avoid tacking on velocity headers.

Second, when you're in phase (on the lift), take sterns or even sail in dirty air temporarily to stay locked into the shifts. And third, at the start of each new beat, check your compass to see whether you are lifted or headed. You want to get on the lifted tack immediately.

The most important thing to know at any time on a beat is whether the wind is oscillating or persistent. This will make a radical difference in your response to

The corner is not usually a very comfortable place to be. It's lonely and deserted, and it takes away all your strategic options to gain on windshifts. So when you find yourself headed toward Cornersville, look for any excuse to go the other direction.





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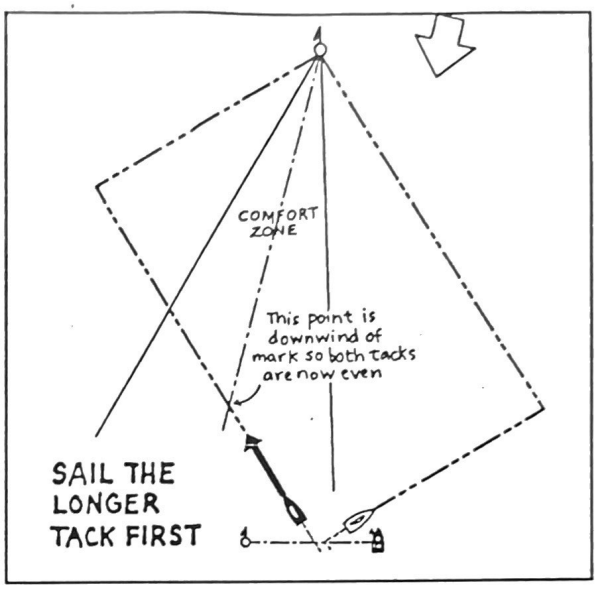

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windshifts. When you get a lift, for example, you should: a) continue on toward the next header if the wind is oscillating; or b) tack toward the new wind if the wind is shifting persistently. When planning your strategy, remember that oscillating shifts are generally more common than persistent shifts.

Strategic principles

No matter what the wind or current is doing, there are several basic principles that can help your strategy be more successful.

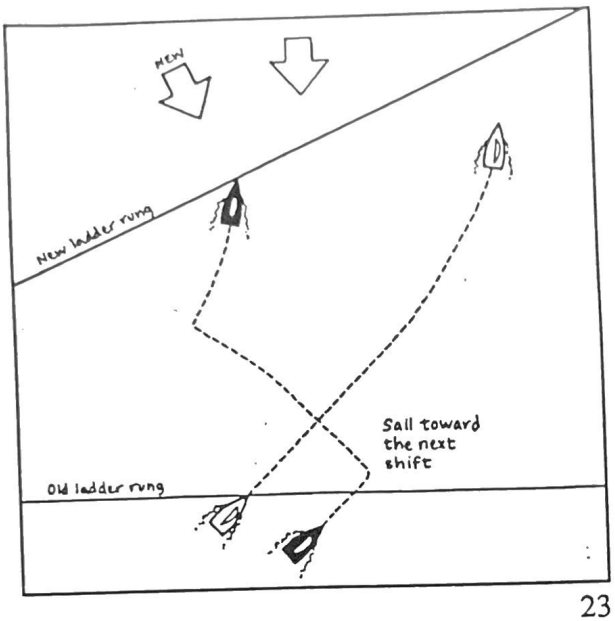
"The comfort zone" As far as strategic options go, it's better to avoid the laylines and corners and stay closer to the middle of the course (Figure 21). When you are in the middle, it's more comforting because you have the chance to play any kind of windshift; when you're on a layline, however, it's like driving down a dead-end street.

Because of this, you want to favor the tack that takes you toward the middle of the course. The closer you get to a layline, the more you should start looking for any chance to get back toward the middle. Tack on smaller headers to get away from the corners. When you are sailing *toward* the middle, ignore the small or temporary headers that might otherwise cause you to tack toward the outside of the course.

Sail the longer tack This is another way to state the principle above. If you sail the longer tack to the mark, you will be heading toward the middle of the course (Figure 22) and staying in the comfort zone longer. You will also be making your best VMG toward the mark, and you'll be in a better position to take advantage of future windshifts.

How do you know which tack is longer? That's easy — it's the tack on which your bow is pointed closer to the mark. Of course, it may change if the wind shifts. If neither tack is obviously longer, don't worry about this principle.

Sail toward the next shift Whether



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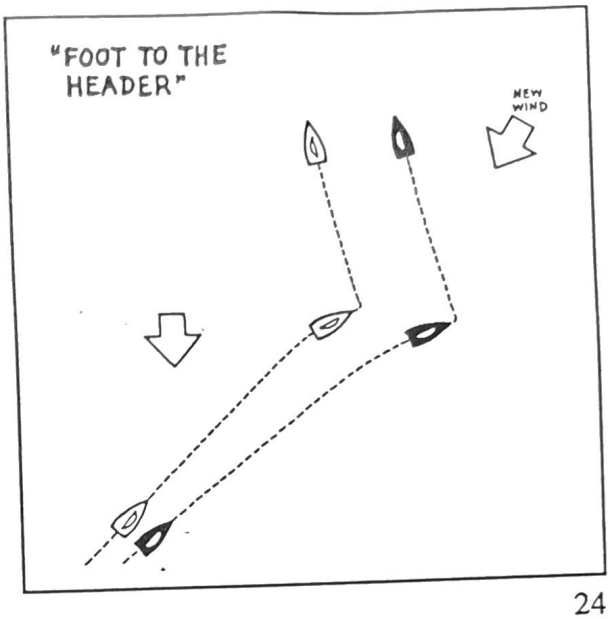

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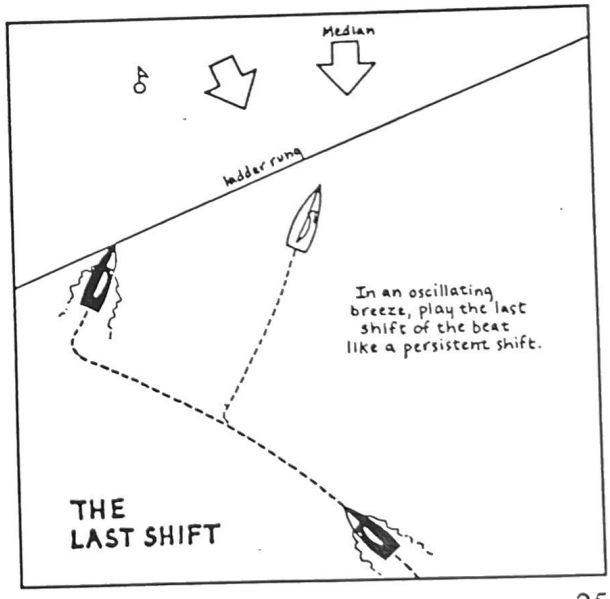
you have an oscillating or persistent breeze, you will always gain by sailing *toward* the next expected shift (Figure 23). This will put you on a higher ladder rung when the shift comes, and that means you will gain in relation to any boats that didn't sail toward the shift.

Foot to the header This is another version of sailing toward the next shift. When you are expecting a header, sail full and fast toward the header (Figure 24). This will increase your separation from the competition and thereby maximize your gain. The converse of this is that when you are expecting a lift you should sail high and slow (or tack).

The last shift When you approach the windward mark in an oscillating breeze, treat the last shift as a persistent shift. Once you get close enough to the mark so the wind only has time for one more shift (you can know this by timing the phases), switch from oscillating to persistent shift strategy (Figure 25).

In other words, continue sailing into the last header and tack just below the layline (allowing room to get lifted up to the mark). You will definitely gain on boats that tack when they get headed to the median. In a slow oscillation, the last shift begins when you are still a long way from the mark, so make sure you keep track of the timing.



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Problems

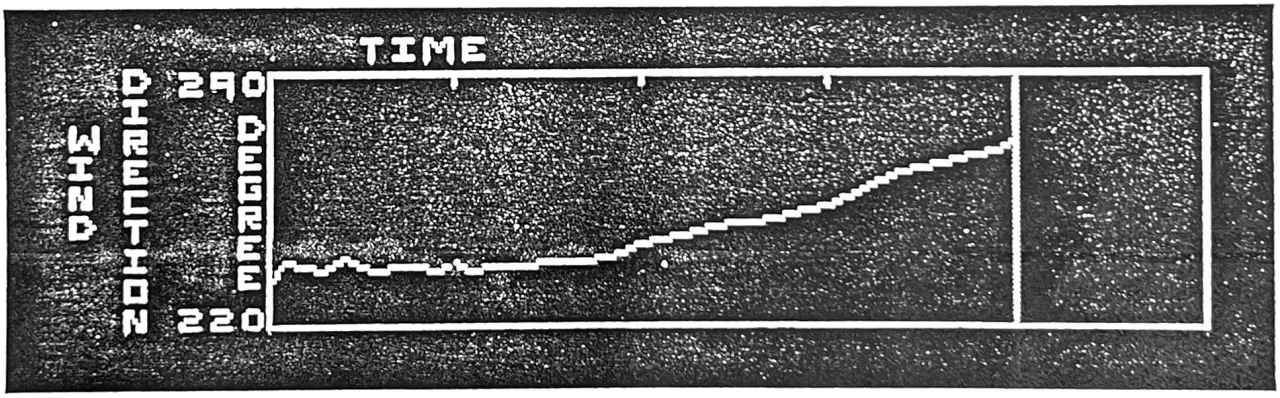
1. OK, you got out to your starting area early, and you've been watching the wind for an hour. You decided to use your headings on each tack as your guides. As the starting time approaches, you look at the numbers you recorded on your deck (see box below right):
   a) What kind of wind pattern do you have?
   b) Write down a rough strategy that you might develop for the first leg of this race.

Problem 1
Pre-start Compass Headings

Port Tack	Starboard Tack
195	105
180	090
190	100
180	085
195	105
175	085
185	095
170	080
180	090

2. What are some possible causes of an oscillating breeze?

3. On the second day of the series, you've plotted the wind direction for an hour before your start and the graph is shown below.
   a) What kind of wind pattern is this?
   b) What is your strategy for the first beat?
   d) Will your strategy for the second beat be the same as for the first?



4. What are some possible causes of a persistently shifting wind?

5. Two nights ago a cold front went through your sailing area with thunderstorms and squalls. Yesterday was quite cool, and the wind was howling from the northwest all day. This morning, however, it seems a bit warmer; the wind is still blowing from the northwest, but it's quite a bit lighter. What conditions do you predict for your race this afternoon?

6. Make a list of all the wind effects that you experience in your local sailing area. First list the predominant wind directions; then, next to each of these, describe how they usually behave in your racing area.
(For example, in the southern part of Long Island Sound, the southwesterly seabreeze is backed to the left along the northerly shore of Long Island.)

Wind direction	What it usually does

7. Describe the ideal way to play an oscillating breeze when sailing upwind.
   a) What's the best way for your crew to call the windshifts?
   b) When should you tack?
   c) Why should you play the last shift as a persistent shift?

8. Name four factors that can make one side of a race course favored over the other.

9. You are racing upwind in an oscillating breeze. For most of the leg, your median headings have been around 350 on port tack and 275 on starboard tack. About two thirds of the way up the beat, you are doing quite well but you find yourself a little farther to the right than you want; in fact, there is only one boat in the fleet closer to the starboard layline. Which of the following options should you follow?
   a) Continue playing the shifts exactly as you have been;
   b) Shift your medians to 345 on port and 270 on starboard;
   c) Shift your medians to 355 on port and 280 on starboard.

10. You got a little too far out to the right corner and now you are exactly on the layline with the mark dead ahead. All of a sudden you get lifted. Should you follow the lift and head higher than the mark or keep heading directly at the mark?