

DOCKING A SINGLE SCREW

Whether you operate a sailboat or powerboat, mastering the art of maneuvering your boat in close quarters makes the last 30.4m (100') of any journey less stressful and more predictable. A professional skipper discusses the inter-relationship of the propeller and rudder and provides drills you can do with your boat.

STORY AND ILLUSTRATIONS BY PETER P. PISCIOTTA

Walk the docks on a sunny afternoon and chances are you won't find many vacant slips. Crowded schedules may be the primary culprit, but anxiety over close-quarter maneuvers — docking in particular — rank second. Docking can be nerve racking.

I have a friend who bought a 18m (60') sailboat in California, sailed through the Panama Canal and ultimately to Florida. He spent two years and 9,655.8km (6,000 miles) anchoring, sailing and weathering storms, eventually earning his USCG operator's license. With all that experience, he was still not comfortable docking a boat.

Fundamentals

At full operating speed, a boat is just like a car: point it and go. As speed reduces, so does steering control until the boat is at the mercy of the elements. If the helmsman doesn't drive the boat, wind and current will. With a few tools, however, even a single-screw boat can be controlled in close quarters under adverse conditions.

Understanding the basic principles about how a boat moves is a key to mastering the skill and overcoming the anxiety of being in close quarters. A boat rotates around an axis roughly one-third of the boat length aft of the bow (**Figure 1**). Most modern sailboats have the mast at this point. Many trawler yachts and some motor yachts have

the helm station here too so the skipper feels like the boat spins beneath his feet. This is why the stern swings wide during turns. Just watch a boat turn in a narrow fairway. Look for stern swing and try to determine where the pivot point is.

A boat naturally lays beam to the wind, not bow into the wind (**Figure 2**). This counterintuitive effect is the result of a complex equilibrium of hydrodynamic (below water) and aerodynamic (above water) forces.

The exact attitude depends upon above and below waterline profiles but all boats have problems holding their bow into the wind. The helmsman must allow extra time and space in handling the boat. Underpowered boats are particularly vulnerable. Add a full keel and long overhangs and it may be impossible to turn through the wind. Next time, before you anchor in a breezy area, let the boat drift and see what position it naturally assumes. Ever notice how an anchored boat swings back and forth in a breeze? The bow is tethered into the wind but the boat naturally wants to be beam to creating conflicting forces.

Propellers are optimized to push water aftward. On the ascending side of the rotating propeller, centrifugal force slings water up into the

FIGURE 1

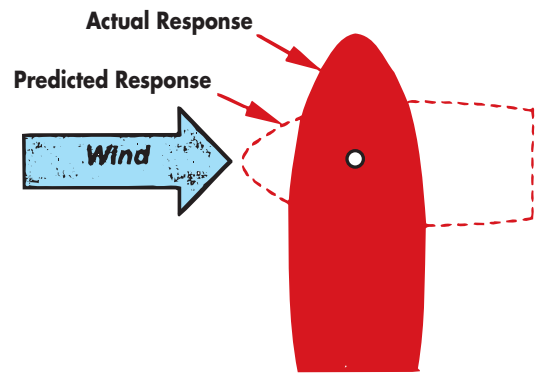
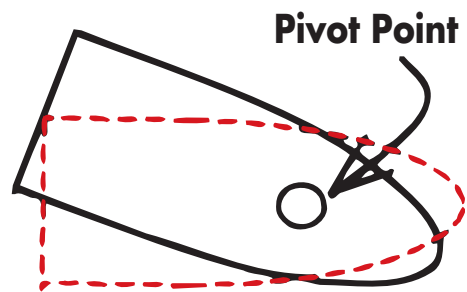


FIGURE 2



hull and is deflected laterally, creating sideward thrust. The stern "walks" sideways in the opposite direction, a phenomenon known as "prop walk" (**Figure 3**). Although prop walk exists almost equally in forward and reverse (the prop is more efficient in forward so the effect is asymmetric), it's virtually imperceptible in forward because the rudder masks the effect. However, in reverse, the effect can be prominent. Look at your prop shaft to see which way it turns. If it turns counterclockwise (viewed from astern), it's a left-hand propeller. It

will pull the stern to the right (starboard) in reverse (**Figure 4**).

A boat turns because the rudder deflects flow — no flow, no response. Sluggish response causes some helmsmen to conclude they must “go fast to maintain headway.” Unfortunately, going fast means there is less time to recover from mistakes, increasing both the likelihood and severity of an accident. There is an alternative: engage the gear in forward to induce propeller discharge current past the rudder (**Figure 5**). Even better, the water moves at a higher velocity thus increasing rudder effectiveness. To test this on your boat, bring boat speed up to about three knots in an open area, then put the gear in neutral. With the boat coasting put the helm hard over to either side and make a note of the circle diameter. Now, with the boat stopped and the helm hard over, put the gear in forward and perhaps raise rpm a few hundred. This turn is much tighter because the rudder is deflecting propeller discharge current. Backing out of slip into a fairway creates rudder discharge current. Most skippers back out, stop the boat by going into forward, and turn the helm in

the desired direction and go. Combining the last two steps results in a crisper turn. As you are backing and preparing to put the gear in forward to slow and/or stop the boat, put the helm hard over in the desired direction first. When the gear is put in forward, discharge current over the rudder will simultaneously slow and turn the boat.

Putting it all Together

At low speeds a propeller does more than just move a boat forward and backward; it can also induce turning forces via prop walk. Prop walk is only noticeable in reverse and pulls the stern to one side or the other depending upon whether the prop is left or right handed. The rudder can be used, even if the boat is stationary, by putting the gear in forward with the helm hard over. Used together, these tools are incredibly powerful.

Combined use of prop walk and rudder deflected propeller wash is an approach known as “back and fill.” This term comes from the old square-rigger days when ships in close quarters would backwind the sails to slow or reverse progress, then fill the sails to go forward. While engines have replaced sails, the process is similar; the boat is alternately placed in forward and reverse to achieve a tight turn (**Figure 6**).

A single screw boat can be turned in just over a boat length but only in the direction that prop walk facilitates. A left-hand prop will pull

FIGURE 3

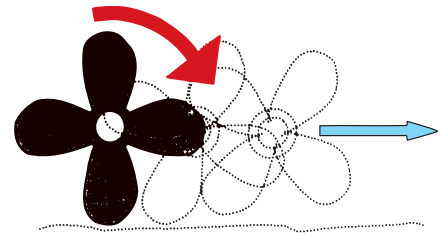


FIGURE 4

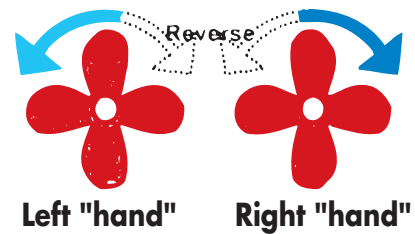


FIGURE 5

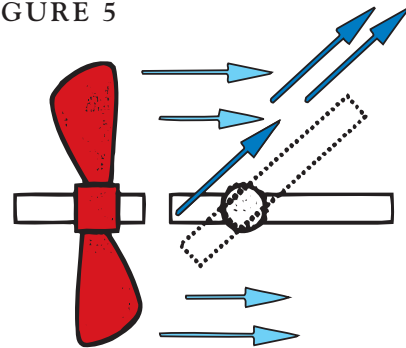
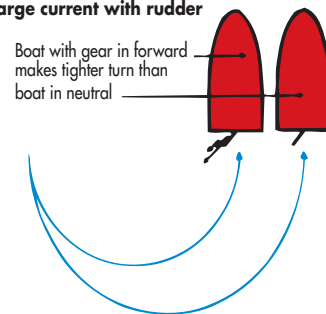


FIGURE 6

Effects of directing propeller discharge current with rudder



to starboard in reverse therefore, whenever possible, all tight turns should be executed making a port turn. Back and fill refers to this favored-side technique. Turning in the opposite direction fights prop walk: whenever the gear is reversed, prop walk terminates,

TIP DOCKING AGAINST THE PROP

What if you must land on the wrong side, the side that is not favored by prop walk? You must minimize the tendency of prop walk to pull the stern away from the dock. Here are four ways to manage an offside approach.

1. Use a shallow angle approach.
2. Go slowly. You will use the rudder to deflect propeller discharge current, also building speed. Plus the faster you are going, the more undesired prop walk develops.
3. Place the stern in the desired direction to counteract prop walk by putting the helm hard over and give a “burp” of forward speed.
4. If at all possible, go past your destination and return in the opposite direction to make a favored-side approach.

instead of contributes to, turning momentum.

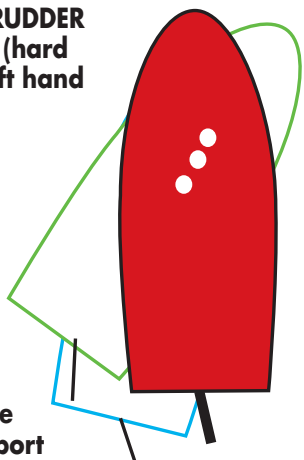
There are two key components to making a back and fill turn: timing and controlling turning momentum. Prop walk is usually most effective as the boat comes to a stop. At this moment the helm should be hard over in the other direction and the gear placed in forward to augment the turn. As soon as forward momentum starts to develop, place the gear back in reverse. The goal is to develop rotational momentum without building either forward or reverse speed.

Practice on a Side-Tie

Side ties are great places to practice because there is usually an open approach area and they are frequently free of obstructions (Figure 7). Here, prudence prevails. Select a safe area with minimal boat traffic and no other boats in your target landing area and a calm day as wind and current mask the procedures described below. It helps build confidence if there is no audience on the dock, as well. Whenever possible, dock on the side that prop walk pulls the boat toward. Docking this way is a simple three-step process.

FIGURE 7

- 1. HARD RIGHT RUDDER**
Right-hand prop (hard left rudder for left hand propeller)
- 2. GEAR IN REVERSE**
Prop walk pulls stern to port
- 3. GEAR IN FORWARD**
Rudder deflects discharge current, pushes stern to port

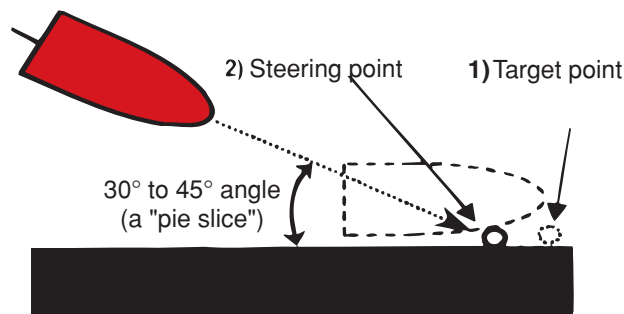


First, pick a point on the dock where you want the bow to end up, usually a cleat or bollard. Aim about one-third to one-half boat length aft of this point.

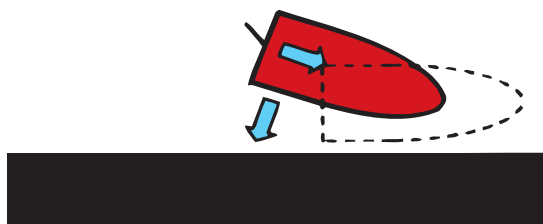
Now, proceed at about a 30° angle, at slow speed, 1-1/2 knots or so. Give your approach a lot of space so you can proceed in a straight line. Finally, when you are about one-half a boat length from the dock, swing the helm away from the dock to initiate the turn and simultaneously put the gear in reverse. Prop walk will pull the stern toward the dock. As soon as the boat stops, put the gear in neutral. If everything has gone perfectly, the stern will still be swinging a little bit and gently rest against the fenders (Figure 8).

Timing, feel and finesse are everything so it takes a lot of practice. Every boat is different. The

FIGURE 8



Gear in reverse to engage prop walk



same boat fully loaded with guests will respond differently. Use "burps" to modulate the approach. ("Burp" is defined as a very short burst of throttle, with a near instantaneous return to neutral or idle, to maintain headway.)

Even if dissecting and describing every docking situation were possible, it simply would not be practical. Your docking plan must be adaptable in case a wind gust rises or another boat unexpectedly appears (or your shift cable parts). Once mastered, these tools enable you to conquer almost any docking situation. After all, there are only two moving parts beneath a single screw boat: a rudder and a propeller. Once you learn the effect, control and inter-relationship of these, the last 30.4m (100') of any journey will become less stressful and more predictable. ⚓

About the author: Peter P. Pisciotta, founder of The Trawler Institute, is a licensed USCG 100 ton vessel operator and owner of SeaSkills Personal School of Seamanship (www.SeaSkills.com). He also conducts demonstrations on boating skills and safety at several West Marine Trawler Fests (www.trawlerfest.com).

DOCKING KNOW-HOW

PIVOT POINT: When proceeding down a narrow fairway, stay in the middle or just starboard of middle. Be wary of wind or current pushing you toward a lateral obstruction. Plan enough lateral space for stern swing.

WIND LOCK: When turning into a slip, think about aligning the pivot point with the centerline of the slip, not the bow.

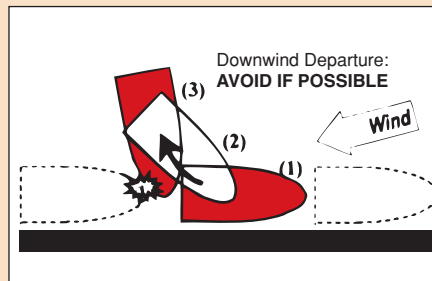
PROP WALK: This has its greatest effect as the vessel stops. Approach an open side tie on a straight course, perpendicular to the dock. Put the boat in reverse and note which side and how much the stern pulls. Finally, you will probably notice the walk increases as the boat comes to a stop.

PROPELLER DISCHARGE CURRENT: Always put the helm over before putting the gear in forward.

BACK AND FILL: Keep the helm hard over throughout the maneuver. No adjustment is necessary. Practice "burping" the throttle by bringing the throttle up 200 to 300 rpm for two or three

seconds. These short blasts are very effective, especially in reverse to amplify prop walk without building speed. Leave the gear in reverse until the precise moment the boat stops. Look abeam and find a stationary object, as soon as the boat stops moving place the gear in forward with only a momentary pause in neutral.

MANEUVERING: Always go slowly. It looks crisp and it gives you time to think. Panicked helmsmen almost never respond appropriately and just dig



1. Boat docked bow into wind, the typical docking maneuver.
2. On departure, boat backs downwind.
3. Difficult to avoid having bow blown down.

themselves a deeper hole. No jumping, no yelling.

AVOID DOWNWIND: Whenever possible, always work into wind or current. Down-wind and/or current maneuvers are extremely dangerous!

TAKE A POWDER: Remember, not everything is possible so prudence prevails. Anchoring out or taking an end tie is always preferable to risking damage. Even professionals pass on some situations.

LEAN-TO: If you ever find yourself too close to an obstruction and contact is inevitable, stop the boat so it rests up against the obstruction. A late attempt to drive away from danger guarantees the stern will strike an expensive glancing blow.

PRACTICE FOR FIVE: Set time aside to practice. Try docking five times and five 180° turns using back and fill one day a week for five consecutive weeks.