

Three Emergency-Steering

BY EVANS STARZINGER

A veteran offshore sailor offers a multilayered defense for avoiding rudder failure—and for coping with it when it does occur.

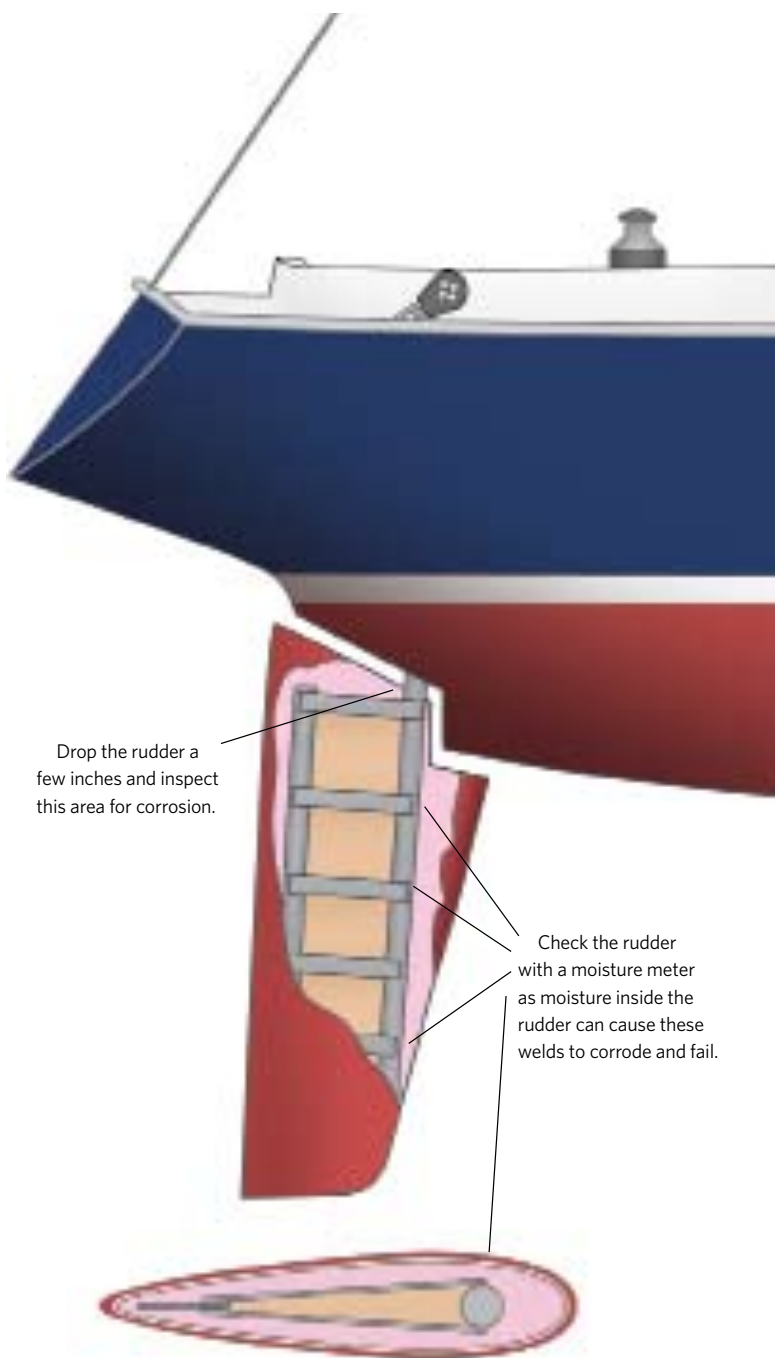
BASED ON STATISTICS THAT MY partner, Beth A. Leonard, and I've been gathering in the decade we've been out cruising, approximately five to 10 boats out of 1,000 suffer a rudder failure while crossing oceans each year. Experienced offshore voyagers consider the successful steering of a boat without a rudder to be one of the most demanding feats of seamanship. Faced with the challenge, some crews simply give up and abandon their boats. However, with the proper preparation and attitude, almost any boat can be steered to within sight of a safe harbor. We've met several crews who've sailed hundreds of miles—and, in one case, more than 1,000 miles—without a rudder.

Rudders Fail in Four Ways

The rudderstock breaks: If the stock fails, the rudder blade will be lost, leaving only the stub of the stock in the boat. A severe impact can break the stock, resulting more often in damage to unprotected spade rudders than to skeg-hung rudders. Corrosion of a stainless-steel stock, though, can result in failure of both spade and skeg-hung rudders. Improper lamination can result in stock failure on fiberglass/carbon stocks. Previous strain can also cause a failure.

The blade detaches from the stock: This can happen in one of two ways. First, when the rudder consists of a stainless-

A rudder with a stainless-steel shaft has a web frame welded to the shaft.



JOSEPH COMEAU

Solutions

steel stock with flat bar webs welded to it and foam and glass shaped over the webbing, the welds can fail at the webs if salt water enters the rudder. In this case, the positive flotation of the rudder blade usually holds it on the stock, but when the helm is turned, the blade doesn't respond. Second, an impact can destroy the blade entirely, leaving only the stock. This happened when acquaintances of ours hit a whale off Nova Scotia.

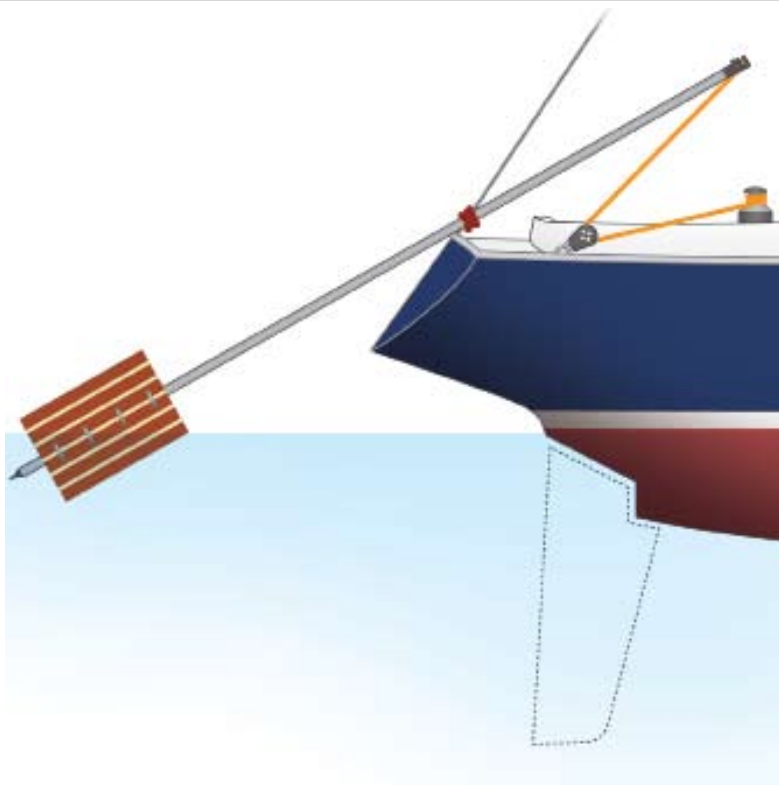
The rudder bearing breaks: On skeg-hung rudders, an impact at the bottom of the skeg can break or detach the bottom rudder bearing. This causes the rudder to drop down until the quadrant/tiller arm inside the boat jams against something. With only one bearing, the rudder will tilt and bind side to side.

The rudder binds: This is by far the easiest rudder problem with which to deal. The culprit usually turns out to be fishing nets or line. Sometimes, even after the visible line has been cut away, the rudder will remain difficult to turn.

Two basic messages cry out from this litany of potential problems: First, both skeg-hung and spade rudders are vulnerable to failure. Second, many of the vulnerabilities can be identified—and subsequent failures avoided—with careful inspection before beginning the passage.

Avoiding Rudder Failures

As with so many emergencies aboard offshore sailboats, the best way to deal with rudder failure is to avoid it entirely. Sailors preparing to embrace long-distance sailing occasionally ask us what our most important piece of equipment has been. I think they expect to hear us say something like refrigeration or a watermaker, neither of which we carry. Instead, I tell them we consider the steering system our most vital gear. The sails and rig come second, and the anchor and windlass third. The GPS and good charts are fourth. Most of those poised to head off spend a good deal of time and do a more than adequate job preparing the second, third, and fourth items. But many take the rudder/steering system for



Lashing a floorboard to the spinnaker pole is one of the best known—and yet least effective—of all emergency-steering strategies.

granted, giving it almost no attention.

The best way to avoid rudder failure at sea is to spend some refit dollars on a new rudder and bearings, even if it means giving up some creature comforts. It's possible to build a virtually failure-proof rudder for less than the cost of many watermakers. We did this for *Hawk*, our aluminum Van de Stadt Samoa 47. We were delighted that we'd done so after we spent an hour bouncing the rudder off some rocks in a remote anchorage in Iceland. In the next harbor, a diver checked the rudder for us. His report? He said he suspected that we might've broken some rocks, but the rudder looked fine. We later built a new rudder with a slightly more sophisticated

shape, and we took the opportunity to make it even stronger.

At a minimum, we'd suggest taking preventative steps before setting sail. First, on a rudder with a stainless-steel stock, use a moisture meter or drill a small hole in the bottom (plug the hole with epoxy afterward) to see if it's wet inside. A surprisingly high percentage of rudders on used boats will have moisture inside. If the rudder is wet, the stainless-steel stock/webbing will corrode and break at some point. To decide how and when to address this problem, talk to your boatbuilder and a good surveyor.

Second, drop the rudder down about 6 inches and inspect the stock where it goes through the hull. This can be easily done with most spade rudders, but it will be a bit more difficult with a skeg-hung rudder. Any signs of corrosion, cracks, or poor lamination in this high-load area may signal a problem. The best solution may well be to have a new rudder built.

Finding Solutions

Making sure that the rudder is strong and in good condition greatly reduces the odds of a rudder failure, but such diligence can't eliminate it. Massive impacts with logs or containers can damage even extremely strong rudders, and many corrosion and lamination problems can't be detected until they reach the breaking point.

If you lose steering, your attitude will be the key factor in determining whether you're successful in sailing the boat to port without a rudder. First, even with the best emergency-rudder solution, expect to make somewhere between a third and a half of the boat's normal speed, with the bow swinging through 60 degrees on either side of the desired course. Sailors with windvane experience will adapt to this more quickly because they know that with proper adjustment, their average track can be quite straight. Those who've only sailed with autopilots will likely have difficulty accepting this oscillation around the desired course.

In addition, be persistent. Jury-rigged rudder solutions we've heard about usually involve three or four attempts before sailors achieve a strong enough jury rig that provides adequate control to make decent progress. As the wind direction and strength shift, the boat's balance will change, and both the sail plan and the rudder solution will need to be adapted. Even in relatively consistent winds and seas, the sail plan and jury-rigged rudder will take constant attention to maintain the best course possible.

Bear in mind that the slower speed and extra distance sailed may increase the passage time by a factor of four or more. Depending on the distance from land and the amount of stores aboard, the crew may have to consider rationing food and fresh water.

Loss-of-Steering Tactics

There are four basic approaches to emergency-steering solutions. A workable arrangement will often combine elements from several.

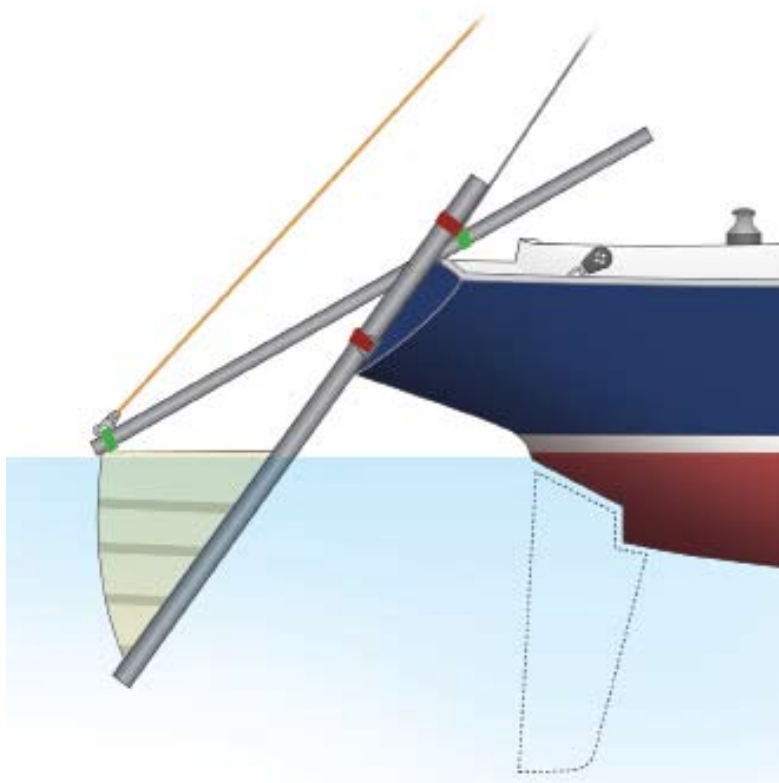
Sail balance: Without a rudder, the boat's normal balance will likely change dramatically, and you'll have to adapt your sail plan and trim to the new balance. On an upwind course, it's possible, on board certain designs, to steer without a rudder by properly balancing the sails. Most of the drive will likely come from

the jib, with a heavily reefed mainsail used as a trim tab: Sheet in to steer higher; sheet out to steer lower.

On a downwind course, get the sails as far forward as possible and as balanced on both sides as best you can. The traditional double-headsail approach, with similar-size jibs poled out port and starboard, offers one workable solution.

A reach will be by far the most difficult course to steer. An eased jib will be the best sail plan on most boats. But the course will change dramatically with small increases or decreases in wind speed.

Drogues: The loss of a rudder means that the boat loses lateral resistance. This usually unbalances the boat. Deploy-



Essentially a sail on a pair of spars, the "soft rudder" was developed by U.S. West Coast naval architect Paul Kamen. Visit www.well.com/~pk/PCrudder-04.htm for more information on his emergency-steering solutions.

This approach was widely used and refined back in the days before good self-steering solutions—windvanes and autopilots—were available. It's self-correcting, because when the boat yaws too much one way, a jib will back and push the bow back down. An alternative downwind approach, for stronger conditions, is to sheet a jib or staysail flat on the centerline. This is also a self-correcting sail plan, since the jib will constantly be pushing the bow back downwind.

ing a drogue adds surface area and restores balance. In addition, by deploying the drogue on a bridle, with one line tied to each stern quarter, you can steer the boat by adjusting the tension between the two bridle lines. (See "Time to Put On the Brakes," in this booklet.) Most people we know who've successfully sailed without rudders have deployed a drogue as a part of their solution.

Jury-rigged rudders: The most common jury-rigged rudder consists of a large board (to create rudderlike surface area) and chain (to sink the steering surface underwater) attached to the end of a spinnaker pole to create a sweep. The pole is lashed to the stern or the backstay so it pivots, and the boat is steered using two lines led from the end of the pole through snatch blocks at the

quarters to cockpit winches.

The loads on this sort of rudder are quite high, and both the means of attaching the board to the pole and the pole to the backstay/stern must be extremely well executed. The most successful approach for attaching the board to the pole is to drill holes down the center of the board in two rows that are spaced slightly narrower than the diameter of the pole. Thread either large hose clamps or strong lashings through each pair of holes, then run the pole down through them. Hose clamps work much better, so it's worth keeping large ones on board. If you use lashings, each will need to be twisted tightly with a Spanish windlass. You'll need chain (or diving weights) tied to the pole end to sink it and keep the board from bouncing along the surface.

Everyone we know who's tried to use a jury-rigged rudder has found that it's difficult to build one strong enough and that the finished device provides much less steering control than expected.

Emergency rudders: By far the best solution is to build and store on board an emergency rudder that's ready to deploy when the need arises. Experience suggests that an emergency rudder must be, at the very least, half the depth of the original rudder to provide steering control. The stock needs to extend above the transom for the tiller attachment.

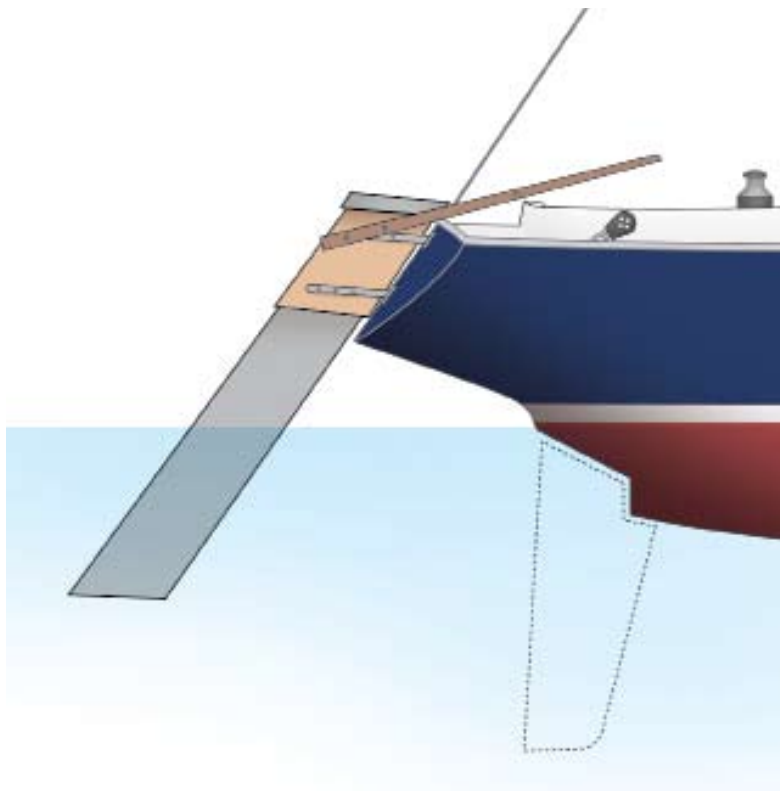
The cassette rudder is widely considered the best design and is a common solution on round-the-world raceboats. This design has four components: two gudgeons permanently (and strongly) fixed to the transom; the cassette, with two bolts or pintles on its forward edge that slide into the gudgeons; the rudder blade, which slides down into the cassette; and a tiller designed to attach securely to either the cassette or the rudder blade.

This design has several advantages over the alternatives. First, it's relatively easy to install at sea, as the cassette can first be fixed on the gudgeons before the rudder is slid into place. One-piece rudders are much more difficult to install because the waves throw the rudder blade around, making it all but impossible to line up the fasteners. Second, the assemblage breaks down into several components, making it easier to build and stow. Third, cassette rudders can be made strong enough to withstand rudder loads more easily than one-piece designs. Finally, if you make

it yourself, the cassette rudder can be a relatively economical solution.

However, we've found that very few cruising boats carry any sort of pre-made emergency rudder, due to the extra expense and the stowage challenge. Many do carry windvanes—such as the Hydrovane or WindPilot Pacific Plus—so picking a windvane design that steers its own

boat back to port safely and relatively efficiently. To deal with the possibility of rudder failure, crews should install a very strong main rudder. They should carry a cassette rudder or mount a windvane with an auxiliary rudder for use in the event the main rudder fails, and in case the cassette or auxiliary-rudder solution can't be fit, or in case the backup also fails, the



Done properly, a cassette rudder is the most efficient emergency-steering solution, but it's bulky to stow.

dedicated auxiliary rudder rather than the boat's main rudder is an alternative. If they're large enough, these rudders can act as full-fledged emergency rudders and require little or no effort to set up.

In 14 runnings of the Pacific Cup from San Francisco to Hawaii, there has been to date a 2-percent to 3-percent rudder-failure rate. In response, the race requires every boat to install and test an emergency-rudder system.

Putting It All Together

As is the case with most emergencies, including rudder failure, a multilayered defense is most likely to get a crew and

crew should be prepared to implement upwind and downwind sail plans to facilitate steering. They should also carry a drogue and be prepared to piece together a pole sweep.

Even with this level of preparation, steering without a main rudder will be a challenge. But these steps should keep you from having to abandon the vessel. With patience and persistence, you, like other crews before you, should be able to get the boat within sight of a port and within range of help.

Evans Starzinger and Beth A. Leonard frequently cruise the high latitudes, where self-reliance is paramount. Beth is the author of *The Voyager's Handbook: The Essential Guide to Bluewater Cruising* (McGraw Hill/International Marine).