

A way to avoid capsizing your boat in bloody big waves in deep water

I recently came across an elegant research report that should be recommended reading for any aspiring researcher or offshore sailor who may find themselves in heavy weather.

For the researcher, it describes the practical side of the research involving water channels and the effects of waves on model boats. It includes a sketch of a testing tank that used a flush of water to simulate breaking waves. They kept increasing the size of the flush until the models capsized.

For the sailor, the ideas in the report just might save your boat from capsize. If the water is shallow enough to use your anchor to keep you pointed into the wind and waves, this will work. However if the water is deeper than your anchor can reach, then a drogue is your friend in places like the shipping channels of Port Philip or the Singapore Deep.

We've all read stories about sea anchors, either shaped like a large funnel and dragged through the water big end first, or shaped like a parachute. Their job is to stop a boat or life raft being blown downwind, and for boats they are supposed to hold the boat's bow or stern towards any oncoming waves. The Jordan series drogue, the subject of the research report, looks like a series of miniature sea anchors. The photo shows the sea anchor from a life raft at the bottom and a short section of a series drogue at the top. A real series drogue for an 8m yacht would have 50m of miniature drogues.



Jordan's experiments revealed one of the problems with large, single drogues. *"The tests clearly showed that a drogue deployed from the stern can pull the boat through the breaking wave crest without capsize. However, if the towline has excessive slack at time of the wave strike, the boat can be capsized before the drogue pulls."* There are also reports of drogues inverting and being

destroyed by large shock loads. In contrast, the series drogue is designed to provide a smaller but more constant load.

Although there is real science in the research that designed the series drogue, anyone can make one. The ingredients are:

- Light weight dacron sail cloth (I used an old sail)
- Nylon rope (Nylon is preferred because it's stretchy which lessens the shock loads. The recommended type is called double braid.)
- Nylon tape (19mm wide)
- A sewing machine.

The Jordan series drogue is called a series because it uses a number of miniature sea drogues, 100 of them strung on 50m of rope line. The line goes through the centre of each drogue. The drogues have a diameter of 125mm at the big end, and 75mm at the small end. Each drogue is sewn from a quarter circle of fabric, and has three tapes that will attach it to the line. The tapes are attached to the line by pushing through and knotting them off. The next photo shows one with the tapes sewn on. It is ready for the straight sides to be stitched to make it into a funnel shape.



Initially I tried making the cones from rip stop nylon. However, it was too flexible and the cones crumpled instead of opening out into the cone shape. The best way to cut the sail cloth is with a hot knife as it seals the edges. I used an electric soldering iron with the tip filed to give an edge at 45 degrees to the handle. Let me know if you want to try making your own Jordan series drogue and I'll send you a copy of the template I made for cutting out the sail cloth.

I tried various ways to push the tapes through the rope before making the pusher shown below. It's a piece of tie wire, squashed to a rounded point, mounted in an old file handle. Simple push it through the rope, feed the tape

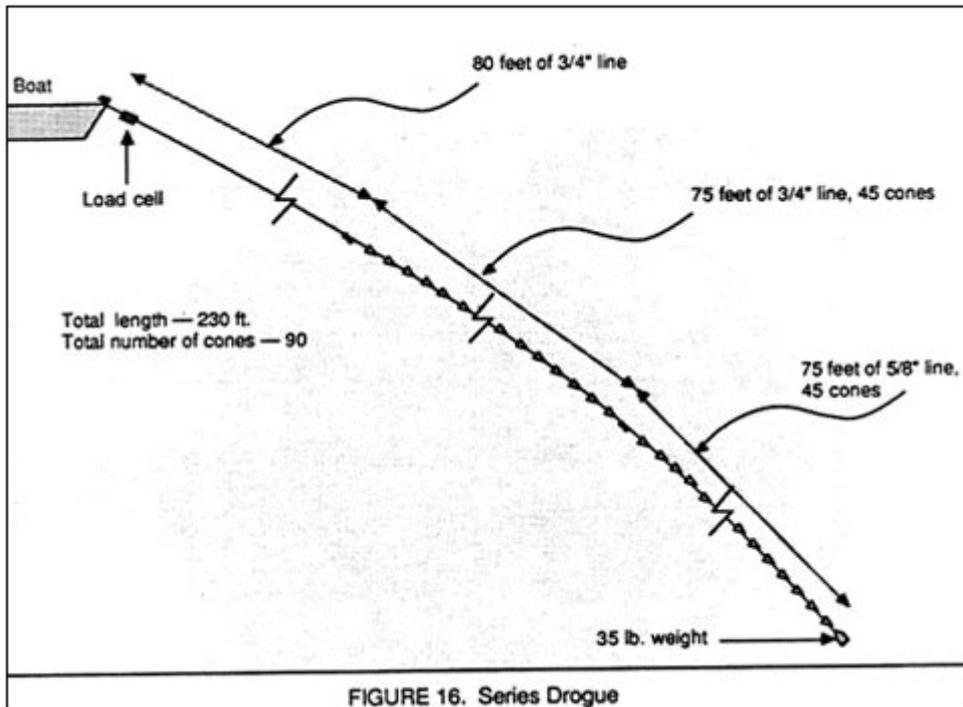
through the wire loop, and pull.



The tape is secured with an overhand knot, as shown in the next photo.



The illustration from Jordan's report shows how the drogue sits in the water when it is in use. A heavy weight keeps the end deep in the water where it is not affected by the wave motion on the surface. The total length of this example is 70m.



Jordan also experimented with having the drogue over the bow or over the stern. Contrary to my expectations, having the drogue over the stern was much more effective in preventing capsizes because of the greater buoyancy at that end of the boat.

For my experiment I made a small section, with five cones on three metres of line. Does it work? As soon as the lockdown is finished I'll take it to the Werribee River and test it off the jetty when the tide is running past. If that looks promising I'll try it from a kayak on a windy day. Who knows, maybe I'll even make a full size one and take it on a trip to Refuge Cove.

Gary Hardy commented on a draft of this note, pointing out that it seems like a fairly complicated piece of kit with a high potential for getting tangled. In the cost benefit analysis, for small boat coastal sailing, how much better would this be than the \$20 dollar sea anchor bought from a chandler?

Well, we'll just have to set up the great drogue shootout to compare them, Jordan series drogue versus ship chandler's single large drogue.



References

Investigation of the use of drogues to improve the safety of sailing yachts published in 1987 by the U.S. Coast Guard, Groton, CT, Report No. CG-D-20-87. The consulting engineer was Donald Jordan, which is why this type of sea anchor is now called a Jordan series drogue. Source: <http://seriesdrogue.com/coastguardreport/drogureport.htm>. Last accessed: 3 June 2021.