SHARK

DROGUE MANUAL

Second Edition

A new science for
handling storms at sea

by ZACK SMITH

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Shark Drogue Manual

A New Science for Handling Storms at Sea

by Zack Smith

Getting you through stormy seas with less wear and tear on you and your boat is what drogue use is all about. If you are reading this manual because you are a Shark owner, want to become one, or just want to know more about it, you will quickly realize why the Shark drogue developed by Fiorentino's research team is unlike any other speed-limiting drogue on the market. There are no shroud lines, bulky chain or stowaway bag to complicate deployment. It's a straightforward, easy–to-use and easy-to-retrieve system.

The Shark itself evolved after 15 years spent sea testing various brands of drag devices on many types of boats in seas ranging from calm to heavy gales. During our observational studies we encountered many operational failures. Some of the worst included shroud tangles, canopy failure, cones jammed around winches, and the frequent occurrence of chain slamming against the hulls of the test boats.

Our biggest discovery was the standard operating procedure (SOP) for deploying drogues proved to be the number one culprit in causing them to fail. Failure is obvious when shock loads vibrate uncomfortably throughout the boat or when equipment breaks. The discovery of these problems led to the development of a hybrid Shark design. The Shark Drogue Manual itself, sets forth new operational procedures that on many levels contradict the industry's SOP.

Our most important breakthrough is that constant tension on rode is necessary for any drag device to function effectively. That discovery led to the development of the "continuous rode tension and rode length formulas" contained in this manual. While such formulas are distinctive and don't always agree with industry recommendations, test results suggest a higher drogue performance level can be attained as sea states change, along with deployment failure reduction.

The "Shark Drogue Manual" offers you practical information on using your Shark to its maximum advantage in heavy seas. Our goal is to give you the information you need to meet the problems that occur with changing sea states.

Developing a Better Drogue

Some of you may recall the first drogue we developed for Fiorentino in 2002 (left photo)—it was rugged, had some great features, but required the same amount of bulky chain as all other conventional drogues on the market. Sailors that I've met, through boat shows or my seminars, complained about the chain and other problems. Their stories motivated me to develop a better drogue system. I submitted a proposal to Fiorentino asking for the funds to develop a new hybrid drogue that would combine the best features and benefits of all the drogues available to sailors. Fiorentino agreed, but with the stipulation the hybrid be "super compact."

Fiorentino's research team and I immediately returned to the sea with an array of prototype drogues and load cell equipment to measure force placed on boating equipment. We also decided to deploy the drogues from many different types of boats in various weather conditions to see how they behaved in changing environments. At that time, the focus was on two types of conventional drogues available on the market—a stopping drogue and a speed-limiting drogue. A key difference between the two types is that one nearly stops the boat, while the other only slows it down a little bit.

Stopping Drogue

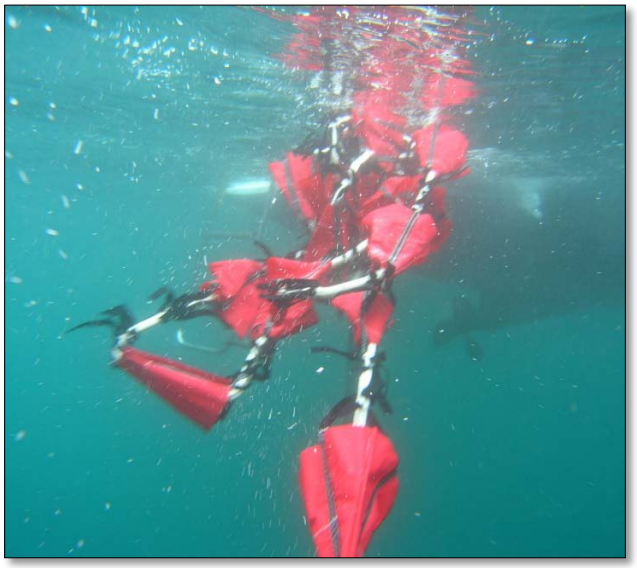
A stopping drogue (referred to as medium-pull or series drogue) is designed to point the stern into approaching waves by nearly stopping the boat's drift rate. This tactic is best accomplished by deploying several hundred feet of nylon rode with cones woven throughout the line. Sailors are told to go below and passively wait out the storm as the boat tends to itself.

Proponents of the stopping drogue claim this is the only type of drogue proven to handle a breaking wave strike versus other drag devices and reference a 1987 USCG report, *"Investigation of the Use of Drogues to Improve the Safety of Sailing Yachts,"* as their evidence. A closer review of the 1987 USCG report demonstrates there are both pros & cons to the stopping drogue as there are with any drag device or storm tactic.

Flat Transom Risk with a Stopping Drogue

Our experience in using and testing conventional drogues has shown us that a stopping drogue can slow a flat transom boat down too much and permit a wave to break on the stern. Such action could damage a steering wheel, blow in the cabin doors, or tear apart a dodger enclosure. For these reasons, the stopping drogue may better suite a canoe stern boat because the transom of this type of boat is designed similar to its bow and can better absorb a breaking wave strike.

A 1987 USCG report, *"Investigation of the Use of Drogues to Improve the Safety of Sailing Yachts,"* emphasizes this same point, but takes it a step further. They recommend special reinforcement in the cockpit area of a flat transom boat to reduce damage created by breaking waves and the increased force generated by the stopping drogue. The report indicates that 7,000- to 27,000 lbs. (3,175- to 12,247 kg) of force can be generated by the stopping drogue in a breaking wave situation if a boat displaces 10,000- to 50,000-pounds (5- to 25 tons). Forces would be higher with vessels that displace over 50,000-pounds (25 tons). If these estimates are correct, the stopping drogue could reach forces over 10 times that of any speed-limiting drogue that we've tested. The result could be a severely damaged boat.



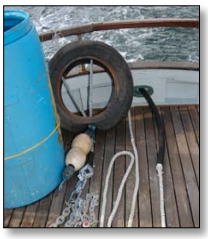
More Stopping Drogue Issues

The two common problems reported by sailors who use the stopping drogue is "heavy pitching" with occasional waves breaking in the cockpit and the difficulty in recovery. Pitch and roll is uncomfortable, but is survivable. The exception is when pitching causes the stopping drogue to wrap itself around the boat's rudder, as reported in one incident in the book *"Drag Device Database,"* by Victor Shane. Fortunately, the sailors were able to untangle the device, thus avoiding damage to the rudder due to drogue force.

I have never encountered a stopping drogue tangle, but I've experienced the exhausting and long process of recovering the stopping drogue. The process rivals that of the bow deployed para-anchor. Part of the difficulty is trying to recover equipment from the stern where you have to be mindful of tangles with the prop and rudder. The other is the tremendous drag created by the cones woven throughout the rope, even after slack is generated in the system by motoring up on the rode. Winches are not that useful because the cones tend to tangle around them. In the *"Drag Device Database,"* a sailor emphasized the difficulty in retrieval by mentioning how "dangerous" it was to place the stopping drogue around a winch because the amount of force placed on the rope nearly "amputated" his hands. The sailor was unable to recover the stopping drogue so he cut it loose.

The potential for waves sweeping the transom, difficulty in recovery, and the requirements for special reinforcement in the cockpit area of a boat make the stopping drogue dangerous to operate. Not only does it take up a lot of storage space, but it can't be used for any other purpose. Conversely, rode used to deploy a speed-limiting drogue is useful for a ground anchorage and/or a bow deployed para-anchor. For these reasons Fiorentino's research team chose not to build a stopping drogue. If something is not simple to use it will sit in the lazerrette or be cut loose…a wasted investment either way.





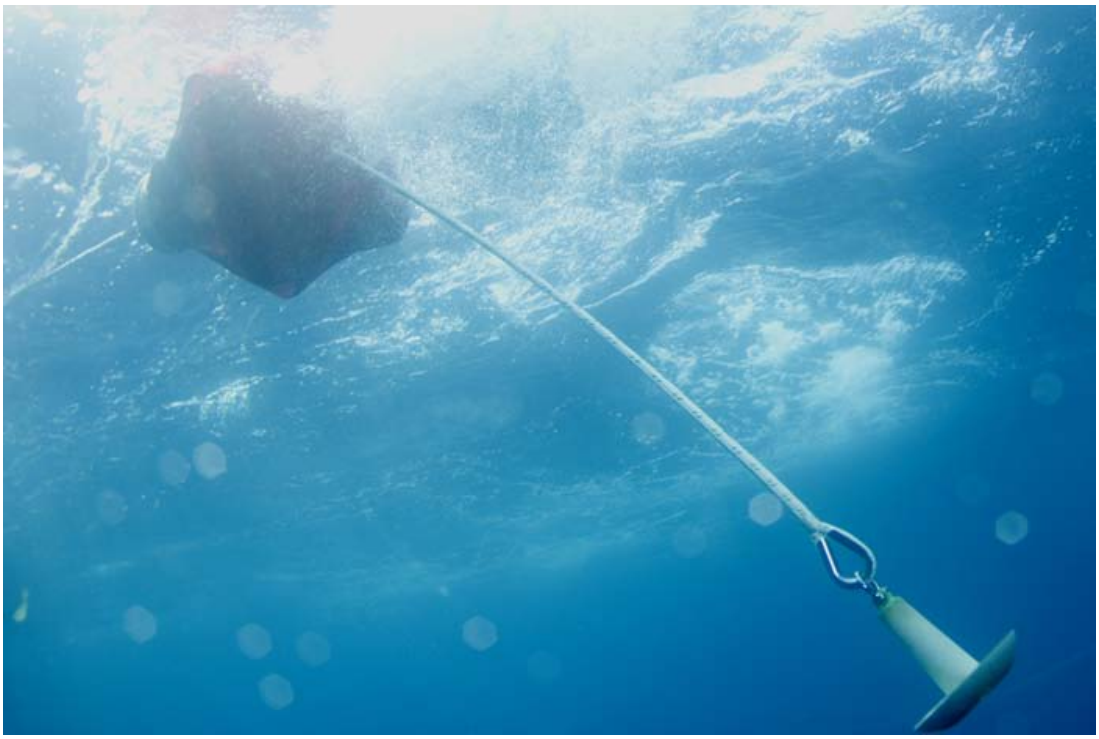
Speed-Limiting Drogue

The speed-limiting drogue is typically a single canopy device that comes in various designs and holds the stern down enough to lessen the chance of a boat being flipped by a wave (pitchpoling). It should also create enough drag to prevent the boat from surfing down the front of a wave while maintaining enough speed to ensure that waves don't break on the cockpit. Directional steering is improved, but speed-limiting drogues do require active crew participation in maneuvering the boat. This action is referred to by many authors as running and is considered the most popular method in handling a storm with a drogue. Still, like any drag device, there are pros and cons. If sea states become extreme, it's unknown if the speed-limiting drogue can slow the boat down enough to do its job. For this reason, chain weight becomes essential to improve a speed-limiting drogue's performance. However, chain can also present some deployment and retrieval problems in a sloppy sea state.

Chain Risk with a Speed-Limiting Drogue

Long lengths of chain are a must for sinking conventional drogues below dangerous breaking waves and to remove slack rode that can lead to shock loads on equipment. The issue of chain weights, however, is particularly challenging because so many sailors, including myself, struggle with chain during drogue deployment and retrieval. My problem with chain is that it often knocks me off balance or slips out of my hands when I deploy and retrieve a drogue from a bouncing cockpit.

The real nightmare is retrieval. I can't tell you how many times I've slammed chain against my boat's hull during the retrieval process. Imagine hauling up the required 20- to 40-feet (6- to 12 m) of chain with an inflated canopy at the end of it. The storm is over, but the sea is still sloppy with your boat pitching back and forth. Because you can't use the cockpit winch to crank in the chain portion of the drogue, it's an intense, time consuming workout. If you do use a winch, I promise your boat will be laden with scratches and chewed-up deck hardware. If you already own a conventional drogue, you have no choice but to pull the chain up and away from your boat's hull to avoid damage…a most difficult angle to retrieve equipment.



Eliminating the Chain Risk

To eliminate the use of chain entirely, my goal was to use equipment commonly found on most boats. After testing 15 proto-type drogues, we eventually designed a more practical attachment point called a *"drogue tail"* so sailors can connect any dinghy or spare anchor onto the backside of the Shark drogue. The *"drogue tail"* is affixed to the mouth (Para-Ring) of the drogue with the bitter end passing through the canopy and ending in a stainless spliced eye. The spliced eye is where the ground tackle is attached (see mushroom anchor in the photo).

Eliminating chain to sink a speed-limiting drogue is a huge advantage because it's so much easier to handle something that's small in volume. This feature permits a sailor to use the boat's primary winch to haul in all of the Shark's deployment rode without the worry of chain scraping the boat. To further reduce any possibility of scratching fiberglass, I like to use either a 10- or 25 pound (5- to 11 kg) nylon covered mushroom anchor. I prefer mushroom anchors because they are solid with no moveable parts. Metal anchors, like flukes with moveable joints, increase the possibility of having the anchor shift in your hand and possibly pinch a finger.

Shark Deployment

Squeeze the mid section of the two vinyl buckles to open the bottom lid.

Allow the 10-foot (3 m) "*drogue tail"* to fall out of the Para-Ring.

Grab the red canopy inside the Para-Ring and pull it completely out.

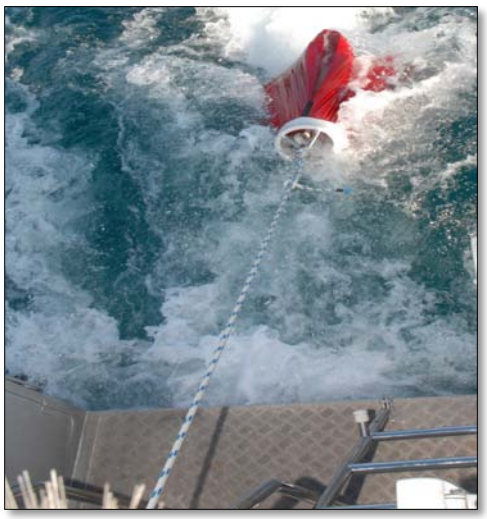
Attach an anchor weight to the *"drogue tail."* You're now ready to drop the Shark over the lifeline or rail and onto the water. Remember to pay attention to the deployment rode to avoid tangles with your feet.

NEW – Rode Tension Formulas --

Slack Rode Problem Update, *"The Big Secret"*
Once you have deployed your drogue, you need to keep the rode taut. Rode that becomes slack for too long a period leaves a vessel swinging beam to, where waves can slam into a boat and knock it down. In 2000, I published a basic formula on how to reduce problems associated with slack rode. Since then, additional tests in gale force conditions have allowed me to create more detailed solutions for what my research team believes is the number one culprit in drag device failure—rode slack.

Slack occurs because rode naturally stretches under force until it becomes taut. As force is reduced, rode becomes relaxed. This accordion effect permanently lengthens and fatigues the rode.

If slack cycles last too long, the drogue will not position the stern of a boat quarter to the waves. Instead, a boat will tend to round up into the wind where waves can push the boat sideways as it falls down into the trough of a wave. Such action gives a second or third wave the opportunity to knock the boat down. This generates huge shock loads that can weaken and break rope fibers. Fortunately, we've developed several formulas for removing slack rode problems. I call them the *"Continuous Rode Tension Solution," "Short Rode Solution," and "Full Rode Solution."* You can read the solution details below. If you have questions about any of the solutions contact me by email at zack@para-anchor.com.



How to Reduce Slack Rode with the
"Continuous Rode Tension Solution" (complete force)
Our research demonstrates that rode retains much of its original tensile strength if constant drogue force is placed on it. Solutions to maximize drag from a drogue to reduce slack rode are: To deploy shorter lengths of rode, place weight next to the drogue, or tow a larger drag device. A secondary solution at a sailor's disposal is to increase vessel speed. I typically raise a storm sail or motor forward. The increased speed downwind usually removes the slack rode. You can tell by *"feel"* when everything is ok because the boat rises and falls with the waves more smoothly. If there's a problem, a boat becomes difficult to steer and the bow starts to torpedo at the bottom of a wave, usually at an angle that can broach your boat.

How to Ease Steerage with the *"Short Rode Solution"*

Rode that is paid out a little at a time maintains constant force on the drogue so that it remains fully inflated. This makes it easier to steer your boat downwind. Consider this option only if you secure the deployment rode to a primary winch. A winch makes it much easier to pay out additional rode that has force placed upon it. You'll know when it's time to pay out more rode when the Shark starts to break the ocean's surface and/or you feel the boat regularly fall down the face of a wave. Eventually, the bow will torpedo underwater, causing vibrations throughout the boat. Another hint that more rode is needed occurs when steering becomes difficult and waves begin to slam heavily against the stern.

The Shark performs best when it sits behind an approaching wave. I usually deploy approximately 150-feet (46 m) of rode as a starting point. Never worry about how many waves are between the boat and Shark. I know the established method is to place a drogue one to three wave lengths behind the boat, but in real-life, it's usually too dark or rainy to see anything. Instead, I advise going by feel. Start with approximately 150-feet (46 m) and then pay out rode until your boat doesn't round up to windward or lurch forward. Once the Shark is set properly the boat becomes easier to steer and rises smoothly with each approaching wave. Even the most novice sailor can tell by feel when everything is functioning properly.

How to Simplify Deployment with the *"Full Rode Solution"*

Deploying the entire drogue setup is the full rode solution [Deployment rode {*10-feet (3 m) for every one-foot (0.31 m) of boat*}, 25 pounds (11 kg) of weight, and a bridle]. Deploying all of your rode at once avoids having to adjust lines as a storm worsens. Motion from a boat sailing forward and the 25 pounds (11 kg) of weight typically maintain constant tension on the deployment rode. However, unusual wave patterns or fluctuating wind could lead to slack rode that places your boat beam to the waves. If you find your boat rounding up to windward or frequently slamming its bow into the trough, then you need to increase vessel speed (with a sail or by motoring downwind).

Constant Rode Tension Controversy

Currently, drag device manufacturers and many authors are resistant to the idea of constant force on rode connected to the drag device because they claim the loads are too high. Their general belief is that you need long lengths of rode with lots of stretch in it to reduce force on equipment.

Alby McCracken, from Para-anchors Australia, claims that "rode stretched to its maximum too much of the time…" may break. From a technical standpoint, this might partially be correct, but shock loading in my opinion, weakens rode far more quickly than stretching out the fibers in rope with constant force. Even Hal Roth, author of *"Handling Storms at Sea,"* states how, "line tends to break in larger vessels, probably because the line is too short to allow much stretch." Roth also felt that "stiffer, stronger line without resilience may be inclined to break or tear out the deck fittings on the boat."

Fiorentino's research conducted in varied weather conditions, with load cell equipment, contradicts both McCracken's and Roth's assertions. The sea tests show that constant force on rode with less stretch exhibits less shock loading with low amounts of peak force recorded on the load cell indicator. The computer readouts from the load cell indicator, which measures force on rode, confirm that a relatively constant rate of force is applied to rope with less stretch. Rope with more elasticity tends to produce more shock loading with higher amounts of peak force recorded on the load cell indicator. The amount of force registered is 2-3 times higher with slack rode than with a system that limits stretch in rode. It's important to mention that larger wave patterns always increase the amount of force that a load cell indicator displays whether or not your setup is designed with less stretch.

Fiorentino's Drogue Tension Guideline® chart below recaps how to provide complete force on rode to maximize a speed-limiting drogue's performance.

Fiorentino's Drogue Tension Guidelines®:

The following chart explains the recommended rode lengths and sinking weights required to properly deploy the Shark drogue from the stern of a boat. You may choose to deploy shorter increments of rode or the full recommended length, based on various actual conditions (current weather, future weather forecast, your experience with the vessel, etc.). The average length of rode to deploy in severe weather is 10-feet (3 m) of rode per every foot (0.31 m) of boat length.

Weather conditions	Calm Weather	Gale Force	Heavy Weather	Severe Weather
Wind speed in knots	< 28	28-47	48-65	66 >
Option 1: Short Rode Deployment	N/A	150 ft. (46m)	300 ft. (91m)	90% of rode
Amount of weight required	N/A	10 lbs. (5kg)	25 lbs. (11kg)	25 lbs. (11kg)
Option 2: Full Rode Deployment	10 ft. x boat length	10 ft. x boat length	10 ft. x boat length	10 ft. x boat length
Amount of weight required	25 lbs. (11kg)	25 lbs. (11kg)	25 lbs. (11kg)	25 lbs. (11kg)

DISCLAIMER: The chart above was compiled following the completion of a 15 year study involving drag device performance, with and without the use of load cell equipment, under varying weather conditions. Developed by Fiorentino Para Anchors, these guidelines are provided for education only. Until further research has been completed the data in these charts should be used with prudence. Due to the dynamics of the relationship between a boat and the ocean, these guidelines cannot be claimed as an exact science. Unusual currents and wave patterns and even boat design can affect the results.

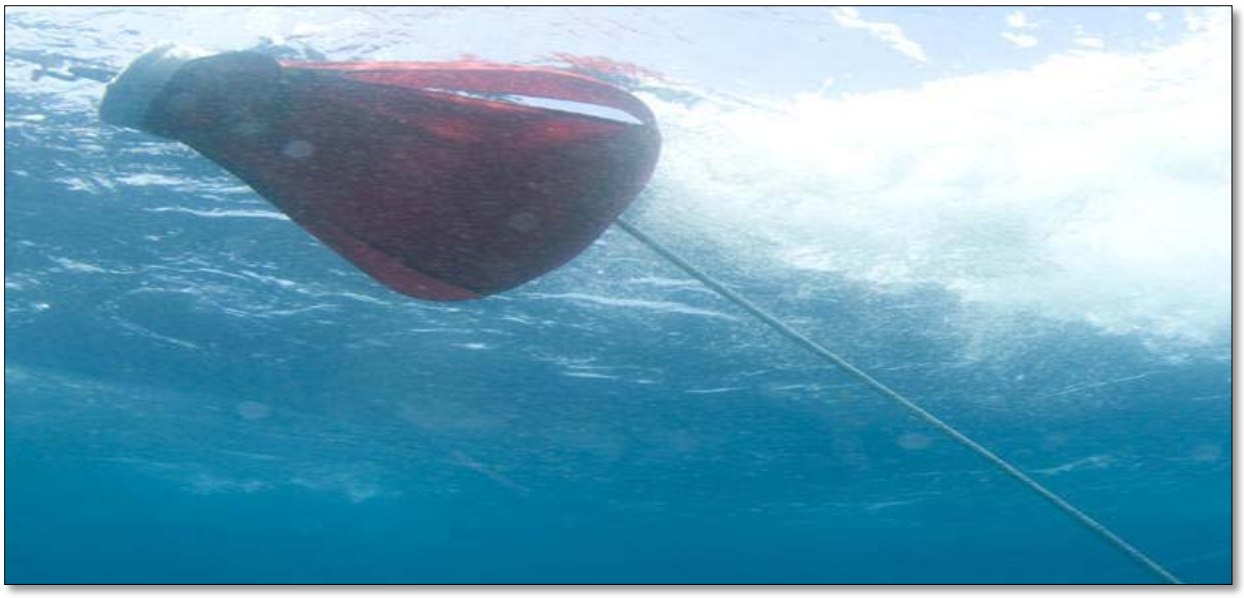
Space Module Challenge: "Rode Tension Formula Put to the Test"
In February 2008, Fiorentino was commissioned by NASA to design a drag device with multifunctional capacities that could stabilize a space capsule in rough seas. Because all the tools associated with boats and drag devices, namely bridles, motors and sails weren't applicable in this situation, our team worked to devise a special hemispherical canopy and use a time proven anti-tangle device called a Para-Ring. The cylindrical Para-Ring permits a swivel to spin while it's under force so shroud lines won't tangle and collapse the canopy of the drag device. We also incorporated custom tow rode with zero stretch in an effort to keep the rode extra taut. In the end, the complete setup had very little shock absorption capability which supplied a constant drag on the capsule.

Part of my confidence with the NASA design was a result of working with three other military contractors whose different setups ended up requiring very little stretch in their systems. The other reason for my confidence was experience gained by working with para-anchor pioneer, Gerrard Fiorentino. Although he never used terms like "constant rode tension," all of his rigging methods for rode and weights demonstrated less stretch is better when using a drag device.

During the Spring of 2009, NASA successfully completed the Open Ocean (seaway) and drag tests aboard their 606D Orion space capsule. While the Fiorentino para-anchor tested better than drogues for stabilizing the capsule, the lack of stretch in the drag devices and deployment rode performed as we expected --with positive results-- reinforcing my belief in the need for "constant rode tension."

Both the open water and drag tests were completed off the Kennedy Space Center in seas of up to nine feet. The test results are significant to the boating community because they demonstrate how "constant rode tension" plays a key part in preventing capsizing.

COMMON SHARK QUESTIONS



What Size Vessel Can the Shark Handle?
There are three standard sizes for power and sailing vessels:
Extra Small Shark: 22- to 31-feet (6.7- to 9.5 m) and up to 20,000-pound (10 ton) displacement.
Small Shark: 32- to 49-feet (9.8- to 15 m) and up to 50,000-pound (25 ton) displacement.
Large Shark: 50- to 90-feet (15.2- to 27.4 m) and up to 200,000-pound (100 ton) displacement.

Custom Extra Large Shark: Available for special tow operations and vessels over 90-feet (27.4 m) in length.

How does the Shark combat shock loads, skipping or popping out of the water?
Using a ground anchor, with the "drogue tail" located on the backside of the Shark, sinks the drogue underwater and removes slack rode at the same time. The anchor weight connected to the *"drogue tail"* is very effective at pulling the back of the canopy down while tilting the mouth of the Para-Ring toward the Ocean's surface. This optimal angle increases water flow into the drogue ensuring that the solid canopy is inflated at all times. A solid canopy that remains fully inflated catches a lot of water to slow your boat. These patented design features permit Fiorentino to build a smaller drogue that takes up less space and is much easier to handle than other drogue devices.

Can any ground anchor be used to sink the Shark?
Yes. While I prefer mushroom anchors, any type of ground anchor can be attached to the *"drogue tail"* located behind the Shark.

Why is a ground anchor easier to handle than chain?
An average of 20- to 40-feet (6- to 12 m) of bulky chain is needed to equal the same weight placement of a small ground anchor. For example, a mushroom anchor is small in volume, making it easier to handle, and it can be used for a secondary purpose such as a dinghy anchor. Chain is more difficult to deploy because of its length and it tends to bang the hull of your boat during retrieval. The Shark is the only speed-limiting drogue that can operate without chain.

How much weight is needed to sink the Shark?
Proprietary tests conducted by Fiorentino suggest the use of *"10-pounds (5 kg) for gale strength weather and 25-pounds (11 kg) for heavy weather conditions."* The amount of weight placed on the Shark is somewhat flexible since the forward motion of your boat maintains some tension in the rode in addition to the weight itself. Total weight placement should not exceed 50-pounds (23 kg).

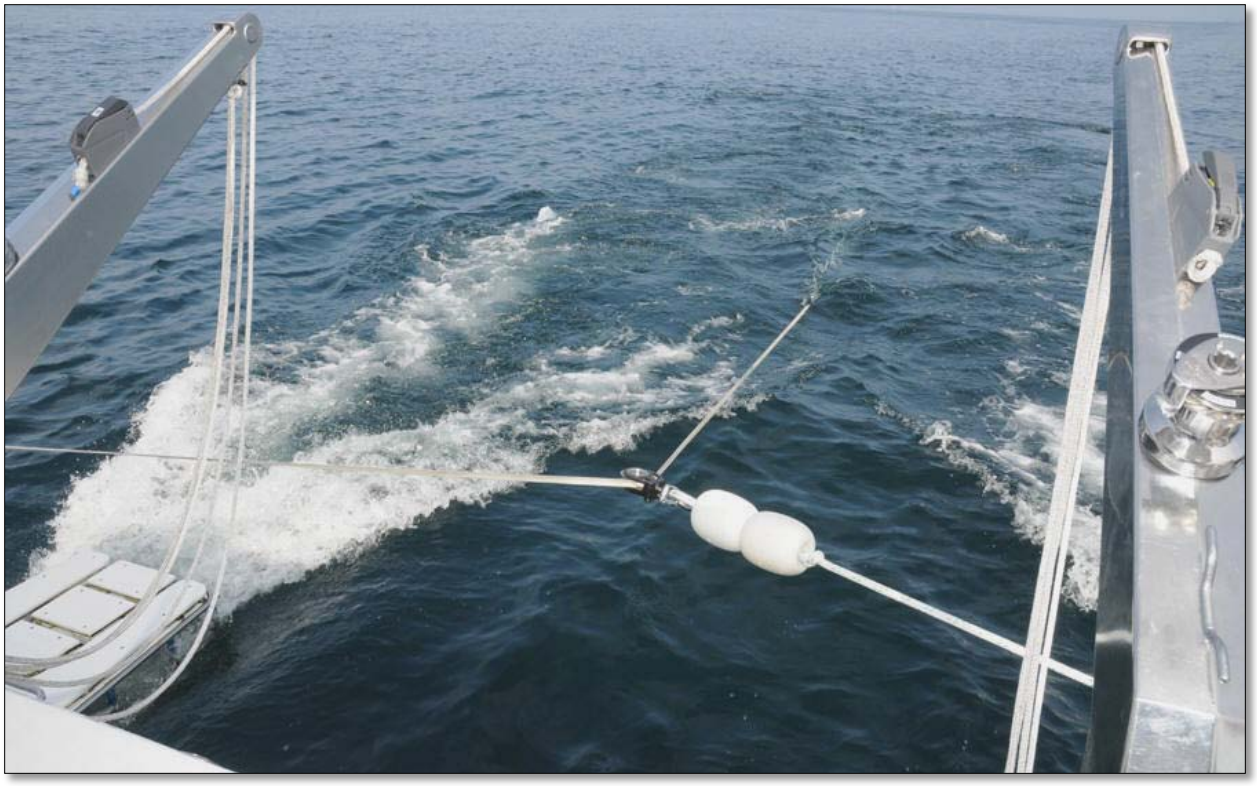
How much force does the Shark generate on your boat?
Fiorentino's average load cell readouts indicate 400 lbs. (181 kg) of force is applied to your vessel when towing a small Shark. Shock loads have been recorded as high as 550 lbs. (250 kg). Fiorentino projects forces could potentially reach 2,200 lbs. (998 kg) in severe weather.

Shark Drag Characteristics: *Excerpts from Technical Reports FPA-120 & FPA-124*

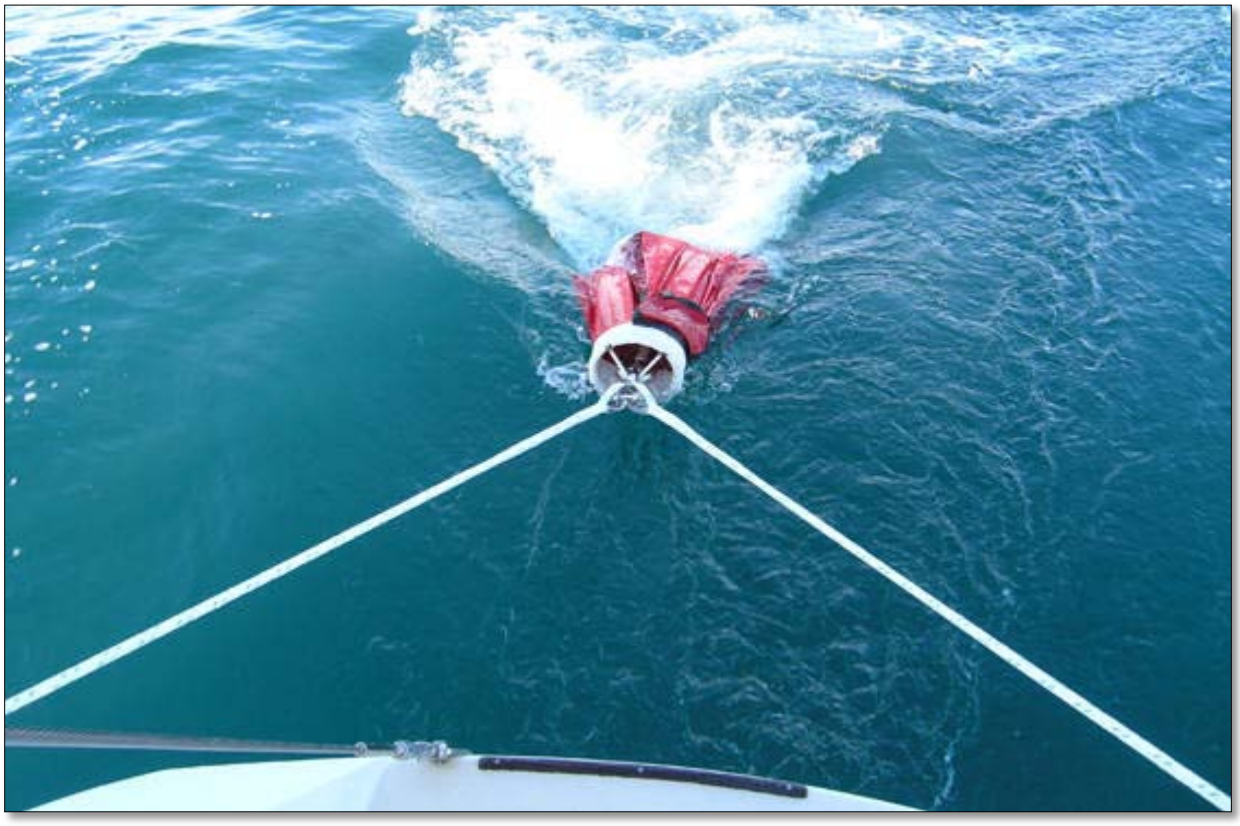
BOAT SPEED & FORCE MEASURMENTS	Large Shark	Small Shark	Large Shark & Small Shark (in tandem)	Large Shark & Small Shark (2nd run)
Boat speed without drogue in knots	7.2	7.2	7.2	7.2
Boat speed with drogue in knots	4.0- to 4.1	5.3- to 5.4	3.6- to 3.8	3.5
Total Boat Speed Reduction in knots	3.1- to 3.2	1.8- to 1.9	3.4- to 3.6	3.7
Load Cell Readout Force in lbs.	232- to 299 358 (high)	332- to 368 438 (high)	272- to 338 338 (high)	290- to 294 320 (high)
Notes	Stopping drogue (103 cones) had a total boat speed reduction of 3.4- to 3.5 knots. Similar drag results are achieved using two Shark drogues towed in tandem or one large Shark with weight attachment. On average, weight placement near each drogue, slows a boat down by approximately 0.5 knots. There is approximately 100 lbs. of extra force placed on equipment with the addition of weight near each drogue. Drag tests were conducted in sea states 1-3.			

How much rode is attached to the Shark?
Tests conducted by Fiorentino indicate that an average length of rode to use with the Shark is *"150-feet (46 m) for gale strength weather and 300-feet (91 m) for storms."* If you choose to prepare for extreme weather, then Fiorentino suggests *"10-feet (3 m) of rode for every foot (0.31 m) of boat."* The most common diameter rode to use with the Shark is 5/8-inches (16 mm). I prefer to use a Dacron/nylon mix rode because the combination stiffens the rope, protecting against chafe and slack while maintaining its ability to absorb shock loads with the nylon.

Can I use gear already on my boat?
Yes. The Shark saves you money and space, because you can use gear like an anchor rode or a spare ground anchor already stowed aboard your boat. Dock lines are useful as well. They can be converted into a bridle setup if you choose to use the Shark as an emergency steering device, a subject I discuss later in this manual.



Should I use a Fiorentino bridle with the Shark?
Yes. A bridle helps because it allows you to easily alter the position of the Shark placing your boat on a better track to improve steering. Typically, waves approaching from the windward quarter bring about the best comfort and steering control. Bridles can also reduce force placed on your boat's cleats. Setting a bridle before or after the Shark is deployed is a matter of personal preference. I've tried various lengths of bridles, but prefer to use shorter ones since rode slackens less and the bridle tends to correct a boat's steering much faster. Bridles should match the diameter of the rode deployed with the drogue and be long enough to span the transom with the option to secure the bitter end to your primary winches.



Can the Shark be used for emergency steering?
Yes. Several race events, like the Transpac, approve the use of the Shark as an alternative emergency steering device in the event your rudder or steering cables break. The small size of the Shark makes this stern drogue exceptionally easy to maneuver. The above photo demonstrates Fiorentino's highly effective *"2-Line"* bridle set-up developed specifically for emergency steering. Both lines are typically anchored to winches. However, cleats may also be utilized.

Can the Shark be converted to a stopping drogue?
Although the Shark's *"drogue tail"* could allow the drogue to be converted into a stopping drogue by attaching a second Shark, it is not recommended. The Shark has been extensively tested through Fiorentino sea-trials and it's intended for use as a speed-limiting drogue. Proprietary test results demonstrate that *"two drogues towed in tandem has essentially the same drag speed reduction as adding weight to a single drogue in tow"* as demonstrated in the Shark Drag Characteristics chart on page 19.

Can you use a trip line to recover the Shark?
I wouldn't. You'll spend more time trying to capture the float at the tail end of the drogue than it takes to recover the drogue set-up. Wind constantly pushes the retrieval float away from the boat making it difficult to capture with a hook. Since recovery is at the stern, you typically motor in reverse in an effort to chase down the retrieval float. Most boats don't maneuver well in reverse, especially with a sloppy sea state. You also have to avoid running over ropes and the drogue at the same time.

How do you retrieve the Shark?
Motor alongside the deployed rode with the boat's bow quartering the waves. This generates enough slack to pull the Shark in by hand or with a winch. As soon as the Para-Ring (mouth of the drogue) breaks the surface of the water, slowly haul up the Shark. This permits water to exit the canopy from four different slots. Once the Shark reaches the deck, grab the *"drogue tail"* and haul in the mushroom weight. The *"drogue tail"* is short so this process occurs rather quickly.

How do you pack the Shark?
Packing is simple after you disconnect the Shark from its deployment rode. Grab hold of the drogue tail and push the red canopy inside the Para-Ring. After the red canopy is inside the Para-Ring coil the drogue tail into a circle. The two nylon buckles snap the bottom lid closed so everything is stored inside the cylindrical package. The unit is self contained without the need for a separate stowage bag.

Can moisture eventually damage or rot the Shark?
Dacron and Nylon fibers are essentially plastic and can't mold or rot. If possible, it's a good idea to rinse the equipment to avoid smelly growths that can develop on the surface of the fabric. A fresh water rinse also prevents any build up of salt or rust blemish on the Jaw & Jaw swivel connected to the Para-Ring hardware. For those who might not know, iron particles that contaminate the surface of stainless steel can rust, if not properly rinsed with fresh water. The stainless itself doesn't rust. The good news is that it takes many years for this type of equipment to wear out. So rinse equipment when it's convenient for you.

More Technical Questions?
If you have any comments or questions please feel free to contact me by e-mail: zack@para-anchor.com

About the Author

Zack Smith is a well-known drag device inventor and head of Fiorentino's Research and Design Team. His Shark™ storm drogue is widely recognized for its innovative design within the safety device industry. Under his guidance, Fiorentino's Research and Design team conducted 15 years of sea trials on varying drag devices which resulted not only in design advances, but the pioneering "Constant Rode Tension Theory." This theory states that "keeping rode taut is the secret of successful use of parachute sea anchors and drogues." Fiorentino has been awarded 14 patents, an industry record, as a result of work done by its Research and Design Team which has developed custom drag devices for the U.S. Navy and U.S. Coast Guard. The team also assisted NASA with original technical reports and counsel during storm drogue tests related to space capsule recovery. Zack is the author of the *Complete Para-Anchor Set-Up*, as well as articles for *Sail Magazine*, *Latitudes and Attitudes* and *Blue Water Sailing*. A life-long sailor, Zack can often be found aboard his Beneteau 35 cruising from Newport Beach, CA to Mexico and back. He is currently working on several new technical reports and instruction videos. For more information visit Zack and Fiorentino at www.para-anchor.com.

Contact Information:
E-mail: zack@para-anchor.com
Phone: 949-631-2336

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Zack Smith

Signed this twelfth day of August Two Thousand Nine

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