

# A New Development in Rope and Line Cutters

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A short paper by Richard Caulfield \*\*

## Overview:

Powered vessels entering fishing grounds risk entanglement from ropes, lines and nets. A common cause of entanglement is lobster and crab trap line. Of this type of line, the most commonly used is polypropylene line or pot rope, as it is known in some and trap line in other countries such as the USA. PP line is favoured by lobster and crab fishermen due to low cost, strength and natural buoyancy. The line is used to raise and lower the trap onto the sea floor. To help locate the line, a floating marker is attached to the line's free end. Ideally, these markers should be highly visible. However in some areas, for reasons best known to the local fisherman, they are often poorly marked and thus difficult to see. Lack of visibility of the trap marker is in all probability the first hazard but perhaps not the most dangerous as long as the length of line is commensurate with water depth and tidal fluctuation. When excess line is employed, the chances increase for a vessel to run across a long wide arc of line floating just at the surface and remaining almost undetectable until too late.

Aside from anchored line another serious encounter could be with a cluster of trailing line and net, likely remnants of a previous encounter, cut away by the crew of a fishing vessel and left to drift. Lines lost overboard, net, plastic sheet, weed or other floating debris can all be caught by the vessel's propeller and the result can range from mere inconvenience to outright life threatening.

A number of commercially available rope or line cutters are available for conventional shaft driven boats and they provide varying degrees of protection.

## What happens when line, rope, net or other debris is caught by the propeller?

- Rope, line or other debris wound around a propeller can lead to loss of propulsion. In safe, warm and calm water the propeller can be cut free with a quick dive over the side, but when there is very cold or rough water, diving over the side can be a dangerous proposition.
- Conventional propeller driven powerboats risk overheating water-lubricated bearings due to lack of lubricating water should a line cutter not be available to cut line that otherwise will wind forward of the propeller and seal the water outlets.
- Powerboats with propeller shaft bearings lubricated with oil risk damage to seals caused by line winding tightly forward.
- A vessel risks structural damage should a lobster, crab, trap or pot wind into the vessels propulsion system. If the vessel sustained enough structural damage, it could sink.

Rope cutters or line cutters reduce the risk of entanglement.

My research indicates there are three categories of commercially available rope or line cutters are currently available:

Scissor, Disc, and since 2004, the development of a new Shaver category.

### **Scissor Cutters (rotating blades shear over fixed blades)**

Scissor cutter blades rotate with the shaft and shear scissor-like over fixed blades. Like conventional scissors, they rely on a sharp cutting edge, blade rigidity and minimal gap between shearing blades. A wide or sloppy gap may allow rope, line or other debris to pass between the cutter blades and wind onto the shaft. When rope, line and other debris is not cut immediately and allowed to pass between the blades, the blades may become ineffective. Pressure will build on the supporting structure and may damage blades rendering them permanently ineffective. Worn or badly fitted cutters or shafts with significant longitudinal play only compound the risk of rope, line, weed or net passing through.

Rotating blades passing over fixed blades shear water in front of the propeller. This cannot but create undesirable water turbulence. Vibration and drag issues with some vessels have been linked to scissor cutters.

Nevertheless, a scissor type line cutter provides reasonably high level of effectiveness against rope, line, weed, net and plastic sheet.

### **Disc Cutters (a sharp-edged disc that rotates with the propeller)**

To cut rope or line the disc must possess a sharp blade and the rope or line has to be simultaneously caught by the strut as well as the propeller. Clearly, this will not always be the case; for example with the vessel travelling astern, rope or line is likely to only be caught by the propeller. In this situation, the disc can not cut the rope or line but instead will convert from being a line cutter to a winch. Once rope or line builds beyond the diameter of the cutter blade, for practical purposes its cutting ability is severely restricted.

Independent tests conducted by Keith Colwell\* in 2000 found that none of three disc cutters tested could cut net, plastic sheet nor 20mm polyester rope despite the rope being held by the propeller and strut.

Turning to drag and water turbulence, disc cutters have a relatively large surface area in front and proud of the propeller hub. The lack of streamlining is self-evident and while well understood in terms of extra drag, the effect of creating turbulence immediately in front of the propeller might be less well known. To operate efficiently, propellers need to "grip" water and propulsion efficiency is improved when an uninterrupted supply of non-turbulent water is delivered to the propeller blades. A high speed propeller will operate more efficiently if it does not have to deal with buffeting from alternating high and low pressure eddies associated with turbulent water. For these reasons disc cutters are impractical for use with fast vessels.

### **Shaver Cutters (radial fixed blades that skim over a spool that rotates with the shaft)**

Shaver cutters are line cutters that work by continuously shaving rope, line or other debris caught by the propeller. As a concept, this is a radical departure from scissor and disc designs which attempt to slice clear through line or rope at first strike.

Shavers employ fixed-position vertical blades riding closely over a cylindrical, smooth surfaced concentric rotating spool. The spool acts as a gathering and cutting table and while preventing line winding onto the shaft it also prevents line sneaking underneath past the blades. The blade angles are positively raked to rapidly remove line whenever line presses against the blade edges. With this arrangement debris has no alternative other than to be cut away. On a typical

shaver line cutter, there is at least one forward and one reverse blade, so the debris is cut no matter which direction the propeller turns nor whether the vessel travels forward or astern. Faced with a severe propeller entanglement such as a large clump of rogue rope, line, or net, by rotating and counter-rotating the propeller, a shaver cutter will inevitably free itself. Faced with a simple entanglement involving a single floating rope or line, a skipper probably would be unaware the cutter had done its job. Using this type of cutter, a skipper's prospects of keeping a vessel's propeller free of rope or line are significantly improved.

A downside to shavers involves the actual installation which is more complex compared to disc and scissor cutters. Generally, it is wise to employ a skilled and authorised professional to carry out an installation.

Footprint (or rather lack of) is a feature that dramatically distinguishes shavers from scissor and disc cutters. Other things being equal, a device with a small footprint produces less turbulence and delivers more undisturbed water to the propeller blade than a device with a large footprint. By comparison with disc and scissor cutters, shavers have insignificant footprints.

Shaver line cutters produce insignificant drag to dampen boat speed and after 4 years commercial use, no complaints regarding drag or vibration have been reported.

Purpose built shavers are capable of cutting up to 3" (76mm) diameter rope and line. Regular shavers quickly and reliably cut through all manner of rope and line up to 1" (25mm) diameter as well as net, plastic sheet, weed and even 3/16" (4.75mm) multi strand stainless wire cable.

Due to their overall robustness and cutting efficiency, I believe that shaver line cutters offer the highest level of protection.

Shaver Cutters are manufactured under license by Quickwater Marine of Australia, under the brand name quickKutter™. The website is <http://www.quickwater.com.au/>