Fisheries Research 177 (2016) 124–127

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Short communication

Line cutter for use when releasing large marine organisms caught on longline gear

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ARTICLE INFO

Article history:
Received 29 September 2015
Received in revised form 14 January 2016
Accepted 19 January 2016
Available online 2 February 2016

Keywords:
Bycatch
Gangion
Line cutter
Monofilament
Prohibited species

ABSTRACT

Releasing large marine organisms captured on longline gear can often be difficult due to problems associated with the use of conventional line cutters. For example, struggling animals can remain below the water's surface for extended periods, thus providing limited access to the end of the leader nearest the hook. We describe a new line cutter design that outperforms conventional designs. The line cutter described herein can be deployed by a single individual and severs leader material in close proximity to the location of hooks while negating the need to bring the captured organism to the surface. The use of the line cutter reduces stress and potential injury to captured animals, is easily and inexpensively constructed, and has applications beyond its intended use, such as freeing lines snagged or entangled under vessels.

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1. Introduction

Bycatch of large marine organisms has received significant attention in recent years and mitigating, or at least minimizing, deleterious impacts of unwanted interactions remains an objective of responsible and conservation minded management practices (Lewison et al., 2004). In some cases, restrictions in fishing effort and changes in gear configurations have helped alleviate bycatch rates; however, bycatch remains a significant issue, particularly for passive gears (Hall, 1996). Many gear types, such as longlines, can have unintended interactions, such as entanglements, or capture organisms that management measures require not be landed (e.g., Garrison, 2007). For example, the United States National Marine Fisheries Service currently lists 21 shark species as commercially prohibited and requires immediate release of all captured individuals without removal from the water (NOAA, 2014). Regardless of the species captured, large organisms are generally highly vagile and powerful. Furthermore, they are frequently physically resistant when they approach or are brought to the water's surface, particularly when distressed. As a result, access to the hooking location on the animal can be completely inaccessible and the only solution is to release the organism by cutting the leader material. Such release practices can result in excess leader material trailing from the organism, which can have further negative effects on the health of the released organism, such as entanglement, abrasions and lacerations (e.g., Gilman et al., 2006), which can lead to an unintended and unaccounted source of mortality within a fishery. Herein, we describe the design, construction, use and performance of an inexpensive line cutter that can reliably be utilized to sever leader material in close proximity to the location of hooking without requiring an organism be brought to the surface.

2. Materials and methods

The design of the line cutter is such that it can be easily secured to a line (monofilament, polypropylene, etc.) and once released, gravity causes the line cutter to travel down the line until stopped by physical contact with the hooked/entangled organism or at a desired point determined by the person deploying the line cutter (handler). The line cutter (Fig. 1) described below costs approximately $250 US dollars in materials and takes a skilled craftsman approximately eight hours to construct. Additionally, the line cutter is maintenance free with the exception of occasional blade and elastic band replacement. The dimensions described below are for a single line cutter; however, dimensions can be easily modified to meet individual needs.

The main body of the line cutter is composed of a hollow 308 stainless steel cylinder into which a line guide is cut (Figs. 1–3). The cylinder (Figs. 1–3; C) is constructed by cutting 2 cm off both ends of an approximately 14 cm section of pipe, with an outer diameter of 6 cm and an inner diameter of 4.2 cm. Both end caps are then modified by cutting a 1 cm vertical section out of the length of the

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http://dx.doi.org/10.1016/j.fishres.2016.01.018
0165-7836/Published by Elsevier B.V.

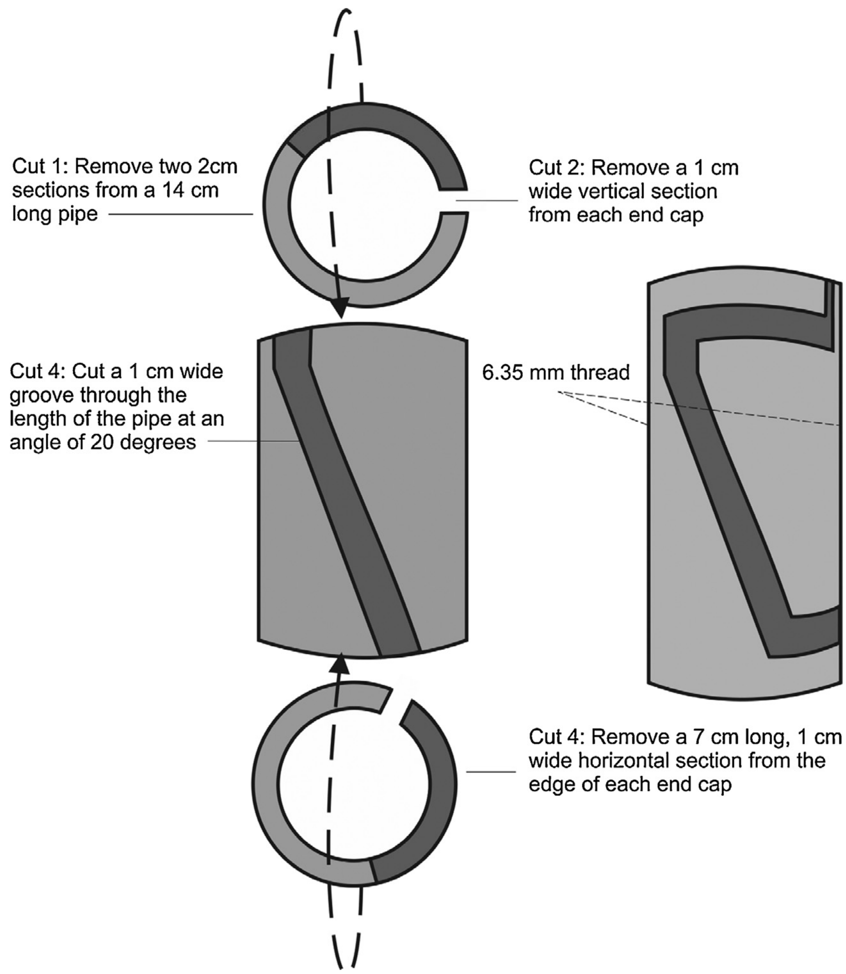

Fig. 1. Construction of cylinder. Areas in dark gray indicate where to remove steel to create line guide.

pipe and then a 7 cm long, 1 cm wide horizontal section around the edge of the pipe, leaving a 1 cm rim of steel along the 7 cm section (Fig. 1). A 1 cm wide groove is then cut at an angle of approximately 20° along the length of the 10 cm pipe (Figs. 1 and 2). Each end cap is then tungsten inert gas (TIG) welded onto the 10 cm section of pipe such that the 1 cm vertical cuts in each end cap is positioned as indicated in Fig. 1 and form a continuous groove, hereafter referred to as the line guide (Figs. 1–3; G). Rough edges are then sanded. A steel ring is then welded 1.5 cm from the bottom of the back side of the cylinder (Fig. 3). This ring will serve as the elastic retainer (Fig. 3; ER) once line cutter assembly is complete. A tap is then used to create 6.35 mm threads on each side of the pipe at 90° and 270°, 4.5 cm from the top to facilitate attachment of the lever (described below) (Figs. 1–3).

The lever (Figs. 2 and 3; L) is constructed of three pieces of 308 stainless steel bar that is 2 cm wide and 2 mm thick. The upper cutting arm of the lever is 16 cm long and right angles are made at 4.5 and 11.5 cm along its length. Two blade mounting holes are drilled into the top of the cutting arm in locations indicated in Fig. 2. The lever handle is constructed of two sections of steel bar that are 15 cm each. Each side of the lever handle is bent at approximately 45° angles at 5 cm from the front edge and then tapered at approximately 8.5 cm so when the left and right sections are joined they form a “wishbone” shape as shown in Fig. 2. After TIG welding the two lever handle sections together, two 7 mm diameter holes are drilled on the midline of the rear of the lever handle at approximately 1 cm (tether eye) and 3 cm (elastic eye) from the rear edge (Fig. 3). Additionally, a 7 mm hole is drilled on the midline, 1 cm from the front of the lever handle on the left and right sections (Fig. 3). These holes will later facilitate mounting of the lever assembly to the cylinder. After construction of the upper cutting arm and the lever handle, the two sections are joined with TIG welds (Figs. 2 and 3). Additionally, the cutting blade (Figs. 2 and 3; B) should be mounted prior to final assembly of the line cutter. There are a number of blade options, however, due to the durability of stainless steel blades, we modified serrated electric fillet knife blades for attachment to the line cutter. This modification was made by removing a 6 cm section of the knife blade with a band saw and then drilling two holes that line up with those on the line cutter cutting arm. The modified blade is then fastened to the cutting arm with two stainless steel mounting screws (Fig. 2; BSS) and nylon locking nuts (Figs. 2 and 3; BSN).

The assembled lever is attached to the cylinder using two 6.35 mm threaded cylinder mounting screws (Figs. 2 and 3; CMS) so that the lever handle is lined up with the center of the back of the cylinder once the lever and cylinder are connected. An elastic band is then attached to the elastic eye (Fig. 3; EE) and elastic retainer (Fig. 3; ER) so that the lever is firmly held in place as indicated in Fig. 3. The tension on the band can be adjusted by both the length and diameter of elastic selected. We find that a 3 mm diameter bungee cord works well, is inexpensive, readily available and can be fastened to the line cutter with basic knots. Finally, a tether is connected to the tether eye (Fig. 3; TE). The length of the tether should be sufficient that once the line cutter is at the maximum depth it will be utilized there will be ample tether so that it can be secured to a cleat, rail, etc. For ease of handling, storage