
# MOORING SNAP-BACK ZONES/AREAS

## How they have changed over the years and what are the latest developments.

Panagiotis Stefanou

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# Abbreviations

| | | |
|---|---|---|
| COSWP | - | Code Of Safe Working Practices For Merchant Seafarers |
| HMPE | - | High Modulus Polyethylene |
| IMO | - | International Maritime Organization |
| ISM code | - | International Safety Management code |
| MCA | - | Maritime and Coastguard Agency |
| OCIMF | - | Oil Companies International Marine Forum |
| P & I Club | - | Protection & Indemnity (insurance) Club |
| PPE | - | Personal Protective Equipment |
| SBA rope | - | Snap-Back Arrestor rope |
| SMS | - | Safety Management System |
| SOLAS | - | International Convention for the Safety Of Life At Sea |

# Introduction

Mooring is considered by all shipping stakeholders and especially seafarers a risky operation (perhaps the most dangerous on board a vessel) and this becomes obvious when we consider the following statistics.

According to the UK P&I Club, accidents during mooring operations 'are the seventh most frequent cause of personal injuries' (2009, p. 1). They also state that the impairments concerning ropes that parted whilst handling them account for more than half (53%) of the total mooring accidents (op. cit.).

Add to that the fact that 14% (1 out of 7) of these accidents end up in the death of the seafarer it is easy to realise the severity and significance of the issue (op. cit.).

The scope of this article is to elaborate on the snap-back zones and how these have been and are being implemented. The measures to minimise the risks and the common practices employed are also going to be examined.

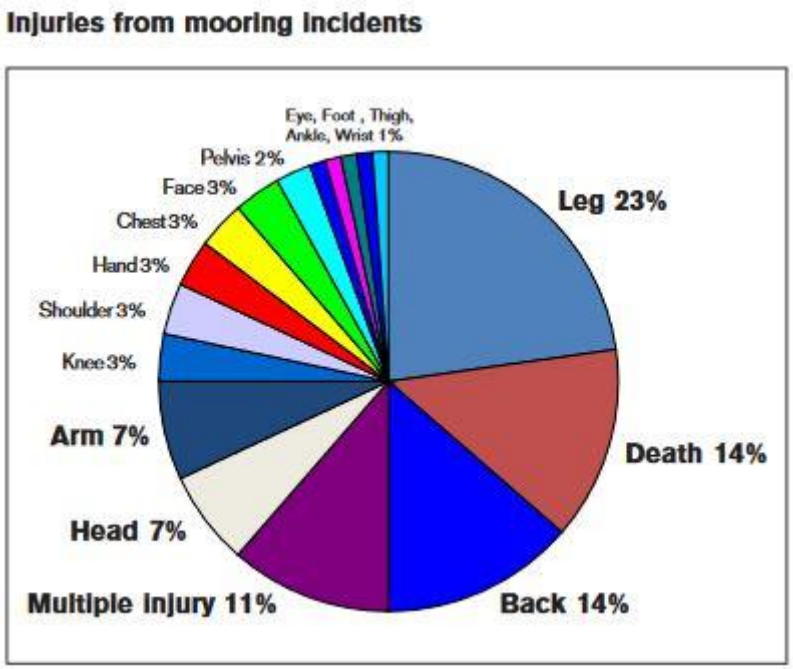


**Diagram 2:** Mooring incidents statistics (UK P&I Club, 2009, p.1).

## What is snap-back and why do we need zones for this?

OCIMF in Mooring Equipment Guidelines refers to snap-back as 'the tendency of the broken ends of a tensioned line' to be reeled in very quickly after a line parts (2018, p 104). This happens when a line stretches and therefore amasses energy. When the line breaks this energy is released and creates what is called snap-back.

Any line can experience snap-back. The risk of a possible snap-back increases with line stretch. Different synthetic lines stretch at different rates (OCIMF, 2019).

Polyamide (nylon) rope is the most flexible type of synthetic mooring line and can withstand the greatest amount of stretching before breaking. Although ropes made of polypropylene and polyester can also extend greatly, their maximum stretching capacity is typically 'only two thirds that of polyamide' (West of England P&I, 2023).

In any case, the maximum degree of a rope's elongation will usually occur when it is brand-new (op. cit.).

The snap-back effect of a mooring rope breaking (synthetic) can be very powerful and the recoiling speed of the rope edges 'can move up to 800km/h' (Caradec, 2022).

On the other hand, the speed that a wire parts under tension is less forceful at up to 500 km/h (300 mph), but still high enough to be dangerous (West of England P&I, 2023).

HMPE ropes are somewhat more elastic than wire, as can be seen in **diagram 3**, so they do also produce snap-back properties, despite different views (Caradec, 2022), albeit less than those of the other aforementioned synthetic ropes.

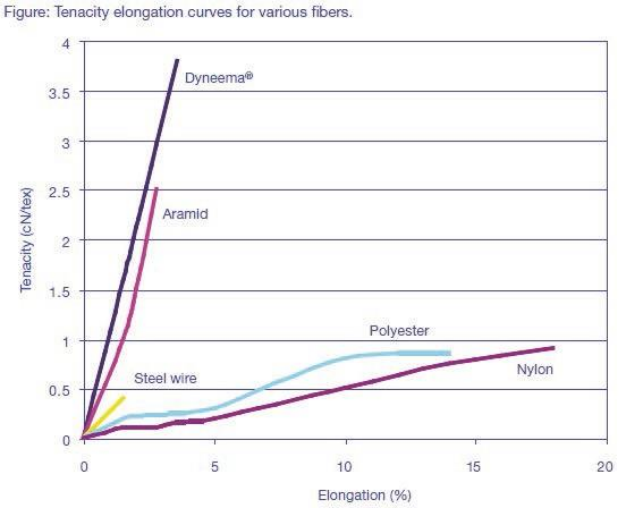


**Diagram 3:** HMPE elongation comparison – Dyneema® and Aramid are HMPE type ropes (MAIB, 2017).

## What are snap-back zones?

'Snap back zones are areas of the deck where the crew are at risk of being struck by one of the broken ends after a line has parted'. A snap-back zone should encompass every potential location in which a broken line end could traverse as it recoils from the point of failure (Clark, 2009).

## Common practices of the past (before 2015)

The common practice in the past can be seen below:

To begin with, in order to make identification of risk areas easier, it is highly advised that a 'bird's eye view of the mooring deck' layout should be created. **Diagrams 4 and 5** depict mooring decks with snap-back zones painted (MCA, 2010, p.364).

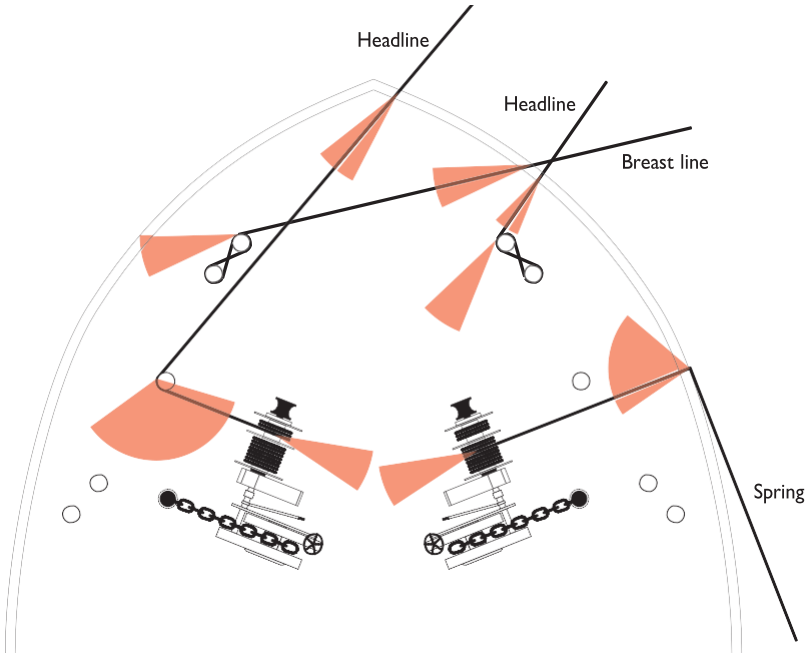


**Diagram 4:** A mooring deck arrangement illustrating potential snap-back zone areas (MCA, 2010, p.372).

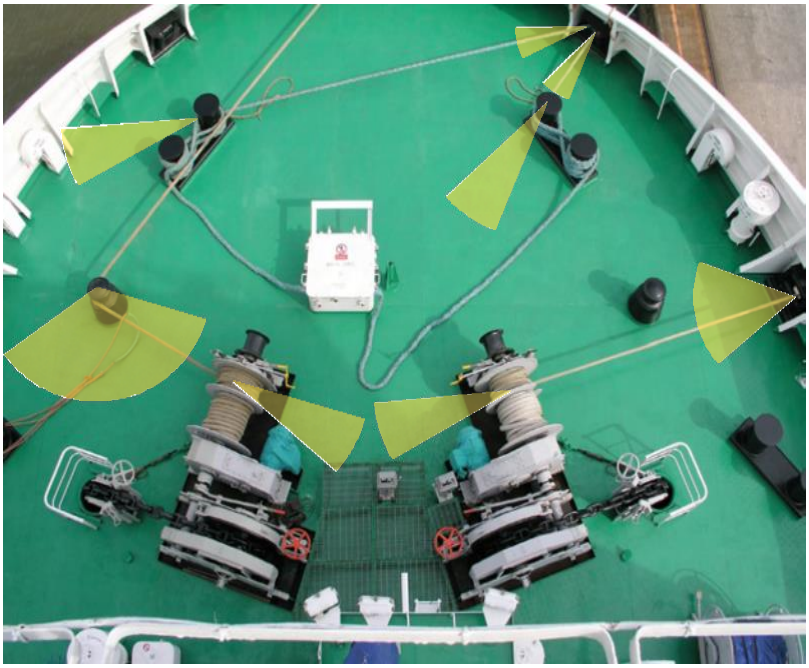

**Diagram 5:** A picture of an actual mooring deck arrangement illustrating potential snap-back zone areas (MCA, 2010, p.373).

What is more, the painting of such kind of zone used to be defined by the following parameters:

‘1) The “snap back distance”

2) The “spread angle θ”’ as reported by Clark (2009, pp. 159-160).

For Clark this distance is called ‘d’ and ‘x’ and is calculated as a percentage of how much the rope can recoil back from the place of failure, where ‘d’ is the initial distance of an object from the point of failure and ‘x’ is the potential distance the same rope can snap-back.

Positive numbers (up to 200% where d=x) mean that the snap-back will reach as far as the point of restraint and negative (i.e. 100%) mean that the rope will not reach this point.

The angle ‘θ’ in degrees shows the amount by which a broken line can deviate from its original path and it is dependent on the rope's elasticity and design. The maximum angle that Clark estimates is about 20°.

Taking into account that lines can also be bended and broken at places such as the pedestal lead then instead of only d, x we have d1, x1 and d2, x2 as the rope’s ends may recoil in more than one direction as can be seen in **diagram 6.**

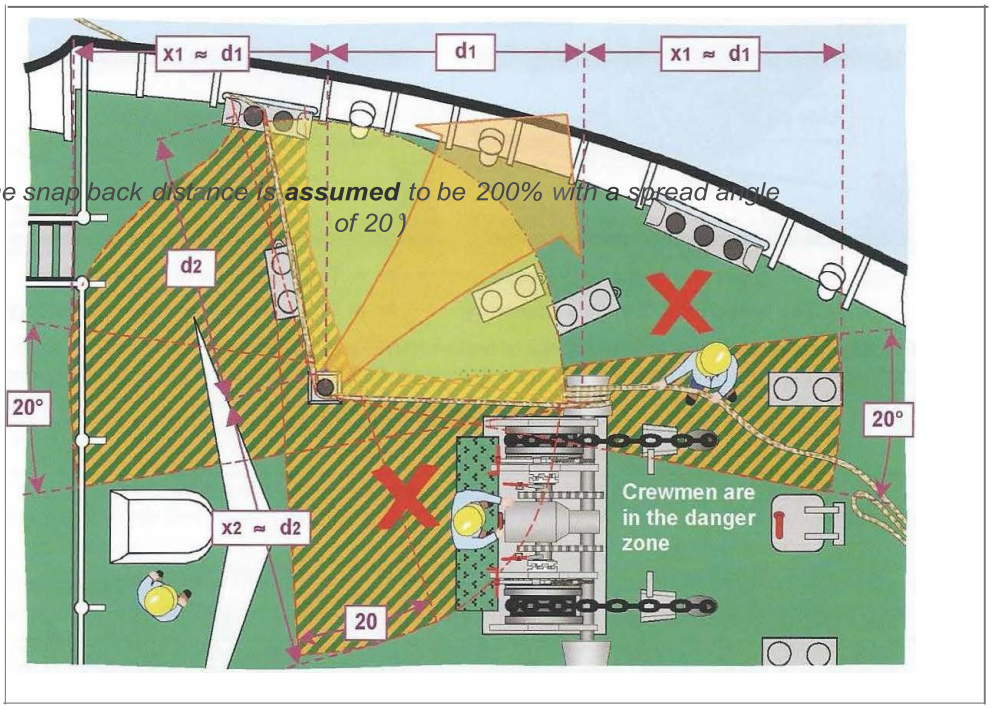


**Diagram 6:** The areas of risk of being hit by a mooring line if it breaks and the pedestal lead fails. Snap back distances d1, x1(200%) - d2, x2 (200%) and the angle θ 20° are clearly visible (Clark, 2009, p163).

This method is not completely accurate and therefore considered unsafe, since the actual path of a line breaking cannot be predicted. It also is heavily oriented towards what is happening on the mooring deck (ship-wise) and on the crew working there but does not take into account what is happening on the outside of the vessel, be it a tug or the shore. This is the case with what happened on the Norwegian Jade in 2013 (ΕΛΥΔΝΑ, 2016).

## Common practices of today (after 2015)

After more and more incidents continued to happen, such as the aforementioned and this one from the OCIMF report (2015), OCIMF and MCA changed their original perspective on how a snap-back zone is defined.

As observed in COSWP and paragraph 26.3.2 MCA (2022, p.408) states that 'the entire area should be considered dangerous in the event of snap-back'.

And continues on to paragraph 26.3.3 where it is reported that 'the painting of snap-back zones on mooring decks should be avoided because they may give a false sense of security' (op. cit.).

At the same time, OCIMF states that 'permanently marking snap-back danger zones on the deck is not recommended' (2018, p.105). It is impossible to precisely determine the entire range of snap-back risk zones required to guarantee worker safety (op. cit.).

In addition, OCIMF in "*Effective Mooring*" (2019, p.28) warns that marking snap-back hazard zones could present crew members with 'a false sense of security'. Thus, 'the entire mooring deck' should be regarded as a 'high-risk' snap-back zone.

Furthermore, for ships that are not tankers or gas carriers RightShip (2023, p.153) in their questionnaire pose the following question 10.13: 'Is the whole mooring deck area marked with clearly visible signage and considered a danger?'

This is in par with Ritchie G. (2017, p.127) who states that 'the risk of snap-back is complex' and therefore, 'the entire mooring area ought to be viewed as a possible snap-back zone'.

Finally, IMO (2020a, p.6) in paragraph 5.1.10 mentions that 'mooring areas should be considered as potential snap-back zones' and that there should be proper signs indicating that.

It is obvious from all of the above that there has been a significant shift on how the snap-back zones/areas are being perceived. From the painting of possible trajectories of ropes recoiling (**zones**) in which parts that are still in harm's way were left outside and thus leading to a false sense of security, to the designation of the whole mooring space (**area**) as hazardous and as a result the heightening of the risk awareness of all involved.

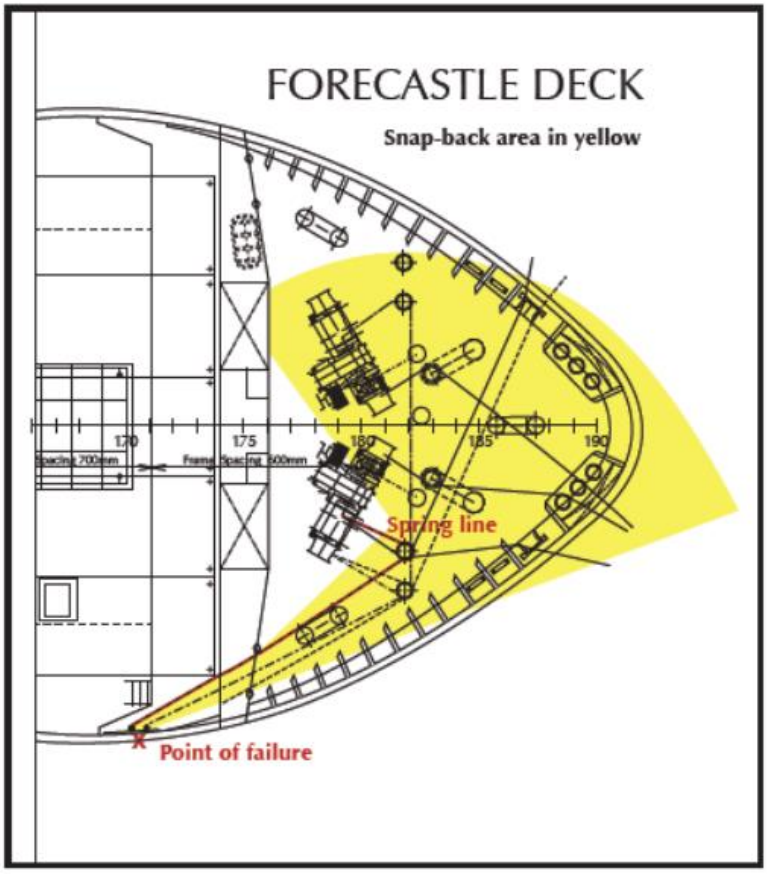


**Diagram 7:** The possible snap-back effect of a rope breaking especially when on a fairlead. The whole mooring area is considered hazardous (MCA, 2022, p.418).

## The future of mooring operations and snap-back in particular.

To start with, new rules are coming into force from the 1st of January 2024. Mooring rules and regulations are being revised, in an attempt to lower incident numbers. These rules are in fact Amendments to SOLAS regulation II-1/3-8 where they introduce new guidelines for safe mooring for all ships (Li, 2020).

These amendments establish suitable and secure mooring arrangement designs, implement a maintenance and inspection schedule, and provide the necessary paperwork. Additional guidelines are also approved, which address shipboard towing and mooring equipment design, the selection of suitable mooring equipment and fittings for safe mooring, inspection and maintenance of mooring equipment, including lines (IMO, 2023).

Additionally, new technologies concerning the ropes themselves are constantly being developed. Two significant outcomes are the SBA rope and the 'smart' ropes.

The SBA core rope is placed in the centre of the main rope in a way that allows full utilization of its elongation. The SBA does not carry any load during normal line operation. If the rope breaks, 'it will absorb part of the energy released thanks to its higher elongation' (Caradec, 2022).

The arrestor also 'guides the broken strand(s) along the current axis of the rope, resulting in a significant reduction of snap-back' (op. cit.).

The SBA will begin to support the load and extend before breaking itself if the load is continued after the rope strands break. It can't support heavy loads, so when it breaks, it will release a lot less energy (op. cit.).

**Diagram 8**: An SBA rope (Wilhelmsen, 2023).

Smart ropes are still in development. These will be equipped with sensors that can send real time information and data about the condition and status of the rope. Crew and shore/tug personnel will be able to monitor at all times the loads on each rope and the possible wear and tear and thus proactively dissipate any potentially hazardous event from happening.

However, even with smart technology and capabilities, ropes will still require upkeep and inspection. According to Li (2020), this 'will require new regimes for the maintenance and management of high-tech ropes, based on knowledge gained in testing and trials'.

## Conclusion

The shipping industry and all of the stakeholders have come a long way to either proactively or retroactively try to reduce the number of mooring accidents/incidents. The promotion of a safety culture is of the utmost importance throughout all those involved and that human life is extremely valuable (together with the environment, animals etc.) and care must be taken to protect it.

The designation of the complete mooring area as a snap-back hazard zone is one of the features set into place in order to alleviate the risks that are interwoven with mooring operations.

More steps need to be taken and although this shift of our views towards the snap-back zones/areas do depict dangers more accurately, still, based on my experience mooring operations will always be a place of high risk. Professionalism, constant training, collaboration and good communication are the best ways to ensure that everyone involved stays intact.

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ΕΛΛΗΝΙΚΗ ΥΠΗΡΕΣΙΑ ΔΙΕΡΕΥΝΗΣΗΣ ΝΑΥΤΙΚΩΝ ΑΤΥΧΗΜΑΤΩΝ ΚΑΙ ΣΥΜΒΑΝΤΩΝ (ΕΛΥΔΝΑ), 2016. *ΕΚΘΕΣΗ ΔΙΕΡΕΥΝΗΣΗΣ ΝΑΥΤΙΚΟΥ ΑΤΥΧΗΜΑΤΟΣ - ΘΑΝΑΤΟΣ ΝΑΥΤΙΚΟΥ ΜΕΤΑ ΑΠΟ ΘΡΑΥΣΗ ΣΧΟΙΝΙΟΥ ΠΡΟΣΔΕΣΗΣ ΣΤΟ Κ/Ζ «NORWEGIAN JADE»,* Pireaus, Greece: ΕΛΥΔΝΑ.

# Appendix:

## Measures to mitigate the danger

Some general guidelines and a list of procedures and rules set by the industry in order to diminish incidents/accidents from happening as much as possible follows. This list is not exhaustive.

To lessen the loss of line strength due to bending, such as around a pedestal roller, it is advised that the lines are deployed using direct leads. Crew should stay away from any fairlead that a line is tensioned around (OCIMF, 2018, p 105).

If any part of the mooring arrangement seems to be under excessive strain, then care should be taken as quickly as possible in order to dissipate the load. Measures must be set into place to ensure that ropes or wires won't jam under pressure and can be swiftly slackened off if needed. Crew must pay particular attention to the bight of the rope when it is being taut (Witherby Seamanship International, 2015, p.870).

List of Industry Standards

Thorough and complete ISM/SMS plan
Line Management Plan (LMP)
Mooring System Management Plan (MSMP)
PPE
Proper Familiarisation
Constant Training
Toolbox meetings
Risk assessments
Risk awareness
Maintenance (brake hold tests, ropes, machinery etc.)
Rope/Wire certificates
Signs/Posters
Effective Communication
Guidance from Organisations (OCIMF, ILO, IMO, MCA, MLA etc.)
Guidance from Class/Flag Administration
and more