Storytelling to Learn:
What happens underwater, stays underwater.

Gareth Lock MSc | LUND UNIVERSITY

Storytelling to Learn:

What happens underwater, stays underwater.

Thesis work submitted in partial fulfilment of the requirements for the MSc in Human Factors and System Safety

Gareth Lock MSc

Under supervision of Dr Anthony Smoker

Lund 2024

Storytelling to Learn:
What happens underwater stays underwater.

Gareth Lock MSc

Number of pages: 140
Illustrations: 14

Keywords

Storytelling, diving, incident analysis, just culture, fear, diving,

Riskhantering och samhällssäkerhet
Lunds tekniska högskola
Lunds universitet
Box 118
221 00 Lund

http://www.risk.lth.se

Telefon: 046 - 222 73 60

Division of Risk Management and Societal Safety
Faculty of Engineering
Lund University
P.O. Box 118
SE-221 00 Lund
Sweden

http://www.risk.lth.se

Telephone: +46 46 222 73 60

Abstract

This research uniquely addresses the underexplored area of storytelling as a medium for learning and safety in sports diving, a high-risk discretionary activity. It achieves this by utilising a comprehensive mixed-method approach, that incorporates online surveys, focus groups, and interviews to gather perspectives from a wide range of stakeholders in the diving community. The informants were diverse, both geographically and in experience and qualification, and covering recreational and professional divers, instructors, and legal experts.

The purpose of the research was to identify the factors that influence the telling of context-rich stories following an adverse event in diving. The research uncovers significant gaps in the existing formal and informal incident reporting systems in diving, primarily marked by a very strong tendency towards attributing individual blame, thereby neglecting systemic factors. The research identifies key barriers to sharing experiences and stories in the diving world, such as cultural norms, fear of litigation, and the absence of effective communication platforms (technical and social). These challenges result in varied perceptions of risk and safety across different diving groups, and consequently, how to manage them.

Numerous learning opportunities are hidden from the diving community because of the socio-technical barriers present; barriers which have been recognised in other domains and where work has been done to dismantle them using the principles and tools from the sciences of human factors and system safety. The application of these tools and principles in domains such as aviation and healthcare have enabled the telling and sharing of context-rich stories surrounding both adverse events and positive outcomes, thereby leading to increased organisational and individual learning and safety. Given that safety is an emergent property of the system, these findings advocate for a similar integration of human factors and system safety principles into the

sports diving domain, cognisant that the sport is, in the main, unregulated and is discretionary in nature. The thesis proposes a shift from a blame-focused culture to a learning-oriented culture, emphasising the necessity of creating a safe environment for divers to share their stories through the development of a Just Culture. This shift is crucial for enhancing safety practices through shared learning. Those responsible for the shift are leaders within the industry – not just those in organisational leadership positions, but also those who are role models in the 'fun' diving and exploration space.

The research contributes substantially to the domain of diving safety by promoting a systemic approach to safety in SCUBA diving, recognising the interdependence of organisational and cultural factors, and the critical factors associated with the telling and sharing of a context-rich story. It emphasises the potential of storytelling as a key tool for learning and safety improvement, advocating for a cultural and organisational change towards openness, learning, and resilience in not just diving, but also other high-risk leisure activities.

Acknowledgements

Over the last 13 years since I have been involved in bringing human factors to the sports diving sector, I have made personal contact with thousands of divers, many of them sharing their stories, sometimes for the first time. We have all learned during those conversations, and often a lightbulb would come on with those divers, as they recognise that it was not just them being 'silly', 'stupid' or 'reckless' during the dive or surface activity. Rather, it was them being human, doing what made sense to them at the time, managing risk and uncertainty in the amazing underwater world. This is the power of storytelling.

Your lightbulb moments are what have kept me motivated over the years and led me to complete this thesis. Thank you.

On a more personal note, thank you to those diving instructors, academics, diving colleagues, and friends who have given me specific feedback and words of encouragement during the dark times of 'doing battle' with the diving industry to bring this topic to the fore.

Relating to the journey at Lund, thank you to the faculty for providing a novel and enlightening experience, especially Smokes for being the walking encyclopaedia and reference library that you are and to JB for making this MSc a world-leading capability.

Thanks to the cohort and alumni for sharing their ideas, frustrations, and encouragement over the last two years. As we know, knowledge is best shared.

Finally, Kate and Alexander, thank you for supporting me as I continue my quest. You are both amazing! This quote below still holds true and continues to be a guiding star, thank you Kate.

"They didn't know it was impossible…so they did it…" – Mark Twain

Executive Summary

This thesis is an in-depth exploration of storytelling as a tool for learning and safety in sports diving, a high-risk leisure activity. The thesis uses a mixed-method approach, that combined online surveys, focus groups, and interviews to gather insights from a diverse range of stakeholders in the diving community, including recreational and professional divers, instructors, and legal experts. The approach ensured diverse perspectives were captured, providing a nuanced understanding of the factors influencing storytelling in diving.

The primary objective of the research is to identify the factors influencing the sharing of context-rich stories following adverse events in diving with the goal of improving learning. The study reveals significant gaps in existing formal and informal incident reporting systems within the diving community. These gaps are primarily characterised by a tendency to blame individuals rather than considering wider systemic or performance shaping factors. Key barriers to sharing experiences and stories include cultural norms, fear of litigation, and the lack of effective communication platforms. These challenges lead to varying perceptions of risk and safety management across different diving groups.

It is argued that there is a need to integrate human factors and system safety principles into the sports diving domain, thereby leading to a transition from a blame-focused culture to a learning-oriented one. This shift, emphasising the creation of a safe environment for sharing stories, is crucial for enhancing safety practices through shared learning. The research highlights storytelling as a potent tool for learning and improving safety, advocating for cultural and organisational changes towards openness, learning, and resilience. This research is not just applicable to diving, but also other high-risk leisure activities.

The thesis includes several specific examples and detailed analyses, such as the case of an 18-year-old diver's fatal accident due to equipment and training failures, highlighting systemic

weaknesses in the training and quality management of diving instructors and centres. Additionally, the thesis examines the lack of effective incident reporting and learning opportunities in the diving industry, comparing it to other high-risk sectors like military aviation, where comprehensive debriefs and learning from incidents are standard practices. The thesis also recognises that despite diving taking place in an austere environment, it is a recreational activity that is discretional in nature, and that those in organisational leadership roles often do this as a part-time activity. Therefore, the ability to transplant tools, techniques, and processes from more regulated environments will not be possible, and domain-specific interventions will need to be developed.

To conclude, the thesis underscores the importance of storytelling as a critical tool for learning and safety improvement in high-risk activities. It highlights that if individual and organisational learning are to be afforded a priority, there is a need for a systemic approach to safety, which considers the interplay of organisational, cultural, and individual factors in incident reporting and learning processes.

Contents

List of Figures

List of Tables

Glossary

BCD – Buoyancy Compensation Device

CCR – Closed Circuit Rebreather

CoP – Community of Practice

GUE – Global Underwater Explorers

IANTD – International Association of Nitrox and Trimix Divers

NAUI – National Association of Underwater Instructors

OC – Open Circuit

RAID – Rebreather Association of International Divers

SDI/TDI – SCUBA Diving International / Technical Diving International

"In the long run, curiosity-driven research just works better... Real breakthroughs come from people focusing on what they're excited about."

Geoffrey Hinton

In 2020, an 18-year-old female diver, Linnea Mills, was undertaking a drysuit diving course in Glacier National Park, USA. Drysuit diving requires additional training and correctly configured equipment. Linnea entered the water overweighted, so much so that her buoyancy compensation device (BCD) did not have enough lift to allow her to ascend when gas was injected into the device. Even though she had a drysuit to deal with the cold, and this would provide additional buoyancy if needed, the low-pressure feed was not connected to the drysuit due to incompatibility of hose fittings. This meant she had no positive buoyancy, descended uncontrollably to 40m and subsequently drowned in a location that was not suitable for this training dive. The investigation highlighted numerous technical, standards-based, and cognitive issues. It also highlighted systemic weaknesses in the system and the training and quality management of the instructor and the dive centre. Court filings show how the organisations charged with managing quality failed in their duty at multiple levels (Mills v Gull Dive Center PADI, 2022). The case was settled out of court for an unknown amount.

Diving takes place in an inherently hazardous environment, it also happens in a primarily unregulated environment, where training is delivered in a compliance-focused manner. Technical, social, and cultural issues need to be considered to remain 'safe'. Consequently, there is a huge amount of responsibility on those in positions of authority and knowledge to ensure that those undertaking the sport are informed of the austere and hazardous environment in which the activity takes place. Those in leadership and supervisory positions manage the risks on behalf of those who are (technically) incompetent, and more importantly, those who unaware of their incompetence (Kruger & Dunning, 1999). The diving industry talks about risk management but given the lack of reliable data, stakeholders are more likely to be dealing with uncertainty than risk (Gigerenzer, 2014). Gigerenzer's work shows that while risk can be managed using

quantitative data, uncertainty is managed using emotions, heuristics, and biases such as recall, recency, severity, outcome, fundamental attribution, and hindsight. This perception and meaning of 'risk' will be part of the research.

From the distant to the personal: in 2006 I was diving off the coast of San Diego and had a near-miss when my BCD failed as the inflator hose was disconnected, and I sank to 30m. I was inexperienced and, in hindsight, should not have been on that dive. I did not know what I did not know. With a bit of trial and error, I managed to resolve the technical issue and ascend safely to the surface. When I returned to the UK, I tried to find a way to share the story so that others could learn from this event - the norm given my profession as a military aviator. I was surprised to find there was not an easy way to share this story. Over the next few years, I worked with the owner of a UK-based online diving forum to create an area where context-rich stories could be shared, and I would moderate the conversations and responses. The rules were simple: focus on the actions and behaviours, not the individuals, and look to understand their decision-making process, a term I now know as 'local rationality'. As the moderator, this was not easy because the shared trust could be destroyed very quickly and would take time to recreate; if it was possible to recreate at all.

In 2011, I wrote a white paper which looked to apply the Human Factors and Analysis Classification System (HFACS) (Shappell, 2000) to diving incidents (Lock, 2011). It took 'best practice' (as it was then) from aviation and applied it to the diving domain. The white paper was critical of practises that took place, and this caused conflict between myself and a couple of the training agencies, with senior staff not talking to me after I delivered the paper at a UK-based dive safety group. In 2012, I started a self-funded Ph.D at Cranfield University but I withdrew in 2018 for a number of reasons: lack of support from the university, lack of support from the industry to provide data, and personal validation from the crew resource management (CRM)/non-technical skills (NTS) training I was delivering to the diving community which

started in January 2016. Since then, more than 500 divers have been trained face-to-face and more than 2000 online through the programmes I have developed and delivered. Unfortunately, none of the diver training agencies has formally incorporated human factors (HF), NTS, and learning from unintended outcomes into their training programmes despite evidence to show its value (Fletcher, 2011; O'Connor, 2007; Tetlow & Jenkins, 2005).

Within any adaptive system, the speed of improvement is based on the quality of feedback (Meadows, 2009; Weick & Quinn, 1999) and stories can provide an effective gateway for this feedback loop to be effective. The sports diving industry will be shown to have limited opportunities for quality feedback - opportunities that are limited for both social and technical reasons. The first steps in identifying a need for change are based on the recognition that there are stories out there which could improve individual and organisational learning, but there are barriers that are preventing the sharing of such stories. Therefore, this research will go some way to identifying the factors that influence the sharing of stories. 'Sharing' has purposely been chosen because initial trial data indicated that the term 'incident reporting' can have multiple, ambiguous meanings.

How to read this thesis

The thesis starts with a literature review, covering the broader topic concerning storytelling and learning from incidents, before moving to previously published literature within the sports diving domain around the topic of safety and incident reporting. The research design section then explains how the mixed-methods research covering an online survey, focus groups, and interviews was put together and how the data was collected. The results and findings sections provide an insight into a subset of the responses along with a coherent summary of the findings from the different datasets. The discussion section then looks at what these findings mean in the context of the existing literature, highlighting how this applies to sports diving and wider, and

what opportunities exist for change in the diving domain. Finally, the conclusion provides a simple, coherent summary of the thesis, together with areas for future research.

"The answers you get from literature depend on the questions you pose." - Margaret Atwood

Literature Review

Broader Topic and Relevance

This research focuses on a high-risk niche leisure activity - SCUBA diving. Given the variability of human performance, incidents, accidents, and near-misses are always present but formal incident reporting is limited to a few organisations who collect, analyse, collate, and disseminate stories and reports, including but not limited to, Divers Alert Network (DAN) (USA), the British Sub-Aqua Club (BSAC) (UK) and NOB/DOSA (NL). Learning from incidents and accidents provides an opportunity for improvement in many activities, especially those involving serious consequences, but it is not clear why such opportunities are limited in the sports diving domain. Maybe because of the resource needed to operate such a system, or maybe because of the lack of the wider organisational structure or oversight surrounding safety in the sports diving sector when compared to gliding, parachuting, or mountaineering, or maybe the focus is on 'fix the errant diver' which means other factors disappear from view. Other informal opportunities to capture, analyse and share incidents exist, such as social media and online forums, but often these are not well informed. The accounts that are told are often incomplete with context missing, and the narratives often focusing on proximal causes. The reason behind the missing data is believed to be one of education, the divers do not know what is important or relevant at multiple levels within this complex system. This assertion is based on two pieces of evidence:

- During conversations the author has had with divers about diving incidents, an iterative exchange has been needed to understand the context and performance shaping factors, with very little consideration given to how the event emerged from 'normal'.
- The online training programmes run by the Human Diver use a video-based case study which the students have to comment on as part of their final assessments and often simple, proximal causes are described.

The author believes the level of knowledge concerning human factors and systems thinking in the sports diving domain is similar to that of the general perception of civil aviation in the 1970s, 'the pilot was last to touch it, so it was their fault the crash happened'. Notwithstanding this, there were some in aviation who recognised the need for change, moving from a technological approach to one that took into account humans and their adaptability, but in general it was easier to blame the pilot when accidents occurred (MacLeod, 2021, pp. 2–5). The watershed moment was the 1975 International Air Transport Association (IATA) Technical Conference when the Secretary General stated:

> "Analysis of our accident data clearly indicates that our historic trends towards reducing accident rates can only be resumed if we address and solve the problem of why critical human beings fail to fulfil expectations. These accidents fifteen or twenty years ago would have been superficially dismissed as due to 'pilot error' or 'controller error.' We now know beyond a shadow of doubt that these descriptions of accident causes are at best misleading and at worst irresponsible.
>
> The issues we now call 'human factors… are the critical issues..." (Orlady & Orlady, 2017, p. 53)

The advent of black-boxes and cockpit voice recorders in aviation allowed a story to be told, often from the grave, highlighting the contribution of these 'human factors'. The ability to

tell context-rich stories is critical to learning in high-risk environments (McCleod, 2019). The term 'context-rich' has been chosen for this research as a way of providing a simple explanation to the readers of this thesis and the informants in the research about the difference between a simple, linear, individually-focused story, and one which has sufficient detail to consider the context in which the adverse event or unexpected event has taken place. The definition used for the purposes of this research is:

> "A context-rich story is one which does not simply include the actions and behaviours immediately prior to, or after the incident, but also the social, cultural, technical, and environmental factors which were present and may have been present for many days, weeks, or months prior. These factors make it easier to do the 'wrong' thing and harder to do the 'right' thing. In many cases, deviations and adaptations, which are normal human behaviour, were present as contributory factors."

Developing an understanding or making sense of an (adverse) event through the lens of systems thinking can help create more effective interventions (Goode et al., 2018; Nyce et al., 2022; Pupulidy, 2015b). However, just because incident report data has been collected, it does not mean it is useful to all stakeholders in the same way, as there are potential competing goals in collection, dissemination, and application of the learning opportunities (Gherardi et al., 1998; Sanne, 2008).

There is a potential gap between the stories that organisations hear regarding adverse events and the rules or processes that should have been followed to create 'safety'. The traditional or orthodox view of safety using processes and procedures looks to compliance to assure safety whereas a more modern perspective looks at adaptability and resilience (Dekker, 2014, p. 5). This revised perspective comes from understanding the shades of grey that exist between 'Work as Done', 'Work as Imagined', and 'Work as Disclosed' (Shorrock, 2016). The disclosure of a story can be limited by social conditions, or because the narrator does not know

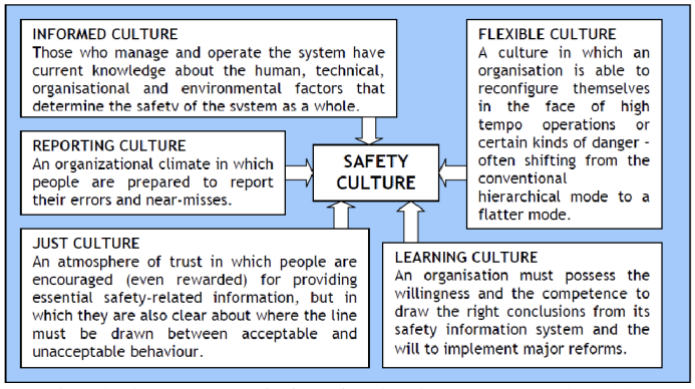
what happened or cannot recall what happened. These shades are more apparent when we consider the perspectives held by different stakeholders and their position within organisations influencing what is acceptable or not (Boskeljon-Horst et al., 2022; Boskeljon-Horst et al., 2023). This difference between 'rules' and 'practice' is something that has been explored by researchers looking at how tacit knowledge is transferred within high-risk teams and how adverse events can be used to develop improved safety and performance via After Action Reviews, debriefs, and Learning Reviews (Klein et al., 1986; Pupulidy, 2015a, 2017; US Forest Service, 2020).

Military aviation has made wide use of post-mission debriefs at an individual or team level, and large-scale learning via exercises like RED FLAG and COPE THUNDER, where the attendees take lessons learned back to their squadrons. Sense-making in these environments develops through the initial sharing of context-rich stories within a small team – the challenge is scaling that knowledge transfer from team to team and team to organisation, a point made by Snowden because knowledge without context is meaningless (Snowden, 2002). Context, especially involving multiple perspectives, has a cost in time and effort to transfer - the less context that is known by the receiver of information, the greater the costs involved in extracting it and transferring it (Patriarca et al., 2022; Snowden, 2002). Consequently, the audience needs must be considered when developing the outputs from incident reporting and learning systems, a key output the Learning Review tool developed by Pupulidy (2017).

Safety Culture, as defined by Reason (2016, p. 195), has five contributory sub-cultures: just culture, reporting culture, informed culture, learning culture, and flexible culture.

Figure 1:

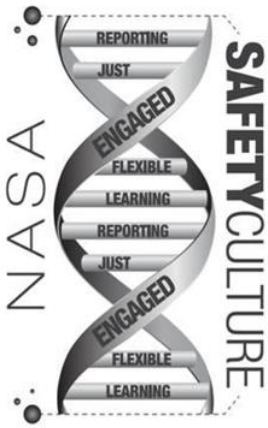
The Components of Safety Culture based on Reason (1997)



One graphical version of Reason's model shows these cultures leading into central box at **Error! Reference source not found.**, but these cultures are interdependent e.g., you cannot have an effective reporting culture without a just culture, and you cannot have learning and informed cultures without data coming in via the reporting systems. An example of this interdependence is NASA's 'Safety Culture DNA' shown in **Error! Reference source not found.** and how they have replaced the term 'informed' with 'engaged'.

Figure 2*:*

NASA Safety Culture Logo (NASA, n.d.)



As a reporting culture contributes to a safety culture, it would appear to be a positive step to improve incident reporting. At the same time, without understanding the factors that influence

what is reported and how it is reported, just saying 'report more' means that the data collection, analysis, and external reporting may not be as effective as they could be. The following questions are relevant to this conundrum - the first informs all the others. Do diving organisations genuinely want to learn from success and failure? Do they know what meaningful learning would look like and what benefits it would provide them? Do organisations provide the social and technical frameworks to enable the reporting system? Do those involved know what should be reported? Do they know how to write (or learn from) a learning-focused report? Does the organisation ask the right questions of the event? Do the final published reports focus on individual factors or wider system issues? (Chan & Li, 2023).

High-risk sports like diving, backcountry skiing & mountaineering, and sports parachuting all have established reporting systems via bodies such as DAN, the American Alpine Club, and the US Parachute Association respectively. However, the quality of the data that is received and how it is analysed often falls short of how incident reporting and analysis systems need to operate in high-risk organisations. These shortfalls include defining and maintaining the goals of the 'learning' system, the availability of personnel resources needed to execute these tasks, the priority afforded to learning across the system, and the framework or conceptual ideas used to understand the system. In the diving domain, the focus is often on the proximal causes rather than wider systemic factors (Denoble et al., 2008; Vann et al., 2012) because of the medical focus of the research organisations like DAN, Underwater and Hyperbaric Medicine Society (UHMS) and the South Pacific Underwater Medicine Society (SPUMS). Moving beyond these proximal causes can identify wider reaching issues, such as quality management, commercial drivers, and the power dynamics that exist within the system. These can be uncomfortable for organisations to consider when compared to focusing on the individual and their 'errant' behaviours.

Incident reporting is regularly seen as something that organisations should improve, often by saying 'report more' and this is replicated in the diving domain, but this simplistic approach is

not much better than telling workers to 'be more careful', 'pay more attention', or 'be better'. We need to understand the systemic causes and influences that support incomplete or ineffective reporting if we are to make improvements and learn more (Waring, 2005). While this research is focused on the sports diving domain, and specifically factors that influence the telling of context-rich stories following an adverse event (and could be captured by an incident reporting system or 'learning product' repository), the research is likely to be applicable in many other sectors, especially those who do not have formal incident reporting programmes, or who are looking to develop them. Two examples of the cross-domain applicability include the Australian Olympic Cycling team who have considered system safety and how 'normal accidents' develop when there are tensions between costs, schedule, and performance (Bryce & Dowling, 2024), and the Wildland Fire Lessons Learned Center in the US where operations take place in an inherently hazardous environment and uncertainty is common.

Learning through storytelling and incident reporting can help individuals and organisations learn, but it is not a simple process. Individuals learn from incidents through participation and reflection, focusing on specific processes like counterfactual thinking and sensemaking, and utilising factors such as open communication, trust, and (incident) learning systems (Drupsteen & Guldenmund, 2014; Murphy et al., 2022). Studies suggest that organisational learning after incidents involves participation and inclusion, learning processes (single and double loop learning), reflection and sensemaking, and focuses on knowledge construction, practice changes, and communication rather than equipment or layout adjustments (Argyris & Schön, 1997; Lukic et al., 2010; Stanton et al., 2017).

Sensemaking goes beyond situation awareness where we sense, process, and project (Endsley, 1995) but rather "comprehending, understanding, explaining, attributing, extrapolating, and predicting." (Starbuck & Milliken, 1988). Furthermore, Jeong and Bowen (2008) state that organisational sensemaking it takes place "in three stages: noticing, interpretation and action…

organizational sensemaking can be understood in its three contexts: the ecological, the institutional, and the social relational." At a simple level, Weick (2005) describes sensemaking as structuring the unknown so we can act upon it.

Dreyfus and Dreyfus (1980) describe the process of individual learning as moving through five different stages of skill acquisition (novice, competence, proficiency, expertise, and mastery) by applying different techniques based around rule following and pattern matching. Notwithstanding the differences in how models of reality were developed, applied, and updated, what was common to them all was the need for accurate and timely feedback so that concepts, rules, and patterns can be updated. Interestingly, as Pupulidy and Vesel describe, organisations want individuals to follow the 'rules' associated with lower levels of skill even though they will be using different cognitive techniques to achieve their goals (2023, p. 30). Dreyfus and Dreyfus (1980) state that more rapid results relating to improvement occurred when the task was presented in a form that related to the activity being undertaken. Therefore, context is important, especially for higher order skills e.g., analysis, synthesis, and evaluation, which go beyond simple techniques like comparison and memorisation. At the 'expert' or 'mastery' level, learning is more about metacognition and sense-making than the acquisition of technical skills and knowing when to use them.

Previous Research in Diving Domain

The initial scope of the literature review was based on four key areas: incident reporting, second-stories, local rationality, and learning. However, without progressing too far into the literature, it was quickly apparent that this would provide too much literature for a MSc thesis, and so the focus narrowed to those topics surrounding the effectiveness and perspectives of reporting systems and how different stakeholders used them, and what factors facilitate effective reporting and learning. Even this narrowed proposal is considered broad, but that is because the

data collected will go beyond the reasonable scope of this thesis as there are many avenues that need deeper exploration.

Previous work by the author identified what was needed if we took a diver on a journey from 'having an incident' to 'learning from the outputs' (Drupsteen et al., 2013; Lock, 2022):

- what should be reported i.e., the social constructions of 'safe' or 'incident' or 'risk',
- where to report,
- what supports/prevents reporting, socially or professionally,
- how does a situation develop leading to an adverse event,
- how to understand the information and make sense/see the context,
- what recommendations did the analysis lead to,
- what feedback was provided to the reporters following their submission(s),
- what outputs or learning products were generated by the system, and finally,
- what was the focus of the output i.e., individual, organisational, or systemic.

The literature directly relating to diving and associated incident reporting is sparse with a significant amount generated in non-peer reviewed outputs by the author since 2011 when they wrote their first white paper on the topic (Lock, 2011). Diving incident data is often presented at conferences ((Vann et al., 2012; Vann & Lang, 2010) and requests are made for improvements in this reporting, however, an approach to 'causality' which addresses system safety has not been adopted by the diving organisations. This is not unsurprising given that the organisations focused on researching diving incidents have their roots in diving and hyperbaric medicine i.e., DAN, UHMS, and SPUMS, and the research tends to take an epidemiological approach (Denoble et al., 2008). Furthermore, the data that is presented often uses a simplistic categorisation of events based on the most severe outcome e.g., decompression sickness or ascent problems (*BSAC:*

Annual Diving Incident Report, n.d.) or equipment issues (Acott, 2003) rather than taking a different approach e.g., a systems perspective like HFACS (Lock, 2011) or AcciMap (Goode et al., 2018; Lock, 2020). Goode et al. (2018) have shown that such an approach is possible in led-outdoor activities. As identified earlier, a system safety approach has been taken by the cycling community and affiliated researchers in Australia (Bryce & Dowling, 2024; Cox et al., 2024)

The focus on counting adverse events in the diving domain echoes that of other domains (Wears, 2008), even though it is recognised that metrics like safety KPIs, including Total Recordable Incident Rates (TRIR), have limited value in determining 'safe' operations or whether there have been improvements over time (Hallowell et al., 2020). KPIs, while countable and therefore appearing useful, add very little when it comes to understanding context, and it is context that allows sense-making to occur. The diving industry has many more confounding issues than a worksite or organisation: the number of divers is not known, the number of dives is not known, the risk exposure period varies considerably based on depth and dive time, the number of non-fatal incidents is not known, and the contributory factors and context are also not known. Consequently, the reasons behind any increase or decrease in outcomes cannot be accurately determined, even if interventions are instituted. It is likely any 'causality' for improved statistics following an 'intervention' is down to confirmation bias rather than a genuine change in the 'safety' of diving.

Learning from adverse events does happen though. One area that has been present for decades is the telling of stories in printed and social media. The BSAC magazine 'DIVE' has a regular section about learning from incidents, the DAN Facebook page has regular summaries from their Diver Incident Reporting System (DIRS), and aquaCORPs, a printed magazine from the 1990s focusing on diving exploration, used to contain accident and near-miss stories. The aquaCORPS stories were, according to those around at the time, well received and this could be because innovation, exploration, and experimentation were prevalent in an immature sport, and

so accidents, incidents, and near-misses were expected as divers pushed limits and used novel technologies like nitrox, trimix, and rebreathers. There is no formal evidence to say that diving safety improved at the time, but anecdotal evidence from conferences and meetings was that they did help reduce accidents and incidents. One document that has survived the test of time from the 1990s, and is still used today during cave diver training and protocol development, is Sheck Exley's 'Blueprint for Survival' which outlines ten rules that should be followed to maximise safety in cave diving (Exley, 1986). These rules are explained through story-telling and are based on the analysis of many hundreds of cave diving incidents and fatal accidents. The Blueprint was published following a high number of cave diving fatalities in 1970s and 1980s, and following the publication, this number dropped. Such a reference guide does not exist in recreational, open water technical, or CCR diver training.

One event that may have impacted the ability to tell context-rich stories is the increase in litigation in the US. The location is relevant because the majority of globally-relevant training agencies e.g., PADI, SSI, SDI/TDI, NAUI and IANTD, are headquartered there. The number of lawyers in the US is growing between 6-8% per year (ABA, n.d.) with insurance claims at an all-time high with two major underwriters pulling out of the diving sector over the last 7 years due to major financial losses following lawsuits (personal communications, Peter Meyer, Owl Underwriting, Oct 2022). Presentations by lawyers to instructors within agencies and at tradeshows, and an online workshop titled Risk Management for Diving Professionals (Clarke, 2023) heavily emphasise the need for paperwork compliance as the first line of defence, and then after an event has occurred, the first person to call after emergency services have been summoned is the agency's attorney. It appears that Europe, the Middle East, and Far East do not have the same perceived fear of litigation. At the same time, the oversight provided by government regulators varies considerably from almost non-existent in some areas, to strict controls in Australia.

Two books have been published in the last four years which focus on diving incidents and storytelling: Under Pressure (Lock, 2019) and Close Calls (Kas, 2020). In Under Pressure, the author provides a brief human factors analysis of the narratives provided by divers, linking stories with human factors and non-technical skills concepts and tools that are also presented in the book, the goal being to bring the theory to life via storytelling and reflection. Close Calls only contains self-authored stories. A brief analysis of the accounts in Kas' book by this author shows that some of these narratives appear to miss critical contributory factors, and rarely cover the wider contextual factors or systemic factors. The documentary 'If Only…' (Lock, 2020), tells the story of a fatal diving accident through the lens of human factors and a Just Culture. This was achieved by interviewing the widow and the dive team, and then providing a developing analysis as the context-rich story unfolded during the video. Feedback from online classes, workshops, and conference presentations indicates that this narrative approach provides a greater insight into how a 'simple' mistake within the complex setting came to be, compared to the simple, linear narratives that are normally told about diving accidents and how observers thought the event(s) occurred. Taking multiple perspectives increases the likelihood that factors outside the immediate time and space are considered as part of the sense-making process and subsequent recommendations (Heraghty et al., 2018; Pupulidy, 2015b).

As already alluded to, there are multiple factors that influence the telling of stories and cover technical, educational, social and cultural norms (ESReDA, 2015). Given the extensive literature covering storytelling and incident reporting, a large percentage of these factors are already likely known to the wider safety and organisational learning community. However, the specific issues as they relate to the diving community will not be, and it is the specifics that are the focus of this research. As a secondary point, specific issues can be more easily addressed with targeted interventions. Given the breadth of diving 'types' across the domains, it is suspected that different groups will have different perspectives concerning these factors and the research was designed with this in mind.

The research question is then defined as:

"What are the factors that influence the telling of context-rich stories that could facilitate learning following an adverse event in sports diving?"

"The outcome of any serious research can only be to make two questions grow where only one grew before." - Thorstein Veblen

Research Design

Methodology and Methods

Each diver will have their own perspective of the world. This perspective will influence their perception of storytelling following an adverse event. This is no different to the author who is a consultant in high-risk domains and has a military aviation background. To construct meaning between the different observers of this problem space, there was a need for a dialogue between the author and the informants, a subset of the diving population. Each observer has an understanding of the situation (Crotty, 1998, pp. 10–12). However, this reality goes beyond the individual level because of the different social and organisational groups that exist within diving. These 'communities of practice' (CoP) within the diving community will also have their own constructed realities (Epstein, 2018). Different CoP within the population were considered: training agency staff, diving instructors, recreational divers, technical divers, cave divers, and lawyers. Their realities or perceptions would be explored as it was hypothesised that there would be both overlapping and discrete themes relating to the factors that influence storytelling. It was not expected to find 'one truth', and it was acknowledged that the research would not identify all of the factors present.

To maximise the likelihood that the constructed reality would be close to the wider diving population's reality, a mixed methods approach was taken. This approach consisted of:

- an online survey that would capture both qualitative and quantitive data across a wide sample population using one case study told from two different perspectives for each of the different CoPs.
- interviews with three lawyers covering US and UK diving injury law.

- five focus groups covering training agency staff, diving instructors, recreational divers, technical divers, and cave divers. The focus groups would use a CoP-specific case study as the discussion point.

The online survey was run between 7 and 22 June 2023, the focus groups took place on 26 May 2023, 2 July 2023, and 9 July 2023, and the interviews took place on 8 June 2023 and 26 June 2023.

Online Survey

The survey was constructed in Typeform in May 2023 and was a mixture of multiple choice and ranking questions, short text answers, and demographic data. The survey was originally assessed by the author to take 20 minutes to complete, which was the ideal maximum time for a survey (Revilla & Ochoa, 2017). The trial surveys validated this at 22 minutes. Table 1 shows the completion data for the online survey.

Table 1:

Completion Data For The Online Survey

Status	Value
Visited	3061
Started	1991
Completed	676
Completion Rate	34%

The critical questions in the survey focusing on the research question were related to whether a diver would share a story about an incident relating to their CoP and why they would or would not share it. The question set and survey design evolved as the three trial surveys took place. Originally, there were three versions of the modified real-world story which took into

account Individual Blame Logic (IBL) or Organisational Function Logic (OFL) (Catino, 2008) and these were shown to the respondents in a sequential order #1, #2, and #3.

The first pilot (n=9) showed that respondents were more likely to share the context-rich narrative (OFL) than the simple one (IBL) but it was not clear whether they were learning more about the event as they moved through the three narratives, or whether it was because the third narrative, which was context-rich and identified significant local rationality, provided more potential learning. Heraghty et al., (2018) undertook a similar research project and randomly allocated respondents, therefore the next trial (n=15) reduced the scenarios to two options, and included a question set that would blind the respondent to their scenario. However, an error was made when setting the logic for the survey tool, and this led to an unexpected result. In each case, (n=4) where they went straight to the second narrative, the respondents would not share. If they selected #1, they should have assessed only #1 and then gone onto the non-case study questions bypassing narrative #2. However, they still had access to narrative #2. Of those who followed this process (n=6), four would share but two would not. Consequently, the survey was modified to provide the two options (simple #1 and context-rich #2) and if a respondent chose #1, they would also view narrative #2. A further option of #1-only was considered but this added complexity. Given that four CoP were being assessed, this option was discounted.

A number of questions were based on short-text answers (100 characters). The questions were primarily looking at the definitions of words associated with safety and reporting. The questions were initially trialled using 70-character responses, but feedback from the respondents indicated that this was considered too short. This was extended to 85 characters on the next trial, and still considered too short. The final trial (n=11) was made with 100 characters and the sentences made more sense because "the response is not being changed to fit the characters available." (Trial 2, Informant #18).

The final non-demographic question asked respondents 'What one thing would you change to improve storytelling?' from a selection of seven options based on modifying the results from Chan and Li's recent work (2023) on trust surrounding Just Culture in an aviation setting.

Demographic information was captured, including a self-classification to which CoP the respondents perceived themselves being closest to. Feedback from the second trial indicated that moving this self-determination question to the start of the survey would provide more context for later questions and increase reliability, and so this was put in place for the final survey. The deployed question set is at Appendix 1.

During the analysis of the online data, it was recognised that the manual coding of 650+ lines of data per question would be beyond the scope of this MSc, and so ChatGPT v4.0 was used, after some trials, as a method of developing the themes. Lund University does not prevent the use of AI or ChatGPT for research processes, but it needs to be declared as part of the submission. More details of the process are contained in the Findings section and Appendix 5.

Focus Groups

Recruitment and Attendees

There is a trade-off between getting a homogenous group and gaining an understanding of the particular issues within that group, and understanding factors that impact the wider diving community when it comes to the research question. The latter will mean a more diverse response but will not identify all the factors present. However, as the purpose of this research was a general approach rather than being specific to a CoP, the reduction in detail caused by a thematic approach, especially given the constraints of a MSc thesis, was accepted.

To recruit informants for the focus groups, a series of posts was made in May 2023 within the HF in Diving Facebook group which the author manages, asking the 11000+ members if

they wanted to be part of a research project looking at the factors that influence storytelling in diving following an adverse event. Those who responded were sent to a Typeform page which sorted responses based on the respondents' self-determined CoP, and then asked a series of questions which related to experience, location, primary training agency certification, gender and age. This demographic information allowed a breadth of perspective to be captured. Focus groups were planned to have approximately six people in them - this would allow conversations to be managed and flow given the 90-120 minutes allocated for the focus groups; this duration was chosen as a compromise between taking people's time and likely reaching thematic saturation. The stratification and diversity of the informants for the focus groups is shown at Table 2 and 3 below.

Table 2:

Responses and Attendance at Focus Groups

Focus Group	Responses to Survey	Number Chosen	Number Attended
Recreational	21	6	4
Technical	24	6	4
Cave	8	6	6
Instructor	17	6	5

The self-classified diver training agency which informants attributed themselves to has been removed from the cave diving focus group informants in Table 3 because only two of the members provided their agency details, and because the community is very small it would be relatively easy to identify who they were if their agencies were listed. Given the topic and narratives provided, confidentiality is critical.

Table 3:

Demographic of Focus Groups

Informant ID	Gender	Type	Agency	Location	Instructor	Total Dives CoP	Years Certified CoP	Avg CoP Dives/ 3 Yr
CD1	Male	Cave Diver	-	Florida	No	66	5	6
CD2	Male	Cave Diver	-	Mexico	No	125	9	40
CD3	Male	Cave Diver	-	Florida	No	500	24	60
CD4	Male	Cave Diver	-	Florida	No	300	17	35
CD5	Female	Cave Diver	-	Florida	Yes	1800	18	200
CD6	Female	Cave Diver	-	Florida	Yes	862	24	38
RD1	Female	Recreational	PADI	Australia	No	32	1	16
RD2	Male	Recreational	SSI	Luxemb'rg	No	300	14	25
RD3	Female	Recreational	PADI	USA	No	440	10	90
RD4	Male	Recreational	PADI	Sweden	No	207	24	28
TD1	Male	OC Trimix	PADI	Portugal	No	390	6	35
TD2	Female	CCR Tec 40	PADI	USA	No	700	6	100
TD3	Male	OC	ITDA	UK	No	430	16	30
TD4	Male	OC Trimix	TDI	USA	No	218	40	3
Inst1	Male	OWSI	SDI	USA	Yes	2000	25	100
Inst2	Female	OWSI	NAUI	USA	Yes	300	1	50
Inst3	Male	Course Dir	PADI	Sweden	Yes	6000	42	60
Inst4	Female	OWSI	PADI	USA	Yes	500	17	75
Inst5	Male	OWSI	PADI	Canada	Yes	1200	20	50

In-Person vs Online Focus Groups

Two focus groups were planned to be in-person with the other three taking place via Zoom. The in-person focus groups were chosen because of physical opportunities to meet informants at already existing meetings. The cave diving focus group was scheduled immediately prior to the 2023 NSS-CDS cave diving conference in Florida - it was hoped that some Mexican cave divers would also be present to increase the diversity of response, however only one applied to attend the focus group. The training agency focus group was planned to occur immediately after the British Diving Safety Group meeting on 27 June 2023.

The online focus groups took place via Zoom.

Agency Training Staff Focus Group

The final focus group was proposed to be made up of UK-based staff members of training agencies (UK & global) to get their organisational perspective and what they believed limited the telling of context-rich stories following an adverse event. To facilitate this, members of the British Diving Safety Group, a UK-based body made up of diver training agencies, government agencies, and specialists, were approached via the chairman on 5 May 2023 to take part in the focus group after the next scheduled meeting on 27 June 2023. To maximise attendance, the focus group was chosen to take place immediately following one of the tri-annual meetings. Of the 9 training agencies represented, only one agency member (from SDI/TDI) replied and said they would attend. Hypothesising that this lack of commitment may have been down to not understanding the research, a short presentation was given at the British Diving Safety Group meeting on 27 June to explain the research and four more dates were proposed for an online focus group. There was no response to this additional request. This lack of engagement was a missed opportunity, especially given the findings that will be presented later and the role of the organisation in setting the culture and practice when it comes to reporting and sharing stories.

RD3 - Individual Letter

Following the recreational focus group, one informant (RD3) was involved in a fatal diving event as an observer and sent an email on their reflections regarding the event and how it was discussed/reported and how learning was potentially limited because of certain factors. This email was entered into the research as a novel perspective. Permission was granted from RD3 to use this as evidence as long as it was de-identified.

Lawyer Interviews

The fear of litigation surrounding the telling of accounts following an incident has been ever present since 2011 when the author became interested in this topic in a more formal manner. The author's experiences during their time as the head of Quality Control within a training agency reinforced this, where the threat of litigation shaped what could and could not be done when it came to capturing and discussing events. This was especially the case if there was a potential that there might be failings within the organisational systems, even if these failures did not contribute to the event being discussed. As such, it was considered essential that the perspective of legal professionals was also captured as part of this research project.

The goal was to interview three lawyers: one from the UK, and two from the US. The lawyers and organisation were chosen based on their experience and because they were also aware of the work that the author had been doing. Two of the lawyers (one UK, one US) were very supportive of the request and the 90-min interviews were scheduled relatively quickly. The third lawyer came from an insurance company and this approach was not successful. Their organisational response, not from the lawyer, but through an intermediary, said that they did not want to be involved in this project in case it compromised client-attorney privileges even though this issue would not come up during the research activity. This was considered a loss given their position within the industry, especially as it was perceived that an insurance company would like to know the context-rich stories to understand what could be done to reduce the events that lead to claims and subsequent pay outs.

The interviews took place via Zoom and lasted 50 mins (UK) and 75 mins (US). The format was similar to the focus groups in that a context-rich narrative was presented and semi-structured interview followed, but this time the emphasis was on what they believed the legal perspectives were when it came to the sharing of context-rich stories.

Ethical Aspects and Confidentiality

The research question was about understanding what influences the telling of some form of 'truth' about what happened following an adverse event. Each of us creates one or more versions of the 'truth' when we tell a story. This research is a story, and its 'truth' needs to be told, considering both the informant's accounts and narratives provided, as well as the findings that are presented. To achieve this, research ethics must be followed. The ethics codes of Lund University were consulted to ensure that the processes were complied with, including informed consent and GDPR: consent forms are at Appendix 2. But process is not enough. The researcher also needs to be aware of their own biases as they interpret and construct ideas from the data presented by the informants. The author recognised this as a potential issue as they had been interested in this topic for the past 15+ years and delivering training for the last seven. On reflection, the author believes this topic is now part of their identity, which strengthens their biases about what is 'right' and 'wrong' or what 'truth' is constructed. To overcome these biases, they kept referring to both the body of literature, but more importantly, what the informants had said as the analysis was undertaken and not introduce additional data outside of that captured during research into the findings. If additional, relevant data, was introduced, then it would be referenced.

What the informants said was influenced by what they were asked during the focus groups and interviews. Using a semi-structured approach provided some freedom towards unearthing rich responses, at the same time, care was needed to not 'lead the witness' during questions, and open questions were used to ensure that the conversations remained close to the research question.

The narratives presented by the informants were confidential and have the potential to cause professional or social harm to them or others if they were released. Therefore, it was emphasised that 'what happened in the room, stayed in the room' during both the face-to-face

and Zoom sessions. The recording of the focus group was covered in the informed consent, and informants were reminded of the confidentiality needed. This allowed candid conversations to be told, and this high level of trust was highlighted as a factor in multiple focus groups as being an essential factor for storytelling, and in one focus group, was the presence of trust was explicitly called out as the reason why an account from two years prior which had not ever been shared was told to the group. The audio (cave focus group) and video (all Zoom sessions) files were kept securely within a password protected folder on a password protected laptop. Once the de-identification happened and coding had taken place, the original files were deleted.

Transcription Process

Given that there was expected to be 11 hours of interview and focus group data, consideration was given to using a transcription service as it would take more than 40 hours to transcribe this data. Using a confidential service that met ethical requirements was too expensive, and so an AI-powered system, rev.com, was used. This platform has no human interaction in the system and so there would be no compromise of confidentiality. The transcripts were reviewed, where the audio and transcript were cross-checked, and errors corrected. It is assessed the transcripts were more than 95% accurate and errors normally came from either strong accents or unclear/mumbled speech.

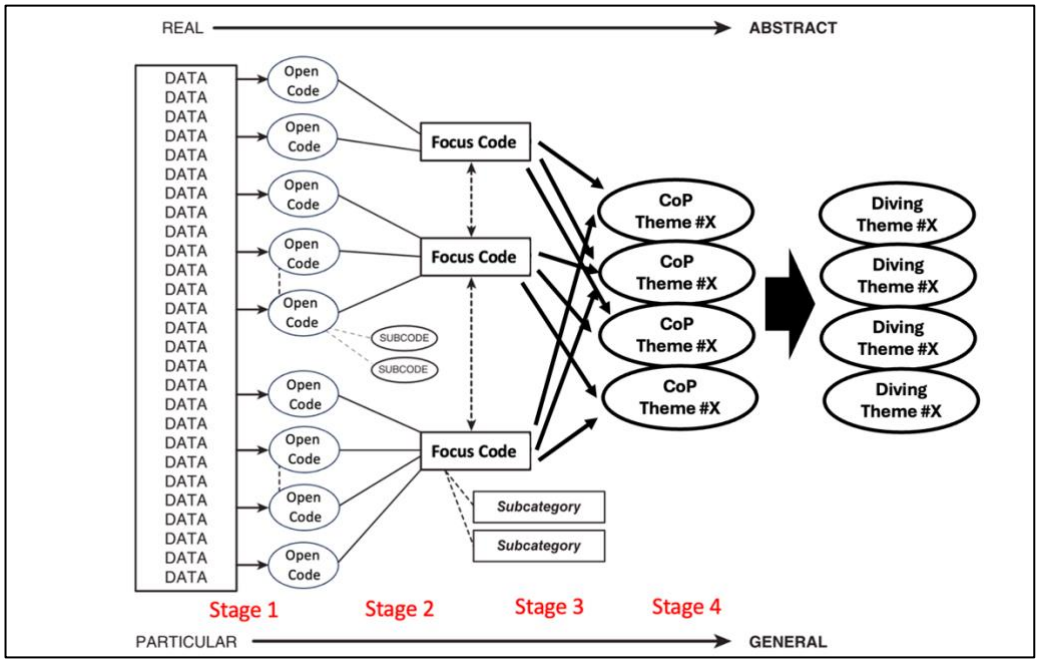
Coding

The original plan was to undertake Open Coding (stage 1), Focus Coding (stage 2), Thematic Analysis (stage 3) all within the different CoP, and finally relation coding across the six CoP (stage 4) (Adu, 2019). However, it was recognised that during the aggregation and comparison process between stages 3 and 4, detail would be lost, and therefore the comparison

between the themes across the different CoP (stage 4) would be done with the focus codes from stage 2. Figure 3 shows this process, moving from open coding to identifying key themes across the data.

Figure 3:

Codes-to-theory model for qualitative inquiry. (Modified from (Saldaña, 2016)).



Open Coding

Open coding is where the raw data is allocated certain codes or attributes to determine a specific idea. It can be applied to a few words or a whole paragraph. The goal is to attribute or construct meaning from the data as it relates to the research question, rather than a technical summary of the words or paragraph (Adu, 2019).

Focus Coding

The next step of the coding process is to collate or focus these open codes into smaller groups. This can help identify themes or concepts between groups of data. The process for this involved exporting the open codes from NViVo (Version 13, Mac Version), importing them into MS Excel as a single column, allocating them to unnamed relationships-based 'bins' (columns) before creating titles or focus codes based on the relationship identified within the column. If pre-determined codes were used, it could mean that data could be forced into topics that were not relevant.

"Through storytelling, an otherwise unexceptional biological species has become a much more interesting thing, *Homo narrans*…he has learned to inhabit mental worlds that pertain to times that are not present and places that are the stuff of dreams." - John D. Niles

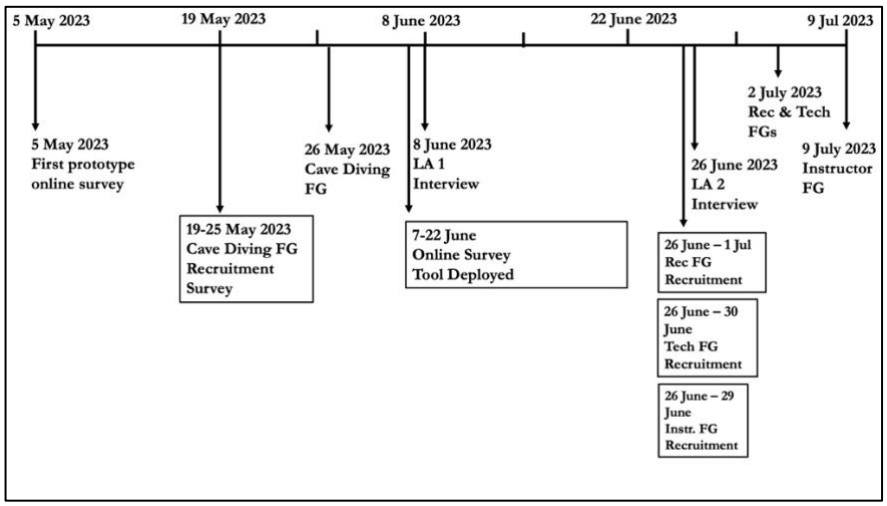
Results and Findings

Introduction

The data were collected over the period 26 May and 9 July 2023 and consisted of online survey responses, focus group transcripts, and interview transcripts from two lawyers. The initial survey design was modified following the focus groups and interviews with the lawyers – the goal being to identify the factors from a wider audience and not just from the focus groups and interviews. The timeline for the data collection process is at **Error! Reference source not found.**.

Figure 3:

Timeline of Data Collection



Open Coding

The number of open codes identified in stage one is shown below at Table 4.

Table 4:

Number of Codes from Open Coding in Each Focus Group

	Recreational	Technical	Instructor	Cave	Lawyer	RD3
Number of Open Codes	74	75	155	117	145	32

Focus Coding

As the data was reviewed, some open codes were moved from column to column. The number of focus codes created for each CoP, their titles, and the codes attributed to each is shown at

Table *5*. The count for each focus code and total number of open codes is shown in brackets in the header e.g., Recreational Focus Group had 74 open codes and 7 focus codes. The two numbers for each focus code are the count and the percentage for that sample e.g., 'The need for context' had 15 counts which equated to approximately 20% of the open codes for the recreational focus group.

Table 5:

Focus Codes Derived from Open Coding (Stage 2) Showing Counts and Percentages

Recreational FG (7, 74)	Technical FG (9, 74)	Instructor FG (14, 155)	Cave FG (10, 116)	Lawyer Interviews (10, 145)	RD3 Letter (5, 31)
The need for context (15, 20%)	Fear (15, 20%)	Trust (22, 14%)	Social/Cultural (22, 19%)	Context helps explain disparity between stories (33, 23%)	Tension between speculation and learning (12, 39%)
Fear and embarrassment (14, 19%)	Context (11, 15%)	Organisational Learning (19, 12%)	Personal/Team (21, 18%)	Conflict between litigation and learning (24, 21%)	Impact of media/social media (8, 26%)
More info, more sharing (12, 16%)	Benefits of Sharing (10, 14%)	Education (16, 10%)	Understanding Context (19, 16%)	Learning systems (23, 20%)	Fear (5, 16%)
Don't know what they don't know (11, 15%)	Trust (10, 14%)	Reputational Risk (16, 10%)	What is an incident? (13, 11%)	Fear of… (18, 16%)	Organisational Influence (5, 16%)
How to brief/debrief (11, 15%)	Who is the audience (10, 14%)	Role Modelling & Leadership (16, 10%)	Risk within Cave Diving (11, 9%)	Community cultures (12, 10%)	Gender (1, 3%)
Group Behaviours &	Personal factors for learning (6, 8%)	Standards (13, 8%)	Organisational Factors (10, 9%)	Can't fix a secret (10, 9%)	
			Prospective Effect of		

Interactions (8, 11%)	Debriefing (5, 7%)	Cultural Aspects (12, 8%)	Experience (8, 7%)	Organisational Behaviours (9, 8%)
Hero or Villain (3, 4%)	Organisational Influence (5, 7%)	The Diving Business (12, 8%)	Focus on Fatalities (6, 5%)	Shift from compliance to learning (9, 8%)
	Gender and Minorities (2, 3%)	Biased by Outcome (8, 5%)	Technical Aspects of Reporting (5, 4%)	How to tell the message (4, 3%)
		Internal Perspective (6, 4%)	Media/Publicity (1, 1%)	Diversity of experience (3, 2%)
		Social Media (5, 3%)		
		Technical Factors (4, 3%)		
		Change (3, XX)		
		Longevity of Messaging (2, XX)		

A Pareto analysis was undertaken across the 61 focus codes to identify those factors that had the greater influence on the telling of context-rich stories. This analysis provided the following graphical outputs.

Figure 5:

Pareto Analysis – Letter from RD3

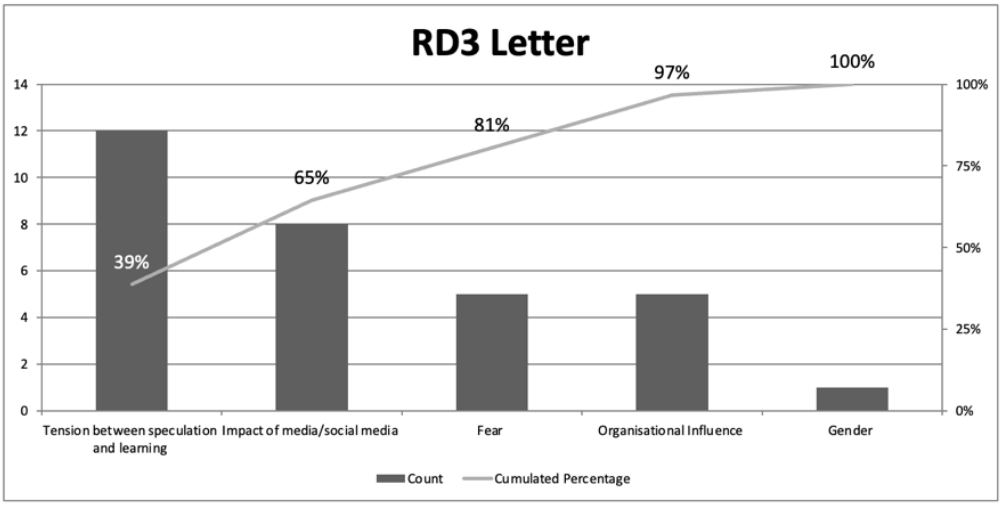


Figure 6:

Pareto Analysis – Cave Diving Focus Group

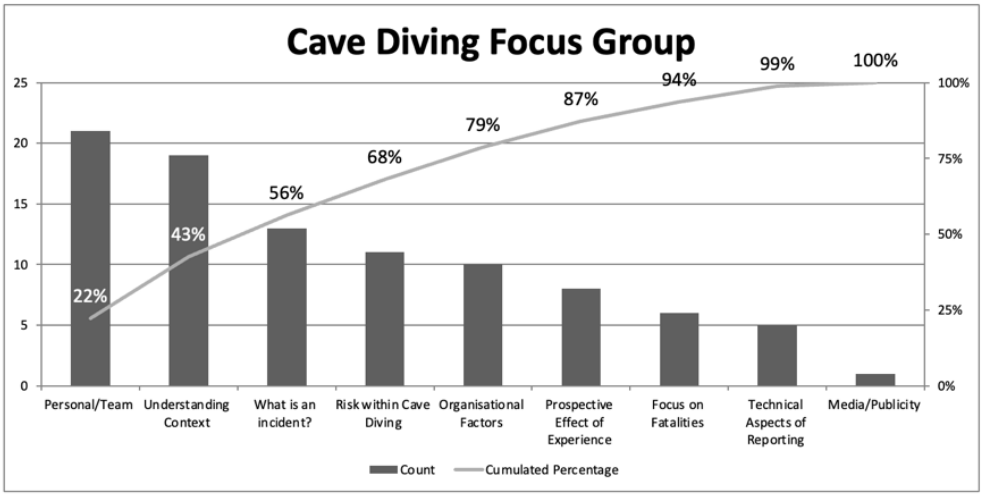


Figure 7:

Pareto Analysis – Lawyer Interviews

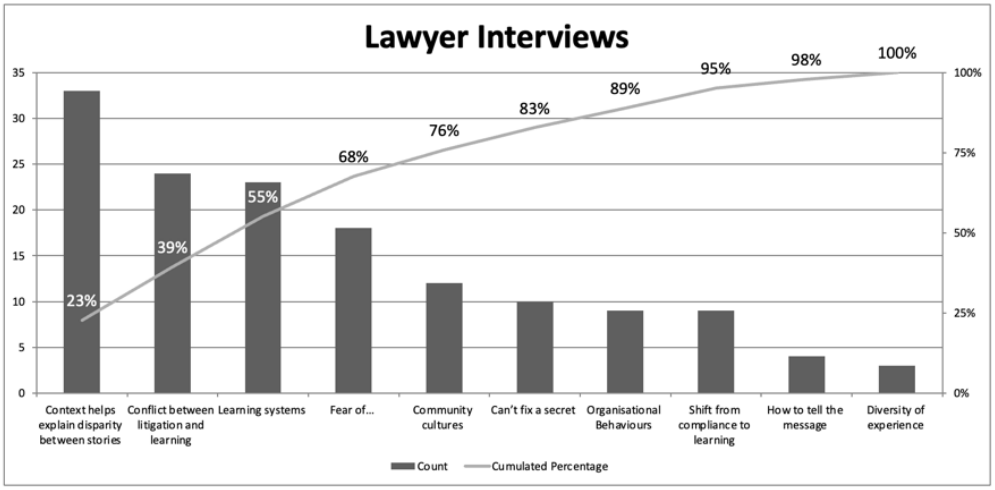


Figure 8:

Pareto Analysis – Instructor Focus Group

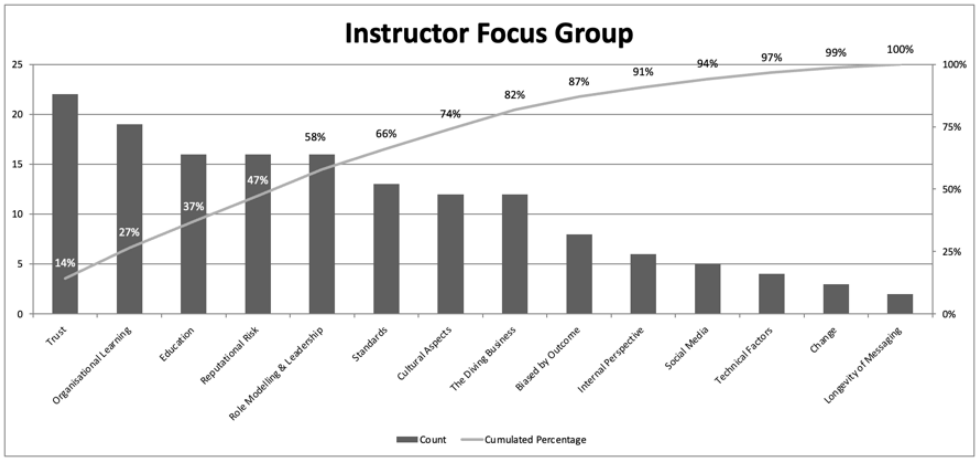


Figure 9:

Pareto Analysis – Recreational Diving Focus Group

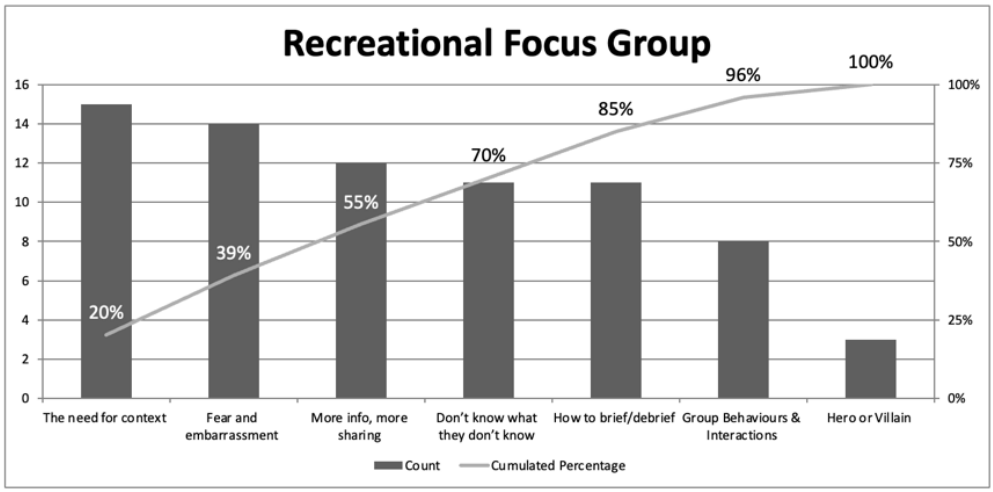
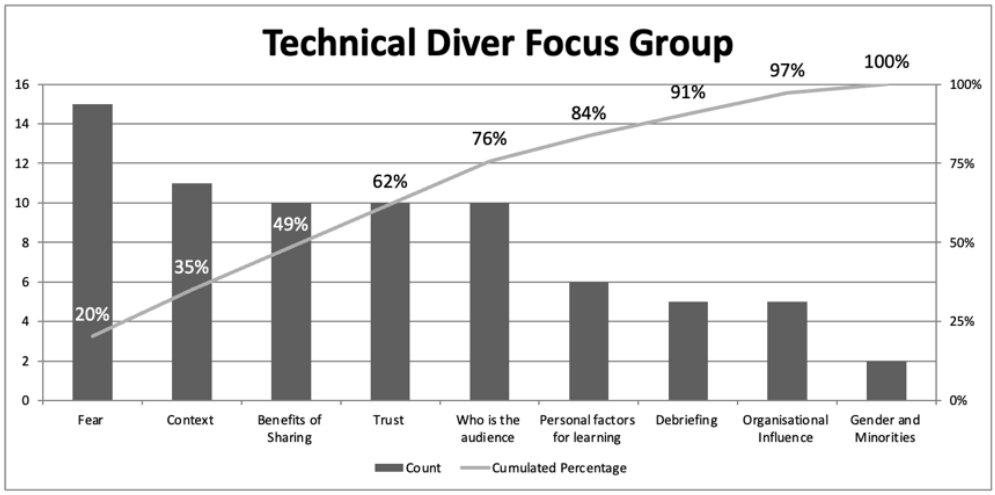


Figure 10:

Pareto Analysis – Technical Diving Focus Group



Using the Pareto analysis from the focus groups and the associated thematic analysis, eight factors emerged that have a major impact on the ability to share context-rich stories. A short explanation and examples of these from the focus groups are provided.

Social, cultural, and organisational factors. These included factors relating to the different CoP and how they referred to each other, gender within the groups and the challenges this introduced when speaking up because females are significantly underrepresented in the community, organisational factors and learning at a local level being different to the organisations, and what could be considered 'wilful blindness' (Heffernan, 2011) .

"I'm not sure people are interested in, in learning. I don't think people, uh, uh, think that there's much to learn. There's stuff for other people to learn, but the course directors, the instructor trainers, they've been doing this a long time. They aren't vulnerable like the rest of you, is kind of the thing." – Inst1

> "Whenever something happens, close call or could have been a close call or whatever, I forced them to write me a report. Okay. This report was going nowhere. Unless they themselves wanted it to go. But we, we were a PADI centre. So they should have sent it

to PADI as well. But I mean, I didn't force them to do that, but I forced everybody to write a report to me." – Inst3

"A lot of, in my view, especially with that particular agency, the reporting of incident, is meant to give them a heads up about the potential for litigation to protect them, it's not about learning, it's not about avoiding incidences. It's no longer about that. There was a time when they wanted to get a handle on things so that they could modify their training. And yeah, that ended in 2010." – LA1

Context surrounding the event. The focus groups identified that having more context would increase the likelihood that they would share a narrative or be less judgemental of another story if it had context. The context helped them understand the local rationality of those involved, thereby increasing the learning opportunity instead of just focusing on the outcome.

"The more information you can have, the more you can, you know, try to understand and take inputs from it."- TD1

"But it's only stupid when you have the extra information. Right. It's not stupid at the time you're making the decision at the time you're making the decision… It doesn't become stupid until you have more information to go. "Actually, that was a really bad idea!" – RD1

"And often when the stories go public and they get passed around, a lot of the context falls." – CD6

Fear of… Examples of different types of fear were articulated in the focus group responses – fear of litigation, fear of criticism, fear of failure, fear of reporting, and fear of criticising a 'name'…

"Would people blackball me for speaking on an accident?" – RD3

> "So I can, tell about my most embarrassing experience because I once did a dive where basically I ran out of air and, managed to hide it from everyone and not share it. And it took me two or three years, and a webinar to get to the point where I'm now willing to share that." RD2

> "a little further down the road that people will judge them heavily for a: showing vulnerability and b: having done something wrong that they admitted to." – Inst5

> "unless you do really want a change in our industry, you're not gonna be vulnerable with your students or with your shop or, um, with your agency. Because some agencies, you know, if you get a mark and you get so many marks, then you're out. So it's like, I'll just keep my mouth shut because I wanna keep teaching." – Inst4.

> "I think fear of risk of litigation, I think there's a real focus by the training organizations on how can we mitigate a risk of litigation." – LA2

Trust between and across the system. It is essential that trust is present when it comes to sharing stories which involve vulnerability, reputation, and safety (Dekker, 2017; Edmondson, 2004). Creating trust in a small group is easier than sharing stories to the organisation or across the internet because you don't know what is going to happen next in the latter cases.

"…even when you do have a situation of protected teammates, mentors that you can have honest discussions with, the flip side is sometimes outside of that circle is a bunch of piranhas and sharks. I've had some things that, you know, I would get on the phone and talk with a buddy, but I'm not putting it in a f**king text message." – CD6

> "If we could have some kind of place or conference or sessions where we can talk about these things where it's open to everyone, but closed and controlled and safe, I don't know how we mandate that… I'm hungering for something like that. Like I would, I would pay good money for a place like that." – Inst1

> "When I message him [Regional Manager for training agency] and say, Hey, I wanna talk about a near miss, he's like, all right, call me nothing in writing. And we talk over the phone, and this is an interesting one because, around here, there's very much a hesitance to put anything in writing when there's a near miss like this. Especially like, had there been the possibility that anything could have been misinterpreted as a standards violation? You put it in writing…It's the drama. Someone will get hold of it and they'll be like, Ooh, I'm gonna put in a quality assurance report against this instructor." – Inst5.

Understanding what an incident is. Within the training agency materials, there is no clear definition of an incident (or a learning event). Consequently, what should divers telling learning-focused stories about?

> **"**Half of the people wouldn't even know how to reflect on it because they basically probably didn't even realize that an incident happened or that something, had all of these contributing factors that in the end turned into something that was, 'uh, that was suboptimal'." – RD2

> "Yeah. So I think the biggest thing, like, I've got a story I've never told anybody, but, you know, all the smaller things that have happened, I mean, I've, I, I don't know, I hate to say, hundreds of things. But I haven't been diving for a long time, so just like CD1 said, at the time you don't think about them being an issue, but the snowball effect is real." – CD4

How to tell a learning-focused story. The stories that get told are often focused on the immediate events and these perceptions are impacted by severity or outcomes biases. This means the learning can be missed or not searched for.

> "I couldn't look at it and go, "this is why I got tangled" because I wasn't, I mean, it happened behind me, so I have no idea what I actually did. And then she wasn't able to provide feedback on, you know, well this is why you got entangled." – CD1

> "I just don't think there is a culture of 'How do I get down…what's happened on that dive?'" – LA2

> "Some of them might actually be able to have some useful feedback to take interesting learnings out of it. But no one ever told them about it. The only thing that you're debriefing is whether the fish were nice and, and 'Hey, I saw a turtle.'" – RD2

The tensions that exist between learning and litigation and speculation. There were a number of comments highlighting the tension between learning and litigation, especially by the lawyers and instructors, but there was also concern about the inability to speculate as that might appear to be judgemental.

> "I also wanted to get ahead of some of the rampant speculation I knew was …which made me think that the finger pointing was about to fly." – RD3

> "So even if everyone's sitting down and discussing, 'What could have gone better on that dive? How can we improve next time? How does everyone feel about that dive?' it comes up against this sort of general approach where we're wanting to avoid litigation." – LA2

> "The social jeopardy is even a bigger hindrance cuz a lot of these near misses, they may not be standards violations, but they just may be judgment violations, right? Yeah. Something like, oh, I hadn't thought of that. So there's no real standards or legal repercussions but there's definitely reputation repercussions." – Inst1

How to create learning through sharing. The focus group informants recognised that sharing stories would allow learning to happen more quickly, but there were going to be barriers present.

"Stories like this I think are very helpful because then you, you hear what somebody else went through and you think, okay, maybe this isn't just something unique to me and that maybe I do need to get this checked out." – TD5

"…shared anonymous stories within classes to kind of get students to think. There has been a few instances of one of the other instructors, locally, that loves to share all the good stuff, but he never shares the bad stuff." – Inst2

"They need to stop selling the lifestyle, as this very much has risks. And one of the ways we mitigate these risks is by actually talking about it." – Inst5

Within a complex socio-technical system, the boundaries between concepts and themes will be blurred or overlapping, therefore determining discrete themes is not considered possible. Meaning has been constructed by the author as the data has been analysed.

Thematic Analysis

The goal of the research question was to look at the factors that influence the telling of context-rich storytelling within the diving community across the different CoP. To ensure that the eight themes that were derived from focus coding and the Pareto analysis were relevant across the different CoP,

Table *6* was constructed: where a theme was present for the CoP, an X is shown.

Table 6:

Sub-Themes Attributed to CoP. Aggregated Themes Across All CoP

	Rec	Tech	Cave	Instructor	Legal	RD3	Aggregated Themes
social, cultural, and organisational factors	X	X	X	X	X	X	
fear of…	X	X	X	X	X	X	Cultural and organisational factors that create and resolve tensions surrounding learning from events
trust between and across the system		X	X	X			
the tensions that exist between learning and litigation and speculation		X	X	X	X	X	
context surrounding the event	X	X	X	X	X		
understanding what an incident is	X		X	X			Defining the event and how to tell a learning-focused story
how to tell a learning-focused story	X	X		X	X		
how to create learning through sharing		X	X	X	X		

Even though two higher-level themes have been developed, there is some overlap because in a complex system, the cultural and organisational factors also impact and influence the context surrounding the event. An example of this in the diving domain is where the risk is transferred to the lowest levels possible when the organisations 'isolate themselves from the risk', and this creates an obvious tension because the organisations do not want to be responsible for what happens at a dive centre or outside the training system and yet drift and adaptations are normal but the organisations are none the wiser.

Online Survey

The online survey questions were informed by the focus group discussions although the coding had not been developed before the survey was initiated. The survey provided a broad range of demographics across the 676 respondents. Demographic and diving experience data is available in a series of tables at Appendix 3.

The respondents were asked to state whether they had undertaken some level of HF training as this might influence their responses. The training was classified as being provided by The Human Diver (of varying levels of detail and duration) and also from other providers or domains e.g., healthcare, aviation and the maritime sectors. From the responses, the informants' definition of HF training by other providers is not consistent or coherent e.g., DAN or EFR courses do not provide HF education, and so they were removed from the data. Table 7 shows this distribution.

Table 7:

Distribution of HF training within respondents (n=676)

	L0: Micro-class	L0: Essentials	L1: Webinar	L2: F2F	Other (inc THD)	Other (Not inc THD)
Count	106 / 15.4%	99 / 14.6%	41 / 6.1%	61 / 9.0%	56 / 8.3%	126 (20.0%)

Findings from Specific Survey Questions

The survey asked 55 questions of the respondents, 13 of which were focused on demographics. This was far in excess of what would be needed for a MSc and only four were chosen for detailed analysis as they were very much focused on the research question. These questions were:

- What is an incident? (How do people know what to report or share a story about?)
- What does risk mean? (As it relates to diving and their CoP)
- What does Just Culture mean? (Does this vary across the different CoP?)
- What one thing to make an improvement? (Does this vary across the different CoP?)

What does an 'Incident' mean?

If divers were to share some learning opportunity, what would this be based upon? In the sports diving domain, there is nothing explicit that says 'this is an incident and should be reported'. Instead, vague statements focusing on 'human error', 'violations', and 'increase in risk' like those contained in Appendix 4 which came from training manuals and agency websites.

Aviation, considered a benchmark when it comes to safety management, defines an incident as "An occurrence, other than an accident, associated with. the operation of an aircraft which affects or could affect. the safety of operation." (ICAO, 2016, pp. 1–2). Looking at how 'safety' is defined, we get "The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level." (ICAO, 2018, p. vii). Aviation generally defines the acceptable level of safety "in terms of the probability of an aircraft accident occurring. It is defined individually for each operator/service provider on the basis of the target level of safety set by the regulator." (ICAO, 2018, p. vii). Diving, in the main, does not have a regulator, so who decides, formally, what an incident is and therefore what can or should learning be based upon? Consequently, the respondents were asked to define an incident within the context of diving: 662 respondents provided a definition.

There were two choices available for coding this data: manually code 650+ lines per question, or to use an AI tool to develop themes and then run multiple analyses to test the reliability between sessions. Initial manual coding was time-consuming and tedious. A trial was made using ChatGPT 4.0 to see if this could help with the burden without compromising the outputs.

Recognising that the ChatGPT 4.0 tool has variability built into it (Nield, 2023), multiple runs were undertaken to identify this variability and increase reliability. The individual results were slightly different, but not majorly. A Pareto analysis was also included as part of the ChatGPT 4.0 analyses. The process used to produce the results for this and the next section are at Appendix 5.

The results at

Table *8* are based on a Pareto analysis from each session run for each CoP. The table is arranged with generated themes in the columns and CoP in the rows. Within each cell there are up to three themes listed which are based on the Pareto analysis each pass. For example, Cave CoP, Theme 1, 1. Deviations from the Plan or Procedure is the first pass in the Cave CoP, but in passes 2 and 3, there was not anything provided outside the Pareto analysis i.e., 80% of the definitions of what an incident was came from this single theme. If there is a dash, it means there was no other theme that contributed to the 80% of the comments.

The first row in the table was constructed using the prompt:

"I am going to give you a number of sets of data. I'd like you to combine them all into a set of 10 common themes, ranked in order of count"

and contains the top five of those 10 themes. The full outputs from ChatGPT are available on request.

Table 8:

What is a 'diving incident'? Top Five Themes developed by CoP via ChatGPT v4.0

	Theme 1	**Theme 2**	**Theme 3**	**Theme 4**	**Theme 5**
Composite across 3 sessions and all participants	Deviation from Plan	Potential for Harm or Actual Harm	Near Misses	Equipment or Protocol Issue	Negative Outcome or Adverse Events
Cave	1. **Deviations from the Plan or Procedure** 2. **Deviation from Plan** 3. Potential Harm or Actual Harm	1. - 2. Near Miss or Potential Harm 3. Deviation from Plan or Procedure	1. - 2. - 3. Event Description	1. - 2. - 3. -	1. - 2. - 3. -
CCR	1. Non-Severe Outcomes or Near Misses 2. **Deviation from the Plan or Expected Procedure** 3. Potential Harm or Actual Harm	1. Deviations from the Plan or Expected Procedure 2. **Potential Harm or Actual Harm** 3. Event Description	1. Errors, Mistakes, and Technical Failures 2. - 3. Event Description	1. - 2. - 3. Unplanned Outcome	1. - 2. - 3. -
Diving Instructor	1. Near-miss or Potential Harm 2. **Deviation from Plan** 3. **Deviation from Plan**	1. Deviation from the Plan 2. Near Misses 3. Near Misses and Close Calls	1. - 2. Injuries and Harm 3. Injury and Harm	1. - 2. - 3. -	1. - 2. - 3. -
OC Technical	1. **Deviation from Plan or Expectation** 2. **Deviation from Plan** 3. **Deviation from Plan**	1. General Negative Outcome or Deviation 2. Near Misses and Accidents 3. **Potential for Injury or Death**	1. Potential or Actual Harm/Injury 2. - 3. Negative Outcomes/Consequences	1. Near Miss or No Serious Outcome 2. - 3. -	1. Training or Equipment Issues 2. - 3. -
Recreational #1	1. **Plan Deviation** 2. Unexpected Events 3. **Deviation from Plan**	1. **Potential Harm** 2. **Potential Danger** 3. **Potential Harm**	1. Unplanned Events 2. Deviation from Plan 3. **Near Misses**	1. Near Misses 2. - 3. -	1. **General Negative Outcome** 2. - 3. -
Recreational #2	1. **Deviation from Plan/Expected Outcome**	1. **Potential Danger/Risk** 2. Dive Specific	1. Actual Negative Outcome	1. Severity Variation 2. -	1. General Deviations 2. -

	2. Potential Danger	3. **Potential Harm/Danger**	2. Deviation from Plan	3. -	3. -
	3. **Deviation from Plan/Expected Outcome**		3. General Negative Outcome		

These composite themes in the first row belie the complexity of the real world. Nearly every dive does not go exactly to plan, so at what point is the deviation from the plan an incident compared to a 'normal' non-incident dive? Furthermore, diving takes place in a hazardous environment, so the 'potential' for harm, danger, or risk is always present. The use of 'potential risk' is tautological and can indicate a lack of understanding of what risk means in the context of diving.

A noteworthy point was that within the ChatGPT 4.0 output streams, the theme of "learning opportunity" came up a couple of times – although not high enough to be part of the Pareto output. The research shows that through storytelling, especially context-rich storytelling, incidents provide an opportunity for learning (Little & Froggett, 2010; Rae, 2016; Sanne, 2008), and so a keyword search across all the responses was undertaken for "learn*" to identify "learn", "learned" and "learning". This search only provided seven counts for 'learn*'. This leads to the question, 'If incidents are not seen as learning opportunities, why would divers bother report or share them?'

What does 'Risk' Mean?

Risk and safety are intrinsic parts of diving because the activity takes place in an inherently hazardous and austere environment. Safety has been defined as 'free from harm' (*Safety*, 2022) but that is very difficult to achieve when you are submerged in an environment that does not support life. The challenge is understanding what 'safe' and 'risky' mean as they can mean different things

to different people, even when looking at the same conditions (Adams, 1995; Pomeroy, 2023). Consequently, an area to explore was 'What does risk mean to you in the context of diving?"

The same ChatGPT 4.0 thematic coding approach was taken as the previous question. The results at Table 9 follow the same format and structure as

Table *8*. The bold text is used to show the link between the composite theme from all responses (first row) and the themes from the CoP.

Table 9:

What does 'risk' mean in the context of diving? Top five themes developed by cop via chatgpt v4.0

	Theme 1	**Theme 2**	**Theme 3**	**Theme 4**	**Theme 5**
Composite across 3 sessions and all participants	Risk Understanding	Training & Preparedness	Planning & Mitigation	Safety & Protocols	Nature & Inherent Risks
Cave	**1. Definition of Risk** **2. Risk Perception & Definition** 3. Risk Management and Minimisation	1. Awareness & Acceptance of Risk 2. Human Factors **3. Awareness and Preparedness**	1. - 2. - 3. -	1. - 2. - 3. -	1. - 2. - 3. -
CCR	**1. Risk Definition & Calculations** 2. Probability and Likelihood **3. Risk Definition and Management**	**1. Training & Preparation** 2. Nature of Diving 3. -	1. - 2. - 3. -	1. - 2. - 3. -	1. - 2. - 3. -
Diving Instructor	1. Mitigation & Management 2. Risk Mitigation and Management 3. Risk Mitigation and Management	1. Inherent Nature 2. Inherent Nature of Risk 3. Understanding and Acceptance of Risk	1. Training & Preparedness 2. - 3. -	1. - 2. - 3. -	1. - 2. - 3. -
OC Technical	1. Mitigation & Management **2. Understanding of Risk** **3. Definition & Understanding of Risk**	1. Severity & Probability 2. Planning and Preparation 3. -	1. - 2. - 3. -	1. - 2. - 3. -	1. - 2. - 3. -
Recreational #1	1. Mitigation & Management 2. Nature of Risks **3. Understanding and Assessment**	1. Severity & Probability 2. Risk Management **3. Mitigation through Preparation**	1. - 2. - 3. Inherent Danger and Acceptance	1. - 2. - 3. -	1. - 2. - 3. -
Recreational #2	**1. Understanding & Assessment of Risk**	**1. Preparation & Mitigation**	1. Inherent Danger in Diving	1. - 2. -	1. - 2. -

	2. Awareness and Preparedness 3. Inherent risks and dangers in diving	2. Consequences of Risks **3. Personal capabilities and training**	2. - 3. Diver choices and behaviours	3. Importance of following procedures and safety	3. Assessment and understanding of risks

Looking at Table 9, there is a noticeable difference between what the diving instructors believe risk means compared to the other CoP because their perceptions do not link with the composite perception in the first row. This might be because of the fear of litigation and the constant reminder that complete and accurate paperwork is critical, and they should be managing the risks of the activity. Unfortunately, there is a difference between operational risk management (safety in the water) and risk management in the context of protecting themselves from litigation – 'paper safe' (Smith, 2018). It is suspected that this process of protection might get in the way of ensuring operations are 'safe'. In the healthcare domain, this is known as defensive healthcare (Catino, 2009).

What does a Just Culture mean?

A Just Culture is essential to support a Reporting Culture (Dekker, 2012, 2017; Reason, 2016). Given this requirement, respondents were asked to define what a Just Culture meant to them in the context of diving. Their responses were subjectively attributed to one of five codes: Agree, Approximately Correct, Disagree, Don't Know or No Answer. Agree, Approximately Correct, and Disagree were based on the definitions from Reason (1987. p. 195)

> "as an atmosphere of trust in which people are encouraged, and even rewarded, for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour."

and EASA's Regulation 376/2014

"A culture in which front-line operators or other persons. are not punished for actions, omissions or decisions. taken by them that are commensurate with their experience and training, but in which gross. negligence, wilful violations and destructive acts are." (EC, 2014)

The results are below at Table 10.

Table 10:

Author's Subjective Assessment of Respondent's Meaning of Just Culture

Percentage of Respondents	Assessment of alignment to Just Culture
30.0%	Counter to the definition of a Just Culture
25.1%	Did not know what a Just Culture meant
21.0%	Aligned with what a Just Culture means
13.9%	Approximately correct to what a Just Culture means
6.1%	More akin to Psychological Safety
3.7%	No answer provided

Some of the incorrect definitions were a little concerning and aligned more with group think, complacency, and normalisation of deviance. e.g.,

"An excuse to dismiss errors and not learn from mistakes."

"Sounds like dangerous habits have gone without anything going wrong for too long it seems ok."

"Cop out"

"Toxic competitive culture (deep diving, air consumption)"

"An excuse to justify poor performance and risk taking."

To determine if there was a difference different between the CoP and their definitions of Just Culture, the data was divided into the respective CoP and analysis conducted. The results for this are Table 17 at Appendix 6.

'One Improvement'

One of the key tenets of modern safety science and human factors is to understand what the front-line operator needs to complete their task and design work with their needs in mind. To that end, the respondents to the survey were asked:

> "If you were to suggest *one thing* to focus on to improve the likelihood that divers would tell context-rich stories that would allow learning, what would it be?"

They were given seven options, based on the work of Chan & Li (2023), which are listed in Appendix 1, and summarised in the header row of Table 11. The first data row in the table shows the sample results, and the subsequent rows show the percentage for each 'one thing to focus on' as they relate to the particular CoP. The bolded data show where there is a notable difference above the norm of the sample. Some are unsurprising e.g., instructors looking for more legal protection and technical divers looking to learn by having better stories.

Table 11:

Percentage (Total and per CoP) of 'one thing' to improve context-rich story-telling in diving

	Confidence about proper use of stories	Improvement by Orgs re: non-fatal storytelling	Guidance on Learning Stories	Presence of Just Culture in Industry	Feedback on submissions to the system	Easy to use Reporting System	Legal Protection for safety stories	No Answer
Total (n=676)	12.6	25.8	8.9	19.4	0.9	16.7	9.3	6.5
Instructor (n=165)	12.7	**26.1**	**10.3**	20.6	0.0	12.1	**12.7**	5.5
Rec (n=306)	**14.4**	**28.8**	6.9	15.4	1.6	**18.0**	8.8	6.2
Tech (n=67)	6.0	22.4	**17.9**	**23.9**	0.0	14.9	9.0	6.0
CCR (n=93)	8.6	21.5	8.6	**24.7**	0.0	**20.4**	6.5	9.7
Cave (n=44)	**18.2**	18.2	4.5	**25.0**	2.3	**20.5**	6.8	4.5

Summary of Findings

Two different datasets (focus groups and online survey) were used to develop an understanding of the factors that influence the telling of context-rich stories following an adverse event in diving:

- an online survey with 676 responses in which four questions were used to examine what an incident meant in diving, what risk meant in the context of diving, what a Just Culture was in the diving domain, and what one improvement should be made in the industry to improve context-rich storytelling
- four focus groups with recreational divers (n=4), technical divers (n=4), cave divers (n=6) and diving instructors (n=5), two interviews with UK- and US-based legal professionals, plus a letter from the recreational diving focus group member

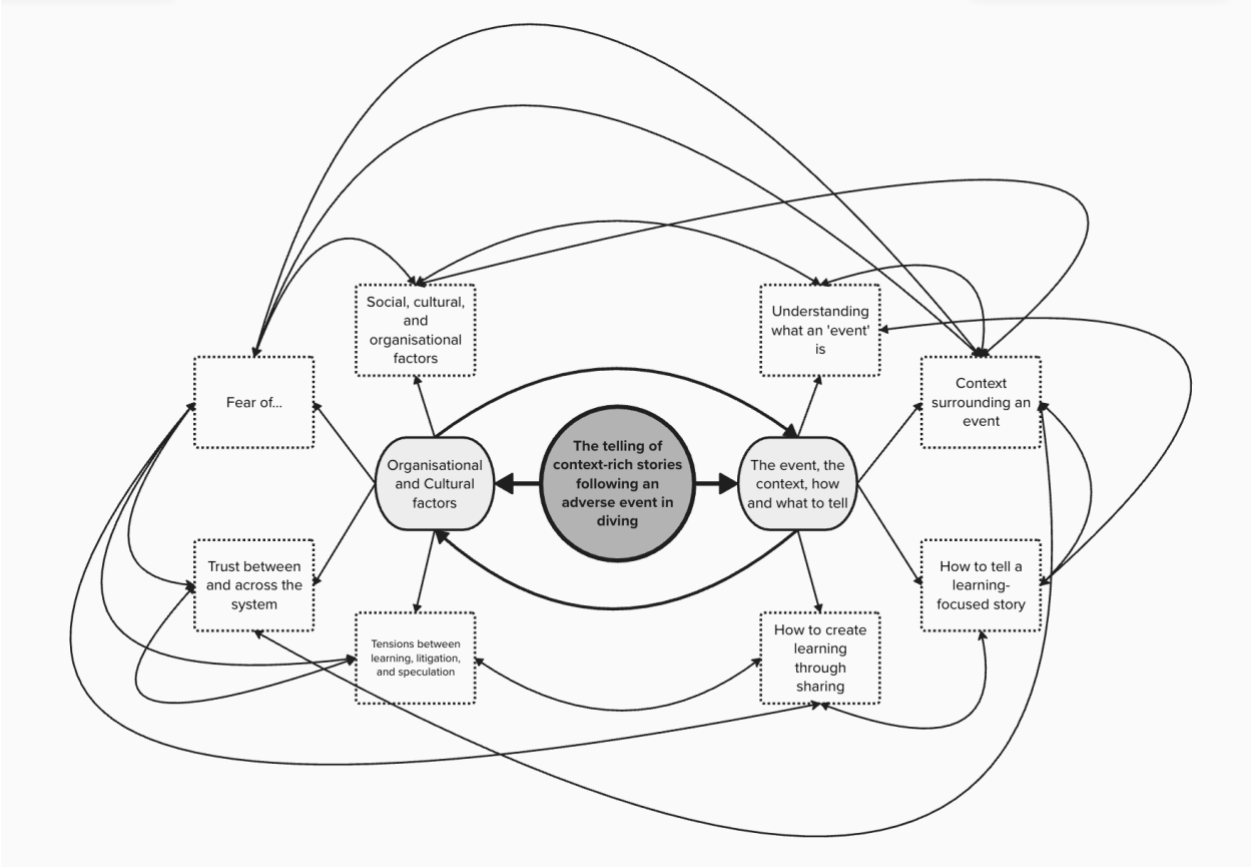
The data was analysed using a mixture of techniques:

- pareto analysis using ChatGPT for the first two survey questions
- qualitative assessment by the author of the definition and meaning of a Just Culture using existing definitions
- a quantitative analysis of the 'one improvement'
- thematic analysis of the themes within the CoP
- a Pareto analysis to determine the key and sub-themes from the focus groups and interviews

Eight sub-themes emerged from the data. Four of them under the supra-theme of organisation and cultural factors, and tensions, and four under the supra-theme of defining the event and how to tell a learning focused story. These are interdependent aspects of the complex system in which diving takes place: trust and fear are linked to social, cultural, and organisational factors, and they also create tension between litigation, speculation, and learning. **Error! Reference source not found.** shows these factors and their interdependence.

Figure 4:

The interdependence between the supra- and sub-themes



An important but unsurprising finding is the inconsistency of definitions as they relate to risk, incident, and a Just Culture. Given that diver training programmes do not cover these topics, the sense-making around these terms will be based on the individual's own knowledge development e.g., social media, reading, or training courses. The survey showed that between 6% and 20% of online survey informants had completed some form of HF training, either provided by The Human Diver or outside of diving. Having a common vocabulary is critical if improvement surrounding certain topics is to occur.

"Knowledge without context is meaningless."- Dave Snowden

Discussion

Introduction

The purpose of this research project was to find the factors that influence context-rich storytelling in the sports diving community so that learning can be improved.

The need to understand second stories (Cook, 2018) and the different perspectives or local rationalities of those involved in an event is needed, but this multi-actor approach poses a problem when it comes to telling these stories because the narratives can appear disjointed (Goode et al., 2018; Heraghty et al., 2018; Pupulidy, 2015b). It is not just the different perspectives of those directly involved in the event that need to be understood, it is also that stories and events have different values whether you are a front-line operator or a manager in an organisation "…the incident-reporting scheme is not integrated into technicians' practices and cultural frame and it does not seem to serve their interests. Storytelling, however, is an integral part of their practices… and it provides a way for the technicians to address risks…" (Gherardi et al., 1998; Sanne, 2008).

The diving community is not homogenous in culture, ideology, values, or training programmes (nor ever will be). Assuming that there would be a diversity of thought and practice across the CoPs, the research was developed to identify overlapping themes and factors, and these could be used as a starting point for that never-ending journey. The research would also allow outlying or interesting themes to be identified that might allow change to happen.

The discussion section is structured around eight interdependent sub-themes and two supra-themes which are shown in **Error! Reference source not found.** at the end of the previous section.

Organisation and Cultural Factors and Tensions

There were eight sub-themes that emerged from the data, four of them under this supra-theme of Organisation and Cultural Factors and Tensions, and these will be dealt with first. They are:

- social, cultural, and organisational factors
- the tensions that exist between litigation, speculation, and learning
- trust between and across the system
- fear of…

These are interdependent aspects of the complex system in which diving takes place: trust and fear are linked to social, cultural, and organisational factors, and they also create tension between litigation, speculation, and learning.

Feedback within Systems

Diving takes place in a complex, socio-technical system. This means there are multiple connections between entities and agents that provide feedforward (bulletins, webinars, and updates to standards and training materials) and feedback (incident reporting systems, social media posts around incidents and accidents, dive clubs, and conference presentations) loops.

Rasmussen's model of dynamic risk management (1997) describes how such a socio-technical system can operate from the highest levels concerning government policy and laws, down to 'work' at the front-line staff level using work instructions inside physical and social

environments. The model also shows how feedback is provided back up the system when adjustments are needed when external or internal pressures come to bear. Rasmussen also identified that each layer of the model would normally have a particular academic discipline associated with it, but that if system safety was to be improved, a holistic approach would be needed.

Sports diving consists of two main 'systems'. Firstly, a training system in which divers are trained using materials developed by a training agency and by instructors who are either self-employed or work for a dive centre. Note, these instructors do not work for the training agency when delivering training to clients, in fact, they can teach using materials from multiple agencies and can issue multiple agency certifications. Feedback is provided through quality management systems, internal reporting, and occasionally, audits. This is not as effective as it could be though.

> "I work in construction, a project manager for my, my day job, and we have near miss reporting. It's anonymous, behaviour-based observations kind of thing. And we don't have that in diving. We don't have a way to track near misses or things that could potentially have an adverse outcome" – Inst1

There is an intentional 'air gap' between the training agencies and the instructors delivering the training to 'isolate' themselves from the risk. The Linnea Mills case is an example of this, along with this comment from Inst4

> "…you know, we're taught that if something does happen on your watch, the shop will cut you and you're on your own and they will walk away from you.".

This comment from Inst3 highlights that some learning can happen at the dive centre level, but it isn't shared with the organisations.

> "I forced them to write me a [incident] report. Okay. This report was going nowhere. Yeah. Unless they themselves wanted it to go. But we, we were a PADI centre. So, they should

have sent it to PADI as well. But I mean, I didn't force them to do that, but I forced everybody to write a report to me. And then after reading, we, we talked about, talked about all this, see what we could learn, what we could change."

Secondly, a 'fun' diving system in which divers are outside of a formal organisational structure of control but can still provide feedback into the 'training' diving system by going through instructors, via safety organisations like DAN, at conferences, clubs or other social events/situations, where information is exchanged in an informal manner.

There is no formal linkage between these two 'systems' as those outside of training system are not directly of interest to the training agencies. This disconnect is not unexpected as they operate on different paradigms: a professional space with limited to no regulatory oversight, and a recreational and discretionary activity space with no formal oversight where higher levels of risk are accepted than would be acceptable in a regulated or controlled environment. There are also volunteer organisations like BSAC and CMAS which provide another complication as they sit outside regulatory controls like the Accepted Code of Practice (ACOPs) for Recreational Diving by the UK HSE.

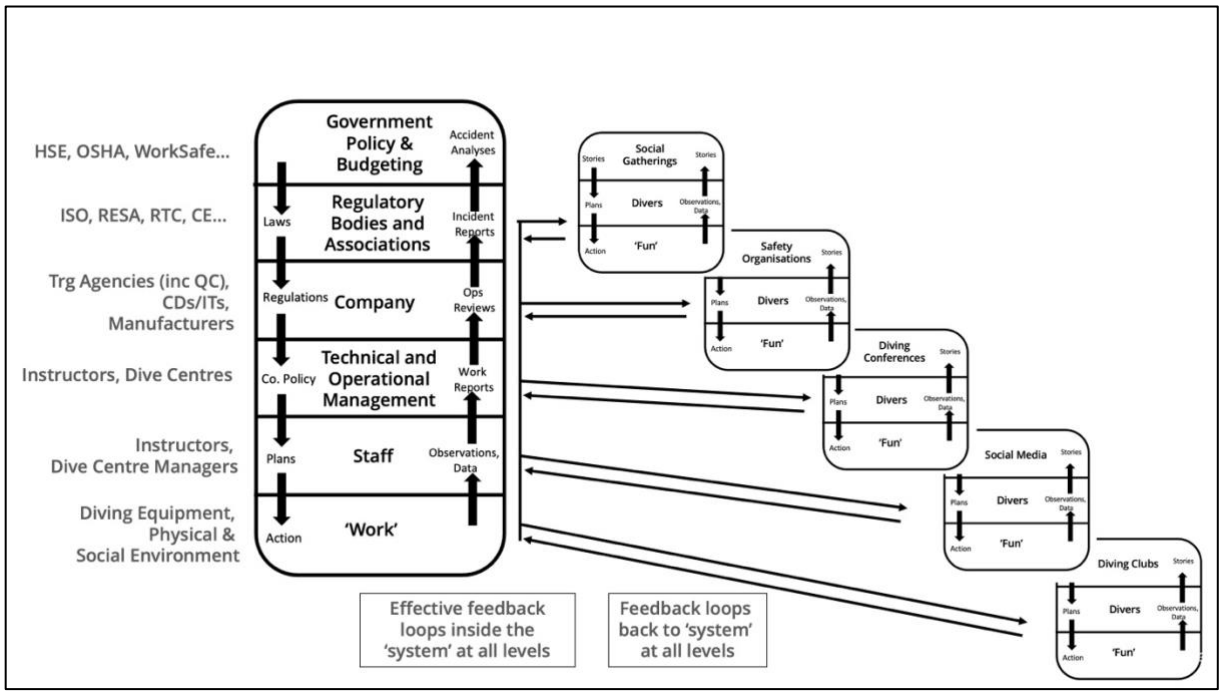
The final question within the online survey also points to this lack of feedback where 25.9% of respondents said that would like "An organisational commitment to improved diving safety by capturing, analysing, and sharing near-miss and non-fatal incident stories."

Error! Reference source not found. shows a modified version of Rasmussen's model and provides an 'ideal' ('Work as Imagined') system complete with internal and external feedback loops. The internal loops are based on Rasmussen's framework and personal experience within the training system as a quality manager – no agency staff contributed to the focus groups, so it is unclear if this is an industry-wide perspective. The findings indicated that the external loops are present because of the social nature of diving but had varying levels of effect.

Feedback and the associated learning are not just about having formal processes or technology in place to capture and disseminate information, the reporting system, which can inform a learning system, also needs to have social and cultural enablers in place. Within diving, the organisational structures and perception of fear associated with storytelling can limit the transfer of knowledge between stakeholders, thereby decreasing the wider learning which might be possible.

Figure 5:

An 'ideal' ('Work as Imagined') system model based on Rasmussen (1997) showing feedback loops from outside formal training system as well as internal feedback loops.



A Just Culture

The ability to tell context-rich stories is key to learning (Allen et al., 2018; Woods et al., 1997, p. 55). They allow local rationality to be explored, as well as exploring the perspectives from multiple participants. This multiple perspective approach can be supported by the presence of psychological safety (coming from management science e.g., (Clark, 2020; A. C. Edmondson,

2019)) and a Just Culture (coming from safety science). Neither are shown on Rasmussen's model nor mentioned in his 1997 paper.

A Just Culture is something many scholars, starting in the 2000s, identified as critical to support a learning-focused organisation (Dekker, 2017; Reason, 2016). Developing a Just Culture is not easy as there is always a tension between creating individual and organisational learning by sharing of the context-rich narratives associated with unintended outcomes, and the threat of external judicial or regulatory scrutiny (Bitar et al., 2018; Boskeljon-Horst, Snoek, et al., 2023; Cromie & Bott, 2016; Dekker, 2017).

There are some factors which make it more difficult to create and 'manage' a Just Culture within diving:

- the organisational structures are weak across and within agencies and dive centres, there is no regulator per se to provide oversight and 'judgements',
- there is no overarching 'policy',
- the prevalence of tort litigation, normally addressed through liability insurance, serious limits learning opportunities.

Fundamentally, how do you create a Just Culture, which is primarily there to help organisational learning, when the organisational influence in large proportions of diving is seriously limited?

The results from the online survey and the focus groups indicate that a Just Culture is missing within the diving domain, and that a priority should be afforded to developing one. This apparent need for a Just Culture was identified in both the focus groups and the online survey responses.

> "…reputation out there of tech divers being arrogant, assholes. Mm-hmm…and in general they are, in my opinion…the funny thing, assholes generally don't tend to admit

> some mistakes…I think people feel safe in discussing things for the most part...except for some personalities know that they rub against other personalities and they know if they admit one tiny little flaw, then they will be like ripped to shreds. So they don't admit anything except in their smaller groups." - TD2.

> "Um, there has been a few instances of one of the other instructors, um, locally that he loves to share all the good stuff, but he never shares the bad stuff… And this instructor has created a group around himself that is not able to challenge him. Okay. And so if us challenges him, he gets very defensive and closed off. And so it's almost to the point where we don't share stories with him or about his classes anymore." – Inst2.

Furthermore, the online survey question "If you were to suggest *one thing* to focus on to improve the likelihood that divers would tell context-rich stories that would allow learning, what would it be?" had "the presence of a Just Culture" (19.4%) second only to "An organisational commitment to improved diving safety by capturing, analysing, and sharing near-miss and non-fatal incident stories" (25.8%). The former 'one thing' intrinsically supports the latter in a structured organisational setting, but what about diving?

Notwithstanding the data from both the focus groups and the online survey indicating that a Just Culture is needed, the results also showed that a large percentage of the online survey respondents did not know what a Just Culture was. As such, could the community be looking for something else other than a Just Culture to help share stories for learning purposes but do not know what it is or how to define it?

'Creating' a Just Culture is not simple, even in highly regulated and heavily resourced domains like aviation, healthcare, and oil and gas. In aviation, a Just Culture has its roots in legislation, and even then, it is supported by strong and well-informed leadership within the organisations – these structures and behaviours do not exist in the diving domain. Maybe the

want for a Just Culture has come from the work by this author over the last 13 years, along with others from aviation and healthcare, to promote a Just Culture to help learning without really understanding the deep requirements to create and support one.

Finally, the 'Just' in Just Culture is short for justice, which infers a level of judgement. For judgement to be fair, we hope there is a line between 'right' and 'wrong'. How is such a line defined and managed when dealing with disparate systems of operation (training & 'fun') and multiple CoP, legal jurisdictions, and cultures? As Dekker (2009) highlights, it is not so much where the line is drawn, but rather who draws it.

Maybe, instead of a Just Culture, it should be a 'culture of justness' that should be pursued. A search of Scopus, Researchgate, Consensus.app, and Academia.edu all returned zero papers when searching for "culture of justness", although Barraz's MSc Thesis (2009) looking at the social construction of errors in Air Traffic Control touched on this topic. This appears to be a serious opportunity for future research, especially in a domain that has limited or ineffective structures.

Fear

Artefacts provide observable aspects of the culture of an organisation or group (Schein, 2004, p. 26). Artefacts concerning diving incidents and their reporting include guidance in training materials, what is said or not said by different agencies or CoP, 'folk' stories, and social media posts. One area often overlooked is how 'success' is described when adaptations and deviations from standards are needed to achieve goals. These artefacts create both hidden and overt fear surrounding the willingness to share stories regardless of outcome, and this then leads to a culture of silence.

Fear at the individual level does not have to be rational, and often it is not. The rationality or irrationality will be based on the individual's perception of danger or external circumstances (Crosby, 1976). Rationality is also personal; some things seem irrational to others and communities can create a shared rationality that accepts, and sometimes encourages, risk. Rebreather diving and cave diving are both example of this encouraged risk given the reduction in margins (both in time and space) for recovery in the event that something goes wrong.

Fear does not just exist at the individual level though; it also exists at the organisational level. For example:

> Training Director, Agency #1 (Oct 2023): "…they think that what you're teaching, learning, and discussing is voodoo. And some feel that should they embrace this, they will be opening some unknown can of worms."

There is a fear of the unknown. This is no different to when Nitrox[1] was introduced into the recreational diving space in the 1980s and 1990s, it was considered a 'voodoo gas' and would likely lead to diving incidents and accidents. Despite these initial reservations, the use of Nitrox has improved diving safety by reducing the inert gas loading by replacing nitrogen with oxygen, thereby reducing the likelihood of a decompression sickness (DCS) event. There are other fears at the organisational level: fear of being regulated as an industry, and fear that exposing at systemic issues will bring criticism/litigation because of known issues and the subsequent ethical fading that has taken place (Tenbrunsel & Messick, 2004).

Fear can arise from uncertainty and a lack of control, both of which are present in complex systems. This quote from an Instructor Trainer and Business Development Manager at Agency #3 (Apr 2023) made during a human factors workshop indicates the need to control what happens, and if it cannot be controlled, then 'we' [the agency] cannot be responsible:

[1] A blend of oxygen and nitrogen where the oxygen context is higher than 21% e.g., Nitrox 32 has 32% oxygen and 67% nitrogen, 1% other gases.

> "We don't have an organisation. We have HQ staff. We can't control what happens at the dive centre or diver level."

The author's response to this comment during the workshop was that while the agency could not control what happens, they could influence it, and develop a culture of learning within their own organisation which would then slowly flow out into the wider 'non-training system'. But before any change can happen, there must be an acceptance of a need for change. Henriqson et al., (2014) describe the catalyst for such a need as a 'politically relevant event', although given the distributed and incoherent organisational nature of the sport, it is not clear if such an event would occur in sports diving.

The Linnea Mills case might be such an example because of the connection between agency culture and instructor behaviour and how far this progressed in the legal process. However, it would be easy for training organisations to dismiss the event as being relevant to them because their own instructors and standards would not allow that to happen rather than look at the systemic issues and influencing conditions. They would likely invoke a 'distancing through differencing' bias which reduces organisational learning (D. D. Woods & Cook, 2017). Learning needs to be focused on the learner's needs, not the organisations' needs. The recounting of stories within each CoP can help facilitate this learning as learners pull out what is relevant to them.

Global Underwater Explorers (GUE), a training agency known for its consistently high standards inside the training system, provides a tangible example of how 'control' inside the system through the open publication of standards, long instructor development process and strict quality management, can influence a culture outside of the training system where practice and continual development are not unusual. It is difficult to say if this 'discretionary' compliance outside the training environment is based around fear (peer-judgement) or the recognition that the standards are effective at increasing margin and capacity for performance (Pupulidy & Vesel,

2023. p.27). There is a cost to the agency for this though: it has a reduced market share because of the time taken to become an instructor, and the effort needed to meet the standards of the training courses by students, but they accept this.

At the same time, if the standard is stated by a higher authority, e.g., a regulator, then change is possible as described by Inst3, a course director in Sweden. They described a situation where the Swedish government mandated change following a couple of fatal diving events during diver training programmes, which led to the reduction of the maximum number of students on certain training courses.

The competitive element across the industry can induce fear and reduce trust between organisations, dive centres, and instructors who are vying for a perceived finite pool of clients or customers. To reduce inaccurate feedback, most training agencies have a clause in their instructor agreements that say they are not to disparage another agency or instructor, and any concerns should be given to agency quality management staff. At the same time, feedback to the organisation must be based on first hand observations and often this comes from students who have had a bad experience, so the instructor cannot provide it and the students are fearful of getting their previous 'instructor into trouble'. 'Disparaging' has often been interpreted as no negative feedback but really means a derogatory comment, showing that the instructor has little worth. Feedback based on actions, not the individual, is not disparaging. The informant's narratives indicated that agencies rarely do anything with the feedback provided to them, and so perceived value is lost.

Given the competitive and, in some cases, toxic nature of the industry, there is a fear that internal weaknesses or failings at an organisational level will be used as a lever for competitive advantage by another party. There is also a fear that such weaknesses will attract the attention of lawyers or regulators.

> Director, Agency #2 (Mar 2021) "The agency doesn't have many employees. The instructors rely on the agency to provide their training materials for them. If the organisation was to go bust because internal failings were known about, then it would have a huge impact on people's livelihoods."

Fear could also be about not wanting to find out what is happening 'at the sharp end' by not encouraging frank, context-rich feedback within the system, Heffernan describes this knowing there is an issue but actively hiding from finding it as 'wilful blindness' and in her book of the same name provides many examples of corporations not accepting their role in the development of adverse events (Heffernan, 2011).

Fear is often an intrinsic part of the folk-stories that get told (Waring, 2015). This fear exists despite the lack of substantiated evidence of unfair treatment. Nothing arose in the research narratives although no direct question was asked. The author has asked questions in multiple different social media groups for examples of where litigation has actually happened but has had zero response. This topic came up from a lawyer to the author in a recent podcast (Offgassing Podcast, 2023).

Leadership can create cultural change and reduce the perceived fear through demonstrable action. Hoffman (2012) describes how Alan Mullaly, the then CEO of Ford, changed the culture surrounding failure by congratulating his executive leadership for highlighting issues they had – this was counter to his predecessor's behaviour who punished his leadership when they did not hit targets or had problems. By changing the approach, and reducing fear, performance and success in the organisation improved (Hoffman, 2012).

Notwithstanding the influence of leadership, Schein highlights that there is a paradox surrounding culture: it is both stabilising but also limits learning (Schein, 2004, pp. 393–394).

When feedback is timely, accurate, and relevant, it is possible for the system to improve in a very positive way (Benn et al., 2009; Leach et al., 2001). However, the traditional safety paradigm leads us to focus on the individual and their errant behaviours rather than wider system issues. Extracts from the IANTD, NAUI, PADI and BSAC training manuals relating to the causes of incidents all indicate that it is the diver that is the problem e.g., poor judgment, lack of awareness, overconfidence, and recklessness, rather than looking at systemic issues and the local rationality of those involved. The question can be therefore be asked, are organisations interested in learning about improving safety? Or are they afraid of pulling a thread which might unravel the tapestry of the 'illusion of safety' in the sports diving industry?

> "In practice, error management requires that organisations learn from their threats to safety, identify the underlying causes, and seek out opportunities for change. This commonly involves the introduction of designated incident reporting systems that enable frontline staff to communicate their safety concerns and experiences of error to those responsible for safety and quality. These incident reports then furnish organisations with the necessary information and capacity to make proactive and remedial changes." (Waring, 2005. p. 1928).

Gender

A couple of the informants (all female) identified that gender has an impact on the openness within the debrief and how stories are perceived. Given that the author is male and gender bias is often hard to address internally, it should not come as a surprise this factor was not considered in the literature review.

"I am very hesitant to, a lot more hesitant to debrief properly when a male dive buddy has done something that makes me feel uncomfortable or wrong…If it's a girl, I'd probably be like, ugh…But if I had done that with, if I had been with a male dive buddy and he was kind of leading and he just went up through that, I don't think I would've said anything because I am a little afraid of sometimes the, uh, puncturing the male ego." – RD3

"There is a gendered aspect to the storytelling and diving. I think girls find it a lot easier to share their stories than gents in my experience, and that is, that is girl to girl as opposed to girl to wider public. Well I think even girl to wider public is still, because I think there does tend to be, and it's not everywhere, but I do see a lot of guys that they, they tell the highlights reel, you know? They'll tell a dive incident, but they'll only tell the highlights reel and they'll only tell the stuff that makes them look good or makes them appear to be more experienced or better, the better diver or whatever, you know." – RD1

"CD5 has something to lose. If she shares a story and it goes viral, you have something to lose because you've got all, you know, you've got this massive background in diving and you're an instructor as well. Oh man. She's an instructor and she did this, she's an instructor and she did this. It's different for you guys. I'm just the guy out there diving if I screw up." – CD6

Examining the literature for how gender impacts safety voice (as distinct to employee voice) , there is a potential conflict between risk perception and safety, and speaking up about it. Znajmiecka-Sikora & Salagacka (2022) state that the feminine dimension has been shown to strengthen safe attitudes and minimise risk-taking, while the masculine dimension weakens attitudes towards safety and strengthens risk propensity. While this can help reduce the potential of an adverse event occurring to the individual, the challenge comes when speaking up about concerns. Although the research from Noort et al. did not mention gender in their safety voice

research, Eibl et al., (2020) showed that gender influences employee voice in male-dominated sectors, with women reporting less self-efficacy and less voice, depending on supportive leadership levels. Given the limited number of visible female leaders in the diving sector, and the perception of negative aspects of male ego, speaking up or telling stories is likely to be much harder.

A Culture of Learning

There are different sub-cultures across the diving community. These differences show up in the outputs from the CoP focus group discussions and the themes that were developed. They also show up in the different definitions of risk, incident, a Just Culture, and what 'one thing' should be improved.

One noteworthy area of difference between the CoP is how the cave diving community uses accident and incident analysis as part of their cave diver training curriculum by using Exley's Blueprint for Survival (Exley, 1986) as the basis for learning-focused discussions. Shek was considered a pioneer and serious explorer and holds 'hero' status in the cave diving community. We learn through storytelling, and while diving 'near miss' stories are told inside and outside of the training environment, this initial approach inside the cave diving training system formalises the value and process of telling stories. The narrative from the recreational, instructional, and legal focus groups was that agencies, especially recreational agencies, shy away from discussing adverse events for fear of scaring potential clients away, and until recently, PADI did not mention death or fatalities in their training materials. Not using accurate language to describe risks or behaviours is an example of self-deception or ethical fading (Tenbrunsel & Messick, 2004) and the race to gain market share is a driver for such unethical behaviours. GUE has been criticised by many in the industry for their strict approach to diver training at the recreational

level, but their core value is summarised by the mantra "Beginning with the end in mind." What this means in practice is that the skills, knowledge, and attitudes required for exploration diving are delivered to divers early on in their development, so they are ingrained, much like aviators are exposed to CRM during their ab initio training. Culture development starts early, and some have commented that GUE is cult-like because of this approach. Unfortunately, there is a negative side to this 'commitment to excellence' and that is the reduced inability to discuss failures for fear of tarnishing the organisational reputation. This is not much different to surgeons and their code of silence (Nashef, 2015).

The focus group and survey data show that the complex nature of diving incidents is often not recognised until a discussion occurs and the narrative can be explored. The development of tools like Learning Teams, Learning Reviews and Local Rationality Investigations have shown the value in understanding the context to make improvements. The theoretical and practical knowledge of human factors and systems learning is limited in the diving domain, and therefore if learning from adverse events is to happen, there is a level of education needed to create change. A post on The Human Diver Facebook Group (19 May 2023, 11:20) highlights this frustration:

> "Also important because -- if everything is equally well written -- the context will provide simply more information. Unfortunately, it goes counter the desire to quick "solutions". It is a problem I often have with online (or offline) discussions about diving incidents: People are very quick in saying "I want to hear about incidents so that I can learn!". But then, very often what follows is a cursory reading of an abbreviated report, and then "Yes, sure, this was reckless!". "With better training this would never...". "Play stupid games...". "Darwin!". It unfortunately often is cargo cult science, as Richard Feynman famously said: people do something that to them superficially looks like an analysis, in the hopes that absolution ("It can never happen to me anyhow, I would not have done that!")

will come."

What one thing?

The final question in the survey asked respondents to prioritise the one thing that would make a difference to improved reporting and story-telling in sports diving. The options provided were all systemic in nature. The top-rated output was "An organisational commitment to improved diving safety by capturing, analysing, and sharing near-miss and non-fatal incident stories" (25.8%) and the second was the presence of a Just Culture in the industry (19.4%). These questions were based on an aviation survey, where an understanding of a Just Culture was likely high. The Tech, CCR, and Cave CoP within the survey all stated that they believe a Just Culture was needed to facilitate context-rich storytelling.

However, care must be taken in interpreting some of this data given the lack of understanding within the community about what a Just Culture actually means. As described earlier, if learning is wanted, is it a Just Culture that is needed to support this, or is it a "culture of justness"? From the author's personal experience of delivering workshops inside and outside of diving, there is a confusion between psychological safety and a Just Culture, and this will likely impact these results and associated meanings.

The low numbers supporting an easy-to-use reporting system by instructors is interesting, maybe because they believe they do not have issues, or if they do, maybe they do not see the need to or want to report given the litigious nature of the industry. Indeed, PADI has the following written at the top of their incident report forms:

"This incident report is being prepared in the event of legal action."

While this message shows the reporter that the contents could be used as evidence in a court case and so are part of the 'work product', it does not exactly encourage instructors to talk about the goals conflicts, workarounds, and adaptations that are part of 'normal work' or 'work as done' (Boskeljon-Horst et al., 2022). The story that could be told here is 'Only tell what you want people to know you've done.'

The Cave CoP response about the confidence that learning stories would be treated correctly aligns with the comments from the cave FG where there was fear of peer criticism and so the story would only be shared to a few trusted individuals, and if went wider than that, there was no control of what happened to it. This would often lead to incorrect, ill-informed, or judgmental comments because the commentator did not have the full context (CD6).

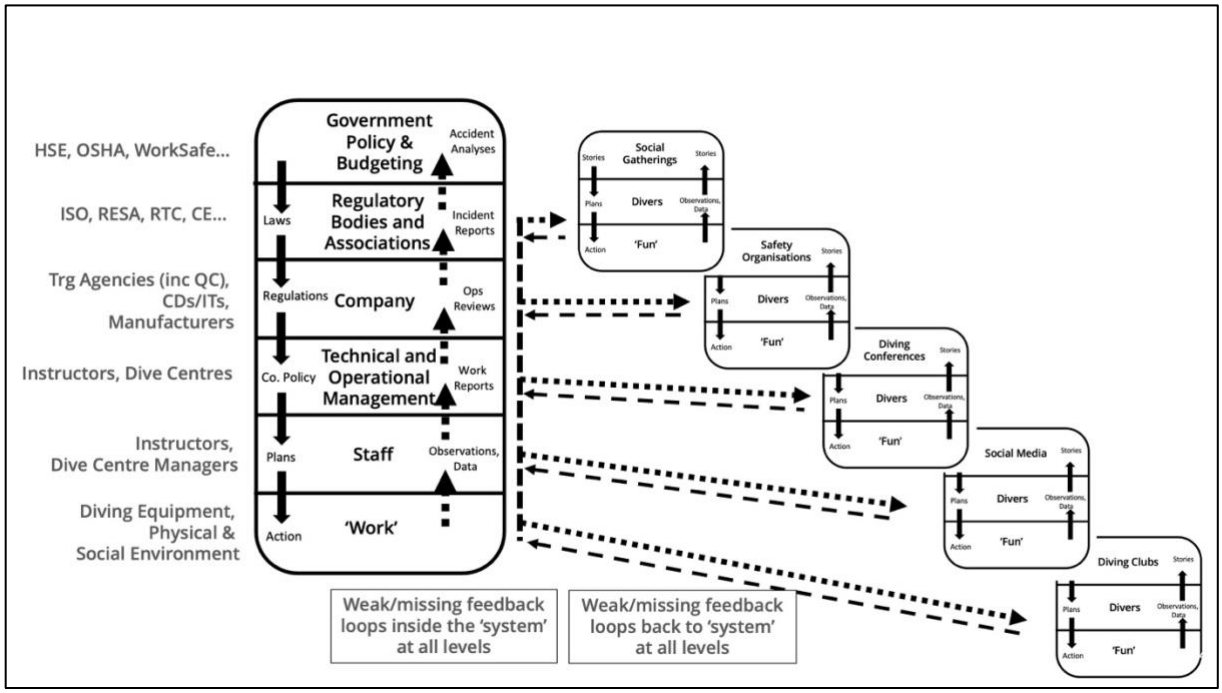
While the highest score was that of the need to improve organisational approaches to story-telling as they relate to non-fatal diving adverse events, all of these factors have connections with other aspects of telling context-rich stories following an adverse event with a view to learning. Given the complexity of each topic, and how each CoP perceives them, each one of the columns or topics shown in Table 9 could provide the starting point for future research projects.

'Feedback as Done'

Earlier in the thesis, a modification of Rasmussen's system model was developed to show the diving industry. However, the sections that followed showed how this was an 'imaginary' model, and a closer reality of the feedback opportunities inside and outside of the training system are shown at **Error! Reference source not found.**.

Figure 6:

'Work as Done' system model based on Rasmussen (1997) showing weak or missing feedback loops from outside formal training system as well as weak/missing internal feedback loops



Linked to this control and feedback model, the question is asked, "Who is responsible for safety and quality in diver training organisations?" Especially as the agency staff also make up the representatives for the 'Regulatory Bodies and Associations' (World Recreational SCUBA Training Council and the Rebreather Training Council) in Rasmussen's model. Are those in role suitably qualified experienced personnel (SQEP)? The author's experience is that those in safety or quality roles in training agencies have little to no formal qualification or experience in quality management or safety management systems despite the activity taking place in an austere environment. Maybe risk management should be afforded a potentially higher priority but the majority of those fulfilling these roles are doing it on a part-time basis where the major organisational focus for risk management could be perceived to be protecting the organisation and increasing revenue.

Despite complying with ISO standards (which requires a feedback process), the diving training system intentionally and unintentionally creates gaps and barriers that make it hard to

provide feedback to the system. Instead of having many opportunities to learn, those opportunities that are available and used are few and far between. When 'errant' individuals are found, anti-heroes can be created because it is easier to blame them than look wider (Dekker et al., 2013). Examples include the Linnea Mills case (Mills v Gull Dive Center PADI, 2022), the case of Brian Bugge (Lock, 2020), and Nigel Craig who was accused of holding a diver down during an emergency ascent (Weinman, 2022). The lack of learning is reinforced because often after the litigation has been finalised, the context and associated learning is not shared. However, LA2 stated that once a case has been settled, there is not anything to stop all parties from releasing evidence as their client/attorney privilege is no longer valid. This would be a major step forward to improved learning opportunities.

Organisational and Culture Factors - Summary

Lewin stated that behaviour is a function of the individual and their environment (TWOWP, 2019). This holds true for divers operating within their socio-technical system and what makes it easier or harder for them to report or talk about adverse events. There is a need to develop the environment in which context-rich storytelling can flourish, and this is done by understanding and addressing the higher-level factors that support or preclude learning. As Drupsteen et al., (2013) identified, the effectiveness of incident reporting is not just improving the collection of narratives, there is also a need to focus on the evaluation of the event and the potential learning that comes from it. Improving the learning from incidents should be considered as a wider system process rather than discrete steps e.g., putting a reporting website together.

It could be argued that a 'culture of learning' is present, but if so, is this culture based around learning from adverse events and successes, or just focused on compliance so that liability

and, potentially reputational risk, are limited? To be able to operate in a dynamic, uncertain, and austere environment like diving, there is a need to develop a culture that supports the telling of context-rich stories to facilitate learning and reduce the many facets of fear that are present. Paradoxically, unmasking the threat can reduce the power it has over us.

Waring describes similar issues in healthcare, "although the fear of blame may indeed be a substantial barrier to reporting, there is little consideration for other cultural factors that could also influence participation in incident reporting." (Waring. 2005, p. 1929). More work is needed to examine the similarities and differences to see what can be learned from elsewhere.

The Event, The Context, How and What to Tell

If we now move from the higher organisational and cultural factors down to a more tactical or practical level, we can see that just saying 'report more incidents' is not enough, and this is where the interdependence between these two supra- and eight sub-themes manifests itself.

What is an Incident?

Examining some of the training manuals from the training agencies (which is where most divers get their initial knowledge from) the definition of an incident is either inconsistent or missing. This means that outside of the training environment, the meaning of an incident is also unclear and inconsistent. This leads to the question "What should divers consider as important or relevant when looking to tell a story?"

Table ***12*** shows results from the online survey, and these indicate that an incident is something that is caused by deviating from the plan, has some potential for harm or actual harm, and likely involves some form of equipment or protocol issue.

Table 12:

Thematic definitions for 'What is an Incident?' from online survey

	Theme 1	**Theme 2**	**Theme 3**	**Theme 4**	**Theme 5**
Composite across 3 sessions and all participants	Deviation from Plan	Potential for Harm or Actual Harm	Near Misses	Equipment or Protocol Issue	Negative Outcome or Adverse Events

Seeing that nearly every dive will deviate from the plan, and there is always the potential for harm because diving takes place in a non-life sustaining environment, there is a need to understand the combination of factors that lead to an incident or adverse event. Current reporting systems focus on outcomes e.g., hypoxia, uncontrolled buoyant ascent, or decompression sickness. While such an outcome-focused approach is considered simplistic in more advanced domains like aviation or nuclear, it may help reporting. Having an open definition means that the responsibility is placed on the diver to determine if something is an incident, and often they do not know what they do not know. A lack of self-awareness and the absence of debriefs further exacerbates this issue.

> "Half of the people wouldn't even know how to reflect on it because they basically probably didn't even realize that an incident happened or that something had all of these contributing factors that, that that, that, that in the end turned into something that was suboptimal… I guess that it's different in club environments because from the people that I know who dive in clubs there, you have more of planning debriefing cycle happening, but in a holiday setup, it's just not there at all. And I think what we need to understand is that…the majority of them is holiday divers in one shape or form." – RD2

The individual diver's definition of an incident will likely be linked to their perception of risk (see 'What does 'Risk' mean?', composite themes 2 and 3), and the results showed that the perception of what risk means is inconsistent within the CoP but also across the different CoP. This should not come as a shock given the research on how perceptions of risk vary based on many different factors (Adams, 1995; Pupulidy & Vesel, 2023). What risk meant within the online survey respondents who were instructors was interesting – they focused primarily on controls and mitigations – none of their themes matched the key themes identified in the Pareto analysis. This might be because of the strong focus during professional diver development (instructor and divemaster) on compliance and the fear of litigation which comes from not managing operational (in-water) risk.

The organisational influence about what defines an incident should not be forgotten. The diver training agency materials reviewed from IANTD, NAUI, PADI and SDI/TDI firmly put the focus on human error or violations as causes of incidents and therefore it is unsurprising that divers do not report in a 'blame culture' because no-one wants to look bad or have punitive action applied. Waring (2005. p. 1934) describes exactly this point in healthcare as a validation for not reporting, so we should not be shocked it is present in diving.

The Context – The How and What to Tell

It was evident from the focus group conversations that more context led to a greater likelihood that a learning opportunity would be presented. Informants described how once they understood the wider context surrounding the event, they would be less likely to judge and more likely to share.

"I think that in the people that I know, people aren't that shy about sharing a thing happened and some facts about the thing…but I think connecting those dots…knowing that you need to provide more context so that you can connect those dots…you could take away from that, that story..." – RD3

"I just kind of was struck that it's not just shorter. It's like the perspective is different." – RD3

"I've never run out of air before and I'm annoyed at myself with that happening…it appears to be the learning is about the preparation rather than the execution…I think that'd be good to share more of that." – TD3

"The more information you can have, the more you can, you know, try to understand and take inputs from it." – TD1

During the cave focus group, one of the informants (CD3) was quite animated about a theoretical incident where their buddy had compromised breathing gas minimum pressures and would have immediately got out of the water and, without a debrief taking place, "ripped him a new one when we got back to the parking lot". However, after one of the other informants (CD4) told an account where they had nearly run out of gas on a cave dive because of multiple distractions and high workload, CD3 recognised that context mattered. CD4 said that they had not shared this story with anyone in the two years since the event happened – not even to his team mate on the dive – and the presence of a learning environment inside the focus group allowed the story to be shared without fear of reprisal, even after the comments that CD3 had made. The trust was created within this setting by the author and showed that a learning environment could be developed relatively quickly, but it required an informed leader to facilitate it within the 'team'. This might have been perceived as a Just Culture by the informants, but given the organisational requirements for a Just Culture, was it one? Edmondson (1999) describes

the ability to share stories for learning in her original work in the healthcare domain where learning was facilitated when there was shared trust within the team.

Looking at the instructor focus group, there was concern that context-rich stories would likely include deviations, modifications, trade-offs, and violations of standards and these would be like gold dust to the lawyers following through a litigation attempt. What was suggested was a system whereby learning stories could be protected like the NASA ASRS.

> "But if you made an error when you were teaching and this is what you learned from it, it may have been a standards violation. Don't, don't police them for it. Have an anonymous way they can actually share the story so somebody can go off and learn from it." – Inst5

As a number of safety leaders have said 'You can learn or blame, you can't do both.' Given the reputation that lawyers have, it was a surprise to hear that they supported the sharing of context-rich narratives. Their perspective was that it helps explain disparity between narratives, it can show where certain narratives cannot be true through 'black box data', it provides much greater understanding of what happened compared to what is in an incident report, and so

> "...families could understand what's happened, why it's happened…The research is clearly shown in the States reduced litigation because people understand what's happened. Understand it's perhaps not as black and white as 'someone messed up' and now my relative is dead'. It's more nuanced than that." – LA2.

Note, both lawyers normally acted in the defence domain, and this may influence their perspective.

Finally, without context, the application of the fundamental attribution bias or error means that individual actions in failed or erroneous situations are likely to be the focus of discussion. This focus means that the ability to extract learning from the wider situational factors is severely limited.

The Learning Opportunities

Within the online survey there were seven mentions of learning or a learning opportunity as part of the response to "What is an Incident?". The phrase 'lessons learned' is often used as a way of describing the benefit of sharing adverse events and their 'causes', but if the surveyed diving community does not see incidents as learning opportunities, then something is amiss.

Notwithstanding this, the different CoP focus groups could see the benefits to sharing adverse events.

> "Celebrate those calling stories out there, you know, calling a dive. Cause to me, that's a learning opportunity to say, actually here's an example of somebody thumbing a dive…I think that that should be, the more that's shared, the more likely people will do it…you know, especially when experienced, God, let's call them, you know, famous, call something that's much more important." – TD3

> "I really do feel that every instructor in every one of their classes should be sharing a story that establishes them as a human and not some kind of demi-god…If the instructor can establish with their students that I've screwed up. Meaning 'you will probably screw it up. It's okay to talk about it.' students will typically trust their instructors and if they see someone they trust saying, 'Yep, this, this happens to all of us, it's totally normal.' they might, then it is very much changing the next generation of divers." – Inst5

> "I would bring it up on staff meetings so everybody could share and talk about, okay, this near miss here, what could we have done differently? So everybody got involved and this really changed a lot of things around in the general community, diving community cuz all of these people, we had about 50 instructors at that time, and, and they all knew each

other. There was roughly 150 around in [city]. So we had one third of them, but everybody knew each other. And there was a huge change that came out. This, I think most of the other shops also copied what we did." – Inst3

"I think we, we could also, we're not just, every time someone has a near miss or a minor incident, they get turned off to scuba diving. I think if we look at this as people are, are safer and more comfortable and happier scuba diving, they're gonna scuba dive more." – Inst1

However, there were many organisational and cultural factors that reduced or removed the opportunity to share these events and the associated stories – see the previous section for more about this.

Individual learning requires a number of factors to be in place, not least the want to learn and the acceptance that change will likely be needed. However, some divers and instructors, including influencers and mentors, do not appear to want to change:

"I find it very difficult to find people that have the same kind of interest in improving and making things better and changing things in, in my area. I'm in the Northeast United States where it was kind of the wild west of wreck diving, and all the books that you've read about. Those guys are the peers of my mentors. And it's just a completely different approach and a less academic approach. It's, you know, 'we've always done it this way. This is the way we do it.' And if you talk to people about safety, they know the things. They will parrot the things, but then you watch them, and they don't do all the things that they tell you that we should do.…I think in their minds, they are doing it. I think there's a big disconnect in what those other incompetent instructors do and what we do…You know, we break the rules, but we know how to break the rules." – Inst1

The above is not universally true as there are some very experienced instructors who have overtly embraced the concepts of human factors and system safety, and actively demonstrate context-rich storytelling following an adverse event, nevertheless, they are the minority.

The Event, the Context, and How to Tell - Summary

Creating the higher-level social, cultural, and organisational structural conditions is important to allow stories to be told and shared. At the same time, the lower-level factors also need to be considered so that the 'right' stories are told, stories that help divers learn and develop, moving from novice through to expertise and mastery. These stories need to move away from the simple, linear accounts that focus on counterfactuals and personal failure, and should expand into understand the context and the local rationality of those involved.

Divers often lack guidance about what an event is, the value of context, how to incorporate it into their stories, and where and how to tell that story to get the maximum effect. Even if wider organisational learning is not possible, addressing the factors in this section will help the local sub-cultures, teams, and dive centres improve their safety and performance.

Summary of Discussion

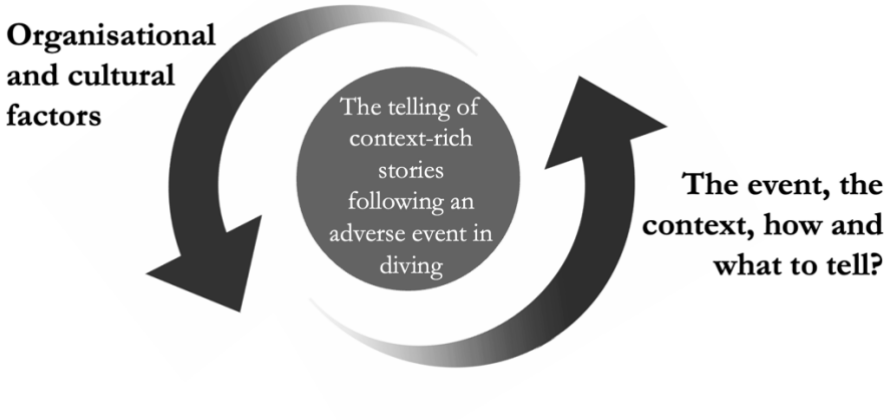
Error! Reference source not found., modified from a leadership/followership model by Chaleff (2009), is developed from synthesising the findings and explicating the relationship between the two key themes and the central point about what factors influence the telling of context-rich stories following an adverse event in diving.

The four sub-themes for each key theme orbit and influence their own and the other key theme as well as the central point. As Drupsteen et al., (2013) pointed out, each of the steps or the topics in a reporting system cannot be treated in isolation and a holistic approach needs to be considered if storytelling is to be encouraged such that learning can occur.

Individual and organisational learning are also intertwined, with the culture of learning developed by the leaders within the system. Those leaders do not have to hold official titles and exist within the 'training system', but can be explorers, mentors and coaches who also dive outside the training system because their role is more about influence than control. Control has limited effect in a complex system where there are multiple competing goals and constraints.

Figure 7:

Interactive model of factors influencing the telling of context-rich stories following an adverse event in diving.



Finally, Waring (2005) states that it is too easy to focus on technical issues, blame, and fear as limiting factors when it comes to incident reporting, and as such, wider cultural and contextual factors also need to be consider if improvement is to occur. The interdependent nature of these factors leads us to the conundrum, which 'piece of the elephant' do you eat first and what is

going to make the biggest impact? In a complex domain, there is no easy answer, and multiple micro-experiments are therefore needed (Snowden & Rancati, 2021).

Research Limitations

The need to understand what influences the telling of context-rich narratives following an adverse event is a global challenge, and not just limited to the sports diving community. To maximise reach, a diverse global audience was approached via social media. Those who responded were a self-selecting audience and so there would already be a bias present to those who informed the study. To reduce the bias associated with diving experience and location, a cross-section of respondents covering experience, location, gender, and age was taken for each focus group. However, for the cave focus group, the predominant home location for informants was Florida with only one informant from Mexico attending. This will have likely skewed the data towards a North American and Floridian culture which is recognisable but atypical.

Focus groups and interviews provided 17 individual and numerous emergent group perspectives of the problem. To gain a wider, but potentially shallower perspective, the online survey respondents yielded 672 views of the factors that influence story-telling. Both populations were self-selecting, and so may not provide a full picture of the problems faced when trying to improve story-telling in diving. Expanding this research to more individuals, both geographically and culturally, might yield new factors, especially as the education surrounding human factors and just culture improves and this aligns with the one of the themes that emerged - *'you do not know what you do not know'* as it applies to the incident developing, the influential factors, and how to tell a learning-focused story.

Finally, given the prominence of social, cultural, and organisational factors, it is shame that the training organisations did not accept the invitations to be part of a focus group to get their experiences and thoughts. It would have certainly provided more richness to the research and obtained the perspective of the other end of the telescope.

"Knowledge is not enough. We must apply. Willing is not enough. We must do." - JW Goethe

Conclusion

Stories exist at all levels within a system. Stories take different forms depending on the goal, purpose, agenda, narrator, or audience. Some stories cannot be told because the narrator does not know what to tell, some cannot be told because the storyteller is emotionally or psychologically traumatised, and some are not told because those involved are protecting their organisations for commercial reasons. There are multiple stories that are not being told in the world of diving and many of them would provide opportunities for learning by helping other divers understand the conditions surrounding a potential event, and what to do when the trajectory of an event starts to be more identifiable and tangible.

This research focused on what factors influence the telling of context-rich storytelling following an adverse event. These factors were expected to exist at all levels within the system, from high-level organisational and cultural factors, as well as individual and practical issues. Following quantitive analysis of four focus groups, two interviews and an informant's letter, a Pareto analysis approach was used to reduce the 55 factors identified to two supra-themes and eight sub-themes. At the higher levels, these included particular social, cultural, and organisational factors relating to training agencies and the CoP, the tensions that exist between learning, litigation and speculation, the trust between and across the system, and finally the 'fear of…' many different outcomes. At the lower levels relating to an event itself, these factors focused on understanding what an event was, the context surrounding the event, how and what to tell to create a learning-focused story.

These eight lower-level factors are interdependent, having interactions up and down, and across the system. This complex interaction is also not unexpected, but the findings highlight the

importance of leaders within the system to help create change; not just those who hold formal leadership positions within the organisations, but also those who are role models (instructors, mentors, and explorers) who can influence change bottom up.

Without a clear idea of the value of reporting following an adverse event in diving, and the change that can be possible, along with what clearer idea what an event is, what language to use to describe the event and the associated context, then the attribution of causes surrounding diving incidents and accidents will continue to be focused on the individuals. This means that the wider, contributory factors and performance shaping factors associated with an adverse event, and likely common across many incidents, will be missed, or actively ignored through wilful blindness.

This research has shown that the more context a diving incident story has, the easier it is to understand the local rationality, and importantly, more likely that the stories would be shared. The informants also demonstrated that they had not considered the relevance or importance of factors in the wider context, and therefore, would not have thought to include it in incident narratives. But for such a context-rich story to be shared, there must be a level of trust that the story will not be treated negatively, maybe through a 'culture of justness' or something similar.

The lack of quality data from internal (agency) or external (safety organisation) reporting systems means that the organisations do not know what to address even if they were not (in the author's opinion) wilfully blind. The fallacy that the absence of data is absence of a problem is very much present in the diving community. The two key suggestions from the informants were the need to improve, or even establish, the ability to tell context-rich stories, led by the training agencies, and to support this, the presence of a Just Culture in the diving industry is required. The presence of a Just Culture may be the wrong term because it was not clearly understood, but nevertheless, something social and cultural that facilitates learning. These will not be easy, given

the litigious nature of the industry, but that does not mean such improvements should not be attempted.

Future research opportunities are identified in Appendix 6.

References

Mills v Gull Dive Center *PADI* (2022). https://www.scribd.com/document/555406095/Mills-v-Gull-Dive-Center-PADI-2nd-Amended-Complaint

ABA. (n.d.). *Growth of the Legal Profession*. ABA: Profile of the Legal Profession 2022. https://www.abalegalprofile.com/demographics.php#:~:text=To%20be%20more%20precise%2C%20there,one%2Dtenth%20of%20one%20percent

Acott, C. (2003). Recreational scuba diving equipment problems, morbidity and mortality: An overview of the Diving Incident Monitoring Study and Project Stickybeak. *South Pacific Underwater Medicine Society (SPUMS) Journal*, *33*.

Adams, J. (1995). *Risk*. UCL Press.

Adu, P. (2019). *A step-by-step guide to qualitative data coding*. Routledge.

Allen, J. A., Reiter-Palmon, R., Crowe, J., & Scott, C. (2018). Debriefs: Teams Learning From Doing in Context. *Am. Psychol.*, *73*(4), 504–516. https://doi.org/10.1037/amp0000246

Argyris, C., & Schön, D. A. (1997). Organizational Learning: A Theory of Action Perspective. *Rev. Esp. Invest. Sociol.*, *77/78*, 345. https://doi.org/10.2307/40183951

Barraz, S. (2009). *Are Errors In Air Traffic Control Socially Constructed And Do They, As A Result, Get Put Into Categories And Managed Differently? Vol. MSc* [MSc]. Lund.

Benn, J., Koutantji, M., Wallace, L., Spurgeon, P., Rejman, M., Healey, A., & Vincent, C. (2009). Feedback from incident reporting: Information and action to improve patient safety. *Qual. Saf. Health Care*, *18*(1), 11. https://doi.org/10.1136/qshc.2007.024166

Bitar, F. K., Chadwick-Jones, D., Nazaruk, M., & Boodhai, C. (2018). From individual behaviour to system weaknesses: The re-design of the Just Culture process in an international energy company. A case study. *J. Loss Prev. Process Indust.*, *55*, 267–282. https://doi.org/10.1016/j.jlp.2018.06.015

Boskeljon-Horst, L., Boer, R. J. D., Steinmetz, V., & Dekker, S. W. A. (2023). Aircrews, Rules and the Bogeyman: Mapping the Benefits and Fears of Noncompliance. *Safety*, *9*(1), 15. https://doi.org/10.3390/safety9010015

Boskeljon-Horst, L., De Boer, R. J., Sillem, S., & Dekker, S. W. A. (2022). Goal Conflicts, Classical Management and Constructivism: How Operators Get Things Done. *Safety*, *8*(2), 37. https://doi.org/10.3390/safety8020037

Boskeljon-Horst, L., Snoek, A., & van Baarle, E. (2023). Learning from the complexities of fostering a restorative just culture in practice within the Royal Netherlands Air Force. *Saf. Sci.*, *161*, 106074. https://doi.org/10.1016/j.ssci.2023.106074

Bryce, C., & Dowling, M. (2024). The road to olympic failure is paved in poor risk management. *Safety Science*, *169*, 106331. https://doi.org/10.1016/j.ssci.2023.106331

BSAC: Annual Diving Incident Report. (n.d.). Retrieved 29 January 2023, from https://www.bsac.com/safety/diving-incidents/annual-diving-incident-report/

Catino, M. (2008). A Review of Literature: Individual Blame vs. Organizational Function Logics in Accident Analysis. *Journal of Contingencies and Crisis Management*, *16*(1).

Catino, M. (2009). Blame culture and defensive medicine. *Cognition, Technology & Work*, *11*(4), 245–253. https://doi.org/10.1007/s10111-009-0130-y

Chan, W. T.-K., & Li, W.-C. (2023). Development of effective human factors interventions for aviation safety management. *Frontiers in Public Health*, *11*, 1144921. https://doi.org/10.3389/fpubh.2023.1144921

Clark, T. (2020). *The 4 Stages of Psychological Safety: Defining the Path to Inclusion and Innovation* (1st ed.). Berrett-Koehler Publishers.

Clarke. (2023). *Risk Management for Diving Professionals*. ScubaGuru Academy. https://www.scubaguruacademy.com/p/risk-management-for-diving-professionals

Cook, R. (2018). Resilience, the second story, and progress on patient safety. In *Resilient Health Care* (pp. 19–26). CRC Press. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85074624328&partnerID=40&md5=025703f19cbb16b7ba8379db314c246a

Cox, J. A., McLean, S., Hulme, A., Read, G. J. M., & Salmon, P. M. (2024). An incident reporting and learning system to understand cycling incident causation in Australia: A 12-month implementation of CRIT. *Safety Science*, *171*, 106392. https://doi.org/10.1016/j.ssci.2023.106392

Cromie, S., & Bott, F. (2016). Just culture's "line in the sand" is a shifting one; an empirical investigation of culpability determination. *Saf. Sci.*, *86*, 258–272. https://doi.org/10.1016/j.ssci.2016.03.012

Crosby, J. F. (1976). Theories of anxiety: A theoretical perspective. *The American Journal of Psychoanalysis*, *36*(3), 237–248. https://doi.org/10.1007/BF01252989

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process* (1st ed.). SAGE Publications. https://www.taylorfrancis.com/books/9781000249569

Dekker, S. (2012). *Just culture: Balancing safety and accountability* (2nd edition). CRC Press.

Dekker, S. (2014). *The field guide to understanding 'human error'* (Third edition). Ashgate.

Dekker, S. (2017). *Just culture: Restoring trust and accountability in your organization* (Third edition). CRC Press, Taylor & Francis Group.

Dekker, S. W. A. (2009). Just culture: Who gets to draw the line? *Cogn. Technol. Work*, *11*(3), 177–185. https://doi.org/10.1007/s10111-008-0110-7

Dekker, S. W. A., Nyce, J. M., & Myers, D. J. (2013). The little engine who could not: "Rehabilitating" the individual in safety research. *Cognition, Technology & Work*, *15*(3), 277–282. https://doi.org/10.1007/s10111-012-0228-5

Denoble, P. J., Caruso, J. L., Dear, G. de L., Pieper, C. F., & Vann, R. D. (2008). Common causes of open-circuit recreational diving fatalities. *Undersea Hyperb. Med.*, *35*(6), 393–406.

Dreyfus, S. E., & Dreyfus, H. L. (1980). *A five-stage model of the mental activities involved in directed skill acquisition*. CALIFORNIA UNIV BERKELEY OPERATIONS RESEARCH CENTER. https://apps.dtic.mil/sti/citations/ADA084551

Drupsteen, L., Groeneweg, J., & Zwetsloot, G. I. J. M. (2013). Critical Steps in Learning From Incidents: Using Learning Potential in the Process From Reporting an Incident to Accident Prevention. *Int. J. Occup. Saf. Ergon.*, *19*(1), 63–77. https://doi.org/10.1080/10803548.2013.11076966

Drupsteen, L., & Guldenmund, F. (2014). What Is Learning: A Review of the Safety Literature to Define Learning from Incidents, Accidents and Disasters. *Journal of Contingencies and Crisis Management*, *22*(2), 81–96. https://doi.org/10.1111/1468-5973.12039

EC. (2014). *Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014*. EC.

Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Adm. Sci. Q.*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Edmondson, A. C. (2004). Learning from Mistakes is Easier Said than Done: Group and Organizational Influences on the Detection and Correction of Human Error. *J. Appl. Behav. Sci.*, *40*(1), 66–90. https://doi.org/10.1177/0021886304263849

Edmondson, A. C. (2019). *The Fearless Organization*.

Eibl, B., Lang, F. R., & Niessen, C. (2020). Employee voice at work: The role of employees' gender, self-efficacy beliefs, and leadership. *European Journal of Work and Organizational Psychology*, *29*(4), 570–585. https://doi.org/10.1080/1359432X.2020.1733979

Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors: The Journal of Human Factors and Ergonomics Society*, *37*(1), 32–64. https://doi.org/10.1518/001872095779049543

Epstein, B. (2018). *Social Ontology: 4. How Social Categories and Kinds Are Set Up*. Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/social-ontology/#HowSociCateKindSetUp

ESReDA. (2015). *Barriers to learning from incidents and accidents—ESReDA guidelines*. ESReDA Project Group.

Exley, S. (1986). *Basic Cave Diving—A blueprint for survival*. National Speliological Society - Cave Diving Section. https://nsscds.org/wp-content/uploads/2018/05/Blueprint-for-Survival.pdf

Fletcher, S. (2011). *Assessment of manual operations and emergency procedures for closed circuit rebreathers* (RR871). HSE Books.

Gherardi, S., Nicolini, D., & Odella, F. (1998). What Do You Mean By Safety? Conflicting Perspectives on Accident Causation and Safety Management in a Construction Firm. *Journal of Contingencies and Crisis Management*, *6*(4), 202–213. https://doi.org/10.1111/1468-5973.00089

Gigerenzer, G. (2014). *Risk Savvy*. Viking.

Goode, N., Salmon, P. M., Lenne, M., & Finch, C. (2018). *Translating systems thinking into practice: A guide to developing incident reporting systems*. CRC press. https://www.taylorfrancis.com/books/mono/10.1201/9781315569956/translating-systems-thinking-practice-paul-salmon-caroline-finch-natassia-goode-michael-lenne

Hallowell, D. M., Quashne, M., & Quinn, E. (2020). *The Statistical Invalidity of TRIR as a Measure of Safety Performance*.

Heffernan, M. (2011). *Wilful Blindness: Why We Ignore the Obvious*. Simon and Schuster. https://play.google.com/store/books/details?id=JWSeefc607cC

Henriqson, É., Schuler, B., van Winsen, R., & Dekker, S. W. A. (2014). The constitution and effects of safety culture as an object in the discourse of accident prevention: A Foucauldian approach. *Saf. Sci.*, *70*, 465–476. https://doi.org/10.1016/j.ssci.2014.07.004

Heraghty, D., Dekker, S., & Rae, A. (2018). Accident Report Interpretation. *Safety*, *4*(4), 46. https://doi.org/10.3390/safety4040046

Hoffman, B. G. (2012). *American Icon: Alan Mulally and the Fight to Save Ford Motor Company*. Crown. https://play.google.com/store/books/details?id=1e_FjpDvMKkC

Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations*. SAGE. https://play.google.com/store/books/details?id=w6z18LJ_1VsC

ICAO. (2016). *Aircraft accident and incident investigation: Annex 13 to the Convention on International Civil Aviation* (11th edition). International Civil Aviation Organization.

ICAO. (2018). *Doc 9859—Safety Management Manual. 4th Ed. 2018*. ICAO.

Jeong, H.-S., & Brower, R. S. (2008). Extending the Present Understanding of Organizational Sensemaking: Three Stages and Three Contexts. *Administration & Society*, *40*(3), 223–252. https://doi.org/10.1177/0095399707313446

Kas, S. (2020). *Close Calls*. Because i can ltd.

Kieran, D. (2023, December 6). *It's The Data, Silly: A Lookback at 2023 and a Peek at 2024 for Scuba Diving Market Surveys & Studies*. InDepth. https://gue.com/blog/its-the-data-stupid-a-lookback-at-2023-and-a-peek-at-2024-for-scuba-diving-market-surveys-studies/

Klein, G. A. (1993). A Recognition-Primed Decision (RPD) Model of Rapid Decision Making. In O. Klein, G.A. J. ,. Calderwood, R. &. C. E. Zsambok (Ed.), *Decision making in action: Models and methods* (pp. 138–147). Ablex Publishing.

Klein, G., Calderwood, R., & Clinton-Cirrocco, A. (1986). Rapid Decision Making on the Fire Ground. *Proceedings of the Human Factors Society Annual Meeting*, 5. https://doi.org/10.1177/154193128603000616

Kruger, J., & Dunning, D. (1999). *Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments*. 34.

Leach, D. J., Jackson, P. R., & Wall, T. D. (2001). Realizing the potential of empowerment: The impact of a feedback intervention on the performance of complex technology. *Ergonomics*, *44*(9), 870–886. https://doi.org/10.1080/00140130118918

Little, R. M., & Froggett, L. (2010). Making meaning in muddy waters: Representing complexity through community based storytelling. *Community Development Journal*, *45*(4), 458–473. https://doi.org/10.1093/cdj/bsp017

Lock, G. (2011). *The Application of the Human Factors Analysis and Classification System (HFACS) to Improve Diving Safety*. https://drive.google.com/file/d/1Iz3qR-Ryo2NjdiBGbPcRhj14NoCTuuM4/view?usp=share_link

Lock, G. (2019). *Under Pressure: Diving Deeper with Human Factors*. Vision Maker Press.

Lock, G. (Director). (2020). *If Only...* The Human Diver. https://www.thehumandiver.com/ifonly

Lock, G. (2022, December). *Learning from Unintended Outcomes*. https://www.youtube.com/watch?v=YTWsmS_qDg0

Lukic, D., Margaryan, A., & Littlejohn, A. (2010). How organisations learn from safety incidents: A multifaceted problem. *Journal of Workplace Learning*, *22*(7), 428–450. https://doi.org/10.1108/13665621011071109

MacLeod, N. (2021). *Crew resource management training: A competence-based approach for airline pilots* (First edition). CRC Press.

McCleod, R. W. (2019). *Learning from Adverse Events*. CIEHF.

Meadows, D. H. (2009). *Thinking in systems: A primer*. Earthscan.

Murphy, V. L., Littlejohn, A., & Rienties, B. (2022). Learning from incidents: Applying the 3-P model of workplace learning. *Journal of Workplace Learning*, *34*(3), 242–255. https://doi.org/10.1108/JWL-04-2021-0050

NASA. (n.d.). *Safety Culture: NASA Safety Culture...It's in Our DNA*. Safety Culture: NASA Safety Culture...It's in Our DNA. https://sma.nasa.gov/sma-disciplines/safety-culture

Nashef, S. (2015). *The Naked Surgeon: The power and peril of transparency in medicine*. Scribe Publications.

Nield, D. (2023, April 30). *How ChatGPT and Other LLMs Work—And Where They Could Go Next*. Wired. https://www.wired.co.uk/article/how-chatgpt-works-large-language-model

Nyce, J., Henglebrok, N., and Modell, S.J. (2022). Rhetoric, Responsibility and Change in a State's Child Protective Services. *The Applied Anthropologist*, 11–21.

O'Connor, P. E. (2007). *The nontechnical causes of diving accidents: Can U.S. Navy Divers learn from other industries? 34*(1).

Offgassing Podcast. (n.d.). *Round Table Discussion: Risk Management and Accident Analysis—10 Jan 2024*. https://www.buzzsprout.com/2191453/14228917

Orlady, H. W., & Orlady, L. M. (2017). *Human Factors in Multi-Crew Flight Operations* (1st ed.). Routledge.

Patriarca, R., Leonhardt, J., & Licu, A. (2022). *Unearthing Weak Signals for safer and more efficient socio-technical systems: The Structured Exploration of Complex Adaptations (SECA) method*. EUROCONTROL.

Pomeroy, J. (2023, April 15). *One Word, Multiple Meanings*. LinkedIn. https://www.linkedin.com/pulse/one-word-multiple-meanings-james-pomeroy%253FtrackingId=30XJD9OQ3BUZd5A49GM26g%253D%253D/?trackingId=30XJD9OQ3BUZd5A49GM26g%253D%253D

Pupulidy, I. (2015a). *Novices, Experts and Errors: Toward a Safer Fire Ground*…. International Association of Wildland Fire. https://www.iawfonline.org/article/novices-experts-and-errors-toward-a-safer-fire-ground/

Pupulidy, I. (2015b). *The Transformation of Accident Investigation: From Finding Cause to Sensemaking* [PhD, Tilburg]. https://drive.google.com/open?id=1AvO-QX_H7eSmAGsw3SazQIApj1fC6Hou&authuser=gareth.lock%40thehumandiver.com&usp=drive_fs

Pupulidy, I. (2017). The Learning Review: Adding to the accident investigation toolbox. *53rd ESReDA Seminar*. 53rd ESReDA Seminar, Ispra, Italy. https://www.safetydifferently.com/wp-content/uploads/2018/08/171024TheLearningReview.pdf

Pupulidy, I., & Vesel, C. (2023). *Human and Organizational Potential*. Dynamic Inquiry LLC.

Rae, A. (2016). Tales of disaster: The role of accident storytelling in safety teaching. *Cogn. Technol. Work*, *18*(1), 1–10. https://doi.org/10.1007/s10111-015-0341-3

Reason, J. (2016). *Managing the Risks of Organizational Accidents*. Routledge. http://dx.doi.org/10.4324/9781315543543

Revilla, M., & Ochoa, C. (2017). *Ideal and Maximum Length for a Web Survey*. *59*(5).

Safety. (2022). OSH Wiki. https://oshwiki.osha.europa.eu/en/themes/safety#:~:text=The%20word%20'Safety'%20means%20the,safety'%20and%20'risk'.

Saldaña, J. (2016). *The coding manual for qualitative researchers* (3E [Third edition]). SAGE.

Sanne, J. M. (2008). Incident reporting or storytelling? Competing schemes in a safety-critical and hazardous work setting. *Saf. Sci.*, *46*(8), 1205–1222. https://doi.org/10.1016/j.ssci.2007.06.024

Schein, E. H. (2004). *Organizational Culture and Leadership* (3rd ed.). Jossey-Bass.

Shappell, S. A. (2000). *The Human Factors Analysis and Classification System–HFACS*.

Shorrock, S. (2016, December 5). *The Varieties of Human Work*. https://humanisticsystems.com/2016/12/05/the-varieties-of-human-work/

Smith, G. W. (2018). *Paper Safe: The Triumph of Bureaucracy in Safety Management*. Wayland Legal Pty Limited. https://play.google.com/store/books/details?id=VYrbvQEACAAJ

Snowden, D. (2002). Complex acts of knowing: Paradox and descriptive self-awareness. *Journal of Knowledge Management*, *6*(2), 100–111. https://doi.org/10.1108/13673270210424639

Snowden, D., & Rancati, A. (2021). *Managing complexity (and chaos) in times of crisis: A field guide for decision makers inspired by the Cynefin framework*. Publications Office of the European Union.

Stanton, N. A., Margaryan, A., & Littlejohn, A. (2017). Editorial: Learning from Incidents. *Safety Science*, *99*, 1–4. https://doi.org/10.1016/j.ssci.2017.07.011

Starbuck, W., & Milliken, F. (1988). Challenger: Fine-Tuning the odds until something breaks. *Journal of Management Studies*, *25*(4), 319–340. https://doi.org/10.1111/j.1467-6486.1988.tb00040.x

Tenbrunsel, A. E., & Messick, D. M. (2004). Ethical Fading: The Role of Self-Deception in Unethical Behavior. *Social Justice Research*, *17*(2), 223–236. https://doi.org/10.1023/B:SORE.0000027411.35832.53

Tetlow, S., & Jenkins, S. (2005). The use of fault tree analysis to visualise the importance of human factors for safe diving with closed-circuit rebreathers (CCR). *Underwater Technology*, *26*(3), 105–113. https://doi.org/10.3723/175605405784426619

TWOWP. (2019, July 11). *Lewin's behavior equation: A simple model of human behavior*. World of Work Project. https://worldofwork.io/2019/07/lewins-behavior-equation/

US Forest Service. (2020). *Learning from Unintended Outcomes: Facilitated Learning Analysis and Learning Review* (p. 93). Forest Service: United States Department of Agriculture.

Vann, R. D., Denoble, P. J., & Pollock, N. W. (2012). Rebreather Forum 3. *Rebreather Forum 3.0 Proceedings*. Rebreather Forum 3, Durham, NC. http://media.dan.org/RF3_web.pdf

Vann, R. D., & Lang, M. A. (Eds.). (2010). Recreational Diving Fatalities Workshop Proceedings. In *Recreational Diving Fatalities Workshop*. https://www.researchgate.net/profile/Richard_Vann/publication/51605460_Recreational_diving_fatalities/links/0f3175335e8c9d0930000000/Recreational-diving-fatalities.pdf

Waring, J. J. (2005). *Beyond blame: Cultural barriers to medical incident reporting*. https://doi.org/10.1016/j.socscimed.2004.08.055.

Wears, R. L. (2008). The Error of Counting "Errors". *Ann. Emerg. Med.*, *52*(5), 502–503. https://doi.org/10.1016/j.annemergmed.2008.03.015

Weick, K. E., & Quinn, R. E. (1999). Organisational Change and Development. *Annu. Rev. Psychol.*, *50*, 361–386. https://doi.org/10.1146/annurev.psych.50.1.361

Weick, K. E., Sutcliffe, K. M., & Obstfield, D. (2005). Organizing and the Process of Sensemaking. *Organisation Science*, *16*(4), 409–421. https://doi.org/10.1287/orsc.1050.0133

Weinman, S. (2022, April 9). *Diving instructor cleared in 'safety-stop' death case*. Divernet. https://divernet.com/scuba-diving/diving-instructor-cleared-in-safety-stop-death-case/

Woods, D., Cook, R. I., & Miller, C. (1997). *A Tale of Two Stories—Contrasting Views of Patient Safety* (p. 87). National Patient Safety Foundation.

Woods, D. D., & Cook, R. I. (2017). *Distancing Through Differencing: An Obstacle to Organizational Learning Following Accidents* (pp. 329–338). CRC Press.

Znajmiecka-Sikora, M., & Salagacka, M. (2022). Analysis of the relationship between psychological gender and risk perception style and attitudes towards safety in a group of women and men. *International Journal of Occupational Safety and Ergonomics*, *28*(1), 364–375. https://doi.org/10.1080/10803548.2020.1760527

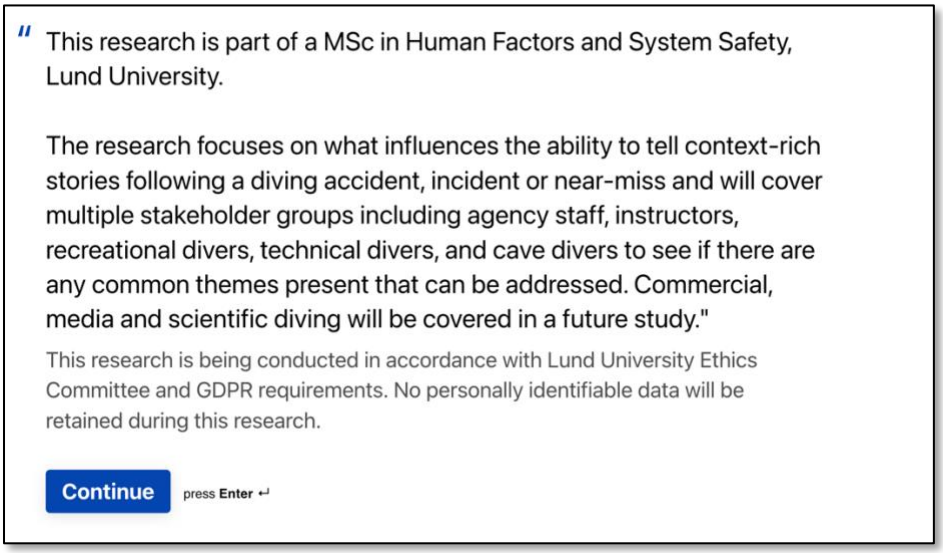
Appendix 1. Online Survey Question Set

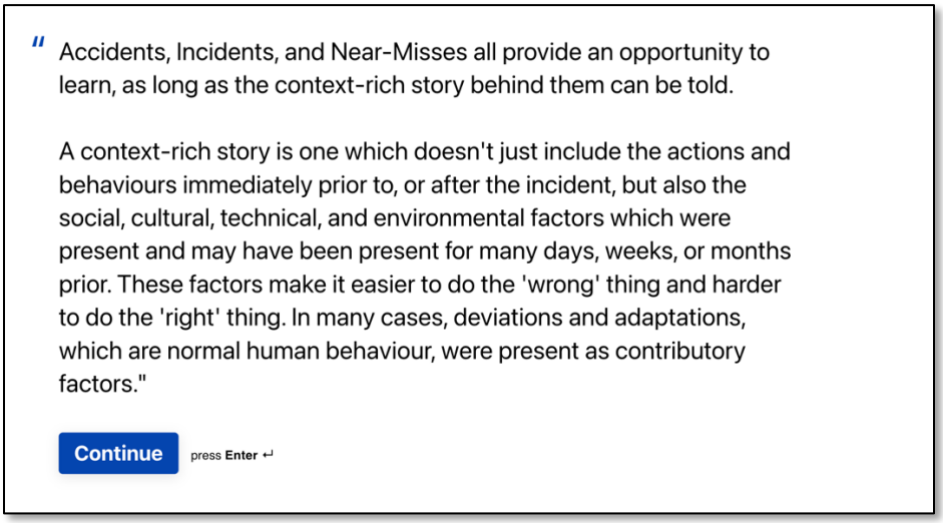
1. Would you classify yourself as: Recreational Diver, OC Technical Diver, Cave Diver, CCR Diver, Diving Instructor?
2. Given the incident in the previous question (Simple Narrative), would you be more likely to share this story via the following?
3. What reason do you have for sharing /not sharing the story?
4. Is this story longer or shorter than you'd normally see online or in a report?
5. Would you write a story of this length to share online or with a formal reporting system?
6. Given the incident in the previous question (Context-Rich Narrative), would you be more likely to share this story via the following?
7. What reason do you have for sharing /not sharing the story?
8. Is this story longer or shorter than you'd normally see online or in a report?
9. Would you write a story of this length to share online or with a formal reporting system?
10. Do you think that (CoP) divers tell incident stories to their friends or colleagues to:
    a. 1 - Internally rationalise to make sense of the event?
    b. 7 - Externally share to allow others to learn from their event?
11. Do (CoP) divers tell incident stories to help themselves or their peers improve the safety and performance of future dives?
    a. 1 - Help Themselves
    b. 7 - Help their Peers/Friends/Other Divers
12. How well do you think other recreational divers learn from the publicly available narratives?
    a. 1 - No learning, they don't change anything
    b. 7 - Safety is continually improved through story-telling
13. What does the term 'human factors' in diving mean to you?
    a. The Human Factor ('human nature')
    b. Factors of Humans ('human characteristics')
    c. Factors affecting Humans ('affecting human performance')
    d. Socio-technical Systems ('how people, technology, environment, culture work together')
14. What does 'human error' mean to you?
15. What does an 'incident' mean to you in the context of 'diving incident'?
16. What does an 'accident' mean to you in the context of 'diving accident'?
17. What does a 'near-miss' mean to you in the context of a 'diving near-miss'?
18. What does 'investigation' mean in the context of an accident or incident investigation?
19. What does 'safety' mean to you in the context of the type of diving you do?
20. What does 'risk' mean to you in the context of the type of diving you do?
21. What does 'just culture' mean to you in the context of the type of diving you do?
22. Can you recall a case where you have personally changed your behaviour because of an incident report or social media post that you have read about?
    a. In the last week
    b. In the last month
    c. In the last 6 months
    d. In the last year
    e. More than a year ago
    f. No

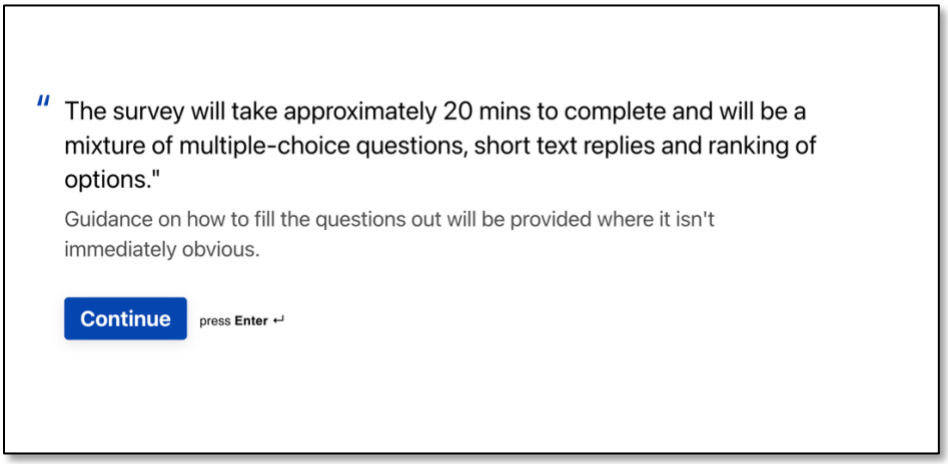
23. Can you recall what the event that you read about was?
24. Can you recall what the change was that followed the event you read about?
25. How did you know your changed behaviour worked?
26. Reflecting on your previous experience, how well do you think you personally learn from incident reports that are published **on social media** like Facebook or forums?
    a. 1 - No learning, I don't change anything
    b. 7 - My safety is continually improved through story-telling
27. Reflecting on your previous experience, how well do you think you personally learn from incident reports that are published in formal reports like the Divers Alert Network or BSAC Annual reports?
    a. 1 - No learning, I don't change anything
    b. 7 - My safety is continually improved through story-telling
28. When you personally look at a diving incident story published, do you tend to look for differences or similarities between your diving and that of the incident dive?
    a. 1. Differences
    b. 7. Similarities
29. Do you think (CoP) are more afraid to share near misses in a public forum because of perceived peer judgement or perceived legal judgement?
    a. Peer Judgement
    b. Legal Judgement
30. Do you think **instructors, in general**, are more afraid to share near misses in a public forum because of perceived peer judgement or perceived legal judgement?
    a. Peer Judgement
    b. Legal Judgement
31. Do you think **instructors, in general,** are more afraid to share near misses in a public forum because of perceived peer judgement or perceived **organisational judgement**?
    a. Peer Judgement
    b. Organisational Judgement
32. Do you think **organisations** are more afraid to share near misses in a public forum because of perceived peer judgement or perceived legal judgement?
    a. Peer Judgement
    b. Legal Judgement
33. How well do you think **diving organisations** learn from publicly available narratives?
    a. 0 - No learning, they don't change anything
    b. 9 - Safety is continually improved through story-telling
34. What does incident reporting mean to you?
    a. verbally sharing with close team
    b. verbally sharing/written narrative with wider team members/peer group
    c. verbally sharing/written narrative with own dive centre team
    d. written narrative with training organisation
    e. verbally sharing narrative with training organisation
    f. sharing via a software tool/app/paper form to an organisation
    g. sharing via a closed social media outlet like FB group or a forum
    h. sharing via an open social media outlet like FB group or a forum
35. Year of Birth
36. Gender
37. Country
38. Dive Experience (Open Circuit)

39. Year you first certified in open circuit diving
40. Dive Experience (Closed Circuit Rebreather)
41. Year you first certified in closed circuit rebreather diving
42. Your highest non-instructional certification in diving
43. Your highest instructional certification in diving
44. Have you undertaken any training courses from The Human Diver?
45. What courses from The Human Diver have you completed?
    a. Level 0: Human Factors in Diving Micro-class (Apr 2016-Oct 2021)
    b. Level 0: Essentials of Human Factors in Diving (Oct 2021-present)
    c. Level 1: 10-week webinar series
    d. Level 2: Face-to-face training using GemaSim/InterLAB
46. Have you undertaken any human factors or system safety training outside of the diving industry e.g., aviation, healthcare, oil and gas...
47. What was the course/were the courses?
48. If you were to suggest **one thing** to focus on to improve the likelihood that divers would tell context-rich stories that would allow learning, what would it be?
    a. An organisational commitment to improved diving safety by capturing, analysing, and sharing near-miss and non-fatal incident stories
    b. The presence of a Just Culture across the industry
    c. Protection from legal action when safety-focused stories are told
    d. Confidence that stories provided would be used appropriately by organisations if reported via a confidential system/by the diving community if reported in a public format
    e. Feedback regarding the stories that have been told to improve the reporter's actions and subsequent safety
    f. An easy to use reporting system to submit confidential stories to
    g. Guidance on what makes an effective learning story, including context and the rationale behind the decisions made, at all levels in the system.

Appendix 2: Informed Consent (Online and Focus Groups)







Online Consent

You can choose to continue this survey or exit at this point. If you continue, you consent to your anonymous data being captured and processed as part of this research project.This question is required.*

Title of the Study: Storytelling to learn: What do some members of the diving community know about adverse events that others don't?

Researcher: Gareth Lock

Purpose of the Study: The purpose of this study is to understand what factors the sports diving community believes influence the telling of context-rich learning-focused stories following an adverse event so that they can be shared in formal or informal systems.

Procedure: You will be asked to participate in an online survey which will take approximately 20 mins to complete.

Risks: There are no physical risks associated with this research. However, some questions in the interview may be emotionally charged. If you feel uncomfortable during the survey, you may stop at any time.

Benefits: Your participation in this research may contribute to a better understanding of the factors that contribute to reporting and subsequently learning from adverse events in diving. It is recognised that more context-rich incident data is needed but no research has been undertaken in the diving domain to identify the real or perceived factors that influence the telling of context-rich stories. Without this data, it is difficult to move

beyond where we are in terms of safety interventions.

Confidentiality: All information collected during this research will be kept strictly confidential. There will be no personally-identifiable information captured in the survey.

Ethics & GDPR: This research meets the ethics and GDPR requirements of Lund University.

Voluntary Participation: Your participation in this research is voluntary, and you have the right to stop at any time without any consequences. If you decide to stop, all information relating to your contribution up to that point will not be saved.

Contact Information: If you have any questions about the research or if you wish to contact the researcher after the research is completed, you may contact Gareth Lock

(*555406095 Mills v Gull Dive Center PADI* (2022). https://www.scribd.com/document/555406095/Mills-v-Gull-Dive-Center-PADI-2nd-Amended-Complaint

ABA. (n.d.). *Growth of the Legal Profession*. ABA: Profile of the Legal Profession 2022. https://www.abalegalprofile.com/demographics.php#:~:text=To%20be%20more%20precise%2C%20there,one%2Dtenth%20of%20one%20percent

Acott, C. (2003). Recreational scuba diving equipment problems, morbidity and mortality: An overview of the Diving Incident Monitoring Study and Project Stickybeak. *South Pacific Underwater Medicine Society (SPUMS) Journal*, *33*.

Adams, J. (1995). *Risk*. UCL Press.

Adu, P. (2019). *A step-by-step guide to qualitative data coding*. Routledge.

Allen, J. A., Reiter-Palmon, R., Crowe, J., & Scott, C. (2018). Debriefs: Teams Learning From Doing in Context. *Am. Psychol.*, *73*(4), 504–516. https://doi.org/10.1037/amp0000246

Argyris, C., & Schön, D. A. (1997). Organizational Learning: A Theory of Action Perspective. *Rev. Esp. Invest. Sociol.*, *77/78*, 345. https://doi.org/10.2307/40183951

Barraz, S. (2009). *Are Errors In Air Traffic Control Socially Constructed And Do They, As A Result, Get Put Into Categories And Managed Differently? Vol. MSc* [MSc]. Lund.

Bitar, F. K., Chadwick-Jones, D., Nazaruk, M., & Boodhai, C. (2018). From individual behaviour to system weaknesses: The re-design of the Just Culture process in an international energy company. A case study. *J. Loss Prev. Process Indust.*, *55*, 267–282. https://doi.org/10.1016/j.jlp.2018.06.015

Boskeljon-Horst, L., Boer, R. J. D., Steinmetz, V., & Dekker, S. W. A. (2023). Aircrews, Rules and the Bogeyman: Mapping the Benefits and Fears of Noncompliance. *Safety*, *9*(1), 15. https://doi.org/10.3390/safety9010015

Boskeljon-Horst, L., De Boer, R. J., Sillem, S., & Dekker, S. W. A. (2022). Goal Conflicts, Classical Management and Constructivism: How Operators Get Things Done. *Safety*, *8*(2), 37. https://doi.org/10.3390/safety8020037

Boskeljon-Horst, L., Snoek, A., & van Baarle, E. (2023). Learning from the complexities of fostering a restorative just culture in practice within the Royal Netherlands Air Force. *Saf. Sci.*, *161*, 106074. https://doi.org/10.1016/j.ssci.2023.106074

Bryce, C., & Dowling, M. (2024). The road to olympic failure is paved in poor risk management. *Safety Science*, *169*, 106331. https://doi.org/10.1016/j.ssci.2023.106331

BSAC: Annual Diving Incident Report. (n.d.). Retrieved 29 January 2023, from https://www.bsac.com/safety/diving-incidents/annual-diving-incident-report/

Catino, M. (2008). A Review of Literature: Individual Blame vs. Organizational Function Logics in Accident Analysis. *Journal of Contingencies and Crisis Management*, *16*(1).

Catino, M. (2009). Blame culture and defensive medicine. *Cognition, Technology & Work*, *11*(4), 245–253. https://doi.org/10.1007/s10111-009-0130-y

Chan, W. T.-K., & Li, W.-C. (2023). Development of effective human factors interventions for aviation safety management. *Frontiers in Public Health*, *11*, 1144921. https://doi.org/10.3389/fpubh.2023.1144921

Clark, T. (2020). *The 4 Stages of Psychological Safety: Defining the Path to Inclusion and Innovation* (1st ed.). Berrett-Koehler Publishers.

Clarke. (2023). *Risk Management for Diving Professionals*. ScubaGuru Academy. https://www.scubaguruacademy.com/p/risk-management-for-diving-professionals

Cook, R. (2018). Resilience, the second story, and progress on patient safety. In *Resilient Health Care* (pp. 19–26). CRC Press. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85074624328&partnerID=40&md5=025703f19cbb16b7ba8379db314c246a

Cox, J. A., McLean, S., Hulme, A., Read, G. J. M., & Salmon, P. M. (2024). An incident reporting and learning system to understand cycling incident causation in Australia: A 12-month implementation of CRIT. *Safety Science*, *171*, 106392. https://doi.org/10.1016/j.ssci.2023.106392

Cromie, S., & Bott, F. (2016). Just culture's "line in the sand" is a shifting one; an empirical investigation of culpability determination. *Saf. Sci.*, *86*, 258–272. https://doi.org/10.1016/j.ssci.2016.03.012

Crosby, J. F. (1976). Theories of anxiety: A theoretical perspective. *The American Journal of Psychoanalysis*, *36*(3), 237–248. https://doi.org/10.1007/BF01252989

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process* (1st ed.). SAGE Publications. https://www.taylorfrancis.com/books/9781000249569

Dekker, S. (2012). *Just culture: Balancing safety and accountability* (2nd edition). CRC Press.

Dekker, S. (2014). *The field guide to understanding 'human error'* (Third edition). Ashgate.

Dekker, S. (2017). *Just culture: Restoring trust and accountability in your organization* (Third edition). CRC Press, Taylor & Francis Group.

Dekker, S. W. A. (2009). Just culture: Who gets to draw the line? *Cogn. Technol. Work*, *11*(3), 177–185. https://doi.org/10.1007/s10111-008-0110-7

Dekker, S. W. A., Nyce, J. M., & Myers, D. J. (2013). The little engine who could not: "Rehabilitating" the individual in safety research. *Cognition, Technology & Work*, *15*(3), 277–282. https://doi.org/10.1007/s10111-012-0228-5

Denoble, P. J., Caruso, J. L., Dear, G. de L., Pieper, C. F., & Vann, R. D. (2008). Common causes of open-circuit recreational diving fatalities. *Undersea Hyperb. Med.*, *35*(6), 393–406.

Dreyfus, S. E., & Dreyfus, H. L. (1980). *A five-stage model of the mental activities involved in directed skill acquisition*. CALIFORNIA UNIV BERKELEY OPERATIONS RESEARCH CENTER. https://apps.dtic.mil/sti/citations/ADA084551

Drupsteen, L., Groeneweg, J., & Zwetsloot, G. I. J. M. (2013). Critical Steps in Learning From Incidents: Using Learning Potential in the Process From Reporting an Incident to Accident Prevention. *Int. J. Occup. Saf. Ergon.*, *19*(1), 63–77. https://doi.org/10.1080/10803548.2013.11076966

Drupsteen, L., & Guldenmund, F. (2014). What Is Learning: A Review of the Safety Literature to Define Learning from Incidents, Accidents and Disasters. *Journal of Contingencies and Crisis Management*, *22*(2), 81–96. https://doi.org/10.1111/1468-5973.12039

EC. (2014). *Regulation (EU) No 376/2014 of the European Parliament and of the Council of 3 April 2014*. EC.

Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Adm. Sci. Q.*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Edmondson, A. C. (2004). Learning from Mistakes is Easier Said than Done: Group and Organizational Influences on the Detection and Correction of Human Error. *J. Appl. Behav. Sci.*, *40*(1), 66–90. https://doi.org/10.1177/0021886304263849

Edmondson, A. C. (2019). *The Fearless Organization*.

Eibl, B., Lang, F. R., & Niessen, C. (2020). Employee voice at work: The role of employees' gender, self-efficacy beliefs, and leadership. *European Journal of Work and Organizational Psychology*, *29*(4), 570–585. https://doi.org/10.1080/1359432X.2020.1733979

Endsley, M. R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors: The Journal of Human Factors and Ergonomics Society*, *37*(1), 32–64. https://doi.org/10.1518/001872095779049543

Epstein, B. (2018). *Social Ontology: 4. How Social Categories and Kinds Are Set Up*. Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/social-ontology/#HowSociCateKindSetUp

ESReDA. (2015). *Barriers to learning from incidents and accidents—ESReDA guidelines*. ESReDA Project Group.

Exley, S. (1986). *Basic Cave Diving—A blueprint for survival*. National Speliological Society - Cave Diving Section. https://nsscds.org/wp-content/uploads/2018/05/Blueprint-for-Survival.pdf

Fletcher, S. (2011). *Assessment of manual operations and emergency procedures for closed circuit rebreathers* (RR871). HSE Books.

Gherardi, S., Nicolini, D., & Odella, F. (1998). What Do You Mean By Safety? Conflicting Perspectives on Accident Causation and Safety Management in a Construction Firm. *Journal of Contingencies and Crisis Management*, *6*(4), 202–213. https://doi.org/10.1111/1468-5973.00089

Gigerenzer, G. (2014). *Risk Savvy*. Viking.

Goode, N., Salmon, P. M., Lenne, M., & Finch, C. (2018). *Translating systems thinking into practice: A guide to developing incident reporting systems*. CRC press. https://www.taylorfrancis.com/books/mono/10.1201/9781315569956/translating-systems-thinking-practice-paul-salmon-caroline-finch-natassia-goode-michael-lenne

Hallowell, D. M., Quashne, M., & Quinn, E. (2020). *The Statistical Invalidity of TRIR as a Measure of Safety Performance*.

Heffernan, M. (2011). *Wilful Blindness: Why We Ignore the Obvious*. Simon and Schuster. https://play.google.com/store/books/details?id=JWSeefc607cC

Henriqson, É., Schuler, B., van Winsen, R., & Dekker, S. W. A. (2014). The constitution and effects of safety culture as an object in the discourse of accident prevention: A Foucauldian approach. *Saf. Sci.*, *70*, 465–476. https://doi.org/10.1016/j.ssci.2014.07.004

Heraghty, D., Dekker, S., & Rae, A. (2018). Accident Report Interpretation. *Safety*, *4*(4), 46. https://doi.org/10.3390/safety4040046

Hoffman, B. G. (2012). *American Icon: Alan Mulally and the Fight to Save Ford Motor Company*. Crown. https://play.google.com/store/books/details?id=1e_FjpDvMKkC

Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations*. SAGE. https://play.google.com/store/books/details?id=w6z18LJ_1VsC

ICAO. (2016). *Aircraft accident and incident investigation: Annex 13 to the Convention on International Civil Aviation* (11th edition). International Civil Aviation Organization.

ICAO. (2018). *Doc 9859—Safety Management Manual. 4th Ed. 2018*. ICAO.

James M. Nyce, G. B., Noel Hengelbrok, Scott J. Modell. (2022). Rhetoric, Responsibility and Change in a State's Child Protective Services. *The Applied Anthropologist*, 11–21.

Jeong, H.-S., & Brower, R. S. (2008). Extending the Present Understanding of Organizational Sensemaking: Three Stages and Three Contexts. *Administration & Society*, *40*(3), 223–252. https://doi.org/10.1177/0095399707313446

Kas, S. (2020). *Close Calls*. Because i can ltd.

Kieran, D. (2023, December 6). *It's The Data, Silly: A Lookback at 2023 and a Peek at 2024 for Scuba Diving Market Surveys & Studies*. InDepth. https://gue.com/blog/its-the-data-stupid-a-lookback-at-2023-and-a-peek-at-2024-for-scuba-diving-market-surveys-studies/

Klein, G. A. (1993). A Recognition-Primed Decision (RPD) Model of Rapid Decision Making. In O. Klein, G.A. J. ,. Calderwood, R. &. C. E. Zsambok (Ed.), *Decision making in action: Models and methods* (pp. 138–147). Ablex Publishing.

Klein, G., Calderwood, R., & Clinton-Cirrocco, A. (1986). Rapid Decision Making on the Fire Ground. *Proceedings of the Human Factors Society Annual Meeting*, 5. https://doi.org/10.1177/154193128603000616

Kruger, J., & Dunning, D. (1999). *Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments*. 34.

Little, R. M., & Froggett, L. (2010). Making meaning in muddy waters: Representing complexity through community based storytelling. *Community Development Journal*, *45*(4), 458–473. https://doi.org/10.1093/cdj/bsp017

Lock, G. (2011). *The Application of the Human Factors Analysis and Classification System (HFACS) to Improve Diving Safety*. https://drive.google.com/file/d/1Iz3qR-Ryo2NjdiBGbPcRhj14NoCTuuM4/view?usp=share_link

Lock, G. (2019). *Under Pressure: Diving Deeper with Human Factors*. Vision Maker Press.

Lock, G. (Director). (2020). *If Only...* The Human Diver. https://www.thehumandiver.com/ifonly

Lock, G. (2022, December). *Learning from Unintended Outcomes*. https://www.youtube.com/watch?v=YTWsmS_qDg0

Lukic, D., Margaryan, A., & Littlejohn, A. (2010). How organisations learn from safety incidents: A multifaceted problem. *Journal of Workplace Learning*, *22*(7), 428–450. https://doi.org/10.1108/13665621011071109

MacLeod, N. (2021). *Crew resource management training: A competence-based approach for airline pilots* (First edition). CRC Press.

McCleod, R. W. (2019). *Learning from Adverse Events*. CIEHF.

Meadows, D. H. (2009). *Thinking in systems: A primer*. Earthscan.

Murphy, V. L., Littlejohn, A., & Rienties, B. (2022). Learning from incidents: Applying the 3-P model of workplace learning. *Journal of Workplace Learning*, *34*(3), 242–255. https://doi.org/10.1108/JWL-04-2021-0050

NASA. (n.d.). *Safety Culture: NASA Safety Culture...It's in Our DNA*. Safety Culture: NASA Safety Culture...It's in Our DNA. https://sma.nasa.gov/sma-disciplines/safety-culture

Nashef, S. (2015). *The Naked Surgeon: The power and peril of transparency in medicine*. Scribe Publications.

Nield, D. (2023, April 30). *How ChatGPT and Other LLMs Work—And Where They Could Go Next*. Wired. https://www.wired.co.uk/article/how-chatgpt-works-large-language-model

Noort, M. C., Reader, T. W., & Gillespie, A. (2019). Speaking up to prevent harm: A systematic review of the safety voice literature. *Saf. Sci.*, *117*, 375–387. https://doi.org/10.1016/j.ssci.2019.04.039

O'Connor, P. E. (2007). *The nontechnical causes of diving accidents: Can U.S. Navy Divers learn from other industries? 34*(1).

Offgassing Podcast. (n.d.). *Round Table Discussion: Risk Management and Accident Analysis—10 Jan 2024*. https://www.buzzsprout.com/2191453/14228917

Orlady, H. W., & Orlady, L. M. (2017). *Human Factors in Multi-Crew Flight Operations* (1st ed.). Routledge.

Patriarca, R., Leonhardt, J., & Licu, A. (2022). *Unearthing Weak Signals for safer and more efficient socio-technical systems: The Structured Exploration of Complex Adaptations (SECA) method*. EUROCONTROL.

Pomeroy, J. (2023, April 15). *One Word, Multiple Meanings*. LinkedIn. https://www.linkedin.com/pulse/one-word-multiple-meanings-james-pomeroy%253FtrackingId=30XJD9OQ3BUZd5A49GM26g%253D%253D/?trackingId=30XJD9OQ3BUZd5A49GM26g%253D%253D

Pupulidy, I. (2015a). *Novices, Experts and Errors: Toward a Safer Fire Ground*…. International Association of Wildland Fire. https://www.iawfonline.org/article/novices-experts-and-errors-toward-a-safer-fire-ground/

Pupulidy, I. (2015b). *The Transformation of Accident Investigation: From Finding Cause to Sensemaking* [PhD, Tilburg]. https://drive.google.com/open?id=1AvO-QX_H7eSmAGsw3SazQIApj1fC6Hou&authuser=gareth.lock%40thehumandiver.com&usp=drive_fs

Pupulidy, I. (2017). The Learning Review: Adding to the accident investigation toolbox. *53rd ESReDA Seminar*. 53rd ESReDA Seminar, Ispra, Italy. https://www.safetydifferently.com/wp-content/uploads/2018/08/171024TheLearningReview.pdf

Pupulidy, I., & Vesel, C. (2023). *Human and Organizational Potential*. Dynamic Inquiry LLC.

Rae, A. (2016). Tales of disaster: The role of accident storytelling in safety teaching. *Cogn. Technol. Work*, *18*(1), 1–10. https://doi.org/10.1007/s10111-015-0341-3

Reason, J. (2016). *Managing the Risks of Organizational Accidents*. Routledge. http://dx.doi.org/10.4324/9781315543543

Revilla, M., & Ochoa, C. (2017). *Ideal and Maximum Length for a Web Survey*. *59*(5).

Safety. (2022). OSH Wiki. https://oshwiki.osha.europa.eu/en/themes/safety#:~:text=The%20word%20'Safety'%20means%20the,safety'%20and%20'risk'.

Saldaña, J. (2016). *The coding manual for qualitative researchers* (3E [Third edition]). SAGE.

Sanne, J. M. (2008). Incident reporting or storytelling? Competing schemes in a safety-critical and hazardous work setting. *Saf. Sci.*, *46*(8), 1205–1222. https://doi.org/10.1016/j.ssci.2007.06.024

Schein, E. H. (2004). *Organizational Culture and Leadership* (3rd ed.). Jossey-Bass.

Shappell, S. A. (2000). *The Human Factors Analysis and Classification System–HFACS*.

Shorrock, S. (2016, December 5). *The Varieties of Human Work*. https://humanisticsystems.com/2016/12/05/the-varieties-of-human-work/

Smith, G. W. (2018). *Paper Safe: The Triumph of Bureaucracy in Safety Management*. Wayland Legal Pty Limited. https://play.google.com/store/books/details?id=VYrbvQEACAAJ

Snowden, D. (2002). Complex acts of knowing: Paradox and descriptive self-awareness. *Journal of Knowledge Management*, *6*(2), 100–111. https://doi.org/10.1108/13673270210424639

Snowden, D., & Rancati, A. (2021). *Managing complexity (and chaos) in times of crisis: A field guide for decision makers inspired by the Cynefin framework*. Publications Office of the European Union.

Stanton, N. A., Margaryan, A., & Littlejohn, A. (2017). Editorial: Learning from Incidents. *Safety Science*, *99*, 1–4. https://doi.org/10.1016/j.ssci.2017.07.011

Starbuck, W., & Milliken, F. (1988). Challenger: Fine-Tuning the odds until something breaks. *Journal of Management Studies*, *25*(4), 319–340. https://doi.org/10.1111/j.1467-6486.1988.tb00040.x

Tenbrunsel, A. E., & Messick, D. M. (2004). Ethical Fading: The Role of Self-Deception in Unethical Behavior. *Social Justice Research*, *17*(2), 223–236. https://doi.org/10.1023/B:SORE.0000027411.35832.53

Tetlow, S., & Jenkins, S. (2005). The use of fault tree analysis to visualise the importance of human factors for safe diving with closed-circuit rebreathers (CCR). *Underwater Technology*, *26*(3), 105–113. https://doi.org/10.3723/175605405784426619

TWOWP. (2019, July 11). *Lewin's behavior equation: A simple model of human behavior*. World of Work Project. https://worldofwork.io/2019/07/lewins-behavior-equation/

US Forest Service. (2020). *Learning from Unintended Outcomes: Facilitated Learning Analysis and Learning Review* (p. 93). Forest Service: United States Department of Agriculture.

Vann, R. D., Denoble, P. J., & Pollock, N. W. (2012). Rebreather Forum 3. *Rebreather Forum 3.0 Proceedings*. Rebreather Forum 3, Durham, NC. http://media.dan.org/RF3_web.pdf

Vann, R. D., & Lang, M. A. (Eds.). (2010). Recreational Diving Fatalities Workshop Proceedings. In *Recreational Diving Fatalities Workshop*. https://www.researchgate.net/profile/Richard_Vann/publication/51605460_Recreational_diving_fatalities/links/0f3175335e8c9d0930000000/Recreational-diving-fatalities.pdf

Waring, J. J. (2005). *Beyond blame: Cultural barriers to medical incident reporting*. https://doi.org/10.1016/j.socscimed.2004.08.055.

Wears, R. L. (2008). The Error of Counting "Errors". *Ann. Emerg. Med.*, *52*(5), 502–503. https://doi.org/10.1016/j.annemergmed.2008.03.015

Weick, K. E., & Quinn, R. E. (1999). Organisational Change and Development. *Annu. Rev. Psychol.*, *50*, 361–386. https://doi.org/10.1146/annurev.psych.50.1.361

Weick, K. E., Sutcliffe, K. M., & Obstfield, D. (2005). Organizing and the Process of Sensemaking. *Organisation Science*, *16*(4), 409–421. https://doi.org/10.1287/orsc.1050.0133

Weinman, S. (2022, April 9). *Diving instructor cleared in 'safety-stop' death case*. Divernet. https://divernet.com/scuba-diving/diving-instructor-cleared-in-safety-stop-death-case/

Woods, D., Cook, R. I., & Miller, C. (1997). *A Tale of Two Stories—Contrasting Views of Patient Safety* (p. 87). National Patient Safety Foundation.

Woods, D. D., & Cook, R. I. (2017). *Distancing Through Differencing: An Obstacle to Organizational Learning Following Accidents* (pp. 329–338). CRC Press.

Znajmiecka-Sikora, M., & Salagacka, M. (2022). Analysis of the relationship between psychological gender and risk perception style and attitudes towards safety in a group of women and men. *International Journal of Occupational Safety and Ergonomics*, *28*(1), 364–375. https://doi.org/10.1080/10803548.2020.1760527

). The thesis will be published on the Lund University website.

Consent: I have read this form and understand the information contained within it. I consent to participate in this research and agree that this data can be used academic research and publishing papers.

- Continue to Survey
- Leave Survey

Informed Consent Form for Qualitative Research (Focus Groups and Lawyers).

Title of the Study: Storytelling to learn: What do some members of the diving community know about adverse events that others don't?

Researcher: Gareth Lock

Purpose of the Study: The purpose of this study is to understand what factors the sports diving community believes influence the telling of context-rich learning-focused stories following an adverse event so that they can be shared in formal or informal systems.

Procedure: You will be asked to participate in this research through a focus group. The focus group will take place in person on XXXX between XXXX at XXXX. Given the amount of information being covering over the 90-120 mins, the sessions will be recorded. All identifying information will be removed during transcription and the audio files will be permanently deleted after transcription.

The focus group will use semi-structured interview technique to guide the conversations around the topics of diving incidents, incident reporting, just culture, and story-telling.

All attendees are requested to watch this 10-minute video prior to the interview/focus group as it provides a grounding of looking at events differently. It is not diving related, but the concepts of learning from adverse events are the same. https://vimeo.com/122851457

Risks: There are no physical risks associated with this research. However, some questions in the interview may be emotionally charged. If you feel uncomfortable during the interview, you may stop at any time.

Benefits: Your participation in this research may contribute to a better understanding of the factors that contribute to reporting and subsequently learning from adverse events in diving. It is recognised that more context-rich incident data is needed but no research has been undertaken in the diving domain to identify the real or perceived factors that influence the telling of context-rich stories. Without this data, it is difficult to move beyond where we are in terms of safety interventions. It is hoped that your responses will be candid.

Confidentiality: All information collected during this research will be kept strictly confidential. Your personal information will only be used for research purposes and will not be shared with third parties. Personal data will only be present in the study until the interviews/focus groups are transcribed and then it will be all be deidentified.

Voluntary Participation: Your participation in this research is voluntary, and you have the right to stop at any time without any consequences. If you decide to stop, all information relating to your contribution up to that point will be destroyed.

Contact Information: If you have any questions about the research or if you wish to contact the researcher after the research is completed, you may contact Gareth Lock (+44 7966 483832). The thesis will be published on the Lund University website.

Consent: I have read this form and understand the information contained within it. I consent to participate in this research and agree that this data can be used academic research and publishing papers.

Date: _____

Participant's Name and Signature: _____

Researcher's Name and Signature: Gareth Lock

Appendix 3: Online Survey Demographic Data

There were 51 nationalities represented, with the most coming from the United States of America and fourteen countries each providing one respondent. The top eight countries represented within the survey are listed below. 'No Answer' was the 6th most prevalent response. A count of nine respondents was chosen as the break point for this table as there were multiple countries with counts of 8, 7, and 6. The count of 7 represented 1% of the sample. An area of research that might be worth exploring is the how nationality and culture impacts sharing given the influence that collectivism and individualism might have on collective learning. The sample of respondents shown at Table 13 is overwhelming biased towards individualistic cultures (Hofstede, 2001).

Table 13:

Distribution of Nationalities of Respondents

Country	Count	Percentage
United States of America	255	37.7
United Kingdom	99	14.6
Canada	52	7.7
Australia	46	6.8
Germany	27	4.0
No Answer	21	3.1
Netherlands	18	2.7
New Zealand	12	1.8
Sweden	10	1.5

Age and gender demographics were also diverse, shown at Table ***14*** with a demographic similar to other samples of the diving population (Kieran, 2023; Vann et al., 2012).

Table 14:

Distribution of Age and Gender of Respondents

Age Range	Count	Gender	Count

<20	1	Male	463
20-29	32	Female	207
30-39	104	Rather not say	4
40-49	181	No Answer	2
50-59	201		
60-69	125		
70+	32		

The qualifications listed showed a diverse experience from Open Water level (beginner) to Advanced Trimix (75m+) in both OC and CCR. The distribution of qualifications is below at Table 15.

Table 15:

Distribution of Highest Non-Instructional Diving Qualification

Qualification	Count	Percentage
Open Water (or equivalent)	22	3.3
AOW (or equivalent)	65	9.6
Rescue Diver (or equivalent)	170	25.1
Divemaster (was not an option, error by the author)	-	-
Advanced Nitrox and Deco Procedures (or equivalent)	120	17.8
OC 'Recreational' Trimix	5	0.7
OC Entry Level Trimix (45m)	36	4.1
OC Normoxic Trimix (60m)	46	6.8
OC Hypoxic Trimix (75m+)	42	6.2
CCR No Decompression	17	2.5
CCR Mod 1 (45m, decompression diving)	36	5.3
CCR Mod 2 (60m, normoxic diluent, deco diving)	47	7.0
CCR Mod 3 (75m+, hypoxic trimix, deco diving)	72	10.7
No Answer	6	0.9

The experience of Open Circuit divers ranged from 0 dives (n=3) to 3000+ dives (n=102) with the mean being 1339 dives. The distribution of dives, years certified, and dives per year since certified are shown at

Table ***16***.

Table 16:

Distribution of OC Diving Experience

Range of Dives	Count	Years Certified	Count	Average Dives Per Year Since Certified	Count
0	3	=<1	26	0	3
<50	46	2-5	81	<10	64
50-99	34	6-10	108	10-29	169
100-199	70	11-15	86	30-49	133
200-499	143	16-20	83	50-69	84
500-999	113	21-25	80	70-89	59
1000-1999	122	26-30	57	90-119	46
2000-2999	39	31-40	93	120-149	26
3000+	102	40+	58	150+	70
No Answer	4	No Answer	4	No Answer	4

From 676 responses, 93 stated that they classified themselves as a CCR diver. The response data for CCR demographic questions covered 205 respondents - not all CCR certified divers continue to dive CCR or classify themselves as a CCR diver. The experience of CCR divers ranged from 0 dives to 4000 dives (n=1), 24 divers had more than 1000 CCR dives, and the mean across the CCR respondents was 320 dives. The distribution of dives, years certified, and dives per year since CCR certified are shown

Table *17*.

Table 17:

Distribution of CCR Diving Experience

Range of Dives	Count	Years CCR Certified	Count	Average Divers Per Year on CCR	Count
		<=1	32		
<50	72	2-5	60	<10	121
50-99	29	6-10	47	10-29	72
100-199	29	11-15	31	30-49	3
200-499	50	16-20	14	50-69	0
500-999	25	21-25	11	70-89	0
1000-1999	19	26-30	8	90-119	0
2000-2999	5	31-40	2	120-149	0
3000+	1	40+	0	150+	0

Appendix 4: Definitions of 'Incident' from Agency Materials

Table 18:

Organisations definitions of incidents or what should be reported.

Organisation	Definition or Statement	Reference
PADI	**Incident Reports** Submit a PADI Incident Report Form to vour PADI Office immediately after you witness or are involved in a diving or dive operation-related accident/incident, regardless of whether the incident occurred in or out of the water; is training related, recreational, technical or seemingly insignificant.	PADI Instructor Manual - A-Z Definitions
PADI	**Quality Management** Make a written report to your PADI Office of PADI Standards violations personally witnessed. Do not submit false reports. If the seriousness of the situation justifies immediate action, membership status may change to Nonteaching pending further investigation.	PADI Instructor Manual - A-Z Definitions
BSAC	**When you should report a diving incident** We are often asked if a particular incident should or should not be reported. All incidents and accidents should be reported, not just serious ones. A great deal can be learnt from analysing a 'near miss' or oversight. The information and research gathered from incidents which are successfully resolved is just as valuable as those which result in injury to people or loss of or damage to equipment.	https://www.bsac.com/safety/diving-incidents/when-you-should-report-a-diving-incident/
NAUI	A diving incident is an unanticipated, diving-related event that may result in injury. Most diving incidents are preventable. They are usually the result of poor decisions or bad judgment. Many diving incidents occur because divers are literally in over their heads in terms of training and experience. Diving accidents are incidents that result in injury to anyone involved. Assisting a tired diver back to the dive platform boat or beach is an incident, but if the person performing the assist is struck by the boat's ladder, for instance, while helping the potential victim aboard, a diving accident has occurred	NAUI Instructor Guide
IANTD	We can say with certainty that the most common cause of trauma in scuba diving is the diver's failure to properly evaluate certain risk situations. There are thousands of possible causes of a diving injury, however they can all be grouped into two categories: • Unsafe Condition • Unsafe Act	IANTD Rescue Manual

	People recognize more easily “unsafe conditions” than “unsafe acts”.	
GUE	In the event that a student is injured during training while under supervision of a GUE instructor, please submit the following form outlining the incident.	GUE Accident Report Form
DAN	DAN’s vision is to make every dive accident- and injury-free. Until that goal is reached, we will continue to collect data about diving mishaps reported by the divers who experience them. This information can, in turn, provide useful insights as to where improvements in diver education, safety practices, and emergency action plans can be made.	https://dan.org/research-reports/research-studies/diving-incident-reporting-system/

Appendix 5: ChatGPT 4.0 Process

In the end, three analyses were undertaken, and a composite analysis was produced.

After some trial and error, it was possible to complete three analyses of the dataset relating to each question in approximately 60 minutes. This compared to a few hours manually open-coding the statements from one question before further analysis could be undertaken. In addition to coding the themes, the AI analysis provided a Pareto analysis for each CoP.

The following prompt was used in ChatGPT 4.0 - September 25 Version.

> "You are an expert in qualitative research and thematic analysis. Your task is to conduct a Pareto analysis of the following data and determine the themes contained within it, and what the top 20% themes are. The output should be a table. You should include a count of statements or codes associated with theme in the output table. Also show the percentage as part of the total."

Filtering the response data by CoP in MS Excel meant that specific responses could be pasted into a single ChatGPT 4.0 session. However, due to the limitations of how much data can be pasted into ChatGPT 4.0, the Recreational CoP with 306 responses had to be split into Recreational #1 and #2, the first with 200 responses, the second with 106.

Appendix 6: What is a Just Culture and is it aligned across COP?

The following findings were developed by analysing the outputs from the survey. A Just Culture could be argued as being critical for the telling of context-rich stories, the specific details contained in this Appendix do not contribute directly to the research question.

Table 19:

Distribution of alignment with Just Culture definition compared to CoP

	Agree	Approx	Disagree	Don't Know	Psych Safety	No Answer
All (n=676)	21.0	13.9	30.0	25.1	6.1	3.7
Recreational	16.1	15.1	29.8	30.5	5.2	3.3
Tech OC	33.3	18.2	22.7	16.7	6.1	3.0
CCR	30.4	12.0	28.3	13.0	7.6	8.7
Cave	25.6	16.3	32.6	23.3	2.3	0
Instructor	19.5	10.4	33.5	25.6	7.9	3.0

Both psychological safety and a Just Culture are critical to support an environment where learning can happen (Dekker, 2017; Edmondson, 1999), but these social/cultural dimensions do not exist in isolation when it comes to the socio-technical systems that supports learning. As such, the final question in the survey asked respondents:

> "If you were to suggest **one thing** to focus on to improve the likelihood that divers would tell context-rich stories that would allow learning, what would it be?"

The seven options provided covered both technical and social interventions – these are listed in the final question at Appendix 1. One of these options was "The presence of a Just Culture across the Industry".

From within the sample population, 19% (n=129) stated that 'The presence of a Just Culture across the Industry' would be their 'one thing'. Given the variance in the understanding of what a Just Culture meant, a subjective assessment of responses by the author was undertaken to determine whether the respondents who said a Just Culture was needed understood the term as defined above.

The responses were:

- 45.7% (n=59) were correct in the interpretation of what a Just Culture meant.
- 22.5% (n=29) did not know, did not answer, or had an incorrect definition of Just Culture.
- 20.9% (n=27) were approximately correct in their definition but missed critical elements.
- 10.9% (n=14) thought that Just Culture meant Psychological Safety, i.e., the shared belief within the group to take an interpersonal risk prior to an adverse event occurring.

Further analysis was undertaken to determine how many instructors had the incorrect definition of Just Culture as these individuals have an influence over divers as they progress through the training system. 24.5% (n=166) of respondents were instructors, and of these 26.3% (n=34) said that a Just Culture would be their priority. Their definitions were aligned as follows:

- 58.8% (n=20) agreed.
- 14.7% (n=5) disagreed.
- 13.9% (n=3) were approximately correct
- 11.8% (n=4) do not know or did not answer.
- 5.9% (n=2) aligned with psychological safety.

Additional analysis was undertaken to determine the impact of human factors training by The Human Diver and HF providers outside the diving domain. The analysis showed that 26 of the 129 respondents (20%) provided a definition that was aligned with Just Culture had undertaken training with The Human Diver, and a further 16 (12%) provided an approximate definition with similar training. An additional 12 (9%) of respondents who had HF training from other domains agreed with or gave an approximate definition of Just Culture. This meant that 41% of the 'agreed' or 'approximate definition' respondents had had some form of HF training, potentially showing the value of undertaking HF training.

Appendix 7: What next?

While this was a comprehensive study into the factors that influence the telling of context-rich story telling following an adverse event in diving, it barely scratched the surface of the research and learning opportunities that are present. Indeed, many of the topics presented at a high-level in this submission would be a MSc thesis in their own right. The scope of the research recognised this limitation and so only focused on a few elements, but the research process collected more data to allow the pursuit of further research to reduce the gap in knowledge that exists. Where possible, that data will be used to develop further research outputs, thereby growing the body of knowledge and, importantly, influencing the prevalence of storytelling in diving.

Topics that are worthy of further pursuit:

- Language is a representation of the reality that we encounter. If we do not have a common language, how do we know we are talking about the same thing, and therefore have created a shared meaning? How do we create a shared understanding surrounding storytelling, incident analysis, human factors, system thinking, and 'human error'?

- Diving is an activity taking place in an austere and hazardous environment. What does 'safety' mean in this context? Safety does not exist in isolation - it is one of the competing narratives within the divers, the instructors, the dive centres, and training agencies. How do stakeholders maximise 'safety'? In the context of diving, should safety be about resilience, rather than focusing on its absence i.e., accidents and incidents? Do the different CoP develop resilience in different or similar ways?

- Often there is a want to focus on a technological solution, and technology is certainly needed for the capture and dissemination of learning products. Can novel technologies be

harnessed for the purpose of improved opportunities for learning e.g., confidential systems using distributed leger techniques and the use of graphical databases to show outputs like Learning Reviews and AcciMap.

- Creating change top-down might have a greater impact, but the further you get from the top, the less engaged individuals are, especially in a discretionary activity like 'fun' diving. How can widespread change be developed when there are so many individual and organisational perspectives with multiple competing commercial goals? Bodies like the World Recreational SCUBA Training Council and the Rebreather Training Council which are supposedly 'regulator-like' are not independent as they inherit the standards they set. How can this be changed?

- Criminal law is based around a lack of trust. As trust is essential for psychological safety and a Just Culture, how does a Just Culture operate within a system without trust? This is especially challenging as trust is an emergent property of a socio-technical system.

- The Sensemaker tool from The Cynefin Company might provide an opportunity to explore narratives at both a local level and a national/global level. However, the development of the triads and diads will need care to maximise value and not end up with a categorisation-based system.

- Power dynamics in the diving industry. Often, we think that the influence of power flows down, but instructors and dive centres have power over agencies when it comes to being part of the sales pyramid and revenue generation, and clients have power over dive centres and instructors when it comes to their revenue generation along with reputational risk management. Another part of the power dynamic is the role of (rebreather) diving equipment manufacturers and who they choose as factory instructors and why. Exploring these dynamics would better help understand where to focus efforts for change.