Factors Associated with Use of Personal Floatation Devices and Personal Locator Beacons by Fish Harvesters: A Systematic Review

A Report Submitted to the

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Submitted by

Kerri Ann Ennis, Fisheries and Marine Institute
Robert Brown, Fisheries and Marine Institute
Kimberley Cullen, Memorial University of Newfoundland and SafetyNet

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1 Introduction

Commercial fishing is one of the most dangerous occupations worldwide, with higher fatality and injury rates compared to national averages for all other occupations (Petursdottir et al., 2001). In 1999 the average annual number of fishing deaths worldwide was estimated to be 24,000 people (ILO, 1999), which had increased to 32,000 by 2019 (FAO, 2024). However, recent research conducted by the FISH Safety Foundation have demonstrated that these estimates are conservative and fishing-related death estimates are well in excess of 100,000 per year (Willis et al., 2023). In Canada, there were 97 fatalities reported in the fishing industry from 2008 to 2017, and in 2018 alone there were 19 fatalities, which was nearly double the 10-year annual average of 9.7 (TSB, 2019). The most recent data available indicates that there were an additional 35 fishing-related fatalities reported in Canadian waters in the three-year span from 2019 to 2021 (TSB, 2022).

Drowning as the result of vessel disasters and falls overboard make up a larger portion of the fatalities (Jensen et al, 2014). To mitigate drowning related fatalities, a personal floatation device (PFD) or lifejacket is the most critically important piece of personal protective equipment (PPE) for ensuring a person stays afloat when they are in the water. However, if the individual is lacking sufficient thermal protection, it also becomes critically important that they be rescued as quickly as possible to reduce their exposure time. One of the most versatile and reliable methods for alerting rescuers is an emergency radio beacon, such as a personal locator beacon (PLB). PLBs are

commercially available electronic radio frequency devices that have helped save thousands of people in distress worldwide each year.

Despite the demonstrated benefits, failure to use PFDs and emergency signaling devices, such as PLBs, has been identified as a factor leading to fatalities in fishing vessel accidents (TSB, 2012). When the TSB examined 63 fishing vessel-related fatalities between 2011 and 2017, they found that the use of a PFD could not be ascertained for 80 percent of cases. In addition, emergency distress signals were not received by authorities for 44 percent of the fatalities (TSB, 2018).

The lack of use is the result of different personal, social, and environmental factors. If we are to improve the rate of PFD and PLB use by fish harvesters, it is critically important to first understand the barriers and facilitators for using these devices. Several studies have identified different barriers associated with the use of PFDs by professional fish harvesters including comfort, risk of entanglement, attitudes and beliefs, culture and habits, lack of regulations, and affordability and accessibility (Ahmad et al., 2017; Oporia et al., 2022a; Weil et al., 2016). Few studies have evaluated interventions that aim to increase the use of PFDs by professional fish harvesters (Oporia et al., 2023a; Sorensen et al., 2021; Teske et al., 2022). We may expect the factors associated with PLB use to be similar to some of those associated with the use of PFDs. In addition, since PLBs are relatively new compared to PFDs, fish harvesters may be less aware of their availability or purpose.

The objective of this systematic review is to synthesize evidence from existing research on factors associated with the use of PFDs and PLBs by professional fish harvesters.

2 Methodology

2.1 Search strategies and databases

Five major electronic databases (Scopus, Web of Science, Medline, Excerpta Media database (EMBASE), and PsycINFO) were searched for articles published in the English language up until 29 February 2024 using a comprehensive search strategy with Boolean logic. The search strategy included three groups of terms, each represented by a circle in the Venn diagram in Figure *1* below, with terms within a group combined using 'OR' logic. The first group included PFD and lifejacket terms, the second group included PLB and emergency signaling device terms, and the third group included boating related terms. The studies included in this review were those from the intersection of all three groups, which were found using the "AND" strategy.

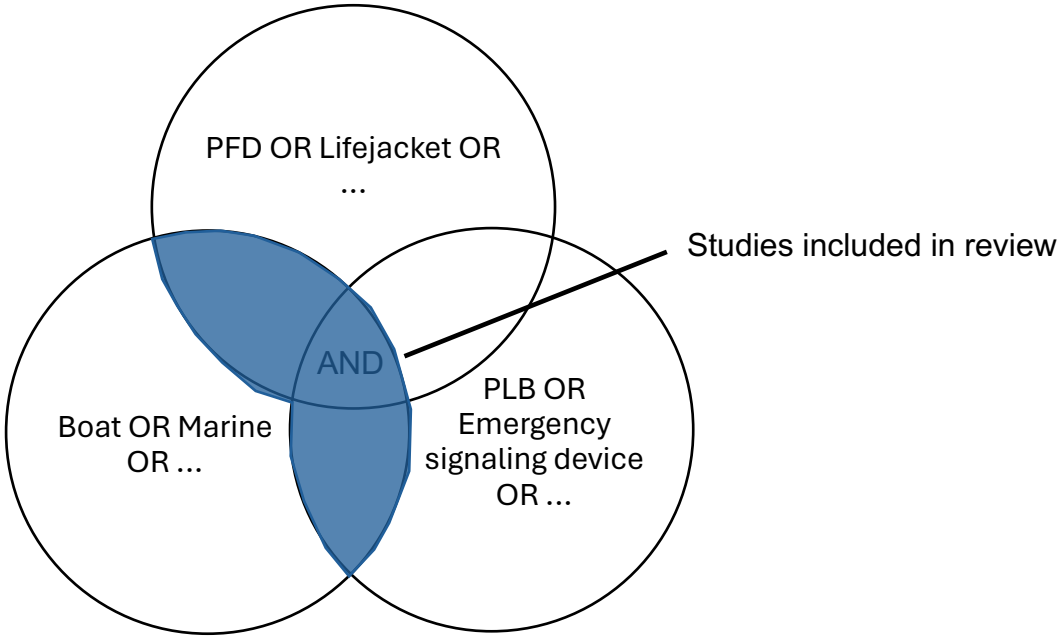

Figure 1 Boolean logic of the search.

2.2 Inclusion and exclusion criteria

We included all journal publications that provided qualitative or quantitative data on factors associated with PFD or PLB use by professional fish harvesters. Studies on PFD or PLB use by recreational boaters or swimmers were excluded, as were studies that included PFD use data for fatalities only. Grey literature was also excluded.

2.3 Review, quality assessment, and data extraction

The title and abstracts of the retrieved articles were each screened by two of the four reviewers (KE and RB or KC or DH) who independently applied the inclusion criteria to select articles for full-text review. Identified conflicts for full-text review were resolved by the first reviewer (KE). Full-text review was then carried out for each article

independently by two of the three reviewers (KE and RB or KC) who then came to a consensus.

Again, pairs of reviewers (KE and RB or KC) used the Mixed Methods Appraisal Tool (MMAT) version 2018 to independently appraise the methodological quality of each study (Hong et al., 2018). Conflicts of appraisals were resolved by consensus between each pair of reviewers. Since it is discouraged to exclude studies with low methodological quality, we did not remove any articles from the review.

3 Results

3.1 Results of the search

After removing duplicate studies, 689 studies were screened for title and abstract and 168 studies for full text. Sixteen studies met our inclusion criteria (
Figure *2*). The remaining 673 studies were not relevant to our review objectives.

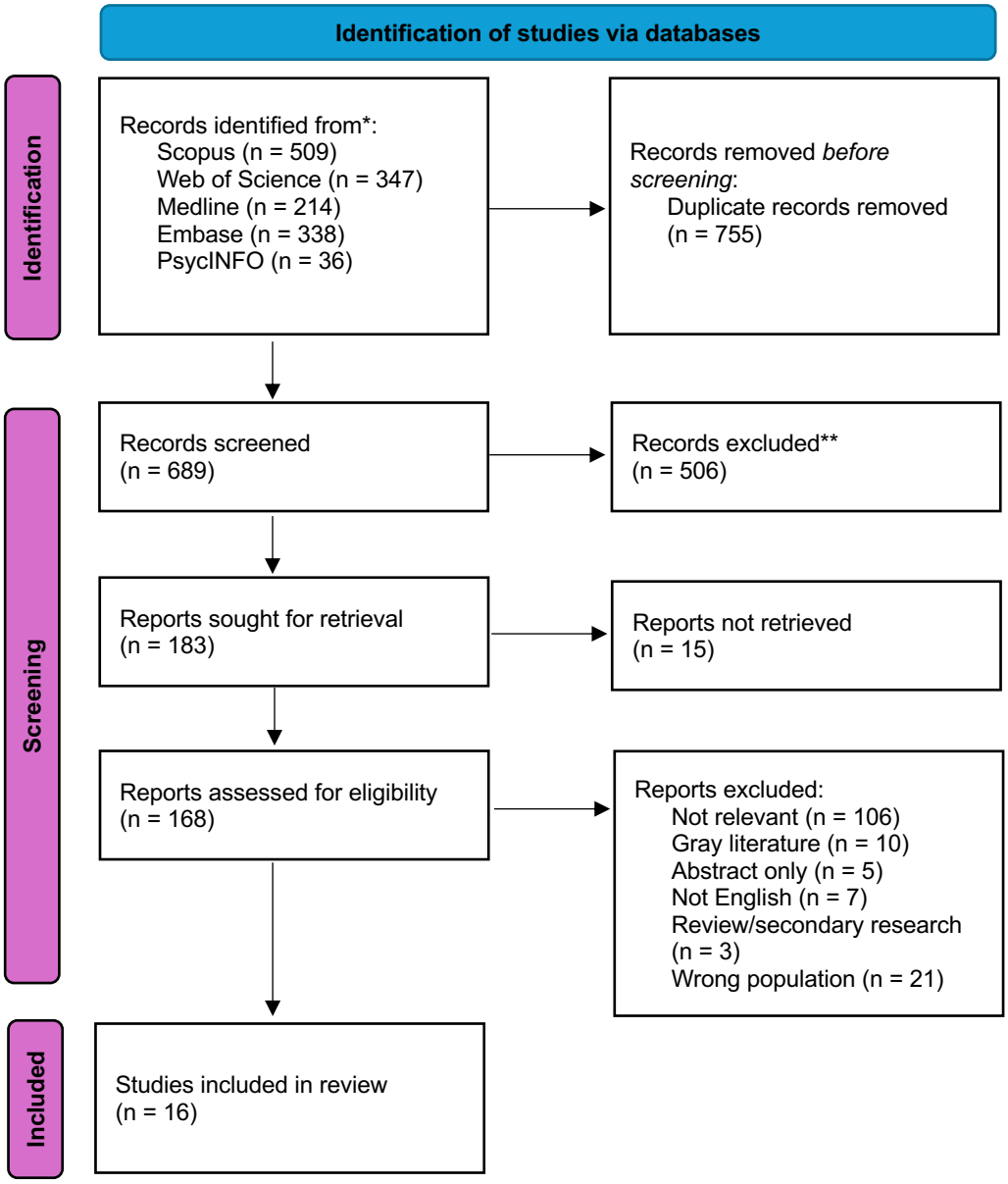

Figure 2 PRISMA flowchart

3.2 Characteristics of the included studies

Of the 16 studies that met our inclusion criteria, all were related to factors associated with PFD use by fish harvesters. No studies were found related to factors associated

with PLB use by fish harvesters. Ten of the 16 studies were quantitative, four were qualitative, and two were mixed methods. Of the ten quantitative studies four were survey-based descriptive studies looking at use and factors associated with use of floatation devices (Ahmad Faud et al., 2017; Lucas et al., 2013; Oporia et al., 2022b; Sharma et al., 2019), one was a field evaluation to determine the factors that influenced PFD use among fish harvesters (Lucas et al., 2012), and one was an experimental assessment of lifejacket seaworthiness (Oporia et al., 2024). Three were non-randomized trials (Sorensen et al., 2019; Sorensen et al., 2021; Teske et al., 2022) and one study was a randomized control trial (Oporia et al., 2023a). Three of these studies assessed the effectiveness of an intervention on the use of PFDs (Sorensen et al., 2021; Teske et al., 2022; Oporia et al., 2023a), while one of the non-randomized studies evaluated various lifejacket designs to identify different preferences and features that could encourage the use of lifejackets (Sorensen et al., 2019).

Four studies were of a qualitative nature, making use of interviews and surveys to determine factors associated with the use of PFDs (Brooks et al., 2007; Fay et al., 2024; Oporia et al., 2022a; Weil et al., 2016). The last two used a mixed methods approach, where one used observations and surveys to determine PFD usage and community knowledge and attitudes regarding water safety (Kobusingye et al., 2017), and the other used a three-phase approach to develop a training manual as an intervention to improve lifejacket use (Oporia et al., 2023b).

Seven studies were conducted in the United States, six came from Uganda, and one each from Australia, India, and Malaysia.

3.3 Factors associated with PFD use

3.3.1 Comfort and accessibility

Over the years, comfort has been identified as one common barrier for using many types of PPE, including PFDs. Ahmad et al. (2017) found that PFDs were underutilized by fish harvesters in their region of Malaysia due to comfort issues. A study in the Northeastern United States also reported that decreased use of PFDs by fish harvesters was associated with a lack of comfort by wearers (Sorensen et al., 2019). In the meantime, when a study looked at the satisfaction of different PFD designs during different fishing activities, they found comfort and satisfaction scores were high for some PFDs which indicates that suitable PFD designs exist for different fishing activities (Lucas et al., 2012). While suitable PFD designs may exist, fish harvesters have identified limited access to suitable PFDs and affordability as barriers to use (Ahmad et al., 2017; Fay Cyr et al., 2024; Oporia et al., 2022a).

3.3.2 Work interference

Related to comfort is the ability to work without interference of the PFD. Some research identified that fish harvesters believe PFDs interfered with their work, which was inversely associated with PFD use (Lucas et al., 2013; Weil et al., 2016). Similarly, fish harvesters also reported that wearing a PFD was inconvenient or impractical (Ahmad et al., 2017; Sorensen et al., 2019). In addition to interfering with work, some fish

harvesters indicated that they believed wearing a PFD was risky because it created an entanglement hazard (Lucas et al., 2013).

3.3.3 Social and cultural norms

Another reoccurring factor associated with the lack of PFD use is related to social and cultural norms. Oporia et al. (2022a) reported that fish harvesters and transporters believed that PFDs were for women only. Other studies have reported that cultural and social norms influence non-compliance because wearing a PFD is often seen as unnecessary and there is a stigma associated with wearing a PFD (Ahmad et al., 2017; Sorensen et al., 2019; Weil et al., 2016). However, Oporia et al., (2022b) found that those who participated in PFD training sessions were more likely to use PFDs.

3.3.4 Perceived risk

Brooks et al. (2007) noted that PFD use by Australian fish harvesters was sometimes based on perceived risk rather than adherence to regulations. Similarly, in Northeastern United States one of the reasons for not using a PFD was because the risk of falling overboard or ending up in the water was deemed to be low (Weil et al., 2016). One study also reported that fish harvesters believed that being able to swim reduced their need to wear a PFD (Ahmad et al., 2017).

3.3.5 Incident exposure and confidence in PFDs

Even when fish harvesters had reported being in a boat that had capsized or nearly capsized, it could not be associated with an increased use of PFDs (Kobusingye et al., 2017). However, Oporia et al. (2022a) did report that fish harvesters and transporters were more motivated to wear a PFD if they had witnessed a drowning incident. Yet the

same study reported harvesters' belief that PFDs are not reliable, and thus a lack of knowledge could be a barrier to use. A test of the seaworthiness was conducted for available PFDs in the Lake Albert region of Uganda and all PFDs failed to meet minimum buoyancy requirements (Oporia et al., 2024).

3.4 Interventions

Three studies investigated the effectiveness of interventions aimed at increasing the adoption of PFDs by fish harvesters. Sorensen et al. (2021) evaluated the effectiveness of a social marketing intervention designed to increase PFD use among lobster fishermen. They found that applying social marketing principles lead to an increased willingness to consider and purchase PFDs. Another social marketing campaign that aimed to increase use of PFDs by addressing common barriers and misconceptions resulted in an increased use of PFDs by fish harvesters while working on deck (Teske et al., 2022). The third study demonstrated that fish harvesters and transporters who received peer-led training were more likely to wear a PFD than those who did not receive peer-led training (Oporia et al., 2023a).

4 Discussion

The objective of this systematic review was to gather existing evidence on factors that influence the use of PFDs and PLBs by professional fish harvesters. Previous studies were found that identified multiple factors leading to an inverse association with PFD use by fish harvesters. These barriers included lack of comfort, cost, work interference, social norms, risk diffusion, and confidence in PFD effectiveness (Ahmad et al., 2017;

Fay Cyr et al., 2024; Lucas et al., 2013; Oporia et al., 2022a; Sorensen et al., 2019; Weil et al., 2016). Conversely, some studies highlighted factors associated with increased use of PFDs, such as exposure to previous incidents and participation in PFD education (Oporia et al., 2022a; Oporia et al., 2022b). Few studies have evaluated interventions that aim to increase adoption of PFDs by professional fish harvesters (Oporia et al., 2023a; Sorensen et al., 2021; Teske et al., 2022).

While no studies were found on factors associated with PLB use, we may expect some of the same factors that are associated with PFD use to influence the use of PLBs. However, we do not anticipate there to be comfort-related reasons negatively affecting the use of PLBs. In addition, since PLBs are relatively new compared to PFDs, fish harvesters may be less aware of their availability or purpose.

5 Conclusion

The evidence collected has already been used to inform the development of our survey to better understand the factors associated with the use PFDs and PLBs by professional fish harvesters in the region of Newfoundland and Labrador, Canada. In addition, the evidence from this systematic review, along with analysis of results from our survey may be used to inform the development of interventions, regulatory measures, and future research aimed at increasing the use of PFDs and PLBs by professional fish harvesters, and subsequently reduce the number of drowning related fatalities. The results of this systematic review will be submitted to an academic journal for peer-review and publication.

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