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## Quantifying an inconvenient truth : revisiting a culture of adjustment on work/rest hours

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# Quantifying an Inconvenient Truth

Revisiting a Culture of Adjustment on Work/Rest Hours

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University join their social science expertise with their seafaring background to  
participate in research to enhance occupational safety and health and safety at sea



*The ITF Seafarers' Trust was established in 1981 as a body with charitable status under UK law. It is dedicated to the welfare of seafarers, irrespective of nationality, race or creed.*

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# Abbreviations and Acronyms

<b>2/O</b>	Second Officer
<b>3/O</b>	Third Officer
<b>ATSB</b>	Australian Transport Safety Bureau
<b>BBC</b>	British Broadcasting Company
<b>BIMCO</b>	International shipping associations representing shipowners
<b>C180</b>	Convention on Seafarers' Hours of Work and the Manning of Ships, No. 180
<b>CHERRIES</b>	Checklist for Reporting Results of Internet E-Surveys
<b>CHIRP</b>	Confidential Human Factors Incident Reporting Programme
<b>CIC</b>	Concentrated Inspection Campaign
<b>C/O</b>	Chief Officer
<b>CROSS</b>	Checklist for Reporting of Survey Studies
<b>DiGiFeMa</b>	Direzione Generale per le Investigazioni Ferroviarie e Marittime
<b>EU</b>	European Union
<b>FMCSA</b>	Federal Motor Carrier Safety Administration
<b>ICS</b>	International Chamber of Shipping
<b>IFSMa</b>	International Federation of Shipmasters' Associations
<b>ILO</b>	International Labour Organization
<b>IMarEST</b>	Institute of Marine Engineering, Science and Technology
<b>IMO</b>	International Maritime Organization
<b>ISM</b>	International Safety Management
<b>ISWAN</b>	International Seafarers' Welfare and Assistance Network
<b>ITF</b>	International Transport Workers' Federation
<b>KPI</b>	Key Performance Indicator
<b>MAIB</b>	Marine Accident Investigation Branch
<b>MCA</b>	Maritime and Coastguard Agency
<b>MLC</b>	Maritime Labour Convention
<b>MSC</b>	Maritime Safety Committee
<b>NI</b>	Nautical Institute
<b>NMA</b>	Norwegian Maritime Authority
<b>NTSB</b>	National Transportation Safety Board
<b>NUMAST</b>	National Union of Marine, Aviation and Shipping Transport Officers
<b>OCIMF</b>	Oil Companies International Marine Forum
<b>P&amp;I</b>	Protection and Indemnity
<b>PSC</b>	Port State Control
<b>RAA</b>	Respondent Anonymity Assurance
<b>REC</b>	Research Ethics Committee
<b>SOLAS</b>	International Convention for the Safety of Life at Sea
<b>SPSS</b>	Statistical Package for Social Sciences
<b>STCW</b>	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
<b>TSB</b>	Transportation Safety Board of Canada
<b>UK</b>	United Kingdom
<b>US</b>	United States
<b>WHO</b>	World Health Organization
<b>WISTA</b>	Women's International Shipping & Trading Association
<b>WMU</b>	World Maritime University

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# Disclaimer

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# Executive Summary



**Work/rest regulations are critical in mitigating fatigue at sea. This report offers a quantitative overview of the implementation of work/rest regulations from seafarers' perspectives. With this report, all stakeholders will gain an empirically-informed understanding of the extent of the issues related to the implementation of work/rest regulations. Ultimately, the study will support policy interventions to mitigate the fatigue risk at sea.**

From June 2022 to December 2022, the research team captured, via a global survey, seafarers' insights on fatigue factors, the effectiveness of the current regulatory regime, work-rest-sleep characteristics, work/rest hours recording practices and associated challenges.

An unprecedentedly large number of seafarers responded to the survey (the sample description is detailed in the report).

The analyses of their responses yielded several key findings:

- **Fatigue perception:** Seafarers identify fatigue as a significant challenge to their safety, health, and well-being. They express the view that the existing regulatory framework is ineffective in alleviating fatigue at sea.
- **Daily work, rest, and sleep hours:** Seafarers report, on average, working for 11.5 hours, resting for 10.8 hours, and sleeping for 7.0 hours daily. Notably, 28.1% of seafarers acknowledge resting less than 10 hours, thus violating rest hours standards.
- **Weekly work hours:** Seafarers report working on average 74.9 hours per week, significantly higher than the global 43 hours per week identified by the International Labour Organization (ILO) 2018 General Survey. This underscores a notable disparity in working time between seafaring and other sectors.
- **Weekly day off:** Seafarers work non-stop. Indeed, 78.3% report not having one full day off during their entire contract period; contradicting the intention of the Maritime Labour Convention, 2006 (MLC, 2006) Standard A2.3 # paragraph 3.
- **Non-compliance with work/rest limits:** A noteworthy 88.3% of seafarers admit to exceeding work/rest hours limits at least once a month. Alarming, 16.5% exceed the limits more than ten times a month.
- **Recordkeeping adjustment:** Only 31.6% of seafarers admit to never adjusting their records.
- **Reasons for adjustment:** The main reasons for adjustment are: first, to avoid non-conformities during inspection (80.2%); second, to avoid problems with the company (75.0%); and third, to gain financial benefits (31.1%).
- **Response to non-compliance:** Only 50.3% of seafarers report non-compliance to their company. Companies reportedly question or neglect non-compliance reports in most cases. In only 22.4% of cases do companies respond by providing additional crewing.
- **Workload challenges:** For 87.6% of seafarers, there is an imbalance between work demand and crewing levels.

Seafarers advocate for recognition from companies, flag States and port States regarding work/rest-related challenges. They emphasise the pivotal role of regulatory reforms in manning (crewing) and working time to mitigate the risk of fatigue effectively.

The research team systematically verified the data with the available literature on the topic. Unequivocally, the literature confirms the findings of the survey. Therefore, the study adds a new set of evidence, gained directly from seafarers, to the existing research. Based on an unprecedented sample size, the survey reinforces previous findings on issues related to seafarers' fatigue and implementation of work/rest regulations.

Adjusting records of work/rest hours comes at a significant cost to seafarers. This practice conceals their excessive working hours, exacerbating fatigue and impacting their well-being, health and safety.

In conclusion, this report serves as a reminder of the need to address this long-standing issue and consider effective regulatory and industry cultural changes.

01

# Background



The 2019 International Maritime Organization (IMO) guidelines on fatigue (MSC.1/Circ.1598) underscore the adverse impact of fatigue on cognitive, physical, and behavioural performance, resulting in increased risks of accidents and long-term detrimental health effects [1], implicitly requiring effective mitigation strategies.

While the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, Chapter V requires that ships be sufficiently and efficiently manned, it is two other international conventions which, complementing the SOLAS requirement, give detailed standards intended to mitigate fatigue:

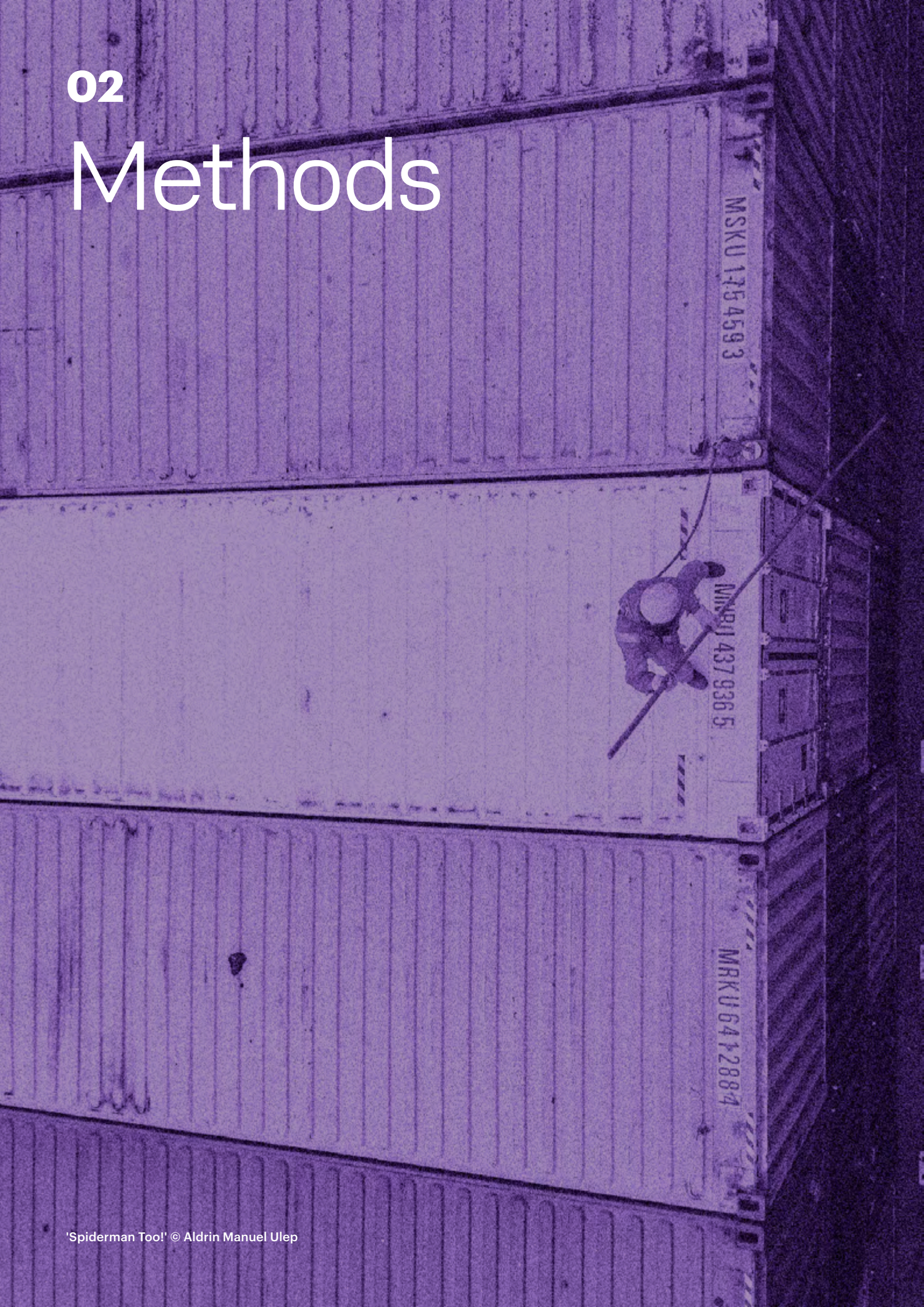
- First, the Seafarers' Training, Certification, and Watchkeeping Code of the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW 1978, as amended) in its Section A-VIII/1;
- Second, the Maritime Labour Convention, 2006, as amended (MLC, 2006), which incorporated the provisions of the Convention on Seafarers' Hours of Work and the Manning of Ships, No. 180 (C180), in its Regulation 2.3.

The provisions of the two conventions require seafarers to register their hours of work/rest. These records are essential for demonstrating (or not) compliance with the standards, enabling enforcement by authorities such as flag States and port States in their exercise of jurisdictional control, and providing reliable insights into seafarers' working hours for improvements in the regulatory regime and industry practice.

However, multiple studies and casualty investigations have revealed that adjusting these records is a regular occurrence, indicating regulatory and enforcement shortcomings [2]–[7], with scientific literature consistently underscoring the prevalence of seafarers' fatigue [2], [8]–[12]. Although both qualitative and quantitative research on this phenomenon of adjustment exist, there is a need for a comprehensive global assessment of this issue.

02

# Methods



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MRKU6412884

An online survey was conducted between June 2022 and December 2022 to capture seafarers' experiences with work/rest hours, workload, and ship manning (crewing). It featured closed-ended questions using a 6-point Likert response format based on previous studies [13], [14] and ranking queries. Additionally, open-ended questions were placed at the end of each section to collect qualitative insights. All questions were voluntary<sup>1</sup>.

To maintain a neutral tone, 'adjustment'<sup>2</sup> was preferred over more explicit terms like 'falsification,' 'cheating,' or 'fabrication'. Similarly, 'possibly exceeded limits' was used instead of 'violation' to probe non-compliance and the inclusion of the term 'possibly' allowed for a more neutral approach without misleading respondents.

The World Maritime University (WMU) Research Ethics Committee (REC) approved the study. Informed consent was a prerequisite for responding to the survey. To ensure respondent anonymity, the survey refrained from collecting personal identifiers, with the 'Response Assurance Anonymity' (RAA) feature in the survey tool reinforcing this measure.

The survey was available in six languages: Chinese, English, Indonesian, Russian, Tagalog (Philippines), and Ukrainian. Seafarers who had worked after 01 February 1997<sup>3</sup> or are currently working on ships were invited to respond.

Fifty-one organisations (from the 88 contacted) promoted the survey. These organisations utilised different methods to promote the survey, including social media networks, official websites, and internal distribution to their members.

Evidence of the validity of the study is provided in section 5 of this report on 'Research strengths and limitations'.

- 1 Except socio-demographic and work-related characteristic related questions.
- 2 In the context of this report, the term 'adjustment' refers to the 'intentional act to conceal non-compliance with work-rest hours regulations'.
- 3 On this date, seafarers' hours of rest regulation came into force under the STCW 1978, as amended.

03

# Results





A total of 9,214 responses were received. This data was subjected to a systematic screening process (outlined in Table 1) using the statistical software SPSS (version 29.0.0.0[241]). Finally, 6,304 valid responses were considered for the analysis.

**Table 1: Survey data screening steps**

No.	Steps	Excluded responses	Remaining responses
0	Initiated the survey	–	9,214
1	Declined to respond	38	9,176
2	Agreed to respond but did not answer any question	1,705	7,471
3	Answered only questions on socio-demographics	1,050	6,421
4	Gave unusual response <sup>4</sup>	21	6,400
5	Straight-lined through all Likert responses <sup>5</sup>	96	6,304

The sample size of 6,304 is deemed sufficient, surpassing the recommended size for a seafaring population by 16.4 times (further details in section 5). Outliers<sup>6</sup> were identified and excluded from the analysis by labelling them as missing values (.) in SPSS.

The report maintains transparency by denoting the number of valid responses for each question as ‘n’. This acknowledges that respondents might not have completed every question due to the voluntary nature of the survey.

- 4 Namely, responses that were unexpected or uncommon. For example, the respondent might respond ‘spaceship’ if queried about the type of ship sailed.
- 5 ‘Straight-lined through all Likert responses’ means a respondent consistently marked the same response (e.g. always selecting the same option) without variation, potentially indicating a lack of engagement or consideration while responding.
- 6 This refers to an error made in the survey response. For instance, when asked about the starting year of the seafaring career, the respondent mistakenly entered 1080 instead of 1980.

## 3.1 Seafarers' socio-demographic and work-related characteristics

On average, respondents reported an age of 37.9 years and a seafaring experience of 14.1 years. Male seafarers (94.6%) constituted the majority, with female respondents making up 4.5%. This diverse group hailed from 113 countries and served on 23 ship types registered with 122 flag States. Their role spanned 26 different ranks, with officers exhibiting a noticeably higher response (76.1%) than ratings (15.7%). Furthermore, 82.6% of the respondents were active seafarers, having sailed during the survey year 2022 (refer to Table 2).

**Table 2: Seafarers' socio-demographic and work-related characteristics**

<b>Characteristics</b>	<b>Number of respondents*</b>	<b>Percentage (%) 100%</b>
<b>Age group (years)</b>	<b>(n=6,299)</b>	
18 or younger	5	0.1
18 – 30	1,699	27.0
30 – 40	2,465	39.1
40 – 50	1,298	20.6
50 – 60	567	9.0
Older than 60	265	4.2
<b>Gender</b>	<b>(n=6,304)</b>	
Male	5,965	94.6
Female	282	4.5
Prefer not to say	54	0.9
Others	3	0.0
<b>Nationality (Top 15 out of 113)</b>	<b>(n=6,304)</b>	
India	1,825	28.9
Philippines	637	10.1
China	630	10.0
Ukraine	436	6.9
Indonesia	236	3.7
United Kingdom	211	3.3
Croatia	203	3.2
Germany	182	2.9
Sri Lanka	141	2.2
United States	141	2.2
Russia	114	1.8
Nigeria	101	1.6
Pakistan	76	1.2
Italy	72	1.1
Brazil	63	1.0
Others	1,236	19.9
<b>Seafaring experience (years)</b>	<b>(n=6,289)</b>	
5 or below	1,354	21.5
Between 5 – 10	1,405	22.4
Between 10 – 15	1,310	20.8
Between 15 – 20	860	13.7
Between 20 – 25	555	8.8
More than 25	805	12.8

**Table 2: Seafarers' socio-demographic and work-related characteristics (continued)**

Characteristics	Number of respondents*	Percentage (%) 100%
<b>Work status</b>	<b>(n=5,596)</b>	
<b>Active seafarer</b>	<b>(n=4,623)</b>	
On-board	2,601	46.5
Not on board (sign off in 2022)	2,022	36.1
<b>Non-active seafarer</b>	<b>(n=973)</b>	
Between Aug 2013 – Dec 2021	757	13.5
Between 2002 – July 2013	171	3.1
Between 1997 – 2002	45	0.8
<b>Rank group</b>	<b>(n=5,182)</b>	
Deck officer	1,772	34.2
Engineer	1,166	22.5
Captain	1,007	19.4
Deck rating	497	9.6
Cadet	243	4.7
Engine rating	187	3.6
Catering	127	2.5
Others	183	3.5
<b>Type of ship (Top 15 of 23)</b>	<b>(n=5,182)</b>	
Container ship	1,041	20.1
Bulk carrier	960	18.5
Crude oil tanker	565	10.9
Chemical tanker	461	8.9
Product tanker	358	6.9
Cruise ship	316	6.1
LPG tanker	201	3.9
General cargo ship	159	3.1
LNG tanker	159	3.1
Offshore support vessel	150	2.9
Tug	137	2.6
Pure car carrier	75	1.4
Multi-purpose vessel	74	1.4
Ferry	66	1.3
RoRo	58	1.1
Others	402	7.8

\* While the data provided in the above table was mandatory to complete in the survey, variation in 'n' exists across different characteristics. The reason is that socio-demographic details were collected at the beginning of the survey. In contrast, ship-related data were completed later in a separate section, with some respondents who dropped the survey and did not complete these details. Conversely, minor differences appear between groups queried within the same survey section (e.g. age group and gender). This slight disparity arises due to outliers (errors in data entry), which were considered 'missing values' for the analysis.

**Table 2: Seafarers' socio-demographic and work-related characteristics (continued)**

Characteristics	Number of respondents*	Percentage (%) 100%
<b>Flag State (Top 15 out of 122)</b>	<b>(n=5,181)</b>	
Singapore	627	12.1
Marshall Islands	581	11.2
Panama	547	10.6
Liberia	462	8.9
Bahamas	342	6.6
Hong Kong	270	5.2
Malta	177	3.4
China	170	3.3
Indonesia	145	2.8
Norway	134	2.6
Cyprus	117	2.3
United Kingdom	111	2.1
United States	109	2.1
Germany	104	2.0
India	97	1.9
Others	1,188	22.9
<b>Type of company</b>	<b>(n=5,183)</b>	
Ship management	2,040	39.4
Crewing agency	1,638	31.6
Ship owners	1,401	27.0
Others	104	2.0
<b>Ship trading area</b>	<b>(n=5,183)</b>	
International	3,739	72.2
Both – International and Coastal	852	16.4
Coastal	507	9.8
Others	85	1.6

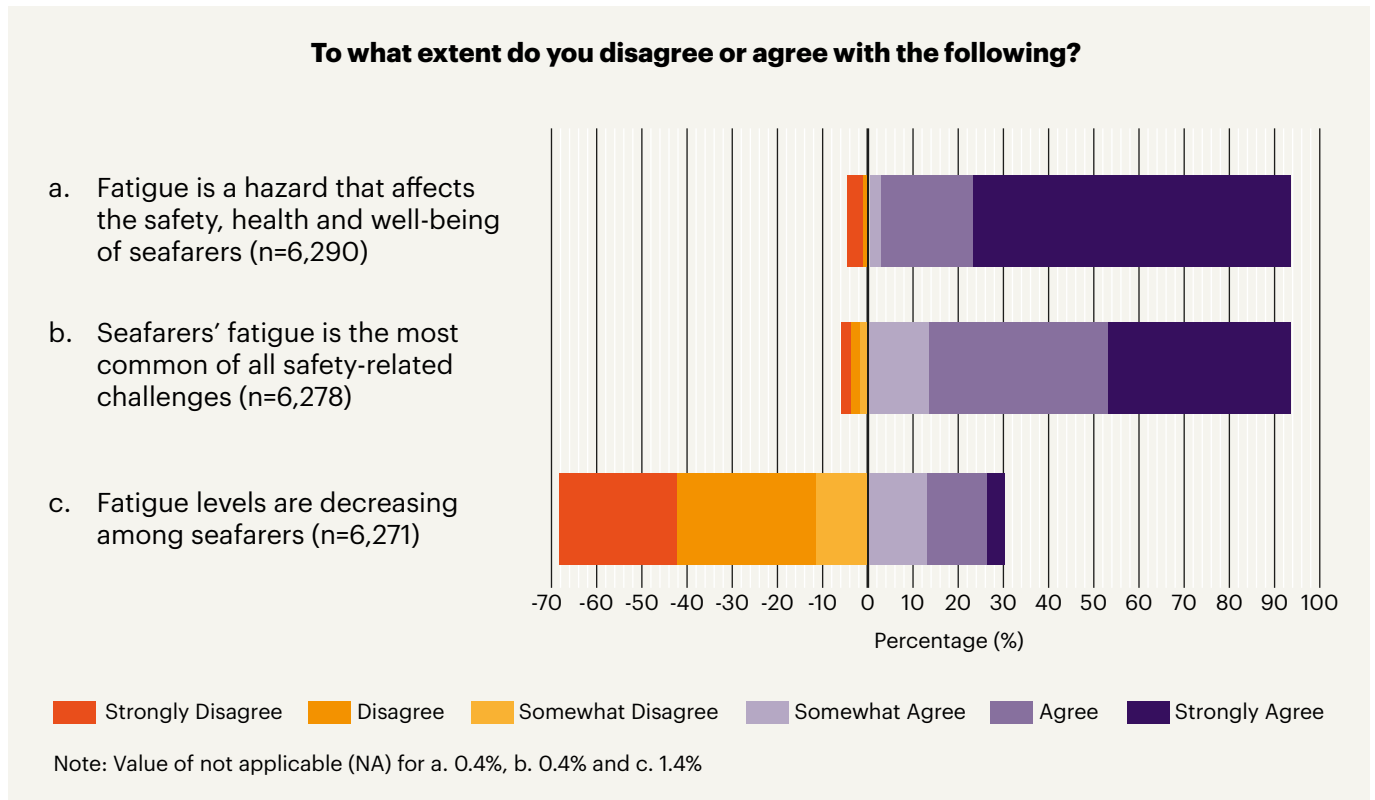
The following sub-sections present descriptive data supported by figures. The findings are then discussed within the context of existing related literature.

## 3.2 Fatigue perception

As shown in Figure 1:

- Almost all respondents (94.9%) recognised fatigue as a hazard that poses risks to safety, health, and well-being;
- Most respondents (93.4%) agreed that fatigue is the most common safety-related challenge;
- More than two-thirds of respondents (68.4%) disagreed that fatigue levels have decreased among seafarers.

**Figure 1: Seafarers’ fatigue perception**



### In the literature

Shan and Neis (2020) highlighted fatigue as the most common safety-related challenge among Canadian seafarers [15]. Garb et al. (2013) indicated that 73.1% of surveyed seafarers perceived fatigue as a prevalent issue on their ships, with an even higher percentage (90.0%) expressing concerns about its common occurrence [16]. Gander (2005) cited a New Zealand Maritime Safety Authority survey revealing that a quarter of New Zealand seafarers commonly experience fatigue, and a similar proportion of ship owners/operators perceive fatigue as a safety risk [9].

The negative impact and consequences of fatigue have surfaced in high-profile maritime disasters such as the Herald of Free Enterprise’s capsizing and the Exxon Valdez’s grounding [17], [18]. Studies suggest that fatigue contributes to maritime accidents within the 10–16% range, aligning with the consensus among 26 renowned fatigue scientists who posit its role in 16–20% of accidents across various transportation modes [19]–[23].

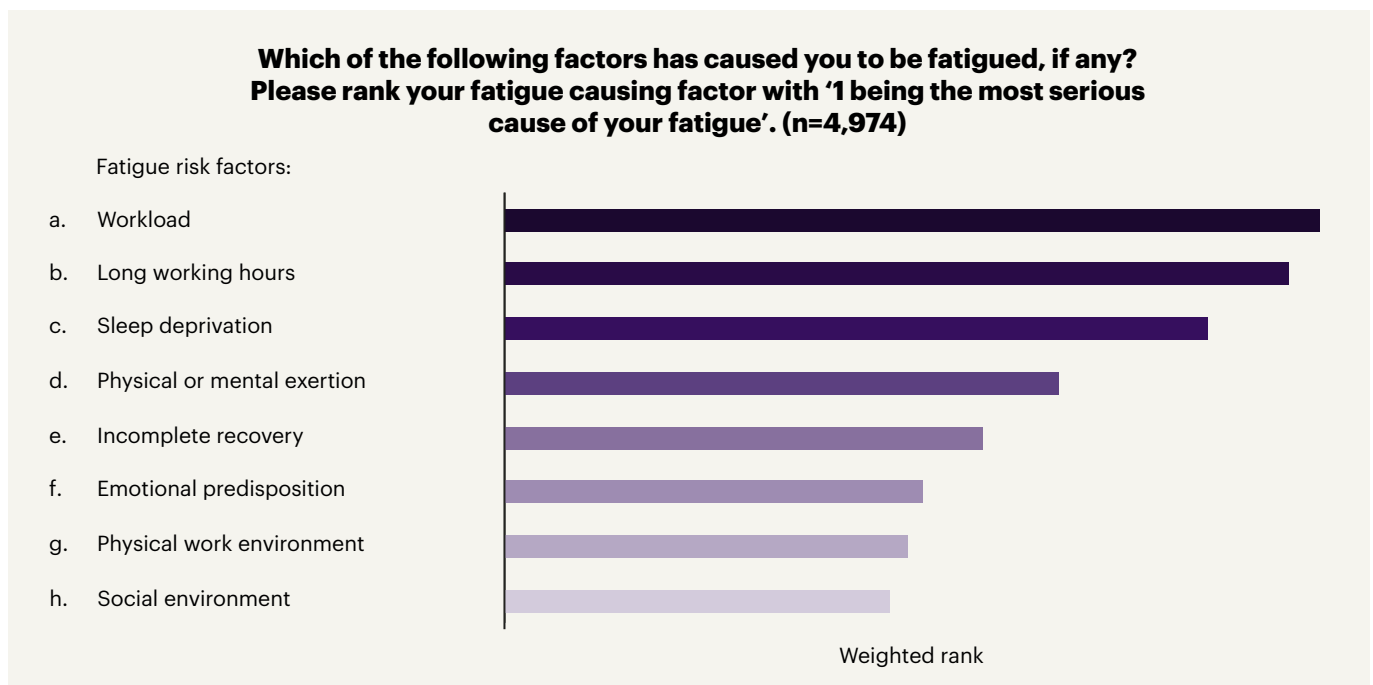
The prevalence of fatigue and recognition of its impact on safety resonates across global maritime safety agendas. The United States (US) and Canadian Transportation Boards included fatigue in their ‘Most Wanted’ safety improvement lists [24], [25]. The UK’s Maritime and Coastguard Agency (MCA) designated fatigue as one of the ‘deadly dozen’ [26]. Moreover, an Australian Parliament’s House of Transport Committee inquiry recognised fatigue as a core safety issue in the transport industry [27].

## 3.3 Ranking of fatigue risk factors

As depicted in Figure 2:

- Seafarers ranked workload as the most serious cause of fatigue;
- Long working hours, sleep deprivation, and exertion (physical or mental) were ranked 2nd, 3rd, and 4th respectively.

**Figure 2: Seafarers' ranked fatigue risk factors**



The possibility to include comments resulted in 1,096 open-ended responses on risk factors. These insights revealed predominant themes centred around workload and work hours, converging with trends observed in the ranked responses. Interestingly, the term 'crewing levels' emerged as the most frequently cited, underscoring the critical significance seafarers attribute to crewing levels in addressing fatigue.

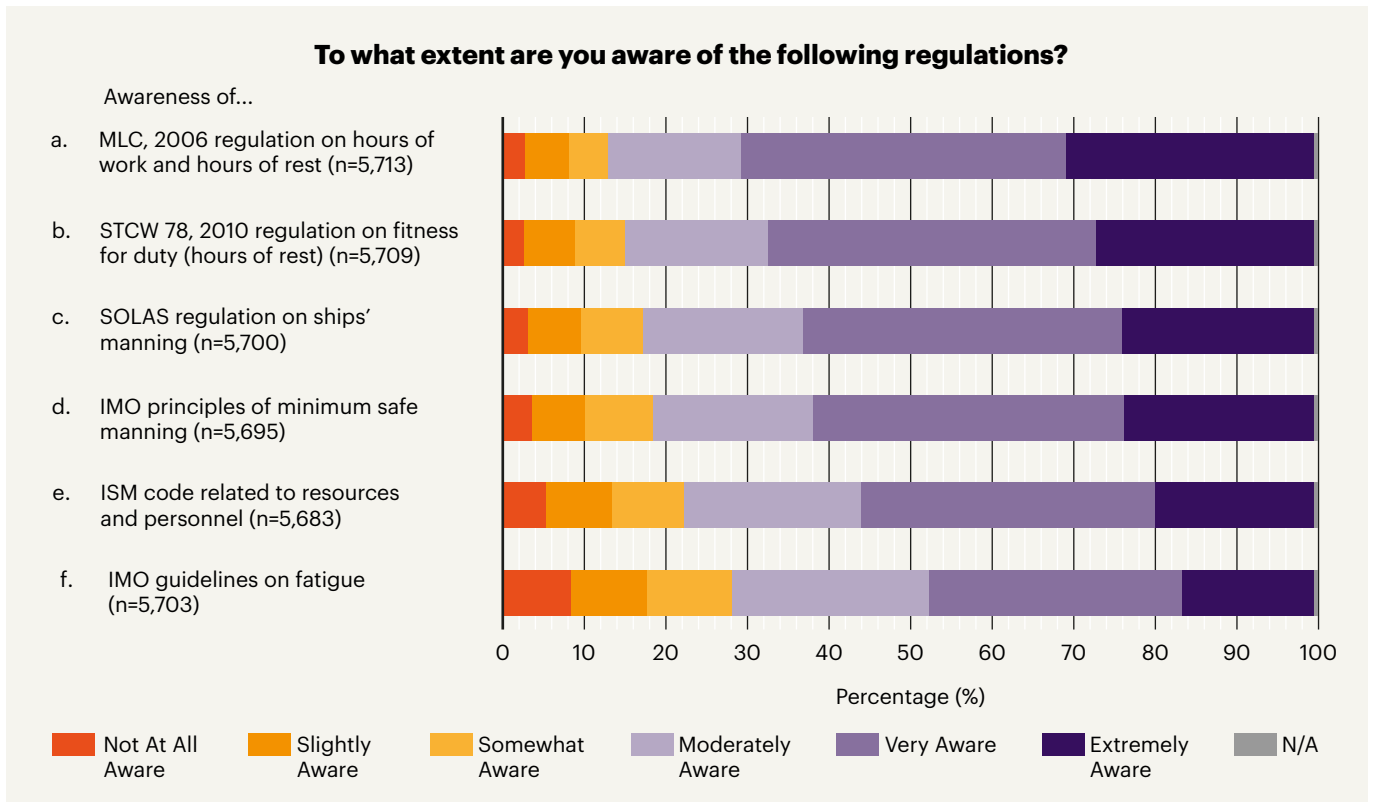
### In the literature

The emphasis on workload and work hours as the primary fatigue risk factors reinforces Dohrmann and Leppin's (2017) examination of 19 studies and Oldenburg et al.'s (2013) analysis of 13 field studies. These reviews underscore that most studies associate seafarers' fatigue with work-related factors such as workload and work hours [8], [12].

### 3.4 Awareness and effectiveness of the current regulatory framework

As shown in Figure 3, seafarers are aware of fatigue-related regulations.

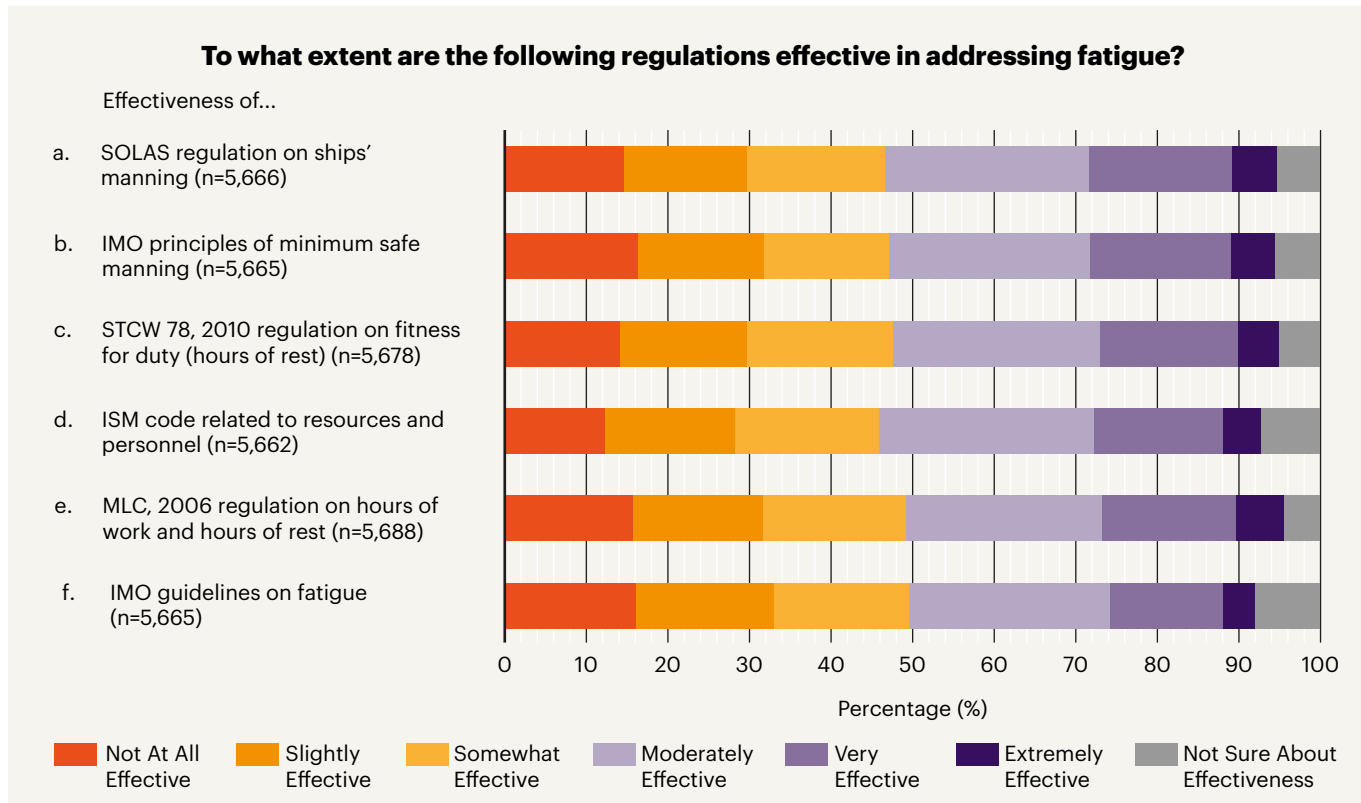
Figure 3: Awareness of the current regulatory framework





However, nearly half of seafarers questioned the effectiveness of the current regulations in addressing fatigue (see Figure 4).

**Figure 4: Effectiveness of the current regulatory framework**



### In the literature

This research contributes insights into the effectiveness of the seafarers' fatigue regulatory framework, with WMU (2020) and Baumler et al. (2021) focusing on the implementation of work/rest regulations. However, there remains a significant gap in research concerning the effectiveness of fatigue mitigation strategies or their implementation within the broader maritime and transportation sectors [13], [14], [28], [29]. This underscores the critical need to increase research efforts in this direction to understand and improve existing fatigue mitigation practices.

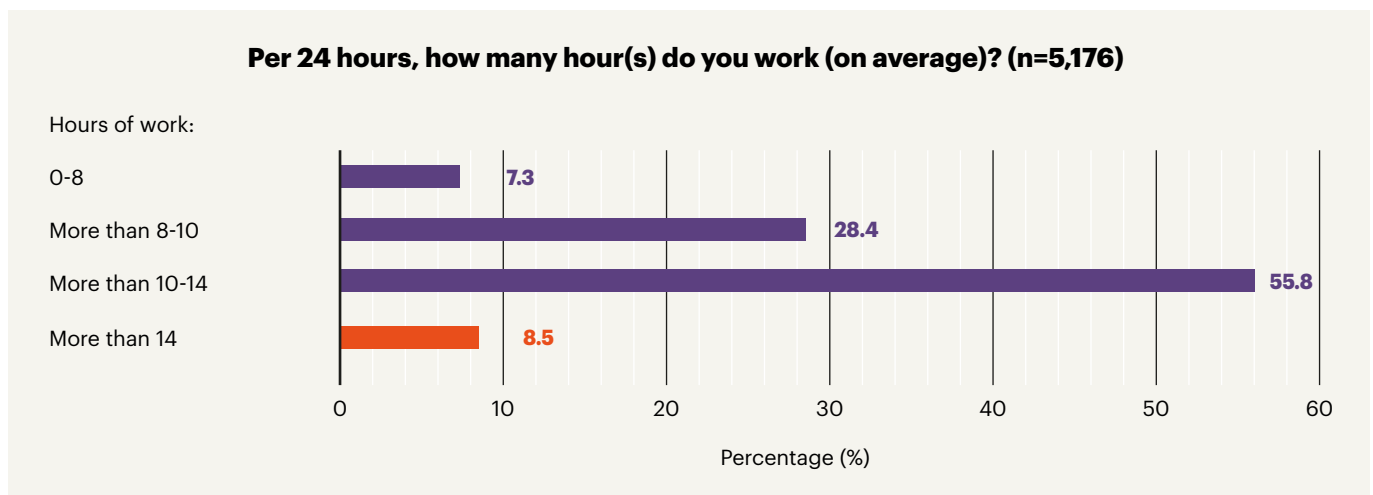
## 3.5 Seafarers' work–rest–sleep characteristics

### 3.5.1 Average work hours

Figure 5 depicts the following:

- The average working hours for respondents was 11.5 hours out of 24 hours;
- The majority (55.8%) reported working between 10 and 14 hours;
- Only 7.3% worked for 8 hours or less;
- Worryingly, 8.5% of respondents reported working beyond 14 hours, indicating continuous non-compliance with regulations.

Figure 5: Seafarers' average daily work hours



## In the literature

Seafarers often exceed 10 hours of work per day, as evidenced by objective and subjective studies conducted over three decades. It is noteworthy that the very early findings are essentially the same as those in the most recent research.

Rutenfranz et al. (1988) recorded an average of 10.4 hours of work by watchkeepers during a two-week field study [30]. Similarly, Sanquist et al. (1997) observed an average of 11.5 hours of work across eight ships during a study spanning 10 to 30 days [31]. Allen et al.'s (2005) field study reported that deck officers were regularly expected to work an additional 1–2 hours from their off-duty period over a 12-fixed-hour work duration [32]. Uğurlu's (2016) case study on tankers revealed that chief officers (C/O) worked over 15 hours for more than 16 days, while second officers (2/O) exceeded 15 hours for seven days per month [33]. Oldenburg and Jensen's (2019) field study reported an average of 11.1 working hours during port stays and 11.7 working hours during river passages on container ships [34].

A NUMAST (1995)<sup>7</sup> survey indicated that 90% of British seafarers worked 10 hours or more daily, while an ITF (1997)<sup>8</sup> survey found that 17% of watchkeepers regularly exceeded 12 hours. Cole-Davies (2001) reported that 50.6% of seafarers worked over 12 hours [35]. McNamara et al. (2005) found that 27.6% of seafarers worked 15 hours or more, with 21.5% dedicating four or more hours daily to additional duties<sup>9</sup> [36]. Wadsworth et al. (2006) found that seafarers worked an average of 12 hours [37]. In a recent study, Buscema et al. (2023) revealed that Italian seafarers consistently worked more than 10 hours daily [38].

### 3.5.2 Average rest hours

Note: As per MLC, 2006 Standard A2.3 # paragraph 1, 'hours of rest' means time outside the hours of work, excluding short breaks.

In essence, 'rest' does not mean *stricto sensu* sleep, but includes other activities during the off-duty periods, of which attending to personal needs (physiological, psychological, spiritual etc.) may account for approximately 2.25 hours per day, as indicated by research of Rutenfranz et al. (1976) [39].

In this study and as illustrated in Figure 6:

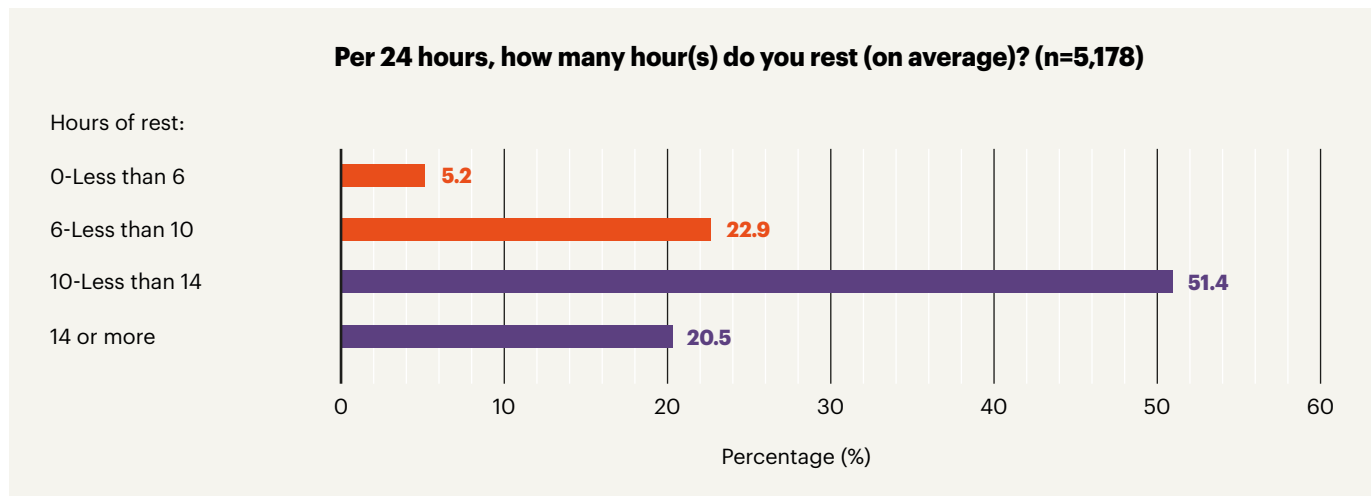
- On average, seafarers reported 10.8 hours of rest in a 24-hour period;
- However, 28.1% of respondents indicated resting less than 10 hours per day, contravening rest hours regulations outlined in MLC, 2006 (Standard A2.3 # paragraph 5[b][i]) and STCW 1978, as amended.

7 Sourced from Reyner and Baulk (1998) [161]. A further 56.0% consider that their working hours present a danger to the health and safety of the ship.

8 Sourced from Smith et al. (2007) [74].

9 The study further found that nearly half (46.7%) of the respondents perceived their working hours potentially threatening their health and safety. Furthermore, approximately one third (32.5%) believed their working hours posed a risk to safe operations aboard their vessel.

**Figure 6: Seafarers' average daily rest hours**



### In the literature

The literature has highlighted insufficient rest compared to established standards among seafarers. For instance, the ITF (1997)<sup>10</sup> surveyed 2,500 seafarers from 60 nationalities serving under 63 flag States, revealing that 36% of respondents did not regularly achieve 10 hours of rest every 24 hours, with 18% unable to secure a minimum of 6 hours of uninterrupted rest.

Similarly, McNamara et al. (2005) found that nearly a third of the sample in their study (30.8%) did not regularly attain 10 hours of rest, while approximately one-tenth (11.9%) failed to regularly obtain at least 6 hours of unbroken rest within a 24-hour period [36].

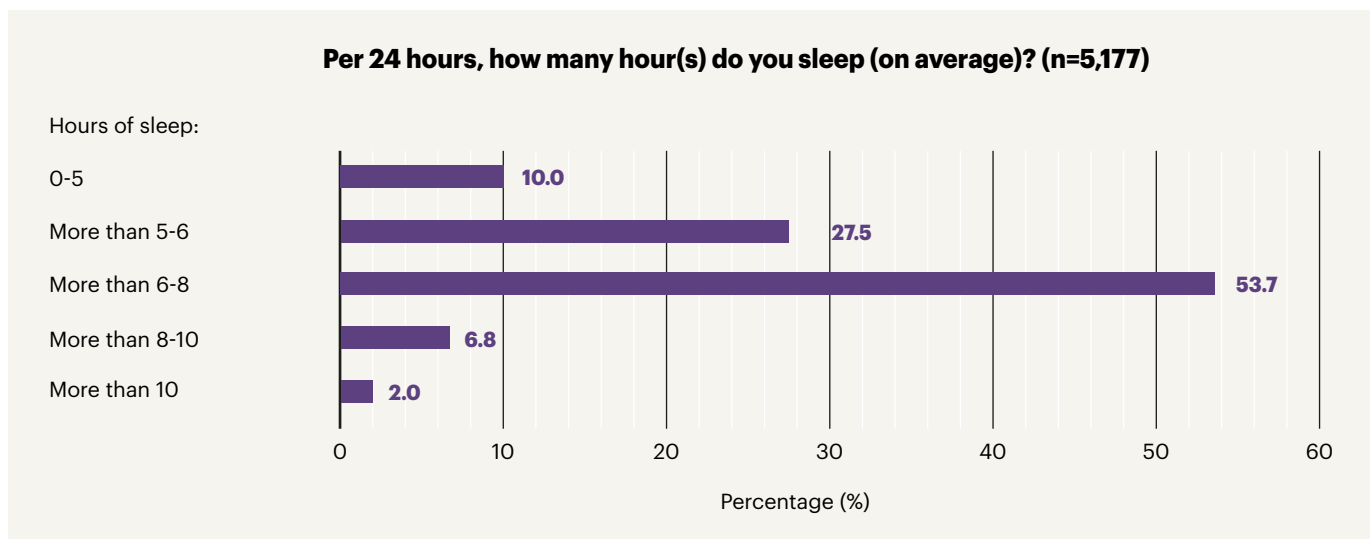
Uğurlu's (2016) study on oil tankers engaged in short sea shipping revealed that C/O's had less than 10 hours of rest per day for over 90% of the month, while 2/O's experienced less than 10 hours of rest per day for more than 79% of the month [33].

### 3.5.3 Average sleep hours

Despite the challenges<sup>11</sup> in self-assessing sleep, seafarers were asked to estimate their average sleep duration. As depicted in Figure 7:

- On average, seafarers reported 7.0 hours of sleep per 24-hour period;
- For the same period, the majority (53.7%) reported sleeping between 6 and 8 hours, with a significant proportion (37.5%) indicating sleeping 6 hours or less.

**Figure 7: Seafarers' average daily sleep hours**



#### In the literature

Numerous studies have linked seafarers' fatigue with sleep quantity and quality [8], [9], [34], [40], [41].

In their self-evaluation of sleep duration, Parker et al. (1997) found that nearly 50% of Australian seafarers reported sleeping less than six hours [42]. Recent interviews by Shan and Neis (2020) emphasised this concern, revealing that many seafarers routinely sleep for under six hours (on ships with two-watchkeeper systems) [15]. It is noteworthy that the two-watch system results in shorter sleep durations than a three-watch system [43].

Objective sleep monitoring studies align with seafarers' self-assessed average sleep durations. Rutenfranz et al. (1988) reported an average of 7.4–7.5 hours of sleep [30], while Sanquist et al. (1997) documented an average of 6.6 hours, less than the 7.9 hours of sleep experienced at home [31]. Van Leeuwen et al. (2013) confirmed this trend in an experimental study, recording an average of 7.0 hours of sleep [44]. Oldenburg and Jensen (2019) differentiated sleeping time according to duty patterns, noting that "watchkeepers showed significantly shorter sleep periods than day workers (5.5 hours vs 5.8 hours)" [34]. Similarly, Youn and Lee (2020) found a significantly lower average

<sup>11</sup> Information and recall biases, and inaccuracies in determining intervals (e.g. between sleep onset and wakening) or estimating times [162].

sleep duration of 5.1 hours in port conditions and 4.5 hours at sea for ships trading in the Asia-Pacific region [45].

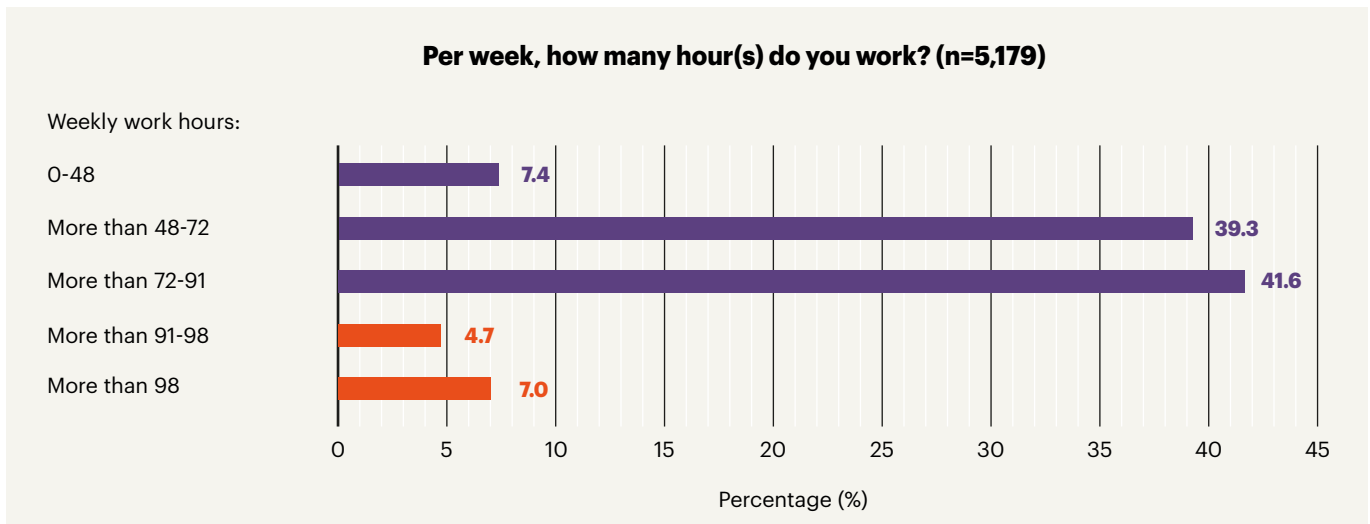
Interestingly, studies documented watchkeepers falling asleep, compromising navigational safety. In Härmä et al.'s (2008) research, 17.6% of the sampled Finnish officers reported falling asleep while on duty at least once during their career [40]. The 2012 European Union (EU) funded Project HORIZON observed that 50% of watchkeepers on a 6-on/6-off schedule had slept on the bridge [43].

### 3.5.4 Average weekly work hours

Figure 8 depicts the following:

- Seafarers reported an average of 74.9 hours of work per week;
- Notably, 11.7% of respondents reported working over 91 hours, indicating potential risks to the implementation of the MLC, 2006.

Figure 8: Seafarers’ weekly work hours



### In the literature

Previous studies showed comparable data on seafarers’ weekly work hours. Andrei et al. (2017) identified that 20.0% of seafarers worked over 69 hours weekly [46], while Mansyur et al. (2021) found that 44.9% exceeded 72 weekly hours<sup>12</sup> [47]. Cole-Davies (2001) reported 50.6% working between 60–80 weekly hours, with 35.3% of seafarers surpassing 85 hours per week [35]. Through a simulation study, Yilmaz et al. (2013) revealed that watchkeeping officers averaged 97.8 weekly hours in short-sea shipping [48]. McNamara et al. (2005) noted that 2.4% of seafarers worked over 100 hours per week [36]. Hjorth (2008) examined work/rest logs on Swedish-flagged ships, revealing records of up to 100 weekly work hours [49]. Uğurlu’s (2016) case study on oil tankers indicated that C/O’s, 2/O’s, and 3/O’s worked an average of 110, 94.5, and 79.7 hours per week, respectively [33].

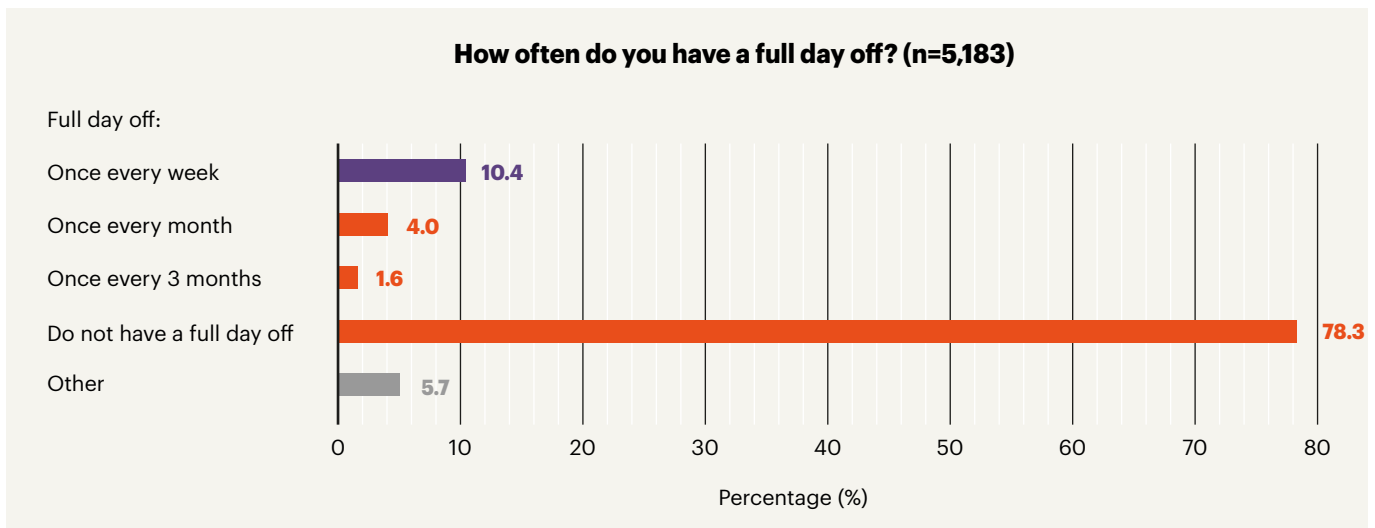
12 With 40.2% reported experiencing fatigue.

### 3.5.5 Weekly day off<sup>13</sup>

Despite being considered essential for protecting the health and well-being of workers and facilitating recovery from both physical and mental fatigue [50], as shown in Figure 9:

- A significant majority of seafarers (78.3%) reported the absence of full days off during their onboard periods;
- Merely 10.4% of respondents reported having a full day off each week.

Figure 9: Seafarers’ weekly day off



#### In the literature

The absence of days off among seafarers highlighted in this study is consistent with previous findings. For instance, Parker et al. (1997) noted that most Australian seafarers worked seven days a week for seven to eight weeks [42]. Bhatia (2019) found that most seafarers lacked a full day off during their contractual period [51]. Furthermore, Slišković (2020) shared an anecdote during the COVID-19 pandemic, detailing a seafarer experience of six months without any days off [52]. Buscema et.al (2023) interviewed Italian seafarers who reported ‘working all days of the week during their time on board’ [38].

13 ‘Weekly day off’ means ‘a continuous 24 hours rest period without any work-related interruption’, in accordance with general principles on which the weekly day off is based [50].

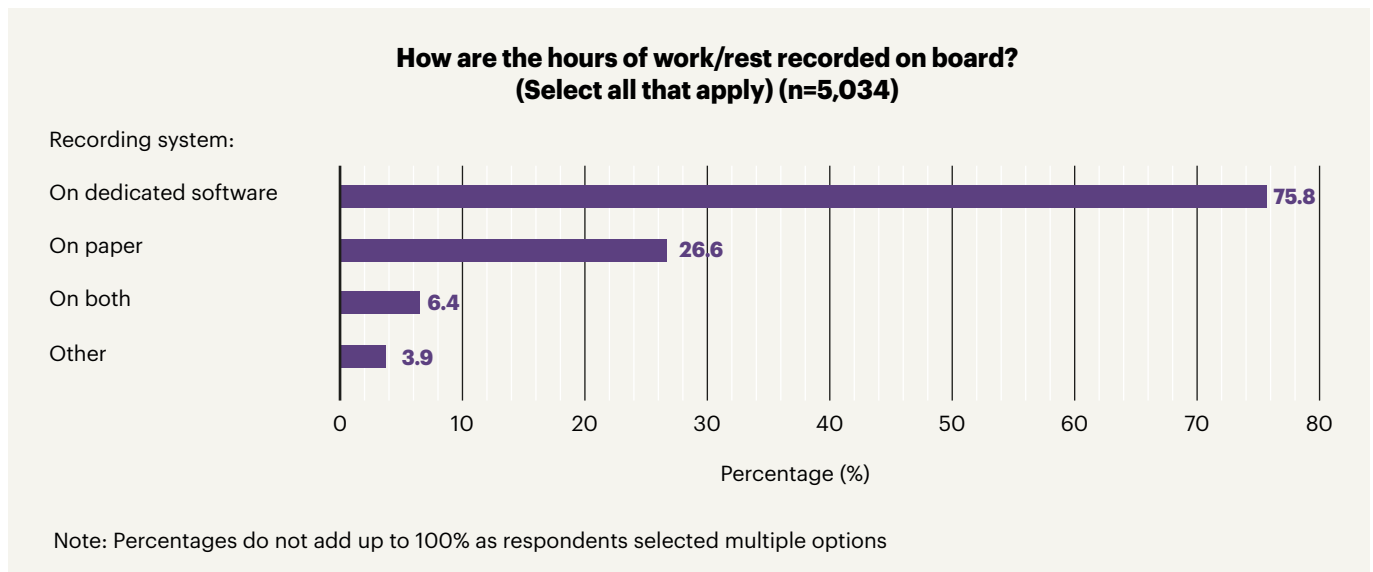
## 3.6 Recording of work/rest hours

### 3.6.1 Recording system

As indicated in Figure 10:

- Most seafarers (75.8%) reported using specialised software to record their work/rest hours, with a smaller percentage (26.6%) relying on paper records;
- A minor percentage (6.4%) indicated using both software and paper methods;
- A few (3.9%) provided qualitative remarks, highlighting the use of electronic spreadsheets for record-keeping.

Figure 10: Work/rest hours recording system

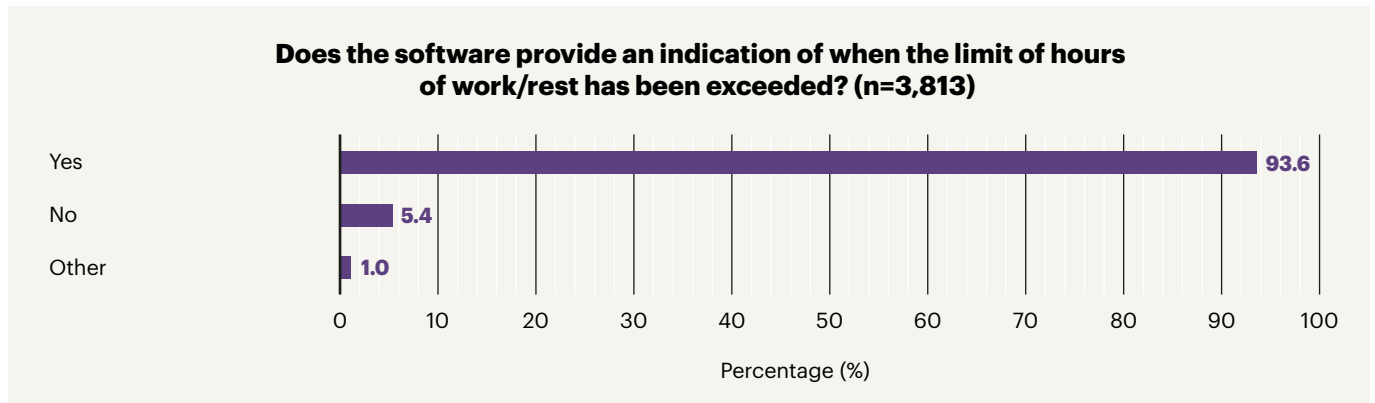




Among seafarers who used software,

- A vast majority (93.6%) reported that it gives alerts for non-compliance, i.e. when the regulatory limits of work/rest hours are breached (see Figure 11).

**Figure 11: Recording software indication on exceeding work/rest limit**



### In the literature

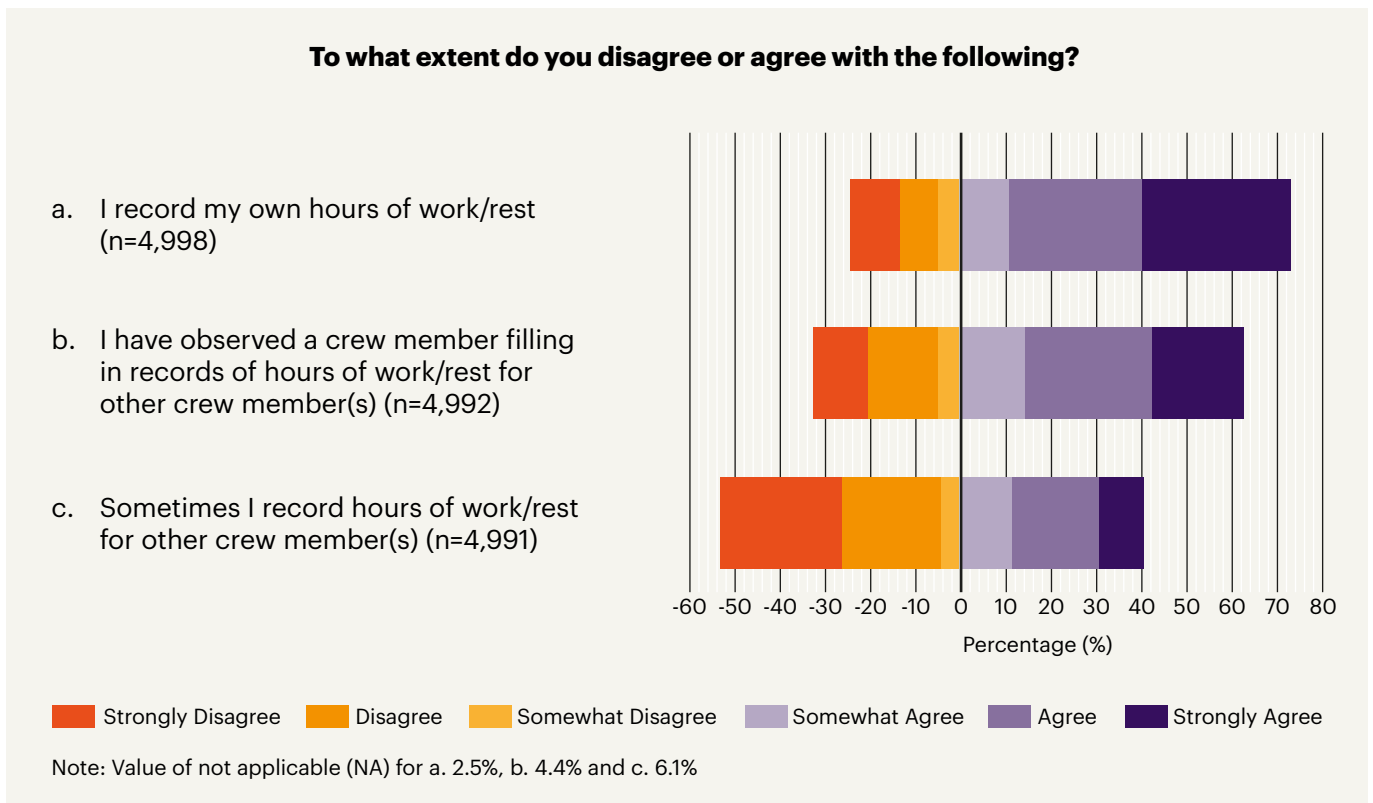
The widespread use of software stems from its perceived benefits, including streamlining record-keeping, as well as the relatively easy monitoring and verification of records [53]. However, certain studies have pointed out unexpected drawbacks, particularly the tendency of software being used to flag non-compliance which seemingly prompts adjustments [13], [51], [54]–[56].

### 3.6.2 Recording practices

Regarding recording practices and as indicated in Figure 12:

- A notable 73.2% of seafarers indicated recording their own work/rest hours;
- A significant percentage (62.7%) reported witnessing other crew members filling in records for their colleagues;
- 40.5% of respondents admitted to sometimes recording work/rest hours for colleagues<sup>14</sup>.

Figure 12: Work/rest hours recording practices



#### In the literature

Research affirms that seafarers indeed maintain records of fellow crew members, and recording practices may exhibit inconsistencies [4], [13], [14], [16], [49], [54].

14 Considering that many respondents were senior officers, it may indicate that they sometimes record on behalf of their crew.

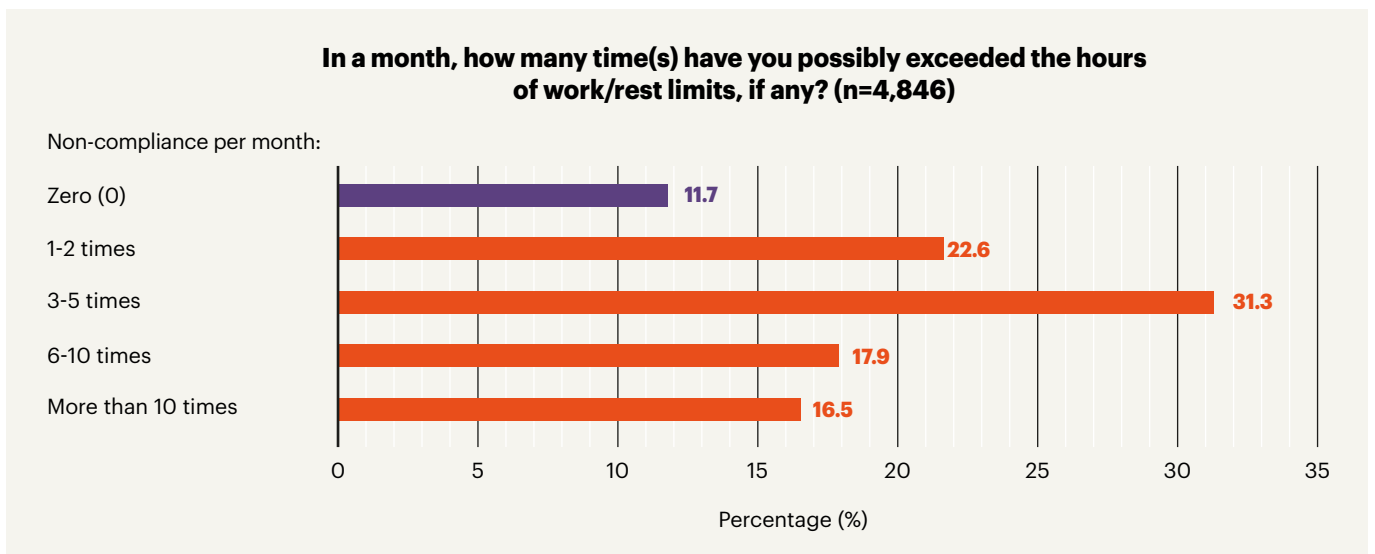
# 3.7 Work/rest: non-compliance and adjustment

## 3.7.1 Monthly non-compliance

As depicted in Figure 13:

- On average, seafarers reported 7.1 instances of non-compliance per month;
- Most respondents (88.3%) admitted to exceeding the working time limits at least once a month, with only a minority (11.7%) reporting full compliance;
- 16.5% of respondents reported exceeding limits more than ten times per month.

Figure 13: Work/rest hours limit non-compliance



## In the literature

Research provides evidence of widespread non-compliance but with varying ranges.

The ITF (1997)<sup>15</sup> survey reported that 36% of respondents could not obtain 10 hours of rest, and 18% could not secure 6 hours of uninterrupted rest within 24 hours, indicating significant non-compliance. McNamara et al.'s (2005) assessment of EU working time directives found that nearly one-third of respondents were non-compliant with prescribed requirements (30.8% of respondents did not rest a minimum of 10 hours within 24 hours, and 11.9% had less than six hours of uninterrupted rest within 24 hours) [36]. Hjorth's (2008) examination of work/rest logs on Swedish ships revealed widespread non-compliance with weekly work requirements, including instances of up to 100 weekly work hours [49].

A study commissioned by France and submitted to the IMO in 2015 revealed that ships employing the 6-on/6-off two-watch system could not fulfil the required minimum 6-hour rest period [57]. Xue et. al (2015) field research illuminated the struggles faced by seafarers, including demanding schedules and extended working hours. Their findings demonstrated that "the real working hours were much longer than the stipulated limit"<sup>16</sup> [58]. Simkuva et al. (2016) highlighted non-compliance as a 'regular and systematic' practice, with their research indicating a mere 1% compliance with regulations among the 340 seafarers studied, with 44% experiencing non-compliance between 6 and 12 times per month [56]. Uğurlu's (2016) case study found that C/O's exhibited non-compliance in over 90% of the cases within a given month, with similar non-compliance among other deck officers [33]. Coutinho's (2023) study revealed non-compliance with work/rest regulations and argued, through data triangulation involving literature review, interviews, and surveys, that non-compliance leads to fatigue [55].

In a more recent development (2023), the Norwegian Maritime Authority (NMA) conducted a survey that found 29% of seafarers regularly worked more than 14 hours a day, with 31% feeling pressure to continue working even when their safety was threatened [59]<sup>17</sup>.

15 Mentioned in Smith et al. (2007) [74].

16 The study also observed that no crew members were willing to raise questions to the company management, as the common sentiment they expressed was 'useless'.

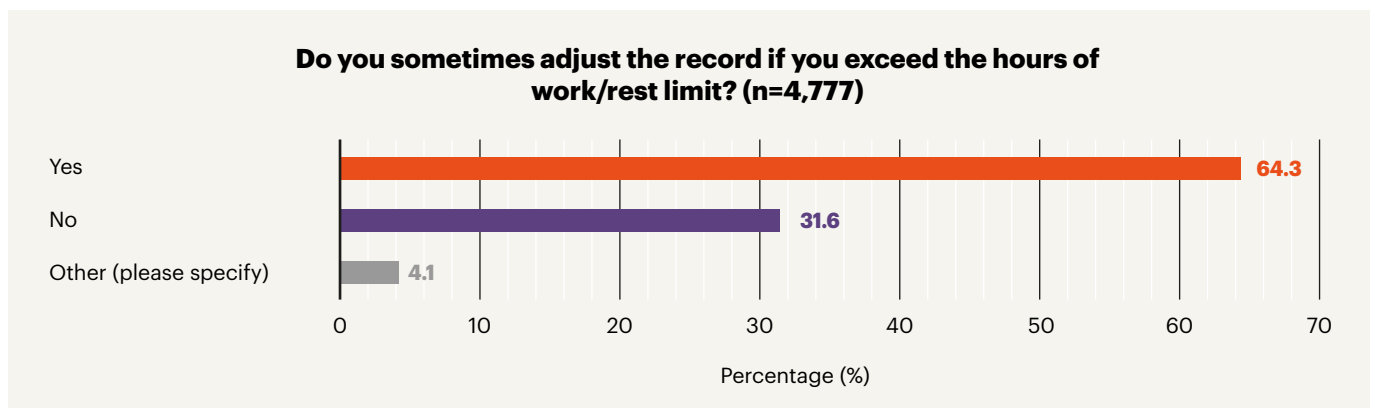
17 Translated version from the Norwegian report.

### 3.7.2 Adjustment of work/rest records

As indicated in Figure 14:

- Less than a third of respondent seafarers (31.6%) reported never adjusting their records;
- Most seafarers (64.3%) reported adjusting their work/rest records;
- Additionally, a small percentage of the respondents (4.1%) reported 'Other', with most from this category specifying that their records are adjusted by someone else (i.e. their superior).

Figure 14: Adjustment of work/rest records on exceeding limits



#### In the literature

Research, casualty investigation reports and a government report have consistently provided evidence of the adjustment of work/rest records over decades.

##### Evidence in qualitative studies

A systematic review of adjustment-related scientific literature resulted in the following list [60]<sup>18</sup>.

1. Bloor et al.'s (2004) field study with Indian, Russian and UK port State control (PSC) inspectors revealed seafarers' "routinely falsified" records [61].
2. Houtman et al. (2005) reported an anecdote of a shipping company representative acknowledging that "the registration of working and sleeping hours can be falsified, and the culture is not promoting in admitting the existence of fatigue" [62].
3. Hjorth's (2008) field study on Swedish flag ships found that hours were not registered according to the actual working time [49].

18 Bhatia et al. (2024) conducted a systematic literature review on the adjustment of work/rest records in the shipping industry. The findings of this review are accessible through the following link [60]: <https://doi.org/10.1016/j.cstp.2023.101125>

4. Bhattacharya (2009), Bhattacharya and Tang (2013), and Tang and Bhattacharya (2018) reported “falsification” during their field studies and interviews [3], [63], [64].
5. Holmberg’s (2012) interviews with Baltic region PSC inspectors revealed that work/rest records are not accurately maintained and “falsified” [65].
6. Garb et al.’s (2013) research reported seafarers discussing ways to “fabricate” or “falsify” work/rest records [16].
7. Sampson et al. (2016) research provided an anecdote of a seafarer being instructed to “adjust [...] rest hours” [66].
8. Devereux (2017) and Devereux et al. (2020) reported 37 interviews, mainly with European seafarers, uncovering “workplace fiddles in the maritime industry”, accounting for practices related to work/rest records [4], [67].
9. Rajapakse et al. (2019) and Rajapakse and Emad (2021) interviewed 41 seafarers, reporting “falsification” and “manipulation” of work/rest hours [68], [69].
10. McVeigh and MacLachlan’s (2019) interview of 32 Filipino seafarers revealed accounts of “exceeded overtime adjustment downwards” [70].
11. Bhatia (2019), WMU (2020) and Baumler et al. (2021) reported interviews with 20 seafarers, 21 PSC Officers, and 35 industry representatives highlighting widespread work/rest hours records “adjustments” [13], [14], [51].
12. Zhang et al. (2020) interviewed 55 Greek seafarers who reported “double book-keeping” with work/rest records [71].
13. Colliander and Olsson (2020) interviewed Swedish seafarers (from the engine department) who reported adjusting work/rest records [54].
14. Kasińska and Jendryczka’s (2022) multi-method study provided a Panama Canal transit case example. It argued the impossibility of compliance with work/rest regulations, hidden through circumvention of the law by “mask[ing], bend[ing] or intentionally falsify[ing] the reality of ship documents” [72].
15. Coutinho (2022) and (2023) conducted interviews with 3 ship managers and 3 seafarers and reported that “WRH [work/rest hours were] adjusted after entry” [55], [73].
16. Rajapakse and Emad (2023) interviewed 63 seafarers, revealing deliberate adjustments to work/rest records [5].
17. Buscema et. al (2023) interviewed 20 Italian seafarers and reported that “the rules for rest time were not respected” and “that records of crew members’ rest periods (which are checked at port [S]tate control) are deliberately falsified” [38].

#### **Evidence in quantitative studies**

During the systematic review of the literature on the adjustment of rest/work hours records, three scientific papers that quantified adjustment were identified [60].

1. McNamara et al. (2005) and Allen et al. (2006) surveyed British seafarers (548 and 557, respectively) as part of a seminal Cardiff University research on seafarers’ fatigue [74], finding that only 37.3% “never under-recording working hours” [2], [36].
2. Simkuva et al. (2016) surveyed 340 Latvian junior deck officers and reported “Only 31% say that never breach the work and rest period regime, all overtime is written down.” [56].

3. Coutinho (2022) and (2023) surveyed 63 seafarers and 24 ship managers and reported that “WRH [work/rest hours] are adjusted mainly to avoid problems with the company and to avoid noncompliance in port being pointed out by the external inspections” [55], [73].

#### **Evidence in casualty investigations (non-exhaustive list)**

Despite not being systematically assessed, adjustments of records have been regularly reported in casualty investigations since 1990.

1. National Transportation Safety Board (NTSB) investigated the Exxon Valdez grounding in 1990, revealing manipulation of “shipboard reporting of crew overtime” to support crewing levels requests [17].
2. Marine Accident Investigation Branch (MAIB) analysis of navigational accidents in 2004 stated that “the records of hours of rest on board many vessels, which almost invariably show compliance with the regulations, are not completed accurately” [6].
3. MAIB’s (2004) investigation revealed that “Jackie Moon was manned in accordance with her Minimum Safe Manning Certificate [...]. However, the deliberate falsification of the hours of work and rest maintained on board is a very strong indication that the ship was unable to keep to her commercial programme without contravening the ILO or even the STCW 95 requirements regarding the hours of work and rest” [75].
4. Australian Transport Safety Bureau (ATSB) investigated the grounding of Shen Neng 1 in 2010 and cited the “falsification” of work/rest records as a contributory cause [59].
5. MAIB (2013) investigated Danio’s grounding and found “falsification” of work/rest records as a contributory cause. Also, falsification was earlier identified during the inspection in 2009 [77].
6. MAIB’s (2016) investigation into a collision incident revealed that the crew of the ship Erin Wood did not maintain work/rest records [78].
7. NTSB’s (2017) investigation into the sinking of El Faro suggested the practice of “fixing numbers” [79].
8. MAIB (2019) investigated the grounding of Priscilla, where records were falsified to deceive auditors to make them believe that an additional lookout at night had been kept when this was not the case [7].
9. MAIB’s (2023) investigation found “[work/rest records] and documentation were systematically falsified on board BBC Marmara to satisfy audit and inspection requirements and avoid sanction or delay” [80].
10. DiGiFeMa (2023) (a national investigating body of Italy) revealed that the level of fatigue among Mika’s crew could not be assessed due to a lack of reliable information regarding the number of work hours and rest hours<sup>19</sup> [81].

#### **Evidence in the government report**

A recent national report from Norway highlights the persistence of inappropriate record-keeping practices.

1. Norway’s ‘Office of the Auditor General’ report (2023) acknowledges deviations noted by NMA, including “recorded rest period not corresponding to the actual work performed, rest period violations, or the vessel operating with insufficient manning levels” [59], [82]<sup>20</sup>.

19 Translated version from the Italian report.

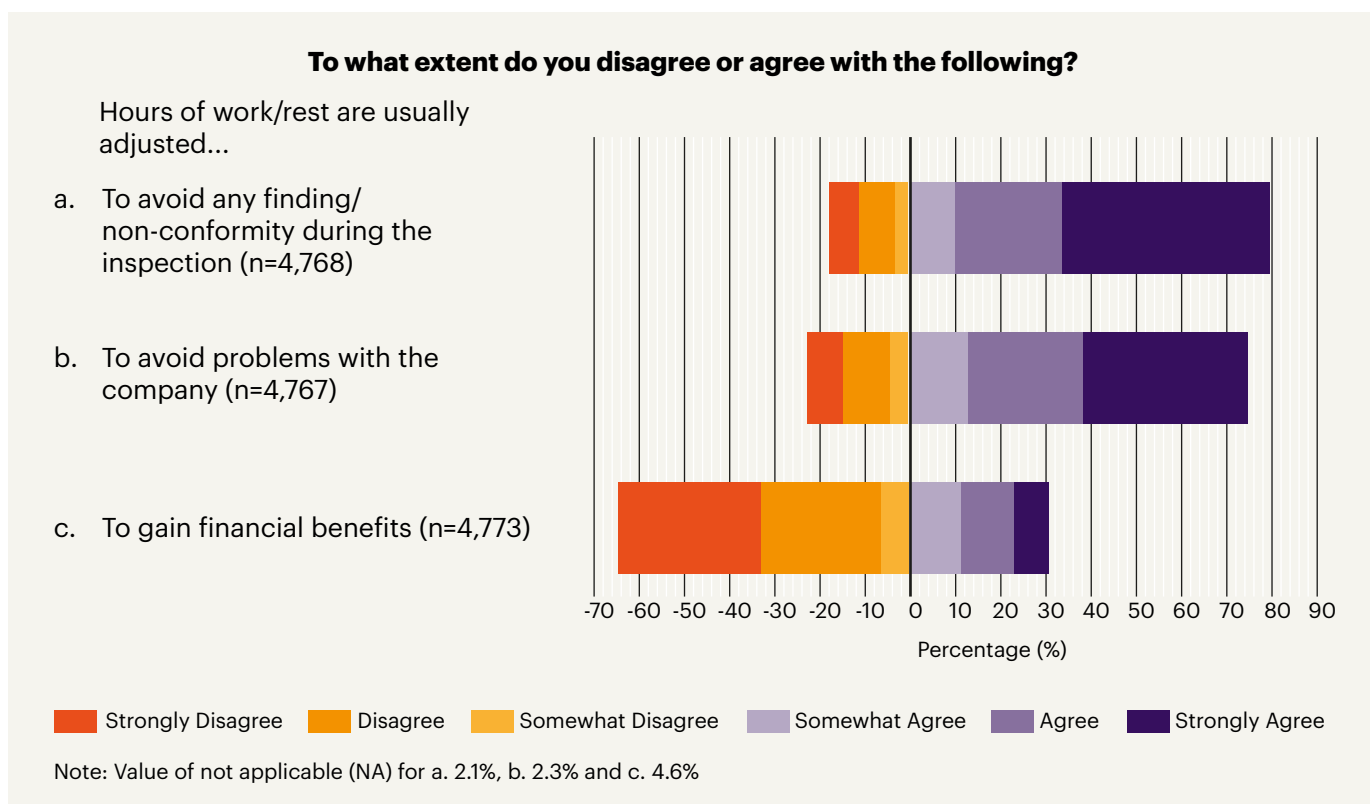
20 Translated version from the Norwegian report.

### 3.7.3 Adjustment justification

As depicted in Figure 15:

- The primary rationale given for adjustment (80.2%) was to avoid any findings during inspections;
- A significant proportion (75.0%) concurred that adjustments were made to avoid problems with the shipping company;
- Meanwhile, 31.1% of respondents reported that their work/rest hours records were adjusted for financial gain.

Figure 15: Seafarers' justification for adjustment of work/rest hours records



### In the literature

Ensuring regulatory compliance for successful inspections, without 'stains' on the ship and meeting the company's key performance indicators (KPIs) has been consistently emphasised as reasons for record adjustment in prior research [3], [4], [13], [16], [54], [56], [63], [71].

Moreover, adjustment is often strategically employed to evade administrative and communication tasks, as well as to deflect questioning by the company and dodge in-depth investigation during inspections [13], [14], [54].

Lastly, personal factors tied with financial benefits, such as bonuses or overtime, along with career-related considerations like preserving employment, establishing a positive reputation, pursuing promotions, managing performance appraisals, and pre-emptively addressing blame, are notable prompts for adjustments [2], [5], [13], [14], [49], [71].



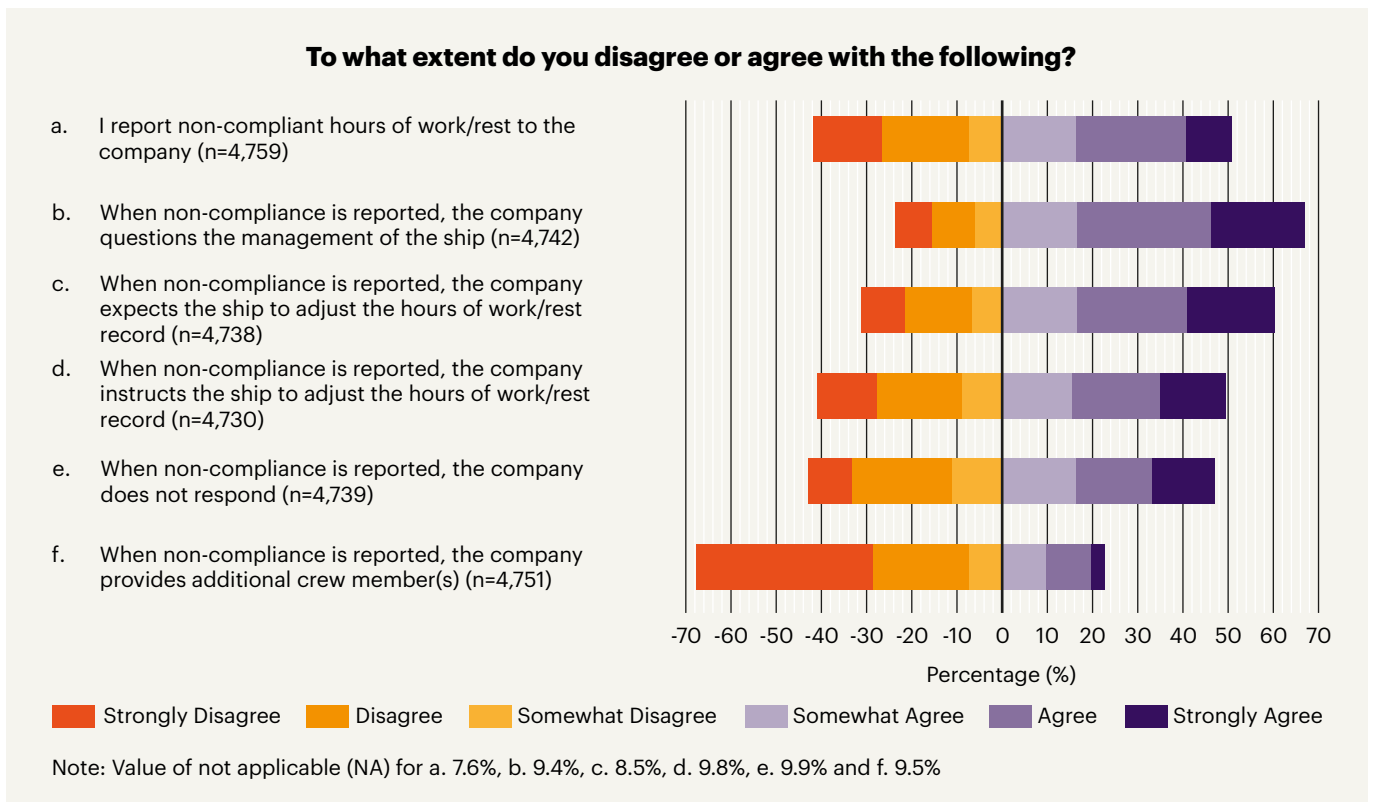
### 3.7.4 Response to non-compliance

Half of seafarers (50.3%) reported notifying their company of non-compliance. However, responses from shore management often appeared ambiguous and were not always perceived as appropriate for addressing the issue. The respondents indicated that informing the company leads to:

- the company questioning the ship’s work/rest management (66.7%);
- the company anticipating an adjustment to the ship’s work/rest hours record (60.1%);
- the company instructing the ship to adjust the record of work/rest hours (49.1%);
- the company not responding (46.7%);
- the company providing additional crew members (22.4%).

Figure 16 graphically depicts these results.

**Figure 16: Seafarers’ and companies’ response to non-compliance**



### In the literature

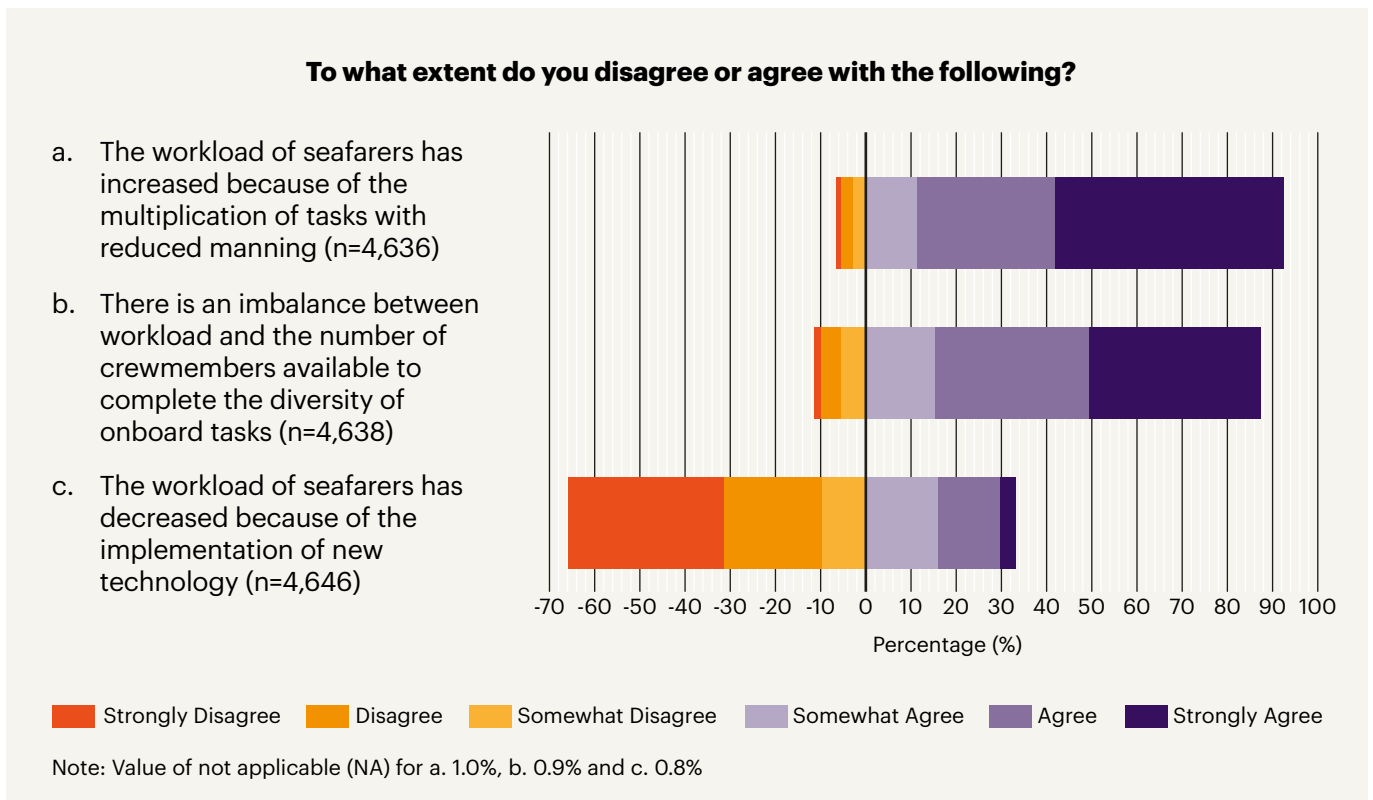
Maritime literature affirms that shore management often scrutinises seafarers’ capabilities [64], [83]. Additionally, shore managers may push for adjustment through authoritative pressure, whether explicit via direct instructions or implicit [3], [13], [14], [69], [71]. When seafarers report non-compliance, shore management often tends to dismiss or oppose their feedback and raise concerns about the seafarers’ professionalism and ability to manage work/rest schedules [13], [54], [56], [71].

## 3.8 Imbalance between workload and ship crewing

As shown in Figure 17:

- Most respondents (92.7%) agreed that workload has increased because of the multiplication of tasks with reduced crewing levels;
- Most respondents (87.6%) affirmed that there is an imbalance between available crew members and the required workload;
- Lastly, most respondents (65.8%) think that the implementation of new technology has not alleviated the workload.

**Figure 17: Imbalance between workload and crewing levels**



### In the literature

The significant shift towards automation is mainly driven by cost reduction through downsizing the crew, assuming it would alleviate workloads [84], [85]. However, seafarers reported that these technological advancements introduce complexities, necessitating oversight [86], [87]. Furthermore, the persistent integration of other workload factors over the years exacerbates its imbalance with crewing levels [88], [89], a trend supported by recent studies [13], [14], [90]. The latest findings indicate that reduced crewing levels have led to a spillover of workload, resulting in work/rest hours non-compliance – a concern raised by 87% of seafarers [55].

## 3.9 Seafarers proposed solutions

The following questions are not supported here by reference to existing literature (although such literature may exist). The questions were designed in this way purposefully to extract novel insights from the seafarers.

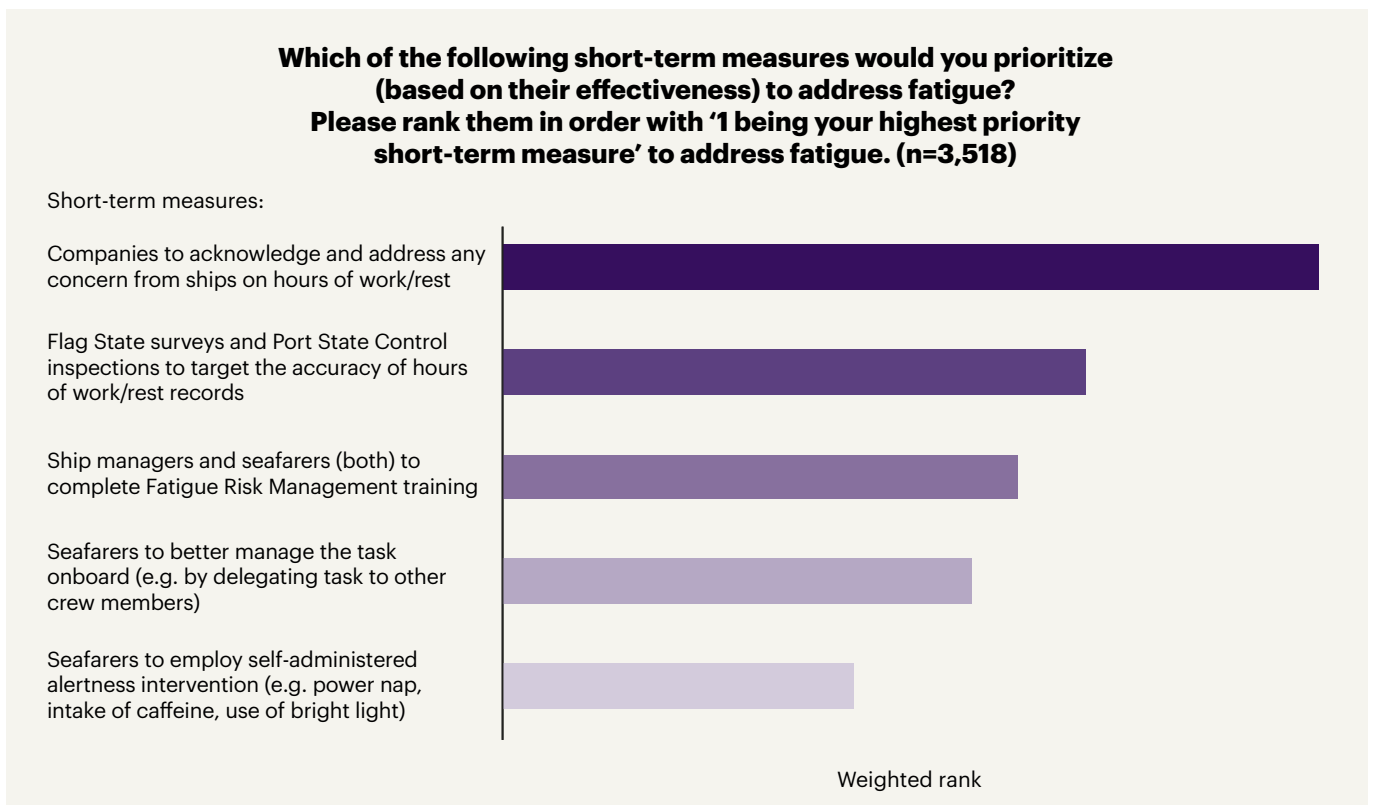
### 3.9.1 Short-term measures

When prompted to rank the best short-term measures to address fatigue among five proposals as indicated in Figure 18:

- Seafarers advocated for acknowledgement/recognition of the concerns by companies in the first place and secondly for authorities (flag and port States) to act in a focused manner with regards to the accuracy of work/rest hours records;
- Fatigue risk management training and onboard changes were considered lower priorities.

This classification suggests seafarers perceive themselves as being at the limit and are unable to take further action. Conversely, they expect those allocating resources to act and those regulating to address the situation.

**Figure 18: Short-term measures to prioritise for managing fatigue proposed by seafarers**



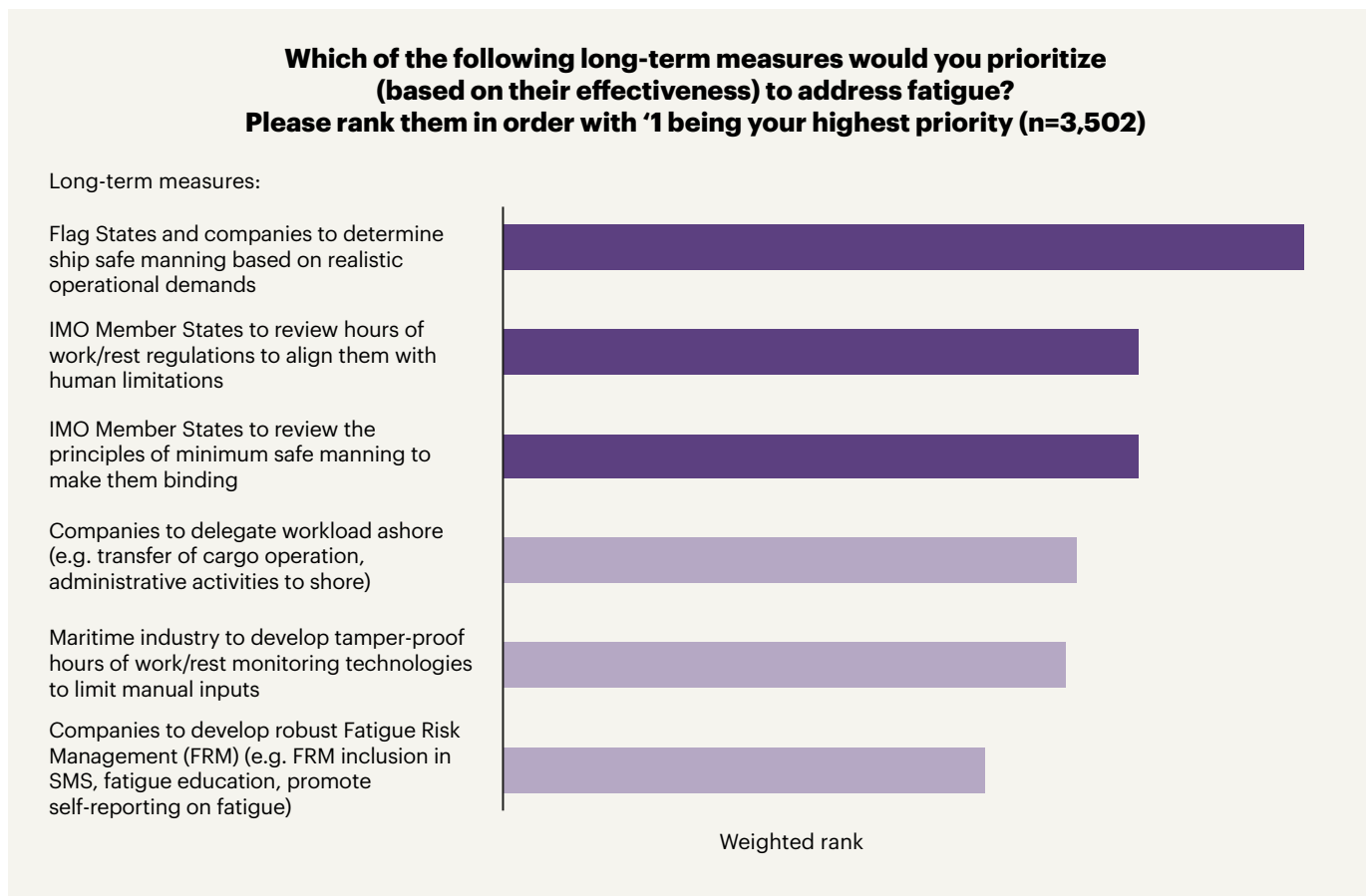
### 3.9.2 Long-term measures

Figure 19 shows the respondents' views when tasked to rank six long-term measures to address fatigue:

- As top priorities to cope with operational demands, seafarers pinpoint regulatory changes, particularly related to crewing levels and working time;
- Externalising ships' workload and developing tamper-proof mechanisms of control were deemed secondary;
- Fatigue risk management tools were considered to have the lowest priority.

Interestingly, seafarers emphasise the role and responsibilities of States in addressing fatigue. They also prioritise crewing levels as a top concern.

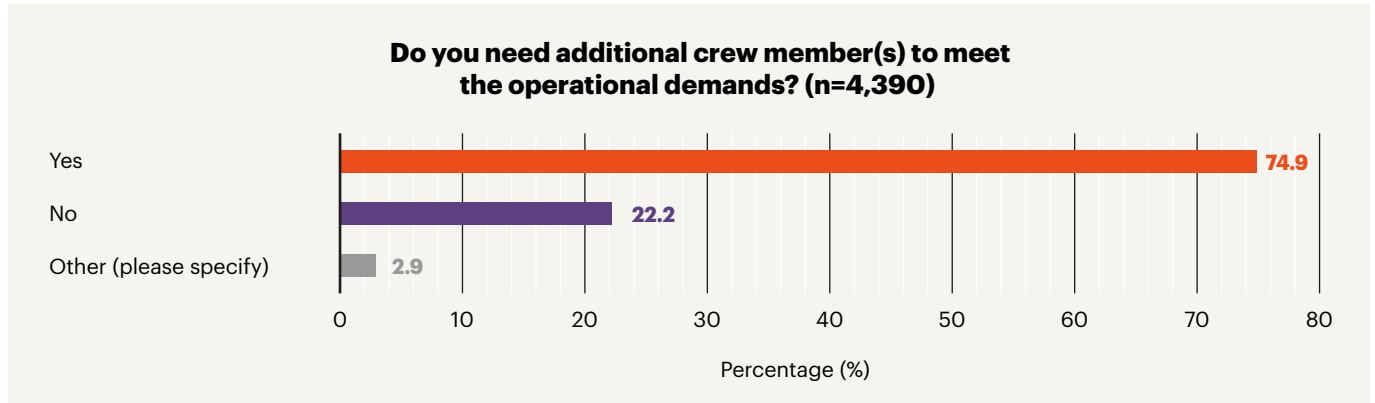
**Figure 19: Long-term measures to prioritise for managing fatigue proposed by seafarers**



### 3.9.3 Need for additional crew

Unsurprisingly, three-quarters of the seafarers indicated the necessity for additional crew members to meet operational demands, as shown in Figure 20.

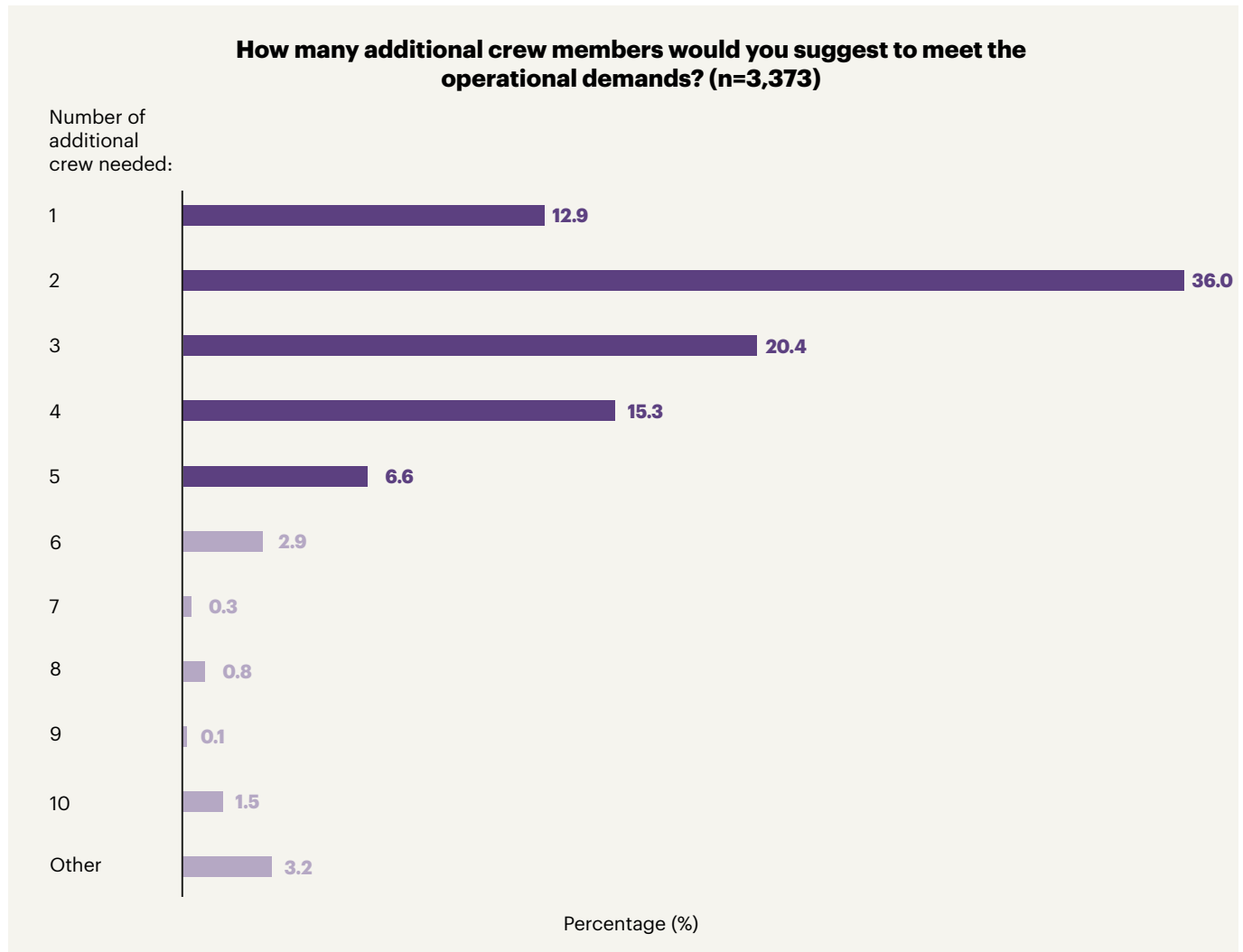
Figure 20: Seafarers' proposal for the need of additional crew



### 3.9.4 Number of additional crew needed

On average, seafarers expressed the need for an extra three (average: 2.92) crew members per ship (see Figure 21).

Figure 21: Number of crew needed as proposed by seafarers

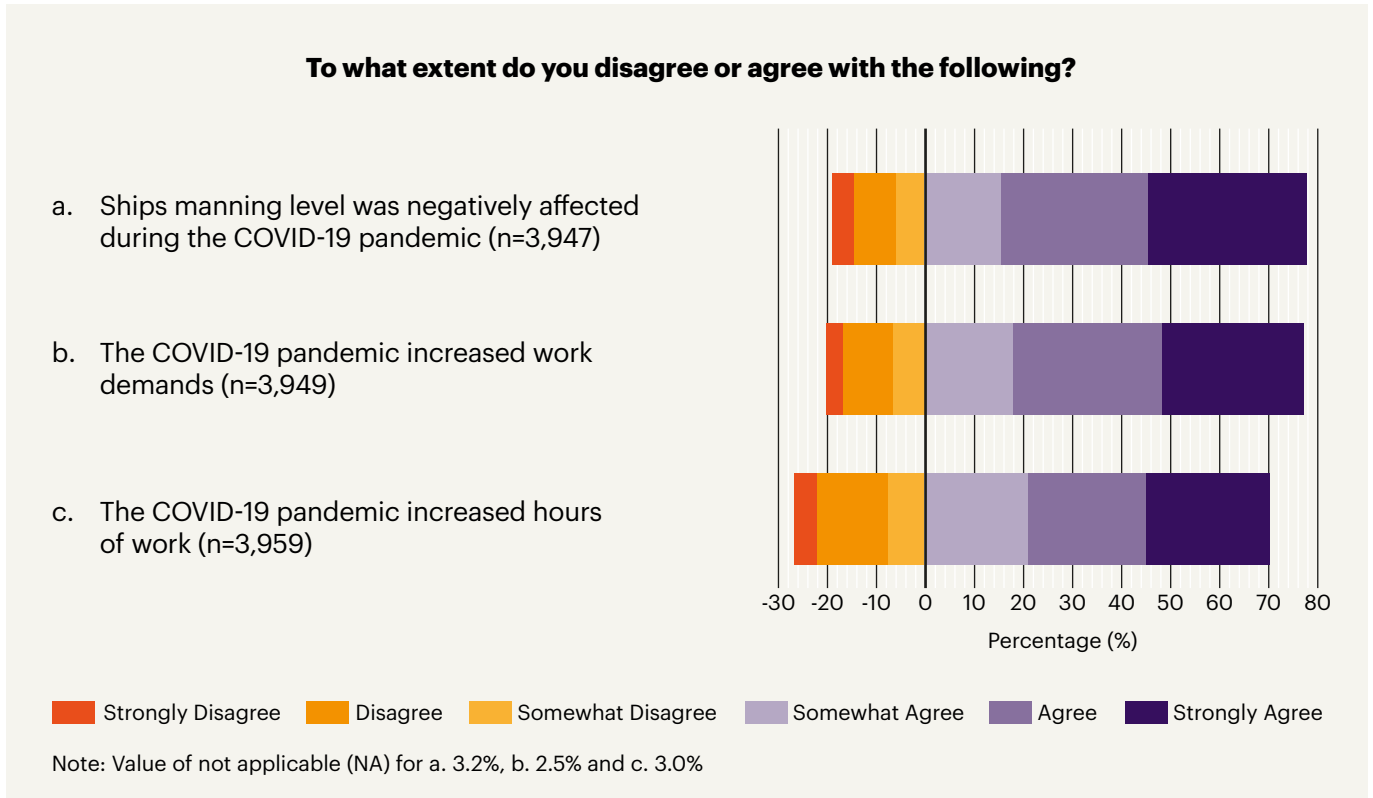


# 3.10 COVID-19 crisis: work hours, workload and ship crewing

Conducted in 2022, the survey was designed to include COVID-19-related questions not only to assess the impact of this particular crisis on work/rest hours, workload and crewing on ships but also to interrogate, by proxy and in a more general way, how an unanticipated event may have an impact on these areas:

- As shown in Figure 22, most seafarers report that the COVID-19 crisis has detrimentally affected their work hours, workload and crewing levels.

Figure 22: COVID-19 crisis affecting work hours, workload and crewing levels



## In the literature

Studies indicate that the implementation of COVID-19 protocols and their related tasks (e.g. disinfection, remote inspections requiring multiple forms of evidence gathering, and new administrative duties) resulted in increased workloads, elevated work-related stress, and reduced rest periods for seafarers [91]–[94]. These challenges, compounded by extended periods at sea and restricted shore leave, exacerbated seafarers' chronic fatigue, leading to the deterioration of their health and well-being and adversely impacting safety [95]–[105].

Notably, seafarers experienced increased vulnerability to fatigue-related accidents due to insufficient crewing resulting from crew being infected or quarantined [98], [106], [107].

In the aftermath of the pandemic, issues related to excessive workload and subsequent fatigue peaked, driven by intensified ship inspection and updated policies and regulations [5], [108]–[110]. While COVID-19 restrictions gradually eased, allowing a sense of stability, seafarers continue to report extended stays on board, a lack of shore leave and an ongoing burden of COVID-related workload as new post-COVID norms [111]–[117].



04

# Conclusion



Seafarers emphasise profound concerns about fatigue, reporting it as a critical health and safety issue. As regularly reported in research literature, the persistence of fatigue questions the effective implementation and relevance of the current regulatory framework.

Consistently, the research affirms that seafarers endure longer working hours than their onshore counterparts. Indeed, this stark reality emerges from the survey informing this particular research, with only 3.3% of seafarers' weekly working hours aligning with the global average of 43 hours [50]. Addressing this evident disparity calls for extending the International Labour Organization's (ILO) General Survey concerning working-time instruments to encompass maritime workers [50]. This step is crucial to rectifying the existing imbalance in working hours and aligning seafarers' working time with global labour standards.

It is worth recalling that working time limitations were originally conceived to preserve workers' safety, health, and well-being. In particular, the first ILO Convention in 1919 adopted the 8-hour workday and 48-hour workweek standards, which are now widely regarded as the "legal standard closest to the point beyond which regular work becomes unhealthy", a threshold recognised in the health literature as 50 hours [118]. While a substantial body of scientific evidence has consistently demonstrated the detrimental effects of long working hours on occupational safety and health [119]–[126], a joint meta-study by the World Health Organization (WHO) and the ILO in 2021 concluded that:

"[...] exposure to long working hours ( $\geq 55$  hours/week) [...] causes large attributable burdens of ischemic heart disease and stroke" [127].

Despite this wealth of scientific evidence, current prescriptive maritime regulations appear to lack the capacity to adequately address the challenge of fatigue [128]. The existing regulations, permitting workweeks of up to 91 hours (MLC, 2006) or even 98 hours (STCW 1978, as amended), seemingly omit the fundamental 'human nature' of seafarers [129], [130]. Accepting human limitations and the design of adequate standards are paramount to effectively managing fatigue risks in the shipping industry. Therefore, it is essential for science to exert a profound influence on the review of the current regulatory frameworks [32], [130], [131], especially concerning its flexibility.

The MLC, 2006 Standard A2.3 # paragraph 3, recalls the spirit of working time limitations for seafarers, echoing the aspiration that:

"[...] the normal working hours' standard for seafarers, like that for other workers, shall be based on an eight-hour day with one day of rest per week and rest on public holidays".

The survey findings and prevailing literature reveal a consistent and pervasive erosion of these 'normal' daily and weekly working time limitations. Indeed, the regulatory allowance of 14-hour workdays has resulted in extended working hours, surpassing the weekly average limit of 72 hours (MLC, 2006 Standard A2.3 # paragraph 5[a]). The near-consensus among the seafarers surveyed is that most flag States opt for standards based on rest hours, permitting 77 hours of rest (or, conversely, 91 hours of work per week)<sup>21</sup>. This regulatory flexibility has led to the normalisation of long working hours within the shipping industry, arguably illustrating that the industry tends to gravitate towards the lowest permissible standards. This tendency is, *de facto*, undermining the possibility of "normal working hours' standards" on ships.

21 Seafarers report an average workweek of 74.9 hours.

After being established, regulations must be implemented and enforced. Substantiated by various research, the stubborn persistence of non-compliance highlighted by this report confirms implementational concerns. Worryingly, most seafarers make up records, erasing evidence of non-compliance to mislead inspectors and avoid blame from their employers. Despite not being designed for such purposes, software solutions assist seafarers in tampering with records by giving alerts for non-compliance and allowing changes. Former MAIB Chief Inspector of Marine Accidents Stephen Meyer encapsulated the gravity of this situation, stating:

“It is an anachronism in the 21st Century that seafarers are falsifying their timesheets to prove that they are working only a 98-hour week!” [132].

Adjustments impact the sector by undermining the intended benefits of regulations, violating the core principles of regulatory compliance and fatigue avoidance, and hindering effective enforcement. It comes at a significant cost to seafarers, obscuring the reality of their excessive working hours, facilitating chronic non-compliance and compromising seafarers’ health and the safety of shipping. Flag administration may never question the “[...] minimum safe manning [crewing] document of a ship which persistently fails to be in compliance with rest hours requirements” [133].

Furthermore, adjustments can lead to misleading casualty investigation outcomes, distorting reality and potentially erasing fatigue as a contributing factor [134]–[136]. Adjustments also create a false sense of compliance, as PSC inspections may indicate a good compliance rate that contradicts seafarers’ actual experiences<sup>22</sup>, impeding regulatory improvements in working time and fatigue regulations [2], [74]. Thus, addressing adjustment is crucial as it could significantly enhance ship safety and improve seafarers’ occupational safety, health, and well-being. However, achieving this requires a culture shift, which does not seem so common. Companies often respond inadequately when non-compliance is reported, frustrating seafarers and discouraging further reporting. Questioning or ignoring frontline operators’ feedback seems not to prompt any organisational safety learning [137]. Finally, adjustments can have severe repercussions for companies, particularly when fatigued seafarers operate ships. In such cases, there is a risk of losing liability exemptions if the adjustments are proven [138], a task that is far from straightforward [3], [4], [63]. It is important to state categorically that the extant situation should not be blamed on seafarers. This appears to be a systemic issue/challenge that all stakeholders may be argued to have contributed to and should work together to resolve.

The shipping sector has accumulated decades of evidence regarding adjustments [61], notably highlighted by seminal studies from Cardiff University that initiated industry-wide discussions to tackle this issue [74], [139]. Workshops conducted by Houtman et al. (2005) and MacDonald (2006) further confirmed the widespread acknowledgement of these malpractices within the industry [62], [140]. Submissions to the IMO have offered evidence of manipulated records and that work/rest regulations are inadequately monitored and enforced [141], [142]. More recently, a 2020 WMU report sparked industry-level dialogues and discussions at the ILO [13], [143]–[145]. Furthermore, online sources are replete with blogs and seafarer testimonials recounting their experiences with adjustments [146]–[150]. It is worth noting that the culture of adjustment can be curbed, as demonstrated by the trucking industry’s efforts to address the issue with minimal research or publicity [151], [152].

22 The analysis of seafarers’ work/rest non-compliance data and the outcome of the Concentrated Inspection Campaigns (CIC) on STCW conducted in 2022 revealed a notable disparity. The findings of this analysis are accessible through the following link [163]: <https://doi.org/10.1016/j.marpol.2024.106105>

05

# Research strengths and limitations

## 5.1 Sample size and diversity

As indicated in section 3, the dataset comprises 6,304 responses, surpassing the recommended sample size of 380 for an estimated global seafaring workforce of 1.9 million [153]–[155]. With 6,304 responses, the survey sample exceeds this requirement by a factor of 16.4. If only the response from active seafarers (i.e. 4,623) are considered, the sample size would still exceed the recommended sample size by 12.2 times. This ample dataset holds particular importance as maritime studies established on such a large sample are rare, given the inherent difficulties in accessing seafarers.

Moreover, respondents show diversity in:

- age (ranging from 17 to 84 years);
- gender (94.6% male and 4.5% female);
- nationality (representing 113 countries);
- seafaring experience (from less than 1 year to 61 years);
- ranks (divided into 26 categories);
- working status at the time of survey (with 82.6% currently active seafarers and 17.4% former seafarers who experienced working after entry into force of work/rest hours regulations);
- ship types (23 categories);
- flag States (representing 122);
- company types (39.4% ship management, 31.6% crewing agencies, 27.0% ship owners); and
- trading areas (72.2% international, 9.8% coastal, 16.4% both international and coastal).

The respondents showed a well-distributed representation across various demographic factors such as age, gender, and experience. Fifteen nationalities, comprising major seafaring nations as categorised by the Drewry [156] and BIMCO/ICS [157], make up 80.1% of the responses. Notably, there is a significant variability in nationality, with Indian seafarers comprising over a quarter of the sample, while Russians represent 1.8%. Ongoing conflicts involving Ukraine and Russia may have impacted responses from these two major seafaring States. Furthermore, in terms of ranks, officers constitute 76.1% of responses, surpassing ratings at 15.7%, in contrast to the general seafaring population, where ratings typically account for approximately 55%.

To account for these variabilities, consistency checks on adjustment data (i.e. responses indicating their never adjusting records) were conducted across different characteristics. In comparison to the overall average of 31.6% (n=4,777) reporting never adjusting their records, certain categories demonstrated consistency with this average. For example, the following categories have maximum and minimum ranges, as shown below:

- working status (33.1–31.3%);
- gender (36.5–31.4%);
- company type (36.0–27.2%); and
- seafaring experience (39.2–28.1%).

However, noticeable variations of those indicating their never having adjusted records were identified:

- across flag States (58.8–14.7%);
- among nationalities (57.4–15.7%);
- between ranks (64.0–23.1%). Deck officers report the highest amount of adjustment;
- among ship types (56.3–18.4%). Passenger ships (ferries and cruise ships) report lowest adjustment;
- between age groups (49.7–27.5%). Seafarers older than 60 report the lowest adjustment; and
- between trading areas (50.0–29.3%). Ships trading internationally reported the highest adjustment.

Despite these variations, the overall message remains identical. The adjustment phenomenon prevails across the broad spectrum of seafarers and shipping characteristics.

## 5.2 Validity and reliability

The survey's design was an extensive process, spanning six months and involving an iterative approach between researchers. Adhering to well-established scientific norms for design, including CHERRIES (for web surveys) [158], CROSS [159], and the survey checklist (manifesto) [160], this survey underwent review by industry experts (a total of 8) and language experts (12) for translation accuracy. It underwent two pilot studies with seafarers and was reviewed by survey tool experts for any technical glitches prior to its release.

While determining response rates is more straightforward for mail surveys, web surveys present challenges. In our case, the survey link received 15,547 clicks, with 9,214 individuals initiating (saying 'yes' to the survey but then not proceeding to answer any question), 6,304 individuals providing at least one answer to the survey questions and 4,350 individuals who indicated completion by clicking on the submit button at the end of the survey. This results in a completion rate of 47.2%. Typically, the initial questions received more attention than the last ones, as respondents opted out during the survey without completing it. The report maintains transparency by disclosing response numbers for each question.

The survey has inherent limitations, including potential inaccuracies and biases in respondents' answers. The report contextualised the findings within the broader scope of existing literature to address these limitations, enhancing its external validity. A significant emphasis was placed on the adjustment literature, allowing validation with previous evidence and demonstrating the widespread nature of work/rest records adjustment in the shipping industry.

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A group of five astronauts in white space suits are huddled together in a circle, looking upwards. The image is tinted with a deep purple color. The astronauts are wearing helmets and have their hands clasped in the center. The background shows the interior of a spacecraft with various panels and equipment.

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