INVESTIGATION INTO THE CAUSES OF ACCIDENTS AMONG SEAFARERS

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(Keywords: *seafarers, sea, accidents, analysis, harbour master's office, port authorities, harbour authorities*)

ABSTRACT

BACKGROUND - Various studies reveal that seafarers are at high risk of accidents, particularly with regards to fatal events. The International Labour Organisation (ILO) has recently approved the new Consolidated Maritime Labour Convention 2006[1] that brings together and updates 68 documents (ILO Conventions and Recommendations) and establishes important principles on health and safety for seafarers, environmental pollution, inspection and coordination activities regarding ship conditions, and seafarers' operations and port activities. In Italy the adoption in 1999 of the European Directives in this area has filled a regulatory void that was of concern to prevention professionals especially because of the unique risk characteristics of the seafaring sector.
OBJECTIVES - In response to the new regulatory framework, in 2001 the Italian National Institute for Occupational Safety and Prevention (ISPESL) launched a research project implementing a prevention information system for the maritime sector. The analysis phase of this research project, which is needed for planning prevention measures through the creation and dissemination of information and training material aimed at the various stakeholders of the national occupational health and safety system, consists in the retrieval and optimisation of information flows regarding accidents and occupational diseases.
The present investigation is also part of this research project and aims at quantifying, from a prevention perspective, accidents to seafarers, their seriousness and causes.
METHOD - This study is based on the analysis of information contained in accident reports received by harbour authorities, focusing on occupational accidents to seafarers in Italy during the period from April 2004 to December 2005.

[1] International Labour Organisation (ILO), Consolidated Maritime Labour Convention, Geneva, 23 February 2006. Available from: http://www.ilo.org/public/english/dialogue/sector/papers/maritime/consolcd/overview.htm

BOW PO/base indexing:

CIS: Causes of accidents [CIS: Ya]; Analysis of accident causes [CIS: Qrua]; Sea transport [CIS: Xubis]; Ships [CIS: Jiwa]; Harbours [CIS: Jiwi]
EUOSHA OSH: Causes of accidents [OSH: 46481C]; Water transport accidents [OSH: 48041D]; Harbours [OSH: 57841C]; Ships [OSH: 59561C]
ATECO: Water transport [ATECO: 61]

The analysis of the data and the in-depth analysis of the causes of these occupational accidents were performed by way of statistical procedures; priority was given to the reconstruction of the events and to the identification of the causes which determined them. Descriptive statistical methods were applied since the data observed was not a sample, but consisted of virtually the entire population of interest.

RESULTS - The main result of the analysis of the information received from the harbour authorities concerns the most frequent way in which accidents occur, i.e., shipboard falls. It appears that shipboard falls are above all related to the specific shipboard activity carried out by personnel rather than to weather conditions, sea state or factors attributable to sea hazards. This highlights the importance of the 'organisation of work on board ship' factor in relation to the *determinants* of accidents, which are too often erroneously ascribed to 'accidental causes'. A detailed knowledge of work cycles and a careful and correct evaluation of risks on board, resulting from the analysis of the determinants of accidents, will lead to the identification of good practices for improving the health and safety conditions of seafarers.

INTRODUCTION

Maritime work represents a particular situation in terms of occupational health and safety. A changeable working environment (the sea), the workplace (spaces and equipment of a ship) and the duration of exposure to various agents (which, indeed, occurs for the entire time served on board) constitute unique risk factors for the health of seafarers.

The health and safety conditions of seafarers have been analysed by a number of authors who, both nationally and internationally, have concerned themselves with fatal [1-3] and not always serious accidents [4-10]. However, other than in the fishing industry, very few studies have been approached from a prevention viewpoint. Indeed, this approach - that also includes the analysis of the causes of accidents that can yield proposals aimed at mitigating risks and damages - has not been observed in other maritime sectors, such as passengers and cargo transport.

The data supplied by international organisations - such as the International Labour Organisation (ILO), the International Maritime Organisation (IMO), the Food and Agriculture Organisation (FAO) and the European Commission[2] - however, highlight that in Europe the incidence of fatal accidents in fishing activities is higher than that in the processing industry [11]. This situation suggests that the scientific community needs to investigate in depth the determinants of these accidents in order to plan and implement effective preventive measures.

The aim of this study is to analyse the data relating to shipboard accidents reported to the harbour authorities in accordance with current legislation[3], in order to quantify and identify the seriousness of the accidents suffered by seafarers. The results of these analyses, could facilitate the development of recommendations, procedural indications and information and training material for targeted prevention interventions.

[2] Directorate-General for Employment, Social Affairs and Equal Opportunities - Health, Safety and Hygiene at Work Unit.

[3] Legislative Decree no. 271 amending the legislation on the health and safety of maritime workers on board national merchant fishing vessels to the requirements of Law N 485 of 31 December 1998. (Official Journal of the Italian Republic no. 185 of 9 August 1999, Ordinary Supplement no. 151).

1. METHODS

Accidents relating to seafarers are reported on standard accident forms[4] wich are submitted to the competent harbour authority. These accident report forms are structured in such a way as to determine the specific accident event and its consequences. ISPESL has signed an agreement with the General Command of the *Capitanerie di Porto* - Coast Guard Corps[5] (harbour authorities) stipulating that the Italian harbour authorities shall forward the Institute copies of all the accident reports that they receive.

It is important for ISPESL to have a database compiled from these reports (which were little used for prevention until now) because the accident report form requests a more detailed description of the accident event than that found in the data from the Italian National Institute for Insurance against Occupational Accidents (INAIL) or the Italian Institute of Maritime Social Security (IPSEMA). Indeed, the accident report form (as can be seen in Table 1) consists of various sections containing information on the vessel (type, shipowner and name), the worker (such as nationality, age and shipboard position), the conditions under which the accident occurred (such as sea conditions, location of the ship and the activity performed by the worker at the time of the accident), the characteristics and consequences of the accident (e.g., type of injury, injured body part and the consequent measures taken) and finally, on what are defined as the causes of the accident (represented by such categories as slips and falls, explosions, injuries from mooring equipment).

Pursuant to Italian privacy legislation, in the copies of the accident reports transmitted to ISPESL, some fields containing sensitive data were omitted (the names of the worker, shipowner and vessel).

In practice, for almost all the cases of interest, only the accidents where the victim was brought ashore for medical attention were reported; however, it must be noted that the same problem is true regarding the data from the two national insurance institutes (INAIL and IPSEMA). During the period under study (April 2004 - December 2005), ISPESL received 1, 114 accident reports. Although this was a sufficient number of reports for a preliminary statistical analysis, in fact - based on verifications performed for 2005 - it only represented around half of the total accidents[6]. Therefore, the accident reports only potentially referred to all accidents suffered by seafarers. In practice this was not the case and so it was not possible to treat the data from the reports as a random or representative sample; for this reason the analysis was based purely on descriptive statistics.

The accident report data were recorded and stored using data management software developed by the institute. All fields included in the accident report form were entered into the database, including a field referring to the harbour authority that forwarded the file.

Then the data was processed using SPSS statistical software (SPSS v. 16.0, SPSS Inc., Chicago Illinois, USA) [12]. The first stage of data processing consisted in eliminating typing errors made during data entry. During this stage, the frequency distributions for all variables were calculated and the variables concerning the time of the accident and what part of the body was injured were recodified into categories. Then, given the high number of modes for 'shipboard position', a new variable, 'position', was created with seven modes (Table 2).

[4] Pursuant to Art. 26(2) of Legislative Decree No. 271/99, the current format of the accident report forms is prescribed in Ministerial Decree of 30 May 2000. Ministry of Transport and Shipping - Approval of the register of accidents and of the statistics form for accidents on board national merchant fishing vessels (Official Journal no. 146 of 24 June 2000).

[5] In Italy the harbour authorities are part of the Coast Guard Corps of the Italian Navy under the General Command of the Corps of the Capitanerie di Porto, which is responsible for the coordination and control of all their activities.

[6] This information was deduced from the number of harbour authorities that never submitted accident reports and from the number of reports filed at IPSEMA in 2005.

Table 1 - Accident report form for accidents involving maritime workers. Inferred information listed by type

VESSEL	WORKER	ACCIDENT	INJURY
Date	Type	Nature of injury	Nationality
Owner	Shipboard position	Time	Injured area
Name of vessel	Section	Light conditions	Cause of accident
		Average time at sea	Consequent measures taken
		Vessel's location at time of accident	Consequences
		Time spent on shift by injured worker at time of accident, from < 2 hrs to > 7 hrs consecutively	
		Weather conditions: wind force, sea state	
		Location of accident	
		Activity at time of accident	

Source: Data compiled by ISPESL from maritime accident files

Table 2 - Shipboard position. Aggregate classification

CATEGORY	POSITION	DETAILS (based on original non-aggregated shipboard position data)
1	Master	Master, Chief officer, Chief Engineer, Chief Purser, Chief medical officer
2	Officers and Cadets	Second officer, Second engineer, Assistant purser, Third officer, Third engineer, Chief steward, Fourth officer, Fourth engineer, Assistant steward, Deck cadet, Engineering cadet, Steward cadet
3	Deck personnel	Boatswain, Able seamen, Ordinary seamen, Deck boy
4	Other deck personnel	Carpenter, Fitter, Deck worker, fireman, Garbage utility
5	Other engine personnel (junior officers and seamen)	Foreman, Engine utilityman, Engine fitter, Electrician, Greaser, Welder, Pipe fitter, Engine room boy
6	Other hotel and service staff (junior officers and ratings)	Maître d'hôtel, Cook, Storekeeper, Sommelier, Baker, Pastry chef, Butcher, Galley steward, Galley boy, Dishwasher, Chief steward, Wardrobe attendant, Waiter, Cabin steward, Junior cabin steward, Laundryman, Ironer, Office assistant, Desktop publisher, Operator, Hostess, Beauty therapist, Manicurist, Hairdresser, Musician, Fitness instructor, etc.
	Medical staff	Second medical officer, Third medical officer, Fourth medical officer, Nurse

Source: Data compiled by ISPESL from maritime accident report forms

The frequencies of this new variable, in conjunction with the 'type of vessel' field, demonstrated that the position is strongly connected with the type of vessel. In the light of this information, the 'type of vessel' field was also aggregated according to the intended use of the vessel (Table 3).

Table 3 - Type of vessel. Aggregate classification

TYPE OF VESSEL	AGGREGATION
Tankers General cargo vessels Container vessels	Freight Ships
Fishing vessels	Fishing Vessels
Hydrofoils High speed crafts Ferries Passenger vessels	Passenger transport Vessels
Tugs	Tugs
Other	Other types of vessels

Source: Data compiled by ISPESL from maritime accident report forms

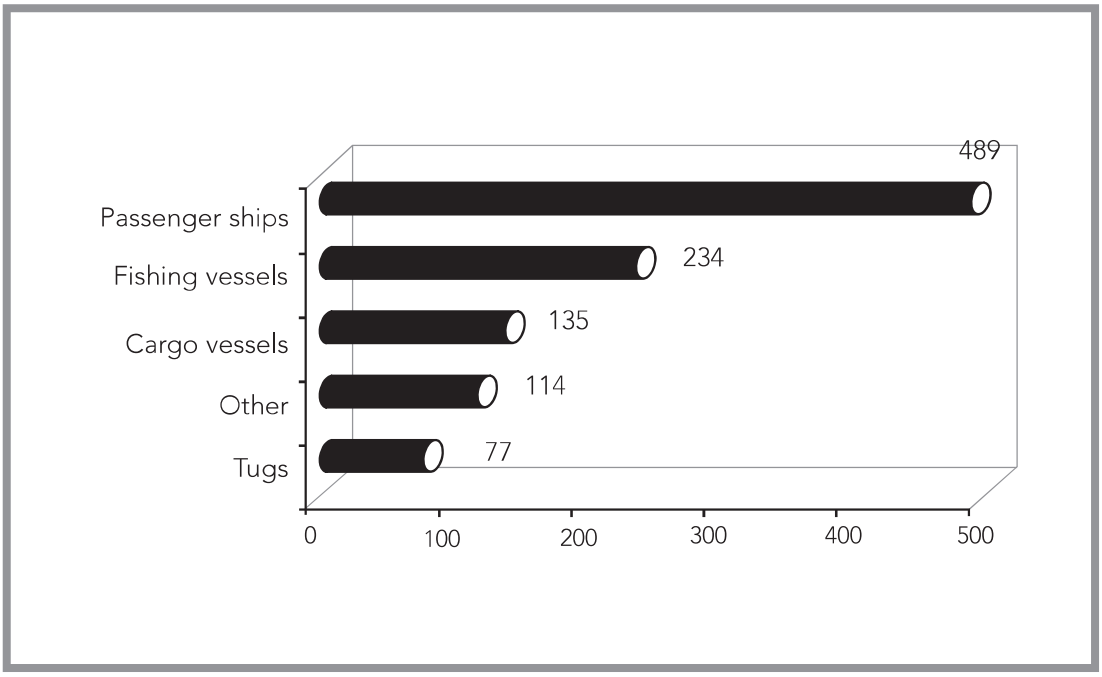
These new aggregates reveal that 82% of accidents involve passenger, fishing and freight vessels. Considering this high percentage, a more detailed analysis of each of these three types of vessel was performed, verifying whether the high incidence of 'shipboard falls' are common to all types of vessel. In particular, this type of accident mostly concerns able seamen on board fishing vessels and hotel or service staff on passenger vessels. Then, in order to determine the principal causes of this type of accident, the variable, 'cause of accident' was examined focusing on the three modes concerning falls (on board and overboard): slipping, waves and other causes.
Using these three modes for each type of vessel, new frequency distributions and contingency tables were produced between variables relating to workers, the accident and injury. The results were compared in order to determine whether the environmental conditions in which the accidents occurred were the same for the various types of vessel. This has led to a number of valuable considerations for studying hazards and risk factors that may lead to accidents.

2. RESULTS

The data analyzed in this study were obtained from 1, 114 reports of accidents that occurred between April 2004 and December 2005. Accident data by type of vessel (Figure 1) indicate the highest accident rates in passenger transport vessels (489 or 47%)[7], fishing vessels (234 or 22%) and freight ships (135 or 13%). These three types of vessel accounted for 82% of accidents.

[1] Passenger transport vessels include hydrofoils, high speed craft, ferries and passenger vessels.

Figure 1 - Distribution of the number of accidents by type of vessel (2004 to 2005)



As regards the shipboard position of the injured personnel, the deck personnel had the highest incidence of reported accidents (32%), followed by 'other hotel and service staff' (21%). The principal cause of accidents was 'shipboard falls due to slipping' (42%), while the location where most accidents occurred was the main deck (18%). Furthermore, bruises and blows were the most common type of injury (51%) and the lower limbs and hands were the most injured body parts (24% and 18% respectively). Also, 44% of accidents occurred between 6 am and 12 noon and in 80% of cases an absence from work of more than 24 hours was requested.

The description of the causes of accidents, as indicated above, focused on falls. The incidence of the various causes of falls on board and overboard (slipping, waves and other causes) totalled 55% of all accidents suffered by seafarers; the remaining 45% was subdivided into thirteen modes, none of which exceed 5% of the total. In Tables 4A to 4N, the absolute values and the percentages of double distributions for falls are listed by type of ship, against different environmental and personal variables.

When the data was compared by type of vessel, there were significant differences regarding the light conditions, location of the vessel and activity performed by the injured seafarer at the time of the accident, as well as to the location of the accident and the age and shipboard position of the seafarer. Conversely, there were few discrepancies reported in terms of the average time at sea, visibility, sea state, wind force, number of hours at sea at the time of the accident and at what time the accident occurred.

In passenger transport ships, workers in the 'other hotel and service staff' shipboard positions suffered the greatest number of falls (45%), which mostly occurred under artificial light conditions (72%) and when the vessel was docked (53%). The accidents mostly occurred along transit areas, on stairs and access openings (23%), during cabin and galley service operations (35%) and involved seafarers between the age of 16 and 25 (20%). The most commonly injured body parts were the lower limbs and head (skull, face and neck) mainly by bruising and blows.

In fishing vessels, the deck personnel suffered the most injuries from this type of accident (68%). The accidents occurred in bright light conditions (62%) and when the ship was at sea (62%). The most dangerous location on the ship was the main deck (41%) and the activities at highest risk were deck duties (45%). In these cases, the 45- to 50-year-old age group was the most affected (23%). The most injured body parts were the hands and lower limbs and the most common injuries were bruises, blows and fractures.
Finally, on freight ships, deck personnel were the most likely to suffer accidents (41%), the most frequent location was the main deck (27%) and the most common circumstance was when the seafarer was on deck (47%). At the time of the accident the ship was docked in 50% of cases and the light conditions were, without distinction, bright (48%) or artificial (46%). The 50- to 55-year-old age group suffered the most injuries; the most injured body parts were the lower limbs and the most common injuries were bruises and blows. Given the nature of shipboard duties, the overall picture of the respective distribution of accidents is not surprising. However, it was surprising to observe that for all types of vessels, the weather and sea conditions and time of accident had little influence on the occurrence of the accidents. Indeed, in most cases, the average time at sea was between zero and two days (72%). In most cases, the accident occurred after no more than four hours of continuous work (79%) and, in many cases, after no more than two hours (40%). Haze was recorded in only 5% of accidents; the wind force was frequently weak, i.e., between zero and three knots (77%), and the sea state did not exceed force three in 76% of cases. Lastly, 73% of accidents occurred between 6 am and 6 pm, which, given the seasonal nature of many maritime activities, frequently equates to *daylight* conditions, i.e. situations where, at least outdoors, there is natural sunlight.

Table 4.A - Analysis of falls on board and overboard. Light conditions (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
light conditions	bright	62	24,12	71	**61,74**	33	**47,83**	166	38,16
	dark	5	1,95	11	9,57	1	1,45	17	3,91
	dim	6	2,33	5	4,35	3	4,35	14	3,22
	artificial	184	**71,60**	22	19,13	32	46,38	238	**54,71**

Source: Data compiled by ISPESL from harbour authority data

Table 4.B - Analysis of falls on board and overboard. Average days at sea (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
average days at sea (days)	not specified	7	2,71	2	1,74	3	4,29	12	2,71
	0 - 2	228	**88,37**	62	**53,91**	31	**44,29**	321	**72,46**
	2 - 9	21	8,14	21	18,26	24	34,29	66	14,90
	9 - 22	1	0,39	26	22,61	5	7,14	32	7,22
	22 or more	1	0,39	4	3,48	7	10,00	12	2,71

Source: Data compiled by ISPESL from harbour authority data

Table 4.C - Analysis of falls on board and overboard. Location of vessel (April 2004 – December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
location of vessel	docked / anchored	136	52,71	41	35,65	35	50,00	212	48,29
	at sea	117	45,35	71	61,74	28	40,00	216	49,20
	loading / unloading	4	1,55	3	2,61	4	5,71	11	2,51

Source: Data compiled by ISPESL from harbour authority data

Table 4.D - Analysis of falls on board and overboard. Number of hours at work at time of accident (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Number of hours at work	less than 2 consecutive hrs	91	35,27	47	40,87	31	44,29	169	39,58
	2 to 4 consecutive hrs	112	43,41	35	30,43	21	30,00	168	39,34
	4 to 7 consecutive hrs	36	13,95	16	13,91	9	12,86	61	14,29
	7 or more consecutive hrs	10	3,88	16	13,91	3	4,29	29	6,79

Source: Data compiled by ISPESL from harbour authority data

Table 4.E- Analysis of falls on board and overboard. Weather conditions/Visibility (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Weather conditions/ visibility	not specified	247	95,74	108	93,91	66	94,29	421	95,25
	haze	11	4,26	6	5,22	4	5,71	21	4,75

Source: Data compiled by ISPESL from harbour authority data

Table 4.F - Analysis of falls on board and overboard. Wind force (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Wind force	not specified	36	13,95	4	3,48	6	8,57	46	10,38
	0 - 3	200	**77,52**	86	74,78	53	**75,71**	339	**76,52**
	4 - 6	20	7,75	23	20,00	9	12,86	52	11,74
	7 - 9	2	0,78	1	0,87	1	1,43	4	0,90
	> 9			1	0,87	1	1,43	2	0,45

Source: Data compiled by ISPESL from harbour authority data

Table 4.G - Analysis of falls on board and overboard. Sea state (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Sea state	not specified	45	17,44	6	5,22	7	10,00	58	13,09
	0 - 3	194	**75,19**	87	**75,65**	55	**78,57**	336	**75,85**
	4 - 6	18	6,98	21	18,26	8	11,43	47	10,61
	7 - 9	1	0,39	1	0,87	0		2	0,45

Source: Data compiled by ISPESL from harbour authority data

Table 4.H - Analysis of falls on board and overboard. Age of injured seafarer (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Age of injured saferer	under 15	2	0,78	1	0,87			3	0,68
	16 - 25	51	**20,00**	5	4,35	4	5,80	60	13,67
	25 -30	21	8,24	9	7,83	5	7,25	35	7,97
	30 - 35	30	11,76	18	15,65	8	11,59	56	12,76
	35 - 40	36	14,12	9	7,83	6	8,70	51	11,62
	40 - 45	33	12,94	15	13,04	9	13,04	57	12,98
	45 - 50	27	10,59	26	**22,61**	11	15,94	64	14,58
	50 - 55	35	13,73	14	12,17	17	**24,64**	66	**15,03**
	55 and over	20	7,84	18	15,65	9	13,04	47	10,71

Source: Data compiled by ISPESL from harbour authority data

Table 4.I - Analysis of falls on board and overboard. Accident location (April 2004 – December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
accident location	Forecastle	6	2,33	3	2,63	4	5,71	13	2,95
	Main deck	12	4,67	47	**41,23**	19	**27,14**	78	**17,69**
	Embarkation deck	6	2,33	1	0,88			7	1,59
	Bridge	6	2,33	5	4,39	0		11	2,49
	Other decks	15	5,84	6	5,26	4	5,71	25	5,67
	Main winch	1	0,39	2	1,75	1	1,43	4	0,91
	Secondary winches	0	0,00	1	0,88	0		1	0,23
	Wheelhouse	1	0,39	1	0,88			2	0,45
	Hold	3	1,17	2	1,75	4	5,71	9	2,04
	Engine rooms	29	11,28	9	7,89	12	17,14	50	11,34
	Galley/Mess/ Pantry	31	12,06	1	0,88	3	4,29	35	7,94
	Cabins	33	12,84	4	3,51	4	5,71	41	9,30
	Ship's entrance	3	1,17	2	1,75			5	1,13
	Emergency routes	1	0,39					1	0,23
	access openings/ transit areas/stairs	59	22,96	9	7,89	10	14,29	78	**17,69**
	Enclosed spaces	5	1,95	2	1,75	5	7,14	12	2,72
	Stores	4	1,56	0		0		4	0,91
	Vehicle deck	16	6,23	0		0		16	3,63
	Travel between/ home and ship	0	0,00	0		4	5,71	4	0,91
	Other working areas	26	10.12	19	16.67			45	10.20

Source: Data compiled by ISPESL from harbour authority data

Table 4.L - Analysis of falls on board and overboard. Activity performed at time of accident (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Activity performed at time of accident	ashore/travelling between home and ship	1	0,39	0		0		1	0,23
	boarding/ disembarking	17	6,59	12	10,43	5	7,14	34	7,71
	deck work	40	15,50	52	**45,22**	33	**47,14**	125	**28,34**
	engine room work	32	12,40	9	7,83	15	21,43	56	12,70
	winch or hoist operations	1	0,39	5	4,35	1	1,43	7	1,59
	operating deck washing tools	7	2,71	3	2,61%	1	1,43	11	2,49
	machine shop work	2	0,78	1	0,87	2	2,86	5	1,13
	mooring/unmooring	10	3.88	3	2.61	4	5.71	17	3.85
	cabin/galley activities	89	**34.50**	5	4.35	4	5.71	98	22.22
	operating work equipment	7	2.71	16	13.91	2	2.86	25	5.67
	resting	31	12.02	3	2.61	1	1.43	35	7.94
	other	19	7.36	6	5.22	2	2.86	27	6.12

Source: Data compiled by ISPESL from harbour authority data

Table 4.M - Analysis of falls on board and over board. Time of accident (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
time of accident	00:00 - 06:00	16	6,35	20	18,35	7	10,14	43	10,00
	06:00 - 12:00	116	**46,03**	46	**42,20**	32	**46,38**	194	**45,12**
	12:00 - 18:00	63	25,00	34	31,19	23	33,33	120	27,91
	18:00 - 24:00	57	22,62	9	8,26	7	10,14	73	16,38

Source: Data compiled by ISPESL from harbour authority data

Tabella 4.N - Analysis of falls on board and over board. Shipboard position (April 2004 - December 2005)

Variable	Mode	Passenger transport		Fishing		Freight		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Shipboard	Master	10	4,37	12	12,24	8	13,79	30	7,79
	Officiers and cadets	17	7,42	2	2,04	13	22,41	32	8,31
	Deck personnel	56	24,45	67	**68,37**	24	**41,38**	147	**38,18**
	Other deck personnel	14	6,11	4	4,08	3	5,17	21	5,45
	Other engine personnel	29	12,66	10	10,20	9	15,52	48	12,47
	Other Hotel and service staff	103	**44,98**	3	3,06	1	1,72	107	27,79

Source: Data compiled by ISPESL from harbour authority data

3. DISCUSSION

The results of the first analysis of accidents suffered by maritime workers based on port authorities' accident reports, constitute an information base for improving risk assessments on board ships and for planning prevention measures aimed at managing the causal factors of accidents or mitigating their seriousness. It is clear, however, that further analysis based on the increasingly comprehensive data that are being submitted to port authorities may confirm (or indeed refute) the results thus far obtained.

The main type of accident among seafarers is 'shipboard falls', but, according to the information in the ISPESL database, this type of event is not particularly correlated with adverse weather or sea conditions, nor with rising tension and workload due to long periods at sea, or long working hours. Light conditions do not appear to be determinant either, and there is no clear trend of the age group that is most at risk. It should be noted, however, that regarding age groups and nationalities most at risk, there may well be some inaccuracy in the data deriving from the presence of unregistered work; for example the nationality of injured workers was reported as Italian in 64% of cases and not declared in 29%, which could be a cause for concern. There are no more than three injured workers for each nationality of seafarers for the period of interest (with the exception of Tunisian which covers 5% of the cases).

Another interesting data point, which would require further research, is the presence of causes that are common to all types of vessel, i.e. the occurrence of similar accidents across a wide range of work activities on board. Further research could be facilitated by the positive collaboration between ISPESL and the harbour authorities, which includes a process of quantitative and qualitative optimisation of the information flow from harbour authorities.

The development of the ISPESL database will improve the capabilities for risk analysis and assessment on board vessels, in addition to indirectly implement other databases at the Institute, which act as sources of technical, organisational and training support for occupational health and safety management.

Following a detailed and coherent risk assessment on board ship, the following basic prevention measures should be planned: actions to eliminate hazards and improve safety in the work environment, with particular attention to the 'transit routes' used for moving about

the ship (access openings, transit areas and stairs); information and training initiatives for seafarers designed to increase awareness of occupational risks associated with their shipboard occupation.
To this end, the monitoring of the dynamics of accidents, which was developed in collaboration with the General Command of the Capitanerie di Porto - Coast Guard Corps (harbour authorities), will provide invaluable quantitative and qualitative information.

ACKNOWLEDGEMENTS

The authors are grateful to the General Command of the Corps of the Capitanerie di Porto who, having transmitted the accident report files to the Italian National Institute for Occupational Safety and Prevention , has enabled the optimisation of the accident data flow of the maritime sector in support of planning prevention and protection initiatives.

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