



MARINE ENVIRONMENT PROTECTION
COMMITTEE
53rd session
Agenda item 19

MEPC 53/INF.7
15 April 2005
ENGLISH ONLY

FUTURE ROLE OF FORMAL SAFETY ASSESSMENT AND HUMAN ELEMENT ISSUES

Fatigue/sleep induced accidents

Submitted by Sweden

SUMMARY

Executive summary: This document reports on a study performed by the Swedish Maritime Administration (SMA) concerning collisions and groundings, in which fatigue/sleep has been shown to be of great or decisive significance. The study may be of interest from a human element point of view. It implies an inherent lack of safety in two-navigator ships trading on short voyages

Action to be taken: Paragraph 26

Related documents: MSC/Circ.1014

Introduction

1 This document reports on a study performed by the Swedish Maritime Administration (SMA) concerning collisions and groundings in which fatigue/sleep was supposed to be of significance.

2 In recent years interest in the human element or factor in accidents at sea has grown. SMA has taken a special interest in lack of sleep and fatigue suffered by crew members. It is well known in the seafaring world that accidents have happened as a result of lack of sleep or fatigue. Much has been said or written about fatigue and lack of sleep on board ships but often in rather general terms. The study which SMA undertook was to begin by looking at the statistical data on collisions and groundings available and then look into the accident reports to see if patterns could be found.

Background

3 When investigating accidents and collecting related data for statistical purposes the importance of system oriented, organizational and human factor aspects and data have increased. SMA has found that, in 2001, 87% of the groundings in Swedish waters were attributable to the human factor. It is also evident to SMA that a large percentage of collisions in Swedish waters are attributable to the human factor. SMA undertook its study by first looking at the statistical data available on collisions and groundings and then looked into certain accident investigation reports to see whether patterns could be found or not.

Scope of the study

4 The study comprises reports and statistical material, available to SMA on reported collisions and groundings, which took place 1997-2002. The accidents were regarded to have – to a high or very high probability – been caused by fatigue or sleep. The data used comprises ships flying the Swedish flag, irrespective of waters, and foreign ships in Swedish waters. The total number was 32 ships.

Results

5 In the study performed the results were compiled in some 40 statistical tables. In this information document 12 tables, which are deemed to be of the greatest interest and importance, are shown at annex.

6 Going through the tables, two of them can be found to rather definitely indicate sleep or fatigue. The tables are 7 and 8 which show the time of day (24 hours) of the accident and the geographical area and time of day of the accident respectively. It should be noted that slightly more than half (53%) of the accidents occurred between 0400 and 0800 and 84% between 2300 and 0800 (table 20).

7 Table 11 shows the position on board of the OOW and the watch keeping-system used on board the ships. That table might, if elaborated, have shown a pattern. There are, however, too many cases in which it is not known which watch-keeping system was normally used on-board or which watch-keeping system was in fact applied at the time of the accident, alternatively there was no specific watch-keeping system applied.

8 In 11 of the 32 cases it is not known which watch-keeping system was applied. Half of the 32 cases concern, however, ships with 2-watch system (table 11). Fishing vessels form a group of ships, which have to great extent used working schedules made up at the spur of the moment, i.e. the crews have not worked according to a fixed system.

9 The cases represent accidents of which 66% involved foreign ships. Swedish ships are represented by 11 ships, Norway five, Germany four and Finland three. In addition, ships of eight other nationalities are represented. As regards the types of ships 19 are bulk carriers (includes general cargo ships), eight fishing vessels, two tankers, one passenger ship and two “other kinds” of ships (table 5).

10 According to table 8 there were eight accidents in the rather narrow Sound between Denmark and Sweden. As is shown in table 9 they all involved bulk carriers.

11 In no case a special helmsman was employed. A look-out is said to have been set in 4 cases but they were at the time of the accidents busy with other tasks.

Comments

12 It must be stressed that the body of statistical data is small and there may be other uncertainties in the data. For this reason the information in the tables should be used with some wariness.

13 One obvious observation that can be made is the times when the accidents have occurred. It cannot be mere coincidence that they take place at night, at dawn or in darkness. Earlier basic research into and studies of land-based activities indicate a good correspondence. People simply wish, biologically, to sleep “at night” but some types of work, e.g. work as an OOW, demand that people work at night.

14 The watch-keeping system most frequently used in the ships involved in the accidents, which are shown in the tables, is the so-called 2-watch system, which is known to be a demanding and fatigue inducing system. This may force the OOWs to work under more difficult circumstances than would be the case ashore. The average age of the OOWs in the accidents studied has also been comparatively high.

15 In addition to the difficulties presented in the preceding paragraph, the accidents have occurred greatly when visibility has been good and the sea smooth or moderate. Since it has, in most cases, been dark outside it is also dark inside the wheelhouse. The automatic steering has been in operation. The prevailing traffic situations are not known but can be assumed not to have been demanding. All this does not create a situation, in which one is encouraged to stay awake. There are many factors, which contribute to people falling asleep.

16 A great contributor to the accidents must also in many cases be the often demanding or tiresome work during the days and weeks before the accident. It is known that in ships applying a 2-watch system, especially the ships with only two navigators on-board, have great difficulties in applying regulations concerning hours of rest. This in combination with an under-stimulating task on the bridge at night creates a risk situation.

17 The majority of ships involved in the accidents are rather small, including Swedish flagged, older fishing vessels. This is not surprising. The ships are mainly used in near coastal and sheltered waters and make frequent calls in port. They very often employ a 2-watch system.

18 There are remarkably few passenger ships involved in accidents, at least when looking at the number of passenger ships flying the Swedish flag. A plausible reason for this, as concerns Swedish ships, is that a great number of passenger ships are small and mainly operated in daylight. The large passenger ships have 3-watch systems, larger manning on the bridge, in most cases a well established timetable and a different kind of operation, which taken together offer far better possibilities for rest.

19 The total number of Swedish fishing vessels is comparatively large. Hence it could be assumed that fishing vessels should have been involved in a larger number of accidents than they have in fact been involved in. Few Swedish fishing vessels fish, however, outside Swedish waters. Most of them fish in near coastal waters and most of them fish for no more than a day at a time, which may explain the relative absence of fishing vessels in the tables.

20 The Swedish ships, called "other ships" in table 1, consist of very diverse ships and probably do not work at night or do shift work to only a small extent.

21 It should be noted that the relation between the number of ships' movements and the number of groundings and collisions in the areas of the accidents is not reported. This is due to the fact that relevant information on ships' movements has been impossible to obtain.

22 Finally, there is reason to reflect on the large number of groundings in the Sound between Denmark and Sweden. At its narrowest point it is some two nautical miles wide. Three shipping companies trade with ferries between Elsinore and Helsingborg on very tight schedules and some 40,000 ships sail through the Sound every year. This would make for a situation, in which one would not be likely to fall asleep but on the other hand, if a navigator falls asleep the effect is fairly immediate; he goes aground rather quickly. In addition, the distances between the points where course has to be changed are short but not – as must be the case – short enough to prevent people from falling asleep.

23 A close study of the eight groundings in the Sound shows that when four out of the eight ships passed Elsinore-Helsingborg, the OOWs were probably asleep/fatigued. In one case the ship was southbound and ran into the south pier of the port of Helsingborg. In the remaining three cases, the ships were northbound but missed a requisite, in accordance with well established practice, change of course to port just north of the ferry route.

24 There is reason to seriously reflect on this situation. In the last six years seven ships have run aground in the Sound in sleep/fatigue related accidents. How many more ships have gone through the Sound with the OOW drowsy, exhausted half asleep or asleep without having run aground or been involved in a collision? Considering the very dense traffic this is a very serious safety problem.

25 In conclusion it can be claimed that sleep/fatigue in connection with duty on the bridge is with very great probability more frequent than one has had reason to believe. The number of unrecorded cases is estimated to be large. Sweden will continue to study the impact of 2-watch systems and especially operational conditions on-board ships employing only two navigators. There is probably an argument to be made that this system in many cases is an unsafe practice.

Action requested of the Committee

26 The Committee is invited to note the information provided in this document and refer it to discussion in the Working Group on the Human Element.

ANNEX

Table 1: Number of Swedish registered ships in the period 1997–2002

Ship type	Passenger ship	Tanker	Bulk carriers	Fishing vessel	Other ships	Total
Year 1997	1284	123	222	2267	2887	6783
1998	1300	113	190	2113	1655	5371
1999	1383	113	189	1990	1889	5564
2000	1430	115	181	1954	2000	5680
2001	1511	112	179	1851	2020	5673
2002	1584	111	185	1822	2114	5816

Table 2: Number of reported groundings, collisions with ships and collisions with other objects by Swedish ships per ship type in the period 1997–2002

Ship type	1997	1998	1999	2000	2001	2002	Total
Passenger ship	60	43	43	35	35	35	251
Tanker	9	9	6	9	6	7	46
Bulk carrier	25	17	11	10	11	12	86
Fishing vessel	16	11	11	10	11	12	71
Other ships	14	6	13	8	14	11	66
Total	124	86	84	72	77	77	520

Remark. The total number of accidents decreased substantially (30%) from 1997 to 1998. For tankers the figures are not as remarkable. The reasons for the changes have not been investigated in this study. Compare the changes in the number of Swedish registered ships in the same period. According to **Table 1** the number of Swedish registered ships was reduced by 21% in the same period.

Table 3: Number of reported groundings, collisions with ships and collisions with other objects by foreign ships per ship type in the period 1997–2002

Ship type	1997	1998	1999	2000	2001	2002	Total
Passenger ship	8	3	3	3	2	2	21
Tanker	8	6	6	1	2	2	25
Bulk carrier	36	25	32	33	27	24	177
Fishing vessel	7	3	2	8	4	7	31
Other ships	4	6	4	4	2	9	29
Total	63	43	47	49	37	44	283

Remark. The total number of accidents decreased significantly (31%) from 1997 to 1998.

Table 4: Number of sleep/fatigue related collisions/groundings per ship type and gross tonnage, Swedish and foreign

Gross tonnage	- 999	1000-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	4000-	Un-known	Total
Passenger ships	-	-	-	-	-	-	-	1	-	1
Tankers	1	-	-	-	-	-	1	-	-	2
Bulk carriers	-	4	5	2	3	3	2	-	-	19
Fishing vessels	8	-	-	-	-	-	-	-	-	8
Other ships	-	-	1	-	-	-	-	-	1	2
Total	9	4	6	2	3	3	3	1	1	32

Table 5: Number of sleep/fatigue related collisions/groundings per ship type and nationality

Ship's type	Passenger ship	Tanker	Bulk carrier	Fishing vessel	Other ships	Total
Sweden	1	2	2	5	1	11
Norway	-	-	5	-	-	5
Germany	-	-	4	-	-	4
Finland	-	-	1	1	1	3
Russia	-	-	2	-	-	2
Denmark	-	-	-	1	-	1
Estonia	-	-	-	1	-	1
Netherlands	-	-	1	-	-	1
Great Britain	-	-	1	-	-	1
Gibraltar	-	-	1	-	-	1
Antigua	-	-	1	-	-	1
St Vincent	-	-	1	-	-	1
Total	1	2	19	8	2	32

Table 6: Number of sleep/fatigue related collisions/groundings per ship type and year of accident

Year	1997	1998	1999	2000	2001	2002	Total
Passenger ship	1	-	-	-	-	-	1
Tanker	-	-	1	-	1	-	2
Bulk carrier	4	3	1	3	3	5	19
Fishing vessel	1	1	-	2	2	2	8
Other ships	-	1	-	-	-	1	2
Total	6	5	2	5	6	8	32

Table 7: Number of sleep/fatigue related collisions/groundings per point of time and person responsible for the bridge duty at the accident

Point of time	Master	Deck officer	OOW	Total
00-01	1	-	-	1
01-02	2	-	-	2
02-03	1	1	-	2
03-04	2	-	-	2
04-05	1	2	-	3
05-06	-	5	1	6
06-07	1	2	2	5
07-08	2	1	-	3
08-09	-	1	-	1
09-10	-	-	-	-
10-11	-	-	1	1
11-12	-	-	-	-
12-13	-	-	-	-
13-14	-	-	-	-
14-15	1	-	-	1
15-16	-	-	-	-
16-17	-	-	-	-
17-18	-	-	-	-
18-19	2	-	-	2
19-20	-	-	-	-
20-21	-	-	-	-
21-22	-	-	-	-
22-23	-	-	-	-
23-24	2	1	-	3
Total	15	13	4	32

Table 8: Number of sleep/fatigue related collisions/groundings per geographic area and point of time of the accident.

Hour	00-04	04-08	08-12	12-16	16-20	20-24	Total
The northern part of the Gulf of Bothnia		1			1		2
Stockholm	1	2		1			4
Bråviken	2						2
Gotland		2				1	3
Kalmar Sound	1						1
The Hanö Bay	1	5	2				8
The Sound	1	6				1	8
The Great and Little Belt		1					1
Kattegatt	1			1			2
Skagerrak						1	1
Total	7	17	2	2	1	3	32

Table 9: Compilation of certain, specific data on ships damaged in The Sound

"Ship No."	"2"	"3"	"11"	"14"	"19"	"27"	"32"
Year of accident	2002	2002	2001	2000	1997	1997	1997
Month	Aug.	April	March	July	Dec.	May	June
Day	31	15	15	24	08	12	14
Weekday	Sat	Mon	Thu	Mon	Mon	Mon	Sat
Hour	0720	2345	0610	0555	0615	0530	0215
Ship type	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Nationality	Russian	Swedish	Gibraltar	Norw.	German	Finnish	St. Vincent
Port of departure	Klaipeda	Oxelösund	Ventspils	Karls-hamn	Stettin	St.Peters-burg	Horsens
Destination	England	Fredricia	Karlstad	Vejle	Seaham	Felixtove	Karls-hamn
Distance from port of depart. to location of grounding	332	326	358	150	183	711	165

Remark. Ship “No. 24” is not included in this compilation due to the specific limitation of The Sound in this table.

Table 10: Number of sleep/fatigue related collisions/groundings per size of the ship’s crew

Size of the crew (number of persons)	1-2	3-5	6-8	9-11	12-	Unknown	Total
Number	3	9	8	3	3	6	32

Table 11: Number of sleep/fatigue related collisions/groundings related to the position of the OOW onboard and the ship’s watch keeping system

	2-watch	3-watch	Unknown	Total
Master	9	2	4	15
Deck officer	7	3	3	13
OOW	-	-	4	4
Total	16	5	11	32

Table 12: Number of sleep/fatigue related collisions/groundings related to the position of the OOW and the year of the accident

	Master	Deck officer	OOW	Total
1997	1	5	-	6
1998	4	-	1	5
1999	2	1	-	3
2000	2	2	-	4
2001	4	-	2	6
2002	2	5	1	8
Total	15	13	4	32