INTERNATIONAL MARITIME ORGANIZATION

E

SUB-COMMITTEE ON IMPLEMENTATION OF IMO INSTRUMENTS
7th session
Agenda item 4

III 7/4
17 April 2020
Original: ENGLISH
Pre-session public release: ☒

LESSONS LEARNED AND SAFETY ISSUES IDENTIFIED FROM THE ANALYSIS OF MARINE SAFETY INVESTIGATION REPORTS

Report of the Correspondence Group on Analysis of Marine Safety Investigation Reports

Submitted by Sweden

SUMMARY

Executive summary:	This document contains the report of the Correspondence Group on Analysis of Marine Safety Investigation Reports
Strategic direction, if applicable:	6
Output:	6.4
Action to be taken:	Paragraph 17
Related document:	III 7/4/1

TERMS OF REFERENCE

1 The Sub-Committee on Implementation of IMO Instruments (III), at its sixth session, established the Correspondence Group on Analysis of Marine Safety Investigation Reports, under the coordination of Sweden,* with the following terms of reference, using IMO Space facilities:

.1 based on the information received from Administrations on investigations into casualties, conduct a review of the marine safety investigation reports assigned by the Secretariat, prioritizing very serious marine casualties involving SOLAS ships, which have occurred since 1 January 2010, and prepare draft Lessons learned from marine casualties, where necessary;

* **Coordinator:**
Capt. Jörgen Zachau
Swedish Accident Investigation Authority
P.O. Box 12538, SE-102 29 Stockholm, Sweden
Phone: +46 8 508 862 13 / Fax: +46 8 508 862 90
Email: Jorgen.Zachau@havkom.se

.2 identify safety issues and make recommendations for further consideration by the Sub-Committee;

.3 identify the type of casualties which occur more frequently than others using the existing data on all casualty analyses conducted in the past, and derive patterns and/or draw conclusions for the consideration of the Sub-Committee; and

.4 submit a report to III 7.

MEMBERS OF THE CORRESPONDENCE GROUP

2 Representatives of the following Member Governments, intergovernmental and non-governmental organizations participated as members of the Group: Antigua and Barbuda; Argentina; Australia; the Bahamas; Barbados; Belgium; Brazil; Canada; Croatia; France; Germany; Hong Kong, China; Indonesia; Iran (Islamic Republic of); Italy; Japan; Liberia; the Marshall Islands; Netherlands; New Zealand; the Republic of Korea; the Russian Federation; Singapore; Sweden; Turkey; the United Kingdom; the United States; European Commission (European Maritime Safety Agency (EMSA)); Marine Accident Investigators' International Forum (MAIIF); Institute of Marine Engineering, Science and Technology (IMarEST); International Association of Classification Societies (IACS); International Chamber of Shipping (ICS); International Federation of Shipmasters' Association (IFSMA); INTERGARGO; International Transport Workers' Federation (ITF); Nautical Institute; Oil Companies International Marine Forum (OCIMF) and Royal Institution of Naval Architects (RINA).

MARINE SAFETY INVESTIGATION REPORT ANALYSIS, OUTCOME AND LESSONS LEARNED FROM MARINE CASUALTIES

3 The list of the 39 marine safety investigation reports which have been reviewed by the analysts as members of the Group is annexed to document III 7/4/1. Overviews of the analyses and of observations on the quality of the reports are presented in paragraphs 11 and 12, and 15 and 16, respectively.

4 A total of 16 Lessons Learned have been compiled during the work of the Group, as set out in annex 1 of this report.

IDENTIFICATION OF SAFETY ISSUES AND RECOMMENDATIONS FOR FURTHER CONSIDERATION

5 During the analysing process no safety issue was identified by the analysts. However, the following two concerns have been raised within the Group:

.1 during the period 2015-2019, the Russian Federation has investigated 31 man overboard accidents on board fishing vessels during fishing operations and having all resulted in loss of lives. The analysis of the reports indicates the difficulties encountered by the crew of the vessel while trying to maintain visual contact with a person in the water at night and/or in difficult weather conditions. A conclusion is that whistle and self-igniting light are not enough to detect a person in open sea. Modern technology may, however, play a larger role in improving safety for such cases; and

.2 an increase in the numbers of pilot ladder-related deficiencies has been reported by New Zealand. For the period January 2015 to February 2020, 210 deficiencies have been reported on SOLAS ships. The deficiencies are

registered as near misses, and no accident has occurred that met the criteria of a very serious marine casualty or marine casualty. Nevertheless, the deficiencies reported may cause concern of being a potential Safety Issue.

6 Both man overboard accidents as well as the increase of pilot ladder-related deficiencies may call for action within the Working Group on Casualty Analysis, if established, which could identify, on the basis of all Member States' experiences, any potential need for further consideration.

CASUALTIES OCCURRING MORE FREQUENTLY THAN OTHERS

7 The Group used existing data on casualty analyses, analysed by the Correspondence Group analysts from III 2 to III 6, as shown in annex 2, in order to identify casualties that occur more frequently than others. The Secretariat provided a data set upon which the table is based. The selection, based on casualties reported to IMO, may not therefore be fully comprehensive.

8 Nevertheless, the data presented may be used for the purpose of identifying suitable types of casualties, occurring more often than others. In this process of selecting types of casualties, the Group decided to select two types of casualties and not only one type, in order to derive patterns and/or draw conclusions. The selected two types of casualties are collisions and occupational accidents. Both represent casualties with severe consequences and cause a high degree of suffering for those affected. No other patterns or conclusions have been derived or drawn during this intersessional period.

9 Collisions and occupational accidents, as types of casualties occurring more frequently than others, are very broad and may need to be divided into sub-categories before any actual analysis can be performed.

10 To be successful in the continuation of the task of deriving patterns or drawing conclusions, and dividing them into sub-categories, the Group recommends a more focused and concerted effort by a smaller group or smaller groups of analysts. The groups could be appointed in the Working Group on Casualty Analysis, if established, and work intersessionally as part of the work of the Correspondence Group, if established, and report to III 8.

OVERVIEW OF MARINE SAFETY INVESTIGATION REPORT ANALYSIS

11 Out of the 39 marine safety investigation reports analysed, 32 were prepared by the marine safety investigation authorities of the flag States and 7 by the marine safety investigation authorities of the coastal or substantially interested States. No marine casualty was reported by both flag and coastal State authorities. However, one marine casualty was reported by two authorities of the same flag State. With regard to the marine casualties covered by the marine safety investigation reports that were analysed during this intersession, the following was noted based upon the analyses carried out:

.1 36 occurrences were very serious marine casualties, and 2 were marine casualties;

.2 1 (3%) occurred in 2010, 2 (5%) occurred in 2013, 5 (13%) occurred in 2014, 6 (16%) occurred in 2015, 3 (8%) occurred in 2016, 7 (18%) occurred in 2017, 13 (34%) occurred in 2018, and 1 (3%) occurred in 2019;

.3 49 ships were involved, including 5 (10%) bulk carriers, 11 (22%) general cargo ships, 10 (20%) tankers, 11 (22%) containerships, 7 (14%) fishing vessels, 1 (2%) refrigerating carrier, 1 (2%) roro vessel, and 3 (6%) other;

.4 numbers of each type of marine casualty involved;

Type of marine casualty	Number of marine casualties
Collision	11
Fire/explosion	7
Grounding	1
Flooding/foundering/capsizing	4
Occupational accident	15
Total	**38**

.5 numbers of dead or missing persons and serious injuries resulting from each type of marine casualty involved;

Type of marine casualty	Number of dead or missing persons	Number of serious injuries
Flooding/foundering/capsizing	66	0
Collision	21	8
Fire/explosion	11	15
Occupational accident		
struck by object	3	2
fall from height	5	0
man overboard	4	0
enclosed space	4	1
other	1	0
Total	**115**	**26**

.6 numbers of dead or missing persons and serious injuries related to each type of ship involved; and

Type of ship	Number of dead or missing persons	Number of serious injuries
Bulk carrier	30	2
Tanker	7	15
Containership	37	1
Fishing vessel	21	8
General cargo	7	0
Refrigerating vessel	1	0
Other	12	0
Total	**115**	**26**

.7 one report contained information on oil leaking into the sea, after the container ship **MSC Chitra** and the bulk carrier **Khalijia 3** collided. The collision resulted in heavy listing and grounding of **MSC Chitra**, and eventually a total loss and some 800 MT fuel oil leaking due to ruptured fuel oil tanks.

12 The marine casualties of **El Faro** (C0010070) and **Stellar Daisy** (C0010620) are noteworthy in respect of the number of persons missing or dead as a result of those marine casualties.

.1 On 29 September the roll-on/roll-off cargo ship **El Faro** sailed from Jacksonville, Florida, towards Puerto Rico. To avoid a strengthening hurricane the vessel diverted from its routine passage. However, the deviation took **El Faro** to the centre of the hurricane where it encountered heavy seas and winds. It subsequently developed a starboard list and began to take water causing the cargo hold to flood. Due to the list and trim of the vessel and low sump tank levels, the main propulsion could not be maintained. The vessel subsequently drifted beam to the hurricane force winds and seas as well as experienced progressive flooding. Though a distress alert was sent out 10 minutes prior to the sinking, followed by an abandon ship order, the search and rescue efforts did not locate any survivors and 33 crew members were lost. The following, inter alia, is noted in the analyses of the marine safety investigation reports (GISIS no. C0010070-R01 and C0010070-R02):

.1 the oversight of the company's management system was inadequate relating to relevant procedures for the casualty, e.g. planning, maintenance and emergency response;

.2 the loss of propulsion was a consequence of maintenance not in accordance with operations manual for heavy weather;

.3 cargo securing was not in accordance with cargo securing manual. Shifting of cargo likely had an impact on water to ingress;

.4 vessel conversion had increased the vessel's vulnerability in heavy weather;

.5 the inadequate Bridge Resource Management techniques adopted on board affected the master's situational awareness negatively; and

.6 the open lifeboats or the rafts could not have provided adequate protection in the prevailing conditions.

.2 After loading 260,000 metric tonnes of iron ore fines (which may liquefy at a high moisture content) **Stellar Daisy** left a Latin American port for China via the Cape of Good Hope. Five days later, the master sent a routine message to the company. Fifteen minutes later, another message said that a water ballast tank was flooded and that the vessel developed a rapid list. Yet another minute later, a DSC distress call was sent. This was the last contact with the ship, which had a crew of 22 people. The following, inter alia, is noted in the analysis of the marine safety investigation report (GISIS no. C0010620-R02):

.1 the vessel had been converted from a VLCC to a VLOC on the assumption that all of the scantlings were as originals, and the structural analysis did not take into account corrosion and material fatigue that had occurred over the past 15 years;

.2 the repair history indicates that there was active corrosion in several ballast tanks;

.3 structural repairs were made but not all were notified to, nor overseen by, the class surveyor;

.4 **Stellar Daisy** had made several short coastal voyages in a partially discharged state, not in compliance with the stability and loading manual. The hull structure would have been overstressed during such voyages;

.5 significant impact loads would have imposed on the weakened forward structure as the vessel maintained with full engine revolutions into 6 to 9 metre-waves; and

.6 inspection requirements due to coating breakdown for water ballast tanks in bulk carriers could be improved to align with those for tankers.

FEEDBACK ON THE QUALITY OF MARINE SAFETY INVESTIGATION REPORTS

13 Marine safety investigation reports selected for analysis during the intersessional analysis process also underwent quality evaluation based on the criteria given in chapter 2, paragraph 2.12 of the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code), adopted by resolution MSC.255(84). The evaluation of the reports did not include the quality of the investigation itself. As agreed by FSI 20 (FSI 20/19, paragraph 5.3.2), in order to provide feedback on the quality of the reports, the completed quality evaluation forms were made available on GISIS – without disclosing the analysts' identity – to the corresponding reporting marine safety investigation authorities, purely for information purposes and for these authorities to act as they deemed appropriate for their internal quality assurance processes. If a report was selected for analysis during the intersessional analysis process, a quality evaluation form would be completed online by the analyst. The feedback did not have to be approved, agreed or discussed between the analyst and the reporting marine safety investigation authority.

14 With these criteria in mind, the following procedure was adopted:

.1 if a marine safety investigation report is selected for analysis during the intersessional analysis process, a quality evaluation form is completed online by the analyst;

.2 the name of the analyst will appear on neither the analysis nor the quality evaluation form; and

.3 only the reporting marine safety investigation authority for each individual report and form may access the quality evaluation form as deemed appropriate for its internal quality assurance process.

OBSERVATIONS ON THE QUALITY OF MARINE SAFETY INVESTIGATION REPORTS

15 The following (figures in "[ ]" brackets relate to the previous intersession) has been observed with regard to the quality of the 39 marine safety investigation reports [27] which have been analysed:

.1 39 [27] marine safety investigation reports were reviewed during the intersession by members of the Group. In 37 cases (95%) [100%] quality evaluation forms were completed and submitted to GISIS by the analysts;

.2 30 reports (81% of the evaluated reports) [67%] met the quality criteria set out in paragraph 2.12 of the Casualty Investigation Code;

.3 seven reports (19% of the evaluated reports) [33%] contained inappropriate or insufficient information according to the requirements of the Casualty Investigation Code. The areas where information was inappropriate or missing (with reference to paragraph 2.12 of the Casualty Investigation Code) were identified by the analysts as follows:

.1 summary outlining the basic facts of the marine casualty or marine incident and stating whether any deaths, injuries or pollution occurred as a result (paragraph 2.12.1) (two reports);

.2 where relevant, the details of the dimensions and engines of any ship involved (paragraph 2.12.3a) (one report);

.3 description of the crew, work routine and other matters, such as time served on the ship (paragraph 2.12.3b) (four reports);

.4 a narrative detailing the circumstances of the marine casualty or marine incident (paragraph 2.12.4) (one report);

.5 analysis and comment on the causal factors including any mechanical, human and organizational factors (paragraph 2.12.5) (two reports);

.6 a discussion of the marine safety investigation's findings, including the identification of safety issues, and the conclusions of the marine safety investigation (paragraph 2.12.6) (two reports); and

.7 where appropriate, recommendations with a view to preventing future marine casualties and marine incidents (paragraph 2.12.7) (one report);

.4 the question of whether the accident had been reported by more than one flag State, and if there were any discrepancies in the reports, has been answered affirmatively in one case. The comment to that answer is that there are two reports submitted into the same occurrence by the same State but by two different agencies and that both reports arrive at nearly the same conclusions on the contributing factors towards the incident; and

.5 other comments or observations relating to the quality of the report were also noted in some cases, describing the analyst's view of the report:

.1 in some cases shortcomings in the report were noted, such as: report format and style not always in line with the requirements of the Casualty Investigation Code; the report did not include any additional investigation to be able to understand or explain the causes; the summary of events described some other casualty than the one declared; the focus was on the application of rules, regulations and procedures which consequently lead to the apportioning of blame; the report structure was such that it was difficult to clearly determine what the findings were; and the report did not include a clear statement of conclusion as to what have led into this accident; and

.2 in yet some cases credits were given, such as: that the report was easily read and understood; information was clearly stated; a good quality comprehensive report; and a very thorough report resulting from an obviously thorough investigation.

16 The analysts were also tasked to identify which annexes in GISIS had been completed for the marine safety investigations in addition to the marine safety investigation report submitted to GISIS. Of the 39 marine safety investigation reports, annex 1 had been completed in 35 cases (90%) [96%], annex 2 had been completed in 33 cases (85%) [89%], and annex 3 had been completed in 24 cases (62%) [70%]. Annex 5 (Damage Cards and Intact Stability Casualty Records) had been completed in two cases (5%) [4%], annex 6 (Fire Casualty Record) had been completed in two cases (5%) [4%], annex 7 (Questionnaire Related to the Global Maritime Distress and Safety System) in one case (3%) [0%], annex 9 (Incidental Spillages of Harmful Substances of 50 tonnes or more) in one case (3%) [0%], and annex 10 (Life-Saving Appliance Casualty Record) in three cases (8%) [0%].

ACTION REQUESTED OF THE SUB-COMMITTEE

17 The Sub-Committee is invited to approve the report of the Correspondence Group in general and, in particular, to:

.1 note the concern of the Correspondence Group regarding man overboard situations, as well as the increase in pilot ladder deficiencies, and instruct the Working Group on Casualty Analysis, if established, on how to proceed with these matters (paragraphs 5 and 6);

.2 approve the selection of identified casualties, occurring more frequently than others, and instruct the Working Group on Casualty Analysis, if established, on how to proceed with this matter (paragraphs 8 to 10);

.3 refer the analysts' reviews of the marine safety investigation reports and the draft texts of Lessons Learned from Marine Casualties to the Working Group on Casualty Analysis, if established, for review (paragraphs 11 and 12, and annex 1);

.4 note the overview of marine safety investigation report analysis (paragraphs 11 and 12); and

.5 note the observations on the quality of marine safety investigation reports and take action as deemed appropriate (paragraphs 15 to 16).

***

ANNEX 1

LESSONS LEARNED FROM MARINE CASUALTIES

1 COLLISION

Very serious marine casualty: Two crew members drowned

What happened?

A container ship collided with two fishing vessels that were fishing in parallel, connected by wires, pulling one set of fishing gear. Both fishing vessels foundered causing the drowning of two crew members. The container ship sustained only superficially hull damage. The container ship collided with the paired fishing vessels while passing through multiple groups of other vessels engaged in fishing when it failed to take action to avoid collision.

Why did it happen?

- Traffic situation.
- Communication and information exchange between pilot and master on board the container ship was not as required in the sense of Bridge Resource Management.
- There was no communication between the vessels including sound or light signals.

What can we learn?

- Awareness of local dangers to navigation is to be increased by informing vessels and also pilots of fishing activities.
- Decisions in relation to avoiding close quarter situations or collision should be made well in advance and with time to spare.
- Bridge Resource Management should be implemented including the pilot; information should be shared and close cooperation is required.
- Fishing vessels fishing in cooperation should be made aware of the changed manoeuvring effects and difference in handling.
- Ensure that reliable means of communication is established between the cooperating vessels.

Who may benefit?

Ship managers, ships masters and navigational officers, pilots and pilot associations, fishing industry.

2 CAPSIZE, SINKING AND LOSS OF LIVES

Very serious marine casualty: Capsize and sinking of a tugboat and loss of lives while assisting a tanker

What happened?

Early in the morning, an 85,000 GT crude oil tanker encountered lightnings in thundery squally weather and strong wind gusts whilst loading cargo moored to a Single Buoy Mooring (SBM). A 500 GT tug vessel was in attendance, fastened at the stern of the tanker by a 31.5-metres long, 46 mm diameter steel wire towing pennant.

The Mooring Master 2 (MM2) ordered the tug to pull back the tanker from contacting the SBM. Shortly afterwards, the Terminal stopped loading and notice was given to the tanker to start its main engine.

Due to the combination of severe weather condition and the pulling by the tug, the bow chain connecting the tanker to the SBM parted and the tanker began drifting away from the SBM, risking damage to the cargo hoses.

To avoid damaging the cargo hoses, the tanker put its rudder hard to starboard, its engine at dead slow ahead and thruster to starboard. The engine was then progressively increased to slow and half ahead, with the rudder put hard to starboard.

Then the tug declared via VHF that it had an emergency on board. The tug was seen shipping seas on deck and rolling heavily when it took two successive large swells on her beam. The tug then capsized and quickly began to sink. The other mooring master (MM1) sent out Mayday, requesting immediate assistance. Another tug arrived shortly and immediately commenced search operation for any survivors.

Ten of the tug's twelve crew perished, one was lost, and one crew survived for 3 days in the overturned hull of the tug. There were no other injuries sustained anywhere and there was no pollution.

Why did it happen?

The bow chain connecting the tanker to the SBM parted due to the combined effects of the severe environmental condition and pull-back by the tug to prevent the tanker from contacting the SBM.

To mitigate the risk of damaging the cargo hoses and to keep the tanker in position and from drifting away from the SBM, the tanker had put its rudder hard to starboard, its bow thruster to starboard, and progressively increased its speed to slow and half ahead. The tug had its tow pennant fastened at the stern of the tanker. The tow pennant was directly shackled to the tug's tow line to the tug's towing winch. Neither gob wire nor towing pins – to prevent girting – were used. The tug wire had slipped on the gunwale to the deck house when the tug listed to starboard when it took two successive large waves on her beam before capsizing.

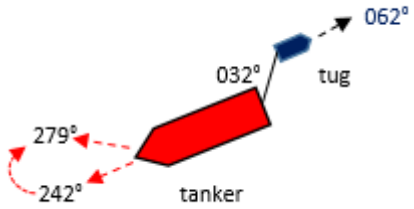

Figure 1. Tug-line was leading 032° (5 o'clock relative to the tanker's heading). Tug's centreline was parallel with tanker's centreline. Tug-wire slipped on gunwale to the deckhouse and the tug listed to starboard when the first wave hit her.

What can we learn?

- Be prepared for the environmental conditions in the area of operation. The incident occurred during the periods of changeover between wet and dry seasons where severe squalls with violent thunderstorms and winds of up to 60 knots are regularly experienced. Weather conditions before was stable with south-south east winds of 16 knots. The weather deteriorated rapidly with heavy rain, lightning, squalls up to 50 knots wind and unpredictable swell of 1.5-2.0 metres height were encountered. These conditions were consistent with known weather patterns and matched the METAREA forecast for the day in question.

- Importance of proper use of equipment.

    - One crew member, stationed aft of the tanker, reported that the towing pennant was connected directly to the tug's tow wire to the towing winch, neither gob wire nor towing pins were deployed. Another crew recalled that the wire to the tug was slipping on the gunwale to the deckhouse and the tug listed to starboard side when the first wave hit her. Had the tow pins (if fitted) and the gob wire been used, the tow wire would not have slipped on the gunwale.

    - The single length chafing chain parted. The investigation shows that the chain had a Safe Working Load (SWL) of between 230-458 tonnes. Recommendations for such chains is a proof load of 482 tonnes and a maximum breaking load of 612 tonnes.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

3 SINKING AND LOSS OF LIVES

Very serious marine casualty: Sinking of vessel resulting in loss of multiple lives

What happened?

A 30,000 GT roll-on/roll-off (ro-ro) cargo ship built in 1975 was en route from a port when she encountered a strengthening hurricane that had formed as a result of a tropical weather system. The Master diverted the vessel's passage, but the deviated passage took the vessel into the eye of the hurricane where she encountered heavy seas and winds.

Seawater started to enter the cargo hold through an open scuttle which caused the vessel to develop a prolonged starboard list. Due to the trim and list, the low lube oil sump tank levels could not maintain the propulsion causing the vessel to drift with its beam to the hurricane force winds and seas.

The vessel subsequently experienced progressive flooding and sank. Although a distress alert was sent 10 minutes prior to the sinking, the search and rescue efforts did not locate any survivors.

Why did it happen?

- The Master placed over-reliance on the weather data package, which was not up to date and was inaccurate, rather than heeding the advice of the navigating officers about the increasing intensity of the hurricane and proposed course changes. Inadequacies in the Bridge Resource Management techniques adopted on board affected the Master's situational awareness.

- The vessel suffered an initial list by an increasing wind on the vessel's beam generated by the hurricane. A scuttle which led to the cargo hold did not have any remote indications of it being open. This opening allowed unintended ingress of seawater into the cargo hold and affected the vessel's watertight integrity.

- The vessel's poorly maintained structures and ventilation dampers further compromised the watertight integrity of the vessel. The vessel's increased load line drafts due to her conversion had subsequently reduced her stability margin and thus increased her vulnerability in heavy weather.

- Lack of oversight of the stevedores and longshoremen resulted in the ro-ro cargo not being secured in accordance with the cargo securing manual, causing the cargo to break free and cause damage below the waterline.

- There was insufficient guidance for the engineers about the list-induced operational limitations of the engine as well as levels to be maintained in preparation for heavy weather. As a result, the vessel departed the port with a lower than recommended lube oil sump level which reduced the crew's ability to maintain lube oil suction for the main propulsion plant.

- The vessel's stability software did not identify the vessel's downflooding points which could have alerted the crew to close the ventilation openings. An approved damage control plan that would have assisted the crew in recognizing the severity of the vessel's condition and in responding to the emergency was not a requirement and thus not available.

- The company's oversight of the effectiveness of the safety management system relating to procedures for ensuring a safe passage, watertight integrity, heavy-weather preparations, emergency response during heavy-weather conditions and evaluating the performance of its officers was inadequate.

- The training for the crew did not cover damage control, stability instrument, advanced meteorology and advanced shiphandling, Rapid Response Damage Assessment service, despite subscribing to such a service.

- The vessel's open lifeboats or the liferafts could not have provided adequate protection to the crew from the severe weather, even if they had been launched timely.

What can we learn?

The investigation report highlighted the importance of:

- Proper voyage planning taking into account all available sources, including seeking timely and accurate heavy weather advice.

- Effective implementation of Bridge Resource Management for ensuring the safety of the vessel and its crew.

- Proper and timely shore office support by identification of all associated risks including but not limited to training of crew for critical operations and emergency response.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

4 COLLISION, CAPSIZE AND LOSS OF LIVES

Very serious marine casualty: Collision between a container ship and a fishing vessel resulting in loss of lives

What happened?

A container ship was early in the morning entering a Vessel Traffic System (VTS) coverage area on her way to the arrival port. The Officer of the watch (OOW) reported its position and gave an Estimated Time of Arrival (ETA). At the time of arrival at the first reporting point, the Bridge of the container ship was manned by yet another officer and one duty able-bodied seaman (AB).

When coming closer to the port, another report was made to the VTS. The VTS then assigned a position for the container ship to anchor.

En route to that position, while at a speed of 15.3 knots, the container ship collided with a fishing vessel, causing the latter to capsize. The coxswain of the fishing vessel was trapped inside the wheelhouse where he subsequently drowned. The other fisherman fell into the sea and was lost.

Why did it happen?

- Non-compliance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).

    - None of the vessels maintained a proper look-out. The target echo of the fishing vessel had appeared on the container ship's radar at a distance of more than 6 nautical miles, but the target was not plotted or checked in order to determine the risk of collision.

- The fishing vessel, being the give-way vessel, did not comply with Rule 16 by not taking any action to keep well clear of the container ship.

- The container ship, being the stand-on vessel in a crossing situation, did not comply with Rule 17 to keep her course and speed, or to take actions as will best aid to avoid collision.

- The container ship did not adhere to the requirements of its shipboard safety management manual relating to Navigating in High-Density Traffic Areas.

  - Before the collision, the container ship was proceeding at a speed of about 15 knots under the conn of a junior officer approaching a port area of high traffic density, without making its main engine ready for manoeuvring. The main engine was only put on stand-by and ready for manoeuvring after the collision, when the container ship was about 7 nautical miles to the entrance buoy.

- The container ship had no planned or executed proper voyage plan.

  - The voyage plan, including the relevant charts, had not been marked where the engine should be made ready for manoeuvring. In addition, the "master's orders for the passage" which required the duty officer to "keep sharp look-out, give wide berth to all passing vessels", and "to keep 1 nautical mile clear of all fishing vessels", was not followed.

- Weak and ineffective Bridge Resource Management and Teamwork on the Bridge of the container ship.

  - According to the Voyage Data Recorder (VDR), the screen display of the container ship's No. 1 radar was fixed on the 6 nautical miles range and displayed off-centre in the relative motion (RM) mode. Neither manual plotting of the fishing vessel, nor change of range or motion mode had been made during the period preceding the collision. No action was taken to check the bearing change of the fishing vessel by using the Electronic Bearing Line (EBL). The whistle was also not sounded to warn the fishing vessel.

What can we learn?

The investigation report highlighted the importance of:

- complying with COLREGs;

- proper planning and execution of the voyage plan;

- adherence to the Company's shipboard safety management manual with respect to navigating in areas of high traffic density; and

- the importance of effective Bridge resource management.

In order to ensure effective implementation of the shipboard Safety Management System (SMS), it is important to conduct internal audits and to provide additional training on Bridge resource management.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

5 PERSON OVERBOARD – PRESUMED DEAD

Very serious marine casualty: Fatality – crewmember washed overboard

What happened?

A laden tanker was en route in heavy weather with force 6-7 winds generated by a tropical storm. At first light on the morning of the accident, the chief mate on watch saw that the forward liferaft embarkation ladder had broken free of its lashings. When the master came to the bridge, the chief mate discussed securing the ladder. They decided to send a four-man team, including the chief mate, forward to secure the ladder and inspect the forecastle. A risk assessment for the task was conducted, in which all four team members participated.

After the maser had reduced the ship's speed and altered course to decrease any waves coming on deck, the four-man team went forward. They identified other issues, including parted anchor wire lashings, so it was decided to address the store issues and inspect the forecastle store. While attending these tasks, one of them exited the store to check the starboard windlass while the other three remained inside. As the man was returning to the store, a large wave washed across the forecastle from port to starboard and washed him overboard. The master initiated a search in which two other ships and a rescue helicopter also joined. However, the man was not located and was presumed dead.

Why did it happen?

- The crewmember was in a very exposed location when the large wave washed across the forecastle.
- The risk assessment was inadequate for the weather conditions and resulted in the master and crew on deck developing a false sense of security.
- Identified precautions were not properly taken, including not making a sufficiently large course alteration and not using safety harnesses and lifelines.
- There was no contingency plan in case the inspection identified additional problems.
- Heavy weather precautions for encountering the tropical storm were inadequate.

What can we learn?

- It is critically important to ensure that a ship is properly secured for sea and that additional precautions are taken before encountering heavy weather.
- It is very hazardous to work on deck in heavy weather and should be avoided unless not doing so will expose the crew and ship to greater risk.
- If it is necessary to work on deck in heavy weather, a complete and realistic risk assessment must first be done followed by taking all necessary precautions.

- Appropriate alterations of course and/or speed are very important precautions before working on deck in heavy weather.

- Safety harnesses and lifelines must always be used in addition to other personal protective equipment identified for working on deck in heavy weather.

Who may benefit?

Seafarers, shipowners and operators.

6 COLLISION

Very serious marine casualty: Loss of vessel and two crew members missing

What happened?

Two vessels collided in the fairway of a river. One of the vessels was seriously damaged and in consequence capsized with two crew members missing.

Why did it happen?

- Pilot/Master communication breakdown.

- Pilot altered course towards other vessel after misinterpreting the situation.

What can we learn?

- Pilot should not make ship turn without communicating with coming vessel, i.e. before altering course, any person on bridge should consult the vessels that probably are in danger of colliding in advance and coordinate the intentions. Vessels should at all times stay on their side of the fairway.

- Agreements between pilot and master or officer of the watch should be kept and followed up if not newly agreed.

- In close traffic situations the VHF should be closely monitored.

- Crossing of fairway should only be executed if sufficient room is available.

Who may benefit?

Ship managers, ships masters and navigational officers, pilot associations, vessel traffic services.

7 FATAL INJURY

Very serious marine casualty: Fatality and injury of two shore workers during unmooring operations

What happened?

During unmooring operation in a shipyard, two shipyard workers were struck by the opened bight from a mooring line tail rope, which was used for the mooring of a liquefied natural gas tanker. One worker was fatally injured.

Why did it happen?

- The set of tail ropes used was recorded to be in good condition prior to being stored for 2 months. This could possibly have affected their condition.

- Shipyard personnel involved with mooring operations was not required to undergo a structured training programme as per competency standards for mooring/unmooring of ships.

- The inspection and appraisal criteria for mooring ropes did not specially include the inspection of the seizing twine, which like the main rope are subjected to similar operational and environmental conditions.

What can we learn?

- The shipyard reviewed its risk assessment and formulated new procedures (safe work procedures) for mooring/unmooring operations.

- When inspecting and appraising the condition of the tail rope, the condition of the seizing twine should be taken into account.

Who may benefit?

Ship managers, shipyards, shore workers, port management, government agency for work, health and safety.

8 OCCUPATIONAL ACCIDENT

Very serious marine casualty: Fatal fall overboard

What happened?

While preparing the pilot ladder the bosun sent his co-workers for more materials. On their return the bosun and the pilot ladder were missing. Having searched they raised the alarm. The bosun's body was recovered from the water sometime later and he died in hospital.

His safety harness was found at the scene. When recovered he was not wearing a lifejacket though he had been seen "wearing" one earlier.

Why did it happen?

- Bosun was not secured to the vessel when working close to the side.

- PPE (lifejacket and safety harness) was not worn.

- Lack of formal procedures in vessel's SMS for this operation – though it was established practice to wear a safety harness – on this occasion the bosun did not.

- Solo working at the time of the accident.

What can we learn?

- Just because an operation is routine does not mean it is of low risk (and thus not being considered in the SMS). It is important to regularly review the SMS to ensure that all operations are correctly considered and appropriate risk mitigation is put in place.

- It is the responsibility of all crew members to look after their own and co-workers' safety.

- In this instance correct wearing and used of provided PPE may have prevented the fatality.

- When solo working, the risks are heightened.

Who may benefit?

All shipowners and operators and vessel crews.

9 OCCUPATIONAL ACCIDENT

Very serious marine casualty: Fatality – struck by a length of drill pipe under tension

What happened?

A floor hand died when he was struck in the head by the bottom end of drill pipe as it was being moved from its storage location to the drill centre.

The vessel is equipped with an automated system for handling pipes. Drill pipes are stored vertically in the setback area and secured in a racking system, called a fingerboard, in the derrick which maintains the pipes vertically and prevents unintentional movement. The setback area is considered a no-entry zone while the pipe handling system is moving pipes.

While removing the 32nd section of pipe, a pipe latch failed to open properly, causing the pipe to bend under load of the handling equipment. As the floor hand stepped into the setback area, the latch released. The end of the pipe sprang out and the floor hand was fatally struck on the head.

It was his first day in the role of floor hand.

Why did it happen?

- Lack of formal training of the floor hand as to the risks involved.

- Poor visibility (situational awareness) of the pipe handling operator who couldn't see the pipe storage area or those working in it.

- Lack of adequate supervision of the floor hand in the first day on the job.

- The incident occurred the 32nd time the operation had been completed that day, leading to a desensitisation / lack of risk perception of the operation, leading to the casualty stepping into a no-go area.

What can we learn?

- Risks of operations need to be properly assessed and adequate mitigation measures put in place, the lack of accidents is not an indicator of safety.
- Staff new in roles need correct training and adequate supervision.
- Where operators of equipment do not have clear sight of the operating area, clear operational and communication protocol need to be stabled to make unseen areas safe before access.
- The risks of reparative jobs need to be regularly repeated to those involved.

Who may benefit?

Equipment operators, deck hands, deck officers.

10 FATAL ACCIDENT

Very serious marine casualty: Enclosed space accident with three fatalities

What happened?

During the passage of a general cargo ship laden with a cargo of wood chips, an able seaman was sent to the forward store to pick up material. When the chief officer went on deck to check up the crew members supposed to work on deck, he could not find anybody and decided to look where they were. He went to the entrance of the forward store, looked down the stairway below deck and saw his three fellow crew members lying at the bottom of the stairs on the floor. The three crew members were retrieved and brought to shore by rescue helicopter but all help came too late to save their lives.

Why did it happen?

- No attention was paid to the dangers the laden cargo posed.
- The cargo safety sheet provided by the shipper upon loading was not disseminated by the master.
- The chief officer did not check the IMBC Code in order to identify potential risks; no risk assessment was conducted.
- Enclosed spaces were entered with no risk awareness.
- Set procedures were probably not followed by the crew members.

What can we learn?

- To create awareness, to prepare and to conduct a risk assessment, the cargo information sheet should be disseminated appropriately.
- Senior officers concerned with cargo and safety should collect all available information of the cargo and given risks in order to take all necessary action.

- Risk assessments are to be done as per Safety Management System requirements, necessary procedures followed and precautions taken.

Who may benefit?

Ship operators, master and navigational officers, crew.

11 Collision

Serious marine casualty: Collision of two cargo vessels in open sea

What happened?

A cargo vessel was navigating heading 240 degrees when the master noticed a target on radar approaching on the aft port quarter with a course of 270 degrees and a distance about 6 nautical miles. About half an hour later, the second officer noticed that the closest point of approach (CPA) had closed to 0.8 nm indicating that the vessel had changed course. The other vessel was turning to starboard toward own vessel which prevailed the second officer to immediately call the other vessel via VHF. As no answer was received, the second officer gave the command to alter the course to hard starboard but a collision between the two vessels could not be avoided.

Why did it happen?

- Both vessels' bridge teams did not maintain a proper or effective lookout to determine if a risk of collision exists.
- Safe speed was not kept related to the traffic situation.
- Not all available means to prevent risk of collision were used.

What can we learn?

- It is important to observe COLREG and good seamanship.
- All available navigational equipment to be adequately used in relation to the prevailing circumstances.
- The use of VHF communications at an early stage to avoid collision is important in the open sea in order to create awareness and a common understanding.
- AIS is to be used as a means to aid the lookout in combination with other means like ARPA.

Who may benefit?

Ship managers, ships masters and navigational officers.

12 CONTACT WITH QUAY

Serious marine casualty: Multi-purpose ship heavy contact with quay

What happened?

At a fair-weather afternoon, a pilot was navigating a multi-purpose ship to berth for cargo discharge. On bridge were also master and AB. A turn of the vessel within the inner basin was intended before getting alongside berth with port side. As two tugs arrived, one was asked to push at starboard mid-aft, the other to push at starboard stern to assist turning, but neither was asked to connect with a line because both pilot and master did not think it was necessary since the vessel had a bow thruster. The vessel arrived 110 metres away from quay at 2.6 knot, and the two tugs were pushing. A series of bow thruster, main engine and helm orders were given by pilot and were executed. The master reminded the pilot that the ship was moving too fast (2.4 knots), but 3 minutes later the vessel got heavy contact with the quay after the master tried to reduce speed by giving orders half astern and full astern.

Why did it happen?

- A detailed and appropriate pilotage plan was not prepared beforehand and the chosen position for turning in basin did not take the conditions at scene fully into consideration.
- The two tugs were not connected, so they could not be used to help reducing the vessel's speed.
- The master was not able to fully fulfil his role of assistance and supervision, as a result of his over trust in pilot and the absence of a detailed, fully communicated pilotage plan.
- Precautionary measures identified from risk assessment about the berthing operation were not fully implemented and no sufficient emergency actions were taken, i.e. let go both anchors.
- The company's shore base did not provide sufficient instruction and support to ship regarding the pilotage operation.

What can we learn?

- A detailed and appropriate pilotage plan, with all available ship and port information taken into consideration should be used.
- An agreement and shared understanding between the bridge team and pilot as to the pilotage plan and monitoring against the plan should be in place.
- The bridge team should actively promote and use the concept of bridge resource management, including the incorporation of pilots into the bridge teams, to manage voyages properly.

Who may benefit?

Seafarers, pilots, shipowners and operators.

13 SUBMARINE OIL PIPELINE RUPTURE

Very serious marine casualty: Fire, fatalities and pollution

What happened?

A laden bulk carrier departed the berth in the evening to anchor outside the port. En route, the pilot showed the master the intended anchoring position on the chart. The master later asked the pilot if the port anchor could be lowered one metre above the water in preparation for anchoring, and the pilot agreed. The ship was transiting a charted restricted area with submarine oil pipelines in depths of about 18 metres.

The master ordered the chief mate in their native language (which the pilot did not understand) to lower one shackle (28 metres) in the water. One shackle of anchor cable was then lowered into the water. The cable soon became tight and the master ordered it heaved in. The pilot asked what was happening and the master advised him of the situation. The pilot asked for the anchor to be heaved up quickly as there were oil pipelines in the area.

The main engine was used to stop the ship and half a shackle of cable was heaved in. The pilot reported the lowering of the anchor to the pilot station as the ship moved past the area. The ship anchored near the southern end of the restricted area and the pilot left the ship.

During the night, oil refinery operators detected oil in the water. In the morning, locals ashore also reported oil but its source could not be identified. About mid-morning, a fire started forward of the ship and engulfed the ship. Firefighting vessels were deployed and, about an hour later, extinguished the fire. The ship was significantly fire damaged and a crew member was injured. Five persons in a boat nearby lost their lives due to the fire and there was significant pollution.

Why did it happen?

- The master pilot exchange of essential information was inadequate.
- A single common working language was not used during the pilotage.
- The anchor was lowered to the seabed, which fouled and ruptured the pipeline.
- The master's workload before the pilotage may have influenced his performance.

What can we learn?

- The master and pilot exchanging essential information is vital for effective bridge resource management (BRM).
- Using a single, common working language is central to clear, unambiguous communication to support effective BRM.
- An anchor must never be lowered in areas where there are submarine pipelines and precautions to prevent its lowering must be in place.
- If an anchor is accidentally lowered to the seabed where pipelines exist, authorities must be notified and the cable released to avoid fouling/rupturing a pipeline.
- Adequate measures to manage an emergency response to a pipeline rupture must be in place.

Who may benefit?

Seafarers, shipowners and operators, pilots, pilotage services and harbour masters

14 CREWMEMBER WASHED OVERBOARD

Very serious marine casualty: Fatality falling overboard

What happened?

The 210 metre-long, 28,000 GT container ship was underway in heavy weather when it was noted that the port anchor was loose. Preparations were made to secure the anchor and the ship was turned to create a lee. Three crewmembers, including the chief officer, were on the forecastle attempting to secure the anchor when a large wave swamped the forecastle. The chief officer was washed overboard and an able seaman was seriously injured.

Emergency procedures were conducted and shore authorities notified. About 2.5 hours later the chief officer was sighted by ship's crew and then retrieved by a rescue helicopter. The two injured persons were evacuated ashore for further treatment. Unfortunately, the chief officer did not survive the injuries sustained during being washed overboard and from more than three hours in the water.

Why did it happen?

The task planning, including a risk assessment, did not adequately assess the hazards posed by the deck work in heavy weather. Furthermore, the planning did not ensure that the crewmembers involved used the personal protective equipment prescribed in the safety management system for work on deck during heavy weather. Lifejackets, safety harnesses and lifelines were not used.

Subsequently, the lee created by manoeuvring the ship, did not effectively shield the crewmembers on the forecastle from the heavy seas.

In addition to these factors, revised safety procedures resulting from a similar incident the previous year had not been effectively implemented.

What can we learn?

- All risks involved with any task being undertaken during heavy weather and/or on deck must be carefully and fully assessed and addressed. This includes the need to provide a lee for sufficient protection against the weather.

- Seafarer training should include regular emphasis on risk management, relevant techniques and emphasising the need to account for changing conditions and the importance of fully implementing risk controls. This should include strictly following guidance on the use of personal protective equipment.

- It is important that lessons learned from previous incidents result in full, effective and verified implementation of safety actions such as revised procedures.

Who may benefit?

Seafarers, management, shipowners.

15 FALL WHILE LOADING

Very serious marine casualty: Stevedore fatality

What happened?

While conducting cargo loading activities on board a 135 metre-long and 14,000 GT refrigerated cargo/container ship, a stevedore fell about six metres between decks in the refrigerated cargo hold. The stevedore was fatally injured in the fall.

Why did it happen?

The stevedore was last seen rigging a portable ladder for access between cargo hold decks. He was alone at the time of the fall and the investigation concluded that he lost his balance while rigging the ladder and fell.

What can we learn?

- All shipboard activities should be considered from a risk management perspective.
- Work at height, including that by contractors or shore labour, should not be conducted alone and without proper assessment of the risks and use of appropriate equipment.
- Stevedoring activities on board ship should include formal supervision to monitor tasks and manage risks.

Who may benefit?

Stevedores, seafarers, management.

16 BARGE IN CONTACT WITH VESSEL, CAUSING VIBRATIONS

Very serious casualty: Fatality during engine maintenance

What happened?

A 120 metre-long, 7,000 GT geared general cargo ship was loading timber logs from barges at a remote anchorage. During the stay, the opportunity was taken to complete the scheduled overhaul of a main engine cylinder and piston. During reassembly, the piston and rod assembly was being lowered into the engine while suspended from the engine room crane. The first engineer entered the crankcase and climbed on top of the crosshead in an attempt to clear an obstruction.

At this time, a cargo barge made heavy contact with the ship causing severe vibrations throughout. The sudden movement caused the securing bolt of the piston lifting tool to fail and the piston and rod to fall. The first engineer was trapped and crushed between the piston rod foot and the crosshead assembly. He was removed from the engine and taken ashore for medical assistance but had sustained fatal injuries.

Why did it happen?

Task planning and identification of potential hazards did not fully consider the effects of vessel movement while conducting maintenance in the engine room. Furthermore, the lifting appliances and tools being used were not fully understood or adequately maintained. As a consequence, when contact between the cargo barge and the ship caused sudden movement, the lifting tool was stressed to failure. This allowed the piston and rod assembly to fall, trapping and fatally injuring the engineer.

The maintenance team were unfamiliar with the task and did not, therefore, effectively consider the risks associated with:

- the lifting tools, appliances and equipment being used and how to use them;
- personnel working in different positions on the engine and the difficulties in maintaining efficient and effective communication, supervision and direction between them; and
- the need to reassess risks and strategies during the work.

The remote location of the anchorage then limited access to timely medical assistance. This was inadequately considered when the decision was made to undertake this work. As a result, it was many hours before the severely injured person reached a hospital and professional medical assistance.

What can we learn?

- All vessel operations, including deck and cargo work, should be considered as part of risk assessments for any engine room maintenance tasks.
- The condition of all tools, equipment and fittings available for and used during maintenance tasks, especially for lifting, should be regularly checked and verified. Records of inspection and equipment histories should be maintained and referred to.
- Access to medical assistance should be considered when assessing and planning for any work done on board ship.
- Personnel should not, for any reason, pass or position themselves under a suspended load.

Who may benefit?

Seafarers, management, shipowners.

***

ANNEX 2

AVAILABLE DATA FROM MARINE CASUALTIES

Table 1: Analysed data III 2 – III 6 (2015-2019)

Occupational Accident	**76**
Collision	**34**
Fire/Explosion	**21**
Grounding	**15**
Other	**10**
Capsizing	**9**
Overboard	**9**
Foundering	**8**
Missing Assumed Lost	**6**
Listing	**3**
Flooding	**3**
Collapsing of Cargo	**1**
Contact	**1**
Contact-Pollution	**1**
Engine Failure	**1**
Ammonium nitrate fertiliser cargo decomposition	**1**
Pollution Incident	**1**
Sinking	**1**