Consolidated Version Capsizing, Sinking, Flooding and Listing

FOUNDERING (III 5)

Very serious casualty: Vessel takes on significant list and founders in heavy weather

What happened?

The ship had recently undergone a change of Management Company and a totally new crew joined the ship. Following a brief handover from the previous crew, the ship sailed with no cargo. The previous crew reported that all the double bottom ballast tanks were full and the wing ballast tanks were 60% to 65% full (about 80% total ballast capacity). The replacement crew did not verify the status of the ballast tanks.

In the next port a total of 116 loaded twenty-foot-equivalent containers were loaded in the holds and on deck (estimated 1,900 tonnes in total). The crew made no changes to the ballast configuration, meaning that in addition to the loaded cargo the ship was still ballasted to about 80% total ballast capacity. The crew had still not verified the status of the ballast tanks.

The ship departed for the next port, where it took on fresh water before departing for its final destination. Shortly after departing, the ship encountered heavy weather caused by a combination of the monsoon winds and a typhoon, which was tracking northwards through a strait.

The ship was rolling heavily and developed a list of about 25 degrees to starboard, towards the wind and waves that were coming from the starboard side. After about one hour the list increased to 30 degrees. Without attempting to establish the cause of the list, the master issued a Mayday and ordered the 12-in-total crew to abandon ship into a liferaft. The crew were all safely retrieved from the liferaft by helicopter.

When the crew boarded the helicopter, they noted the ship was listing about 45 degrees. All of the deck containers were still in place, and as they had left the main engine and generators running, the lights were still burning. The crew reported that there had been no noticeable failure of the ship's equipment or systems, and there had been no movement of the containers on deck. The crew assumed that there was no movement of the containers in the holds because the containers were so tightly packed athwart ships that no appreciable transverse movement would have been possible.

Six days later a search found the ship still afloat and listing between 15 and 30 degrees to starboard. All of the deck containers were missing, but the hatch covers were in place and appeared intact. However, when a salvage tug arrived about four days later, the ship had sunk.

Why did it happen?

The cause of the ship taking on a list and subsequently sinking was not conclusively identified.
The crew were not fully aware of the severity of the forecast weather conditions and consequently, the ship had not implemented heavy weather procedures.

The course of the ship was beam on to a heavy sea and swell, resulting in heavy rolling for a sustained period of time.

In the absence of any other obvious factors, the reason for the ship developing a heavy list is likely related to a change in stability resulting from an ingress of water, and/or an uninitiated change in the status of the ballast tanks.

The crew had not verified the amount of water in each ballast tank since they had boarded the ship more than three weeks before the casualty. Therefore, the pre-departure stability calculation made on

the ship's stability computer might not have been a true representation of the ship's actual stability condition.

The crew took no action to identify the reason for the ship taking on a list and therefore took no remedial action (if any was possible).

The crew were unlikely to have been properly familiarized with their ship before it departed on the accident voyage.

There appeared to be minimal support and assistance provided to the new crew by the new ship management company when it took over the operation of the ship.

What can we learn?

- It is essential that the officers and crew be fully familiar with a new ship, particularly when an entire crew change has taken place.
- It is essential that the master and deck officers check and monitor the distribution of cargo, ballast and all other fluids within their ship in order to have an accurate appreciation of the ship's stability at all times.
- The master and crew should have a good appreciation of the likely weather to be encountered during the voyage, and prepare the ship accordingly before any adverse weather is encountered.
- When something unusual happens to a ship, such as taking on a substantial list, all early efforts should be made to identify the cause and take remedial action before it is too late.

Who can benefit?

Seafarers, ship managers, shipowners, ship operators.

SINKING (III 1)

Very Serious Marine Casualty: Fishing vessel sinking with loss of life

What happened?

The skipper of a fishing vessel was at the helm keeping the wind on the stern while the crew member was hauling crab pots. One of pots became snagged under the water and the fishing vessel, which was in proximity to shore, went broadside to the seas and ended up on it beam ends. The two men, who were likely thrown from the fishing vessel into the water, were found deceased several days later. Only one of them was wearing a personal flotation device.

Why did it happen?

The fishing vessel was fishing in proximity to the shore in an area where large seas were breaking at the time. Winds in the area were gusting up to 30 knots and a maximum wave height of about 6 metres was recorded.

It is likely that the skipper became distracted when one of the pots became snagged and the vessel went broadside to seas before being knocked over on its beam ends by a large breaker.

The vessel's weight distribution raised its centre of gravity and decreased its stability.

What can we learn?

- The importance of assessing the vessel's stability and knowing its operational limitations.
- Maintaining constant vigilance regarding vessel handling when fishing in poor weather.
- The importance of wearing personal flotation devices whenever there is a risk of falling overboard.

Who may benefit?

Fishing vessel operators and crews.

CAPSIZE (III 1)

Very Serious Marine Casualty: Capsize and foundering of a fishing vessel.

What happened?

A 14.94 metre long fishing vessel was lost while fishing approximately 6 nautical miles from the coast. While loading the catch, two waves swamped the deck, leading to flooding of the fish hold and eventual capsize, resulting in the loss of the skipper.

The vessel was trawling for sprats and had loaded approximately 20 tonnes of fish into its fish hold via a flush deck scuttle. The fish hold hatch cover had been removed for access and two deck freeing ports on the vessel's starboard side had been closed. There was a significant catch still left in the net and, as the next portion of the catch was being lifted on board, a wave swamped the starboard quarter. The crew replaced the fish hold hatch cover and the skipper started pumping out the fish hold. A second wave then swamped the deck, leaving the vessel with a starboard list and substantial water on deck.
A rope securing the net to the starboard side was released and the vessel was steered slowly round into the wind. Shortly afterwards, it capsized to starboard. The mate and crewman managed to swim clear of the vessel and were rescued 20 minutes later by the crew of another fishing boat that was nearby. The skipper was lost with the vessel.

Why did it happen?

The vessel capsized because in her loaded state it had an insufficient reserve of stability to withstand the sudden flooding and its associated free-surface effect.

The vessel's stability information booklet, approved in 1995, specified that catch should be limited to 17.08 tonnes, though modification to the vessel after 2007 would have reduced this limit. Routine landing of catches of this quantity without incident would have reinforced a belief that it was safe to carry such loads. However, when heavily laden, the vessel had a low freeboard aft, which increased the risk that waves might wash over the deck. As the weight of catch in the hold increased, so did the risk of down flooding should a wave wash over the deck while fish were being loaded into the fish hold through the open fish deck scuttle, and with the fish hold hatch cover also open.

What can we learn?

- Skippers of fishing vessels need to be aware of the stability characteristics of their vessels and the hazards associated with poor or reduced stability.
- Fishing vessels should have their stability checked and assessed at regular intervals to take account of modifications.
- Skippers and crew of fishing vessels should be encouraged to wear lifejackets.
- The use of deck scuttles to load fish from the deck creates a significant down-flooding hazard.
- The closure of freeing ports restricts the ability of a vessel to shed water from its deck.

Who may benefit?

Fishing vessel owners, operators and crews.

SINKING (III 1)

Very Serious Marine Casualty: Flooding and sinking of Ro-Ro cargo ship.

What happened?

A Ro-Ro cargo vessel sailed from port with a newly joined master and chief engineer. At about 2300 and at a distance of 42 nautical miles from the coast, the vessel started taking water in the engine-room. The chief engineer did not attempt to find the source of the water or start any bilge pumps. Power was lost and no attempt was made to restore emergency power.

At about 0130, a coastguard vessel came alongside and all crew disembarked safely via a pilot ladder. The vessel was reported to have sunk by 1300 the following day.

Why did it happen?

- An unexplained ingress of water to the engine-room.
- A failure to attempt to find the source of the flooding.
- A failure to attempt to pump the water out.
- A failure to restore emergency power.
- A failure to secure the watertight integrity of the engine-room.

What can we learn?

- The importance of ensuring that equipment necessary to respond to emergencies is functioning properly and ready for use.
- Early detection of water ingress is important to take timely action before a developing situation becomes an emergency.
- When faced with an actual emergency, the response of those who have received training and practice is more automatic, coordinated and timely.
- The importance of new crew members gaining familiarity with a vessel and its critical system.

Who may benefit?

Ship operators and crews.

CAPSIZE (III 1)

Very Serious Marine Casualty: Capsize of a fishing vessel during fishing activities.

What happened?

A 9-metre long fishing vessel with a skipper and a crew member on board was fishing in an estuary. The vessel had already harvested 58 of an intended 80 bags of mussels, weighing approximately 1,450 kg and stored on deck. The vessel turned to port and stopped in order to hoist the dredge and to ride over the wake created by a passing merchant vessel. A pump for washing the mussels was discharging water overboard. At the stern, the dredge was fully hoisted, and then the crew member tried to attach a line to the bottom of the dredge. The vessel suddenly rolled to starboard, and then flooded and sank. The skipper survived but the crew member was found dead after the accident; neither of them was wearing a life jacket.

Why did it happen?

The two fuel tanks were about 1/3 full and were interconnected, which allowed the fuel to flow to starboard when the fishing vessel rolled. The flow of fuel increased the list to starboard, and the free-surface effect decreased the GM.

The uneven distribution of accumulated bags of catch on deck probably increased the starboard list as the arrangement for washing the mussels restricted the number of bags that could be stowed on the port side.

The dredge was not hanging vertically from the gantry, but swinging freely above the deck and hanging to starboard. This situation probably increased the vessel's list to starboard.

The sea condition with wind force 3 to 5 might have increased the list to starboard.
Under normal conditions, the fishing vessel was not upright; her floating equilibrium was slightly to starboard.

The skipper and crew member were not wearing lifejackets.

What can we learn?

- It is important for fishermen to have knowledge of stability; what happens if the fuel tank is not full, what happens if the accumulated bags or fishing nets are not distributed evenly on deck, what happens if the dredge is not hanging vertically but to either side.
- An authorized body needs to check whether a vessel's stability would be maintained when an alteration is intended that would affect the stability of a fishing vessel.
- While engaged in fishing activities, all crew members on board need to wear lifejackets. The value of and need for stability training for commercial fishing industry masters.
- Understanding the significant dangers of free surface effect on vessel stability.
- The serious hazardous and negative impact on vessel stability of hoisting heaving loads in a seaway.

Who may benefit?

Fishing vessel owners, operators and crews, and authorized bodies.

SINKING (III 1)

Very Serious Marine Casualty: Flooding and sinking of a dive support vessel

What happened?

A 7,000 gross tonnes dive support vessel was docked in a floating dry dock for class renewal survey, repair and maintenance work. Access holes were produced by cutting the shell plating in order to facilitate work around a tank. Ten access holes were made approximately 0.3 metre above the waterline. Even though the work had not been completed, the vessel was refloated and moored alongside another vessel. Some days later, the vessel suddenly listed to starboard and sank. Crew members in the cabins noticed the flooding and evacuated the vessel. There were no injuries.

Why did it happen?

The vessel, alongside which the dive support vessel was moored, discharged water overboard and into the dive support vessel through the access holes that had been cut into its shell plating.

Because the manholes doors to the engine-room were not secured shut, the flood water flowed into the engine-room.

After the access holes had been cut into the shell plating, no protective measures to prevent the ingress of seawater had been taken both by either the shipyard workers or the vessel's crew members.

Communication about the work to be done between the shipyard workers and the crew members was insufficient. Crew members did not recognize that the access holes were vulnerable to the ingress of seawater.

There was no responsible officer on watch to monitor any change of the vessel's condition when it left the floating dry dock.

What can we learn?

- The situation surrounding the vessel changed after it shifted from a floating dry dock, the shipyard needed to consider new hazards and take measures to reduce the level of risk incurred by the shifting.
- Communication between shipyard workers and crew members is important since sharing information about the work to be conducted would provide awareness about the risk they might encounter. A meeting on the day's work between shipyard workers and crew members is encouraged to share information.
- Whenever any change of plan at the shipyard is made, the shipyard needs to evaluate a new hazard or control that is no longer effective by the change. In this case, a change happened when the vessel was shifted out of the floating dock, but no risk assessment was carried out. The control taken during the work at the floating dry dock had become ineffective.

- A responsible officer needs to monitor the safety situation of the vessel to identify any risk incurred by a change of work plan.

Who may benefit?

Shipyards, classification societies, shipowners, operators and crews.

CAPSIZE AND SINKING (III 1)

Very Serious Marine Casualty: Capsize and sinking of a livestock carrier.

What happened?

A livestock carrier, fully loaded with cattle and sheep, was waiting to berth at its destination port when deteriorating weather and winds of up to force 9 caused it to proceed out of the anchorage area. At that time, the ship had a list of 5 degrees to starboard and was rolling in the seas. Following the master's order, the crew began using hoses to clean cargo decks 1 through 6 and the side shell doors on deck 6 were opened to help with the clearing of water from that deck. As the list increased to 14 degrees, the master ordered that the cause for the increase be investigated. As the list increased to 24 degrees, the master ordered the abandonment of the ship, altered the ship's heading to port and stopped engines. Not all crew members heard the abandon ship alarm. At around the same time, the chief officer, who was supervising the deck washing operations, went to deck 6 and observed water entering through the open side shell doors. Approximately 20 minutes after the engines were stopped, the ship capsized. It then sank in about 3 minutes. Of the 83 crew members on board, 40 were rescued, 11 died, and 32 were unaccounted for and presumed deceased. Many of the deceased crew were on board for the handling and welfare of the livestock.

Why did it happen?

The crew was cleaning cargo decks using hoses and with the side shell doors in the opened position.

The scuppers may have become blocked by solid wastes from the livestock, resulting in an accumulation of water on deck.

As the heel increased to about 20 degrees, additional water from the surrounding sea was seen to enter deck 6 through the side shell openings with each roll of the ship, increasing the free surface effect on board.

Watertight doors were noted to have been left open to ease the movement of the cleaning crew.

The vessel lost stability due to the accumulation of water on deck 6, the partially filled tanks, and a shift in cargo (as a result of the possible failures of the pen gates and rails), among others.
There was a lack of coordination during the abandonment of the ship, possibly as a result of a lack of basic safety training and ineffective conduct of drills, and not all crew heard the abandon ship alarm.

What can we learn?

The importance of monitoring vessel stability at all phases of a voyage while considering all relevant factors before starting an operation which poses a risk to stability.

The importance of ensuring that all crew on board, certified and un-certified, are familiar with and competent to carry out emergency procedures.

Who may benefit?

Ship operators, officers and crew.

STRUCTURAL FAILURE RESULTING IN FOUNDERING WITH LOSS OF LIFE (III 1)

Very Serious Marine Casualty:

What happened?

A general cargo ship loaded with limestone have a bulk density *** of 1850 kg/m3 experienced a structural failure when heading directly into rough seas and gale force winds. The vessel sank approximately 15 minutes later. Two of the vessel's eight crew managed to swim clear of the foundering vessel and were subsequently rescued from a liferaft.

Why did it happen?

The cargo, which was high density, had been loaded as a single pile within the central section of the hold. As a result, significant stresses were generated in the vessel's midship section. These were exacerbated by the rough seas in which the wavelength was similar to the length of the vessel.

The ship's hull strength had likely weakened significantly over the previous 2½ years through corrosion and wastage. The maintenance and repair of the vessel had lacked focus and oversight; no structural repairs had been undertaken recently.

Other contributing factors included: non-compliance with the International Maritime Solid Bulk Cargo Code, ineffective safety management, poor quality of survey and audit, lack of oversight of the classification society by the Flag State. The investigation also identified several safety issues concerning the immersion suits and lifejackets available on board the vessel.

What can we learn?

*** According to the IMSBC Code, a high density solid bulk cargo is a solid bulk cargo with a stowage factor of 0.56 m3/t or less, i.e. bulk density of 1780 kg/m3 or more. The bulk density range on the individual schedule for limestone in the IMSBC Code is 1190 tom 1493 kg/m3.

- Dry bulk cargoes should be loaded and carried in accordance with the International Maritime Solid Bulk Cargoes Code (IMSBC Code) in order to ensure a vessel's structural integrity is maintained at all times.
- A vessel's course and speed should be adjusted to reduce placing undue stress on the vessel's hull.
- Lifesaving appliances provided on a vessel should be compatible and fit for purpose as well as the need for regular drills that should include the donning of immersion suits.

Who may benefit?

Flag States, port States, shipowners, operators, crews and classification society surveyors.

FLOODING AND SINKING (FSI 21)

Very serious casualty: Flooding and sinking of general cargo/containership

What happened?

During the early hours of the morning while a small containership was sailing, the engine-room bilge alarm sounded. The engine room was manned and the duty engineer noted a rising level of water below the bottom plates. The Master and Chief Engineer were called. By the time they both arrived in the engine-room, water had begun to cover the bottom plates.

No pumps were started in order to pump out the water. No other actions were taken to reduce the flooding or the water level. The source of the flooding was not established.

The engine-room was abandoned half an hour after the ingress was discovered, however no efforts were made to ensure that watertight doors leading to the port and starboard passageways connected to the engine-room were fully and effectively closed and battened down.

The Master ordered that the ship be abandoned around 45 minutes after discovery of the flooding. The freefall lifeboat was launched another 35 minutes later with all crew on board (at 0320hrs). Problems were encountered with the engine of the lifeboat, which failed after 5 minutes due to a clogged fuel filter. The crew were all seasick in the lifeboat.

The Master reboarded the ship from the lifeboat around 0830hrs and communicated with head office. By this time, the main deck was awash in front of the accommodation, but the emergency generator was still running.

The entire crew was rescued shortly before noon by another ship. Although still afloat at 1700hrs, the ship eventually sank.

Why did it happen?

The engineer on duty took no immediate action to reduce the effect of the flooding, e.g. opening the emergency bilge suction and starting the ballast pump. (It has been calculated that the rate of water ingress was approximately the same as the capacity of the ballast pump.)

On arrival in the engine-room, neither the Master nor Chief Engineer ordered any action to reduce the flooding.

The watertight doors leading from the engine-room to the port and starboard passageways were not adequately secured. The ship had sufficient stability to remain afloat if these watertight doors had been secured.

What can we learn?

In this case the decision to abandon ship proved to be premature. Although safety of life must be the highest priority, abandoning ship should be the last resort as it brings its own dangers and removes from the scene the people necessary to help save the ship.

It is important for all ships to have contingency plans for dealing with the flooding of various compartments and to drill the crew against these plans.

All engineer officers should be able to take initial remedial action against flooding in the engine-room by opening the appropriate valves and starting pumps immediately.

The importance of securing watertight doors in emergency situation should be made clear to all personnel on board.

Lifeboat engines require prolonged running on test and not just a weekly run of a few minutes. This is necessary in order to uncover problems such as debris in the fuel tanks and lines.

Who may benefit?

Seafarers.

FOUNDERING AND SINKING (FSI 20)

Very serious casualty: flooding and sinking of a cargo vessel with the loss of 6 lives

What happened?

A 3,500 gt general cargo vessel sailed from a port in an apparently overloaded and unseaworthy condition. The lifeboats' engines were in a dismantled condition. The vessel encountered heavy weather soon after sailing. Due to the poor condition of the main deck, hatches, watertight openings and doors, the vessel began to take on water. On the second day after sailing water was found in No.2 hold. The weather deteriorated further the next day, and further spaces were flooded, including the CO_2 room, chain lockers, forecastle store and paint locker. Holes in the deck allowed water to enter the cargo holds and ballast tanks; the tarpaulin was ripped from the hatch cover by the wind allowing further ingress. The master reversed course and diverted the vessel towards a safe port of shelter. This put the weather on the other (starboard) beam which caused flooding of the engine-room by way of water entering the accommodation. On the evening of the 4th day after sailing the vessel blacked out and lost all propulsion, with the vessel drifting south towards an island. However, the vessel continued to flood and then started to list to port and the master ordered the crew to abandon ship at around midnight. The list prevented the launch of lifeboats, so a liferaft was used. The vessel started to capsize during the abandon ship and all crew jumped overboard with 12 making it into the raft and 7 in the sea. The vessel reportedly sank within 3 minutes. The raft (now reportedly containing only 7 of the original 12 occupants), plus 3 survivors and 3 further bodies were washed ashore on the island. The following day, 2 further survivors were washed ashore. The chief officer was washed ashore on a separate part of the island and remained there, living with locals for almost 3 months until rescued. Sadly, 6 of the original crew of 19 were dead or missing.

Why did it happen?

The watertight integrity of the vessel was compromised. The hull and watertight openings were reported to be in a very poor condition and allowed flooding of the cargo holds and other spaces including the engine-room. The cargo hatch cover tarpaulins failed to remain intact.

The ship was reported overloaded. The master took the vessel to sea in an overloaded and unsafe condition. The combination of overloading and lack of watertight integrity is a recipe for disaster.

The lifeboat engines were reported to be disassembled, although other problems prevented the boats from being launched anyway.

The ship had not been adequately maintained. The Classification Society awarded the vessel certificates of Class implying that the ship was safe to put to sea only one month before the incident. The ship's owners and operator appeared to have no interest in the safety of the vessel or crew.

What can we learn?

- A certificate from a Classification Society is no guarantee of safety of a vessel. The owners must ensure that a vessel is maintained and seaworthy at all times.
- It is essential for the master (as the person on the spot able to take action) to ensure that the vessel is fit and safe to proceed to sea. Once at sea, the safety of life is paramount.
- Life-Saving Appliances is a priority and should be ready for immediate deployment and crew trained in its use.
- Overloading a ship is both illegal and extremely dangerous. The load lines of the vessel are there for the safety of the crew.
- Maintenance of watertight and weathertight closures are critical. They should always be kept in good working condition.

SINKING (FSI 20)

Very Serious Casualty: tug sank while moored alongside bunker barge

What Happened?

A bunker barge and its pusher were made fast alongside a tanker. The tug was moored alongside the barge with a bow line, a forward spring and an aft spring. The skipper shut down
the tug's engine and then went on board the tanker to prepare for bunker transfer. The tanker, and hence the tug and the barge, was lying with its bow facing into the 3 to 4 knot current of tide.

Half-an-hour after the bunker transfer started, the tug skipper noticed that the tug was inclining to port and that water was entering the main deck. Water continued to enter the main deck and soon started flooding through open port holes. The bunker transfer was stopped and the bunker hoses had been disconnected. 30 minutes later the tug sank.

Why did it happen?

The force of the 3 to 4 knot tide acted on the bow of the tug, opening the distance to the barge. As the tug's bow moved away from the barge, the tug heeled to port. Eventually, the tug heeled to the point where water entered the main deck. The tug continued to heel to port and water then started entering through open port holes on the vessel's port side. The ingress of water eventually resulted in the tug sinking.

What can we learn?

- A vessel should be moored in such a way that prevents the bow opening, presenting a wedge to an oncoming tidal flow.
- A vessel's watertight integrity should be maintained at all times.

FIRE AND SINKING (FSI 20)

Very serious casualty: fire on board a fishing vessel, leading to sinking

What happened?

A 3,500 gt, 90 metre long, 34-year-old steel fishing vessel sailed from port following a post lay-up refit. During the refit various electrical cabling within the vessel and on deck was replaced. However due to time pressure to sail from the repair yard, replacement of cabling to the lighting within the fish storage tanks was not carried out (despite requests from the chief engineer - blackening of the cables was visible). No close-up visual inspection was done due to the height of the cabling from the deck (2.9 metres), however operation and insulation checks were done. Three days after sailing a fire broke out in a fluorescent light in an empty crew cabin; the fire was quickly detected and extinguished using a portable extinguisher. The captain, aware of the hazards posed by the shortcomings of some of the electrical systems, initiated enhanced fire patrols every 2 hours; the fish storage tanks were not included in these rounds. 4 days after the first fire, a fire broke out in fish storage tank 2. At the time the tank contained 20,000 paper fish-boxes and 50,000 paper bags, plus 105 two hundred litre drums of oil. The bags and boxes were stacked to within 20cm of the deckhead. Attempts were made to extinguish the fire using fire hoses, but due to a blocked drain line from the fish hold, water built up in the space causing the vessel to list. The master ordered the crew to try to extinguish the fire by suffocation. However gaps around the main hatch allowed air to enter the hold despite efforts to block the gap with blankets etc. A day later the space was opened and further unsuccessful attempts were made to extinguish the fire with water, so the hatch was closed again. 3 days after the start of the fire another unsuccessful attempt was made to enter the hold and put out the fire. Unfortunately on this occasion the fire spread rapidly out of control and the Master requested a nearby fishing vessel for assistance and the crew abandoned the vessel. The vessel became engulfed in fire and sank on the same day. There was no loss of life, seven crew members suffered the effects of toxic smoke inhalation. All were rescued by the second fishing vessel.

Why did it happen?

It is strongly suspected that a short circuit in the cabling in the fish hold caused an electrical fire which ignited the combustible contents of the hold. It was noted that the no fuse breaker (NFB) had failed to trip.

The fire was detected after it had already taken hold. Attempts to extinguish the fire with water were frustrated as this affected the stability of the vessel due to blocked drain lines. The hatches to the fish hold could not be sealed in order to suffocate the fire due to inadequate maintenance.

The ship sailed from the repair yard without completing work on the electrical cabling. The cabling was 34 years old. The NFB failed to cut the power to the cabling.
Fire rounds did not include the fish hold.

What can we learn?

- Electrical cabling identified by visual inspection and subsequent testing to be below the required performance specification should be replaced at the earliest opportunity; meanwhile the faulty circuit should be isolated.
- When fighting a fire by suffocation, the space should remain sealed until it is sure that the fire is out.
- Fire rounds and fire protection systems must cover all areas of the ship.
- Electrical safety devices, such as NFBs must be maintained and tested regularly.

LISTING AND SINKING (FSI 19)

Very serious casualty: listing due to heavy weather, loss of steering capability and sinking of an anchor handling tug leading to the death of one crew member

What happened?

After departing port in fair weather, the about 460 gt ocean going anchor handling/towing tug encountered increased wind, seas of approximately 4-5 metres and heavy swells. In the bad weather some of the cargo broke loose and the tug listed to starboard. The list increased as waves and swell continued to break over the deck.

The steering gear failed and the ship turned abeam on to the wind and swell worsening the situation considerably.
A distress call was made and answered by a large motor yacht in the area. The yacht immediately headed for the disabled ship.
Shortly after the broadcast the ship sank.
Three crew members managed to enter a liferaft and the other eight were scattered in the water by wind and swell.
The crew members in the liferaft were rescued by helicopter and the seven in the water were rescued by the motor yacht under the most difficult conditions. The last of the crew members in the water was rescued by helicopter. He died subsequently.

Why did it happen?

The cargo (one container) on the deck broke loose due to ineffective securing arrangements, causing the cargo to shift and dislodging other deck cargo. The container was damaged and filled with water adding a large weight on the deck. This reduced the stability. The integrity of the hull was breached, and due to the bad weather and the additional submersion, water ingressed into the ship causing a loss of stability and buoyancy, which resulted in the foundering and sinking of the vessel.

What can we learn?

- On ships not specially fitted for carrying deck cargo thorough assessment shall be made whenever carrying cargo on the deck.
- Emphasis on route planning and taking meteorological information into account at the time of departure and continuously during the voyage.
- The importance of making an early distress call.

FLOODING AND SINKING (FSI 19)

Very serious casualty: flooding and sinking of a trawler

What happened?

An about 10 m long, wooden-built trawler departed with two persons on board to trawl for shellfish. After hauling in the trawl net, it was noticed that it had been damaged. As another trawl net was being deployed the master heard an unusual noise coming from the engine. An inspection of the engine compartment revealed that it was flooding. The master turned on the pump and alerted the authorities, who issued a MAYDAY RELAY. The master and crew member abandoned the vessel into the inflatable liferaft. They were rescued by another fishing vessel that was in the area. The vessel later sank.

Why did it happen?

To eliminate "nuisance" alarms, the master turned off the bilge pump and water level alarms. The pump and alarm system was of a type used on pleasure craft and small fishing vessels. The sensor for the alarm was installed near to the floor of the compartment and would frequently sound.
The wooden-hull vessel was over thirty years old and subject to water ingress.

What can we learn?

- The importance of installing water level alarm systems that are appropriate for the type of vessel and that are set up to reduce the number of nuisance alarms and maximize the opportunity to detect impending dangers.
- The importance of carrying out adequate maintenance of the hull and through-hull fittings.

- The importance of an early distress call.

CAPSIZING AND SINKING (FSI 19)

Very serious casualty: sinking of a fishing vessel caused by failure of the shipside connection of the fish chute

What happened?

The about 400 gt fishing vessel capsized and sank about 170 miles offshore.
Capsize occurred about one hour after flooding started and about 30 minutes after flooding was first noticed by the crew.

Why did it happen?

All weathertight doors and hatches in the fishing station were not closed. Though capsizing would have eventually occurred, the time to capsizing would have been about 2 hours after water ingress was first discovered.
The owners and crew did not pay sufficient attention to the condition of the fish chute's shipside connection. Furthermore; the vessel left port with a negative freeboard, thus the main deck and the shipside connection of the fish chute were below water.

The abandon ship was incorrectly done. The crew had poor competency in the English language and therefore poor communication with rescuers.

What can we learn?

- Procedures for familiarization with a particular vessel need to be understood and followed.
- Emergency drills must be carried out prior to departure and periodically as outlined in Rules and Regulations for vessels.
- The importance of maintaining watertight integrity of the vessel and the importance of early detection of a flooding condition in order to afford the crew sufficient time to take early and appropriate action before a developing flooding situation becomes an emergency situation.
- The rescuers had difficulty in communicating with the crew since the crew had difficulty with the English language.

SINKING (FSI 18)

Cargo hold flooding and subsequent loss of vessel
What happened?

A single-hold general cargo vessel with a cargo of clay and manganese was en route to its next destination when the weather deteriorated and the winds became south-westerly at Beaufort force 10. A trim by the head was observed and an inspection of the cargo hold revealed the presence of water; however, the location of water ingress could not be determined. Pumps were deployed, but were unable to stem the vessel's increasing draft. The vessel was abandoned and it later sank.

Why did it happen?

- Although it could not be determined with certainty, it is likely that the water ingress occurred in the forward part of the cargo hold or in the area of the rope racks welded on deck at the forward end of the vessel.
- At the time the ingress of water was discovered, the quantity of water in the hold was sufficient to trim the vessel by the stem. The vessel was not fitted with water level detectors and alarm system.

What can we learn?

- The importance of taking measures, such as the fitting of alarms, taking soundings or monitoring roll periods, to ensure the early detection of any ingress of water into the hull.

SINKING (FSI 18)

Engine-room flooding and subsequent loss of vessel

What happened?

This dynamically positioned supply vessel was operating with the machinery space unmanned. At 0350 hrs the machinery space bilge alarm sounded. The investigating duty engineer found water covering the floor-plates to a height of 70 cm. He could not locate the source of the leak. He tried to pump out the compartment via the emergency bilge suction but could not reach the seawater mains isolating valves or the emergency bilge suction valve. The vessel was eventually towed to a sandbank and beached. After subsequent attempts to float her failed, she was declared a constructive total loss.

Why did it happen?

The prime cause of the water ingress was found by divers to be the failure of a short, 90/10 cupro-nickel, spool piece in the seawater line to the central auxiliary cooler serving air conditioning and refrigeration services. It was located immediately prior to a steel pipe intended to act as a sacrificial anode to protect the cooling water system. The cause of the failure was presumed to be modification of the properties of the cupro-nickel, arising from the welded flanges, coupled with the exclusive extended service of the vessel in warm, high-salinity, seawater. The management had prepared a generic Emergency Manual with the intention that the master of each vessel modified it to suit the particular vessel. This included assignment of specific responsibilities for each type of emergency event. The manual also identified the need to prepare an annual list of drills to be performed each month. The plan on board the vessel did not, however, give sufficient detail to cover the type of flooding event experienced in this instance.

Contributing factors to the subsequent loss of the vessel were:

- Failure to detect the rising bilge water level until it had reached a height of 70 cm above the floor plates;
- Inaccessibility of the manually-operated emergency bilge suction valve located below the floor plates. Note that this is contrary to the requirements of SOLAS for unmanned machinery spaces;
- Inaccessibility of manually-operated seawater inlet valves at the time of discovery of the The chief engineer was ashore for medical reasons at the time of the incident so there was insufficient engine-room staff on board to effectively control and cover the emergency actions required.

What can we learn?

- Bilge alarm systems should be tested regularly.
- While periodic five-yearly surveys should identify wastage in piping systems, surveys are not infallible and, in some cases, even when components withstand a pressure test, subsequent corrosion can advance at an accelerated rate. Operators should include in their planned maintenance routines visual and Non Destructive Examination (NDE) inspections of below-floor-level piping systems, especially when vessels are being operated in aggressive water conditions.
- Operators should be sufficiently familiar with the location and operation of important valves to the extent that they can locate and operate them in emergency conditions.
- Owners should provide documented ship-specific procedures covering emergencies. These should be validated by actual trials. They should be available on plastic-laminated instructions/diagrams. As a minimum they should cover:

- the valves to operate (opening or closing, how accessible if flooding occurs, whether they are remote controlled or manually operated); and.
- the pumps to start (location of starters and operation in an emergency).

Response to emergency situations needs to be rapid and coordinated. It is essential for management to prepare appropriate emergency plans and promote a strong safety culture to encourage correct deployment of planned procedures.

- Familiarity with the layout and function of emergency systems is essential – e.g., bilge pumping, ballast transfer and fire. Engineers should be encouraged to physically trace essential service lines themselves when first joining ships.
- Realistic drills covering such events as flooding and fire need to be conducted on a regular basis.

FLOODING (FSI 18)

Flooding caused by heavy weather

What happened?

The 1972 built bulk carrier was intentionally grounded by its master after the ship took water into cargo holds Nos. 6 and 7 during cyclonic weather and seas. The water could not be removed by either the ship's fixed pumps or portable pumps lowered into the holds. All crew members were safely evacuated from the ship after the grounding.

Why did it happen?

- The severe weather, and the resultant effect on the ship's structure caused by the ship's movement (pounding, slamming, pitching and rolling), probably resulted in water entering cargo holds Nos. 6 and 7.
- The ship's pumps (both fixed and portable) could not get the water out.
- The hygroscopic[1] nature of the cement cargo led to the water being taken up by the cargo over a period of time. By the time the water was floating on top of the cargo (saturated), it was too late.
- Absorbing or attracting moisture.
- The master did not appreciate the risk the weather posed to his ship when he planned for the passage. Consequently, he sailed the ship into the cyclone, exposing the aging ship to the effects of the severe weather.

What can we learn?

- The importance of properly identifying the risks of the weather on any passage.
- The importance of following guidance with regard to cargo monitoring during loading and on passage.
- The need to consider the effects of weather on an old ship's structure.

CAPSIZING (FSI 17)

What happened?

The fishing vessel was engaged in trawling about three cables from shore with seas broad on the beam when it was struck by a large breaking wave and capsized. The master, who was alone in the wheelhouse, had noticed the approaching wave was much larger than the others and had begun turning the vessel to port to meet it. The master was thrown into the sea and managed to swim ashore. Two other crew members who were resting below in the accommodation did not survive.

Why did it happen?

The master was alone on the bridge engaged in both navigating the vessel and fishing. The vessel was in close proximity to the shore and in an area of shallow waters known for its large breaking waves. Guard rings were set up on the radar to maintain a course along the limit of the zone, but the alarms were not enabled.

What can we learn?

- To recognize and take into account the risks associated with the operating conditions of the area to be fished.
- The importance of making full use of navigational equipment alarms.
- The importance of keeping watertight doors closed when at sea.

CAPSIZING (FSI 17)

What happened?

The offshore anchor handling tug and supply vessel capsized while attempting to lay one of eight anchors for the drilling rig. Eight of the 14 persons on board lost their lives.

Why did it happen?

The anchor handling capabilities of the vessel did not match the physical and environmental challenges of the task on which it was employed and the crew was not sufficiently familiarized with the vessel to recognize its limitations. The plan for the rig move was made on the false expectation that the vessel was capable of retrieving the situation when it drifted off position, rather than having conducted a detailed risk assessment for the move, which should have included calculating the physical forces that could potentially be imparted to the vessels engaged in the operation and each vessel's capability to withstand them.

What can we learn?

- Special marine operations must be carefully planned to take account of all identifiable risks, must include contingencies and ensure the operation is appropriately resourced.
- Crews of specialized vessels need to be fully familiarized and practiced with the vessels they are operating.
- Effective communication between all parties involved in multi-vessel operations is critical to a safe outcome.
- The stated design capability of a vessel is not always the same as its actual capability under all circumstances.

CAPSIZING (FSI 17)

What happened?

The ship was a whelk fisher. The Skipper had taken over the ship the day before the capsize. They were two men on board, both experienced fishermen, when they sailed for fishing on a summer morning in fine and calm weather.

While they were preparing to lay a line of whelk pots, the vessel suddenly, rapidly and without warning, capsized and sank.

The two fishermen ended up in the water and swam for several hours until one of them, the crew man, drowned. The other one, the skipper, reached the shore after about 10 hours in the water. He survived.

The vessel was subsequently found and salvaged.

Why did it happen?

The vessel had a low freeboard and water on deck. Through several open bolt holes in the deck, the seawater, unnoticed by the crew, down-flooded into the fish hold and the aft compartment. The fishermen were not warned because there was no bilge alarm fitted to the vessel, and because the bilge pumps were in a poor condition and wrongly wired for automatic operation. Finally the vessel had a low level of inherent stability.

No alarm was raised from the vessel, because it was not equipped with EPIRB.
The vessel was not equipped with a life raft.
The crew did not use lifejackets.

What can we learn?

When you take over a vessel, you should acquaint yourself with it, its equipment and its weaknesses before you use it.

High freeboard, watertight integrity and a good stability are indispensable safety factors for the work of fishermen.

In case of an accident, well-kept life appliances, life raft and lifejacket can save your life and the lives of your crew members.

SINKING (FSI 17)

What happened?

A stern trawler engaged in fishing developed a list after the drag net had snagged. After manoeuvring the vessel so as to disengage the net, the list remained and it was discovered that there was ingress of water in the engine-room space. The four crew members abandoned into two life rafts. The vessel sank shortly afterwards in 100 metres of water.

Why did it happen?

The ingress of water into the engine-room compartment was likely the result of corroded piping that ruptured. There was no remote means to close the intake. At the time the ingress of water was discovered, the quantity of water in the compartment prevented the closing of the sea water intakes. The failure of the audible/visual alarm to indicate the presence of water in the engine-room compartment prevented early detection of the water.

What can we learn?

- The importance of taking measures to ensure the early detection of any ingress of water into the hull.
- Verify that alarms fitted for detecting water ingress are in good working order prior to each departure.
- Installation of a remote means for closing a sea intake valve provides a precautionary measure should the compartment become inaccessible.

SINKING (FSI 17)

What happened?

While performing a routine maintenance job on a fishing vessel's main sea suction strainers, water entered into the engine-room. This water could enter the engine-room because one valve was not properly closed. This ingress of water could not be stopped, and the vessel partly sank alongside the quay on which it was moored.

Why did it happen?

The engineer who had changed over the valves to carry out the maintenance job had not checked the position of the outboard valve. The open-close indication on the valve could not be seen easily from the location of operation of the valve.

What can we learn?

The importance of checking thoroughly the position of valves, especially in the case of outboard valves, must be stressed. Routine jobs should not slacken the awareness of dangers involved.

CAPSIZE (FSI 16)

What happened?

The 23.78 m steel hulled beam trawler caught her port trawl gear on a fastener (seabed obstruction) while fishing. During the ensuing attempts to free the gear from the fastener, the vessel listed to port rapidly and capsized. There was only one survivor of the four crewmembers on board.

Why did it happen?

After the vessel became fast, the starboard trawl gear was hauled first to the surface, and the derrick was raised and the net and beam brought clear of the water. The port gear, with its derrick in the normal horizontal towing position, was hauled until the warp was tight, causing the vessel to list to port.

What can we learn?

It was contrary to good practice to have left the starboard derrick topped while exerting force to free the port gear.

The vessel complied with all the required minimum stability and freeboard requirements for a vessel of her size and type. However, in common with all beam trawlers, she was still vulnerable to capsize under certain conditions.

Captains of beam trawlers fitted with the winch emergency release systems have shown a lack of understanding of its design and operation.

Some of the lessons from previous accidents have not been learned. In addition the crew of the vessel were not wearing life jackets while carrying out the hazardous operation to free the port trawl gear from a seabed obstruction.

CAPSIZE (FSI 16)

What happened?

A trawler came fast while trawling in the vicinity of seabed pipelines. The aft net drum space immediately began to flood through the port transom door, which had been inadvertently left open from the previous voyage. A port list quickly developed, which worsened as more water poured in through the transom door. The crew abandoned into the life raft, around 15 minutes after first coming

fast. Shortly afterwards, the vessel capsized, and sank by the stern. Not all of the crew members had been able to put on their lifejackets. A nearby fishing vessel had responded to the earlier “Mayday” issued by the vessel, and safely recovered the crew.

Why did it happen?

The port transom door leading into the net drum space had been left open while the vessel was trawling before the wind and sea.

What can we learn?

The vessel was knowingly trawling in the area of seabed pipelines. It is likely that her net snagged on large boulder clay mounds by a pipeline trench.
The vessel’s freeboard was lower than when originally designed due to the fitting of additional ballast.

CAPSIZE (FSI 16)

What happened?

The snagging occurred during the trawl while the small fishing vessel was stern to the moderate wind and rough sea. Engine power was used to try to free the vessel, but wave broke over the stern and swamped the working deck. The floodwater was trapped within the vessel’s shelter and did not have time to clear through her freeing ports. Shortly after, the vessel capsized. The two survivors boarded the life raft and then rescued.

Why did it happen?

The vessel had not been appropriately surveyed by an authorized agency. As a result, inadequate freeboard due to carrying too heavy fittings and equipment and the area of freeing ports were left without giving appropriate measures.

What can we learn?

The skipper operating a small fishing vessel of stern trawler should recognize that:

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- in view of the vessel’s limited freeboard and the fact that she was stern-to the wind and waves, he should move head to sea and/or wait until slack water;
- a local inshore maritime weather forecast should be obtained instead of a TV weather broadcast;
- if an EPIRB was fitted, the time of rescue could have been shorter;
- self-inflating lifejackets should be worn all time when working on the open deck;
- the benefit of carrying a life raft rigged with a Hydrostatic Release Unit.

CAPSIZE (FSI 16)

What happened?

While attempting to retrieve the trawl net which contained a heavy weight in the cod end, the small trawler capsized and sank. As the vessel capsized, the crew members launched the life raft, without having time to transmit a distress or don life jackets. Fortunately, the vessel’s EPIRB floated free and started to transmit. The crew was rescued by a passing container ship.

Why did it happen?

A heavy weight in the net which the vessel was hauling over the top of a high gantry created a capsizing lever on her and the vessel carried a lot of top weight which was instrumental in jeopardizing

her stability.

What can we learn?

- It must be recognized that there is only a certain amount of top weight that can be added to a vessel before she becomes unstable.
- If appropriate daily working life jackets were not worn but were stowed in accommodation, the crew's chances of survival would be limited.
- The life raft and EPIRB carried by the vessel undoubtedly saves the crew's lives.

CAPSIZE (FSI 16)

What happened?

When the vessel, which had been converted from a dive boat to a dragger including the installation of an A-frame and a cable winch, was under way, one of the drags was deployed over the stern and the cable run out on the winch. The fishing gear became caught on the seabed, the vessel capsized and sunk. No distress call was transmitted. Several days later, the one deceased crew member and two guests were discovered. The operator is still missing.

Why did it happen?

The transverse stability of the small vessel, which is not required to be assessed, was adversely affected due to the added weight from modification and the inherent low free board permitted water to be shipped and retained on deck.

What can we learn?

- Although there is no requirement to equip an EPIRB on the small vessel, the captain should recognize the benefit to equip it in order to increase the chances of survival when the vessel do not have enough time to send a distress message.
- Although there is no requirement to equip a life raft equipped with deep chock or a hydrostatic release unit, the captain should recognize the benefit to equip it in order to increase the chances of survival when there is little time for the crew to manually deploy a life raft.

A CAPSIZE OF A CARGO SHIP IN FAIR WEATHER (FSI 15)

What happened?

On approaching port in fair weather with a load of 107 containers the vessel started to list to starboard. The transfer of 5 tons of gas oil reduced the list. One hour later the vessel began to list to port. It was then noticed that water flowed into the cargo hold through a hole in the breather pipe of a ballast tank. Due to the increasing list the ships derrick broke loose and swung to port and several containers rushed to port and created port list still further. The crew abandoned the vessel. 10 crew members were rescued, one lost his life. The vessel capsized and sank.

Why did it happen?

The ship was old and the maintenance standard poor. There was lack of reliable inspections. There was an underlying pressure by the owner on the master to "keep the boat running" although several certificates were outdated.

Serious hull failures caused water ingress and a free surface effect due to water in the cargo hold created the list. Further water ingress due to failure to close the emergency escape hatch between the engine room and the hold increased the list to the point of capsizing.

What can we learn?

A careful, qualified and documented maintenance is of great importance for the safety of the ship, especially for old ships, and its crew.

CAPSIZE (FSI 12)

What happened?

A stern trawler fishing vessel of 24 m in length was trawling in heavy weather, in following seas, when the trawl was caught on a seabed obstruction. The Skipper used the engine power to free the trawl, without success. During this operation, a large amount of water flooded the freeboard deck (working deck) through the superstructure aft doors which were open. The Skipper changed the course, the vessel was hit by 2 or 3 waves, capsized, and sank. Consequences of the casualty were two fatalities, two persons missing, one person seriously injured, total loss of the vessel and minor pollution.

Why did it happen?

The Skipper didn't release the winch brakes or run the trawl warps off. The trawler capsized due to a combination of factors, such as water on the freeboard deck, free surface of liquids,
increased loads in the warps caused by the increased engine power, asymmetric and transverse loads on the trawl cables, and the impact of waves.

What can we learn?

Skippers/operators of stern trawlers should be aware of the procedures to free the trawl from a seabed obstruction and related basic principles of stability considering bad weather conditions and following and quartering seas.
During fishing operations the vessel superstructure weathertightness shall be kept by all means.
Sea state thresholds beyond which fishing work should be avoided or extra-caution taken should be established.

FLOODING (FSI 11)

What happened?

A bulk carrier was on a ballast passage and conducting ballast exchange operations when a large gate valve in the engine room on the ballast/bilge system failed, causing severe flooding. Further flooding occurred when the crew attempted to de-ballast and trim the ship until eventually the flooding in the engine room was over 8 metres deep. Having lost all propulsion and electrical power, the vessel had to be taken in tow as a salvage operation.

Why did it happen?

The valve failed due to high pressure in the system or sudden, shock pressure loading. This was possibly caused by other, hydraulically operated, valves in the ballast system closing too fast, as their actuators were out of adjustment. Also it may ha ve been exacerbated by the practice, used during surveys, of pressurising ballast tanks to show that they were full.
Further flooding, during attempts to de-ballast, was caused by insufficient knowledge of the ballast system on the part of the crew and the fact that no ballasting procedures had been developed for the ship. It was made worse by a lack of communication between bridge and engine room personnel during the crisis.

What can we learn?

Ship’s staff must have a thorough knowledge of the vessel’s piping systems. Drawings of these systems must be correct and readily available on board. The principles of Bridge Resource

Management, such as consultation and cross-checking, are equally applicable to engine room operations, particularly during an emergency.
The ship must have established procedures (as required by the ISM Code) for safely conducting routing operations such as exchanging ballast. These must be known and followed.

What happened?

A fully laden bulk carrier in heavy seas lost steerage due to flooding of the steering gear flat by sea water. The propeller pitch had to be set to zero and the ship drifted for more than 7 hours while attempts were made to control the flooding and restore steering. While not making way, the vessel rolled heavily in starboard beam-on seas and green water was taken over the main deck and hatch covers. As a result of the seas and rolling, the fuel oil service tanks took on sea water and the vessel assumed a port list due to shifting cargo.

Why did it happen?

The dogging devices for the hatch cover to the aft rope locker had not been properly maintained.
Sea water entered through the non-tight rope locker hatch cover sealing surface and flooded the rope locker. The bulkhead separating the rope locker from the steering gear compartment was not watertight and progressive flooding of the steering gear flat occurred. Steering was lost when the steering gear motors became submerged in sea water. The fuel oil service tanks took on sea water due to poorly maintained tank breathers.

What can we learn?

The installation of bilge water alarms may have given an early warning that water was accumulating in the steering gear compartment.
The condition of the aft rope locker hatch securing devices and fuel oil tank breathers should have been checked during a recently conducted load line survey. Shipboard personnel should not rely solely upon these surveys to ensure adequate watertight and weathertight integrity of the vessel.

CAPSIZE (FSI 11)

What happened?

A small general cargo vessel was loaded with a bulk cargo of 6,000 tonnes of pyrite concentrate.
Soon after leaving the port, the cargo liquefied, forming a free surface and causing a severe list and loll. The crew made several attempts to correct the list by ballasting without success, with the vessel taking a severe list first to one side then the other. Eventually it capsized and sank.

All the crew, however, were rescued.

Why did it happen?

The moisture content of the cargo was excessive. The cargo had been rained upon while on the wharf before it was loaded. No moisture tests were carried out before loading and no information regarding the characteristics of the cargo had been provided to the ship owner or the
Master.
Once agitated by the motion of the ship, the cargo underwent liquefaction. By ballasting incorrectly to correct the list, the ship's staff made the problem worse, until the vessel eventually capsized.

What can we learn?

All relevant information on the characteristics of the cargo being carried, including the TML (Transportable Moisture Limit), must be provided to the ship owner, Master and officers who must all make themselves familiar with this information.

When transporting cargoes subject to liquefaction, the moisture content of the cargo must be

measured as close as possible to the time of loading.

The cargo must be inspected before loading.

Ship's officers should have a thorough knowledge of stability, particularly the difference between a static list and a loll caused by free surface and the appropriate ballasting measures to adopt.
Do not correct a list due to free surface (a loll) by ballasting the 'high' side.