



ITALIAN MINISTRY OF INFRASTRUCTURE AND TRANSPORT

General Directorate for Railway and Maritime Accident Investigation

***FINAL REPORT OF INVESTIGATION ON COLLISION BETWEEN M/N "MIKA" AND M/P
"LUGARAIN" RESULTING IN THE SINKING OF THE M/P "LUGARAIN" on 19 OCTOBER 2022
OFF THE COAST OF RAVENNA (EMCIP ref. 2022/018917)***



ROME, 27 November 2023

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Abbreviations and Acronyms

AIS	Automatic Identification System
CP	Harbour Master's Office (Capitaneria di Porto)
CCNL	National Collective Labour Agreement (Contratto Collettivo Nazionale di Lavoro)
COLREG	International Regulations for Preventing Collisions at Sea
COG	Course over ground (course)
DiGIFeMa	General Directorate for Railway and Maritime Accident Investigation
EMCIP	2European Maritime Casualty Information Platform
EMSA	European Maritime Safety Agency
Epirb	Emergency Positioning Indicating Radio Beacon (Trasmettitore di localizzazione di emergenza)
IMO	International Maritime Organization
LT	Local time
M/c	Tanker (Motocisterna)
M/p	Fishing vessel (Motopesca)
M/n	Motor vessel (Motonave)
NM	Nautical mile
SIGE	DiGIFeMa Database Event Management System
SOAM	Systemic Occurrence Analysis Methodology
SOG	Speed over ground
TSS	Traffic Separation Scheme
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
UTC	Coordinated Universal Time
VDR	Voyage Data Recorder

PREFACE

This investigation report was conducted by DiGIFeMa independently, in accordance with the provisions and criteria of Legislative Decree no. 165/2011, Directive 2009/18/EC and the IMO Accident Code.

The aim of this technical investigation is to prevent any possible future accidents of this type, by ascertaining and analysing their causes and circumstances.

The investigations, carried out in accordance with the discipline established by the aforementioned Decree, are not aimed at determining any type of blame or liability.

The report of this technical investigation, also in relation to the results included, the conclusions drawn and the recommendations issued, can not in any way be considered as a source of evidence in any administrative or criminal proceedings.

1. RELEVANT LEGISLATION

- ✓ Resolution MSC.255 (84) on the “IMO Casualty investigation Code”;
- ✓ IMO Resolution A.1075(28) Guidelines to assist investigators in the implementation of the IMO Code on the investigation of maritime accidents;
- ✓ Directive 2009/18/EC of the European Parliament and of the Council of 23 April 2009 laying down the fundamental principles in relation to the investigation of accidents in maritime transport sector;
- ✓ Commission Regulation (EU) no. 1286/2011 of 9 December 2011 adopting a common methodology for investigating maritime accidents and incidents pursuant to Article 5(4) of Directive 2009/18/EC of the European Parliament and of the Council;
- ✓ Legislative Decree no. 165 of 6 September 2011 laying down the basic principles in relation to the investigation of accidents in the maritime transport sector and amending Directives 1999/35/EC and 2002/59/EC;
- ✓ Ministerial Decree no. 218 of 5 August 2002 “Safety Regulation for vessels authorized for coastal fishing” and subsequent amendments and integrations;
- ✓ Law no. 1085 of 27 December 1977 ratifying and implementing the Convention on the International Regulations for Preventing Collisions at Sea 1972, with annexes, signed in London on 20 October 1972;
- ✓ Legislative Decree no. 271 of 27 July 1999 “Adaptation of the health and safety legislation of seafarers on board national merchant ships and fishing vessels, in accordance with Law no. 485 of 31 December 1998”
- ✓ Legislative Decree no. 298 of 17 August 1999 “Implementation of Directive 93/103/EC concerning the minimum safety and health requirements for work on board fishing vessels”.

2. SUMMARY

2.1 Brief description of the event

On 18.10.2022, the motor vessel named “MIKA” no. IMO 8321656 departed from the port of Brsica (Croatia) with a cargo of approximately 2000 tons of stone chippings in bulk heading for Ravenna (Italy).

The vessel named “LUGARAIN”, registered to the Ufficio Circondariale Marittimo di Cesenatico (FC) under no. 4RM730 of RR.NN.MM. & GG., it left on 18.10.2022 from the port of Cesenatico to carry out fishing activities.

At approximately 05.10 a.m. LT on 19.10.2022, off the coast of Ravenna, at the coordinate point Long. 44°28.076' N - Lat. 012°33.592' E, the M/n “MIKA”, during the manoeuvre to enter the Ravenna Traffic Separation System (TSS), collided with the “LUGARAIN” vessel, engaged in fishing activities, causing a gash on the starboard side that in turn generated its sinking.

The 5 (five) crew members of the fishing vessel, which subsequently sank, were able to reach safety by jumping onto the deck of the vessel due to the low freeboard height of the vessel. The crew, first rescued by the vessel’s seafarers, was then transferred to the MV CP 847 which intervened at the site of the accident, for subsequent transport on land. Two crew members of M/p “LUGARAIN” were injured as a result of the accident. They were transferred to the hospital of Ravenna for further medical examination and discharged on 19 and 20 October 2022 respectively.

This investigation report was also made on the basis of the documentation submitted and uploaded by the Ravenna Harbour Master's Office in SIGE, the DiGIFeMa database, in which information on accidental events in the maritime sector is collected.

3. OBJECTIVE DATA ON THE ACCIDENT

3.1 Data of the vessels involved

3.1.1 Vessel 1 – M/p “LUGARAIN”

General data (excerpts from SIGE database F2022.0086)

M/p “LUGARAIN” Description

VESSEL TYPE:	FISHING VESSEL >15 m
CALL SIGN:	IUQZ
FLAG:	ITALY
NAME:	LUGARAIN
REGISTRATION NUMBER:	4RM730
OVERALL LENGTH (m):	23.70
GT (tons):	59.82
YEAR OF MANUFACTURE:	1988
HULL MATERIAL:	WOOD
NAVIGATION CERTIFICATE:	NATIONAL COASTAL FISHING
STAGE OF THE JOURNEY:	UNDERWAY
CURRENT ACTIVITIES:	FISHING
PARTY INVOLVED:	SIDE
PORT OF DEPARTURE:	CESENATICO (FC)
PORT OF ARRIVAL:	CESENATICO (FC)
MAIN CURRENT ACTIVITY:	FISHING
SEVERITY OF THE EVENT:	VERY SERIOUS
DAMAGE TO THE SHIP:	YES
SUNK VESSEL:	YES
VESSEL UNABLE TO PROCEED:	YES
FUEL LEAK:	NO
AMOUNT OF SPILLED BUNKERS (tons):	

Figure no. 1 – M/p “LUGARAIN”



➤ Main data extracted from the technical specifications and unit certificates

Navigation type certification	Close coastal fishing within 40 miles of the coast, limited to the Adriatic Sea
Entrusted body	Bureau Veritas
Motor	diesel inboard engine – overall power 478 kW
Rescue equipment	No. 1 inflatable raft for 8 people No. 6 life vests No. 2 life-rings No. 6 thermal suits No. 1 smoke buoy
Safety annotation (ref. D.M. 5.08.2002, no. 218)	Certificate no. 2020/4235 issued by the Ufficio Circondariale Marittimo of Cesenatico release date: 13.11.2020 expiration date: 25.10.2023
Declaration for the purposes of Security Annotation	Certificate no. NS 2020 0101649 issued by Bureau Veritas release date: 18.09.2020 expiration date: 29.03.2023
Navigation Certificate	No. 2020/3174 issued by the Ufficio Circondariale Marittimo of Cesenatico on 01.09.2020 and expiring in 31.08.2026
License for minor vessels and floats	No. 03/2016 issued by the Ufficio Circondariale Marittimo di Cesenatico on 22.02.2016
Properties	Soc. PESCA di MAZZOTTI Graziano and LACCHINI Giovanni & C. S.A.S.
Ship owner	Soc. KHAYAT KHALED & C. SNC

Ship's crew article	No. 18865 T issued by the Ufficio Circondariale Marittimo di Cesenatico on 23.10.2020
Minimum safe manning (ref. Ordinance no. 25/2019 of 22/06/2019 issued by the Ufficio Circondariale Marittimo of Cesenatico)	No. 1 boat head, no. 1 licensed engineer and no. 1 ship's boy that is No. 1 boat head also holding the title of machine (1) No. 1 seaman and No. 1 ship's boy

3.1.2 Crew composition

The crew of M/p "LUGARAIN" at the time of the accident consisted of no. 5 (five) seafarers:

- no. 1 captain;
- no. 3 seamen, one of whom is licensed as vessel head for coastal fishing;
- no. 1 staff member not taken on board from ship's article, but with an employment contract for the quay carrying out the duties of seaman.

3.1.3 Vessel 2 - M/n "MIKA"

General data (excerpts from SIGE database F2021.0025)

M/n "MIKA" description

VESSEL TYPE:	SOLID LOAD-GENERAL CARGO
CALL SIGN:	OYDZ2
FLAG:	DENMARK
NAME:	MIKA
IMO NUMBER:	8321656
OVERALL LENGTH (m):	82.48
GT (tons)	1660
YEAR OF MANUFACTURE:	1983
HULL MATERIAL:	STEEL
NAVIGATION CERTIFICATE:	INTERNATIONAL

STAGE OF THE JOURNEY:	ON ARRIVAL
CURRENT ACTIVITIES:	UNDERWAY
PARTY INVOLVED:	BULB
PORT OF DEPARTURE:	BRISICA
PORT OF ARRIVAL:	RAVENNA
MAIN CURRENT ACTIVITY:	NAVIGATION
SEVERITY OF THE EVENT:	LESS RELEVANCE
DAMAGE TO THIRD PARTIES:	YES
SUNK VESSEL:	NO
VESSEL UNABLE TO PROCEED.	NO
FUEL LEAK:	NO

Photo no. 2 - M/n "MIKA"



* For this vessel, since the gross tonnage is less than 3000 tons, the VDR system is not mandatory, in accordance with Annex II — on-board equipment requirements — of Directive 2011/15/EU of 23.02.2011 COMMISSION DIRECTIVE 2011/15/EU of 23 February 2011 amending Directive 2002/59/EC of the European Parliament and of the Council establishing a Community vessel traffic monitoring and information system

➤ *Main data extracted from the technical specifications and unit certificates*

Ship particulars	
Entrusted body	RINA
Crew list	IMO FAL form 5 on 18/10/2022
Class Certificate	No. 98596-R010-001 issued by RINA A Chioggia (VE) on 14.07.2022 and expiring 31.12.2023
Table of shipboard working arrangements M/N "MIKA"	

3.1.4 Crew composition

The crew of M/n "MIKA" consisted of no. 7 (seven) persons, with the following qualifications:

- no. 1 Captain
- no. 1 Chief Engineer
- no. 1 Chief mate
- no. 1 Second Engineer
- no. 3 deck members

With regard to maritime professional qualifications (STCW), which were found to be in order, were not obtained in the file, but duly checked during the PSC inspection conducted by staff of the Port State Control Unit of the Ravenna Harbour Master's Office.

3.2 Travel data

Place:	territorial sea <=12 NM
Maritime compartment:	Ravenna
Geographical location:	Lat. 44° 28.076' N - Long. 012° 33.592' E at about 11 NM abeam the port of Ravenna
State of the sea:	calm (0 m)
Wind force:	absent (0-1 knots)
Weather conditions:	clear
Visibility:	Good (>=5<25 NM)

3.3 Information on the maritime accident or incident

IMO Classification:

VERY SERIOUS ACCIDENT

For the purposes of the IMO Code for the investigation of Marine accidents, IMO Resolution MSC.255(84), the extraordinary event is to be classified as “*very serious marine casualty*” as it resulted in the loss of the vessel itself involved in the collision.

Type of the event:	collision with another vessel
Date and time:	19.10.2022 at 05.10 a.m. LT
Location and place of the accident	Lat. 44° 28.076' N - Long. 012° 33.592' E at about 11 NM abeam the port of Ravenna
Activities of vessels and part of the journey:	M/p “LUGARAIN” in fishing activities M/n “MIKA” in underway

Consequences

The collision resulted in:

- A gash on the stem side of the hull of the M/p “LUGARAIN” causing a leak resulting in massive flooding of the vessels causing it to sink;
- The abandonment of the vessel by the entire crew of the M/p “LUGARAIN”;
- Minor injury of 2 (two) crew members of M/p “LUGARAIN”;
- The sinking of the fishing vessel “LUGARAIN”;
- Insignificant damage to the forward part of M/n “MIKA”.

*The navigational charts and instrumentation on the pilot bridge of the ship "MIKA" was found to be in order, particularly the radars are of an approved type and certified by the Recognized Body and in regular operation, as found following the inspections carried out on board by the Port State Control Unit of the Ravenna Harbour Master's Office.

3.4 Intervention of the relevant Maritime Authority and emergency measures

After being rescued by M/n “MIKA”, and subsequently transhipped onto the M/V Harbour Master's Office 847, which intervened on the spot for ground transportation, all crew members of M/p “LUGARAIN” received their first treatment at quay by 118 healthcare staff, two of whom were transferred to the hospital in Ravenna for medical examination.

At the same time, the M/V Harbour Master's Office 847 also rescued the Epirib of the sunken fishing vehicle.

On 19 October 2022 the diving unit VV. F of Ravenna on request of the Coast Guard of Ravenna, intervened for exploration activities and possible containment resulting from oil spills and security of the area, installing a signal buoy. On 24 and 25 October 2022 a team of the 1th Diving operators Unit of the Coast Guard of San Benedetto del Tronto, proceeded to inspect and film the wreck lying on the seabed at a depth of about 27 meters, acquiring information regarding any critical issues concerning the safety of navigation and potential sources of pollution.

4. DESCRIPTION OF THE STAGES OF THE EVENT

The reconstruction of the main phases of the accident was possible thanks to the collection of data from the software system “Pelagus” supplied to the Corps of the Harbour Master's Office - Coast Guard, the documents and logbooks of the vessels involved, from data extracted from the VDR (Voyage Data Recorder) of the vehicle “VALLERMOSA”, present in the area, but not involved in the accident and from the additional documentation included in BD SIGE by the Harbour Master's Office of Ravenna, the following information could be obtained, including the AIS tracks related to the navigation routes of M/n “MIKA” and M/p “LUGARAIN”.

4.1. Track of M/p “LUGARAIN” of 19 October 2022

The M/p “LUGARAIN” left Cesenatico at 8:00 a.m./LT on 18 October 2022 heading north for fishing activities.

In the statements made, the Captain of the fishing vessel declared:

- that he was engaged in fishing operations with a northern course approximately 11 miles from the coast abeam a farming plant;
- that he saw the M/n “MIKA” in the distance;

- that he communicated with the fishing vessel “NONNO ALI” in the area, regarding the sighting of M/n “MIKA” and the manoeuvre he would have made to overtake it;
- that he communicated with the M/p “GIOMADA” and “VICHINGO” for communications related to fishing;
- that he was committed to compiling the log book (nautical journal) with a north course at a speed of approximately 3 knots;
- that he noticed, at 05:10 a.m./LT, evidently turning to his own right, the proximity to the M/n “MIKA”, he took the binoculars but could only see the bow of the vessel and not the navigation lights, therefore, he began to shout to the crew to be careful, he activated the sound signals, he stopped the vessel first slowing ahead and then moving full speed ahead, but the vessel continued its route and violently hit the starboard gunwale of the fishing vessel.

4.2. Net lowering operations of the M/p “LUGARAIN”

The M/p “LUGARAIN” lowered the nets, at about 03:00 a.m./LT. At the end of net lowering, all crew members, except the Captain who was on the pilot bridge, were at the stern as they were trawling.

4.3. Tracking of the navigation of the M/n “MIKA” on the day of 19 October 2022

The M/n “MIKA” departed from the port of Brsica (Croatia) on 18.10.2022 heading for Ravenna, with a load of 2000 tons of stone chippings.

At approximately 04:55 a.m./LT on 19 October 2022 M/n “MIKA” sailed at a speed of 8.2 knots and a true course of 220.9°, in order to go into the Traffic Separation scheme and head for the port of Ravenna.

At 05:00 a.m./LT the navigation shall continue smoothly with almost equal course and speed.

The M/n “MIKA” will maintain constant element of motion such as course and speed (equal to 8 knots) until the moment of collision.

This situation can be clearly seen in the figure below, in which the distance between the point where the M/n “MIKA” was at 04:55 a.m./LT and the point where the collision will occur at 05:10 a.m./LT can be seen. (fig. 3)

In the adjacent area sailed the M/c “VALLERMOSA” (from which it was possible to obtain the VDR extracts to better understand the courses followed by the vehicles involved in the event) with true course 269°.

At 05:01 a.m./LT the M/c “VALLERMOSA” starts the steerage to the left (5° left the helm).

At 05:03 a.m./LT end of the steerage to the left for the M/c “VALLERMOSA”.

At 05:11 a.m./LT collision.

At 05:11 a.m./LT the vessels begin to make leeway together, the M/n “MIKA” continues to proceed at 7.7 knots.

At 05:11:54 a.m./LT the M/c “VALLERMOSA” contacts M/n “MIKA” without receiving a reply. At 05:12 a.m./LT the M/c “VALLERMOSA” tries to contact M/n “MIKA” again. At 05:13 a.m./LT the M/n “MIKA” and the fishing vessel “LUGARAIN” start to make leeway south at speed of 2.5 knots.

At 05:21 a.m./LT the Ravenna Harbour Master's Office contacts the M/n “MIKA” without receiving a reply.

At 05:22 a.m./LT the Ravenna Harbour Master's Office contacts the fishing vessel “LUGARAIN” without receiving a reply. At 05:26 a.m./LT the Ravenna Harbour Master's Office contacts M/n “MIKA” and receives a reply. The M/n “MIKA” informs that it has had an accident with a fishing vessel and that all the crew of the fishing vessel “LUGARAIN” is on board the M/n “MIKA”.

At 05:27 a.m./LT the fishing vessel “LUGARAIN” sinks and AIS contact is lost.

At 05:28 a.m./LT the M/n “MIKA” reports that the vessel has sunk.

At 05:31 a.m./LT, the captain of the fishing vessel, through the VHF of the M/n “MIKA”, reports to the Ravenna Harbour Master's Office that all 5 crew members are on board M/n “MIKA” and need medical assistance.

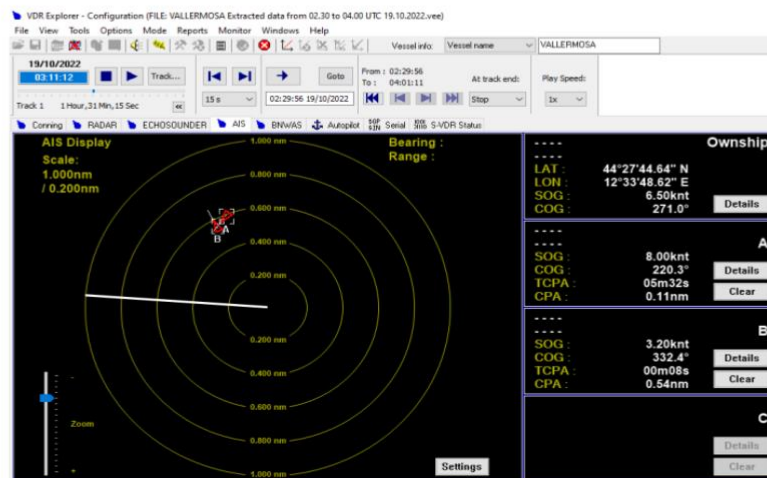
IMAGES EXTRACTED FROM THE VDR OF THE M/c “VALLERMOSA

Photo no. 3 – Course and speed M/n “MIKA”

ORE 04:55



ORE 05:11 COLLISION

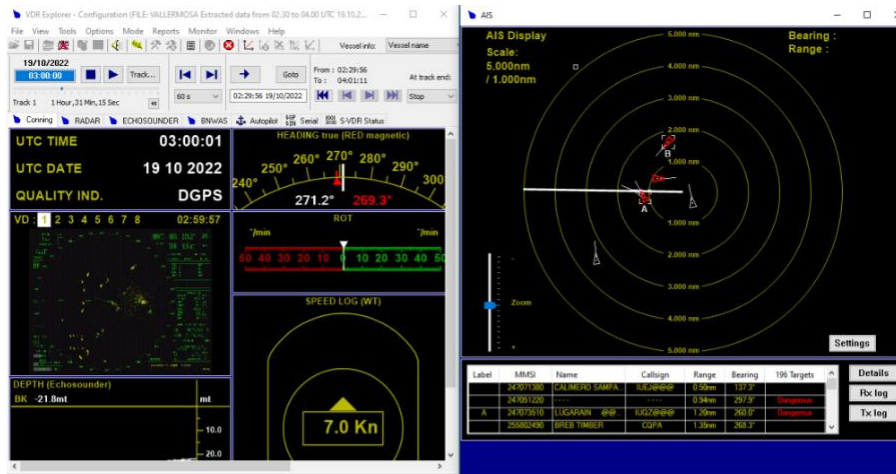


COG: 220°

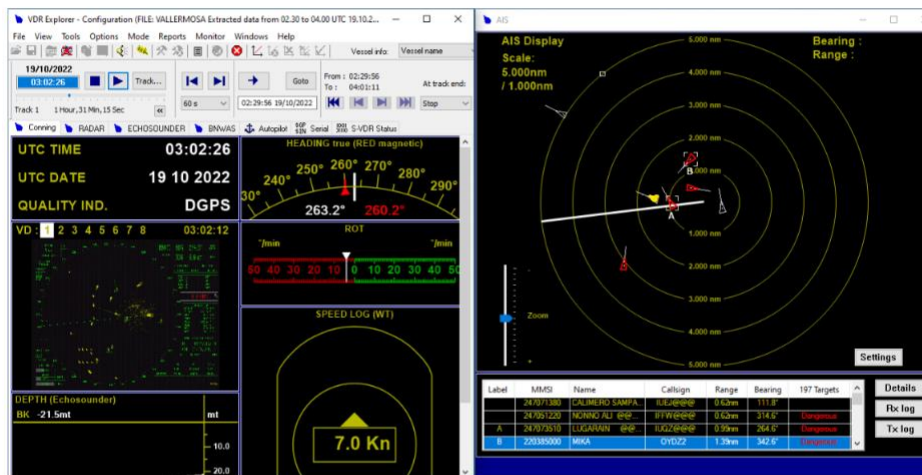
SOG: 8 knt

(the units of measurement remain almost the same from 04:55 a.m. to the time of collision 05:11 a.m.)

Figure no. 4 - steerage manoeuvres M/c "VALLERMOSA"



ORE 05:01 INIZIO ACCOSTATA A SINISTRA (5° DI BARRA A SX) PER IL VALLERMOSA



ORE 05:03 FINE ACCOSTATA A SINISTRA (BARRA AL CENTRO) PER IL VALLERMOSA

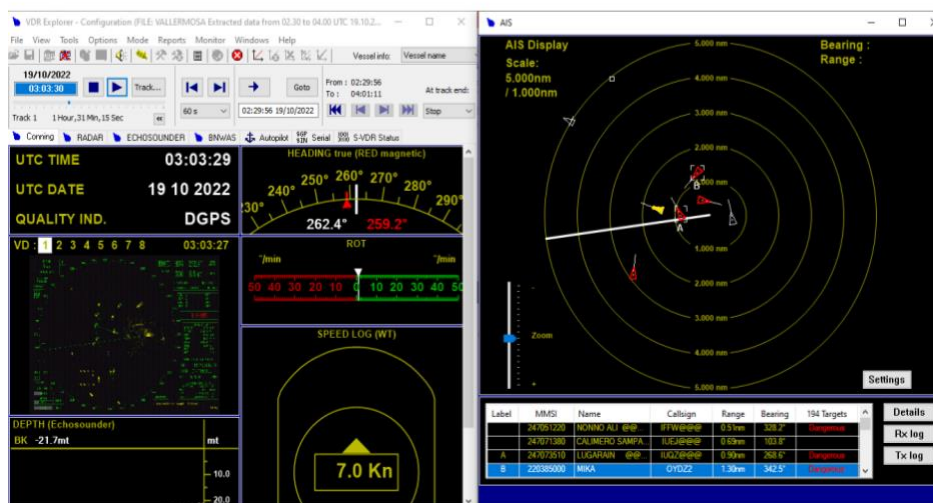
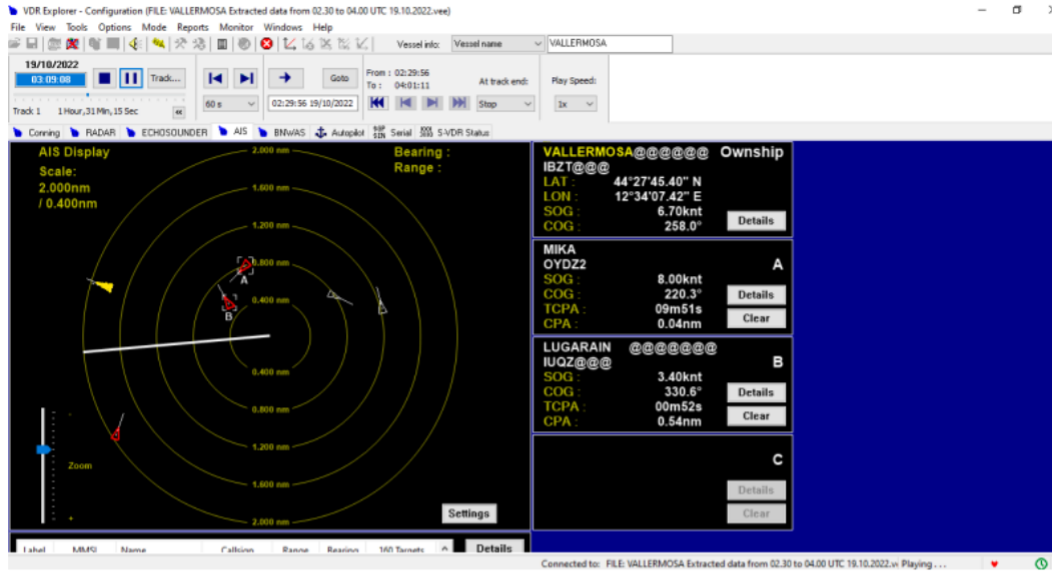


Figure no. 5 – during the collision

ORE 05:09



ORE 05:11 COLLISIONE

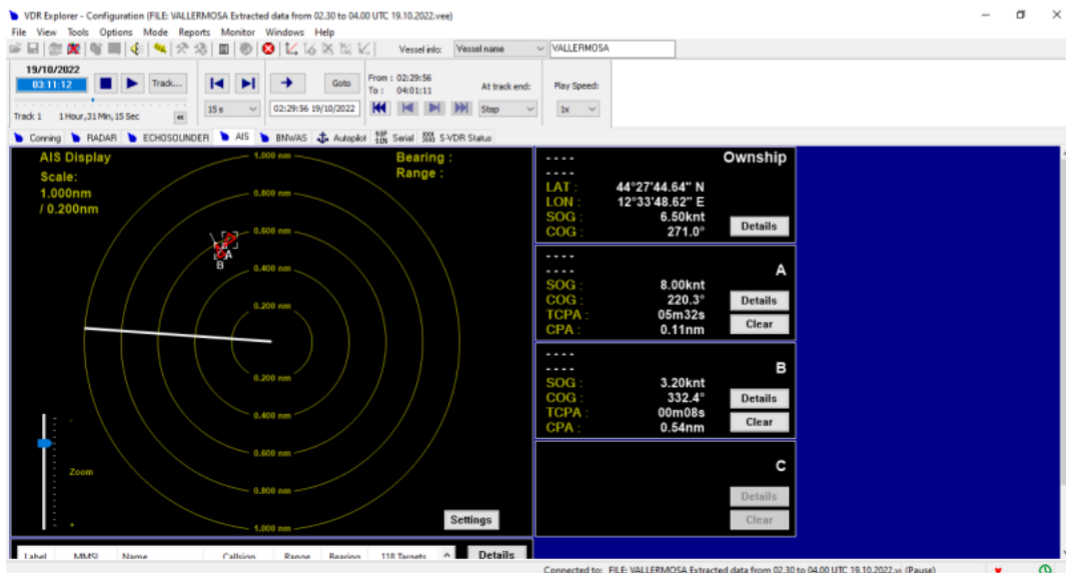
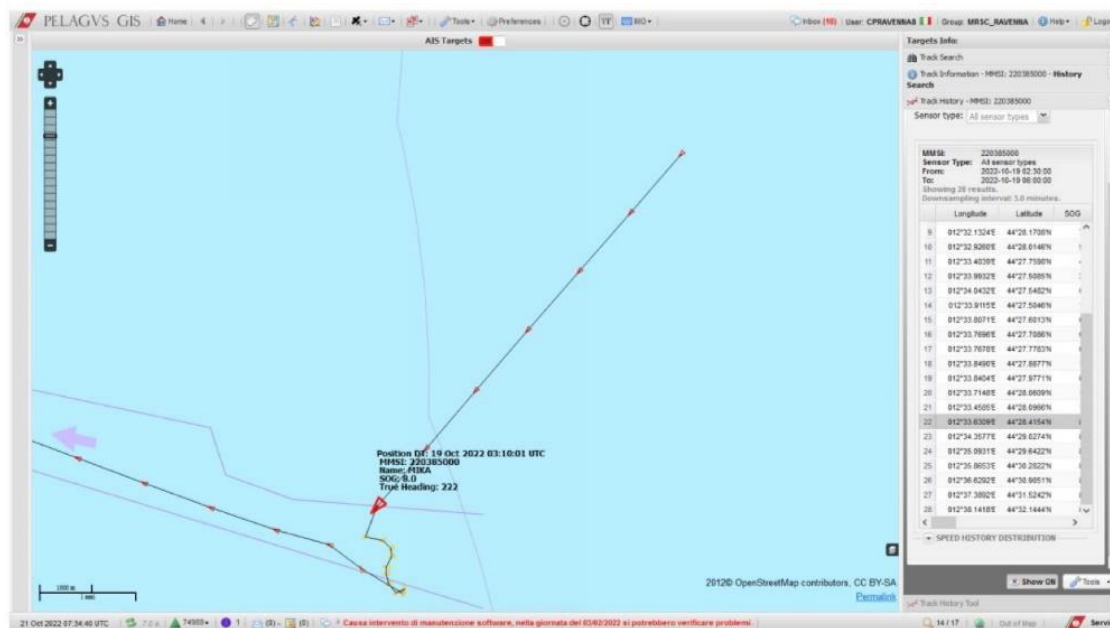
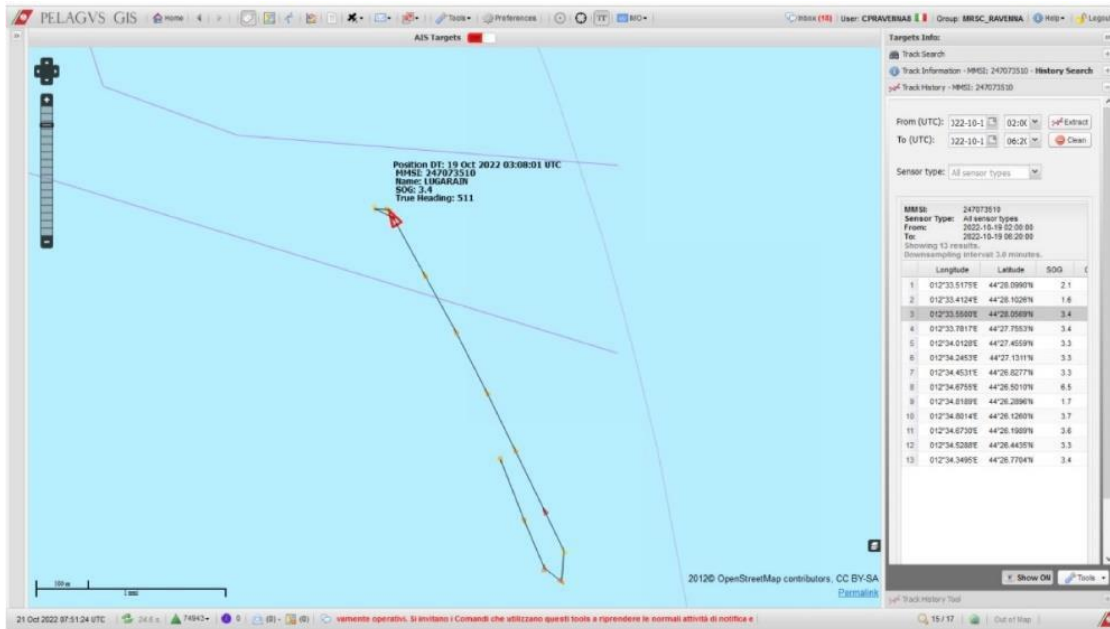


Figure no. 6 – PELAGUS Extract course of the vessels involved



The motor vessel Captain said:

- that he sighted a number of targets including the vessel “LUGARAIN” at approximately 200 meters left side, as well as the M/c “VALLERMOSA” in navigation to the left of the vessel which was carrying out the same manoeuvre to enter the T.S.S. The fishing vessel was initially between the vessel “MIKA” and the M/c “VALLERMOSA” and only after the tanker overtook the vessel “MIKA” was the fishing vessel sighted;
- that he sighted the fishing vessel by optical sighting and with radar equipment set at a 2-mile scale at about 05:00 a.m./LT;
- that he sighted the fishing vessel at about 05:10 a.m./LT, when it was fishing at approximately 50 meters on the left side of the vessel, which was not contacted by radio because it was too late;
- at the same time, he claimed that he had emitted sound and light signals, stopped the vessel and manoeuvred it back.

Ultimately, in the time period between 04:39 a.m./LT and 05:10 a.m./LT (time of collision), the M/n “MIKA” followed, albeit with a course change of a few degrees, a direction equal to true course 220.

4.4. Radio communication between the two vessels

- ✓ There is no evidence of contact, or attempted contact, between the M/p “LUGARAIN” and the M/n “MIKA”, either via VHF or by on board whistle or siren or any other signalling device, in order to interrogate the other vessel about the manoeuvring intentions or even just signal the risk of boarding and/or collision.

4.5. Watchkeeping on board the two vessels before the collision

- ✓ At the time of the collision the fishing vessel had only the Captain on the pilot bridge, while the M/n “MIKA” had the 1st Chief mate and the Captain, who had arrived a few minutes before the collision to carry out the manoeuvre to enter the Traffic separation scheme.

4.6. Working and rest time of the two vessels

- ✓ From the vessel's registry hours of work, the crew's working and rest shifts on board M/n "MIKA" appears to be in compliance with the MLC 2006 and the STCW 78 Convention as amended.
- ✓ National Collective Labour Agreement (CCNL in Italy) in the maritime sector (period of validity from 1 October 2021 to 30 September 2024).
- ✓ There is no objective evidence of the shift of the working and rest time of the crew on board the M/p "LUGARAIN", but there are only data that can be deduced from the documentation collected:
- ✓ the fishing vessel and its crew turn out to have been engaged continuously in fishing activities from 8:00 p.m. LT on 18 October 2022 (start of exit for fishing activities) to 05:10 a.m. LT on 19 October 2022 (time of collision), a period in which the third set of fishing nets was taking place.
- ✓ the Captain of the fishing vessel declared: *"we do about 60 hours per week in four days"*.

4.7. The final dynamics of the collision

The captain of the M/p "LUGARAIN" was on guard duty on the pilot bridge while the rest of the crew was carrying out the usual trawling duties. When he noticed the situation of an imminent risk of collision coming from its starboard, he stopped the vessel, he activated the sound signals, he stopped the vessel first slowing ahead and then moving full speed ahead, but he was not able to manage to avoid the collision with the vessel.

The M/n "MIKA" collided on the starboard side of the M/p "LUGARAIN" at 05:10 a.m./LT (03:10 a.m./UTC), in the position with coordinates latitude 44°28',46 N, longitude 012°33',09 E. An examination of the kinematic data collected, the statements made by the two captains and the damage suffered by both vehicles show that:

- the M/n "MIKA" did not suffer any significant damage to the forward submerged part of the vessel;
- the starboard side of the M/p "LUGARAIN" had a gash in the hull that generated a leak and caused it to sink.

At the time of the collision the weather conditions were characterised by absent wind and calm sea, good visibility, absent rainfall and clear sky (cf. METEOMAR Form of 18.10.2022).

4.8. Management of the emergency phase by the crew of M/p “LUGARAIN”

The crew members of the M/p “LUGARAIN” reached safety by first climbing into the cabin of the M/p “LUGARAIN” and then by jumping onto the deck of M/n “MIKA”. No individual life-saving equipment was worn.

The fishing vessel was sinking after the collision (last AIS transmission was at 05:20 a.m./LT). There were no on-board VHF radio communications between the vehicles on the collision course.

Figure 7 – Schematisation of the collision between the M/n “MIKA” and the M/p “LUGARAIN” (source: summary investigation report of the Ravenna Harbour Master's Office)

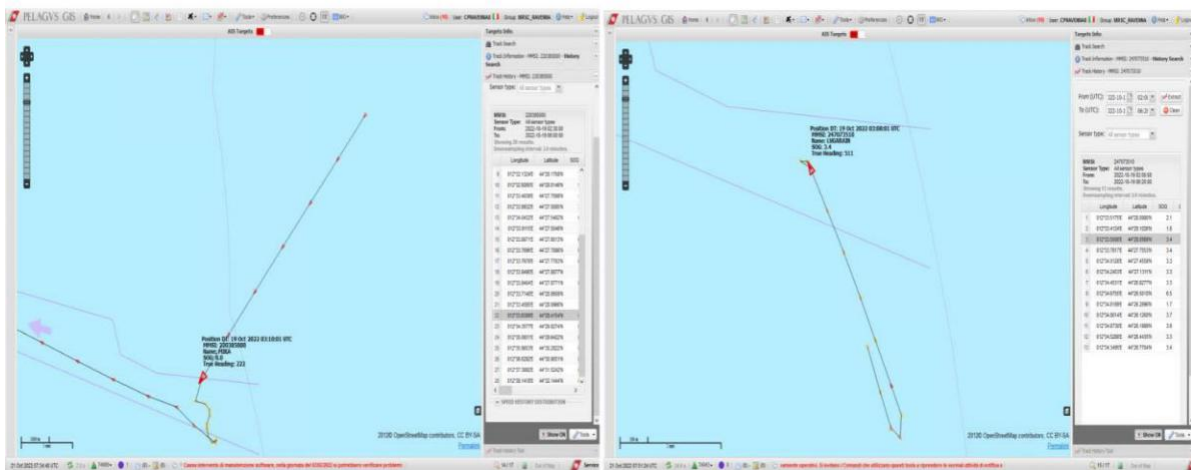


Figure 8 - Ravenna Traffic separation scheme (S.S.T.)



An underwater inspection shows that the hull of the wreck suffers from a great deal of damage from the impact with the vessel, especially at the abaft of the starboard side, a leak that probably caused the shipwreck. Other damage to the hull is present on the left side but of little importance ⁽²⁾.

Figure 9 - Underwater shooting of the collision area of M/p "LUGARAIN"



Figure 10 - In the following image, a frame of the underwater shot is shown, from which the leak on the hull of the M/p "LUGARAIN" following the collision can be seen.



²) source: Service report of the 1th Diving Operators Unit of the Coast Guard of San Benedetto del Tronto

4.9. Rov services EMSA

On 7 and 15 February, the investigators responsible for carrying out the investigation of the event went to Ravenna to assist or help the surveying operations by means of R.O.V. (remotely operated vehicle), which is a service provided by EMSA (European Maritime Safety Agency) and requested on 25.01.2023 with the aim of determining the condition of the wreck and of extrapolating significant images and videos for the purpose of the safety investigation.

REPORT: the intervention ended successfully on 15/02/2023 when the wreck was located and the visual evidence was collected under the coordination of DiGIFeMa. The inspection focused on:

A. External inspection of the wreck

B. A detailed overview of damage, with an estimate of the size of the cracks resulting from the collision. Underwater lasers were used as a system measurement reference in the project. The laser provides a visual reference on video sequences of a known distance. This allows end users to resize elements of the video image to get their approximate size.

Estimated measurements:

- crack no. 1: 250 mm x 200 mm
- crack no. 2: 300 mm x 90 mm
- crack no. 3: 400 mm x 90 mm
- crack no. 4: 650 mm x 10 mm
- crack no. 5: 100 mm x 10 mm

Figure 11 - Area of the M/p "LUGARAIN" affected by the collision
(source: photo report realised by ACSM)



5. ANALYSIS

The investigation was conducted on the basis of documents received and/or requested from the parties involved. In particular, the following were analysed:

- the documents transmitted on the BD SIGE by the Ravenna Harbour Master's Office;
- the documents requested to Bureau Veritas;
- the study conducted by EMSA “*Analysis on marine casualties and incident involving fishing vessels*”, April 2018;
- the study “*Analysis of the human factor – rail and maritime sectors*” ⁽³⁾, carried out by DiGiFeMa, 2017.

This investigating body has established that in rail accident and marine casualty investigations, it is essential to classify human error from the interaction between the planning phase of the action and the execution phase of the action.

5.1. SOAM Analysis

This section describes the application of the six steps of the SOAM methodology (from level 0 to level 5) to the collision between the M/p “LUGARAIN” and the M/n “MIKA”. The section concludes with the SOAM diagram of the event, summarising all elements considered in the analysis and the relationships that were identified between these elements.

5.2. SHELL resources relevant to the event (Level 0)

As explained above, in the preliminary phase of the SOAM analysis all Software, Hardware, Liveware and Environment resources considered relevant to the event were identified, based on the SHELL model. Their identification resulted from the documentary analysis of the material transmitted by the Harbour Master's Office, from the interviews carried out with the people involved in the accident, and from the knowledge of the DiGiFeMA staff.

For the sake of clarity, the table is divided into two parts: the first one dealing with SHELL resources related to the M/p “LUGARAIN” and the second one dealing with the motor vessel “MIKA”.

3) See the study “*Analysis of the human factor – rail and maritime sectors*”, published in 2017 by DIGIFEMA at the following link <http://digifema.mit.gov.it/wp-content/uploads/2016/04/Relazione-Digifema-su-Fattore-umano.pdf>

Software	Hardware	Liveware	Environment
<ul style="list-style-type: none"> - ColReg: regulation for preventing collisions at sea - ColReg: guard (watchkeeping) on the pilot bridge - AIS use to identify traffic - Work division on LUGARAIN, i.e. 1 person on guard, also dedicated to filling the Logbook - Radio contact with others fishing vessels - Custom "[others Vessels] can pass through even at very close distance". - Followed course for fishing activities - Knowledge of the Traffic Separation Scheme - Seafarers' working hours 	<ul style="list-style-type: none"> - AIS LUGARAIN - Binoculars LUGARAIN - Lights of navigation LUGARAIN - Lights of signalling fishing activities 	<ul style="list-style-type: none"> - Captain LUGARAIN - Crew LUGARAIN - Crew fishing boat Nonno Ali 	<ul style="list-style-type: none"> - Scheme of Separation of the Traffic of Ravenna - Decent condition of visibility - Night time: 5:11 a.m. local time, i.e. about 2 hours and 20 minutes before dawn (7:32 a.m. in Ravenna).
<ul style="list-style-type: none"> - ColReg: guard (watchkeeping) on the pilot bridge - AIS use to identify traffic - Course set for Ravenna - Communication between the first Chief mate and the Captain (briefing on changing the rudder) 	<ul style="list-style-type: none"> - AIS MIKA, probably set at 6-miles zoom - Lights of MIKA navigation 	<ul style="list-style-type: none"> - First Chief mate MIKA - Commander MIKA 	

The analysis takes into account the persons present at and involved in the event, e.g. the entire crew of the M/p "LUGARAIN" and the Captain of the M/n "MIKA", even if they did not play an active role in the collision.

Similarly, the crew of the fishing vessel "NONNO ALI" is listed, in light of the communication with the M/p "LUGARAIN"

For the other resources, it was decided to limit the analysis to those resources that are actually relevant to the reconstruction of the event, omitting, for example, the Software and Hardware resources used during fishing activities.

The table only serves to delimit the perimeter of the analysis by listing the relevant SHELL resources. The interactions between the various elements will instead be analysed in the next steps of the SOAM methodology (see paragraphs 5.3 to 5.9 below).

5.3. Barriers not present or of limited effectiveness (Level 1)

The following collision prevention barriers are relevant to the event:

- Watchkeeping officer by the M/p “LUGARAIN” and the M/n “MIKA” – Identification type barrier
- Use of AIS by the M/p “LUGARAIN” and the M/n “MIKA” – Identification type barrier
- Navigation rules within the Traffic Separation Scheme – Restriction type barrier

As regards the first two barriers, Navigation rules 5 and 7 [COLREG 1972], concerning respectively the lookout service and the use of radar equipment, are relevant. Although the two barriers are present in the event under analysis, they will be ineffective due to the errors and Contextual Conditions described below. In more detail, the two barriers did not work because the two people at the helm of the two vessels report that they identified the other vessel in good time using the AIS, but they first probably miscalculated its trajectory as “unproblematic” and then failed to visually locate the other vessel.

Navigation rules within the Traffic Separation Scheme are a barrier precisely because they separate traffic in two directions, limiting possible crossings. They also prohibit fishing activity in this area. They did not work due to the presence of the M/p “LUGARAIN” in this area, probably due to a deliberate and routine violation.

There are also protection and containment barriers (the resistance of the hull to collisions and the balustrades to hold on to), and barriers that allow people to reach safety (procedures for abandon ship). In this case, they functioned properly, allowing the crew of the M/p “LUGARAIN” not to suffer any serious damage during the collision and reach safety.

È On the other hand, it should be noted that there is no record of the Captain telling the crew to wear life-saving equipment.

It is not clear from the statements whether this

was not due to a lack of time, or whether it was a deliberate choice, and how easily accessible the devices were during fishing operations. Note that one of the sailors manages to pull off his work coveralls.

5.4. Errors and/or Violations (Level 2)

The analysis of the actions of the people involved leads to the identification of five errors and two violations. It should be highlighted that these terms are used in a technical sense, taking into account their definition in the context of the taxonomy for the analysis of human error (see Annex (a)), and without any judgement on the actions of people, or attribution of responsibility for the incident, which fall outside the aims of this report. In SOAM method, errors and violations are considered as evidence from which contextual and organizational conditions can be traced, and not as “the actual causes” of the incident.

The violations and errors identified are listed below, identifying who committed them and describing their circumstances.

Errors are therefore actions carried out voluntarily by a person who fail to achieve the desired goal. They are considered errors if the person had an alternative action available. In the specific event we can identify as errors:

- Error 1 – The Captain of the M/n “MIKA” sights the LUGARAIN fishing vessel too late: this error leads to a late avoidance action by the motor vessel.
- Error 2 - The Commander of the M/p “LUGARAIN” sights the M/n “MIKA” too late: this error leads to a late avoidance action by the fishing vessel.

Two other errors, prior to error 1 and error 2, relating to the decision of the Captain of the M/p “LUGARAIN” not to monitor the other vessel through the AIS and of the Captain and first Chief mate of the M/n “MIKA” not to monitor nearby traffic using radar, are also plausible.

- Error 3 - The Captain of the M/p “LUGARAIN” does not monitor the course of the M/n “MIKA” on the radar: this error results from the underestimation of the collision risk (see below contextual conditions), expecting the Captain that the other vessels carry out the appropriate manoeuvres, as (International Regulation to prevent collisions at sea). Linked to this error we can also mention the failure to use the radio to try to contact the “MIKA” vessel.

- Error 4 -The Captain and first Chief mate of the M/n “MIKA” do not monitor nearby traffic through the radar: error 1 is linked to this error, since the late visual sighting occurs plausibly also due to a non-use of the radar. It is not clear from the minutes whether the radar is not used because they are concentrated on the manoeuvres for entering the Traffic Separation Scheme (call to the pilots of Ravenna and presence of the M/c “VALLERMOSA”), or whether it is used but the M/p “LUGARAIN” cannot be identified due to an incorrect range setting. In this regard, we find two contradictory statements in the minutes of the Harbour Master's Office: the first Chief mate speaks of a range set to 6 miles, while the Captain indicates 2 miles. Linked to this error, we can also mention the failure to use the radio to try to contact the ‘LUGARAIN’ fishing vessel.

Subsequently to these errors, a situation of imminent collision arises, during which we can highlight another error of the Captain of the M/p “LUGARAIN”.

- Error 5 - The Captain of the M/p “LUGARAIN” performs an incorrect operation to avoid the collision, first reducing the speed and then increasing it. In light of the knowledge available to date, it is likely that a different sequence of actions – abandoning the fishing nets and increasing speed – would have prevented the collision.

Note that this action can only be considered as an error in light of the previous error of the pilot of the M/n “MIKA”, i.e. how the Captain of the M/p “LUGARAIN” is manoeuvring (according to Rule 17 of [COLREG, 1972]) because the M/n “MIKA” has not previously carried out useful manoeuvres to avoid the collision (Rule 18 [COLREG, 1972]).

On the other hand, in this situation of imminent collision, there does not seem to be any errors committed by the Captain of the M/n “MIKA”, who operates the only possible actions, namely to activate sound and visual signals and insert “vessel back”. It is important to remember how mistakes are considered such only if the person has an alternative action available.

Considering the taxonomy of the SHIELD error, errors 1 and 2 are errors of perception. Errors 3 and 4 are errors of poor planning and of decision-making, as the people involved in the event decide to take certain actions (e.g. Log Book filling, visual guard, coordination with Ravenna, etc.) instead of spending time on the

traffic monitoring via AIS. Error 4 could also fall into a performance error (omission of action), if the failure to change the radar range was due to forgetfulness and not a deliberate decision. This possible ambiguity does not change the overall framework of the analysis in subsequent SOAM steps and for the purposes of subsequent recommendations. It will then be omitted.

On the other hand, violation are actions committed in the knowledge that they are acting in a way that is not in accordance with the rules recognized in the specific working environment. In the present case, the violations concern:

- Violation 1 – The Captain of the M/p “LUGARAIN” carries out fishing activities within the Ravenna Traffic Separation Scheme.

Although this violation does not alter the fact that M/n “MIKA” should have manoeuvred to avoid the fishing vessel, it makes a risky situation more likely, since other vessels may legitimately not expect fishing activities to be present in this area.

- Violation 2 – The M/n “MIKA” enters the Traffic Separation Scheme in a way that does not comply with the navigation rules. As also highlighted in the report of the Ravenna Harbour Master's Office, the M/n “MIKA” “cuts” the entrance to the Traffic Separation Scheme (see Figure 6).

However, it should be noted that this violation is not a factor in worsening the risk of collision.

With regard to violation 1, it should also be noted that the staff of the M/p “LUGARAIN” reported during the declarations made to the Harbour Master's Office that they were aware (“only through some voice communication but nothing official”) of the separation scheme and that they did not know the relative rules of navigation. For also this reason, the violation 2 does not seem to be significant, because the M/p “LUGARAIN” had therefore no specific expectations with respect to the course that M/n “MIKA” would follow. In the context conditions analysis, it will be highlighted that the knowledge of the SST does not correspond to an appropriate perception of the risk of collision, probably higher because of the expectations of other vessels ‘there is no fishing activity in this sea area’ and especially the density of traffic in this sea area. This is therefore most likely a routine violation.

In addition, it is useful to avoid the re-occurrence of the same event, to carry out the so-called substitution test already at this level of analysis, i.e. to ask whether “would another person in the same

situation have acted differently"? Based on the information currently available, we can reasonably expect that:

- Error 1 and Error 2: the contextual conditions, i.e. the presence of another vessel between the M/n "MIKA" and the M/p "LUGARAIN", lead to the conclusion that this error is likely to occur again as well as other people at the helm.
- Error 3: also in this case it is likely that other captains of fishing vessels may act in a similar manner, expecting to be avoided by the vessels.
- Error 4: the collision occurs as soon as a rudder shift is made and in conjunction with the actions related to the entry of the Traffic Separation Scheme. It is plausible to expect that other crews may also view radar monitoring as a lower priority activity than ongoing actions.
- Error 5: given the short decision time available and the environmental conditions (with not immediate and clear perception of the distance and direction of the M/n "MIKA"), it is possible that another Captain would have acted in the same way, namely preserving fishing nets and trying to avoid collision by acting only on speed.
- Violation 1: from the interview with the crew members of the M/p "LUGARAIN" this violation may have been committed by other fishing vessels in the past.
- Violation 2: we have no evidence of similar violations by other vessels.

5.5. Contextual Conditions (Level 3)

Contextual conditions are factors present at the specific location where the accident occurred, which may have been preconditions that make individual errors possible or beneficial (see definition in Annex (a)). These preconditions may include physical environment, equipment and work environment, communication, teamwork, poor perception factors, awareness, memory, workload, personal factors, physiological conditions, use of medicines, drugs or alcohol, and skills and abilities.

In the SOAM method errors are considered as a guideline for identifying significant Contextual Conditions. For this reason, the individual errors and violation are listed in this paragraph, and then the contextual conditions attached to them are listed below.

Error 1 - The Captain of the M/n “MIKA” sights the M/p “LUGARAIN” too late.

Physical environment: despite the discreet visibility, the night time has surely made the M/p “LUGARAIN” less immediately identifiable. See, for example, the declaration made by the first Chief mate to the Harbour Master's Office, which reports (erroneously) the vessel in parallel navigation.

Physical environment: a very significant condition in inducing the Captain of the M/n “MIKA” to error is the temporary interposition of the M/c “VALLERMOSA”, which blocks the view of the M/p “LUGARAIN” until it passes its bow.

Equipment and work environment: the AIS radar is reported by the first Chief mate as set at 6 miles so not useful to identify the M/p “LUGARAIN” given the proximity between the two vessels. As already pointed out, the Captain reports having set the range to 2 miles. If there is no confirmation of either statement, we report this contextual condition as probable but uncertain.

Interpersonal communication: the collision occurs in the minutes immediately after the Captain takes the helm of the M/n “MIKA”, at least according to his own statements and those of the first Chief mate. There is no indication of a communication between the Commander and the first Officer regarding the presence of the M/p “LUGARAIN”, and it is therefore possible that the former was not aware of the potential danger. We do not know whether this does not occur because the two do not carry out any handover or if they do so but not completely.

Work load: concurrent activities (change of command of the vessel, communication with the Port of Ravenna) may have drawn the attention of the crew, distracting them from the watchkeeping on the pilot bridge.

Physiological factors: the night time may have affected the Captain's alert level. In particular, the Captain goes on the bridge after a rest shift. It is therefore presumable a reduced level of alert due to the circadian minimum window (approximately 2 hours before the usual wake-up time) and more specifically due to sleep inertia, namely a reduction in the alert level in the minutes immediately following the wake-up time (inertia typically estimated to be 20 minutes, up to 2 hours in case of sudden wake-up time and not aligned with the circadian cycle). It is noteworthy

how the Working and Rest time register of the M/n “MIKA” reports implausible times because they are too regular, as is also evident from the statement by the first Chief mate ‘my working hours are different from those indicated in the work schedule’.

Error 2 - The Captain of the M/p “LUGARAIN” sights the M/n “MIKA” too late.

Physical environment: poor visibility due to night time as evidenced by M/p Commander “LUGARAIN” who does not immediately understand which the course of the M/n “MIKA” is.

Physical environment: the presence of the M/c “VALLERMOSA” also affects the error of the Captain of the M/p “LUGARAIN” by obstructing the view of the M/n “MIKA” until 05:00 a.m. LT (see Figure 4).

Awareness: there seems to be an underestimation of the risk posed by the M/n “MIKA” due to high expectations and previous experience, in which some motor vessels passed very close by the fishing vessel “they can pass through it even at a very close distance without problems”.

Physiological factors: the night time may have affected the Captain’s alert level, although the concomitant fishing activity leads to the conclusion that this condition is potentially less relevant than the M/n “MIKA”. The level of fatigue due to shifts and rest on previous days should also be assessed, but there is no reliable information in the documentation available to perform the analysis with the risk factor assessment matrix “number of hours worked and number of hours rested”.

Workload: the concomitant fishing activity may have drawn the Captain’s attention by distracting him from watchkeeping on the pilot bridge.

Error 3 - the Captain of the M/p “LUGARAIN” does not monitor the course of the M/n “MIKA” on radar. Awareness: the most relevant contextual condition to facilitate this error is undoubtedly the expectation due to previous experience, in which some motor vessels passed very close by the fishing vessel “they can pass through it even at a very close distance without problems”.

This expectation leads the Captain of the M/p “LUGARAIN” not to carefully monitor the other vessels, thus underestimating the risk posed by the M/n “MIKA”.

Note: The failure to use the radio to contact the M/n “MIKA” may also be due to the contextual condition of interpersonal Communication, in particular the language barrier with a foreign vessel. We do not include this contextual condition because the minutes and statements do not reveal any supporting elements.

Error 4 - the Captain and the First Chief mate of the M/n “MIKA” do not monitor nearby traffic through radar.

Equipment and work environment: as highlighted above, this error may have been driven by the radar range not being set correctly.

Workload: the event takes place just after the change at the helm, with the crew of the M/n “MIKA” probably focused on the manoeuvre approach to Ravenna, in particular on the course of the M/c “VALLERMOSA” and on communication with the pilots of Ravenna (which occurs in the minute immediately before the collision). The workload could then have impacted awareness.

Error 5 - the Captain of the M/p “LUGARAIN” performs an incorrect operation to avoid the collision.

Poor perception: the night time may have affected the perception of the distance and direction of the “MIKA” M/n, leading it not to perform the best manoeuvres to avoid the collision, first reducing the speed and then increasing it.

Physiological factors: the night time may have affected the Captain’s alert level, leading him to choose a not optimal action. For the assessment of the fatigue risk factor, see the note above concerning error 2.

Violation 1 – the Captain of the M/p “LUGARAIN” carries out fishing activities within the Ravenna Traffic Separation Scheme. Awareness: underestimation of the risk of fishing in this area. The lack of awareness of the Traffic Separation Scheme is evidenced by the interview minutes, in which the Captain declares that he is aware of the SST “only through some verbal communication” and that he is not informed of the rules governing the SST.

Violation 2 – The M/n “MIKA” enters the Traffic separation scheme in a way that does not comply with the navigation rules.

Personal reasons: in this case, the violation appears to be due to the need to optimise the course, i.e. not to lengthen the course in order to avoid “cutting” the entrance to the Traffic Separation Scheme.

5.6. Leadership and supervision (Level 3)

Compared to the SOAM methodology, the SHIELD analysis adds the level of supervision as a potentially significant level of analysis to explain some errors or contextual conditions. In the event in analysis, we can identify two significant leadership aspects: one for the M/n “MIKA” and one for the M/p “LUGARAIN”.

With regard to MIKA, we have made it clear that a proper handover does not seem to take place. This type of lack can be attributed to the Activity Guide category, which is the lead and example role that a Captain should have. In this case, reinforcing the good practice of handover even in standard situations.

The same Activity Guidance category leads the Captain of the M/p “LUGARAIN” to the decision of operating within the Traffic Separation Scheme. To confirm this conclusion, it should be noted that no crew member of the motor vessel reports knowledge of the SST and the navigation rules in force there.

5.7. Organisational Factors (Level 4)

Organisational factors are elements that may have contributed to the occurrence of the critical event, but which already existed even before the event happened. They relate to aspects of how a particular organization operates or to the practices and cultural aspects of a domain such as navigation. The analysis of the organizational factors for the present event is based on plausibility assumptions, as we have not had the opportunity to analyse in depth the organizations linked to the two vessels. Instead, we focused on the cultural aspects of the maritime environment relying on the knowledge of the writers’ domain.

Safety culture.

The event appears to be influenced by an underestimation of the collision risk by both crews. This factor is particularly noticeable in the light of the frequency with which such events have occurred in Italy and Europe.

Promotion of safety.

Closely linked to the previous point there is a lack of awareness on the part of the “LUGARAIN” M/p Commander of the navigation rules within the Traffic separation scheme. This aspect is mentioned in particular in the light of a potential recommendation to reinforce the promotion activities that are already actively carried out at local level.

5.8. Other System Factors (Level 5)

In the opinion of the writers, it should also be noted that 4 of the 5 crew members of the M/p “LUGARAIN” complained of poor cooperation and empathy by the M/n “MIKA” staff following the collision. Statement denied by the crew of the M/n “MIKA”.

Although these different perceptions can be easily explained by the high emotional load caused by the collision, and can certainly be attributed to the subjective perception of all subjects (by its nature “non-objective and factual”), it seems appropriate to consider awareness-raising and training actions in the management of the post-accident, thus at the safety culture level. In this specific case, the different perception of willingness to cooperate and to help has probably had only psychological consequences, but in other cases it could lead to a not optimal containment, recovery and/or mitigation of the consequences of a collision.

As an example, the so-called Critical Incident Stress Management protocol, which aims to manage the impact of stress on individuals involved in critical events, has been a good practice in the aeronautical world for years: “managing stress reactions caused by a critical incident and re-establishing its ability to work” [Eurocontrol (2021), Critical Incident Stress Management: Implementation Guidelines]. CISM takes shape as a structured assistance to achieve normal reactions to abnormal events. In the present case, it could be hypothesised to recommend the implementation of a similar intervention protocol

aimed at ensuring normal cooperation even in the immediate stages of an accident in a perspective of strengthening useful barriers to recover or limit its consequences.

5.9. SOAM Diagram of the event

The SOAM diagram (figures 12 and 13) summarises all the elements of analysis described above, which have been identified as contributing to or at least enabling the occurrence of the events leading to the accident. Secondly, the diagram facilitates the identification of conceptual and time links between all identified elements at different levels of analysis.

The diagram should be preferably read from the right side (that of the accident and the actions of the staff working on the front lines), to the left side (that of the factors physically and temporally more distant from the scene of the event). For clarity of representation, we use two separate diagrams: one for the analysis of the perspective of the M/p “LUGARAIN” and one for the perspective of the M/n “MIKA”.

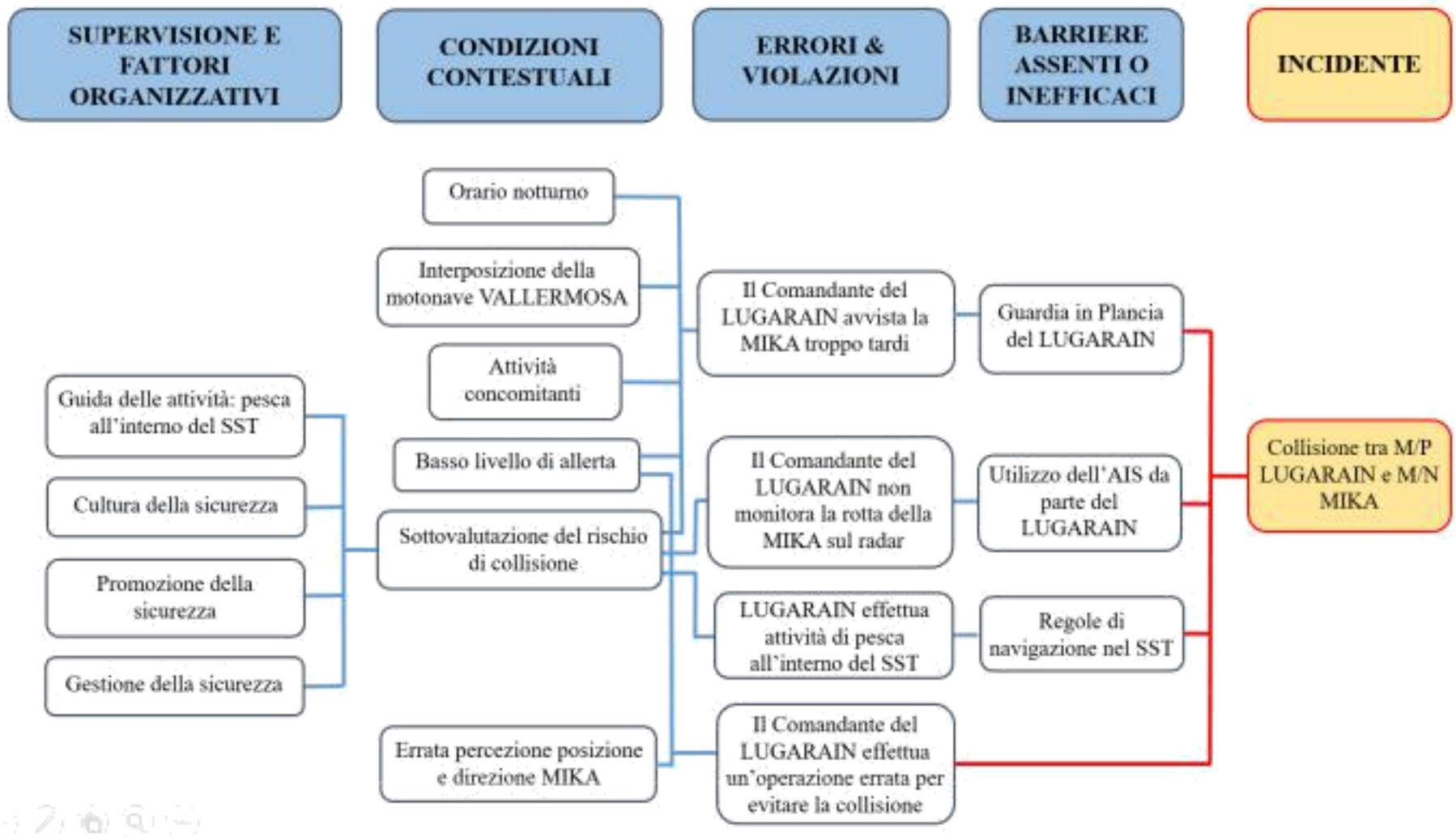


Figure 12: SOAM Collision Diagram – LUGARAIN perspective

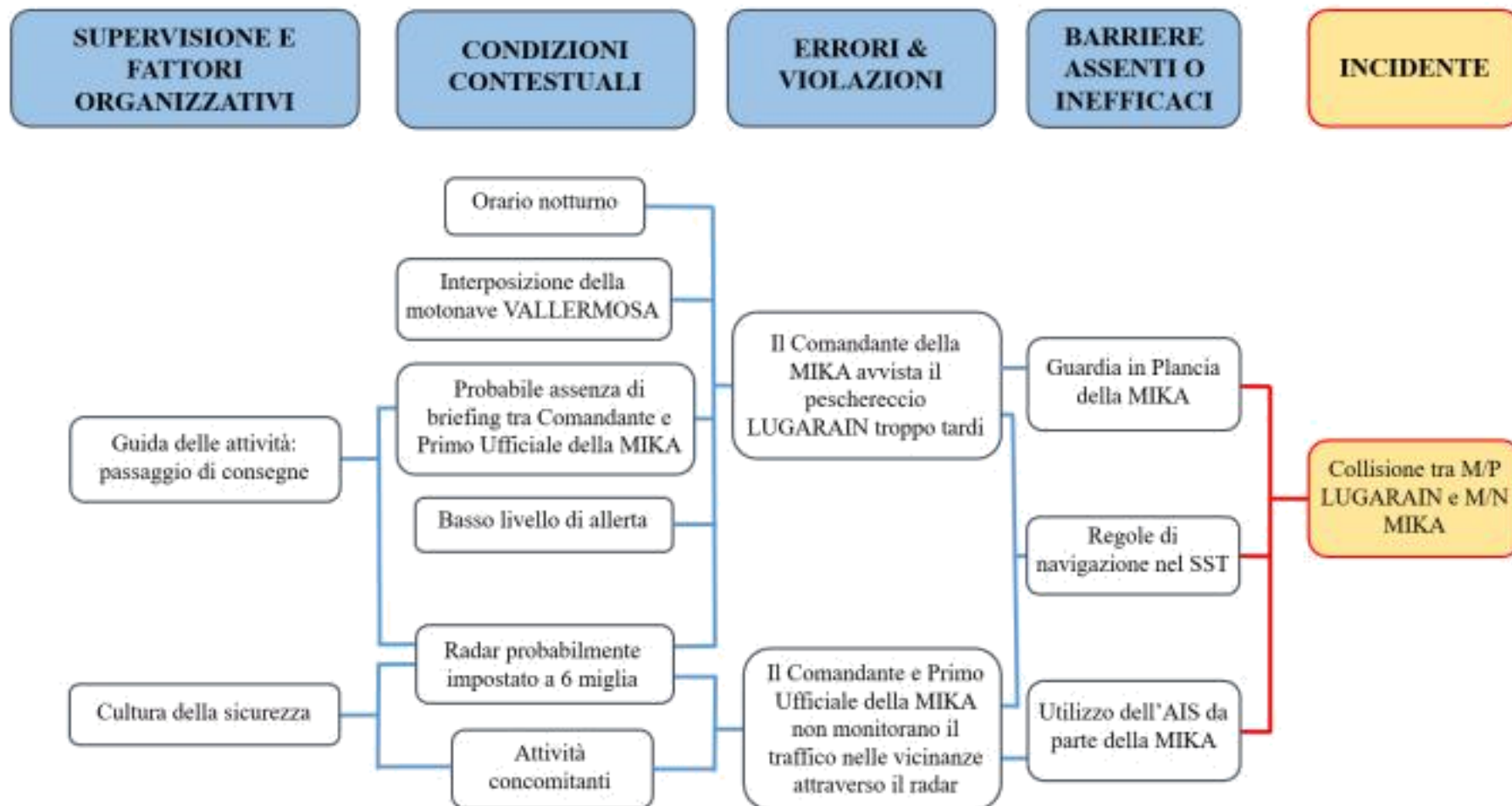


Figure 13: SOAM Collision Diagram – MIKA perspective

5.10. Comparison with EMSA analysis results of collisions involving fishing vessels

In 2018, EMSA published a broad-spectrum analysis – 6 years, 2404 events – of accidents involving fishing vessels [EMSA (2018). Safety Analysis of Data Reported in EMCIP. Analysis on Marine Casualties and Incidents Involving Fishing Vessels]. The collision analysis identified some recurrent safety issues (Safety Issues) and prioritized them based on quantitative (frequency and severity) and qualitative (EMSA experts' assessment) considerations. It is interesting to note that three of the main issues are also observed in the event “LUGARAIN-MIKA”. In particular:

- Safety and risk assessment by the person at the helm: typically, in the form of underestimation of the actual risks, resulting in not optimal watchkeeping, or inadequate use of the AIS radar, and finally not timely reaction in case of actual risk.
- Working methods, in particular with regard to the watchkeeping on the pilot bridge: “in some cases the effectiveness of the watchkeeping by a single person is questionable or seemed inadequate. Inappropriate practices with regard to watchkeeping on the pilot bridge were reported by investigators as recurring on board fishing vessels” (p. 23).
- Management factors, or rather lack of a proper safety management structure due to the fact that the owner, the manager, and the Captain are often the same person, thus giving greater priority to fishing activity than safety considerations. EMSA reports a focus on maximising fishing results with the risk of working at the limits of safety [p. 26].⁴

In the context of the SOAM analysis discussed here, the first two issues can be positioned at the level of Leadership and Guide Supervision of activities, while the third concerns the

⁴ EMSA reports these factors with regard to on-board injuries. In the specific event, the lack of an organizational dimension of “safety identification and management” leads instead to the underestimation of the collision risk, and is therefore included as significant.

organizational level, which is understood as a Culture of Safety (underestimation of the risk), but also as an organizational structure of Safety Management.

A. NORMATIVE REFERENCES

In the present case, reference may be made to Part B “Rules of steering and manoeuvring”, - Section I “Lookout of vessels in all visibility conditions” of the Convention on the International Regulations for Preventing Collisions at Sea — 1972, ratified by Law 1085/1977, and other regulations referred to in the national legislative landscape, listed below, which led to an incorrect management in the steps of approach between the courses of the two vessels. In particular:

- art. 5 paragraph 3 Law 51/2001;
- art. 2 paragraph 3 letter d) and art. 3 of the order no. 32/2022 of the Ravenna Harbour Master's Office concerning the T.S.S. (Traffic Separation Scheme) as punished by art. 1231 of the Navigation Code “non-compliance with rules on safety of navigation”;
- art. 8 paragraph 4 of order no. 32/2022 of the Ravenna Harbour Master's Office on the T.S.S. (Traffic Separation Scheme) as punished by art. 1231 of the Navigation Code “non-compliance with rules on safety of navigation”.

RULE 5: LOOKOUT SERVICE [COLREG, 1972]

Each vessel shall always maintain an appropriate lookout, visual and auditory service, using all available means appropriate to the circumstances and conditions of the time to enable a full assessment of the situation and the risk of boarding to be made.

RULE 6: SAFETY SPEED [COLREG, 1972]

Every vessel shall always proceed at a safe speed so that it can act appropriately and efficiently to avoid boarding and to be stopped within a distance appropriate to the circumstances and conditions of the time. In determining the safe speed the following factors shall be taken into account: a) For all vessels:

- i) visibility;
 - ii) traffic density, including the concentration of fishing vessels and other types of vessels;
 - iii) the manoeuvrability of the vessel with special reference to stopping distance and its evolutionary qualities under current conditions;
 - iv) the presence of background lights such as those due to coastal lights and the glare of their own lights at night;
 - v) wind, sea and current condition and the proximity of navigational hazards;
 - vi) the draught in relation to existing seabed in the area.
- b) In addition, for vessels equipped with radar:
- i) characteristics, efficiency and limitations of the radar equipment;
 - ii) the limitations imposed by the radar scale in use;
 - iii) the effect on radar detection of meteorological conditions and other sources of interference;
 - iv) the fact that small vessels, small icebergs and other floating objects may not be detected by radar;
 - v) the number, position and movement of the vessels as detected by the radar;
 - vi) the highest probability of sighting when radar is used to determine the distance of nearby vessels or other objects.

RULE 7: BOARDING RISK [COLREG, 1972]

- a) Each vessel shall use all available means appropriate to the circumstances and conditions at the time to determine whether there is a risk of boarding. In cases of doubt the risk must be deemed to exist.
- b) If there is an operational radar equipment on board, it shall be used appropriately using long-range exploration in order to obtain as soon as possible indications of boarding risk to carry out course plotting or equivalent systematic observations of detected objects.
- c) One must avoid drawing conclusions from insufficient information, especially from insufficient radar information.

d) When assessing the existence of the boarding risk, due account should be taken of account the following considerations:

- i) This risk shall be deemed to exist if the compass bearing of an approaching vessel does not considerably change;
- ii) Such a risk may sometimes exist even when a considerable variation in detection is observed, particularly when a large vessel or trailer approaches, or when the approaching vessel is at very short-range.

RULE 8: BOARDING AVOIDANCE MANOEUVRE [COLREG, 1972]

a) Any manoeuvre undertaken for the purpose of avoiding boarding, if the circumstances of the case permit, must be carried out with determination and ample time and with due respect of the rules of seamanship.

b) Any change in course or in speed to avoid boarding shall, if the appropriate circumstances permit, be large enough to be apparent to the other vessel observing either visually or through radar; a succession of small changes in course or in speed or both shall be avoided.

c) If the water surface is large enough, change in course alone may be the most effective manoeuvre to avoid dangerous approaches, provided that it is done in good time, it is decisive and does not cause any other situation of excessive proximity to other vessels.

d) The manoeuvre aimed at avoiding boarding with another vessel shall be such as to lead to passing at a safe distance. The effectiveness of the manoeuvre shall be carefully monitored until the other vessel has passed and is released.

e) If necessary, in order to avoid boarding or to gain time and better assess the situation, a vessel shall reduce speed, stop or reverse course.

RULE 10: TRAFFIC SEPARATION SCHEMES [COLREG, 1972]

a) This rule applies to traffic separation schemes adopted by the Organization.

b) A vessel using the traffic separation scheme shall:

- i) proceed in the appropriate traffic lane in the general direction of traffic flow for that lane;

- ii) keep clear, if possible, of the line or traffic separation area;
- iii) generally speaking, enter or leave a traffic lane at its ends, but if this is not possible, it is advisable to enter or exit following a course that has a small angle to the general direction of traffic flow.
- c) A ship shall, if possible, avoid crossing traffic lanes, but if obliged to do so, it shall cross them, as far as the circumstances permit, with a perpendicular course to the general direction of traffic flow.
- d) Coastal traffic zones shall in general not be used by vessels, which can safely use the appropriate lane within the adjacent traffic separation scheme.
- e) a vessel that is not passing through a traffic separation scheme shall in general not enter the separation area or cross the separation line except in the following cases;
 - i) in case of emergency to avoid an immediate danger;
 - ii) to carry out fishing operations in the separation area.
- f) A vessel navigating in the areas close to the terminal parts of traffic separation schemes shall proceed with particular caution.
- g) A vessel shall as far as possible avoid anchoring in a traffic separation scheme or at its terminal areas.
- h) A vessel not using the traffic separation scheme shall be kept as far away as possible from it.
- i) A vessel engaged in fishing shall not obstruct the passage of vessels following a traffic lane.
- j) A vessel of less than 20 m in length or a sailing vessel shall not obstruct the passage of a electrically-powered vessel following a traffic lane.

RULE 17: BEHAVIOR OF THE VESSEL NOT TO MANOEUVRE [COLREG, 1972]

- a) i) When one of the two vessels must clear the course, the other shall maintain the course and speed unchanged.
- ii) the latter vessel may, however, take the initiative of manoeuvring to avoid

the boarding as soon as it becomes clear that the vessel required to clear the course is not manoeuvring appropriately in accordance with these rules.

b) When, for some reason, the vessel required to maintain its course and its speed is so close that the manoeuvre of the vessel, which must clear the course, is insufficient to avoid the boarding, it shall manoeuvre in the most appropriate manner to avoid the boarding.

c) A electrically-powered vessel, in a situation of crossing courses, shall manoeuvre in accordance with paragraph a) ii) of this rule to avoid boarding with another electrically-powered vessel, shall not, if circumstances permit, pull over to the left if the other vessel is on its left.

d) This Rule does not exempt the ship, which shall manoeuvre, from its obligation to clear the course.

RULE 18: LIABILITY BETWEEN VESSELS [COLREG, 1972]

Except as otherwise provided in Articles 9, 10 and 13:

a) An electrically-powered vessel in navigation shall clear the route:

i) to a vessel that does not steer;

ii) to a vessel with limited manoeuvrability; iii) to a vessel engaged in fishing; iv) to a sailing vessel.

b) A sailing vessel shall while underway clear the route:

i) to a vessel that does not steer; ii) to a vessel with limited manoeuvrability; iii) to a vessel engaged in fishing.

c) A vessel engaged in fishing shall, when underway, as far as possible, clear the course:

i) to a vessel that does not steer;

ii) to a vessel with limited manoeuvrability.

d) i) All vessels, except those which do not steer or which have limited manoeuvrability, shall, where circumstances permit, avoid impeding the safe passage of a vessel influenced by its draught displaying the signals referred to Rule 28;

ii) a vessel influenced by its draught shall sail with particular caution with due regard to its special condition.

e) A floating seaplane shall, in general, keep well away from all vessels and avoid impeding their navigation. However, in cases where there is a risk of boarding it shall comply with the rules of this part.

Particularly at night, this can lead to the information from the on-board instrumentation (AIS and radar) not being readily available and a consequent failure to respond appropriately to the potential collision risk situation.

5.11 Collisions involving fishing vessels

The following table shows the history of the ‘Collision with another vessel’ events reported in BD SIGE from 01.01.2020 to the day of the event being reported.

Table no. 1 – Events involving fishing vessels

DATE	NAME OF VESSELS INVOLVED	ROOT CAUSE	ACCIDENT AREA
19.05.2021	M/p “Mario LC”	Failure to comply with COLREG procedures	Strait of Sicily
25.03.2021	M/p “Futuro”	Flooding	Adriatic Sea
06.09.2021	M/p “Aurora”	Flooding	Adriatic Sea
06.05.2021	M/p “Folgore” with cargo vessel	Failure to comply with COLREG procedures	Adriatic Sea
09.02.2021	M/p “Mimma Francesca” with M/p “Stella Marina”	Failure to comply with COLREG procedures	Adriatic Sea
14.10.2020	M/p “Twenty Two” with cargo vessel	Failure to comply with COLREG procedures	Strait of Sicily
01.10.2020	M/p “Morfeo” with cargo vessel	Failure to comply with COLREG procedures	Adriatic Sea
16.07.2020	M/p “Francesco B” with leisure boat	Failure to comply with COLREG procedures	Adriatic Sea
13.05.2020	M/p “Nuova Iside” with cargo vessel	Failure to comply with COLREG procedures	Strait of Sicily

5.12. EMCIP DATA

The following table shows the events that occurred and registered into the EMCIP database with similar characteristics to those found in this event.

The following filters were used for the search:

- Occurrence: Collision with other ship
- Sea area of occurrence: Territorial sea
- Ship/Craft type involved: Fishing vessels
- Date of occurrence: 20/10/2019 to 19/10/2022

Coastal states aff.	Date of occurrence	Title of occurrence
UNITED KINGDOM	21/10/2019	Collision between cargo ship and fishing vessel
UNITED KINGDOM	03/11/2019	Collision between cargo ship and fishing vessel
UNITED KINGDOM	14/12/2019	Collision between cargo ship and fishing vessel
UNITED KINGDOM	24/01/2020	Collision between cargo ship and fishing vessel
UNITED KINGDOM	15/03/2020	Collision between cargo ship and fishing vessel
NORWAY	28/04/2020	Collision between cargo ship and fishing vessel
INDONESIA	19/07/2020	Collision between cargo ship and fishing vessel
UNITED KINGDOM	05/08/2020	Collision between cargo ship and fishing vessel
GREECE	25/09/2020	Collision between cargo ship and fishing vessel
ITALY	01/10/2020	Collision between cargo ship and fishing vessel
CHINA	01/10/2020	Collision between cargo ship and fishing vessel
UNITED KINGDOM	08/11/2020	Collision between cargo ship and fishing vessel
FRANCE	26/11/2020	Collision between cargo ship and fishing vessel
FRANCE	05/02/2021	Collision between cargo ship and fishing vessel
GREECE	21/04/2021	Collision between cargo ship and fishing vessel
DENMARK	04/08/2021	Collision between cargo ship and fishing vessel
SPAIN	20/12/2021	Collision between cargo ship and fishing vessel
CHINA	10/01/2022	Collision between cargo ship and fishing vessel
SPAIN	29/03/2022	Collision between cargo ship and fishing vessel
ITALY	16/05/2022	Collision between cargo ship and fishing vessel
SPAIN	13/06/2022	Collision between cargo ship and fishing vessel
FRANCE	24/08/2022	Collision between cargo ship and fishing vessel
ITALY	19/10/2022	Collision between cargo ship and fishing vessel

5.13. Sinking similarities M/P “FUTURO”

By analogy, the event involving the M/p “FUTURO” is considered significant according to the meaning of the investigation being conducted (the event summary and the general data of the vessels are given below). In particular, in the event mentioned above, occurred:

- a underway collision;
- shipwreck of the fishing vessel.

Summary of the event

On 25.03.2021, the FUTURO fishing vessel departed from the port of Rimini at 02:56 a.m./UTC and - after carrying out a transfer navigation to reach the fishing site, lowered its nets using all the equipment on board at approximately 04:50 a.m./UTC.

- The M/n “BERGF JORD”, flying the Albanian flag, had instead departed on 23.03.2021 from the port of Shengjin (Albania) heading for Ravenna, with an empty cargo vessel (600 ton of ballast water), and on 25.03.2021 it was in transfer navigation.

At about 05:50 a.m. UTC, off the coast of Rimini, the M/n “BERGF JORD”, heading for the port of Ravenna, collided with the fishing vessel “FUTURO”, which was engaged in fishing activities, causing its sinking. The sinking occurred about 22 miles from the coast and in an area with a seabed of 40 meters. The crew of the sunken fishing vessel, consisting of 4 (four) people regularly on board, remained in the water for about 40 minutes and was helped and rescued by the crew of the vessel “BERGF JORD”. Only one crew member of the M/P “FUTURO” was injured as a result of the accident and declared healed in 5 days.

General data (excerpts from SIGE database F2021.0023)

IMO CLASSIFICATION:	VERY SERIOUS
TYPE OF THE EVENT:	COLLISION WITH ANOTHER VESSEL
PLACE:	OPEN SEA – WITHIN EEZ 200 NM
MARITIME COMPARTMENT:	RIMINI
DATE:	25.03.2021
TIME:	06:40
LATITUDE:	44°22' N.
LONGITUDE:	012°54' E
STATE OF THE SEA:	0 - CALM (0 m)
WIND FORCE:	1 - LIGHT AIR (2-3 KNOTS)

WEATHER CONDITIONS: CLEAR
VISIBILITY: GOOD (vis.>=5.0/2,5,0 NM)

Number of vessels involved: 2 vessels

M/P “FUTURO”

VESSEL TYPE:	FISHING VESSEL >15 m
IMO NUMBER:	N/A
CALL SIGN:	IMCF
NAME:	FUTURO
REGISTRATION NUMBER:	RM4413
OVERALL LENGTH (m):	21.60
YEAR OF MANUFACTURE:	1995
HULL MATERIAL:	WOOD
GT:	59
VESSEL OWNER:	
NAVIGATION CERTIFICATE:	OTHER
STAGE OF THE JOURNEY:	UNDERWAY
PART OF THE VESSEL WHERE THE EVENT ORIGINATED:	
	SIDE
PORT OF DEPARTURE:	RIMINI
PORT OF ARRIVAL:	RIMINI
MAIN CURRENT ACTIVITY:	FISHING
SEVERITY OF THE EVENT:	VERY SERIOUS
DAMAGE TO THE SHIP:	YES
SUNK VESSEL:	YES
VESSEL UNABLE TO PROCEED:	YES

M/n “BERGF JORD”

VESSEL TYPE:	SOLID LOAD – GENERAL CARGO
IMO NUMBER:	9012989
CALL SIGN:	ZADP8
NAME:	BERGF JORD
REGISTRATION NUMBER:	
OVERALL LENGTH (m):	82.20
YEAR OF MANUFACTURE:	1991
HULL MATERIAL:	STEEL
VESSEL OWNER:	
NAVIGATION CERTIFICATE:	INTERNATIONAL COASTAL

STAGE OF THE JOURNEY:	UNDERWAY
PART OF THE VESSEL WHERE THE EVENT ORIGINATED:	SIDE
PORT OF DEPARTURE:	SHENGJIN
PORT OF ARRIVAL:	RAVENNA
MAIN CURRENT ACTIVITY:	ON GUARD DUTY
SEVERITY OF THE EVENT:	VERY SERIOUS
DAMAGE TO THE SHIP:	NO
SUNK VESSEL:	NO
VESSEL UNABLE TO PROCEED:	NO

6. CONCLUSIONS

To summarise what happened, it should be noted that this event also results from the interaction between two chains of factors occurring at the same time, as often happens in such accidents.

Immediate causal factors can be attributed to the following actions:

- The Captain of the M/n “MIKA” sights the fishing vessel “LUGARAIN” too late.
- The Captain and the First Chief mate of the M/n “MIKA” do not monitor nearby traffic through radar.
- The Captain of the M/p “LUGARAIN” sights the M/n “MIKA” too late.
- The Captain of the M/p “LUGARAIN” does not monitor the course of the M/n “MIKA” on radar. There is also the ineffective collision avoidance manoeuvre by the Captain of the M/p “LUGARAIN”.

Causal factors related to contextual conditions (which facilitated errors) are largely common to both crews:

- the underestimation of the collision risk, especially by the M/p “LUGARAIN” but also present in the actions of the M/n “MIKA”.
- the poor visibility due to night time.
- the interposition of the motor vessel M/c “VALLERMOSA”.
- the concurrent activities that probably distracted the watchkeeping on the pilot bridge.
- a probable low alert level due to time and fatigue (probably more relevant for the M/n “MIKA”).

Contextual conditions significant only for the crew of the motor vessel “MIKA”:

- probable absence of briefing in the handover between the First Chief mate and the Captain.
- AIS radar range probably set at 6 miles.

Contextual conditions significant only for the crew of the trawler “LUGARAIN”:

- incorrect perception of the position and direction of the M/n “MIKA” (condition related to the imminent collision phase).

Finally, the supervisory and organisational factors include:

- the poor steering and supervision of the two Captains, which does not prevent bad practices such as the probable absence of handover (M/n “MIKA”) and fishing activities within the Traffic Separation Scheme (M/p “LUGARAIN”).
- the not optimal safety culture that leads to underestimating the risk of collision, by focusing for example on other concurrent activities.
- the main focus on maximising fishing activity at the potential expense of safety, due to the coincidence for the M/p “LUGARAIN” in a single person of the roles of ship owner, manager, Captain.

7. SAFETY RECOMMENDATIONS

Based on the conclusions of the analysis, seven recommendations to prevent a similar occurrence are defined. The table below summarises and then describes them in more detail later.

SUBJECT	RECOMMENDATION
Trade Associations of the fishing sector	Promoting safe pilot bridge watchkeeping practices
General Headquarters of the Harbourmasters' Corps	Raising fishermen's awareness of the risk of collision
General Headquarters of the Harbourmasters' Corps	Informing the fishing community about the navigation rules within the Traffic Separation Scheme
General Headquarters of the Harbourmasters' Corps	Enhancing radar surveillance of the relevant sea area by radar
Trade Associations of the fishing sector	Raising crew's awareness of the fatigue and of the appropriate management strategies
Ministry of infrastructures and transport	Improving data collection on actual work shifts
Ministry of Agricultural and Forestry Policy	Raising crew's awareness of the management of the phases immediately following the accident

RM2022.0086-01: It is recommended that the Trade Associations of the fishing sector (AGCIPESCA - FEDERCOOPESCA - FEDERPESCA - LEGAPESCA) consider promoting information-training and awareness-raising campaigns among the Trade Associations of the fishing sector.

In particular, prepare and spread an information package to promote safe navigational watchkeeping on pilot bridge practices, raising awareness of: (i) risks related to multi-tasking, (ii) risks related to teamwork (e.g. miscommunication or distraction), (iii) more frequent types of errors and adverse context conditions, (iv) good practices to reduce risks under points i-ii-iii, (v) use of assistance tools such as radio communications and radar.

RM2022.0086-02: It is recommended that the General Headquarters of the Harbourmasters' Corps, and in particular the Port Authority of Ravenna and other Captaincies involved in intense fishing activities, raise awareness among fishermen of the risk of collision by preparing appropriate information material to be presented at meetings with fishermen's cooperatives, or other representatives of the local fishing communities. The material should cover the frequency and causes of collisions recorded in recent years, then repeat the meeting regularly and present the events of the last period. The aim is to raise awareness of the risk, thus eliminating one of the most relevant contextual conditions of the event in question.

RM2022.0086-03: It is recommended that the General Headquarters of the Harbourmasters' Corps, and in particular the Harbour Master's Office of Ravenna and other Harbour Master's Offices involved in naval Traffic Separation Schemes, strengthen the safety promotion activities already actively carried out at local level, by informing the fishing community about the navigation rules within the Traffic Separation Scheme. In particular, it is recommended to identify the best way and means of communicating with local fishermen, be it face-to-face, in dedicated meetings, through particularly influential figures in the community, and so on. It is recommended that this recommendation be implemented in synergy with the one on collision risk awareness.

RM2022.0086-04: It is recommended that the General Headquarters of the Harbourmasters' Corps, and in particular the Ravenna Harbour Master's Office and other Captaincies involved in the Traffic Separation Schemes, strengthen the surveillance of the sea area concerned by means

of radar, to identify other similar violations. With a view to Just Culture, surveillance is aimed not at sanctioning, but at improving vessels' awareness of the rules of navigation in the concerned sea area. Crew members of the M/p "LUGARAIN" reported how fishing within the Traffic Separation Scheme may be a 'usual' violation by some vessels (note: statement not supported by any factual evidence, therefore to be verified).

RM2022.0086-05: It is recommended that the Trade Associations of the fishing sector (AGCIPESCA - FEDERCOOPESCA - FEDERPESCA - LEGAPESCA) prepare and share an information package to raise crew awareness of the issue of fatigue and appropriate management strategies.

For greater effectiveness, it is recommended to differentiate the awareness-raising activity by considering the different possible target groups and defining the priority of intervention: e.g. fishing vessels managed by individual vessel owners or fishing companies. The topic of fatigue is often little discussed in various working environments due to a cultural preconception according to which 'fatigue equals weakness'. Other domains, such as aviation, for example, have introduced the obligation to educate operators on the subject, with special training on what fatigue is, what effects it has on human performance, and how best to manage it on an individual and organisational level [European Commission Implementing Regulation (EU) 2017/373]. In this case, the obligation is not limited to awareness-raising, but also includes the monitoring and control of risk, which is always present in round-the-clock work.

RM2022.0086-06: It is recommended that the Ministry of Sustainable Infrastructure and Transport (Directorate General for the Supervision of Port System Authorities, Maritime and Inland Waterway Transport) improve data collection on actual work shifts by carrying out random data collection campaigns, in order to more accurately estimate the risk of fatigue in the various maritime transport sectors.

RM2022.0086-07: It is recommended that the Ministry of Agricultural and Forestry Policy consider promoting information-training and awareness-raising campaigns among Trade Associations of the fishing sector. In particular, prepare and share an information package to raise awareness of the management of the immediate post-accident phases of the crew. For greater effectiveness, it is recommended to differentiate the awareness-raising activity by

considering the different possible target groups, defining an initial priority segment, in order to test and refine the approach.

For information purposes, it is highlighted below that some of the recommendations of this report were already included in the report on the M/p "FUTURO" involved in a similar collision (see paragraph 5.13). The comparison is useful to highlight the general validity of the investigation work, when directed to identify systemic factors, beyond the specifics of each individual accident.

RECOMMENDATION	M/p "FUTURO" REPORT
Promoting safe pilot bridge watchkeeping practices	Yes
Raising fishermen's awareness of the risk of collision	No
Informing the fishing community about the navigation rules within the Traffic Separation Scheme	No
Enhancing radar surveillance of the relevant sea area by radar	No
Raising crew's awareness of the fatigue appropriate management strategies	Yes
Improving data collection on actual work shifts	No
Raising crew's awareness of the management of the phases immediately following the accident	Yes

The Investigation Commission

Mr. Simone Pozzi

Mr. Giovanni Greco