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Analysis of the Obligations and Responsibilities of Anchored Vessels in Vessel Collision Avoidance

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Abstract: Collisions between anchored ships and ships under way at sea often occur. In the handling of collision accidents at sea, anchored vessels are often mistaken for not being liable for collision losses or only bearing a small proportion of liability due to their limited maneuverability. When a vessel under way collides with an anchored vessel, whether the latter has the duty and responsibility to take appropriate actions to avoid the collision is directly related to the determination of the responsibility of the collision between the two vessels. By analyzing international conventions, regulations and local laws and regulations related to ship collision, this paper sorts out the requirements for anchoring ships in avoiding collision, and analyzes the limitations of anchoring ships in avoiding collision by means of navigation simulator. Collision of ships is a kind of tort, and the undertaking of responsibility depends on the degree of the fault. This paper also analyzes the possible faults of anchoring ships, and the reasonable responsibilities to be taken by anchored vessels in a collision by combining the requirements of laws and regulations on the duty of care of anchored vessels, and put forward reasonable measures to be taken in avoiding collision by anchored vessels, in order to provide references to the ship crew, ship manager and owners.

Keywords: Anchored Vessels, Collisions, Faults, Obligations and Responsibilities, Watch-Keeping

1. Introduction

In the handling of ship collision accidents at sea, anchored ships are often misunderstood as not having to bear liability for collision losses or only having to bear a small proportion of liability due to their limited handling capacity. However, after the collision accident, the fault of the anchored ship will not be exempted because of the ship's limited maneuverability, and that is why the anchor ship is ordered to bear a large proportion of the collision liability in some judgments of ship collision cases, and may be judged to bear the main responsibility or even all the responsibility in extreme cases. This paper intends to analyze the requirements of laws and regulations on duty of care of anchored ships, analyze the common faults of anchoring ships in collisions, and analyze the difficulties and obstacles in the measures that anchoring ships can usually take to avoid collisions, and summarize lessons from accidents to provide suggestions for shipping companies, ship management companies and crew members.

2. Legal Provisions Relating to Watch-Keeping on Anchored Vessels

Although the International Regulations for Preventing Collision at Sea, 1972 (hereinafter referred to as “COLREG 1972”) do not directly stipulate the collision avoidance obligations of anchored vessels, the requirements of some provisions apply to the state of anchored vessels [1]. Meanwhile, both the STCW Convention and On-Duty Rules of Seamen of the People’s Republic of China (hereinafter referred to as “On-duty Rules”) clearly put forward the watch-keeping requirements for anchored vessels.

Rule 5 look-out, Risk 7 Risk of Collision, Rule 8 Action to Avoid Collision, Rule 30 Anchored Vessels and Vessels aground, Rule 35 Sound Signals in restricted Visibility of COLREG 1972 are all suitable for the watch-keeping of anchored vessels, and the above provisions request anchored vessels to undertake the following obligations:

1. Always maintain a proper look-out so as to make a full appraisal of the situation and of the risk of collision.
2. Use all available means appropriate to the prevailing circumstance and conditions to determine if risk of collision exists.
3. Any action to avoid collision should be positive, carried out in sufficient time and with due regard to the observance of good seamanship.
4. Display the signal type of horn lights and sound the acoustic light signals as required. [2]

The STCW Convention on watch-keeping for anchored vessels are mainly shown in Part A Mandatory Standards regarding Provisions of the Annex to the STCW Convention VIII. The standards regarding watch-keeping were proposed, including frequent positioning, regular observation, patrol of vessels, observation of external environment, and display of the signal and light type according to regulations.

Article 46 of the Rules of the People's Republic of China on watch-keeping for Seafarers (hereinafter referred to as the "watch-keeping Rules") sets out the general requirements and operational specifications for watch-keeping on board an anchored vessel. If the vessel is judged to be a threat, the crew should keep a regular lookout. If a threat is judged to be to the ship, warn the other ship with all signals. If the vessel or another vessel is at anchor, or if the passing vessel is too close to cause a dangerous situation, take all effective measures to avoid or reduce damage and inform the master.

Laws and regulations both at home and abroad have put forward regulations on anchoring duty, such as look-out, collision hazard judgment, early action, display of light patterns and sound of audible signals.

3. Obligations of Anchored Vessels in Collision Avoidance

3.1. Characteristics of Anchored Vessels

COLREG 1972 divided the state of vessels into underway, anchored, moored, and stranded. Anchoring is a state of movement of a vessel under the grip of an anchor, where the vessel's anchor position does not move and the vessel drifts back and forth with the wind and current around the anchor position within the limits of the length of the anchor chain. The vessel usually has the following characteristics during anchoring:

(1) Bridge should always be on duty. The bridge should be manned at all times while the vessel is at anchor, even though the vessel is no longer required to be manned at all times. Therefore, although the anchored vessel cannot be maneuvered at all times, other equipment is available.

(2) The host is usually in a complete state. When a vessel has finished anchoring, it is usually in a complete state and the engine room can be left unmanned.

(3) It takes a long time to prepare the vessel. If the vessel is at anchor and needs to start the main engine in an emergency, it will take at least 5 minutes [3] to complete the preparation procedure. However, the emergency start procedure of coiling and rushing may cause impurities and water in the cylinder to be blown out, which may damage the cylinder and crankshaft if it is serious. If the wheel is undergoing main-engine maintenance, the time to complete the emergency standby will be significantly extended, and even some times the emergency preparation operation is not feasible.

(4) Anchoring operations take long time. When a vessel is at anchor, in order to ensure that the anchor has sufficient holding power, the actual length of the chain needs to take into account the loading status of the ship and the external environment. The actual length of the chain outlet must take into account the state of the vessel's load and the external environment. Take the fast flowing waters at the mouth of the Yangtze River in China as an example, where the water depth is 20m and the current speed is 4kn, the chain length is usually about 5 knots. At a normal anchoring speed of 3 minutes per anchor chain, the entire anchoring process for a ship at anchor here would take 15 minutes, plus the time for personnel to get from the living quarters to the bow and prepare for anchoring, which would mean that the normal anchoring process would take at least 20 minutes.

3.2. Obligations of Anchored Vessel to Avoid Collision

(1) Always keep a regular lookout. The look-out clause of COLREG 1972 requires all vessels to maintain a regular lookout by visual, auditory and all other suitable means. The understanding of the means of lookout focuses on what is appropriate to the circumstances and situation. T Visual and auditory means are the most basic means of lookout. Vision is used to observe the outside navigation environment, and in particular to judge the movement of a vessel by the number of light shapes displayed in the past. Nevertheless, when visibility is poor, human vision can be greatly restricted and the availability of visual look-out can be greatly diminished. So the whistles of other ships can be obtained by hearing to get an idea of other ships' movements, their general bearing, and their distance. The reliability of the aural lookout can also be greatly reduced when there are many ships around, dense sound and signals, and acoustic refraction. Radar look-out is an important look-out method for modern vessel navigation. However, radar can be interfered with by cluttered short range waves and spurious echoes such as sidelobes, multiple reflections, indirect reflections etc., which may not be detected by non-

steel vessels with weak reflectivity [4]. AIS equipment and VHF watch-keeping can also be used as auxiliary lookout means. In view of this, a correct lookout is a process of constantly synthesizing and comparing the observation information obtained by various means, and it is necessary to double check the information obtained by the lookout to avoid mistakes. The "On-Duty Rules" set out more specific requirements for lookouts. Article 46 of the Rules emphasizes that if the anchorage position of the incoming vessel, the vessel weighing anchor or the passing vessel is found to be close to the vessel, the other party should be notified and warned.

(2) Regularly measure the vessel's position to judge whether there is a risk of collision with another vessel. Both The STCW Code and the "On-Duty Rules" require that the vessel's position should be determined as soon as the anchor is dropped and the anchor position and gybe range marked on the chart, with constant observation of the vessel's position and the force on the vessel's anchor chain to determine whether the vessel is at anchor. Meanwhile, it is necessary to keep a close eye on passing vessels and vessels at anchor in nearby waters to determine whether the actions of other vessels pose a risk of collision between the two vessels [5].

(3) Display the correct light patterns and sound signals according to the regulations. The laws and regulations specify the type of light and horn to be displayed and the audible signals to be sounded by the anchored vessel. They are required to comply with the regulations in order to assist them and other vessels in determining the state of encounter and the risk of collision, and to take appropriate and effective action [6].

4. Analysis of Anchored Vessels' Faults

4.1. Analysis of Common Faults of Anchored Vessels in Collision

4.1.1. Negligence in Lookout

Negligent lookout is the overwhelming cause of collisions, with 99 of 108 collision investigation [7] reports indicating that negligent lookout was one of the causes. The overwhelming majority of ship collisions involve negligent lookout to the extent that the danger of collision is not appreciated. Although the lookout provisions of the collision avoidance rules do not distinguish between the duty of care of a ship at sea and a ship at anchor in relation to lookout, all ships are required to keep an effective lookout. However, the negligence of the anchored vessel often results in only a minor liability for collision compared to the negligence of the two vessels on board [8].

4.1.2. Failure to Warn the Ship of the Other Party in a Reasonable Manner

An anchored vessel shall, immediately after judging that there is a danger of collision between the other vessel and her, or if it is in doubt as to the manoeuvring dynamics of the incoming vessel, send a warning signal to the incoming vessel which will attract the attention of the other vessel [9]. Such signals usually include light signals, such as ring lights, searchlights, Morse signals or sudden flames, and sound signals, such as horn, bell, gong or other effective sound bursts. In addition, using VHF to establish contact with the other vessel is an effective warning measure, especially if the anchorage is affected by the surrounding traffic and background lights on shore. As an anchored vessel, the most effective and convenient avoidance coordinated action for avoidance is to warn the other party with sound and light or even voice signals, failure to do so can result in the court finding a greater proportion of liability.

4.1.3. Correct Light or Sound Signals Are Not Displayed

The arrangement of light and sound signals facilitate the identification and determination of the type, size, dynamics and nature of work of a vessel at sea and also provides the pilot with effective collision avoidance assistance information to enable correct collision avoidance decisions to be made. COLREG 72 requires motor vessels to display the anchor ball during daylight hours when at anchor, and to display the anchor light and deck working lights from sunset to sunrise (not required for vessels less than 100 meters in length). Furthermore, both the anchor light and the anchor ball should be displayed during daylight hours when visibility is poor. By observing the lights or shapes of the anchoring ship, the vessel underway can clearly judge the actual state of the ship and take appropriate collision avoidance action. If the anchored vessel fails to display its signal light and/or type to indicate its anchoring state as required by the rules, it is extremely vulnerable to misjudgment or failure to detect the presence of the vessel, and if this results in a collision, the anchor vessel will be held primarily responsible for the collision.

4.1.4. Improper Selection of Anchorage

Wherever possible, vessels should anchor in areas designated on the charts as anchorages or in areas designated by the traffic control authorities. If no area is delineated or designated, vessels should choose their anchorages in such a way as to avoid obstructing the normal passage of other vessels [10]. COLREG 1972 requires vessels to anchor away from narrow channels, within divided navigable areas and at both ends. Special regulations made by the relevant competent authorities usually have requirements on anchoring locations, for example, the fourth chapter of The Regulations on Vessels' Routing in the Yangtze Shanghai Section requires anchoring vessels to anchor within the anchorage areas announced by the competent authorities, to report to the Traffic Control Centre before anchoring, to prohibit anchoring in no-anchor zones, and to choose safe waters for emergency anchoring and stay away from no-anchor zones [11].

4.2. Analysis of Steering Fault of Anchored Vessels in Collision

In view of the diversity of situations encountered at sea and the different maneuvering abilities of vessels, the rules of navigation, both on board and at anchor, try to avoid instructing crews on exactly how to maneuver to avoid them, often giving only the timing of measures to be taken and actions to be avoided, usually without providing specific measures to be taken with the car and/or rudder.

From a nautical practice point of view, the main avoidance measures that can be taken by an anchored vessel include heaving up the anchor chain, depending on the situation; anchor winching or even anchoring up after notifying the engine room to avoid the situation; dropping the anchor chain to avoid the situation in case of emergency [12].

4.2.1. Loosen the Anchor Chain

In case the risk of collision with another vessel is detected and no effective contact can be established with the other vessel, and the danger level of the incoming vessel to the vessel continues to increase after the warning, the officer on duty of an anchored vessel should immediately inform the master, notify the engine room, open the anchor machinery and avoid collision or reduce collision damage by letting go the anchor. Such measures are more effective for avoiding incoming vessels too close to the vessels at anchor, but for regular underway vessels or other situations, the effectiveness should depend on the circumstances.

4.2.2. Weigh Anchor

Anchoring after preparation is often an avoidance measure for vessels underway and vessels at anchor too close together. As shown in the previous section, it usually takes about 20 minutes for an anchor to be heaved up, and the time will be increased by the time taken to prepare the machinery and the effect of larger vessels. In more open anchorages, the distance between two moored vessels is usually kept at 0.5 nautical miles or more, whereas in heavily trafficked anchorages the distance between two vessels is often only 0.3 nautical miles, which leaves very little room for anchoring and can lead to secondary accidents if not careful [13]. At the same time, it is very difficult for even an experienced skipper to decide when to prepare the anchor in a busy traffic area. Taking an incoming vessel travelling at 3 knots as an example, if it takes 20 minutes for the anchored vessel to heave up anchor, it would require the anchored vessel to be ready for any incoming vessel one nautical mile away, which is not in line with nautical practice. In the collision between vessel E and vessel Z, vessel E was accelerating away from the anchorage and vessel Z was at anchor (ready). The simulation showed that the collision could not have been avoided if the mooring vessel Z had acted when it noticed that the E was just 0.3 nautical miles away, and that the collision could have been avoided if the anchored vessel Z had acted when it noticed that the E was just 0.5 nautical miles away. In this incident, however, the Z was still at anchor but was ready to move, and even so, effective action could not have been taken in time. In nautical practice, an anchored vessel may only consider the need to take action when the two vessels are close enough to be considered a definite danger by the anchoring vessel and it is clear that the vessel in question is not taking appropriate avoidance measures [14].

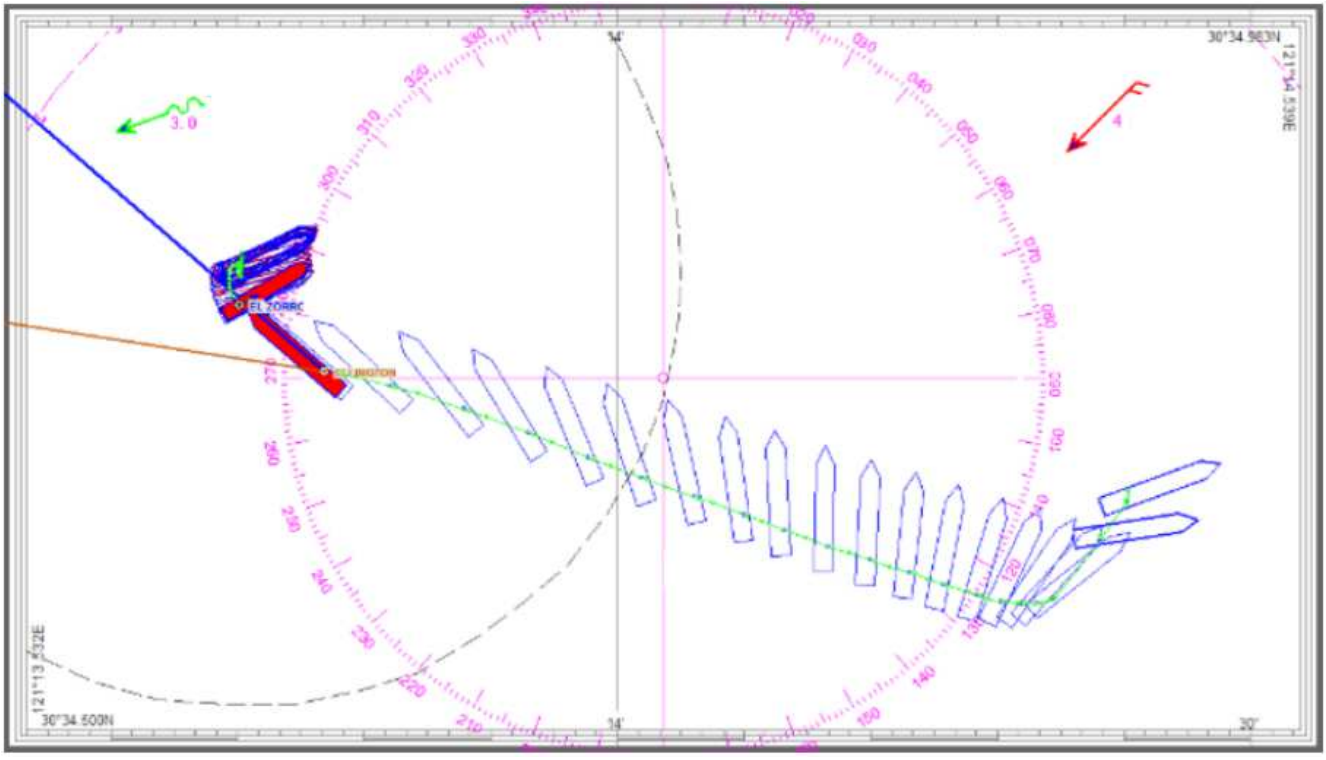

Figure 1. *Collision trajectory revivification Z and E.*

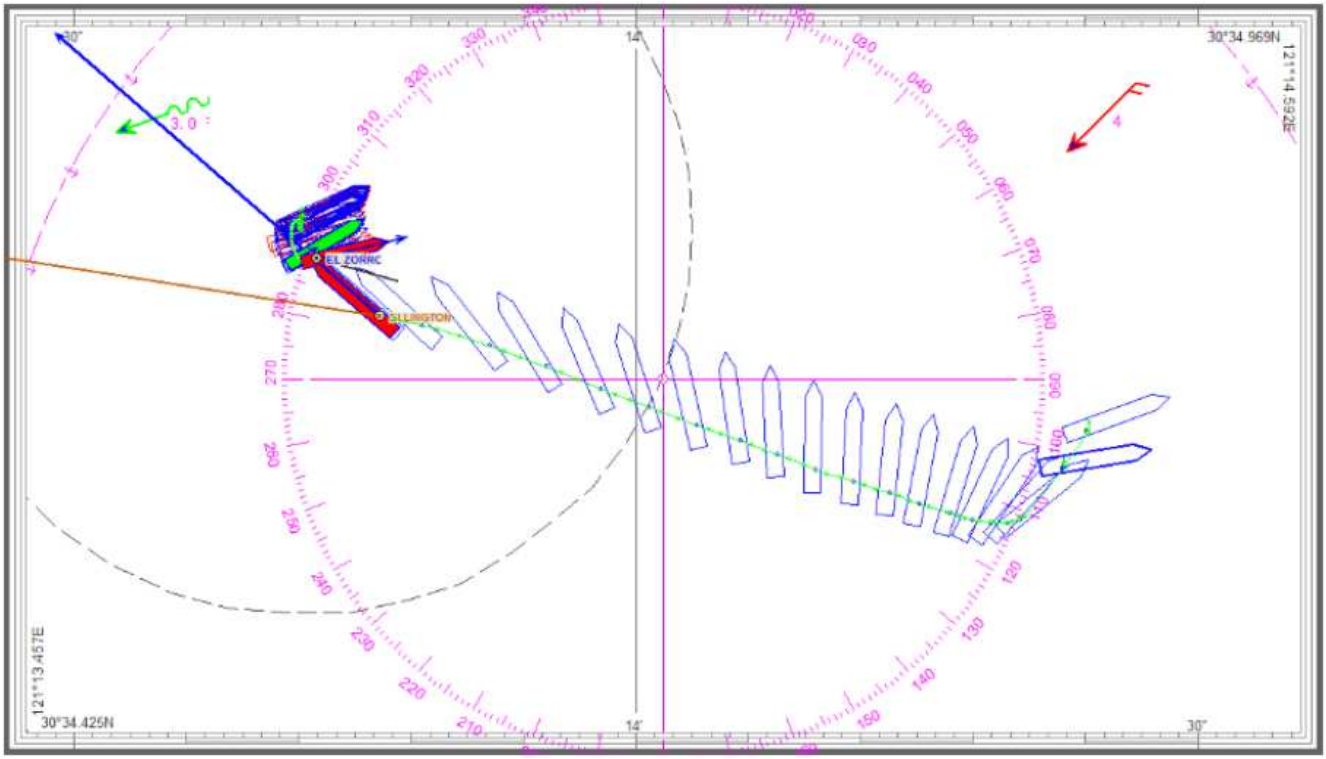

Figure 2. *Simulated maneuvering test trajectory of Z when the distance between the two vessels was 0.3 nautical miles.*

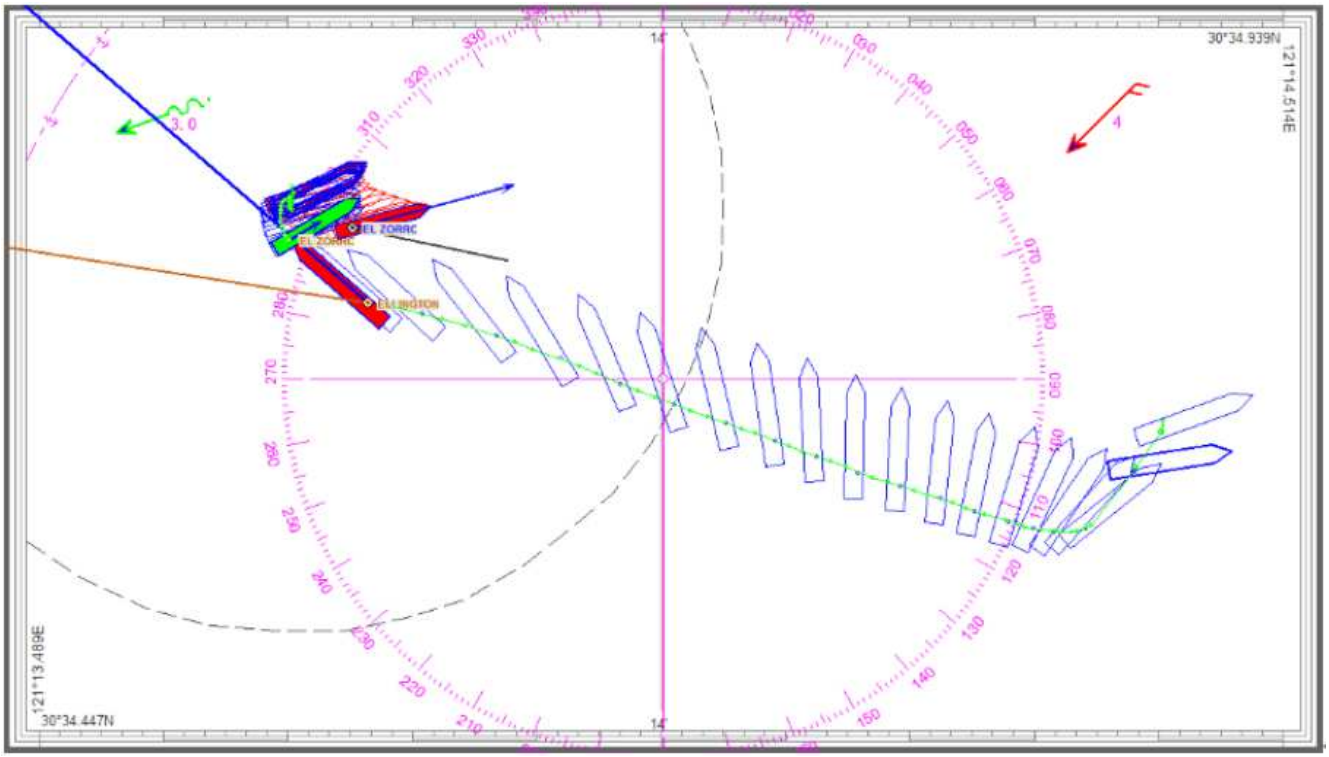

Figure 3. *Simulated maneuvering test trajectory of Z when the distance between the two vessels was 0.5 nautical miles.*

4.2.3. Anchor Abandoning Avoidance

The anchor abandonment procedure takes 1 minute when the main engine is ready, and all navigation officers and engineers are on standby. An additional factor to be considered is the timing of the anchor chain abandonment, as the Master's decision to abandon the anchor will result in property damage to a set of anchor chains and the anchor, and even if the anchor can be successfully salvaged later, the cost may be in the hundreds of thousands of dollars, and the impact on the ship's schedule may be even greater. It is therefore very difficult for the master to take such action

unless he has to [15]. The law should also respect the right of crew members to choose their own response in an emergency situation and it is not appropriate to be too critical of crew members who do not take such emergency measures, or to use a magnifying glass after the fact to examine the negligence of crew members in an emergency situation.

In summary, there are limited emergency measures that an anchored vessel can take in the event of a collision. The most effective and common way is to establish contact with the other vessel as soon as it is detected, using sound and light signals and VHF voice communication to alert the other vessel, while avoidance by releasing the anchor chain, raising the anchor in an emergency or abandoning the anchor chain is more limited.

5. Conclusions and Suggestions

As mentioned at the beginning of this paper, anchored vessels are limited by their maneuvering capabilities, but in the event of a collision, the negligence of the pilot of an anchored vessel is not absolved because of the vessel's limited maneuverability. Based on this, this paper puts forward the following suggestions for vessel owners, vessel managers, as well as vessel pilots:

(1) Choose a suitable anchorage. Anchor in charted anchorages, in VTS-designated waters or in suitable waters that do not impede other normal navigation. If in a VTS reporting area, always follow VTS advice or obtain permission to anchor, or if no such anchorage is available, avoid obstructing the normal flow of traffic by anchoring the vessel.

(2) Keep a regular lookout and operate radar, AIS, GPS and other equipment correctly. Use all means to check the anchor position of the vessel, while keeping a systematic view of the surroundings and keeping a close eye on surrounding vessel movements.

(3) Display the signal type correctly. Always check the anchor light and anchor ball signal on each shift after anchoring.

(4) Be aware of early warnings of collision hazards and communicate with the public in a timely manner, using lights and sound to sound warning signals.

(5) Take active and early action to avoid collisions, coordinate collision avoidance by loosening the anchor chain and preparing the vehicle for movement whenever possible.

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