Safety Problems in Typhoon Weather of Anchored Fishing Vessels in Zhejiang Coast

Xiao-xia GU, Qing-bo WEI, Jia-hong WANG and Wan-zheng AI

Marine College of Zhejiang Ocean University, Zhoushan 316000, P. R. China

**Keywords:** Typhoon, Coastal mooring fishing boat, Safe, Haven, Measure.

**Abstract.** Coastal fishing boats play an important role in the development of our economy. Typhoons have always had an important impact on the safety of fishing boats along the coast. Coastal mooring fishing boats are smaller in size and weaker in typhoon resistance than bulk carriers and container ships. This paper studies the safety guarantee of fishing boats in Zhejiang coastal areas in typhoon weather. By consulting and studying relevant literatures, the influences of external conditions and ship conditions on the safety of fishing boats are discussed respectively. Finally, this paper summarizes the measures to cope with the typhoon weather, by analyzing the impact of various aspects.

**Introduction**

The vast territory is owned by China, and Zhejiang Province as a coastal province of China. A close relationship is owned by Zhejiang and the Ocean. In recent years, the rational use of marine resources has been emphasized by China, so that the fishery has developed rapidly. The advantage of developing fisheries is owned by Zhejiang Province, which is located in the middle of the subtropics. But at the same time, due to the monsoon climate, many typhoons occurred in Zhejiang Province, especially during the summer and autumn. Many coastal mooring boats in Zhejiang are worked within a few tens of nautical miles from the coast, and the ship is small. The longer ship age is owned by most of the fishing boats, and the equipment equipped with fishing equipment and navigation aids are relatively backward. The wind, the big waves, the rain, the fog and other weather effects are all present when the ship is working. In addition, there is an indispensable impact between the conditions of the safe haven and the emergency capacity of the anchoring boat itself. According to statistics, in the total number of accidents caused by typhoons in Zhejiang coastal fishing vessels in the past decade, the proportion caused by improper operation of crew members is nearly 50%, and accidents due to meteorological factors account for nearly 25%, and there are 14% of accidents in equipment conditions. The safety accidents of coastal moored fishing boats under typhoon weather are studied and analyzed in this paper. From the perspective of self and external factors, the following reasons are summarized and some countermeasures are proposed.

**Impact of Climate and Typhoon in Coastal Areas of Zhejiang**

China is located between the Eurasian continent and the Pacific Ocean, and the difference between sea and land thermal properties is huge. The coastal climate is affected by factors such as latitude, sea and land, and atmospheric circulation. Most of them are monsoon climates. Most of the typhoons in China are concentrated in the summer and autumn, and August is the most active typhoon in the year. The typhoon is characterized by a large number and a wide range of attacks[1]. Zhejiang Province is east to the East China Sea and is located in the middle of the subtropical zone. It is a monsoon humid climate. The terrain of Zhejiang is undulating and is affected by the weather system of the westerly belt and the easterly belt. Therefore, various meteorological disasters are frequently triggered.

In typhoon weather, larger challenges will be faced in the voyage of fishing boats. Coastal moored fishing vessels generally work in close proximity to the coast. Compared with large cargo ships, the size of the fishing boat is much smaller, so the impact of bad weather on the stability of
the anchored fishing boat is more intense, which will make the ship sway, the heading and speed are not easily controlled, and deviate from the heading will be easier made. At the same time, with the strong winds and waves generated by typhoon weather, the greater the wind, the bigger the waves generated. When the wave height reaches 4m, the anchoring of the anchored fishing boat is the most direct impact. When the position of the typhoon changes, the direction of the wind will be changed. When the wind and waves hit the deck and enter the cabin, the ship will be damaged by certain "rolling" or "panning" and "sagging" or "middle arch". These can cause damage and overturning of the ship, and the safety of personnel and cargo on board will be threatened.

The Impact of Safe Harbor on Anchored Ships

When the ship may encounter typhoon weather, the ship should be evacuated to a safe haven as soon as possible. The safety of fishing vessels is directly affected by the ability of the shelter’s anchorage to withstand wind. The property safety of fishing boats and fishermen is also affected by the accuracy of the typhoon forecast by the safe haven. If the safe haven for typhoon is not accurate enough and timely, It will result in a far-away haven being chosen by the coastal anchored fishing boats, and the best time and choice to avoid the typhoon is missed.

When choosing a safe haven, we have to choose a safe haven that can withstand strong winds in one direction. Have a suitable water depth, suitable bottom quality, sufficient roundabout for the ship to maneuver are also requested. If the anchorage is not good enough, the anchor of the ship is not secure, and the anchoring event is easy to happen[2,3].

The flow of wind and waves can be changed by the breakwater of the safe haven, and the impact of heavy winds on the anchorage of the harbor basin is also reduced. The ability of the haven to withstand waves and storm surges can be affected by the robustness of the anti-wave. The ability of the safe haven to resist the squally winds on the harbor basin will be highly affected by the breakwater. Whether it can withstand the direct impact of wind and waves will be affected by the length of the breakwater. Whether the anchored fishing vessel entering the safe haven can be safely and accurately anchored will be directly or indirectly affected by such factors as whether the port is regularly dredged.

In the coastal areas of Zhejiang, the wind direction before and after the arrival of the typhoon has changed from northeast or southeast to northwest or southwest. According to the change of wind direction, the fishing boats generally choose the safe harbors that can better resist the northwest and southwest winds before the typhoon arrives.

The Impact of Ship Factors on the Safety of Fishing Vessels

According to statistics, most of the fishing boats in China are older. Many of them are second-hand ships imported from abroad. The fishing equipment of the ship is backward and the information cannot be obtained in time. In the harsh sea conditions, the safety of fishing boats will also be affected by the many factors of ships[2,4].

First, the ship's follow-up is the performance of the ship being controlled to change course. The navigation of a ship is affected by the initial swing capacity and the ability of deflection suppression of the ship. The larger the P value of the index (Nubin index), the better the change of the ship's head, the easier it is to change the course. Typhoon weather is generally accompanied by heavy winds. At this time, better maneuvering ability is required by the fishing vessel, so fishing vessel can respond quickly to steering and heading changes, and arrive in the designated direction and designated location in time. The ship's swirling property is measured by K value. It is known from K=M/N that the larger the K value, the larger the turning moment generated by the rudder and the smaller the damping torque, so making the K of the ship as large as possible is we hoped.

Second, the maritime instruments and communication equipment on board are poor and poor in performance, which makes the information received by the typhoon not timely and inaccurate. For most coastal mooring vessels, too little money is invested in ship safety equipment. Many of the second-hand ships have been aging, and the maintenance and repair of the ships have not been
carried out in time. As a result, dangerous situations can’t be avoided by the fishing vessels due to the backwardness of the communication facilities and navigation facilities.

Third, for the anchored fishing boat with a large age, because the repair and maintenance are not timely, and the impact ability of the ship itself against the strong winds and waves is not strong enough, and the loading condition of the fishing boat is constantly changed by the fishing work. And trim, drag, the stability and anti-sinking are also changing. The danger of the ship in inclement weather has been increased by these uncertainties.

Fourth, the crew as the operator of the ship’s navigation, and ship safety is influenced by its professional and technical level, work attitude, work experience, and ability to respond to emergencies. The maneuverability of the ship is determined by the professional skill of the crew. The strength of maneuvering ability plays a key role in the safety of ship navigation. The risk of a safety accident in a ship under typhoon weather is increased, because the crew does not pay attention to their duties during the voyage, and the attitude is not rigorous, and they do not pay attention to the sights and collisions during the voyage. Under typhoon weather, the crew’s work experience and ability and quality in responding to emergencies also play a role in the safety of anchored fishing vessels. The experienced crew can calmly face the bad weather, and the correct decision can be made by the crew.

The Measures to Deal with

The safety of fishing boats under typhoon weather is greatly threatened. However, the risks posed by the typhoon can also be defeated. By analyzing the safety factors that threaten anchored fishing vessels under typhoon weather, the measures that can be taken can be drawn from us.

First, research on marine meteorology and capture of information should be strengthened by relevant departments of marine meteorology. Weather information should be released in a timely and accurate manner before the arrival of bad weather. This can avoid accidents in fishing boats because they cannot receive information in time[5].

Second, communication equipment should be strengthened and improved by coastal mooring vessels. So that, the safety of the navigation area can be guaranteed. The meteorological situation of the sea issued by the meteorological department must be actively concerned by the fishing boat. So that relevant preventive measures and preparations can be done well in the premise of bad weather. Then the accident can be avoided.

Third, When the typhoon is encountered by the fishing boat, and fishing boat sailing in the rough winds, the correct decision should be made by the crew as soon as possible based on the weather conditions and the typhoon path at the time. The safe area should be reached as soon as possible in the shortest time by selecting the most suitable anchorage site, and correctly maneuvering the ship, choosing the appropriate mooring method, and jointly use the car and the rudder. So the purpose of minimizing the loss of the ship can be achieved.

Fourth, sufficient professionalism should be cultivated on the crew. In the event of inclement weather, the crew should keep calm and not panic. The situation around the ship should always be concerned. The work of resisting wind and waves should be closely coordinated with various departments to avoid accidents caused by the crew being negligent and blindly panic.

Fifth, after the storm, the ship should be repaired and maintained in time through the captain and other crew members. Relevant experience should be summarized and prepared for the future.

Conclusion

Typhoon is a natural factor which can’t be avoided when fishing boats operate at sea. In bad weather, accidents are likely to occur on fishing boats operating in the sea area. Therefore, whether fishing boats can operate safely in bad weather is a focus of our attention. Factors affecting the safety of fishing vessels under typhoons are analyzed in this paper. The direct impact of the typhoon, the impact of the safe harbor and the impact of the ship's own factors were analyzed. Finally,
combined with the three influencing factors, the counter measures should be taken to ensure the safety of fishing vessels under typhoon weather.

Acknowledgements
This research was financially supported by the National Science Foundation. In the process of completing this paper, I have benefited from the advice of my teachers and my friends. They enthusiastically helped me gather the materials I needed and made many useful suggestions. I hereby extend my grateful thanks to them for their help.

References
[1] Pan Liping. Research on Safe Navigation Countermeasures of Fishing Vessels in Coastal Waves in China [D]. Zhejiang Ocean University, 2015.

[2] Liu Qi. Safety evaluation and application of coastal anchorage vessels in China under typhoon weather based on FIS [D]. Zhejiang Ocean University, 2018.

[3] He Caifen, Xu Bin, Jin Wei, Ni Yongsen, Niu Ruke. Analysis of wind characteristics of anchorages in Ningbo fishing boats and their decision-making services[J]. China Water Transport (2nd half), 2017, 17(10): 116-118.

[4] Liu Zhen. A pre-risk analysis of fishing vessels returning to Hong Kong under typhoon weather based on AHP[J]. SAR Economics, 2018(07):122-125.

[5] Ge Kun. Research on Meteorological Support for Fishing Vessels under the Conditions of Heavy Wind Waves in China[D]. Dalian Maritime University, 2013.